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UNITED STATES NATIONAL MUSEUM

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The scientific publications of the National Museum include two series, known, respectively, as *Proceedings* and *Bulletin*.

The *Proceedings* series, begun in 1878, is intended primarily as a medium for the publication of original papers, based on the collections of the National Museum, that set forth newly acquired facts in biology, anthropology, and geology, with descriptions of new forms and revisions of limited groups. Copies of each paper, in pamphlet form, are distributed as published to libraries and scientific organizations and to specialists and others interested in the different subjects. The dates at which these separate papers are published are recorded in the table of contents of each of the volumes.

The present volume is the ninetieth of this series.

The series of *Bulletins*, the first of which was issued in 1875, contains separate publications comprising monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, catalogs of type specimens, special collections, and other material of similar nature. The majority of the volumes are octavo in size, but a quarto size has been adopted in a few instances in which large plates were regarded as indispensable. In the *Bulletin* series appear volumes under the heading *Contributions from the United States National Herbarium*, in octavo form, published by the National Museum since 1902, which contain papers relating to the botanical collections of the Museum.

ALEXANDER WETMORE,
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NEW FISHES OF THE FAMILY CALLIONYMIDAE, MOSTLY PHILIPPINE, OBTAINED BY THE UNITED STATES BUREAU OF FISHERIES STEAMER "ALBATROSS"

By Henry W. Fowler

In my studies of the Indo-Pacific fishes of the family Callionymidae, with special reference to those of the Philippines, I found a number of interesting new species in the collections of the United States National Museum. These are described and figured herein, with the same methods employed as in an earlier paper.[1] Each figure is drawn in lateral view, with an insert showing a dorsal view of the head and predorsal region and a ventral view showing the under surface of the head, together with the chest and breast. The head is measured to the gill opening.

ANALYSIS OF GENERA

a^1. Two distinct dorsal fins.
  b^1. Callionyminae. No supraorbital tentacle; body smooth.
    c^1. Lateral line single.
      d^1. Gill opening superior, above opercle; ventral without free ray.
        e^1. Ventral with last membrane connected to middle of base of pectoral.
          f^1. Gill opening exposed, superior on neck; opercular membrane not free posteriorly.
            g^1. Lateral line simple ..... **Callionymus**
            g^2. Lateral line jointed ..... **Paracallionymus**
          f^2. Gill opening above or hidden by opercle; opercular membrane forms free flap posteriorly ..... **Synchiropus**
        e^2. Ventral with last membrane not united with pectoral; gill opening hidden by opercle ..... **Eleutherochir**

[1] Proc. U. S. Nat. Mus., vol. 85, pp. 31-135, figs. 1-61, 1938.

d^2. Gill opening behind opercle; opercular membrane without free lobe; ventral with free ray, posterior part of fin with ventral membrane united to middle of anterior pectoral base ..... **Dactylopus**

c^2. Two lateral lines ..... **Dicallionymus**

b^2. AMORINAE. Each eye with long tentacle above; gill opening behind preopercular spine; body spinulose ..... **Amora**

a^2. DRACULINAE. Only one dorsal, corresponds to second dorsal of other genera ..... **Draculo**

CALLIONYMINAE, new subfamily

Type genus.—Callionymus Linnaeus.

No supraorbital tentacle. Body smooth. Two distinct dorsal fins.

Genus CALLIONYMUS Linnaeus

ANALYSIS OF SPECIES

a^1. Maxillary entire, without serrae.

b^1. First dorsal spines not prolonged, or but little longer than first ray of second dorsal.

c^1. Chest and breast dark or blackish brown ..... **umbrithorax**

c^2. Chest and breast pale to whitish like rest of under surface of body.

d^1. Preopercular spine slender, straight, with 7 to 9 small antrorse serrae along its inner edge.

e^1. Parietal region rather coarsely rugose; snout but little longer than eye ..... **scabriceps**

e^2. Parietal region with more obscure and radiating striae; snout much longer than eye ..... **boleogenys**

d^2. Preopercular spine more robust, with 4 recurved denticles; eye greatly exceeds short muzzle ..... **marisinensis**

d^3. Preopercular spine with 2 recurved denticles; eye subequal with muzzle ..... **hudsoni**

b^2. Spines of first dorsal more or less prolonged or filamentous.

f^1. Only first dorsal spine free terminally or prolonged.

g^1. Eye subequal with muzzle; inner edge of preopercular spine with 4 or 5 antrorse spinules.

h^1. Preopercular spine inserted close behind eye ..... **longi**

h^2. Preopercular spine inserted well behind eye, or nearer gill opening than eye ..... **brunneus**

g^2. Eye 2 in muzzle; preopercular spine with 7 antrorse spinules along its inner edge ..... **punctilateralis**

f^2. First 2 dorsal spines elongated; preopercular spine with 4 recurved denticles ..... **keeleyi**

f^3. First 3 dorsal spines elongated filaments; preopercular spine short, curved, with 2 curved denticles on inner edge ..... **distethommatus**

a^2. Maxillary with outer edge denticulate in males, entire in females; preopercular spine long, with 4 recurved denticles on its inner edge; chest with a contrasted white band on each side and approximating forward. **leucobranchialis**

CALLIONYMUS UMBRITHORAX, new species

FIGURE 1

Depth 7; head 3⅛, long as wide. Snout 3 in head; eye 3, subequal with snout; maxillary not quite reaching eye, entire; mouth cleft short, reaches halfway to eye, lower jaw very slightly shorter and included in upper jaw; lips narrow; teeth very minute, villiform, in moderate bands in both jaws; interorbital very narrow bony frenum, with longitudinal groove. Preopercular spine large, nearly long as eye, ends

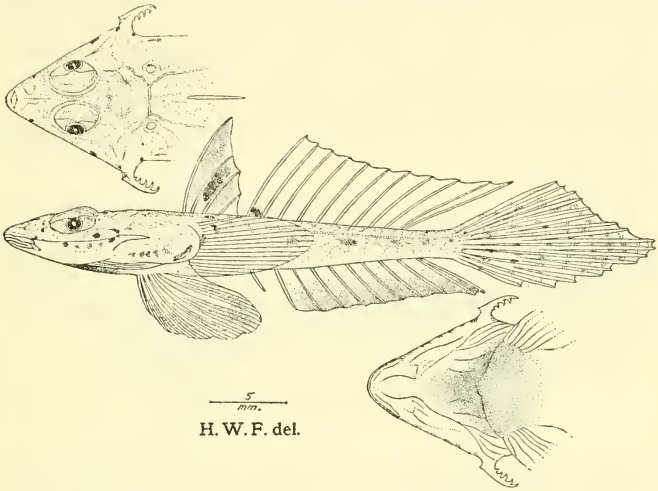

FIGURE 1.—*Callionymus umbrithorax*, new species. Type.

incurved in point followed by four recurved denticles along its inner edge, and a small subbasal denticle in front pointing forward.

Lateral line complete, high along side of back, simple.

D. IV–10, 1 first spine 1⅞ in head, first ray 1½; A. 9, 1, first ray 3; caudal 2¼ in rest of fish, cuneate; least depth of caudal peduncle 5 in head; pectoral 1¼, rays 17; ventral rays I, 5, fin 1⅛ in head. Anal papilla elongate, conic, length half of eye.

Color in alcohol, rather light brown above, with many obscure or faint darker rings and arcs on trunk and tail above. Six dark- to blackish-brown spots close below along lateral line. Various blackish-brown spots scattered about upper surface of head; pair on each side of snout, 2 each side before preopercular spine, and several on opercle especially distinct. Under surface of body largely whitish. Breast and chest blackish brown, dark area extending between bases of ventrals.

First dorsal shaded with dark brown, and large black ocellus on second membrane. Second dorsal largely transparent, with dark basal spot in front. Anal dark brown marginally, pale basally. Caudal white, with 10 transverse rows of dark-brown spots, these chiefly on membranes. Pectoral transparent, with 2 dark spots subbasally above. Ventral becomes dark brown terminally, also with some ill-defined scattered brown spots on rays.

Philippines. A species defined chiefly by the dark-brown color of the breast of the male. It is quite different from *Callionymus maldivensis* Regan,[2] the males of which are said to have an oblong blackish blotch on the throat. *Callionymus margaretae* Regan,[3] based on material 47 mm. long without caudal, is described with an oblong blackish or triangular patch on the throat in the male. It differs in the male having the first dorsal spine produced in a filament 2⅝ in the fish excluding the caudal. Its preopercular spine is said to be straight, with serrated inner edge and forwardly directed spinous extension at base in front.

Type.—U.S.N.M. No. 99433. D. 5345. Cliff Island, S. 43° E., 4.4 miles (lat. 10°50′ N., long. 119°22′03″ E.), Malampaya Sound, Palawan Island. December 26, 1908. In 7 fathoms. Length 47 mm. Male.

Paratype.—U.S.N.M. No. 99434. Same data. Length 38 mm. Female.

(*umbra*, dark place+thorax.)

CALLIONYMUS SCABRICEPS, new species

FIGURE 2

Depth 6; head 3⅘, length 1 1/10 in width. Snout 2⅘ in head; eye 2⅘, subequal with snout, well protruded on upper profile of head; maxillary reaches three-fourths to eye, entire; mouth cleft reaches halfway to eye, upper jaws greatly protractile and mandible shorter or included in upper jaw; teeth very fine, minute, villiform, in narrow bands in jaws; no interorbital space, eyes closely set in apposition. Preopercular spine long, slender, greater than orbit, inner edge with eight antrorse spinules, and small spine at front of base directed forward.

Lateral line elevated, high along side of back, complete. Along and above course of lateral line four short vertical bars of papillae or pores, last over caudal peduncle before caudal fin base. Parietal region of head with striate rugae, rather coarse and irregular.

D. IV–9, I, first spine 1⅛ in head, first ray 1⅓; A. 8, I, first ray 2½; caudal 2⅓ in rest of fish, cuneate; least depth of caudal peduncle 4 in

[2] Trans. Linn. Soc. London, ser. 2, vol. 12, Zool., p. 247, pl. 30, fig. 3, 1908 (type locality: Maldives, S. Nilandu, in 30 to 36 fathoms).

[3] Journ. Bombay Nat. Hist. Soc., vol. 16, No. 2, p. 326, pl. 3, fig. 3, 1905 (type locality: Muscat, in 15 to 30 fathoms).

head; pectoral rays 19, fin 1 in head; ventral 3 in fish without caudal, rays I, 5.

Color in alcohol, back brown, with six darker saddlelike cross bands, though ill-defined and more or less obscured by paler rings or blotches, the various shades producing more or less mottled appearance above. Dark-brown blotches also on sides of head and prepectoral region. Eye gray-brown, with darker mottling and spots. Under surface of body uniform whitish. First dorsal with dark-brown spots, obscurely ocellated with paler and with some irregular white spots on last two membranes. Second dorsal transparent, with three and sometimes

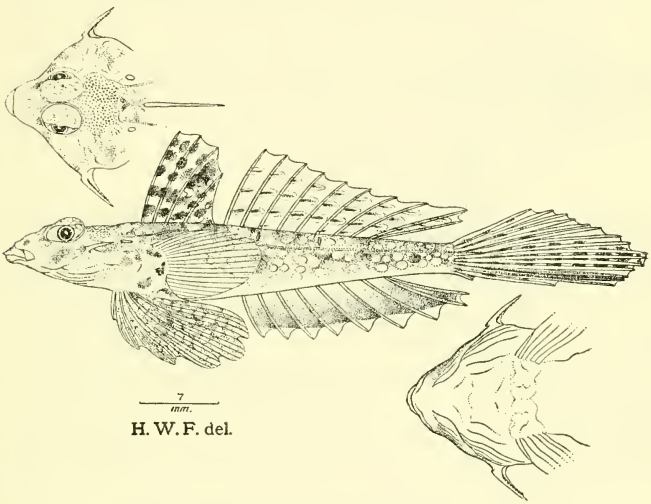

FIGURE 2.—*Callionymus scabriceps*, new species. Type.

four longitudinal rows of black ocelli, subbasal and median series most contrasted. Anal with rays tipped white and submarginally dark brown, shading paler basally on fin. Caudal transparent, with eight transverse dark-brown bands on lower two-thirds of fin, and in each band brownish-black spot, only distinct as fin is expanded. Pectoral largely colorless. Ventral variegated with brown, as pale to whitish spots, producing a mottled appearance.

Philippines. Distinguished by its combination of characters, especially the prominent long slender attenuated preopercular spine, which is 1¼ times the eye and furnished with 8 antrorse spinules along its inner edge, besides a small spine directed forward at its base in front. Top of head rugose. Snout subequal with eye.

Type.—U.S.N.M. No. 99406. Jolo, Jolo Islands. February 8, 1908. Length, 58 mm.

Paratype.—U.S.N.M. No. 99407. Surigao, Mindanao. Fifty-foot seine. May 8, 1908. Length, 38 mm.

(*scaber*, rough + κεφάλή, head.)

CALLIONYMUS BOLEOGENYS, new species

FIGURE 3

Depth 7⅛; head 3⅝, width 1⅛ in its length. Snout 2¼ in head; eye 2⅗, 1⅝ in snout; maxillary reaches four-fifths to eye, entire; mouth

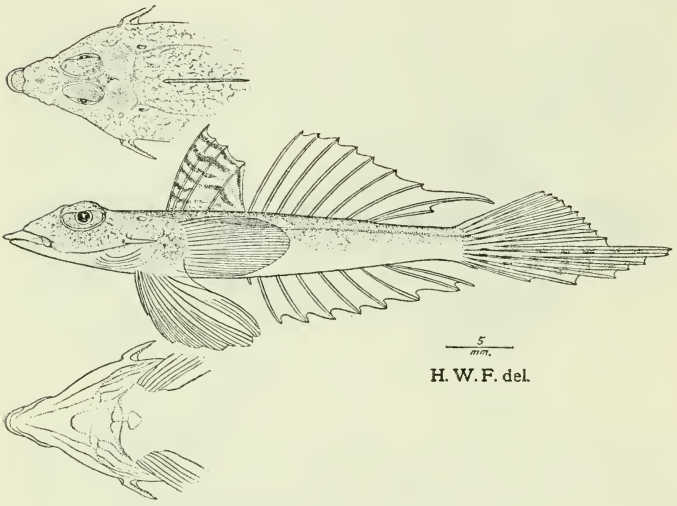

FIGURE 3.—*Callionymus boleogenys*, new species. Type.

cleft reaches two-fifths to eye, long premaxillaries well protruded and a little protractile, lower jaw shorter; teeth very minute, villiform, in narrow bands in jaws, none on palate; interorbital narrow bony frenum, with median longitudinal shallow concave groove. Preopercular spine long, straight, slender, ends in short spine and also short basal spine directed forward; eight fine antrorse serrae along inner edge.

Lateral line complete, high along side of back, and continued on caudal base. Parietals with very fine or weak radiating striae.

D. IV–8, 1, first spine 1⅛ in head, first ray 1⅓; A. 7, 1, first ray 2⅓; caudal 3⅛ in rest of fish, cuneate, with upper rays graduated shorter; least depth of caudal peduncle 4; pectoral 1⅜, rays 15; ventral rays I, 5, fin equals head. Anal papilla small, short, depressed or subconic fleshy point.

Color in alcohol, back and upper surfaces very pale brown, washed with rose, with still paler to whitish blotches, ringed areas and irregular and slightly darker arcs, circles, etc. Eye gray-white, with pink tinge above, and variegated with gray to dark gray. Under surface of body uniform whitish, with six longitudinal gray bands, variable and irregular. Caudal with seven rows of large blackish blotches on lower half. Fins otherwise all pale to transparent.

Philippines. Characters of distinction are the long, slender preopercular spine which equals the eye, protractile mouth, very pale coloration washed with rose and with pale to whitish spots. The low first dorsal has gray longitudinal lines and narrow bands.

Type.—U.S.N.M. No. 99408. Pandanan Island. Seine, 130 feet. March 23, 1909. Length 51 mm.

Paratype.—U.S.N.M. No. 99409. Same data. Length 32 mm.

(βολίς, dart+γένυς, cheek; with reference to the slender preopercular spine.)

CALLIONYMUS MARISINENSIS, new species

FIGURE 4

Depth 8⅕; head 4, length 1⅛ in its width. Snout 4 in head; eye 2⅒, about twice snout length, enters upper profile of head; maxillary reaches front eye edge, unarmed; mouth cleft reaches halfway to eye, lower jaw slightly shorter or included in upper jaw; teeth minute, villiform, firm, simple, in narrow bands in each jaw; interorbital narrow firm bony keel and separating eyes. Preopercular spine long as eye, ends in rather short and slightly curved in spine, followed by three or four more slightly recurved spines along its inner edge, first longest and fourth (anterior) smallest; at base in front short spine directed forward. Gill opening superior, small, about half long as pupil.

Lateral line high along side of back, simple, complete to caudal base.

D. IV–9, I, first spine 1½ in head, first ray 1½; A. 9, I, first ray 2⅓; caudal 3½ in rest of fish, rounded behind; least depth of caudal peduncle 4 in head; pectoral 1, rays 18, fin rounded; ventral rays I, 5, long as head. Anal papilla short, depressed, pointed.

Color in alcohol, brown above, with innumerable darker brown lines forming a marbled appearance, due to arcs, curves, rings, and blotches darker and paler. Iris silvery gray. Under surface of body uniform whitish. Dorsal dark or gray black with four whitish oblique bands. Soft dorsal pale or whitish, with faint brown spots on each ray. Anal pale or whitish. Caudal pale, with six brown spots on each membrane, forming dark transverse bands in retracted fin. Paired fins pale, pectoral with brown cross lines and ventral with faint brown spots on each ray.

China Sea. Greatly resembles *Callionymus hudsoni*, but with an entirely different preopercular spine long as eye.

Type.—U.S.N.M. No. 99410. China Sea, vicinity of Hong Kong, lat. 21°44′ N., long. 114°48′ E. In 34 fathoms. August 9, 1908. Length 48 mm. [D. 5303.]

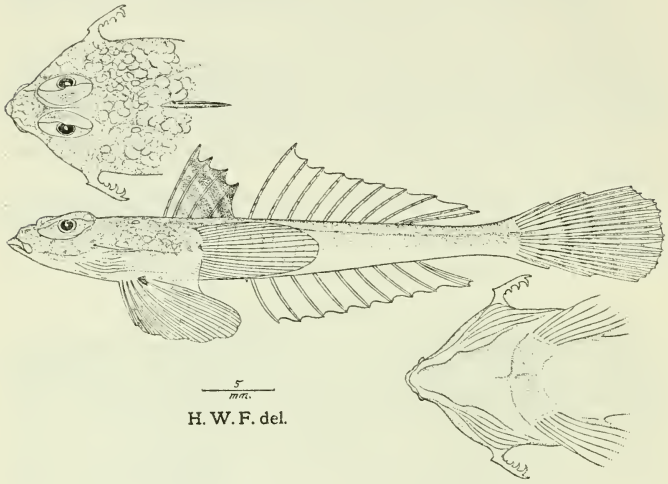

FIGURE 4.—*Callionymus marisinensis*, new species. Type.

Paratype.—U.S.N.M. No. 99411. Tinakta Island (N.), S. 80° W., 3.3 miles (lat. 5°12′30″ N., long. 119°55′50″ E.). February 21, 1908. Length 36 mm [D. 5157.]

(*marisinensis*, of China Sea.)

CALLIONYMUS HUDSONI, new species

FIGURE 5

Depth 6⅘; head 3⅗, width 1⅕. Snout 3⅗ in head (in profile); eye 3, slightly greater than snout; maxillary not reaching eye, length 4⅕ in head; mouth cleft 5⅛ in head from snout tip, extends halfway to eye, lower jaw well protruded in front; teeth very minute, in narrow villiform band, firm, more easily felt than seen without a lens; interorbital narrow, with large eyes set close. Preopercle ends in spine directed up and back, with small one at base in front and two large, subequal, recurved spines along its hind edge. Gill opening small, high, faces upward.

Lateral line high, complete, simple.

D. IV–9, I, first 2 spines end in short filaments, first spine 1½ in total head length, first ray 1⅘; A. 7, I, first ray 2⅔; caudal 1, rounded or convex behind; least depth of caudal peduncle 4⅛; pectoral 1⅒, rays 18; ventral rays I, 5, fin 2⅘ in fish without caudal.

Color in alcohol, very pale gray brown above, with slightly darker variable spots, blotches, and bars. Iris silvery to coppery gray. Entire under surfaces of head and body white. Fins all largely whitish. First dorsal with dark or blackish brown blotch on most membranes marginally. Few scattered pale brown spots on ventral rays.

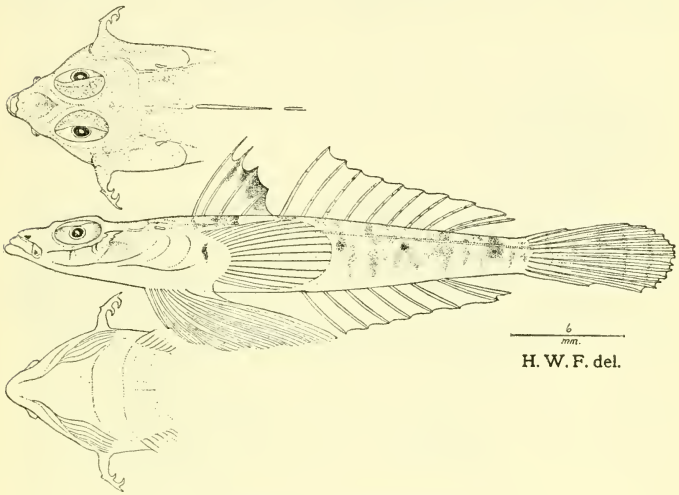

FIGURE 5.—*Callionymus hudsoni*, new species. Type.

Known only from the Philippines. Characterized by its moderate caudal, large ventrals, and coloration, the inner edge of the preopercular spine with only two recurved hooks.

Type.—U.S.N.M. No. 99412. Pandanan Island. Seine, 130 feet. March 23, 1909. Length 35 mm.

Paratypes.—U.S.N.M. No. 99415. Cabugao Bay, Catanduanes Island. From seine. June 9, 1909. Length 40 mm.

U.S.N.M. No. 99417. Cebu market, Cebu. March 20, 1909. Length 50 mm.

U.S.N.M. No. 99414. Mantacao Island. From seine. April 8, 1908. Length 38 mm.

U.S.N.M. No. 99416. Port San Vicente, Luzon side (beach). November 18, 1908. Seine 130 feet. Length 29 mm.

U.S.N.M. No. 99413. Reef opposite Cebu, Cebu Island. April 7, 1908. Length 44 mm.

(Named for Capt. Charles B. Hudson, whose valuable figures of Japanese dragonets were published in 1903.)

CALLIONYMUS LONGI, new species

FIGURE 6

Depth 9; head 4$\frac{1}{10}$, length 1$\frac{1}{10}$ in its width. Snout 2$\frac{7}{8}$, in head; eye 2$\frac{7}{8}$, subequal with snout; maxillary nearly reaches orbit, length 3$\frac{1}{8}$ in head; mouth cleft reaches three-sevenths to eye, lower jaw

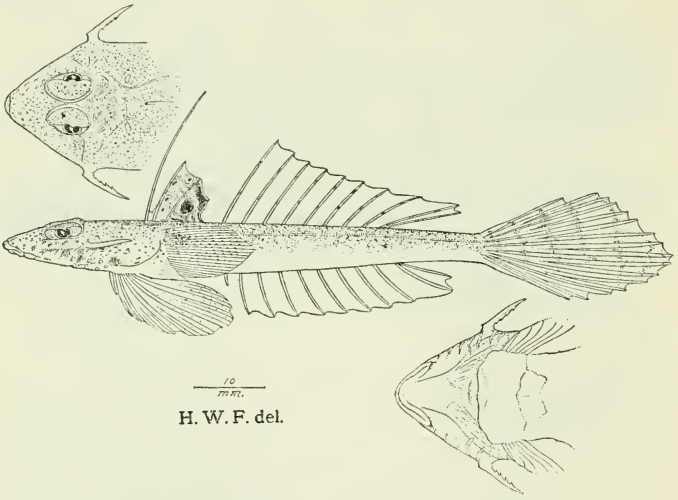

FIGURE 6.—*Callionymus longi*, new species. Type.

shorter or included in upper; teeth villiform, fine, close set, simple, conic, in bands in jaws, narrowing along sides of jaws; interorbital bony frenum separating large close set eyes. Preopercular spine very long, slender, but slightly curved and ends behind in a long slender spine, four low broad spinules along its inner edge, and small forward directed basal spine in front.

Lateral line complete, high along side of back, with loop above close before caudal fin, and extending out on caudal base. Occiput finely striate, with striae not greatly developed.

D. IV–9, I, first spine slender, ends in free filament 3$\frac{1}{4}$ in fish without caudal; A. 9, I, first ray 2$\frac{3}{4}$ in head measured to gill opening; least depth of caudal peduncle 4$\frac{1}{4}$; pectoral 1$\frac{1}{4}$, rays 20; caudal 2$\frac{5}{8}$ in rest

of fish; ventral 3⅜, rays I, 5. Anal papilla conic, pointed, nearly long as pupil.

Color in alcohol, back and upper surfaces light brown, warmer tint on trunk and tail. Back also variegated with pale and dark rings and marbling. Under surfaces of body white, with pale buff and brown tints. Side of head with rather large brown spots interspersed with white dots and small spots, and on under sides of head variable, inclined, short white lines and bars. Eyes brown, variegated with dark blotches above. First dorsal whitish, with black pale-edged ocelli, on last two membranes largest and with dark to black bands. Second dorsal pale or transparent with several brown spots on each ray. Anal transparent. Caudal transparent whitish, with six transverse bars made up of dark-brown spots, chiefly on upper half of fin. Pectoral white, with small brown spots mostly on upper part of fin. Ventral pale or whitish, with scattered brown spots on hind half of fin.

Philippines. Known by the long preopercular spine 1+⅜ times eye, ends in a backward directed barbed point behind; four low broad spinules along its upper edge and a small basal forward directed spine in front. The first dorsal spine is an extended filament, little shorter than head. Entire under surfaces uniformly white.

Type.—U.S.N.M. No. 99418. Pajumajan Island (W.), S. 2° W., 2 miles (lat. 5° 22′ 55″ N., long. 120° 15′ 45″ E.), Sulu Archipelago, Tawi Tawi Group. In 34 fathoms. February 18, 1908. Length 98 mm. Bureau of Fisheries (No. 22922). [D. 5152.]

(Named for Bayard Long, of the Department of Botany, Academy of Natural Sciences of Philadelphia, to whom I am indebted for many American fishes.)

CALLIONYMUS BRUNNEUS, new species

FIGURE 7

Depth 9½; head 3⅜, long as wide. Snout 2¾ in head; eye 3⅛, 1⅛ in snout; maxillary reaches halfway to eye, length 4⅜ in head; mouth cleft reaches two-fifths to eye, lower jaw included; premaxillaries very protractile; teeth fine, conic, pointed, villiform, in bands in jaws, broader anteriorly and on sides narrowing back; interorbital narrow bony frenum, separating large closely set eyes. Preopercular spine large, slender, slightly longer than eye, nearly straight, ends in slender long spine, with five recurved denticles along inner edge, and small subbasal denticle in front directed forward.

Lateral line complete, runs little high along side of back and out on caudal base. Parietal region smooth, only some very feeble radiating obscure striae, little visible except under a lens.

D. IV–9, 1, first spine 1½ in head, first ray 1½; A. 9, 1, first ray 2⅞; caudal 3⅛ in rest of fish, cuneate; least depth of caudal peduncle 4⅔ in head; pectoral 1⅓, rays 19; ventral rays I, 5, fin 3⅞ in fish without caudal. Anal papilla depressed, narrowly triangular, two-fifths of eye.

Color in alcohol, back and upper surfaces brown, variegated with slightly darker rings, arcs, circles, and spots, all producing little contrast. Under surface of body uniform whitish, with buff and pale-brown suffusions. Several well-inclined dark-brown bars along lower side of head and cheek. Opercle with brown spots, these extending on connecting membrane below to ventral fin. Obscure brown spots

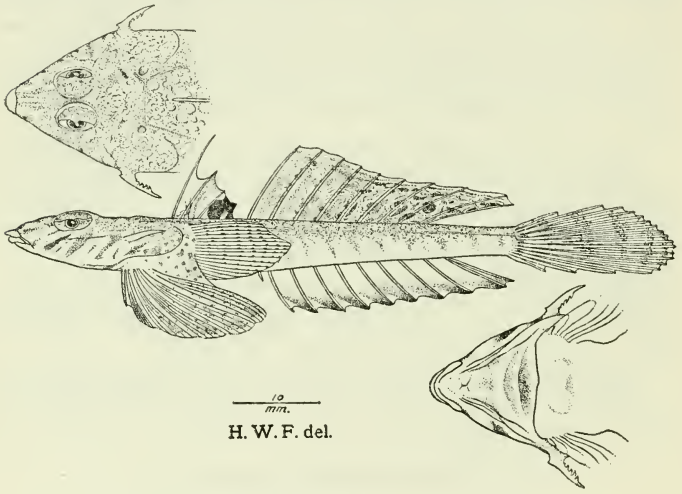

FIGURE 7.—*Callionymus brunneus*, new species. Type.

little inclined back and below along side of tail. Eyes gray, brown above with darker spots and blotches. First dorsal with pale brown membrane, large black blotch on two last membranes, with several dark streaks on first two membranes. Second dorsal transparent, greatly variegated with dark brown spots, ocelli and blotches. Anal transparent basally, with blackish brown shading terminally on each membrane and lower edge of each interradial membrane white in front. Caudal pale to whitish with six transverse dark bars, mostly made up of spots. Pectoral whitish, upper portion with small numerous dark-brown spots. Ventral whitish basally, dark brown terminally, upper outer surfaces also thickly spotted with still deeper brown

Philippines. A species easily known by its general brown appearance. Its long slender straight preopercular spine ends in a slender

spine directed straight back, with five small antrorse spines along its upper edge, and a small spine directed forward from its base. First dorsal spine a little longer than the others in the male and less than the head. Last two dorsal membranes black and anal with a black submarginal line.

Type.—U.S.N.M. No. 99419. Balayan Bay, Taal. January 19, 1908. From fishermen's seine. Length 80 mm.

Paratypes.—U.S.N.M. No. 99420. Same data as for type. Length 67 to 78 mm. Seven specimens.

U.S.N.M. No. 99421. Subig Bay, Subig, southern Luzon. From seine. January 7, 1908. Length 34 to 52 mm. Two specimens.

(*brunneus*, brown.)

CALLIONYMUS PUNCTILATERALIS, new species

FIGURE 8

Depth 8; head 4⅜, length ⅞ of width. Snout 2 in head; eye 4, 2 in snout; maxillary reaches two-thirds to eye, ridges and edges entire; mouth cleft reaches halfway to eye, lower jaw slightly shorter and included in upper when mouth is closed; teeth in villiform bands in jaws, bands broken anteriorly; teeth strong, firm, conic, close set, and in quite narrow bands on sides of jaws; interorbital narrow, concave, width about equals diameter of pupil. Preopercular spine slender, 1½ times eye, ends in point behind; seven recurved small denticles along inner edge; small basal spine directed forward. Gill opening small, an orbital diameter behind eye.

Lateral line complete, but little waved or undulate, high along side of back. Parietals each with radiating striae.

D. IV–9, I, first spine largely detached, prolonged, 3¼ in fish without caudal, first ray 1⅕ in head; A. 9, I, first ray 2½; caudal 2⅞ in rest of fish; least depth of caudal peduncle 3½ in head; pectoral rays 20, fin 1⅓ in head; ventral rays I, 5, fin 3¾ in fish without caudal. Anal papilla slender, tapering, depressed, three-fourths length of orbit.

Color in alcohol, burnt umber or warm brown above, variegated with many close-set intricated darker marblings, arcs, circles, and vermiculating lines. Lower surfaces uniform whitish. All along sides of head and body very numerous thickly strewn, dark to blackish-brown spots. On lower side of head and thorax spots larger or as blackish blotches, especially contrasted with whitish of under surfaces. Iris gray, variegated with darker spots on orbit above. First dorsal with first and second membranes largely white, marked with some black white-ringed ocelli; other membranes blackish, with four or five oblique whitish lines. Second dorsal with gray to black ocelli, variable on fin membranes. Anal largely shaded gray-brown below or toward margins. Caudal marked with large white-ringed ocelli on greater

upper portions, and fin otherwise with variable more or less transverse gray waved parallel lines or narrow bands. Pectoral whitish, with numerous small blackish-brown spots on upper part. Ventral whitish, rays dark brown terminally and axillary membrane finely spotted with black.

Philippines. Known by its small dark spots scattered over the side of the body in the male.

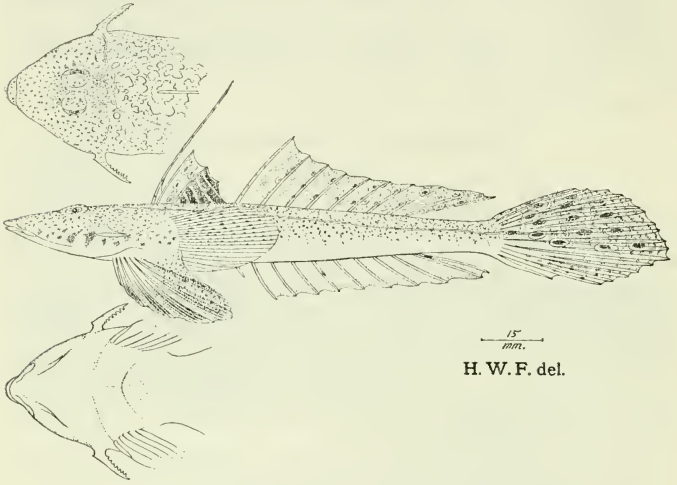

FIGURE 8.—*Callionymus punctilateralis*, new species. Type.

Type.—One example. U.S.N.M. No. 99422. Tigbauan, Panay Island. May 14, 1929. Male. Length 162 mm.

Paratypes.—Four examples. U.S.N.M. Nos. 99423 and 99424. Below mouth of Mindanao River, Cotabato, Mindanao. Seine. May 20, 1908. Two males and two females. Length 52 to 84 mm.

(*punctum*, spot+*lateralis*, of the side.)

CALLIONYMUS KEELEYI, new species

FIGURE 9

Depth 7⅕; head 3⅗, long as wide. Snout 2⅖ in head; eye 3⅕, 1⅓ in snout; maxillary concealed; mouth cleft reaches halfway to eye, lower jaw little shorter; teeth villiform, fine, conic, simple, in rather wide short bands in jaws, form narrow band along each side of jaw; mandible shallow, rami not elevated inside mouth; interorbital narrow bony ridge separating large close set eyes. Preopercular spine ¾ of

eye, ends in small slightly recurved denticle, four more mostly larger ones along inner edge, and small basal denticle in front pointing forward.

Lateral line complete, high along side of back, simple, and extends out on caudal base. Parietal region smooth.

D. IV–9, 1, first 2 spines prolonged into long filaments, first longer or 1⅝ in fish without caudal, first ray 1½ in head; A. 9, 1, first ray 2¾; least depth of caudal peduncle 4; pectoral 1⅛, rays 19; ventral rays I, 5, fin 3⅛ in fish without caudal; caudal 1¾. Anal papilla conic, simple, depressed, long as pupil.

Color in alcohol, back and upper surfaces brown, variegated with darker and paler marblings. Eight diffuse or obscure median darker

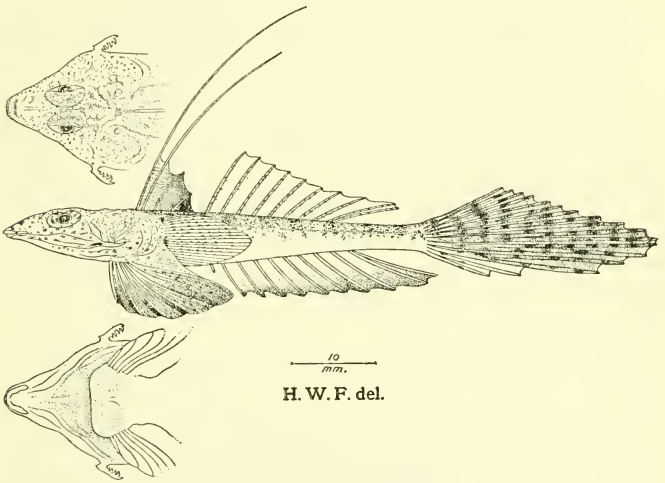

FIGURE 9.—*Callionymus keeleyi*, new species. Type.

blotches on back. Sides of head and body with more defined and contrasted dark spots on sides. Eyes gray, with silvery tints and darker markings. All under surfaces of body immaculate whitish. First dorsal dark gray to gray-black, especially on second and third membranes; some paler longitudinal lines on first two membranes. Second dorsal transparent, with scattered dark spots or specks on rays. Anal pale, dark to blackish brown marginally. Caudal whitish, gray terminally, and with a dozen irregular transverse rows of dark to blackish spots. Pectoral whitish, with numerous small, irregular, blackish-brown spots above. Ventral pale to whitish basally, dark to blackish brown terminally, and inner half of fin with connecting membrane marked with small dark to blackish dots.

Philippines. Known by the orbit 1⅛ in snout and first dorsal with two spines elongate filaments, fin dark, on last membrane black with white lines. Caudal with a dozen rows of dark spots and anal border black. Pectoral with many fine dark spots and ventral blackish terminally.

Type.—U.S.N.M. No. 99425. Cebu. April 17, 1929. Lt. H. C. Kellers. Length 80 mm.

(Named for Frank J. Keeley, of the department of mineralogy, Academy of Natural Sciences of Philadelphia.)

CALLIONYMUS SCHAAPII Bleeker

FIGURE 10

Callionymus schaapii BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 3, p. 455, 1852 (type locality: Banka).—GÜNTHER, Catalogue of fishes in the British Museum, vol. 3, p. 148, 1861 (copied).—BLEEKER, Versl. Meded. Akad. Wet. Amsterdam, ser. 2, vol. 14, p. 94, 1879 (Singapore; Banka; Java).

Depth 7⅘ to 8½; head 4⅛ to 4⅜, length 1¼ in its width to width 1⅛ in its length. Snout 3 to 3½ in head; eye 3⅛ to 3¼, subequal with snout; maxillary reaches three-fifths to eye, entire; mouth cleft with rictus halfway in snout, lower jaw little shorter than upper, which protrudes in front; teeth very small, fine, simple, conic, close set, villiform, in narrow bands in each jaw; interorbital narrow, concave, with median longitudinal groove, bony width wide as pupil. Preopercular spine large, bent, ends in small terminal point, also similar small basal point in front directed forward, and along inner edge four or five rather large recurved denticles.

Lateral line high along back to caudal base, simple and continuous with loop above over caudal peduncle posteriorly. Parietals with fine, narrow striae.

D. IV–9, 1, first spines end in long filaments, second spine 1⅞ to 3½ in fish without caudal, first ray 1¾ to 1⅘ in head; A. 9, 1, first ray 2⅘ to 2⅞; caudal 2⅞ to 3 in rest of fish, convex behind; least depth of caudal peduncle 3⅓ to 4 in head; pectoral 1⅑ to 1+⅑, rays 20; ventral rays I, 5, fin slightly longer than head to twice length of head. Anal papilla simple, conic, three-sevenths of eye.

Color in alcohol, dull brown above, with many obscure darker spots, specks, and blotches; also many arcs, rings, and circles on trunk and tail above; on tail form four obscure dark saddles. Dark-brown spot about half size of orbit, on opercular flap. Dorsals and anals largely transparent. Caudal with five transverse darker bars. Pectoral with five or six dark transverse bars, more or less forming imperfect pale rings over upper part of fin. Ventral pale to whitish, each ray with four or five brown spots.

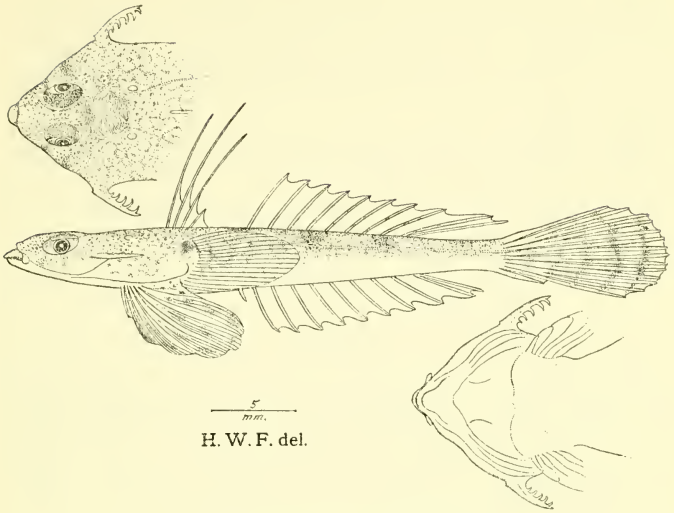

FIGURE 10.—*Callionymus schaapii* Bleeker.

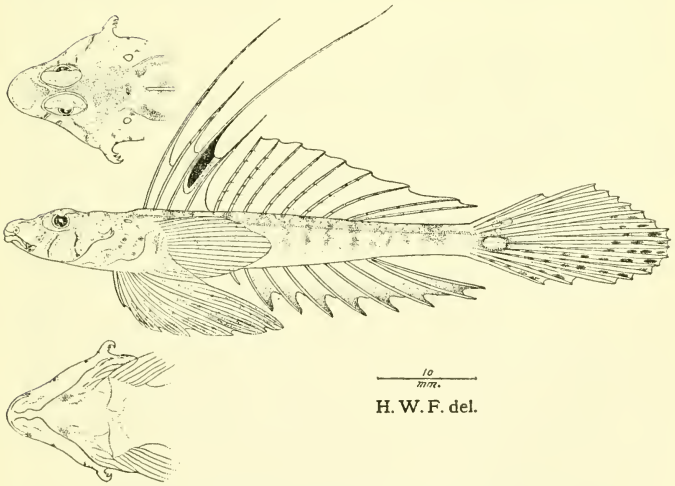

FIGURE 11.—*Callionymus distethommatus*, new species. Type.

East Indies, Philippines. Resembles *Callionymus hudsoni* and *Callionymus marisinensis* but differs in having the preopercular spine 1+¼ times the eye, first three dorsal spines filamentous and prolonged, also the head striate behind eye. The species may be known by the very conspicuous ocellated black blotch below and before the pectoral origin.

Fifteen examples: Buenavista, Guimaras Island. Seine. January 14, 1909. Length 54 to 88 mm.

One example. Cebu. April 14, 1921. Lt. H. C. Kellers. Length 70 mm.

Four examples. Iloilo market, Panay. March 28, 1908. Length 57 to 85 mm.

CALLIONYMUS DISTETHOMMATUS, new species

FIGURE 11

Depth 7¼; head 4, broad as long. Snout 3⅕ in head; eye 3⅕, invades upper profile of head; maxillary reaches below front of eye, length 3½ in head; mouth cleft reaches two-thirds to eye, greatly protractile down and forward; teeth fine, villiform, in narrow bands in jaws; interorbital very narrow frenum, or bony ridge with median fine longitudinal groove, separating two large close-set eyes. Preopercle with moderate spine, ends in recurved denticle and followed by two others along hind edge; small basal spine in front directed forward.

Lateral line high along upper side of body, simple, complete. Parietal with very fine rugae.

D. IV–8, 1, spines all prolonged in filaments so third 1⅘ in fish without caudal, first ray 1⅘ in head; A. 7, 1, first ray 2⅕; least depth of caudal peduncle 4; pectoral 1, rays 18; ventral rays I, 5, fin 2⅘ in fish without caudal; caudal 2⅘, cuneate. Anal papilla conic, slender, 2 in orbit.

Color in alcohol, pale or light grayish above variegated with gray-brown and brown, forming five transverse dark bars or blotches on back. Snout pale above. Many small black to blackish-brown ocelli scattered on sides of head and top of head and on fins, also two below head at front of branchiostegal region. Iris gray and pearly. First dorsal with large black ocellus on third membrane. Second dorsal with some faint dark spots on rays. Anal blackish brown marginally. Caudal pale to whitish, with large pearly ocellus basally and many dark ocelli on lower and terminal part of fin. Pectoral largely whitish, only very faint trace of gray spots. Ventral whitish, grayish terminally and each ray with a few dark spots.

Philippines. A very handsome and ornamental species, with very definite color pattern.

Type.—U.S.N.M. No. 99426. Cebu market. August 28, 1909, Length 69 mm. Male. [1835.]

Paratypes.—U.S.N.M. No. 99429. Cebu market, Cebu. March 20, 1909. Length 40 mm. Female.

U.S.N.M. No. 99431. Cebu market. March 28, 1909. Length 41 mm. Male.

U.S.N.M. No. 99428. Cebu market. August 26, 1909. Length 52 to 58 mm. Males. Three examples.

U.S.N.M. No. 99427. Cebu market. August 28, 1909. Length 45 to — mm. Males. Two examples.

U.S.N.M. No. 99432. Guijulugan, Tañon Strait, east coast of Negros. Shore seine. April 2, 1908. Males. Length 48 to 59 mm. Two examples.

U.S.N.M. No. 99430. Port Matalvi, off western Luzon. Seine 150 feet. November 23, 1908. Females. Length 35 to 42 mm. Two examples.

(δίς, twice + στῆθος, breast + ὄμμα, eye; with reference to the double ocellated spot on each side of breast.)

CALLIONYMUS LEUCOBRANCHIALIS, new species

FIGURES 12 (male), 13 (female)

Depth 8½ to 10¾; head 3⅞ to 4⅜, long as wide. Snout 2¾ to 3 in head; eye 2⅔ to 3, subequal with snout; maxillary reaches seven-eighths to eye or little below front of eye; outer ridge in males with row of denticles, entire in female; mouth cleft horizontal, rictus three-sevenths in space to eye; lower jaw slightly included in male, jaws subequal or lower slightly protrudes in female; teeth fine, minute, villiform, crowded and in narrow bands in both jaws; interorbital narrow bony frenum, with longitudinal groove, bony width about half diameter of pupil. Preopercular spine long as eye, ends in short curved point behind, with three or four recurved denticles along its inner edge, and short denticle basal in front directed forward.

Lateral line complete, distinct, extends high along side of back out on caudal base, with or without loop over caudal peduncle above and just before caudal base. Parietal region smooth, radiating striae feeble and not very distinct.

D. IV–9, I, or 10, I, spines all prolonged into slender free filaments terminally reaching well into caudal base in males, first dorsal spine 1½ in head in females, first dorsal ray 1⅛ to 1⅓; A. 9, I, first ray 2⅛ to 2⅔ in males; caudal nearly long as rest of fish, in females caudal 3 in rest of fish; least depth of caudal peduncle 4¾ to 5 in total head length; pectoral greater than head in males or 3⅔ in fish without caudal, subequal with head in females, rays 17 or 18; ventral rays I, 5, fin 3⅞ in fish without caudal or 1⅛ in head. Anal papilla long, slender, conic.

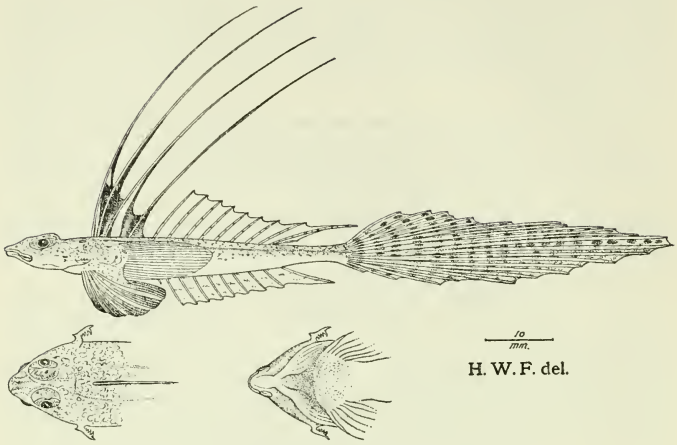

FIGURE 12.—*Callionymus leucobranchialis*. Type. Male.

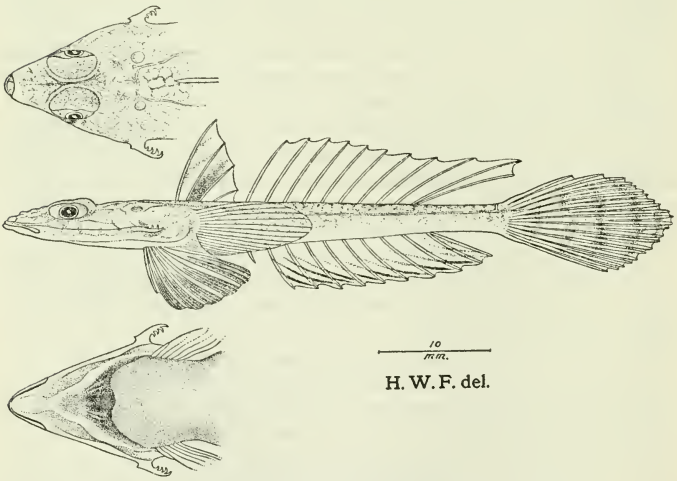

FIGURE 13.—*Callionymus leucobranchialis*. Paratype. Female.

Color in alcohol, light brown, on back with many faint and indistinct brown rings, arcs, and mottlings. Under surfaces largely whitish. Groove of lower lip each side of mandible, dark brown. Throat, chest, and breast rather light to pale brown, with strongly contrasted white gills. Iris silvery gray, with brown variable lines or arcs. First dorsal variegated with white marks on dark gray-brown background in male, less contrasted in female. Second dorsal pale or transparent whitish, with dull brownish spots on rays. Anal similar to second dorsal, or with oblique dark streaks below. Caudal pale or whitish basally, with five to seven transverse series of large rounded dark-brown spots, in closed fin forming transverse bands; terminally fin darker or brown with still darker mottling or obscure blotches. Pectoral pale, with about nine transverse brown lines. Ventral whitish basally and marked with many inconspicuous brown spots; fin gray black terminally.

Philippines. Apparently approaches *Callionymus neptunia* Seale [4] based on examples 160 to 190 mm. It differs from that species in the preopercular spine robust, but with the terminal spine small and straight anterior basal spine directed forward well developed, and only four large strong denticles along the upper edge of the spine. Moreover the four dorsal spines are greatly elongated and reach the basal part of the caudal fin. The coloration is also different.

Type.—U.S.N.M. No. 99393. San Fernando Point Light, N. 39°E., 8.4 miles (lat. 16°30′36″ N., long. 120°11′06″ E.), west coast of Luzon. In 45 fathoms. May 11, 1909. Length 99 mm.

Paratypes.—U.S.N.M. No. 99399. Same data as for type. Length 43 to 97 mm. Six specimens.

U.S.N.M. No. 99400. Bacoor, Luzon. Seine. June 15, 1908. Length 60 mm.

U.S.N.M. No. 99395. Same data as preceding. Four specimens. Length 38 to 59 mm.

Other specimens.—U.S.N.M. No. 99403. Bolalo Bay, Malampaya Sound, Palawan Island. Dynamite. December 21, 1908. Length 42 to 73 mm. Two examples.

U.S.N.M. No. 99394. Cavite and San Roque markets. June 27, 1908. Length 53 mm. 12819.

U.S.N.M. No. 99396. Cebu market. April 5, 1908. Length 73 mm. 8564.

U.S.N.M. No. 99401. Manila Bay, Luzon. December 12, 1908. Length 42 mm.

U.S.N.M. No. 99402. Manila Harbor, Luzon. Seine of 34 feet. March 16, 1908. Length 68 mm.

U.S.N.M. No. 99397. Outside harbor wall, Manila Bay, Luzon. Dredge. December 12, 1907. Length 40 to 43 mm. Three examples.

[4] Philippine Journ. Sci., vol. 4, No. 6, p. 539, 1909 (type locality: Balayan Bay, Luzon).

U.S.N.M. No. 99404. Philippines. Length 48 to 65 mm. Two examples.

U.S.N.M. No. 99405. D. 5442. San Fernando Point Light, N. 39° E., 8.4 miles (lat. 16°30′36″ N., long. 120°11′6″ E.), west coast Luzon. May 11, 1909. Length 28 to 73 mm. Five examples.

U.S.N.M. No. 99398. Sandakan Bay, Borneo. Seine. March 2, 1908. Length 58 to 66 mm. Three examples.

(λευκός, white+βράγχια, gills)

Besides the above several other interesting species in the collection are:

CALLIONYMUS SAGITTA Pallas

Callionymus sagitta Pallas, Spicilegia zoologica, vol. 8, p. 29, pl. 4, figs. 4–5, 1770 (type locality: Amboyna).—Jordan and Richardson, Bull. U. S. Bur. Fisher., vol. 27, p. 283, 1908 (Manila).—Borodin, Bull. Vanderbilt Marine Mus., vol. 1, art. 2, p. 61, 1930 (Manila Bay).—Herre, Fishes Herre 1931 Philippine Expedition, p. 94, 1934 (Manila).

22169. Davao, Mindanao. May 16, 1908. Length 58 mm.

One example. Cebu. April 24, 1909. Lt. H. C. Kellers. Length 66 mm.

CALLIONYMUS BENITEGURI Jordan and Snyder

Callionymus beniteguri Jordan and Snyder, Proc. U. S. Nat. Mus., vol. 23, p. 370, pl. 17, 1900 (type locality: Tokyo Bay).—Jordan and Fowler, ibid., vol. 25, p. 956, 1903 (Misaki, Otaru, Wakanoura, Kobe, Hakodate, Aomori, Hiroshima, Nagasaki, Matsushima Bay).—Jordan and Hubbs, Mem. Carnegie Mus., vol. 10, No. 2, p. 317, 1925 (Toba, Kobe, Tatoku Island, Mikawa Bay).—Schmidt, Trans. Pacific Committee Acad. Sci. U. S. S. R., p. 143, 1931 (Nagasaki).

Calliurichthys beniteguri Franz, Abh. Bayer. Akad. Wiss., vol. 4, Suppl. Band 1, p. 84, 1910 (Yokohama).

U.S.N.M. No. 49402. Bay of Tokyo, Japan. K. Otaki. Length 185 mm. Type.

One example. Miyazaki, Japan. Rev. Cyrus A. Clark. Oberlin College. Length 105 mm.

CALLIONYMUS VALENCIENNEI Schlegel

Callionymus valenciennei Schlegel, Siebold's Fauna Japonica, Poissons, pts. 7–9, p. 153, pl. 78, fig. 3, 1845 (type locality: Nagasaki, Japan).—Jordan and Hubbs, Mem. Carnegie Mus., vol. 10, No. 2, p. 317, 1925 (Kobe, Toba).

Callionymus valenciennesi Bleeker, Versl. Meded. Akad. Wet. Amsterdam, ser. 2, vol. 3, p. 238, 1869 (Japan).

Calliurichthys valenciennesi Franz, Abh. Bayer. Akad. Wiss., vol. 4, Suppl. Band 1, p. 84, 1910 (Sagami Bay; Aburatsubo).

Callionymus japonicus (not Houttuyn) Valenciennes, Histoire naturelle de poissons, vol. 12, p. 299, 1837 (Japan).

Callionymus simplicicornis Valenciennes, ibid., p. 303, 1837 (type locality: Guam).

Callionymus reevesi (part) Richardson, Zoology of the voyage of H. M. S. *Sulphur*, Ichthyology, p. 60, pl. 36, 1844 (female; on drawing made in Canton, not type).

Callionymus flagris JORDAN and FOWLER, Proc. U. S. Nat. Mus., vol. 25, p. 952, fig. 7, 1903 (type locality: Tsuruga; Tokyo; Aomori; Kobe; Nagasaki; Owari Bay; Matsushima Bay).

Two examples. China. A. de W. Sowerby. Length 64 to 75 mm.

Genus SYNCHIROPUS GILL

ANALYSIS OF SPECIES

a^1. Second dorsal elevated; pectoral long, reaches halfway to caudal---pallidus
a^2. Second dorsal lower; pectoral moderate, reaches ⅔ to caudal------grinnelli

SYNCHIROPUS PALLIDUS, new species

FIGURE 14

Depth 6⅓; head 3¼, wide as long. Snout 4 in head (in profile) to gill opening; eye 2⅔, greatly exceeds snout; maxillary reaches below

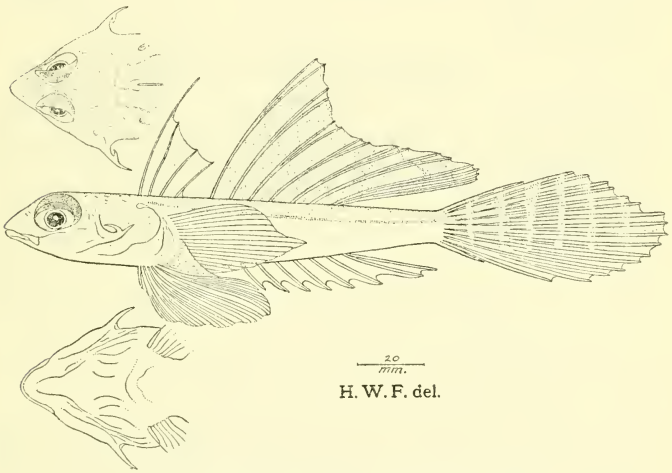

FIGURE 14.—*Synchiropus pallidus*, new species. Type.

front of eye, length 3⅓ in head to gill opening, entire; mouth cleft reaches three-fourths in snout, lower jaw very slightly shorter; jaws greatly protractile down and forward; teeth small, very close set, villiform, in bands in jaws which narrowed posteriorly or along sides of jaws; bony interorbital narrow, width two-thirds of pupil, shallowly concave; preopercle spine less than eye, curved, ends in slender spine and rather large forward curved denticle on inner upper edge; no basal spinule in front.

Lateral line complete, simple, extends on caudal base, and its course little high along side of body. Parietals striate, rather smooth.

D. IV–7, 1, first spine terminally free, equals head, first ray 2½ in fish without caudal; A. 7, 1, first ray 3⅔ in head to gill opening; least depth of caudal peduncle 4; pectoral 1⅒, rays 19; ventral rays I, 5, fin 3⅒ in fish without caudal; caudal 2, cuneate. Anal papilla very short, conic, simple.

Color in alcohol, very pale brown above, whitish below. Iris copper color, dark gray on eyes above. Fins all pale to transparent. First dorsal with eight transverse and slightly inclined pearl-white lines and about six on caudal.

Known by its very pale general coloration and the second dorsal with eight transverse, pearly white, wide-spaced, narrow bands, the caudal with six.

Type.—U.S.N.M. No. 99437. No. 1355. Length 190 mm. to end of broken caudal.

(*pallidus*, pale.)

SYNCHIROPUS GRINNELLI, new species

FIGURE 15

Depth 6¾; head 3⅗, width 1. Snout 4⅕ in head; eye 2¾, greatly exceeds short obtuse snout, with orbits conspicuously impinging on upper profile of head; maxillary reaches below front part of orbit; mouth cleft slopes little down and forward, rictus extending very nearly opposite front edge of orbit and lower jaw slightly shorter than upper; teeth small, simple, conic, close set or crowded, uniformly villiform and in moderate bands in jaws, which little broader anteriorly; no teeth on palate; interorbital narrow bony frenum separating very large orbits and traversed by a shallow longitudinal groove. Preopercular spine large, strong, ends in slightly upturned spine and another on inner edge recurved, and both invested in connecting membrane. Gill opening rather large, nearly opposite first dorsal origin.

Lateral line complete, high at first along back, posteriorly falls until axial along middle of side of tail and caudal peduncle on to caudal base. Parietal areas of cranium osseous, with pits and short anastomosing radiating bony branches. Preorbital broadly triangular, with fine radiating striae.

D. IV–9, 1, first 2 spines with ends flexible and filamentous, first spine 1½ in head, first ray 1⅗; A. 7, 1, first ray 3¼; caudal cuneate or hind edge obliquely and slightly convex down to lower branched rays, which longest and fin 3 in rest of fish; least depth of caudal peduncle 5 in head; pectoral 1¼, rays 20; ventral rays I, 5, length 1 in head Anal papilla very short, depressed, blunt, cutaneous flap.

Color in alcohol, pale buff-brown, inclining to whitish below. Upper part of back with very faint traces of light blotches or spots, variable though rather large. Iris grayish. First dorsal whitish, with large black ocellus terminally on third membrane, and other membranes with white and brownish shades. Second dorsal pale, with some pure-white blotches medially or in upper half, in some lights these markings reflected as brownish. A pale or transparent like second dorsal, with subterminal dark-brown band, beyond or on edge of narrow white line. Caudal transparent with white markings as three imperfect transverse bands sloping little back, as upper part of fin,

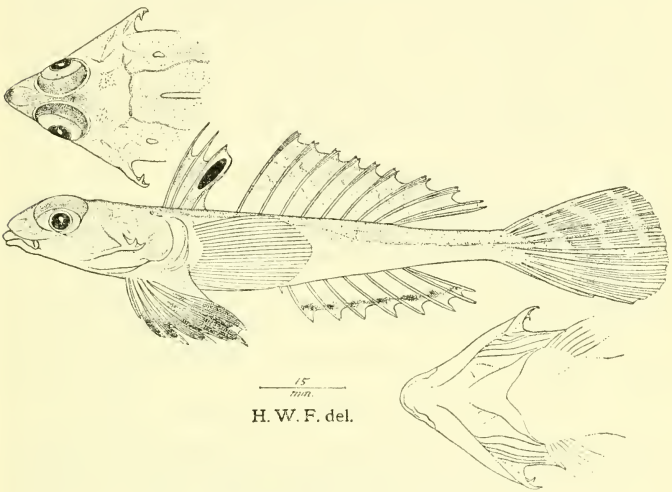

FIGURE 15.—*Synchiropus grinnelli*, new species. Type.

and two large white basal blotches. Pectoral transparent, with obscure whitish basally and two very imperfect whitish bars above transversely. Ventral pale to whitish, with two dark blotches on each ray, outer or subterminal darker, and fin edge narrowly white.

A handsome species with large orbits greatly exceeding length of snout. Preopercular spine half length of orbit, ends in upturned spine, besides another spine above slightly bent forward, but no lower basal spine. The species is known by its peculiar physiognomy, the greatly enlarged orbits, and bony broad triangular postorbital. Dorsal and anal both with membranes notched marginally.

Type.—U.S.N.M. No. 99436. D. 5475. San Bernardino Light, S. 27° W., 11 miles (lat. 12°55′26″ N., long. 124°22′12″ E.), east

coast of Luzon, San Bernardino Strait to San Miguel Bay. In 195 fathoms. June 24, 1909. [1699.] Length 118 mm.

(Named for the late Dr. Joseph Grinnell, of the Museum of Vertebrate Zoology, Berkeley, Calif.)

Besides the above, there are several very handsome specimens of the following:

SYNCHIROPUS OCELLATUS (Pallas)

Callionymus ocellatus PALLAS, Spicilegia zoologica, vol. 8, p. 25, pl. 4, figs. 1–3, 1770 (type locality: Amboina).—WEBER, *Siboga* Expedition, vol. 57, Fische, p. 524, 1913 (Beo; Kabaena Island; Ambon; Nusa Laut; Tiur).

Synchiropus ocellatus JORDAN and RICHARDSON, Bull. U. S. Bur. Fisher., vol. 27, p. 282, 1907 (1908) (Calayan).—HERRE, Fishes Herre 1931 Philippine Exped., p. 94, 1934 (Dumaguete).

Callionymus punctulatus LACÉPÈDE, Histoire naturelle des poissons, vol. 2, pp. 328, 340, 1800 (type locality: No locality).

Three examples. Gubat Bay, Luzon. Tide pools. June 23, 1909. Length 31 to 73 mm. [1693, 1696.]

SYNCHIROPUS SPLENDIDUS (Herre)

Callionymus splendidus HERRE, Philippine Journ. Sci., vol. 32, p. 416, 1927 (type locality, Bungau).—WHITLEY, Rec. Australian Mus., vol. 16, No. 4, p. 222, pl. 17, figs. 1 a–b, 1927 (Hayman Island reef, Whitsunday Group, Great Barrier Reef, Queensland).

Synchiropus splendidus GILTAY, Mém. Mus. Roy. Hist. Nat. Belge, Hors sér., vol. 5, fasc. 3, p. 84, 1933 (reference).

One example. Biri Channel. June 1, 1909. Dynamite. Length 70 mm. [1545.]

Genus ELEUTHEROCHIR Bleeker

Eleutherochir BLEEKER, Versl. Meded. Akad. Wet. Amsterdam, ser. 2, vol. 14, p. 103, 1879. (Type, *Callionymus opercularioides* Bleeker, orthotypic.)

Brachycallionymus HERRE and MYERS, in Herre, Proc. Biol. Soc. Washington, vol. 49, p. 12, 1936. (Type, *Brachycallionymus mirus* Herre=*Callionymus opercularioides* Bleeker, orthotypic.)

There is hardly any question that the small specimens named as *Brachycallionymus mirus* Herre are the young of *Eleutherochir opercularis*.

Eleutherochir differs from the other genera especially in its even head with straight profile. The gill opening resembles that of *Synchiropus*, but is larger and hidden under the opercle, which is extended back in a free-pointed lobe.

ELEUTHEROCHIR OPERCULARIS (Valenciennes)

Callionymus opercularis VALENCIENNES, Histoire naturelle des poissons, vol. 12, p. (228) 305, 1837 (type locality: "L'embouchure de la rivière d'Arian-Coupan").—DAY, Fishes of India, pt. 2, p. 323, 1876 (Pondicherry; Madras).—WEBER, *Siboga* Expedition, vol. 57, Fische, p. 522, 1913 (Menado; Ambon).

Synchiropus opercularis GILL, Proc. Acad. Nat. Sci. Philadelphia, 1858, p. 130 (reference).—HERRE, Fishes Herre 1931 Philippine Expedition, p. 95, 1934 (Lemery).

Callionymus opercularioides BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 1, p. (30) 32, 1850 (type locality: Padang, Sumatra).

Eleutherochir opercularioides BLEEKER, Versl. Meded. Akad. Wet. Amsterdam, ser. 2, vol. 14, p. 103, 1879 (Sumatra; Bali; Celebes; Batjan; Ceram; Amboina; Guebe).

Brachycallionymus mirus HERRE, Proc. Biol. Soc. Washington, vol. 49, p. 12, 1936 (type locality: Celebes; Philippines).

Two examples. Camp Overton, Mindanao. August 15, 1909. Electric light. Length 24 mm.

Nine examples. Malabang. May 21, 1908. Electric light. Length 20 to 23 mm.

One example. Nato. June 18, 1909. Electric light. Length 24 mm.

One example. Taal. February 20, 1909. Electric light. Length 20 mm.

U.S.N.M. No. 98827. Romblon. March 25, 1908. *Albatross* Collection. Length 16 mm. Paratypes of *Brachycallionymus mirus*. Two examples.

U.S.N.M. No. 98828. Nasugbu, Batangas Province. January 15, 1908. *Albatross* Collection. Length 15 mm. Paratype of *B. mirus*.

22170. Davao, Mindanao. Seine 150 feet. May 16, 1908. Length 59 to 85 mm. Six examples.

20824. Lingayen Gulf, Luzon. May 11, 1909. Seine 500 feet. Length 77 mm.

One example. Nasugbu, Luzon. Seine. January 16, 1908. Length 52 mm.

13959. Paluan Bay, Mindoro. Seine 130 feet. December 11, 1908. Length 37 to 70 mm. Three examples.

24132. Port San Vicente, Luzon. Seine 130 feet. November 18, 1908. Length 57 mm.

Two examples. San Vicente Harbor, Luzon shore. November 13, 1908. Seine. Length 54 to 59 mm.

ELEUTHEROCHIR MCCADDENI, new species

FIGURE 16

Depth 7; head 3, width 1¼. Snout 3⅓ in head; eye 3, slightly greater than snout; maxillary reaches opposite front of eye, entire; mouth but little inclined from horizontal, mouth cleft with rictus reaching halfway to eye, and lower jaw well protruded in front; teeth fine, conic, simple, close set, villiform, very minute, and set in inconspicuous narrow band above; lower teeth uniserial, rather large in comparison with upper, little curved in, situated along outer edge of

mandible and always visible, even in closed mouth; rami of mandible well elevated inside mouth; no teeth on palate; tongue small, entire, rounded and free in front; interorbital narrow, bony width two-fifths of eye, flattened. Preopercular spine curved back and up terminally, ends in strong spine, and two spines curved up and back on its upper edge. Opercular flap extends well back on pectoral base.

Lateral line complete, little high at first, becomes axial along side of tail.

D. IV–9, I, spines not free, short, flexible, first 2⅛ in total head length, first ray 2; A. 10, I, first ray 2⅛; caudal 3½ in rest of fish,

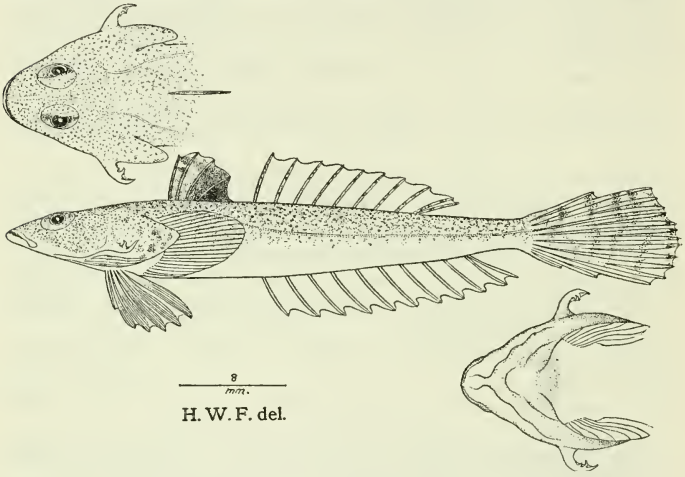

FIGURE 16.—*Eleutherochir mccaddeni*, new species. Type.

rounded convexly behind; least depth of caudal peduncle 3⅘ in head; pectoral 1⅗, rays 20; ventral rays I, 5, fin 1⅛ in total head length.

Color in alcohol, back and upper surfaces dull brown, everywhere more or less finely specked, dotted and spotted with darker, though markings nowhere much contrasted. On sides of head and opercle they are larger, coarser, and fewer. All over back above traces of dark arcs and circles, nowhere prominent. Entire under surfaces whitish, with dull-gray or brown tints. Eyes dark gray above, with dark blotches and mottling, pale to whitish below. First dorsal gray black, with some obscure pale blotches on first membrane. Second dorsal pale, with two dark spots on each ray. Caudal pale or light brown, with five transverse dark bars, last subterminal and empha-

sized with several blackish-brown spots. Anal transparent. Pectoral pale, with four very slightly darker transverse bars above. Ventral pale.

Philippines. Known chiefly by the long preopercle spine and white color of the thorax.

Characterized by its dentition and especially by the long opercular flap encroaching on the pectoral fin base. Ventral without upper basal membrane connecting fin to lower outer part of pectoral. It differs from *Eleutherochir opercularis* in the projecting lower jaw, the crooked or arched terminal preopercular spine, narrower bony interorbital, and pale ventrals.

Type.—U.S.N.M. No. 99435. Hinunañgan Bay, Leyte. Seine. July 30, 1909. Length 52 mm.

(Named for David McCadden, formerly taxidermist in the Academy of Natural Sciences of Philadelphia, to whom I am indebted for many American fishes.)

DICALLIONYMUS, new genus

Type.—Callionymus goramensis Bleeker.

Body elongate, slender, depressed anteriorly. Head moderate, depressed, as seen from above tapering into rather narrowly triangular muzzle. Snout nearly pyramidal. Eye rather large, well invading upper profile of head, upper velum of eye invading pupil above. Mouth protractile down and forward, jaws subequal or lower little shorter. Maxillary reaches front of eye, entire. Teeth in villiform bands in jaws. Interorbital very narrow bony frenum, between large close-set eyes. Long preopercular spine 1½ times eye in length; with small basal denticle directed forward, terminal spine upturned and with five others along its upper edge. Gill opening small slit, concealed by opercular flap, which rounded and not reaching pectoral base. Upper lateral line normal, along upper side of back; lower lateral line extends only along lower side of tail, and like upper extended on caudal base. First dorsal spine elongate, filamentous, reaches back well into middle of second dorsal. Last dorsal ray nearly long as head and reaches well into caudal base. Edge of soft dorsal entire. Anal with a slight notch along edge of each membrane. Caudal but little longer than head, cuneate, lower median rays longest. Pectoral broad, little shorter than head. Ventral longer than pectoral, broad with inner membrane well connected up on pectoral base. Anal papilla simple point. Coloration pale, variegated.

Distinguished from *Synchiropus*, with which it was later placed by Bleeker, this genus is unique among the Callionymidae in the presence of two lateral lines. It resembles *Synchiropus* in its gill openings.

(δις, two + *Callionymus;* with reference to the two lateral lines.)

DICALLIONYMUS GORAMENSIS (Bleeker)

Callionymus goramensis BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 15, p. 214, 1858 (type locality: Goram Island).

Synchiropus goramensis BLEEKER, Versl. Meded. Akad. Wet. Amsterdam, ser. 2, vol. 14, p. 101, 1879 (Goram).

Eleven examples. Pandanan Island. Seine 130 feet. March 23, 1909. Length 33 to 71 mm.

AMORINAE, new subfamily

Type genus.—*Amora* Gray.

Long tentacle above each eye. Gill opening behind preopercular spine. Body spinulose. Two distinct dorsal fins.

Genus AMORA Gray

Amora GRAY, Illustrations of Indian zoology, Hardwicke, vol. 2, pl. 90, fig. 1, 1833–34. (Type *Amora tentaculata* Gray, monotypic.)

Anaora GRAY, ibid., in directions for arranging the plates. (Type, *Amora tentaculata* Gray.)

Body moderately elongate, little broader than deep. Head large, depressed moderately. Snout rather long. Eye large, elevated, but little advanced in head length. Mouth terminally inferior. Above each eye a filament, twice eye length. Gill opening behind preopercular spine. First dorsal begins over gill opening, with four spines, about high as second dorsal. Second dorsal with eight rays, last branched. Anal similar with seven rays; also last branched. Paired fins little shorter than head.

This genus, long overlooked, was originally established on the colored figure published and named by Gray as *Amora tentaculata*. Bleeker in 1879 appears to have been the last author that accepted it. Though he diagnosed the genus he failed to call attention to any of the specific characters, some of which are of sufficient importance to be readily made out. He mentioned that the body is spinulose, and this is better indicated by Gray's figure 1a, giving a dorsal view. This suggests that *Callionymus fimbriatus* Herre,[5] described with short conspicuous cutaneous filaments on the body, and otherwise largely in agreement, is a synonym of *Amora tentaculata* Gray.

AMORA TENTACULATA Gray

Amora tentaculata GRAY, Illustrations of Indian zoology, Hardwicke, vol. 2, pl. 90, figs. 1, a-b, 1833–34 (type locality: Amboina).—BLEEKER, Versl. Meded. Akad. Wet. Amsterdam, ser. 2, vol. 14, p. 107, 1879 (reference).

Synchiropus tentaculatus HERRE, Philippine Journ. Sci., vol. 35, p. 33, pl. 3, 1928 (type locality, Puerto Galera).

One example. Port Caltom. December 15, 1908. Caught in seine. Length 46 mm.

[5] The fishes of the Herre 1931 Philippine Expedition, p. 94, 1934 (type locality: Sitanki Reef).

Two examples. Port Galera, Mindoro. June 9, 1908. Caught in a seine. Length 36 to 48 mm.

One example. Romblon. March 26, 1908. Caught in seine. Length 62 mm. [817].

19319. Sandakan Bay, Borneo. March 2, 1908. Caught in seine. Length 39 mm.

[2158.] Great Tobea Island. Tide pool. December 15, 1909. Length 42 mm.

DRACULINAE, new subfamily

Type genus.—*Draculo* Snyder.

Only one dorsal, corresponds to second dorsal of other genera.

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REVISION OF THE NORTH AMERICAN MOTHS OF THE FAMILY OECOPHORIDAE, WITH DESCRIPTIONS OF NEW GENERA AND SPECIES

By J. F. Gates Clarke

INTRODUCTION

This study of the North American Oecophoridae was begun several years ago at the suggestion of August Busck, of the United States Bureau of Entomology and Plant Quarantine. In the beginning I had intended to do only a specific revision of the genera *Agonopterix* and *Depressaria*. It soon became apparent, however, that it would be necessary to study carefully all the species known from North America together with many from other parts of the world. Hence this paper has become a revision of the entire family.

In North America the family Oecophoridae comprises a large group of small to medium-sized moths most of which are inconspicuously colored. A few, however, are brilliantly marked. The moths are chiefly nocturnal, but some may be seen flying about in the bright sunlight. Because of their retiring habits they are seldom seen and are best secured by rearing the larvae.

The majority of the Oecophoridae are leaf and flower feeders in the larval stage. Those that feed in the inflorescence usually attack plants of the family Umbelliferae, while the leaf feeders attack a large variety of plants in many families. Some are forest insects.

Besides the leaf and flower feeders there are others that feed on stored products, such as dried foods, bulbs, and tubers. Some are scavengers and feed in the refuse occurring in the nests of mice and birds. Some live in the cracks of bark, others beneath the bark where

they feed either on refuse or bits of dried vegetable matter. One (*Martyrhilda sphaeralceae*, new species) is a leaf miner.

Among the flower feeders the most important is *Depressaria heracliana* (Linnaeus) (the parsnip webworm), which does considerable damage to commercially grown parsnips by destroying the flower-heads and immature seeds. A closely related species, *D. cinereocostella* Clemens, has been recorded from caraway but is most frequently found on closely related indigenous plants such as *Sium lineare* Michx.

Among the forest insects we find *Agonopterix argillacea* (Walsingham), which has been reared in quantity from willow (*Salix* spp.). The species of the genus *Psilocorsis* attack beech (*Fagus grandifolia* Ehrh.), oak (*Quercus* spp.), and pecan (*Carya pecan* Aschers. & Graebn.) and hickory (*Carya ovata* (Mill.) Koch). *P. caryae*, new species, is of considerable importance in the South, where it is destructive to pecan. In the immediate vicinity of Washington, D. C., the larvae of *P. faginella* (Chambers) do a great deal of damage to beech.

In addition we have the European *Carcina quercana* Fabricius, which is an oak feeder and has been introduced on Vancouver Island, British Columbia, and *Machimia tentoriferella* Clemens, which feeds on *Castanea*, *Juglans*, *Quercus*, and *Prunus*.

The scavenger bulb moth, *Hofmannophila pseudospretella* (Stainton), is recorded from stored bulbs and tubers of tulip, dahlia, and gladiolus and from dried fruits and other stored products (see hosts under species) and is a common pest in houses. It is found throughout Europe and America and in New Zealand.

Endrosis lactella (Schiffermüller) does considerable damage on the Pacific coast and in Europe, feeding on stored cereals, fruits, and other products.

The pupae are formed in debris, in leaves, or in hollow stalks and do not protrude at the time of emergence of the moth. Many species hibernate as adults.

Several species are of considerable economic importance. Notable among these are *Endrosis lactella* (Schiffermüller), *Hofmannophila pseudospretella* (Stainton), and *Depressaria heracliana* (Linnaeus).

The distribution of the North American Oecophoridae appears to center about the Southwestern States, particularly Arizona, Colorado, and California. The genus *Agonopterix*, the largest in the family, is particularly well represented in western North America.

Since Busck[1] published his paper on the North American moths of this family no attempt has been made to revise the group. He

[1] Busck, A., A generic revision of American moths of the family Oecophoridae, with descriptions of new species. Proc. U. S. Nat. Mus., vol. 35, pp. 187–207, 1908.

recognized 19 genera and 121 species of North American Oecophoridae. In the Barnes and McDunnough list[2] the authors followed Busck in recognizing 19 genera but enumerated only 98 species, the remainder being transferred to other families. Meyrick[3] recognized 17 North American genera and 104 species.

EXCLUSION OF UNRELATED FORMS

Within the family I recognize 22 genera and 117 North American species. Six genera, 19 species, and 1 race are described as new in this paper.

The genus *Endrosis* is retained in the family with doubt. Busck[4] transferred *Triclonella* to the Cosmopterygidae in 1932. I have removed *Eumeyrickia* and *Gerdana* from the family and have placed them in the families Ethmiidae and Blastobasidae, respectively. For part of the species formerly placed in *Borkhausenia* I have erected the genus *Anoncia* and have referred it to the Cosmopterygidae. For *Semioscopis acertella* Busck I have erected the genus *Antequera* and have placed it in the family Cosmopterygidae.

CHARACTERS OF THE FAMILY

Head usually smooth, with loosely appressed scales; often with raised side tufts. Antenna simple to strongly ciliated, usually with pecten on basal segment but frequently with pecten absent or slightly developed. Labial palpus well developed, usually long, upwardly curved, variously scaled; terminal segment acutely pointed. Maxillary palpus short, filiform, appressed. Prothoracic and mesothoracic legs normally slender, moderately long; posterior tibia with long rough hairs above.

Fore wing with 12 veins (or 11 by coincidence of veins 7 and 8); 1b furcate at base; 1c always preserved, at least at margin; 7 and 8 stalked or coincident, 7 to costa, apex or termen.

Hind wing with eight veins or rarely seven by coincidence of veins 5 and 4 (*Endrosis*); veins 6 and 7 remote, subparallel; veins 3 and 4 normally stalked or connate (rarely separate); 8 free; 5 nearer to 4 than to 6 (except *Oecophora* and *Mathildana*).

Male genitalia symmetrical; harpe with or without clasper, base of harpe broadly attached; sacculus well defined; cucullus rounded or pointed except in *Carcina*, where it is greatly reduced and weakly sclerotized. Anellus a simple plate or with moderately or well developed lateral processes. Aedeagus with very small "blind sac" or

[2] Barnes, W., and McDunnough, J., Check list of the Lepidoptera of Boreal America, pp. 160–162, 1917.

[3] Meyrick, E., *in* Wytsman, Genera insectorum, fasc. 180, 1922.

[4] Busck, A., Proc. Ent. Soc. Washington, vol. 34, p. 19, 1932.

none. The entrance of the penis is dorsal, near the proximal end. Vinculum bandlike or moderately produced. Gnathos present.[5] Socii and uncus present or absent. First and eighth segments simple or with hair pencils.

Female genitalia: Ostium opening in median part of genital plate, the latter simple or modified (*Fabiola*, *Inga*); signum present or absent; abdomen weakly or strongly sclerotized; sometimes spinose.

The foregoing characters will serve to distinguish this family from all other Lepidoptera except a few Blastobasidae and Ethmiidae. The Blastobasidae may be separated from the Oecophoridae by the widely separate veins 11 and 10 of the fore wing, the proximity of veins 2 to 10, and the thickening of the membrane below the costa (the "stigma" of Zeller). Certain of the oecophorid genera have some of the characters of the Blastobasidae while lacking others. *Endrosis* possesses a spinose abdomen, a character frequently encountered in the Blastobasidae,[6] but lacks the characters listed in the foregoing paragraph as being typical of that family. The larva of *Endrosis* further suggests Blastobasidae. The Ethmiidae may be distinguished from the Oecophoridae (except *Oecophora* and *Mathildana*) by the proximity of vein 5 to 6 of the hind wing; and the characteristic male genitalia, which exhibit a primitive segmented type of harpe.

I have removed the genera *Oecophora* and *Borkhausenia* from our American lists, as the only species formerly included are referable to other genera.

For *haydenella* and *pseudospretella* I have resurrected the names *Chambersia* Riley and *Hofmannophila* Spuler, respectively. For *ascriptella* Busck I have erected the genus *Carolana*. I propose the genus *Mathildana* for *newmanella* and have restricted *Oecophora* to *bractella* and its congeners. I retain all these in the family Oecophoridae.

Larva.[7]—With primary setae only (except in *Apachea*, which has a few secondary hairs in group VII on most of the abdominal segments and two or three on the prothoracic shield); three setae on prespiracular shield of prothorax; setae IV and V approximately and directly below or (frequently) ventrocephalad of the spiracle on proleg-bearing segments; on eighth abdominal segment seta III usually dorsocephalad of the spiracle, rarely directly above, never dorsocaudad or with a

[5] The genera of the family fall into two groups on characters of the gnathos. *Agonopterix*, *Bibarrambla*, *Apachea*, *Depressaria*, *Semioscopis*, *Martyrhilda*, *Machimia*, *Himmacia*, and *Psilocorsis* fall into a group with a spiny gnathos. The remaining genera are without spines on the gnathos. This suggests a division that may be of subfamily significance.

[6] The spinose abdomen is found in at least seven other oecophorid genera. They are *Martyringa*, *Borkhausenia*, *Hofmannophila*, *Carolana*, *Pleurota*, *Inga*, and *Semioscopis*.

[7] The setal characters of group VII should be used with caution as occasional abnormal specimens occur in nearly all species. A hair may be missing from the group on either the first or eighth abdominal segment, but only on one side of the insect. The opposite side is nearly always normal.

pigmented sclerotized ring surrounding the base of the tubercle; on ninth abdominal segment seta I ventrocephalad of II, rarely approximate to II (*Endrosis*, *Hofmannophila*), usually about equidistant from II and III, III much nearer to IV–V than to I, IV and V closely approximate, VI rarely (*Psilocorsis*) on the same pinaculum with IV–V, sometimes approximate to VII, VII unisetose. Legs and prolegs normal. Crochets in a complete circle, biordinal and, occasionally, irregularly triordinal, never in a penellipse (or a ring broken outwardly).

Head with adfrontals extending to incision of dorsal hind margin of epicranium; frons not extending to incision of hind margin; a longitudinal ridge always present; epicranial seta L^1 usually closer to A^3 than A^3 is to A^2. Ocelli normally six (reduced to 4 or 2 in *Hofmannophila* and *Endrosis*), arranged approximately in a parallelogram; 3 and 4 mostly in a straight line with 2 and 5; 3 and 4 closely approximate.

Pupa.—Smooth or pubescent. Body usually depressed. Epicranial suture present; frontoclypeal suture not distinct for its entire length or reaching the meson; maxillary palpi present, large, usually reaching proximolateral angles of maxillae; caudal portions of antennae lying adjacent on the meson, separating at their distal ends to expose metathoracic legs; maxillae from one-half to two-thirds the length of wings; labial palpi rarely exposed (*Endrosis*). Prothoracic femora sometimes exposed, often not. Abdomen with segments 4 to 6 movable and with deep incisions between these segments on dorsal and ventral surfaces; genital and anal openings slitlike in both sexes; no hooked setae on ventral surface of ninth segment; cremaster absent or shortly developed.

CLASSIFICATION

In the classification of this family venation, palpi, general habitus, and genitalia have been employed in this revision. The genitalia are especially helpful and have been used to separate species as well as genera. I have found the anellus of the male genitalia to be particularly useful, and in most cases it is possible to separate species as well as genera by this structure.

The palpi are normally useful in the separation of genera but in a few cases cannot be relied upon. The eyes and vestiture of the head may be useful taxonomically, and Meyrick laid great weight on the length of the ciliation of the antennae, but the modifications of these characters appear to be too gradual for safe generic differentiation and have not been employed in this paper.

Venation is usually reliable within a genus, but occasionally unusual venation is encountered. A large number of genera have nearly identical venation, but such cases are easily separable on genitalia or ex-

ternal characters. In a few the venation is unstable. This is particularly true of veins 2 and 3 of the fore wing of *Semioscopis* and veins 3 and 4 of the hind wings of *Agonopterix* and *Depressaria*. The genitalia of these three genera distinguish them, however, from all others. The species fall, with one or two exceptions, into natural groups on habitus as well as on structure, so that the definition of genera is comparatively simple.

In a few genera it is not entirely clear what we are dealing with. For example, in *Depressaria* there are five distinct species groups, which may actually represent separate genera. The *leptotaeniae-multifidae* group is especially interesting and represents a series of "species" that may represent only simple Mendelian variants of *one* species. As will be noted, in the proper place, all these except *yakimae* are of practically the same color and have closely similar habits and hosts, yet all have distinct genitalia.

In the genus *Psilocorsis* it is particularly difficult to separate many of the species (*reflexella-faginella* group), and here we are confronted again with the problem of what actually constitutes a species.

These problems can be settled only by careful breeding, and in the meantime we shall have to content ourselves with the supposition that genitalic differences represent specific entities or genera depending on their nature. Nevertheless, I strongly suspect that Mendelian variation may be transmitted to the genitalia as well as other structures and that eventually we shall be able in most instances to use genitalic characters for group separation only.

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The drawings for this paper were made by the author. Whenever possible the genitalia were figured from the type, either male or female, and where the type was not available, from paratypes or authentically determined specimens. I have been able to examine the genitalia, both male and female, of all the genotypes and of either male or female, or both, of all the species of *Agonopterix* and *Depressaria* except *A. endryopa* (Meyrick), *A. murmurans* (Meyrick), *D. nymphidia* Meyrick, *D. corystopa* Meyrick, *Borkhausenia aciculata* Meyrick, and *Paratheta astigmatica* Meyrick. I am unable to recognize these species.

For most of the Canadian records no reference is made to the sex of the specimens. These records were sent to me by Dr. McDunnough.

The following keys to the genera include all genera discussed by Busck (1908), with the addition of two old and six new genera described in this paper.

ARTIFICIAL KEY TO THE GENERA

1. Basal segment of antenna with pecten (figs. 3, 4, 6, 9, etc.)---------- 2
   Basal segment of antenna without pecten (figs. 7, 10, 14, 18, etc.)------ 13
2. Second segment of labial palpus long, straight, porrect (fig. 6)
   12. **Pleurota** (p. 230)
   Second segment of labial palpus otherwise (figs. 3, 4, 9)---------- 3
3. Antenna longer than fore wing---------- 13. **Carcina** (p. 233)
   Antenna shorter than fore wing---------- 4
4. Veins 7 and 8 of fore wing coincident (fig. 55)------ 16. **Decantha** (p. 241)
   Veins 7 and 8 of fore wing not coincident---------- 5
5. Veins 2 and 3 of fore wing stalked (figs. 29, 44, 45)---------- 6
   Veins 2 and 3 of fore wing separate---------- 8
6. Costa of fore wing arched; costa of hind wing arched, veins 4 and 5 well separated (figs. 29, 45)---------- 7
   Costa of fore wing straight or slightly concave; costa of hind wing concave, veins 4 and 5 closely approximate at bases (fig. 44)---------- 2. **Martyrhilda** (p. 125)

[8] Now at the Department of Botany, University of California, Berkeley, Calif.
[9] Now at the Department of Botany, University of Hawaii, Honolulu.

7. Abdomen flattened; labial palpus with well-developed brush on second segment; hind wing lobed at anal angle--- 1. **Agonopterix** (p. 43)
Abdomen not flattened; labial palpus without well-developed brush on second segment; hind wing without lobe at anal angle. 3. **Bibarrambla** (p. 146)
8. Costa of hind wing excavated (fig. 51)---------- 22. **Endrosis** (p. 262)
Costa of hind wing not excavated---------- 9
9. Second segment of labial palpus with brush (figs. 11, 16)---------- 10
Second segment of labial palpus without brush (figs. 3, 4, 12)---------- 11
10. Brush of labial palpus broadly triangular (fig. 16)----- 6. **Apachea** (p. 197)
Brush of labial palpus not broadly triangular (fig. 11) 5. **Depressaria** (p. 163)
11. Fore wing lanceolate, apex pointed; veins 3 and 4 of hind wing stalked (fig. 49)---------- 15. **Carolana** (p. 239)
Fore wing not lanceolate, apex not pointed; veins 3 and 4 of hind wing connate or closely approximate (figs. 43, 46)---------- 12
12. Veins 2 and 3 of fore wing remote (fig. 46)------- 19. **Chambersia** (p. 252)
Veins 2 and 3 of fore wing approximate (fig. 43) 21. **Hofmannophila** (p. 258)
13. Fore wing: Veins 8 and 9 out of 7 (fig. 39)-------- 11. **Martyringa** (p. 228)
Fore wing: Vein 9 separate---------- 14
14. Labial palpus with longitudinal stripes---------- 9. **Psilocorsis** (p. 204)
Labial palpus without longitudinal stripes---------- 15
15. Fore wing with veins 7 and 8 coincident (fig. 41)------ 17. **Fabiola** (p. 244)
Fore wing with veins 7 and 8 otherwise---------- 16
16. Hind wing with vein 5 nearer to 6 than to 4 (fig. 50) 14. **Mathildana** (p. 236)
Hind wing with vein 5 nearer to 4 than to 6---------- 17
17. Discocellulars of hind wing strongly outwardly oblique between veins 4 and 6 (fig. 31)---------- 8. **Himmacia** (p. 202)
Discocellulars not outwardly oblique between veins 4 and 6---------- 18
18. Fore wing with vein 2 distant from 3 (figs. 33, 47, 56)---------- 19
Fore wing with vein 2 approximate (sometimes connate or stalked with 3 in *Semioscopis*) to 3 (figs. 35, 37)---------- 21
19. Costa of hind wing excavated (fig. 47)---------- 20. **Epicallima** (p. 254)
Costa of hind wing not excavated (figs. 33, 56)---------- 20
20. Fore wing broad; termen straight (fig. 33)---------- 7. **Machimia** (p. 198)
Fore wing narrow, pointed; termen confluent with inner margin (fig. 56)---------- 18. **Schiffermülleria** (p. 246)
21. Fore wing with costa and inner margin parallel; vein 11 from middle of cell (fig. 37)---------- 10. **Inga** (p. 217)
Fore wing with costa and inner margin strongly divergent; vein 11 from well before middle of cell (fig. 35)------ 4. **Semioscopis** (p. 149)

KEY TO THE GENERA BASED ON MALE GENITALIA

1. Gnathos strongly spined (figs. 59, 62, 64, etc.)---------- 2
Gnathos not spined (figs. 60, 76, 78, etc.)---------- 10
2. Transtilla and anellus fused (fig. 86)---------- 6. **Apachea** (p. 197)
Transtilla and anellus not fused (figs. 62, 64, etc.)---------- 3
3. Anellus with long, free lateral processes (fig. 70)---- 7. **Machimia** (p. 198)
Anellus without long, free lateral processes (figs. 59, 64, etc.)---------- 4
4. Uncus well developed (figs. 59, 64)---------- 5
Uncus absent, or if present, poorly developed (figs. 62, 65, 67, etc.)---- 6
5. Clasper present (fig. 64)---------- 8. **Himmacia** (p. 202)
Clasper absent (fig. 59)---------- 9. **Psilocorsis** (p. 204)

6. Sacculus extended as a furcate process or as a broad truncated expansion with a small toothlike clasper; or vesica armed with a forked or strongly curved single cornutus. 4. **Semioscopis** (p. 149)
Sacculus and cornuti not as above 7
7. Clasper absent or present; if present then the aedeagus twisted; or sacculus with process from base; or aedeagus with basal process ..... 5. **Depressaria** (p. 163)
Clasper always present but without the above combinations (figs. 62, 65, 67) 8
8. Clasper divided (fig. 67) ..... 2. **Martyrhilda** (p. 125)
Clasper simple (figs. 62, 65) 9
9. Uncus and socii fused forming hood (fig. 65) ..... 3. **Bibarrambla** (p. 146)
Uncus (if present) and socii not fused (fig. 62) ..... 1. **Agonopterix** (p. 43)
10. Anellus with lateral processes (figs. 60, 61, 62, etc.) 14
Anellus without lateral processes (figs. 69, 72, 78, 80) 11
11. Clasper present (figs. 78, 80) 12
Clasper absent (figs. 69, 72) 13
12. Clasper concave distally; aedeagus coiled, bandlike basally (figs. 78, 78a) ..... 21. **Hofmannophila** (p. 258)
Clasper never concave distally; aedeagus never coiled or bandlike basally (figs. 80, 80a) ..... 10. **Inga** (p. 217)
13. Gnathos flat, broad, shovel-shaped; vinculum narrowly rounded (fig. 69) ..... 15. **Carolana** (p. 239)
Gnathos narrowed distally; vinculum strongly produced anteriorly (fig. 72) ..... 11. **Martyringa** (p. 228)
14. Extension of sacculus with tuft of strong, curved setae (fig. 71) ..... 13. **Carcina** (p. 233)
Sacculus without such tuft 15
15. Sacculus with pointed, curved or nearly straight, free extension (figs. 60, 61, 66, 81) 16
Sacculus without such free extension (figs. 74, 76, 79, 82) 19
16. Vinculum spatulate (fig. 60) ..... 22. **Endrosis** (p. 262)
Vinculum rounded (figs. 61, 66, 81) 17
17. Vesica unarmed (fig. 61a) ..... 17. **Fabiola** (p. 244)
Vesica strongly armed (figs. 66a, 81a) 18
18. Lateral processes of anellus flattened and expanded distally (fig. 66) ..... 16. **Decantha** (p. 241)
Lateral processes of anellus not appreciably flattened; pointed distally (fig. 81) ..... 20. **Epicallima** (p. 254)
19. Vesica strongly armed (fig. 74a) ..... 14. **Mathildana** (p. 236)
Vesica unarmed (figs. 76a, 79a, 82a) 20
20. Lateral processes of anellus sharply pointed; aedeagus small, weak (figs. 79, 79a, 82, 82a) 21
Lateral processes of anellus dilated distally; aedeagus stout (figs. 76, 76a) ..... 12. **Pleurota** (p. 230)
21. Lateral processes of anellus very broad basally; gnathos pointed (fig. 79) ..... 19. **Chambersia** (p. 252)
Lateral processes of anellus of about equal width throughout; gnathos not pointed (fig. 82) ..... 18. **Schiffermülleria** (p. 246)

KEY TO THE GENERA BASED ON FEMALE GENITALIA

1. Anterior apophyses branched (figs. 101, 116) 2
Anterior apophyses not branched (figs. 95, 97, etc.) 3

2. Ovipositor always extended after death; ductus bursae not convoluted (fig. 116)---------- 22. **Endrosis** (p. 262)
   Ovipositor not extended after death; ductus bursae convoluted (fig. 101)---------- 21. **Hofmannophila** (p. 258)
3. Bursa copulatrix single (figs. 97, 99, etc.)---------- 4
   Bursa copulatrix double (fig. 105)---------- 9. **Psilocorsis** (p. 204)
4. Ductus bursae with saclike evagination from ventral surface (fig. 118)---------- 14. **Mathildana** (p. 236)
   Ductus bursae without such evagination---------- 5
5. Inception of ductus seminalis at, or anterior to, middle of ductus bursae (figs. 87, 91, 95, 98, 115)---------- 6
   Inception of ductus seminalis posterior to middle of ductus bursae (figs. 109, 110, etc.)---------- 10
6. Signa several (fig. 87)---------- 12. **Pleurota** (p. 230)
   Signum, if present, single---------- 7
7. Signum a weakly developed toothed plate (figs. 91, 115)---------- 8
   Signum absent or, if present, not as above---------- 9
8. Ductus bursae membranous (fig. 115)---------- 19. **Chambersia** (p. 252)
   Ductus bursae at least partly sclerotized (fig. 91)---- 16. **Decantha** (p. 241)
9. Genital plate strongly convex, protruding (fig. 95)----- 17. **Fabiola** (p. 244)
   Genital plate convex but not protruding (figs. 98, 213–215) 18. **Schiffermülleria** (p. 246)
10. Ductus bursae strongly sclerotized, broadened and somewhat flattened posterior to inception of ductus seminalis (figs. 90, 92, 99)---------- 11
    Ductus bursae otherwise---------- 13
11. Signum present; sclerotized portion of ductus bursae armed on inner surface (fig. 99)---------- ---------- 20. **Epicallima** (p. 254)
    Signum absent; ductus bursae unarmed (figs. 90, 92)---------- 12
12. Ostium protruding; ventroanterior edge strongly sclerotized (fig. 90)---------- 11. **Martyringa** (p. 228)
    Ostium not protruding; ventroanterior edge membranous (fig. 92)---------- 7. **Machimia** (p. 198)
13. Signum very large, broadly oval or elongate (fig. 100) 2. **Martyrhilda** (p. 125)
    Signum, if present, otherwise---------- 14
14. Signum absent (figs. 89, 229, 240, 272)---------- 15
    Signum present (figs. 96, 102, 109, etc.)---------- 16
15. Area surrounding ostial opening always membranous (figs. 89, 206–210)---------- 10. **Inga** (p. 217)
    Area surrounding ostial opening always sclerotized (figs. 229, 240, etc.)---------- 1. **Agonopterix** (part) (p. 43)
16. Genital plate dilated ventrolaterally; ostium transverse, slitlike (fig. 88)---------- 13. **Carcina** (p. 233)
    Genital plate otherwise---------- 17
17. Signum a toothed plate (figs. 102, 103, 109, etc.)---------- 18
    Signum a small plate with median keel (fig. 110)---- 8. **Himmacia** (p. 202)
18. Ductus bursae armed with small teeth for much of its length (fig. 96)---------- 15. **Carolana** (p. 239)
    Ductus bursae otherwise---------- 19
19. Signum a distinct cross; ostium very large (fig. 94)---- 6. **Apachea** (p. 197)
    Signum and ostium otherwise---------- 20

20. Signum a moderately large plate with two or three large strong teeth (fig. 109)---------- 3. **Bibarrambla** (p. 146)
Signum otherwise---------- 1. **Agonopterix** (part) (p. 43); 5. **Depressaria** (p. 163); 4. **Semioscopis** (p. 149)

1. Genus AGONOPTERIX Hübner

PLATE 2, FIGURE 13; PLATE 6, FIGURE 45; PLATE 8, FIGURES 62, 62a; PLATE 17, FIGURE 103

Agonopterix HÜBNER, Verzeichniss bekannter Schmetterlinge, p. 410, 1826.—PIERCE and METCALFE, The genitalia of the British Tineina, pp. 35–38, 1935. (Genotype: *Pyralis ocellana* Fabricius, Systema entomologiae, p. 652, 1775.)

Agonopteryx BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.—WALSINGHAM, Biol. Centr.-Amer., Lepidoptera-Heterocera, vol. 4, pp. 135–136, 1912.—BARNES and BUSCK, Contr. Lepid. North America, vol. 4, pp. 231–233, 1920.—SASSCER, Journ. Econ. Ent., vol. 13, p. 183, 1920.—BRAUN, Proc. Acad. Nat Sci. Philadelphia, vol. 73, pt. 1, p. 10, 1921.—BUSCK, Can. Ent., vol. 53, pp. 277–278, 1921.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, pp. 236–241, 1923.—CLARKE, Can. Ent., vol. 65, pp. 84–85, 1933.—MCDUNNOUGH, Can. Ent., vol. 67, pp. 74–75, 1935.

Agonopterys ELY, Proc. Ent. Soc. Washington, vol. 12, p. 68, 1910.

Agnopteryx BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, p. 160, 1917.

Epeleustia HÜBNER, Verzeichniss bekannter Schmetterlinge, p. 410, 1826.—WALSINGHAM, Biol. Centr.-Amer., Lepidoptera-Heterocera, vol. 4, p. 136, 1912.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 169, 1922. (Genotype: *Tinea hypericella* Hübner, Sammlung europäischer Schmetterlinge, vol. 8, fig. 441, 1796.)

Pinaris HÜBNER, Verzeichniss bekannter Schmetterlinge, p. 411, 1826.—WALSINGHAM, Biol. Centr.-Amer., Lepidoptera-Heterocera, vol. 4, p. 135, 1912.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 169, 1922. (Genotype: *Tinea gilvella* Hübner, Sammlung europäischer Schmetterlinge, vol. 8, fig. 96, 1796; synonym of *Agonopterix arenella* Schiffermüller.)

Tichonia HÜBNER, Verzeichniss bekannter Schmetterlinge, p. 412, 1826.—WALSINGHAM, Biol. Centr.-Amer., Lepidoptera-Heterocera, vol. 4, p. 136, 1912.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 169, 1922. (Genotype: *Phalaenae Tineae atomella* Schiffermüller, Systematisches Verzeichniss der Schmetterlinge der Wiener Gegend, p. 137, 1776.)

Haemylis TREITSCHKE, Die Schmetterlinge von Europa, vol. 9, p. 235, 1832.—WALSINGHAM, Biol. Centr.-Amer., Lepidoptera-Heterocera, vol. 4, p. 136, 1912.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 169, 1922. (Genotype: *Haemylis assimilella* Treitschke, Die Schmetterlinge von Europa, vol. 9, p. 259, 1832.)

Head with appressed scales; tongue developed; antenna ciliated or simple; basal segment elongate, with pecten; labial palpus long, recurved; second segment with well-developed furrowed brush; terminal segment shorter than (or rarely as long as) second segment, sometimes roughly scaled, acute. Thorax smoothly scaled to strongly crested.

Fore wing elongate (narrow to moderately broad); 12 veins; 2 and 3 stalked; 7 and 8 stalked; 7 to costa or apex.

Hind wing as wide as or wider than fore wing, with costa nearly straight, termen evenly rounded; 8 veins; 3 and 4 connate or short-stalked; 5 curved, approximate to 4; 6 and 7 subparallel. Abdomen flattened.

Male genitalia.—Harpe ample; clasper present, simple. Anellus without well developed fingerlike processes. Vesica with or without cornuti. Socii fleshy. Uncus reduced or lacking.

Female genitalia.—Bursa copulatrix with or without signum; ductus bursae membranous throughout (except *fulva*).

Larva.—Ninth abdominal segment with setae I and II well separated (I as near or nearer to III than to II) : seta VI not on a single pinaculum with IV and V but not approximate to VII. Setal group VII bisetose on first and seventh abdominal segments, unisetose on eighth and ninth abdominal segments, normal (trisetose) on proleg-bearing abdominal segments. Ocelli normal. Submentum without sclerotized pit.

Pupa.—Pubescent. Prothoracic femora and labial palpi not exposed. Cremaster absent.

Remarks.—*Agonopterix* is a valid genus readily separable from *Depressaria*, with which Meyrick and others continue to synonymize it, and from *Apachea*. The stalking of veins 2 and 3 of the fore wing in *Agonopterix* is constant and is associated with the absence of the long lateral processes of the anellus so frequently encountered in *Depressaria* and other oecophorid genera. The pattern of the fore wings of *Agonopterix* always differs from that of *Depressaria* by entirely lacking conspicuous longitudinal streaks such as are found in the latter genus.

The moths of this genus, with the exception of one small group, form an extremely compact assemblage of species, often difficult to separate. The male genitalia are strikingly similar, species being best separated on characters of the anellus, clasper, and aedeagus. The anellus seems to be the most stable of the three and may suffice for separation of species where the other two fail. The length of the harpes (*psoraliella* and others) and the shape of the cucullus are apt to vary considerably. (In preparing mounts of the genital organs great care must be exercised to eliminate distortion and shrinkage.)

The remaining species of the genus all have fingerlike claspers, small, numerous, few, or no cornuti on the vesica, and all the females have a closely similar type of genitalia with or without a signum. The wing form varies from moderately narrow to broad, and the palpus has a well-developed brush on the second segment. There are, however, in this last large group, sections that show divergence

from the usual type. One section of the group, consisting of *atrodorsella*, *scabella*, *pulvipennella*, *pteleae*, and *eupatoriiella*, forms a very closely knit complex. Another section, consisting of *gelidella*, *hyperella*, *lythrella*, *nubiferella*, and *arcuella*, forms another complex of species so closely related that separation on male genitalia is difficult. The female genitalia, however, usually give good characters, but where they fail larvae or host plants suffice to distinguish the species.

In addition there are two species, *fulva* and *arnicella*, which have become modified and represent offshoots from the type stock.

The remaining species form a group of very closely related forms.

Busck [10] lists 39 species as belonging to this genus, one (*plummerella*) being described as new. The latter falls as a synonym of *eupatoriiella*. In 1920 Meyrick [11] described *dryadoxena* (synonym of *costosa*) and *sciadopa* (and proposed the new name *testifica* for the supposedly preoccupied *hyperella* Ely). That same year Barnes and Busck [12] described *pteleae*, *latipalpella*, *blacella*, *callosella*, and *terinella*, of which *pteleae* and *latipalpella* are valid species; *blacella* falls as a synonym of *argillacea*, *terinella* falls to *pallidella*, and *callosella* to *sabulella*. In 1921 Busck [13] described *blackmori* (synonym of *costosa*) and Braun [14] described *nivalis*, the latter being valid. In 1926 Braun [15] added *cogitata* (synonym of *canella*), and in 1933 [16] I added *serrae* (synonym of *pallidella*). Keifer [17] added *clarkei* in 1936. In the present paper I have transferred eight species to the new genus *Martyrhilda* and have described eight species and one race as new, bringing the total number of described species for our fauna to 44. There are additional species on hand at the present time, but these are represented by poor or unreared material, and I deem it inadvisable to add more names for these. When long or reared series can be obtained, then, and then only, can we safely add new names. The larvae of comparatively few of the species of this genus are known, but those known are found attacking a large variety of plants. Many larvae roll the leaves of the host plants and feed within the tube thus formed; some are leaf tiers and others feed in webs in the inflorescence or leaves. Pupation occurs in debris on the ground or, occasionally, in the leaf roll made by the larva.

[10] Busck, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.
[11] Meyrick, Exotic Microlepidoptera, vol. 2, p. 315, 1920.
[12] Barnes and Busck, Contr. Lepid. North America, vol. 4, p. 231–233, 1920.
[13] Busck, Can. Ent., vol. 53, p. 277, 1921.
[14] Braun, Proc. Acad. Nat. Sci. Philadelphia, vol. 73, pt. 1, p. 10, 1921.
[15] Braun, Can. Ent., vol. 58, p. 47, 1926.
[16] Clarke, Can. Ent., vol. 65, p. 84, 1933.
[17] Keifer, Bull. Southern California Acad. Sci., vol. 35, p. 10, 1936.

KEY TO THE SPECIES OF AGONOPTERIX BASED ON COLORATION

1. Fore wing roughened with numerous raised scales 2
   Fore wing smooth or with few raised scales 5
2. Fore wing light ochreous-brown with black markings 3
   Fore wing ochreous-fuscous thickly mottled with black and white scales 4
3. A large blackish-fuscous spot at end of cell reaching costa **pteleae** Barnes and Busck (p. 72)
   No such large spot ..... **latipalpella** Barnes and Busck (p. 118)
4. Terminal segment of labial palpus long, recurved **eupatoriiella** (Chambers) (p. 74)
   Terminal segment of labial palpus short, hardly recurved **scabella** (Zeller) (p. 72)
5. Fore wing with crescentic discal dash before middle 6
   Fore wing otherwise 10
6. Fore wing predominantly grayish ochreous **curvilineella** (Beutenmüller) (p. 62)
   Fore wing otherwise 7
7. Discal spot at end of cell yellow or cream colored 8
   Discal spot at end of cell white 9
8. Fore wing grayish lavender ..... **hyperella** Ely (p. 56)
   Fore wing brownish purple ..... **lythrella** (Walsingham) (p. 59)
9. Fore wing predominantly reddish purple ..... **arcuella**, new species (p. 58)
   Fore wing purplish fuscous ..... **gelidella** (Busck) (p. 55)
10. Fore wing some shade of ochreous or yellow 11
    Fore wing otherwise 5
11. Base of fore wing blackish fuscous ..... **atrodorsella** (Clemens) (p. 70)
    Base of fore wing otherwise 12
12. Inner margin of fore wing immaculate, or with minute, inconspicuous dark irrorations 14
    Inner margin of fore wing with conspicuous dark markings 13
13. Inner margin with fuscous subtornal blotch ..... **posticella** (Walsingham) (p. 119)
    Inner margin strongly suffused basally with blackish to reddish-fuscous ..... **flavicomella** (Engel) (p. 105)
14. Third segment of labial palpus with at least two dark annuli 18
    Third segment of labial palpus with one or no dark annulus 15
15. Outer discal spot fuscous 16
    Outer discal spot cream colored or yellow 17
16. Abdomen suffused with fuscous beneath; terminal segment of labial palpus with brownish-red subapical annulus **nubiferella** (Walsingham) (p. 60)
    Adbomen with black lateral line on each side beneath; terminal segment with subapical annulus and apex blackish fuscous **sabulella** (Walsingham) (p. 111)
17. Outer discal spot yellow; terminal segment of labial palpus fuscous with creamy-white median fascia; abdomen with black lateral line on each side ..... **dimorphella**, new species (p. 97)
    Outer discal spot cream colored; terminal segment of labial palpus with apex and subapical annulus black; abdomen with row of black spots on each side beneath ..... **costosa** (Haworth) (p. 113)
18. Outer discal spot absent or indistinct; subbasal annulus of third segment of labial palpus brick red ..... **robiniella** (Packard) (p. 92)

Outer discal spot conspicuous; subbasal annulus of third segment of labial palpus never brick red 19

19. Outer discal spot preceded by an orange-red streak ..... **thelmae**, new species (p. 96)
Outer discal spot not preceded by any such streak 20

20. Outer discal spot whitish or whitish ochreous 21
Outer discal spot black or blackish fuscous 24

21. At basal third of fore wing two conspicuous black discal spots surrounded by a pale ochreous shade ..... **lecontella** (Clemens) (p. 94)
Discal spots at basal third of fore wing not surrounded by a pale ochreous shade 22

22. Ground color of fore wing reddish ochreous; outer discal spot white ..... **pulvipennella** (Clemens) (p. 76)
Ground color otherwise 23

23. Ground color of fore wing whitish ochreous; outer discal spot white with black ring ..... **arnicella** (Walsingham) (p. 90)
Ground color of fore wing pale grayish ochreous; outer discal spot sordid whitish ..... **argillacea** (Walsingham) (p. 98)

24. Fore wing ochreous overlaid with reddish fuscous; third segment of labial palpus with subbasal and supramedial annuli and tip black ..... **fusciterminella**, new species (p. 80)
Fore wing light ochreous irrorated with blackish fuscous and shaded with fuscous; third segment of labial palpus with subbasal and supramedial annuli blackish fuscous, tip whitish ochreous ..... **pallidella** (Busck) (p. 88)

25. Fore wing predominantly red, tawny-red or reddish brown 26
Fore wing otherwise 33

26. Fore wing tawny-red ..... **fulva** (Walsingham) (p. 53)
Fore wing otherwise 27

27. Costa of fore wing conspicuously grayish 28
Costa of fore wing otherwise 29

28. Brush of second segment of labial palpus trumpet-shaped ..... **antennariella**, new species (p. 108)
Brush of second segment of labial palpus not trumpet-shaped ..... **oregonensis**, new species (p. 65)

29. Fore wing crimson-red irrorated with black and cinereous scales; costa lighter, tawny-red ..... **walsinghamella** (Busck) (p. 78)
Fore wing otherwise 30

30. Fore wing reddish brown 31
Fore wing ochreous-white suffused with reddish fuscous and sparsely irrorated with black scales 32

31. Third segment of labial palpus with subbasal and subapical annuli and apex black; abdomen with a lateral row of black spots on each side beneath ..... **psoraliella** (Walsingham) (p. 121)
Third segment of labial palpus with subbasal and subapical annuli black; apex yellowish white; abdomen with four longitudinal rows of fuscous spots beneath ..... **clemensella** (Chambers) (p. 68)

32. Fore wing strongly suffused with reddish fuscous; discal spots usually not sharply contrasted ..... **rosaciliella** (Busck) (p. 83)
Fore wing liberally sprinkled with fuscous to black scales, but these and discal spots usually sharply contrasted ..... **echinopanicis**, new subspecies (p. 86)

33. Fore wing some shade of gray 34
Fore wing otherwise 38

34. Brush of second segment of labial palpus trumpet-shaped; fore wing lavender-gray ..... **nebulosa** (Zeller) (p. 110)
Brush of second segment of labial palpus not trumpet-shaped; fore wing not lavender-gray 35
35. Fore wing without row of dark subterminal spots; ground color gray, carmine tinted; third segment of labial palpus light grayish ochreous with black apex and black spot near base anteriorly ..... **sanguinella** (Busck) (p. 123)
Fore wing and labial palpus otherwise 36
36. Third segment of labial palpus with two conspicuous dark annuli 37
Third segment of labial palpus without conspicuous bands; suffused with ochreous-gray outwardly ..... **muricolorella** (Busck) (p. 64)
37. Fore wing pale yellowish gray with rosy tint on apical third of wing and on basal half of inner margin ..... **canadensis** (Busck) (p. 104)
Fore wing ochreous-gray without rosy tint ..... **senicionella** (Busck) (p. 107)
38. Fore wing grayish fuscous 39
Fore wing otherwise 40
39. Fore wing without dark subterminal spots; third segment of labial palpus with subbasal and supramedial annuli and tip black ..... **cajonensis**, new species (p. 82)
Fore wing with dark subterminal spots; third segment with subbasal and supramedial annuli black; apex sordid whitish **novi-mundi** (Walsingham) (p. 87)
40. Fore wing some shade of brown or fuscous 41
Fore wing luteous, infuscated; cilia fuscous, tipped with luteous **clarkei** Keifer (p. 66)
41. Alar expanse, 16–17 mm 42
Alar expanse, 20–25 mm 43
42. Fore wing violaceous-brown; apical third of terminal segment of labial palpus black ..... **amyrisella** (Busck) (p. 124)
Fore wing ochreous-brown; terminal segment of labial palpus with subbasal and supramedial annuli black; apical third ochreous-white **amissella** (Busck) (p. 117)
43. Fore wing light brown, without row of dark subterminal spots **pergandeella** (Busck) (p. 116)
Fore wing brownish or ochreous-fuscous and with row of dark subterminal spots 44
44. Third segment of labial palpus with basal three-fourths and apex black **nigrinotella** (Busck) (p. 101)
Third segment of labial palpus with subbasal and supramedial annuli and apex blackish fuscous ..... **costimacula**, new species (p. 102)

KEY TO THE SPECIES OF AGONOPTERIX BASED ON MALE GENITALIA

1. Clasper short, flattened, longitudinal; tegumen and socii strongly sclerotized (fig. 152) ..... **fulva** (Walsingham) (p. 53)
Clasper not flattened and socii never appreciably sclerotized (figs. 153, 157, etc.) 2
2. Socii small and widely separated; tegumen truncated (fig. 153) 3
Socii and tegumen otherwise (fig. 62) 7
3. Hairs of the transtillar lobes coarse and strong (fig. 156) 4
Hairs of the transtillar lobes fine and weak (fig. 153) 6

4. Coarse, strong hairs of the transtillar lobes three or less (fig. 156)..... 5
Coarse, strong hairs of transtillar lobes at least six
lythrella (Walsingham) (p. 59)
5. Clasper of harpe stout, curved (fig. 156)..... **hyperella** Ely (p. 56)
Clasper of harpe stout, straight (fig. 154)..... **arcuella**, new species (p. 58)
6. Anellus broader than long (fig. 161)..... **nubiferella** (Walsingham) (p. 60)
Anellus longer than broad (fig. 153)..... **gelidella** (Busck) (p. 55)
7. Costa and sacculus of harpe parallel; cucullus broad and rounded (fig. 186)..... **arnicella** (Walsingham) (p. 90)
Costa and sacculus of harpe not parallel and cucullus not broad and rounded (figs. 157, 158, etc.)..... 8
8. Clasper attaining or reaching beyond costa of harpe (figs. 174, 177, 190)..... 9
Clasper not attaining costa of harpe (figs. 169, 170, etc.)..... 11
9. Clasper reaching beyond costa of harpe (figs. 177, 190)..... 10
Clasper not reaching beyond costa of harpe (fig. 174)
costimacula, new species (p. 102)
10. Harpe long, slender; posterior edge of anellus strongly concave (fig. 190)..... **posticella** (Walsingham) (p. 119)
Harpe broad; posterior edge of anellus nearly straight, with shallow median cleft (fig. 177)..... **psoraliella** (Walsingham) (p. 121)
11. Anellus broader than long (figs. 173, 183, 184, 185)..... 12
Anellus longer than broad (figs. 181, 182, etc.)..... 16
12. Aedeagus short, stout (figs. 183a, 185a)..... 13
Aedaegus otherwise..... 14
13. Posterior margin of anellus strongly convex, smooth (fig. 183)
pergandeella (Busck) (p. 116)
Posterior margin of anellus not strongly convex or smooth (fig. 185)..... **nebulosa** (Zeller) (p. 110)
14. Clasper very stout, nearly reaching costa of harpe (fig. 184).
costosa (Haworth) (p. 113)
Clasper slender, not reaching far beyond center of harpe (figs. 159, 173)..... 15
15. Clasper straight, with small basal protuberance; distal end serrate (fig. 173)..... **flavicomella** (Engel) (p. 105)
Clasper hooked, without basal protuberance; distal end not serrate (fig. 157)..... **curvilineella** (Beutenmüller) (p. 62)
16. Clasper abruptly broadened at distal end (fig. 181)
sabulella (Walsingham) (p. 111)
Clasper otherwise..... 17
17. Lobes of anellus large, prominent (figs. 158, 159)..... 18
Lobes of anellus small, inconspicuous (figs. 169, 170, 176, 179)..... 30
18. Posterior margin of anellus distinctly concave (figs. 158, 159, 160, 163, 164, 165, 180, 188)..... 19
Posterior margin of anellus not distinctly concave (figs. 162, 166, 172, 178, 182)..... 26
19. Clasper reaching well beyond middle of harpe (figs. 159, 160, 163, 164, 180, 188)..... 20
Clasper not reaching much beyond middle of harpe (figs. 158, 165)..... 25
20. Aedeagus slender, sharply pointed (figs. 159a, 163a, 164a, 180a)..... 21
Aedeagus stout (figs. 160a, 188a)..... 24

21. Anellus narrowed posteriorly; clasper very slender (fig. 159) **clemensella** (Chambers) (p. 68)
Anellus not appreciably narrowed posteriorly; clasper strong (figs. 163, 164) ---- 22
22. Anellus with a narrow, biramous, strongly sclerotized median area ---- **pulvipennella** (Clemens) (p. 76)
Anellus without such sclerotized area (figs. 163, 180) ---- 23
23. Lateral lobes of anellus nearly attaining posterior edge of central plate (fig. 180) ---- **cajonensis**, new species (p. 82)
Lateral lobes of anellus not nearly attaining posterior edge of central plate (fig. 163) ---- **eupatoriiella** (Chambers) (p. 74)
24. Anellus strongly constricted anteriorly; harpe abruptly narrowed beyond clasper (fig. 160) ---- **atrodorsella** (Clemens) (p. 70)
Anellus not strongly constricted anteriorly and harpe not abruptly narrowed beyond clasper (fig. 188) **latipalpella** Barnes and Busck (p. 118)
25. Distal half of aedeagus much more slender than proximal half (fig. 165a) ---- **walsinghamella** (Busck) (p. 78)
Aedeagus of about equal thickness throughout its length (fig. 158a) ---- **muricolorella** (Busck) (p. 64)
26. Clasper nearly attaining costa of harpe (figs. 162, 178) ---- 27
Clasper not reaching much beyond middle of harpe (figs. 166, 172, 182) ---- 28
27. Posterior edge of anellus convex (fig. 178) ---- **clarkei** Keifer (p. 66)
Posterior edge of anellus not convex (fig. 162) **pteleae** Barnes and Busck (p. 72)
28. Aedeagus long, slender (fig. 166a) ---- **rosaciliella** (Busck) (p. 83)
Aedeagus stout (figs. 172a, 182a) ---- 29
29. Anellus with a narrow, longitudinal, weakly sclerotized median area; cucullus rather pointed (fig. 182) ---- **pallidella** (Busck) (p. 88)
Anellus without such median area; cucullus rounded (fig. 172) **senicionella** (Busck) (p. 107)
30. Clasper twisted (fig. 168) ---- **novi-mundi** (Walsingham) (p. 87)
Clasper not twisted (fig. 167, etc.) ---- 31
31. Clasper reaching at least three-fourths of the way to costa of harpe (figs. 170, 187) ---- 32
Clasper reaching to or slightly beyond middle of harpe (fig. 167, etc.) ---- 34
32. Clasper straight (figs. 170, 187) ---- 33
Clasper definitely curved distally (fig. 176) ---- **oregonensis**, new species (p. 65)
33. Clasper stout (fig. 187) ---- **amissella** (Busck) (p. 117)
Clasper slender (fig. 170) ---- **nigrinotella** (Busck) (p. 101)
34. Posterior edge of anellus concave (figs. 171, 179) ---- 35
Posterior edge of anellus not concave (figs. 167, 169, 175, 189) ---- 36
35. Clasper slender, reaching slightly beyond middle of harpe (fig. 171) ---- **argillacea** (Walsingham) (p. 98)
Clasper stout, not reaching beyond middle of harpe (fig. 178) **dimorphella**, new species (p. 97)
36. Anellus nearly round (figs. 169, 189) ---- 37
Anellus roughly rectangular (figs. 167, 175) ---- 39
37. Posterior margin of anellus with shallow cleft; cucullus sharply pointed (fig. 189) ---- **sanguinella** (Busck) (p. 123)
Posterior margin of anellus without any trace of a median cleft; cucullus dull-pointed (fig. 169) ---- 38

38. Cornuti fine, spiculate (fig. 169a)---------- robiniella (Packard) (p. 92)
Cornuti coarse, small---------- thelmae, new species (p. 96)
39. Posterior margin of anellus distinctly convex (fig. 167)
fusciterminella, new species (p. 80)
Posterior margin of anellus not distinctly convex (fig. 175)
antennariella, new species (p. 108)

KEY TO THE SPECIES OF AGONOPTERIX BASED ON FEMALE GENITALIA

1. Bursa copulatrix with signum (figs. 241, 255, 270, etc.)---------- 5
Bursa copulatrix without signum (figs. 229, 240, 272)---------- 2
2. Ductus bursae short, not much longer than bursa copulatrix (fig. 272)---------- amyrisella (Busck) (p. 124)
Ductus bursae much longer than bursa copulatrix---------- 3
3. Anterior edge of genital plate convex, entire; ostium large, round (fig. 240)---------- hyperella Ely (p. 56)
Anterior edge of genital plate produced (figs. 229, 259A)---------- 4
4. Produced margin of genital plate before ostium truncate; ostium round (fig. 229)---------- dimorphella, new species (p. 97)
Produced margin of genital plate before ostium strongly convex; ostium broadly oval (fig. 259a)---------- thelmae, new species (p. 96)
5. Signum minute, round; area posterior to ostium with two small sclerotized patches (fig. 259)---------- robiniella (Packard) (p. 92)
Signum a small to large toothed or scobinate plate (figs. 242, 245, 250, 255, etc.)---------- 6
6. Ductus bursae with a large sclerotized patch adjacent to bursa copulatrix (fig. 248)---------- fulva (Walsingham) (p. 53)
Ductus bursae without such sclerotized area---------- 7
7. Anterior margin of genital plate cleft (figs. 230a, 249–253)---------- 8
Anterior margin of genital plate not cleft---------- 13
8. Lobe of ovipositor clothed with spines (fig. 230)----clarkei Keifer (p. 66)
Lobe of ovipositor not clothed with spines (figs. 249–253)---------- 9
9. Cleft narrow (figs. 251, 253)---------- 10
Cleft semicircular (figs. 249, 250, 252)---------- 11
10. Inception of ductus seminalis at the ostium (fig. 251)
pteleae Barnes and Busck (p. 72)
Inception of ductus seminalis a short distance before the ostium (fig. 253)---------- pulvipennella (Clemens) (p. 76)
11. Anterior points of genital plate nearly touching (fig. 252).
atrodorsella (Clemens) (p. 70)
Anterior points of genital plate widely separated (figs. 249, 250)-------- 12
12. Ostium occupying over half length of genital plate (fig. 249).
eupatoriiella (Chambers) (p. 74)
Ostium occupying less than half length of genital plate (fig. 250).
scabella (Zeller) (p. 72)
13. Genital plate with pronounced anteromedian ventral evagination (fig. 274)---------- posticella (Walsingham) (p. 119)
Genital plate without such evagination---------- 14
14. Anterior margin of genital plate produced (figs. 255, 261, 265, 266, 269, 270, 273)---------- 15
Anterior margin of genital plate not produced---------- 26
15. Production of margin as wide or nearly as wide as genital plate is long (figs. 255, 265)---------- 16
Production of margin of genital plate narrower---------- 17

16. Ostium large, round (fig. 265)---------- **nigrinotella** (Busck) (p. 101)
Ostium spindle-shaped (transverse) (fig. 255) **argillacea** (Walsingham) (p. 98)
17. Ostial opening definitely in anterior half of genital plate (fig. 261). **costimacula**, new species (p. 102)
Ostial opening not definitely in anterior half of genital plate (figs. 262, 263, 264, 266, 267, 268, 269, 270, 273)---------- 18
18. Ostial opening about middle of genital plate (figs. 266, 269)---------- 19
Ostial opening definitely in posterior half of genital plate (figs. 262, 264, 267, 268, 270, 273)---------- 20
19. Anterior to ostium a strongly sclerotized crescent-shaped bar; posterior to ostium a small sclerotized rectangular area (fig. 269)---------- **amissella** (Busck) (p. 117)
Anterior to ostium an elongate, slightly curved, sclerotized margin; no sclerotized area posterior to ostium (fig. 266) **nebulosa** (Zeller) (p. 110)
20. Signum distinctly 4-pointed (figs. 262, 264, 270, 273)---------- 22
Signum not 4-pointed (figs. 267, 268)---------- 21
21. Genital plate broad, with a gently concave, narrow, sclerotized anterior margin; ostial opening on extreme posterior edge (fig. 268)---------- **latipalpella** Barnes and Busck (p. 118)
Genital plate narrow with a broad, convex anterior margin; ostial opening not reaching extreme posterior edge of genital plate (fig. 267)---------- **flavicomella** (Engel) (p. 105)
22. Ostial opening occupying more than half length of genital plate (figs. 262, 263, 270)---------- 24
Ostial opening occupying half or less than half length of genital plate (figs. 264, 273)---------- 23
23. Signum large, with small, scattered teeth; lateral points much larger than anterior and posterior points (fig. 273) **costosa** (Haworth) (p. 113)
Signum small, with strong teeth; lateral, anterior, and posterior points about equal in length (fig. 264) **antennariella**, new species (p. 108)
24. Posterior and anterior points of signum of about equal length (fig. 263)---------- **senicionella** (Busck) (p. 107)
Posterior and anterior points of unequal length (figs. 262, 270)---------- 25
25. Anterior point of signum longer than posterior point (fig. 262) **canadensis** (Busck) (p. 104)
Anterior point of signum shorter than posterior point (fig. 270)---------- **sabulella** (Walsingham) (p. 111)
26. Signum situated in extreme anterior end of bursa copulatrix (figs. 242, 243, 245, 247a, 271)---------- 27
Signum not situated in extreme anterior end of bursa copulatrix (figs. 241, 246, 254, 256, 257, 258)---------- 31
27. Ostial opening at extreme anterior margin of genital plate (fig. 271)---------- **psoraliella** (Walsingham) (p. 121)
Ostial opening not at anterior edge of genital plate (figs. 242, 243, 245, 247)---------- 28
28. Ostial opening at extreme posterior edge of genital plate (fig. 242)---------- **clemensella** (Chambers) (p. 68)
Ostial opening not at posterior edge of genital plate (figs. 243, 245, 247)---------- 29

29. At posterior end of ostium two small, sclerotized lateral areas (fig. 243)---------- **muricolorella** (Busck) (p. 64)
No such sclerotized areas at posterior end of ostium (figs. 245, 247)---------- 30
30. Signum a distinctly 4-pointed plate (fig. 247a)---- **gelidella** (Busck) (p. 55)
Signum irregular, not 4-pointed (fig. 245) **curvilineella** (Beutenmüller) (p. 62)
31. Ostial opening at extreme posterior edge of genital plate (fig. 254)---------- **walsinghamella** (Busck) (p. 78)
Ostial opening otherwise (figs. 244, 246, 256, 257, 258)---------- 32
32. Bursa copulatrix symmetrical (figs. 244a, 256, 257, 258)---------- 34
Bursa copulatrix distinctly asymmetrical (figs. 241, 246)---------- 33
33. Signum oval; ostium oval (fig. 246)---------- **arcuella**, new species (p. 58)
Signum diamond-shaped, ostium elliptical (fig. 241) **oregonensis**, new species (p. 65)
34. Signum large (figs. 244a, 258)---------- 35
Signum small (figs. 256, 257)---------- 36
35. Signum a 4-pointed plate (fig. 244a)------- **cajonensis**, new species (p. 82)
Signum roughly diamond-shaped (fig. 258) **fusciterminella**, new species (p. 80)
36. Signum bilobed (fig. 257)---------- **rosaciliella** (Busck) (p. 83)
Signum oval (fig. 256)---------- **pallidella** (Busck) (p. 88)

AGONOPTERIX FULVA (Walsingham)

PLATE 25, FIGURES 152, 152a; PLATE 42, FIGURE 248

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Agnopteryx fulva (Walsingham) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6453, 1917.

Agonopterix fulva (Walsingham) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8446, 1939.

Labial palpus with second segment tawny-red outwardly irrorated with whitish and fuscous scales, whitish inwardly; third segment sordid whitish with a poorly defined narrow, light tawny-red subapical band. Antenna pubescent, fuscous, narrowly and faintly annulated with ochreous. Head, thorax, and ground color of fore wing tawny-red; thorax suffused with fuscous and irrorated with white posteriorly; fore wing irrorated with fuscous and with a large fuscous shade at end of cell; in the center of this shade is a white discal spot (absent in some specimens); at extreme base of wing on inner angle a small transverse whitish patch not reaching costa; veins, beyond cell, marked with fuscous scales; cilia grayish fuscous edged lightly with rosy red. Hind

wing and cilia grayish fuscous, the latter lightly edged with rosy red. Legs whitish inwardly, overlaid outwardly with tawny-red and with a rosy-red suffusion; tarsi fuscous narrowly annulated with whitish. Abdomen grayish-fuscous above, whitish beneath, strongly overlaid with fuscous.

Male genitalia.—Strikingly different from those of any other described North American species: Harpe only moderately clothed with hairs at the cucullus and along the costal edge; sacculus deeply folded and very strongly sclerotized; clasper short, flattened, longitudinal, constricted at middle, broadly rounded at its extremity. Anellus broadly oval, moderately sclerotized, with a deep excavation on the posterior edge. Vinculum broadly rounded. Aedeagus sharply bent near the middle, slender, dilated at the distal end; armed with many short, stout, cornuti. Tegumen strongly sclerotized, more so along the ventral edges. Socii strongly sclerotized flaps, very sparsely clothed with hairs. Gnathos a small, round, spined knob.

Female genitalia.—Genital plate broad, strongly sclerotized except for a narrow, median, longitudinal membranous portion posterior to ostium. Ostium large with deeply concave anterior edge, and opening near anterior edge of genital plate. Ductus bursae membranous except for a large sclerotized patch adjacent to bursa copulatrix and a short portion before ostium; anterior to the latter the ductus bursae is constricted at the inception of the ductus seminalis. Signum a small, irregular sclerotized plate.

Alar expanse, 22–24 mm.

Type.—In the United States National Museum.

Type locality.—Not designated.

Food plant.—Unknown.

Distribution.—Rocky Mountains region of the United States and Canada, and eastern Canada.

United States records

Arizona: White Mountains, Apache County, near McNary P. O., ♀ (1–15–IX–25, O. C. Poling).

Canadian records

Alberta: "Head of Pine Creek," Calgary, ♂ (VIII–5–05, F. H. Wolley-Dod).
British Columbia: Jesmond, ♂ (2–VIII–1937, J. K. Jacob).
New Brunswick: Fredericktown, ♂ ("August 20").
Ontario: Stittsville, ♂, ♀ (21–VIII–1939, E. G. Lester).

I have seen other specimens without locality labels.

Remarks.—An easily recognizable species not to be confused with any other described from North America.

The type, which is before me, shows only a single white scale in the single discal spot at the end of the cell as described by Walsingham, but a "homotype" from Alberta, which is clearly this species, shows a

well-defined spot at the end of the cell. A third specimen, from Beutenmüller's collection, has only a few blackish scales suggesting this same spot.

The female from Arizona, which I have identified as this species, undoubtedly belongs here.

AGONOPTERIX GELIDELLA (Busck)

PLATE 25, FIGURES 153, 153a; PLATE 42, FIGURES 247, 247a

Depressaria gelidella BUSCK, Proc. Ent. Soc. Washington, vol. 9, p. 90, 1908.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 177, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 325, 1939.

Agonopteryx gelidella BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.

Agnopteryx gelidella (Busck) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6450, 1917.

Agonopterix gelidella (Busck) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8451, 1939.

Labial palpus yellowish white; second segment purplish black outwardly tinged with carmine; third segment strongly suffused with purplish black anteriorly, tip white. Antenna purplish black on basal segment, remainder fuscous. Head grayish fuscous. Thorax purplish gray; tegula purplish black tipped with whitish. Ground color of fore wing dark purplish fuscous, sparsely irrorated with black; near base, from inner margin, a transverse yellowish-white streak, not reaching costa; on the disk, at basal third, a crescent-shaped black dash with a few carmine scales mixed and followed by a white patch; at the end of cell a white spot edged with black; costa faintly spotted with whitish; from costa a poorly defined, narrow, outwardly curved whitish line to inner margin before tornus; around termen a series of blackish-fuscous spots forming an almost continuous fine line before cilia; inner margin and apical portion of wing carmine tinted; cilia grayish fuscous. Hind wing yellowish fuscous; cilia light fuscous with considerable white mixed. Legs yellowish white inwardly, purplish black outwardly. Abdomen grayish fuscous above, yellowish white beneath, suffused and irrorated with fuscous and with a longitudinal row of black spots on each side.

Male genitalia.—Harpe only weakly sclerotized and moderately clothed with hairs; cucullus rounded; clasper very stout, somewhat dilated distally; outer edge rough; reaching two-thirds distance toward costa. Anellus narrow, longer than broad, roughly rectangular, emarginate on the posterior edge; lateral lobes weak. Vinculum broad, rounded. Aedeagus moderately stout, gently curved and terminating in a sharp upturned point; just before middle a forked sclerotized arm by which it is attached to the anellus. Transtilla a weakly sclerotized band with large, hairy lateral lobes, the hairs fine

and weak. Gnathos an oval, spined knob. Socii very small, widely separated, sparsely clothed with fine hairs. Tegumen truncated.

Female genitalia.—Genital plate broad with a row of strong hairs on posterior margin. Ostium large, round, nearer to anterior than to posterior edge; anterior edge well sclerotized. Ductus bursae long, rather stout, constricted just before ostium at inception of ductus seminalis. Bursa copulatrix large with a well developed 4-pointed signum in the anterior end.

Alar expanse, 19–20 mm.

Type.—In the United States National Museum.

Type locality.—Winnipeg, Manitoba, Canada (A. W. Hanham)

Distribution.—Alberta, eastward to Ontario.

Canadian records

Alberta: Nordegg, ♂ (1–VIII–1921, J. McDunnough).
Manitoba: Winnipeg, 2 ♂ ♂ (no date, A. W. Hanham).
Ontario: Ottawa, ♂, ♀ (9–VII–1905, 25–VII–1906, C. H. Young); Trenton, ♂ (27–VI–1911, Evans).
Saskatchewan: Earl Grey, ♂ (24–VII–1925, J. D. Ritchie); Indian Head, ♀ (3–VIII–1925, J. J. de Gryse).

Remarks.—This and the following species are similar in pattern to the European *conterminella* (Zeller).

The abdomen of the type is missing, but I do not hesitate to place the series before me under this name.

Through the courtesy of Dr. McDunnough I have been able to dissect one of the only two females I have seen and have figured the genitalia.

This species has been recorded from British Columbia, but all specimens so determined are referable to *oregonensis* (new species).

AGONOPTERIX HYPERELLA Ely

PLATE 25, FIGURES 156, 156a; PLATE 42, FIGURE 240

Agonopterys hyperella ELY, Proc. Ent. Soc. Washington, vol. 12, p. 68, 1910.
Agonopteryx hyperella (Ely) FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 240, 1923.
Agonopterix hyperella (Ely) McDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8438, 1939.
Agnopteryx hyperella (Ely) BARNES and McDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6457, 1917.
Depressaria testifica MEYRICK, Exotic Microlepidoptera, vol. 2, p. 316, 1920; *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922. (New synonymy.)
(Not *Agonopteryx hyperella* McDunnough, Can. Ent., vol. 67, p. 74, 1935.)

Labial palpus creamy white, exteriorly heavily overlaid with fuscous; third segment with a broad black subapical annulation. Antenna dark purplish fuscous annulated with gray. Head creamy

white in front, grayish above. Thorax lavender-gray overlaid with cinereous to white scales. Fore wing dark grayish lavender shaded with yellowish brown, especially toward inner margin; at base of wing, from inner angle almost to costa, a transverse yellowish line preceded by two black spots, one near costa, the other at inner angle; in center of cell a black crescent-shaped dash margined with yellowish brown and followed by a grayish shade; between the upper point of this dash and the costa a small black spot similarly edged with yellowish brown; at the end of cell a conspicuous, though small, cream-colored or yellowish spot edged with brown and preceded and followed with a few scattered black scales; costa somewhat strigulated with fuscous and grayish; around termen, at base of cilia, a thin fuscous to black line; cilia light purplish fuscous mixed with gray. Hind wing smoky fuscous; cilia somewhat more brownish with a fuscous basal band. Legs creamy white to yellowish shaded with fuscous exteriorly except at joints. Abdomen grayish fuscous above; beneath, yellowish overlaid with fuscous and with indistinct black lateral lines.

Male genitalia.—Harpe slender, moderately clothed with fine hairs; clasper very stout, gently curved inwardly, its outer edge rugose; cucullus bluntly pointed; sacculus short, broadly folded. Anellus deeply incised on posterior margin, concave laterally; lateral lobes scarcely developed. Aedeagus curved, pointed, with a short ventral arm which articulates with the anellus; vesica armed with fine cornuti. Vinculum rounded. Transtilla a narrow sclerotized band with well-developed lateral lobes; each lateral lobe bears three long, stout hairs. Gnathos a spined oval knob. Socii small, widely separated. Tegumen truncated.

Female genitalia.—Genital plate broad, moderately sclerotized; anterior edge convex, entire. Ostium large, round; at center of genital plate. Ductus bursae membranous; inception of ductus seminalis shortly before ostium. Bursa copulatrix without signum.

Alar expanse, 15–18 mm.

Type.—In the United States National Museum.

Type localities.—Great Falls, Md., and Great Falls, Va.

Food plant.—*Hypericum prolificum* L.

Distribution.—Middle Atlantic States.

United States records

Maryland: Great Falls, 2 ♂ ♂, ♀ (V–26–09, Chas. R. Ely); Plummers Island, ♂ (V–30–09, Chas, R. Ely).

Virginia: Great Falls, ♀ (V–31–10, Chas. R. Ely).

Remarks.—Meyrick proposed *testifica* in place of *hyperella* thinking that the latter name was intended for *hypericella* of Hübner and further states that *hyperella* is preoccupied by *hypericella.* Ely's

species is distinct from the European *hypericella*, and *hyperella* is not invalidated by Hübner's name. I, therefore, reinstate Ely's species and sink Meyrick's name.

The stout, gently recurved clasper of *hyperella* distinguishes it from both *lythrella* and *arcuella*. The clasper of *lythrella* is slender and straight, and that of *arcuella* is stout and straight. The separation of *lythrella* from *gelidella* is discussed under *lythrella*. The females, however, give the best characters for separating *hyperella* from *arcuella*. The signum is present in *arcuella*, absent in *hyperella*.

AGONOPTERIX ARCUELLA, new species

PLATE 25, FIGURE 154; PLATE 42, FIGURE 246

Agonopteryx hyperella McDUNNOUGH [not Ely], Can. Ent., vol. 67, p. 74, 1935.

A small reddish-purple species closely related to the foregoing two and to the following species.

Head yellowish ochreous, mixed with golden-brown; labial palpus whitish ochreous; brush of the second segment narrow, heavily overlaid with reddish purple and black outwardly and beneath; terminal segment thickened, reddish purple and black exteriorly, with incomplete reddish-purple basal and subapical annuli; antenna with basal segment blackish fuscous, with narrow ochreous apical annulus; remainder of antenna fuscous, ochreous annulated, and the whole with a purplish sheen.

Thorax strongly crested, yellowish ochreous mixed with golden-brown; tegula and crest yellowish purple, the former strongly shaded with fuscous. Ground color of fore wing reddish purple strongly suffused with fuscous along costa and at base; the fuscous basal shading terminated by a sharply contrasting, narrow, whitish ochreous line and including a sharply contrasted black spot near dorsal edge; another similar black spot at base of radius; costa strigulated with whitish and carmine; at basal third an outwardly curved black crescent preceded by carmine and followed by whitish scales; discal spot at end of cell white; from middle of costa to center of wing a strong whitish shading from costa; at apical third an indistinct fascia outwardly curved to between veins 6 and 7, then turned back, parallel to termen, nearly to dorsum; cilia purplish fuscous, carmine tipped, with black basal line from veins 3 to 7. Hind wing brownish fuscous; cilia a shade lighter with dark subbasal and light basal line; underside with strong black line at base of cilia. Legs blackish fuscous, with whitish outwardly on femora and reddish purple on tibiae and tarsi; tarsi annulated yellowish ochreous. Abdomen fuscous with much yellowish ochreous beneath.

Male genitalia.—Harpe moderately sclerotized and sparsely clothed with hairs; cucullus rounded; clasper stout, straight, rugose on outer

edge; anellus roughly oval, emarginate on posterior edge; lateral lobes undeveloped; aedeagus stout, pointed, slightly curved, with large spinulate patch. Vinculum rounded. Transtilla a sclerotized band with large lateral lobes, the latter with few strong, coarse hairs. Gnathos an oval spined knob. Socii small, widely separated, with few hairs. Tegumen truncated.

Female genitalia.—Ostium large, oval at about center of genital plate; genital plate membranous or sclerotized posterior to ostium; ductus bursae long, membranous, slightly dilated at point of inception of ductus seminalis; bursa copulatrix large, asymmetrical, bulging on left side; oval, with oval, spined signum.

Alar expanse, 16–18 mm.

Type.—In the Canadian National Collection.

Paratypes.—U. S. N. M. No. 52078. Also in Canadian National Collection and collection of Dr. A. F. Braun.

Type locality.—White Point Beach, Queens County, Nova Scotia.

Food plant.—*Hypericum virginicum* L.

Remarks.—Described from the ♂ type, 16 ♂ ♂ and 10 ♀ ♀ paratypes all from White Point Beach, Queens County, Nova Scotia (VIII–7 to 13–34, J. McDunnough); 2 ♂ ♂, ♀, Sparrow Lake, Ontario (VII–1–26, A. F. Braun); ♀, Black Mountains, North Carolina ("VII–20").

McDunnough misidentified this species and reported it under the name *A. hyperella* Ely. In addition to the above I now have two specimens from Chamcook, New Brunswick, Canada (4–5–VIII–1938, T. N. Freeman; Rf. *Hypericum* sp.) submitted by Dr. J. McDunnough, and three specimens from Orrington, Maine (24–VII–1922, A. C. Ward; Rf. *Hypericum* sp.), submitted by J. V. Schaffner.

AGONOPTERIX LYTHRELLA (Walsingham)

PLATE 25, FIGURE 155

Depressaria lythrella WALSINGHAM, Ins. Life, vol 1, p. 257, 1889.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 744, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5879, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6422, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 332, 1939.

Agonopteryx lythrella (Walsingham) BUSCK, Proc. U. S. Nat Mus., vol. 35, p. 199, 1908.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 63, p. 240, 1923.

Agonopterix lythrella (Walsingham) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8437, 1939.

Agnopteryx lythrella (Walsingham) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6468, 1917.—BRIMLEY, The Insects of North Carolina, p. 304, 1938.

Labial palpus yellowish mottled exteriorly with purplish fuscous; third segment with indistinct basal and subapical fuscous annuli. Antenna fuscous broadly annulated with tawny. Head and thorax cinereous, the former with a fuscous median shade, the latter irrorated with purplish fuscous; tegula purplish fuscous. Fore wing brownish purple dusted with fuscous and with much cinereous scaling along costa; at base, from inner angle almost to costa a narrow, cream-colored, transverse line preceded at inner angle by a distinct black spot; on disk, before middle, a short outwardly curved, black crescent-shaped dash edged with reddish and followed by cinereous; at end of cell a small cream-colored spot edged with fuscous; from costa to termen at apical third a more or less distinct cinereous fascia; inner margin narrowly shaded with reddish; around termen, at base of cilia, a narrow blackish-fuscous line; cilia purplish gray. Hind wing and cilia brownish gray, the latter edged with cinereous. Legs cream-colored strongly overlaid and irrorated exteriorly with purplish fuscous except at joints. Abdomen purplish gray above; beneath, cream-colored strongly suffused and overlaid with purplish fuscous.

Alar expanse, 13–18 mm.

Type.—In the British Museum.

Type locality.—"Illinois."

Food plant.—Lythrum alatum Pursh.

Distribution.—Eastern United States.

United States records

Illinois.

North Carolina: Black Mountains (July 20, from larvae).

Remarks.—The male genitalia of this species are nearly identical with those of *hyperella*, *arcuella*, *nubiferella*, and *gelidella*. The clasper of the harpe (fig. 155), however, is much more slender than that of any of the other four. Each of the hairy lobes of the transtilla bears about half a dozen strong hairs. In *hyperella* and *arcuella* there are only two or three hairs and in *gelidella* the hairs are numerous but weak. I have not seen the female genitalia of this species. All females examined are without abdomens.

AGONOPTERIX NUBIFERELLA (Walsingham)

PLATE 26, FIGURES 161, 161a

Depressaria nubiferella WALSINGHAM, Proc. Zool. Soc. London, 1881, p. 316, pl. 36, fig. 6.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 745, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5881, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No 6424, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 27, p. 764, 1904.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 335, 1939.

Agonopteryx nubiferella (Walsingham) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 199, 1908.

Agonopterix nubiferella (Walsingham) McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8450, 1939.

Agnopteryx nubifercUa (Walsingham) Barnes and McDunnough, Check list of the Lepidoptera of Boreal America, No. 6470, 1917.

Labial palpus light ochreous, second segment overlaid with brownish red exteriorly; third segment with subapical annulus of the same color. Antenna fuscous with slight reddish luster. Head, thorax, and ground color of fore wing ochreous; tegula and anterior part of thorax overlaid with brownish red. Extreme base, except costa, of fore wing unmarked, remainder of wing suffused with brownish red and irrorated with scattered fuscous scales; from costa, across end of cell, almost to inner margin, a dark brownish-red shade with a fuscous central discal dot; this shade is preceded by two more or less distinct brownish-red discal dots, obliquely one above the other; along costa a series of reddish-fuscous spots; around termen, at base of cilia, a line of the same color; cilia ochreous, shaded with brownish red. Hind wing grayish fuscous; cilia yellowish basally, grayish fuscous apically. Legs light ochreous; anterior and median pair strongly overlaid with reddish fuscous except at joints; posterior legs irrorated and suffused with light fuscous except at joints. Abdomen ochreous overlaid with fuscous beneath.

Male genitalia.—Harpe clothed with rather coarse hairs; cucullus rounded; clasper short, reaching just beyond middle, but very stout, bluntly pointed. Anellus a lightly sclerotized plate, broader than long, indented at the posterior edge; lateral lobes undeveloped. Vinculum rounded. Aedeagus stout, dorsoventrally depressed, with a slightly upturned point; near the base is a bifid plate by which the aedeagus articulates with the anellus. Transtilla a narrow band with large, hairy lateral lobes, the hairs fine and weak. Gnathos an oval spined knob. Socii very small, widely separated, and sparsely clothed with fine hairs. Tegumen truncated.

Alar expanse, 18–20 mm.

Type.—In the British Museum.

Type locality.—Rogue River, Oreg.

Food plant.—*Hypericum perforatum* L. (The *Hypericum* referred to by Walsingham is probably this species also.)

Distribution.—Western United States and Canada.

United States records

California: Mendocino and Shasta Counties (June and July 1871, Walsingham).
Idaho: Lapwai (V–28 to 1–VI–35, J. F. G. Clarke [reared]).
Oregon: Rogue River.
Washington: Logan Hill, Chehalis (IX–8–29, T. M. Clarke); Pullman (VII–24–98 and VIII–10–98, C. V. Piper).

Canadian records

British Columbia: Shawnigan Lake, Vancouver Island (VII–14–23, E. H. Blackmore).

Remarks.—This and the four foregoing species all have very similar genitalia, but *nubiferella* has distinctly narrower harpes than the others and is widely different in pattern and coloration.

All the specimens I have seen are males. The California and Oregon specimens (including cotypes) are all considerably lighter in coloration than specimens from Washington, Idaho, and British Columbia. The northern specimens may represent a species distinct from that represented by the California and Oregon specimens, presenting a parallel case with that of *arcuella* and *hyperella* in which the females give the only reliable character for separation. The type locality (from which I have two specimens) is not far from the locality where the Idaho material was collected, and it does not seem likely, therefore, that the two color forms represent different species. Until females from both northern and southern localities are obtained I believe it advisable to leave both color forms under one name.

AGONOPTERIX CURVILINEELLA (Beutenmüller)

PLATE 26, FIGURES 157, 157a; PLATE 42, FIGURE 245

Depressaria curvilineella BEUTENMÜLLER, Ent. Amer., vol. 5, p. 10, 1889.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5874, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6417, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 321, 1939.

Depressaria curviliniella RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5260, 1891.—DIETZ, *in* Smith, Catalogue of the insects of New Jersey, p. 474, 1900.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 742, 1902.

Agonopteryx curviliniella BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.

Agonopteryx curvilineella (Beutenmüller) FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 240, 1923.

Agonopterix curvilineella (Beutenmüller) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8439, 1939.

Agnopteryx curviliniella KEARFOTT, *in* Smith, Catalogue of the Insects of New Jersey, p. 561, 1910.

Agnopteryx curvilineella (Beutenmüller) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6445, 1917.

Labial palpus white; second segment irrorated with blackish fuscous exteriorly; third segment with basal and subapical bands and apex blackish fuscous. Head, thorax, and ground color of fore wing light grayish ochreous; face white; base of tegula and fore part of thorax suffused with brown; fore wing, except extreme base and basal half of costa, strongly suffused with brown and irrorated with scattered

blackish-fuscous scales; in pale basal patch two small blackish-fuscous spots; along costa and around termen a series of blackish-fuscous spots, those around termen small and indistinct; at end of cell a white discal spot edged with blackish fuscous and preceded by a long, curved, blackish-fuscous discal dash; cilia light grayish ochreous, suffused with brown. Hind wing grayish fuscous; cilia white with grayish-fuscous basal band. Legs white suffused with fuscous; tarsi of hind legs with a fuscous spot at the base of each. Abdomen grayish ochreous above suffused with fuscous; beneath, whitish sparsely irrorated with fuscous scales and with a row of blackish-fuscous spots on each side; between these rows of spots two rows of smaller spots of the same color.

Male genitalia.—Harpe broad, profusely clothed with fine hairs, particularly basally; cucullus pointed; sacculus moderately sclerotized, broad; clasper slender, heavily sclerotized, hooked, reaching two-thirds distance toward costa and without basal protuberance; anellus moderately sclerotized, oval, broader than long, with weak lateral hairy lobes. Vinculum with a well-developed dorsoanterior process. Aedeagus nearly straight, wedge-shaped, bluntly pointed. Transtilla a narrow sclerotized band, with sparsely hairy, lateral lobes. Gnathos a finely spined, elongate-oval knob. Socii weakly sclerotized, broad, hairy flaps.

Female genitalia.—Genital plate moderately sclerotized. Ostium near middle of genital plate. Ductus bursae long, slender, membranous. Bursa copulatrix oval; signum a small, irregular, sclerotized plate, armed with short thornlike teeth.

Alar expanse, 15–20 mm.

Type.—In the United States National Museum.

Type locality.—"New York."

Distribution.—Eastern United States and Canada.

United States records

District of Columbia: Chain Bridge, 2 ♀♀ (October 20, 1920, A. Busck).

Maryland: Cabin John (II–26–11, F. Knab); Plummers Island, 29 ♂♂, 14 ♀♀ (March and April dates; A. Busck and H. S. Barber).

New Jersey: Essex County Park, ♀ ("June 10," W. D. Kearfott).

New York: 2 ♀♀ (Beutenmüller); Ithaca, 2 ♀♀ (6–15–V–30, A. B. Klots); Rochester, 2 ♀♀ (8–VII–33, A. B. Klots).

Pennsylvania: New Brighton, 10 ♂♂, 10 ♀♀ (May and August to November dates, H. D. Merrick); Oak Station, Allegheny County, 3 ♂♂, ♀ (July and September dates; Fred Marloff).

Canadian records

Manitoba: Aweme (28–IX–23, N. Criddle); Winnipeg, ♂ (A. W. Hanham. no date); ♀ ("1–5–98," no collector).

Ontario: Ottawa (28–VII–2–VIII–1905, C. H. Young).

AGONOPTERIX MURICOLORELLA (Busck)

PLATE 26, FIGURES 158, 158a; PLATE 42, FIGURE 243

Depressaria muricolorella BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 741, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5873, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6416, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 333, 1939.

Agonopteryx muricolorella BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 199, 1908.

Agonopterix muricolorella (Busck) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8441, 1939.

Agnopteryx muricolorella (Busck) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6455, 1917.

Labial palpus creamy white; outside of second and all of third segment suffused with ochreous-gray; second segment sparsely irrorated with fuscous. Antenna dark ochreous-gray. Head, thorax, base and basal third of costa of fore wing light grayish brown; fore wing dark mouse gray with sparse blackish-fuscous irrorations and with a purple tint around edges and at apex; at end of cell a white discal spot edged outwardly with a semicircle of blackish-fuscous scales; first discal spot indicated by a few scattered blackish-fuscous scales at basal third; on costa and around termen a series of indistinct blackish-fuscous spots; cilia mouse gray with some mixture of pale whitish ochreous. Hind wing grayish fuscous; cilia a shade lighter with light fuscous band and whitish tips. Legs light grayish ochreous suffused with fuscous. Abdomen dark purplish gray above; beneath grayish ochreous shaded with fuscous.

Male genitalia.—Harpe moderately clothed with fine hairs; cucullus pointed; clasper rather stout, lightly sclerotized, constricted just before middle and having a twisted appearance; apex heavily sclerotized, rough. Anellus oval, longer than broad, with large hairy lateral lobes; posterior edge concave. Vinculum rounded with a well developed dorso-anterior process. Aedeagus stout, curved, and terminating in a sharp, slightly upturned point. Transtilla a sclerotized band with well developed hairy lateral lobes. Gnathos oval, clothed with spines. Socii broad, hairy lobes. Tegumen terminating in a single short median projection.

Female genitalia.—Genital plate moderately broad; deeply cleft on posterior edge. Ostium small; near anterior margin of genital plate; at posterior end of ostium two small, sclerotized lateral areas. Ductus bursae long, gradually enlarged to form the small oval bursa copulatrix. Signum an oblong, sclerotized plate with projections on the anterior and posterior edges.

Alar expanse, 17–18 mm.

Type.—In the United States National Museum.

Type locality.—Golden, Colo.

Food plants.—"An umbelliferous plant" (Dyar); *Lomatium grayi* Coult. and Rose (Clarke).

Distribution.—Western United States.

United States records

Colorado: Golden, ♀ (Dyar and Caudell, no date).

Washington: Snake River, Whitman County, opposite Clarkston, 3 ♂♂, 3♀♀ (V–30–31, VI–4 to 18–33, and V–11–34, J. F. G. Clarke).

Remarks.—With Busck's unique type male I associate six reared specimens from the Snake River, Wash. (Clarke Nos. 2944, 4416, 4417, 4418, 4419, and 5209). The Washington specimens fit the description in every detail except that some of them show two discal spots, the single discal spot not being present. In specimen 5209 veins 3 and 4 of the hind wing are short stalked as described, but in the remaining specimens they are connate. In spite of the variation in venation it would be illogical to consider the Washington specimens anything but one species. The male genitalia show some slight variation in the length of the harpe and shape of the cucullus, but this is not significant.

AGONOPTERIX OREGONENSIS, new species

PLATE 31, FIGURES 176, 176a; PLATE 42, FIGURE 241

A small reddish species with contrastingly lighter costa.

Antenna with basal segment blackish fuscous; remainder shining grayish fuscous, darker distally; narrowly annulated with blackish fuscous; the whole with a faint reddish sheen. Labial palpus with second segment light whitish ochreous, the brush pink beneath both inwardly and outwardly; outwardly, and at apex inwardly, irrorated with fuscous; third segment blackish fuscous with a pink-tinged whitish-ochreous median fascia. Head light brownish fuscous with a pink suffusion; scales tipped with whitish ochreous; face shining whitish ochreous. Thorax, tegula, and fore wing brownish fuscous, the fore wing so heavily overlaid with brick-red scales that it appears dark reddish. Thorax and tegula with a strong reddish suffusion anteriorly and much whitish-ochreous scaling posteriorly. Base of fore wing and costa to middle a contrasting light gray; beyond middle of wing the light-gray scaling diminishes; extreme costal edge bright pink spotted with black; along costa, inside the grayish area, and along veins toward the apex, with abundant black scaling. At the end of cell a conspicuous white spot encircled with black scales; at basal third two small, obliquely placed black spots followed by white scaling; cilia fuscous with pink suffusion. Hind wing dark smoky fuscous; cilia fuscous; pink tinged apically. Legs whitish ochreous

much suffused and irrorated with fuscous; tarsi fuscous above except for narrow band of whitish-ochreous at distal ends of segments. Abdomen grayish fuscous above, whitish ochreous below; posterior edges of segments above whitish ochreous; on underside a lateral row of black spots; anal tuft tinged with pink.

Male genitalia.—Harpe clothed with many long hairs; cucullus pointed; costa strongly sclerotized; clasper stout, pointed, reaching three-fourths of way to costa; definitely curved distally; sacculus moderately sclerotized. Anellus an elongate, moderately sclerotized plate, lateral edges concave; anterior edge convex, posterior edge deeply cleft, lateral lobes small. Vinculum rounded. Aedeagus slender, gently curved, pointed. Transtilla a narrow, strongly sclerotized band, lateral lobes large, hairy. Socii large, fleshy, hairy lobes. Tegumen pointed.

Female genitalia.—Genital plate broad. Ostium large, broadly elliptical. Lobes of ovipositor clothed with long coarse hairs. Ductus bursae long, membranous; inception of ductus seminalis just before ostium. Bursa copulatrix large with well developed diamond-shaped signum.

Alar expanse, 15–18 mm.

Type.—U.S.N.M. No. 52079.

Type locality.—Salem, Oreg. (March; E. Y. Lansing, Jr.)

Described from the ♂ type and 5 ♂ ♂ and 10 ♀ ♀ paratypes as follows: ♂, Pullman, Wash. (8–II–30, J. F. G. Clarke); 2 ♂ ♂, Duncan, British Columbia (26–II–21, W. Downes); ♂, Duncan, British Columbia (25–III–21, A. W. Hanham); ♂, Fitzgerald, British Columbia (14–V–22, E. H. Blackmore); ♀, Salem, Oreg. (March; E. Y. Lansing); ♀, Logan Hill, Chehalis, Wash. (15–X–29, T. M. Clarke); ♀, Departure Bay, British Columbia (4–II–29); ♀, Fitzgerald, British Columbia (14–V–22, E. H. Blackmore); ♀, Fraser Mills, British Columbia (22–XI–23, L. E. Marmont); ♀, Quamichan Lake, British Columbia (1–IV–23, E. H. Blackmore); 2 ♀ ♀, Victoria, British Columbia (21–III–21, E. H. Blackmore; 23–VI–23, W. R. Carter); 2 ♀ ♀, no locality but British Columbia, specimens under Blackmore No. 160 (13–IV–23; 5–V–23).

Remarks.—This species has been placed under the name *gelidella* in collections.

AGONOPTERIX CLARKEI Keifer

PLATE 31, FIGURES 178, 178a; PLATE 40, FIGURES 230, 230a

Agonopteryx clarkei KEIFER, Bull. Southern California Acad. Sci., vol. 35, p. 10, pl. 4; pl. 7, fig. 6, 1936.

Agonopterix clarkei (Keifer) McDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8415, 1939.

Depressaria clarkei (Keifer) GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 315, 1939.

Labial palpus luteous; second segment irrorated with fuscous outwardly and in brush; third segment somewhat darker than second with poorly defined blackish-fuscous basal and subterminal annuli. Antenna fuscous with narrow, darker annulations, the latter obscured below. Head, thorax, base and costa of fore wing luteous, the head infuscated above; thorax infuscated particularly anteriorly; costa with fuscous spots and dashes throughout its length; beyond luteous basal patch deeply infuscated, this color rapidly fading; at middle a dark blotch from costa; first and second discal spots minute, black, obliquely one above the other; third discal spot at end of cell whitish followed by a black scale or two; all discal spots practically obsolete; cilia fuscous tipped with luteous. Hind wing luteous, darker apically; cilia with a fuscous basal band. Legs luteous overlaid and suffused except at joints; posterior legs somewhat lighter. Abdomen luteous, darker above than below; on each side, beneath, a blackish-fuscous line.

Male genitalia.—Harpe heavily clothed with long hairs; cucullus bluntly pointed, sacculus moderately sclerotized, narrow; clasper long, slender, straight, nearly reaching costa. Anellus a simple sclerotized plate with deeply excavated lateral, and convex posterior edges; longer than broad; hairy lateral lobes well developed. Vinculum evenly rounded. Aedeagus short, stout, strongly bent; vesica armed with many small spinules. Transtilla a narrow sclerotized band with well-developed hairy lateral lobes. Socii large, hairy, fleshy flaps.

Female genitalia.—Genital plate broad, moderately sclerotized, anterior margin cleft. Ostium small, situated near posterior edge of plate. Ductus bursae membranous, moderately long; inception of ductus seminalis just before ostium. Bursa copulatrix large, with a large, strongly sclerotized, toothed signum. Lobe of ovipositor with a few long, strong hairs and numerous moderately long stout spines.

Alar expanse, 18–20 mm.

Type.—U.S.N.M. No. 52092.

Type locality.—Missouri Flat, Placerville District, Calif.

Food plant.—*Artemisia vulgaris* L. var.

Remarks.—Keifer has discussed and figured this species in his paper, but I have refigured it for completeness' sake.

I have before me the specimens from Aweme, Manitoba, which Keifer discusses, but I do not believe these represent a different species. Although they could possibly be considered as a race, they differ from the typical specimens only in the slightly paler pink coloration in the cilia of the fore wing and in the apparently slightly

shorter spines of the lobes of the ovipositor. Until we know more about the specimens from Aweme I decline to give them a separate designation.

The type of ovipositor found in this species is unique for the genus.

AGONOPTERIX CLEMENSELLA (Chambers)

PLATE 26, FIGURES 159, 159a; PLATE 42, FIGURE 242

Gelechia clemensella CHAMBERS, Can. Ent., vol. 8, p. 173, 1876.

Depressaria clemensella (Chambers) BUSCK, Proc. U. S. Nat. Mus., vol. 27, p. 766, 1904.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 315, 1939.

Depressaria applana (Fabricius) WALSINGHAM, Trans. Amer. Ent. Soc., vol. 10, p. 175, 1882.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5251, 1891.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5862, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6405, 1903.

Agonopteryx clemensella (Chambers) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.

Agonopterix clemensella (Chambers) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8430, 1939.

Agnopteryx clemensella (Chambers) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6447, 1917.

Agonopteryx applana clemensella (Chambers) FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 239, 1923.

Labial palpus yellowish white; second segment irrorated with fuscous exteriorly and with a strong pink suffusion in the brush; third segment with basal and broad subapical annuli black. Antenna fuscous, somewhat lighter beneath. Head, thorax, and base of fore wing very light yellowish gray with fuscous and reddish-brown irrorations and a rosy suffusion. Ground color of fore wing reddish brown; costa and termen blotched with alternate fuscous and yellowish-white spots; whole surface of wing marked with scattered yellowish-white scales; discal spots four, white; one at end of cell preceded by one at middle of wing; at basal third two, one obliquely above the other; the outer surrounded by a dull fuscous cloud, the inner, oblique pair preceded by a few black scales; cilia reddish brown suffused with fuscous and irrorated with yellowish white. Hind wing and cilia shining yellowish fuscous, the latter with a fuscous basal band. Legs yellowish white overlaid and irrorated with fuscous exteriorly; posterior pair lighter in color, all with a rosy tint. Abdomen grayish fuscous above, yellowish white beneath with four longitudinal rows of fuscous spots.

Male genitalia.—Harpe slender, heavily clothed with hairs; sacculus moderately sclerotized; clasper slender, nearly reaching costa of harpe, slightly thicker at middle, strongly curved toward the cucullus. Anellus broadly rectangular, slightly constricted posteriorly; posterior

margin concave and with well developed lateral lobes. Vinculum broad with a pointed dorso-anterior process. Aedeagus long, curved, terminating in a sharp slender point; basally there is a sclerotized biramous arm by which the aedeagus articulates with the anellus. Transtilla a narrow sclerotized band, with large, profusely hairy, lateral lobes. Gnathos long, oval, slender, clothed with fine spines. Socii broad fleshy lobes.

Female genitalia.—Genital plate broad, lightly sclerotized; ostium small oval, at posterior edge of genital plate. Ductus bursae membranous, inception of ductus seminalis rather remote from ostium; bursa copulatrix oval. Signum a small, more or less rectangular plate, slightly cupped and covered with thornlike teeth.

Alar expanse, 16–20 mm.

Type.—In the Museum of Comparative Zoology, Cambridge, Mass.

Type locality.—Easton, Pa.

Food plant.—Parsnip; wild parsnip?.

Distribution.—Northeastern United States and eastern Canada.

United States records

Connecticut: ♂ (Beutenmüller).
District of Columbia: Chain Bridge, ♀ ("2–4–85"); Washington, ♀ ("21–4–85").
Illinois: Putnam County, ♂ (M. O. Glenn).
Maryland: Plummers Island, ♂ (March 1908, H. S. Barber).
New Hampshire: Hampton, ♂ (IV–26–04, S. A. Shaw).
New York: Ilion, ♂ (IX–3–11, McElhose); Ithaca, 2 ♀♀ (5–19–V–31, A. B. Klots); Lockport, ♀ (XI–30–35, L. L. Pechuman); Long Island: Orient, ♂ (VII–27–26; Ray Latham); Montvale, ♀ (November 26, 1923, F. M. Schott); Rochester, ♀ (3–IV–33, A. B. Klots).
Pennsylvania: New Brighton, 12 ♂♂, 7 ♀♀ (March and July to November dates, H. D. Merrick); Oak Station, Allegheny County, 2 ♀♀ (Oct. 15, 1908, and March 30, 1910, Fred Marloff); Pittsburgh, ♂ (IV–7–06, Henry Engel).
Vermont: Clarendon, ♂ (no date or collector).
Wisconsin: Millwood County, ♂ ("X–14–08").

Canadian records

Ontario: Ottawa (VIII–21–05, C. H. Young); Toronto ("III–2 to 8–95").

Remarks.—Busck [18] pointed out that in all probability *clemensella* is distinct from the European *applana.* There can be no doubt about the close relationship between the two species, but they can be separated easily on genitalic characters as well as pattern.

The ground color of *applana* is much lighter than that of *clemensella;* in the former there is a tendency to coalescence of the discal spots, whereas in the latter the spots are smaller and distinctly separated.

The male genitalia of *clemensella* show a slender, gradually finely

[18] Busck, Proc. U. S. Nat. Mus., vol. 27, p. 766, 1904.

pointed aedeagus and a very slender clasper as compared to a more abruptly pointed aedeagus and a stouter clasper in *applana*. The female genitalia show fewer differences, but those examined indicate that the ductus bursae of *applana* is longer in proportion to the other structures than that of *clemensella*. I have examined 16 European and 41 American specimens, all of which bear out the above conclusion.

In view of this evidence, I believe it is certain that the European *applana* does not occur in North America.

AGONOPTERIX ATRODORSELLA (Clemens)

PLATE 26, FIGURES 160, 160a; PLATE 43, FIGURE 252

Depressaria atrodorsella CLEMENS, Proc. Ent. Soc. Philadelphia, vol. 2, p. 124, 1863.—PACKARD, Guide to the study of insects, p. 349, 1869.—ROBINSON, Ann. Lyc. Nat. Hist. New York, vol. 9, p. 156, pl. 1, fig. 7, 1870.—CLEMENS, *in* Stainton, Tineina of North America, p. 91, 1872.—CHAMBERS, Can. Ent., vol. 4, p. 91, 1872.—ZELLER, Verh. zool.-bot. Ges. Wien, vol. 23, p. 233, 1873.—CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 138, 1878.—WALSINGHAM, Proc. Zool. Soc. London, 1881, p. 312.—COQUILLETT, Papilio, vol. 3, p. 98, 1883.—BEUTENMÜLLER, *in* Smith, Catalogue of the insects of New Jersey, p. 355, 1890.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5255, 1891.—DIETZ, *in* Smith, Catalogue of the insects of New Jersey, p. 473, 1900.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 736, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5854, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6397, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 173, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 310, 1939.

Agonopteryx atrodorsella (Clemens) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 238, 1923.

Agonopterix atrodorsella (Clemens) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8409, 1939.

Agnopteryx atrodorsella (Clemens) SMITH, Catalogue of the insects of New Jersey, p. 561, 1910.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6433, 1917.

Labial palpus and face yellowish white; second segment of palpus irrorated with fuscous exteriorly and in the brush, the latter also tinted with pink; third segment with basal and subapical annuli and tip blackish fuscous. Antenna with black, ochreous-tipped basal segment; remainder fuscous annulated with ochreous-fuscous. Head reddish ochreous with median fuscous area. Thorax and extreme base of fore wing blackish fuscous; collar whitish. Fore wing yellowish ochreous with sparse blackish irrorations; costa with four to six or seven blackish-fuscous spots; at basal third a black discal dot followed by a white one at the end of cell; from center of cell a longitudinal reddish blotch extending to apical third and enclosing the white discal spot; on costa, from apical third to apex, a longitudinal fuscous and ochreous cloud; cilia reddish ochreous. Hind wing light

reddish fuscous; cilia whitish with basal and two subapical bands fuscous. Legs yellowish white strongly overlaid with blackish fuscous except at joints; the latter suffused with pink. Abdomen light brownish ochreous, lighter on posterior margins of segments; beneath, yellowish white with broad, blackish-fuscous longitudinal, lateral stripes and two rows of similarly colored spots between.

Male genitalia.—Harpe broad basally but abruptly narrowed beyond clasper; moderately clothed with hairs; clasper long, slender, slightly bent, not quite reaching costa. Anellus a sclerotized plate, longer than broad, concave on posterior edge, constricted anteriorly, with prominent hairy lateral lobes. Aedeagus stout, slightly curved, pointed, with large spinulate patch in basal two-thirds of vesica. Transtilla a narrow sclerotized band with well developed, hairy, lateral lobes. Gnathos an elongate, oval, spined knob. Socii large fleshy, hairy flaps.

Female genitalia.—Ostium large, near posterior edge of genital plate. Genital plate very broad, produced anteriorly; anterior edge deeply cleft, the cleft semicircular, the anterior points nearly touching. Ductus bursae long, membranous, gradually tapering to form the large oval bursa copulatrix; inception of ductus seminalis just anterior to ostium. Signum a large diamond-shaped, spined plate.

Alar expanse, 18–24 mm.

Type.—In the Academy of Natural Sciences of Philadelphia.

Type locality.—Pennsylvania.

Food plants.—*Bidens frondosa* L., *Myrica asplenifolia* L., *Eupatorium* sp.

Distribution.—Eastern United States and Canada.

United States records

Connecticut: ♂ (Beutenmüller, coll.).

District of Columbia: Washington, ♂ (X–25–02).

Illinois: Flosmoor, ♂, ♀ (no date or collector); Evanston, ♂ ("4–99").

Massachusetts: Cummington, ♂ (no date or collector); Dover, ♂ (8–7–33, no collector); Marthas Vineyard, ♂ ("1–3," George D. Eustis); Winchendon, ♂ (IX–28–02, no collector).

New Hampshire: Hampton, 3 ♂♂ (V–10–13, S. A. Shaw).

New Jersey: Cedar Grove, ♂ (IV–9–24, F. M. Schott).

New York: Ilion, ♂, ♀ (V–3–13, H. McElhose); Ithaca, ♀ (X–24–35, J. G. Franclemont); 2 ♂♂ (12–V–31, 5–V–31, A. B. Klots); Liberty, ♀ (no date or collector); New Windsor, 2 ♂♂ (13–VIII–'93; 23–VIII–'97, E. L. Morton).

Pennsylvania: New Brighton, 4♂♂ (IX–7–02, IX–27–02, V–25–06, IX–29–06, H. D. Merrick).

Vermont: Clarendon, ♂ (W. D. Kearfott).

Wisconsin: Cranmoor, Wood County, ♀ (IV–22–08, C. B. Hardenberg); Madison, ♂ (XI–10–23, S. B. Fracker).

Canadian records

Ontario: Bobcaygeon (July 24, 1931, J. McDunnough); Hymers, ♂ (IX–16–23); Merivale (May 1, 1936, W. J. Brown); Ottawa, ♂ (IV–21–1900); (3 specimens, May 9, 1904, C. H. Young; March 29, 1906, May 1, 1906, J. Fletcher); Toronto (no further data); Trenton (May 5–21, 1911, Evans).

Quebec: Aylmer (April 29, 1904, C. B. Hutchings); Chelsea (July 17, 1915, J. McDunnough); Fairy Lake (April 24, 1932); Knowlton (September 11, 1929, J. McDunnough); Meach Lake (March 29, April 25, 1900; September 25, 1902; May 4, 1901, C. H. Young).

Remarks.—In addition to a long collected series of this species I have a specimen before me from Madison, Wis., reared from *Myrica asplenifolia* by S. B. Fracker, and four from Dover, Mass. (Gipsy Moth Lab.), reared from "*Coreopsis*" (synonym of *Bidens*). The wide difference in food plant is very surprising in view of the fact that nearly all species are either host specific or feed on very closely related species of plants. The specimen from Bobcaygeon, Ontario, was reared from *Eupatorium.*

AGONOPTERIX SCABELLA (Zeller)

PLATE 43, FIGURE 250

Depressaria scabella ZELLER, Verh. zool.-bot. Ges. Wien, vol. 23, p. 236, 1873.—CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 138, 1878.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5280, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 749, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5892, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6435, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 177, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 348, 1939.

Depressaria scabrella WALSINGHAM, Proc. Zool. Soc. London, 1881, p. 312.

Agonopteryx scabella (Zeller) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 239, 1923.

Agonopterix scabella (Zeller) MCDUNNOUGH, Check List of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8453, 1939.

Agnopteryx scabella (Zeller) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6439, 1917.

Alar expanse, 24 mm.

Type.—In the British Museum.

Type locality.—"Ohio."

Remarks.—I have one specimen, supposedly this species, before me and have figured the genitalia (fig. 250, ♀), which show it is very close to *atrodorsella.*

AGONOPTERIX PTELEAE Barnes and Busck

PLATE 27, FIGURES 162, 162a; PLATE 43, FIGURE 251

Agonopteryx pteleae BARNES and BUSCK, Contr. Lepid. North America, vol. 4, p. 231, pl. 28, fig. 13; pl. 38, fig. 1, 1920.

Agonopterix pteleae (Barnes and Busck) McDUNNOUGH, Check list of Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8426, 1939.

Depressaria pteleae (Barnes and Busck) MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 175, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 342, 1939.

Labial palpus light ochreous; second segment with fuscous base and irrorations exteriorly; third segment with fuscous basal and subapical annuli. Antenna fuscous. Head reddish ochreous above; face light silvery ochreous. Thorax and fore wing light ochreous-brown mottled and suffused with black and brown, the entire surface roughened with raised scales; extreme base at inner angle whitish ochreous broadly edged with black; from costa to end of cell a large blackish-fuscous blotch; along costa and around termen a series of blackish-fuscous spots; first and second discal spots black, the latter obscured by the large costal blotch. Hind wing light ochreous fuscous; cilia light ochreous brown with basal band a shade lighter. Legs light ochreous brown suffused and annulated with blackish fuscous. Abdomen light ochreous-brown, with two lateral longitudinal rows of black spots on the underside.

Male genitalia.—Harpe moderately sclerotized, pointed, and almost entirely clothed with fine hairs; at base, just inside costa, is a group of long fine spines; clasper and a narrow "spur" of the sacculus adjacent to it, heavily sclerotized. The clasper tapers gently to a fine point, is slightly curved, and reaches almost to costa. Anellus a heavily sclerotized oval plate, longer than broad, with truncated posterior edge; lateral lobes large, hairy. Transtilla a narrow sclerotized band with well-developed, hairy lateral lobes. Aedeagus rather stout, curved, and pointed, with a lateral, lightly sclerotized flap from about the middle to the apex. Gnathos a short oval knob armed with many spines. Socii small, mainly indicated by hairs. Tegumen with a single apical projection.

Female genitalia.—Ostium large, near posterior edge of genital plate. Genital plate greatly produced anteriorly and narrowly cleft on anterior margin. Extreme posterior portion of ductus bursae abruptly constricted before ostium, where ductus seminalis enters; ductus bursae gently tapering to form the large bursae copulatrix. Signum a roughly diamond shaped, sclerotized, spined plate.

Alar expanse, 20–22 mm.

Type.—In the United States National Museum.

Type locality.—Decatur, Ill.

Food plant—Ptelea trifoliata L. (hoptree).

Remarks.—This species is exceedingly close to *pulvipennella* but differs from it by the rough-scaled fore wing, smaller anellus, and less sharply pointed anterior margin of the genital plate.

Besides the type series in the National collection from Decatur, Ill. (June 1–15), there are two specimens from Rockford, Ill. (collector "O. H. S.") among the undetermined material, which, although somewhat larger and darker than the types, undoubtedly belong here. This species has an unmistakable roughened appearance due to the presence of many long, slender, almost hairlike, upturned scales on practically the entire insect.

AGONOPTERIX EUPATORIIELLA (Chambers)

PLATE 27, FIGURES 163, 163a; PLATE 43, FIGURE 249

Depressaria eupatoriiella CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 82, 115, 1878.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5261, 1891.

Agonopteryx plummerella BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 199, 1908.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 239, 1923. (New synonymy.)

Agonopterix plummerella (Busck) MCDUNNOUGH, Check List of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8454, 1939.

Agnopteryx plummerella (Busck) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6456, 1917.

Depressaria plummerella MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 177, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 340, 1939.

Depressaria pulvipennella BUSCK, not Clemens (in part), Proc. U. S. Nat. Mus. vol. 24, p. 737, 1902.

Labial palpus light ochreous-gray: second segment lightly irrorated with black scales; third segment almost wholly black, with only narrow, poorly defined, median and apical bands of the light ground color showing; long, recurved. Antenna dark fuscous narrowly annulated with light ochreous. Head, thorax, and fore wing ochreous-fuscous; face shining light ochreous-gray; thorax and fore wing speckled with numerous black and white scales, the majority of the former raised; at the end of cell a white discal spot surrounded by a few black scales and preceded by two black discal spots at basal third, the latter obliquely one above the other; along costa a series of poorly defined blackish spots; cilia ochreous-fuscous. Hind wing shining fuscous, lighter basally than apically; cilia light fuscous, whitish distally with a narrow dark basal band. Legs whitish ochreous overlaid and mottled with fuscous except at joints. Abdomen ochreous-fuscous above, whitish ochreous beneath with four longitudinal rows of blackish-fuscous spots.

Male genitalia.—Harpe rather short, broad, with the costal two-thirds clothed with fine hairs; cucullus rounded; sacculus and clasper moderately sclerotized; clasper slightly curved toward cucullus distally and reaching about two-thirds distance across harpe. Anellus oval, longer than broad, well sclerotized, with posterior edge concave; lateral lobes clothed with fine hairs. Vinculum rounded. Aedeagus

slender, bent just before middle, apex pointed, upturned. Transtilla a narrow, weakly sclerotized band with well-developed, hairy lateral lobes. Gnathos an oval spined knob. Socii broad flaps, weakly sclerotized and with few hairs.

Female genitalia.—Ostial opening very large, occupying over half the length of the genital plate; genital plate broad; anterior margin with semicircular cleft, the anterior points of which are widely separated. Ductus bursae long, gradually broadening into the large bursa copulatrix; at posterior end of ductus bursae an elongate, lightly sclerotized patch. Signum a large, strongly sclerotized, diamond-shaped plate with the anterior and posterior points of the diamond curled. The plate is armed with short stout teeth.

Alar expanse, 22-24 mm.

Types.—In the Museum of Comparative Zoology, Cambridge, Mass. (*eupatoriiella*); in the United States National Museum (No. 11943) (*plummerella*).

Type localities.—"Kentucky" (*eupatoriiella*); Plummers Island, Md. (Busck); Cincinnati, Ohio (Dr. A. F. Braun) (*plummerella*).

Food plant.—Eupatorium.

Distribution.—Eastern United States probably as far north as New England.

United States records

Illinois: Putnam County, ♀ (14–IV–1939, M. O. Glenn).

Maryland: Plummers Island, 10 ♂♂, 6 ♀♀ (March to August dates, 1905–1908, A. Busck and H. S. Barber).

Ohio: Athens, 3 ♂♂, 2 ♀♀ (11–XI–39, 29–I–40, 10–II–40, R. C. Barnes); Noble County, ♂, ♀ (10–IX–39, 31–XII–40, R. C. Barnes).

Pennsylvania: Pittsburgh, ♂, ♀ (4–IV–06, 18–XI–06, Henry Engel).

Remarks.—This species is apparently very close to *scabella* Zeller, but since I have no authentic material of the latter species, I cannot be sure of the genitalia. I quote, in part, a letter from Mr. Stringer of the British Museum, to Mr. Busck concerning *plummerella* and *scabella*, which was written before I had an opportunity to examine *eupatoriiella:*

"I have carefully compared *plummerella* with our type of *scabella* Z., and have no doubt that they are distinct. The labial palpi of *scabella* have the *Depressaria* "furrow" on second joint but much more compact and the terminal joint is shorter, not so pointed or recurved as in your species and *nebulosa* Z.; in color markings there is no difference. In size and color of fore wings your species is nearer to *nebulosa; scabella* is a smaller species with much narrower fore wing and is brown-gray, not salt and pepper; it is also devoid of any markings on the underside of either wing as in *plummerella* and almost all of the species of the genus."

I have examined the type of *eupatoriiella* in the Museum of Comparative Zoology and have made a slide of the female genitalia. This and *plummerella* appear to be identical; *eupatoriiella* was synonymized with *pulvipennella* Clemens through misidentifications made by Lord Walsingham. The specimens in the United States National Museum, referred to by Busck,[19] are clearly *pulvipennella; pulvipennella* lacks the rough scaling which is found on the wings of *eupatoriiella* and so cannot be confused with it. Chambers clearly states in his description of *eupatoriiella*, "the palpi and wings dusted with blackish atoms, *each of which is a minute tuft* * * *"

AGONOPTERIX PULVIPENNELLA (Clemens)

PLATE 27, FIGURES 164, 164a; PLATE 43, FIGURE 253

Depressaria pulvipennella CLEMENS, Proc. Ent. Soc. Philadelphia, vol. 2, p. 421, 1864.—ROBINSON, Ann. Lyc. Nat. Hist. New York, vol. 9, p. 157, 1868.—CHAMBERS, Can. Ent., vol. 4, p. 91, 1872.—CLEMENS, *in* Stainton, Tineina of North America, p. 244, 1872.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5276, 1891.—BUSCK. Proc. U. S. Nat. Mus., vol. 24, p. 737, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5858, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6401, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 342, 1939.

Depressaria fulvipennella DIETZ, *in* Smith, Catalogue of the insects of New Jersey, p. 474, 1900.

Depressaria solidaginis WALSINGHAM, Ins. Life, vol. 1, p. 255, 1899.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5281, 1891.

Agonopteryx pulvipennella (Clemens) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 238, 1923.

Agonopterix pulvipennella (Clemens) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8440, 1939.

Agnopteryx pulvipennella (Clemens) SMITH, Catalogue of the insects of New Jersey, p. 561, 1910.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6449, 1917.

Agnopteryx pulvipenella BRIMLEY, The insects of North Carolina, p. 304, 1938.

Labial palpus whitish ochreous tinged with pink; second segment irrorated with blackish fuscous exteriorly; third segment with basal and subapical annuli and tip black. Antenna fuscous. Face shining whitish ochreous. Head reddish ochreous suffused with fuscous posteriorly. Thorax and fore wing light reddish ochreous mottled and irrorated with blackish fuscous; extreme base of the light ground color and followed by a rapidly fading fuscous shade that does not reach costa; at basal third two black discal spots obliquely one above the other, followed by a third, white discal spot at the end of cell; in center of wing beyond the first and second discal spots a blackish-fuscous shade surrounding the third discal spot; along costa and around

[19] Busck, Proc. U. S. Nat. Mus., vol. 24, p. 737, 1902.

termen a series of blackish-fuscous blotches and spots; cilia light ochreous-fuscous. Hind wing light fuscous; cilia somewhat lighter with a dark basal band. Legs whitish ochreous suffused and mottled with blackish fuscous except at joints; at joints the ochreous is strongly tinged with pink. Abdomen grayish ochreous above; beneath whitish ochreous with broad blackish-fuscous longitudinal lateral lines and two rows of blackish-fuscous spots between the lateral lines.

Male genitalia.—Harpe broad, clothed with fine hairs; clasper straight, slender, reaching well beyond middle of harpe; cucullus bluntly pointed. Anellus a large oval plate, longer than broad, with concave posterior margin, narrow biramous, strongly sclerotized median area and well developed hairy, lateral lobes. Aedeagus slender, sharply curved, pointed; vesica with large spinulate patch. Vinculum rounded. Transtilla a moderately broad, sclerotized band, with well developed, hairy, lateral lobes. Gnathos an oval, spined knob. Socii large, sparsely hairy, fleshy flaps.

Female genitalia.—Ostium small, near posterior margin of genital plate. Genital plate very broad, produced anteriorly and deeply and narrowly cleft on median anterior edge. Ductus bursae long, membranous, gradually tapering into the large bursa copulatrix; inception of ductus seminalis very near ostial opening. Signum a large, diamond-shaped, spined plate; posterior and anterior points curled.

Alar expanse, 18-24 mm.

Type.—In the Academy of Natural Sciences of Philadelphia.

Type locality.—"Illinois."

Food plants.—*Solidago* and *Urtica*.

Distribution.—Eastern United States and Canada.

United States records

Connecticut: East River, ♀ (September 3, 1908, Chas. R. Ely).

District of Columbia: Washington, 3 ♂♂, ♀ (IV–21–85); ♂ (IV–7–1900); ♂ (IV–21–1900).

Louisiana: Natchitoches, ♂ (August, G. Coverdale).

Maine: Orono, 2 ♂♂ (October 8, '88, one, no date).

Maryland: Plummers Island, 17 ♂♂, 4 ♀♀ (March, April, and September dates, collected by H. S. Barber, A. Busck, E. A. Schwarz).

Massachusetts: Chilmark, ♂ (IX–3–1935, George D. Eustis); Cohasset, ♀ (May 11, '07, Owen Bryant); Framingham, ♀ (April 21, 1905); Springfield, ♂ (no date, G. Dimmock); Winchendon, ♂ (IX–28–02).

Missouri: (One specimen, no date.)

New Hampshire: Hampton, ♂ (IV–30–04, S. A. Shaw).

New Jersey: Denville, ♀ ("X–14"); Essex County, ♀ (IV–20–09, W. D. Kearfott).

New York: Ilion, ♂, 2 ♀♀ (IX–3–11, H. McElhose); ♀, same (IX–2–12); Ithaca (many ♂♂ and ♀♀, various dates in coll. Cornell Univ.).

Ohio: Athens, 2 ♀♀ (29–I–40, R. C. Barnes).

Pennsylvania: New Brighton, ♂, ♀ (IX–27–02, X–23–07, H. D. Merrick).

Virginia: Vienna, ♀ (February 14, 1915, R. A. Cushman).

Wisconsin: Cranmoor, Wood County, ♂ (IV–22–08, C. B. Hardenberg).

Canadian records

Manitoba: Cartwright, ♀ (X–11–03, E. F. Heath).
Nova Scotia: Bridgetown, ♂, ♀ (5–9–IX–1912, G. E. Saunders).
Ontario: Ottawa (♀, April 28, 1905; ♂, May 7, 1905, C. H. Young); Trenton, ♂ (25–IV–1911, Evans).
Quebec: Meach Lake (♀, April 19, 1902; October 12, 1907, C. H. Young); Montreal, ♂ (V–3–04, "A. F. W.").

Remarks.—The variety of food plants indicates that this species is a rather general feeder. I believe we are dealing with at least two very closely related species, which can be separated only by a careful comparison of larvae and pupae, the adult characters not being sufficient for separation. Moths reared from *Solidago* are darker, and the coloring is more suffused than in the majority of specimens. This may be due entirely to the difference in food plant, but there is not sufficient material at hand to determine this definitely.

The species appears to be confined to midwestern and eastern North America.

AGONOPTERIX WALSINGHAMELLA (Busck)

PLATE 28, FIGURES 165, 165a; PLATE 44, FIGURE 254

Depressaria walsinghamella BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 739, 1902.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 356, 1939.

Depressaria fernaldella WALSINGHAM, Ins. Life, vol. 1, p. 256, 1889.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5864, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6407, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922. [Not *Depressaria fernaldella* Chambers, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 82, p. 138, 1878.]

Agnopteryx fernaldella BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6443, 1917.

Agonopterix fernaldella (Walsingham) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8443, 1939.

Agonopteryx walsinghamella FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 239, 1923.

Agonopteryx walsinghamiella BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.

Agonopterix walsinghamiella MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8443, 1939. [As synonym of *fernaldella* (Walsingham).]

Labial palpus pale cinereous strongly suffused with reddish; second segment irrorated with blackish scales exteriorly; third segment with blackish scales exteriorly; third segment with blackish-fuscous basal and median annuli (the former poorly defined) and apex. Antenna fuscous annulated with dull cinereous and tinged with reddish. Head tawny-red with slight cinereous irrorations; face pale cinereous. Thorax and base of fore wing, except costal part, cinereous; fore part

of thorax and tegula suffused and irrorated with reddish. Fore wing deep crimson-red sparsely irrorated with black and cinereous scales; costa, nearly to apex, broadly tawny-red with veins 9 to 12 strongly indicated by cinereous and irrorated with black scales and with poorly defined fuscous spots on extreme edge; discal spots white; first discal spot at basal third edged with carmine; second at end of cell preceded by a few carmine scales; cilia reddish fuscous edged with carmine. Hind wing light fuscous, darker apically than basally; cilia light fuscous with whitish irrorations and pale pink suffusions. Legs pale cinereous overlaid and irrorated with fuscous, except at joints, and suffused with reddish. Abdomen pale grayish fuscous above; beneath, pale cinereous with two black longitudinal lateral stripes.

Male genitalia.—Harpe moderately clothed with fine hairs, tapering gently to a pointed cucullus; clasper short, stout, straight, scarcely exceeding middle of harpe, slightly rugose on exterior edge. Sacculus narrow, moderately sclerotized. Anellus longer than broad, concave on posterior edge, narrowed basally, with well-developed, sparsely hairy lateral lobes. Aedeagus stout, curved, much narrower in distal than proximal half; vesica armed with numerous spinulate cornuti. Vinculum rounded. Transtilla a narrow, lightly sclerotized band with moderately well developed, hairy lateral lobes. Gnathos a spined oval knob. Socii fleshy, hairy flaps. Tegumen terminating in a moderately long, pointed process.

Female genitalia.—Genital plate broad, lightly sclerotized. Ostium round, opening at posterior edge of genital plate; the area around ostium slightly raised above the remainder of surface of plate. Ductus bursae long, membranous; ductus seminalis opening well before ostium. Bursa copulatrix large with small signum situated about middle.

Alar expanse, 20–22 mm.

Type.—In the British Museum.

Type localities.—Orono, Maine; Wisconsin.

Food plants.—*Myrica asplenifolia* L. and *Myrica carolinensis* Mill.

Distribution.—Eastern United States and Canada.

United States records

Connecticut: East River, ♂ (August 5–13, Chas. R. Ely).

Maine: Bar Harbor, 8 ♂♂, ♀ (May to November dates, 1934–1938, A. E. Brower); Kennebunkport, 2 ♀♀ (September 24–30); Orono, ♀.

Massachusetts: Springfield (a series of 4 ♂♂ and 3 ♀♀ reared from *Myrica asplenifolia* by Dimmock).

New Hampshire: Hampton, 8 ♂ ♂ (March and April dates; S. A. Shaw, coll.).

New York: Albany.

Pennsylvania: Hazelton, ♂ ("9–12–04").

Wisconsin: (Acc. Forbes.)

Canadian records

Nova Scotia: Digby, ♂ (IX–19–07, J. Russell); White Point Beach, Queens County, ♀ (VIII–20–34, reared, J. McDunnough).

Ontario: Biscotasing (May 16, 1931, Karl Schedl); Constance Bay (October 3, 1932, W. J. Brown).

Quebec: Kazubazua (August 13–23, 1933, G. S. Walley); Laniel (June 3, 1932, H. S. Fleming).

Remarks.—The identity of this species and the invalidity of Walsingham's name have been established by Busck.[20]

AGONOPTERIX FUSCITERMINELLA, new species

PLATE 28, FIGURES 167, 167a; PLATE 44, FIGURE 258

Depressaria yeatiana WALSINGHAM (not Fabricius) Proc. Zool. Soc. London, 1881, p. 316.

Depressaria arenella WALSINGHAM (not Schiffermüller), Trans. Amer. Ent. Soc., vol. 10, p. 175, 1882.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America. No. 5253, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 743, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5877, 1903.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6420, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 174, 1922.

Agonopteryx arenella BUSCK (not Schiffermüller), Proc. U. S. Nat. Mus., vol. 35, p. 199, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6446, 1917.

Antenna fuscous, faintly and narrowly annulated with ochreous; apex and underside of basal segment whitish ochreous sprinkled with black or dark-brown scales outwardly; palpus with brush well developed; terminal segment with black subbasal and supramedial annuli and black tip. Face and head whitish ochreous, the latter intermixed with brownish scales. Thorax whitish ochreous; dorsally the ground color is liberally mixed with brown and blackish scales. In the posterior half are two crests of raised scales. Fore wing with ochreous ground color strongly overlaid with reddish brown and liberally sprinkled with fuscous to black scales; extreme base ochreous followed, in dorsal half, by a strong red-brown patch, the latter mixed with black in basal part; at the base of cell two small obliquely placed black spots followed by a strong fuscous or black cloud; the latter surrounded by a reddish-brown suffusion; at the end of cell another small black spot. Costa and termen with conspicuous black spots. Cilia ochreous with brown scales intermixed and the whole with a distinct rosy tinge. Hind wing whitish, strongly suffused apically with fuscous; scales at base of cilia, along termen, and frequently around posterior margin, black. Cilia light brownish ochreous. Underside of hind wing with many black scales in apical half. Legs ochreous; fore leg with femur fuscous inwardly; anterior surface of tibia bright pink with overlying brownish scales, the

[20] Busck, Proc. U. S. Nat. Mus., vol. 24, p. 739, 1902.

latter having a purplish sheen: tarsi broadly edged with fuscous. Mesothoracic legs like anterior pair but without fuscous femora and with more fuscous on tibiae and tarsi. Hind legs almost wholly whitish ochreous except for delicate pink suffusion on tibiae and fuscous tibial spurs. Abdomen ochreous with broken black lateral lines beneath and suffused with fuscous above.

Male genitalia.—Harpe elongate, narrow; weakly sclerotized except for clasper, sparsely clothed with fine hairs; clasper straight, blunt, pointed, reaching about two-thirds distance across harpe. Anellus longer than broad, subrectangular, moderately sclerotized; posterior edge convex; lateral lobes little developed. Transtilla a narrow sclerotized band with weak lateral lobes. Aedeagus moderately slender, with sharp, upturned point. Gnathos an oval, spined knob. Socii well developed hairy flaps.

Female genitalia.—Base of lobe of ovipositor with a row of long stout hairs. Ostium moderately large, round. Genital plate broad, moderately sclerotized. Ductus bursae long, membranous; inception of ductus seminalis near opening of ostium. Bursa copulatrix large, oval, symmetrical, merging gradually with the ductus; signum a large, roughly diamond-shaped, spined, sclerotized plate.

Alar expanse, 22–25 mm.

Type.—U.S.N.M. No. 52077.

Type locality.—Duncan, Vancouver Island, British Columbia.

Food plant.—*Cynoglossum grande* Dougl. ex Lehm.

Remarks.—Described from the ♂ type and 5 ♂ ♂ and 13 ♀ ♀ paratypes as follows: Type ♂, Duncan, Vancouver Island, British Columbia (July 1, 1910, Hanham); paratypes, 3 ♂ ♂ and 7 ♀ ♀, Duncan, British Columbia (June and July dates, Hanham); ♂ and 2 ♀ ♀, Wellington, British Columbia (April and October dates, G. W. Taylor); ♂ and 4 ♀ ♀, Phoenix Lake, Marin County, Calif. (V–11 to VI–2–1927, H. H. Keifer).

Paratypes in the U. S. National Museum and H. H. Keifer collection, Sacramento, Calif.

In superficial appearance very much like the European *arenella* but easily differentiated from it by the genitalia; in the male of *arenella* the clasper is very broad and flattened, with a deep excavation on the outer edge, while the clasper of *fusciterminella* is straight, fingerlike; the harpe of *arenella* is shorter and broader than that of *fusciterminella*. In the female of *arenella* the anterior edge of the genital plate is strongly convex but that of *fusciterminella* is much less strongly so.

The California specimens are somewhat darker than those from British Columbia, but this may be due to their having been reared.

The northern specimens show more pink on the legs also, but they are identical in other characters, including genitalia.

This species has been confused with *pallidella* Busck and has been placed in collections under that name.

AGONOPTERIX CAJONENSIS, new species

PLATE 31, FIGURES 180, 180a; PLATE 42, FIGURES 244, 244a

This species is much like *argillacea* but lacks the median dark shade of the fore wing.

Labial palpus light ochreous-white, lightly mottled exteriorly on second segment with fuscous; third segment with black subbasal and supramedial bands and tip; the basal band is poorly defined. Antenna fuscous with ochreous-white scaling on basal segment and basal third. Head, thorax, and ground color of fore wing grayish fuscous heavily overlaid with ochreous-white; face light ochreous-white; base of fore wing and basal third of costa ochreous-white; the light basal portion is followed by a dark fuscous shade; whole surface of fore wing sparsely irrorated with small fuscous spots; at the end of cell a conspicuous ochreous-white spot narrowly edged with fuscous; cilia grayish fuscous. Hind wing grayish fuscous; cilia concolorous with light basal band. Legs grayish fuscous strongly overlaid with ochreous-white. Abdomen grayish fuscous above with posterior margins of segments ochreous-white; beneath ochreous-white with a well-defined lateral stripe on each side and a pair of black spots on the posterior margin of each segment between the lateral lines.

Male genitalia.—Harpe rather sharply narrowed before cucullus; cucullus bluntly pointed; clasper long, curved, slightly dilated distally; sacculus moderately sclerotized. Anellus longer than broad, slightly constricted at about middle; posterior edge concave; lateral lobes large, extending nearly to posterior edge of central plate. Aedeagus slender, curved, pointed, with ventral sclerotized arm by which it is attached to the anellus; vesica armed with an elongate patch of fine cornuti. Vinculum rounded, with well-developed dorsoanterior process. Transtilla a moderately broad sclerotized band with well-developed lateral lobes. Tegumen pointed.

Female genitalia.—Genital plate very broad, strongly sclerotized. Ostium small, crescentic, opening slightly posterior to middle. Ductus bursae long, membranous; inception of ductus seminalis just before ostium. Bursa copulatrix large, oval, symmetrical, with well-developed 4-pointed signum.

Alar expanse, 20–23 mm.

Type.—U.S.N.M. No. 52948.

Type locality.—Cajon Valley, Calif.

Food plant.—Unknown.

Remarks.—Described from the type ♂ and 1 ♀ paratype (Cajon Valley, Calif., 25–VI–1937, Grace H. and John L. Sperry).

Both specimens were received from Mr. Sperry in material submitted for determination.

AGONOPTERIX ROSACILIELLA (Busck)

PLATE 28, FIGURES 166, 166a; PLATE 44, FIGURE 257

Depressaria rosaciliella BUSCK, Proc. U. S. Nat. Mus., vol. 27, p. 763, 1904.—ANDERSON, Catalogue of British Columbia Lepidoptera, No. 1093, 1904.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 346, 1939.

Depressaria ciliella WALSINGHAM (not Stainton), Proc. Zool. Soc. London, 1881, p. 316.—BUSCK (not Stainton), Proc. U. S. Nat. Mus., vol. 24, p. 739, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5863, 1903. [Not *Depressaria ciliella* Stainton, Trans. Ent. Soc. London, 1849, p. 161, pl. 17, fig. 7; or Rebel, *in* Staudinger and Rebel, Catalog der Lepidopteren des palaearctischen Faunengebietes, vol. 2, No. 3234, 1901.]

Depressaria rosiciliella MEYERICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922.

Agonopteryx rosaciliella BUSCK, Proc. U. S. Nat Mus., vol. 35, p. 198, 1908.—BRAUN, Proc. Acad. Nat. Sci. Philadelphia, vol. 73, pt. 1, p. 10, 1921.

Agonopterix rosaciliella (Busck) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8431, 1939.

Agonopteryx ciliella FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 239, 1923.

Agnopteryx rosaciliella (Busck) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6448, 1917.

Labial palpus ochreous-white suffused with pale reddish; second segment mottled exteriorly with blackish fuscous; third segment with basal and subterminal bands and tip black. Head, thorax, and fore wing ochreous-white heavily overlaid with reddish, suffused with reddish fuscous, and irrorated with sparse blackish scales; face whitish; light basal portion of fore wing containing a fuscous spot and followed by a deep reddish-fuscous shade, the latter diminishing in intensity outwardly; costa and termen with a series of more or less distinct fuscous spots, those on costa alternated with small whitish-ochreous spots; discal spots four, white, edged with black; first and second obliquely one above the other, third and fourth in line with second, the fourth at end of cell; cilia fuscous with strong reddish suffusion. Hind wing and cilia light fuscous, the latter with a strong reddish suffusion. Legs ochreous-white with reddish tinge and strongly overlaid and irrorated with blackish fuscous except at joints.

Male genitalia.—Harpe long, lightly sclerotized, bluntly pointed, very hairy, especially in costal half. Clasper straight, slender, gradually tapering to a blunt point, reaching beyond middle of harpe. Vinculum produced anteriorly to form a broad, rounded, short projection. Anellus a more or less rectangular plate, longer than broad, slightly emarginate on posterior edge, with large, hairy, lateral lobes.

Aedeagus slender, not heavily sclerotized; dilated basally and sharply pointed distally; the point is slightly upturned; vesica armed with numerous fine, long cornuti. Transtilla a weakly sclerotized band with slightly hairy, lateral lobes. Gnathos conical, slender; covered with fine spines. Socii fleshy lobes mainly indicated by hairs.

Female genitalia.—Genital plate broad, moderately sclerotized. ostium situated at about center of plate. Ductus bursae very long (permitting the bursa coupulatrix to reach extreme anterior portion of abdomen), slender, gradually becoming larger to form the symmetrical bursa copulatrix; inception of ductus seminalis well before ostium. Signum a small, lightly sclerotized, spined, bilobed plate.

Alar expanse, 20–26 mm.

Type.—In the United States National Museum.

Type locality.—"Camp Watson," Oreg. (III-IV-1872, Walsingham).

Food plants.—*Osmorhiza* (Dr. A. F. Braun, 1921); *O. occidentalis* Torr. (Clarke, 1935).

Note.—*Osmorhiza occidentalis* Torr. Although the three species of *Osmorhiza* (*occidentalis*, *divaricata*, and *brevipes*) that are indigenous to the State of Washington were found at Godman Springs, Blue Mountains, at an altitude of approximately 6,000 feet, larvae infested only *O. occidentalis*. An extended search was made to determine the host specificity of the species, and in all localities where the food plants were found *rosaciliella* attacked only *O. occidentalis*.

Distribution.—Northwestern United States and southwestern Canada.

United States records

Montana: Glacier National Park, ♂ (August 7, 1920, A. F. Braun).
Oregon: "Camp Watson," ♀ (III–IV–1872, Walsingham).
Washington: Godman Springs, Blue Mountains, alt. 6,000 feet, 8 ♂♂ (VIII–3 to 8–35); Pullman, ♀ (III–1–98, C. V. Piper).

Canadian records

British Columbia: Kaslo, ♂ (Dyar and Cockle); Trout Lake, ♂ (18–VIII–1937, H. Leech).
Saskatchewan: Scott, ♀ (20–X–1923, Kenneth M. King).

Remarks.—I have before me a series of 12 specimens reared from *Osmorhiza occidentalis* and 90 from *Echinopanax horridum*. The former series is from the interior of Washington State, while the latter is from the Puget Sound (coastal) region.

For some time I have thought that these two series represented two distinct but closely related species. I am now of the opinion, however, that they are conspecific, but that the coastal specimens represent a distinct race. The interior specimens are, with one exception, considerably darker and more suffused than those from the Puget Sound

area, but on genitalia characters they are identical, and for this reason I do not feel justified in separating them specifically. The larvae show a few differences in coloration, but larvae of this group are likely to vary even though they may come from eggs of the same female. No doubt the color variation existing between the two groups of specimens is induced by differences in food plants. The habits of the larvae are much the same, both forming rolls, but those on *Osmorhiza* have an easier time of it because of the small size of the leaves on which they work; those on *Echinopanax* have to cut the leaf from the edge inwardly first and then form the roll.

I am including a description of the larvae from both localities so that their similarities and differences may be appreciated better. In the main the larvae are the same.

Dr. Braun has been kind enough to send me a specimen from Yellowstone National Park reared by her from *Osmorhiza*. It resembles the Puget Sound series more closely than do the eastern Washington specimens.

The larva is as follows: Length, 15–16 mm. Head dull yellowish brown, spotted with a darker brown posterolaterally; from the base of the antenna, extending in a line to the posterior edge of the head, is a broad blackish-brown band constricted in the middle (in some specimens the band is considerably broader than in others); ocelli light brown. The margins of the underside of the head are blackish brown. Cervical shield pale green, broadly edged laterally and posteriorly with black and bisected with a fine whitish-green median line. Thoracic and abdominal segments bright green heavily suffused with reddish purple in the dorsal half when the larva is mature. Posteriorly on the segments the reddish-purple color entirely obscures the green. In the dorsal half there are three brownish-fuscous longitudinal stripes, the outer ones fully twice as broad as the median one. On abdominal segments 2–7 inclusive, near the dorsoanterior margin, on each side of the dorsal stripe, is an outwardly oblique line of 4 to 6 small green spots. Between the longitudinal lines are several small green spots generally following folds in the skin. Anal plate green, heavily suffused with reddish purple. Tubercles black centrally, whitish green outwardly. Spiracles ringed with black, with a whitish-green suffusion outwardly. Thoracic legs concolorous with segments.

Dr. A. F. Braun first discovered larvae of this species in Yellowstone National Park. She has sent me one bred specimen from this lot of larvae. Although the food plant is widespread throughout the inland empire, the larvae are very difficult to locate. Much time has been spent in a search for these larvae in order to clear up the status of this and related species. On July 13, 1935, a stand of *Osmorhiza* was found at Godman Springs, Blue Mountains, Columbia County,

Wash., at an altitude of 6,000 feet. After a somewhat prolonged search ten larvae and one pupa were collected, the latter being the first found.

The larva is distinctly a leaf roller, not invading the umbels as is done so commonly by members of *Agonopterix* and *Depressaria*. The pupa was found in an umbel, but there was no sign of feeding having taken place, and I do not think it is the usual habit for pupation to occur there. It seems more likely that pupation generally occurs about the base of the plant in debris. This larva is one of the most active in the group, being easily disturbed and very difficult to capture.

Pupa: Normal for group: Wing, antenna, and leg sheaths bright green. Abdominal segments green heavily suffused with reddish purple dorsally. On the second day the color begins to deepen; the sheaths become a duller and darker green and the abdominals a light reddish brown. The color gradually becomes darker until the pupa is almost black.

The pupal period is 13–14 days.

This species is very close to the European *ciliella* and was identified as such by Walsingham. The American *rosaciliella* has a much more slanting termen and appears to be a more narrow-winged species than *ciliella*. The genitalia of the male of *rosaciliella* show a truncated anellus, while in *ciliella* the anellus is concave. The harpes of the former species are less pointed and broader than those of the latter.

The abdomen of the type is lost, but I do not hesitate to place the reared series under this name.

AGONOPTERIX ROSACILIELLA ECHINOPANICIS, new variety

Similar to typical *rosaciliella* but may be distinguished from it by the generally lighter color and less suffused and less smoky appearance. The black scaling is sparser and more sharply contrasted.

The male and female genitalia are the same as those of typical *rosaciliella*.

Alar expanse, 20–26 mm.

Type.—U. S. N. M. No. 52252.

Type locality.—Skyline Ridge, Mount Baker district, Whatcom County, Wash. Altitude 2,500–3,000 feet.

Food plant.—*Echinopanax horridum* (Smith) Dene. and Planch.

Remarks.—Described from the type ♂ and 78 ♂ and ♀ paratypes as follows: Skyline Ridge and Bagley Creek, Whatcom County, Wash., altitude 2,500–3,000 feet, 35 ♂ ♂ and 40 ♀ ♀ (September 5–12, 1933 and 1935, J. F. G. Clarke); Fraser Mills, British Columbia, 2 ♀ ♀ (IV–10–21, IV–4–23, L. E. Marmont); Vancouver, British Columbia, ♀ (no date).

Paratypes in the United States National Museum, Canadian National collection, and the collection of H. H. Keifer, Sacramento, Calif.

The larva is as follows: Length, 14–16 mm.; head dark brown to black. Thoracic shield greenish to light brown bisected by a whitish median line and broadly bordered with black on the posterolateral edges. Thoracic and abdominal segments green, the latter suffused dorsally with reddish; from the mesothorax, in the dorsal half, two broad longitudinal brown stripes; a third median longitudinal stripe of the same color beginning at the first abdominal segment and continuing posteriorly the full length of the body. Thoracic legs greenish. Tubercles black. Spiracles edged with black. Anal plate light brown.

Pupa: At first yellowish green with the abdominal segments suffused with reddish dorsally. In 24 hours the wing sheaths become green and the abdominal segments reddish brown. The pupa finally turns deep reddish brown; wing sheaths nearly black, but they still retain a greenish sheen.

The pupal period of 12 to 15 days.

AGONOPTERIX NOVI-MUNDI (Walsingham)

PLATE 28, FIGURES 168, 168a

Depressaria parilella novi-mundi WALSINGHAM, Ins. Life, vol. 1, p. 256, 1889.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5273, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 74, 1902.

Depressaria novimundi (Walsingham) BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5866, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6409, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 175, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 335, 1939.

Agonopteryx novimundi (Walsingham) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.

Agonopterix novimundi (Walsingham) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8428, 1939.

Agnopteryx novimundi (Walsingham) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6454, 1917.

Labial palpus sordid whitish; irrorated with blackish fuscous inwardly and outwardly on the second segment and in the brush; third segment with black subbasal and supramedial annuli. Antenna blackish fuscous with grayish annulations. Head, thorax, and ground color of fore wing grayish fuscous, the latter heavily overlaid with dull purplish fuscous; head scales and dark scales of fore wing tipped with cinereous; at base of fore wing an indistinct fuscous patch followed by a poorly defined yellowish-brown shade; at basal third an outwardly oblique black dash in disk edged with yellowish

brown; at end of cell an indistinct white discal spot; between veins, in apical third, yellowish-brown shading; along costa and around termen a series of poorly defined fuscous spots; cilia fuscous tipped with white. Hind wing shining yellowish fuscous; cilia concolorous, lighter apically. Legs cinereous strongly overlaid with shining yellowish fuscous except at joints.

Male genitalia.—Harpe broad, sparsely clothed with hairs; clasper slender, pointed, dilated about middle, reaching two-thirds distance to costa. Anellus more or less rectangular, longer than broad, concave on each side before posterior end and also on posterior margin; lateral lobes weak, hairy. Vinculum rounded. Aedeagus stout, bent, pointed, the point slightly upturned; vesica with a weak spinulate patch about middle. Transtilla a broad, sclerotized band with large hairy lateral lobes. Gnathos an oval, spined knob. Socii large hairy, fleshy flaps.

Alar expanse, 16 mm.

Type.—In the British Museum.

Type localities.—Mount Shasta, Siskiyou County, Calif., and "North Oregon."

Remarks.—Various specimens in collections have been associated with this species, but the only two I have seen that belong under this name are paratypes of Lord Walsingham's that he deposited in the National collection. I have seen no females.

AGONOPTERIX PALLIDELLA (Busck)

PLATE 32, FIGURES 182, 182a; PLATE 44, FIGURE 256

Depressaria pallidella BUSCK, Proc. U. S. Nat. Mus., vol. 27, p. 765, 1904.—ANDERSON, Catalogue of British Columbia Lepidoptera, No. 1095, 1904.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 174, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 337, 1939.

Agnopteryx pallidella (Busck) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6461, 1917.

Agonopterix pallidella (Busck) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8418, 1939.

Agonopteryx terinella BARNES and BUSCK, Contr. Lepid. North America, vol. 4, p. 232, pl. 28, fig. 15, 1920.

Agonopterix terinella (Busck) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8418, 1939. (As synonym of *pallidella* (Busck).)

Depressaria terinella MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 174, 1922.

Agonopteryx serrae CLARKE, Can. Ent., vol. 65, p. 84, pl. 5, 1933.

Agonopterix serrae (Clarke) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8418, 1939. (As synonym of *pallidella* (Busck).)

Depressaria serrae (Clarke) GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 350, 1939

Labial palpus whitish ochreous, second segment irrorated with blackish fuscous exteriorly; third segment with subbasal and supramedial bands blackish fuscous. Antenna fuscous. Head, thorax, and fore wing light ochreous. Face shining light silvery ochreous; head with light infuscation anteriorly; thorax and fore wing irrorated with blackish fuscous and shaded with fuscous; extreme base whitish ochreous, with a single blackish fuscous spot in the fold and followed by a rapidly fading fuscous shade; along costa and around termen a series of blackish fuscous spots; at basal third, in cell, two black discal spots, obliquely one above the other, followed by a fuscous cloud; the latter is in turn followed by a blackish fuscous spot at end of cell; cilia light grayish fuscous irrorated with whitish ochreous. Hind wing grayish fuscous, cilia concolorous, with a slightly darker basal band. Legs whitish ochreous; fore and mid legs heavily overlaid with fuscous except at joints; hind leg overlaid with fuscous on femur with slight infuscation on tibia and tarsus. Abdomen fuscous above; beneath whitish ochreous with broad, fuscous lateral line on each side.

Male genitalia.—Harpe almost entirely clothed with fine hairs; cucullus rounded, with several long, coarse marginal hairs; clasper straight, reaching just beyond middle of harpe; anellus a moderately sclerotized plate (with the posterior edge convex), with large sparsely hairy lobes laterally. Vinculum rounded, with dorsoanterior process well developed. Aedeagus stout, slightly bent about middle, and bearing a flat, sclerotized basal process by which the aedeagus articulates with the anellus. Transtilla a narrow, lightly sclerotized band. Gnathos a heavily spined cone. Socii flat, hairy lobes. Terminal portion of tegumen pointed.

Female genitalia.—Genital plate narrow. Ostium semicircular. Ductus bursae membranous, becoming gradually larger to form the symmetrical bursa copulatrix. Signum an oblong-oval, toothed plate.

Alar expanse, 17–24 mm.

Types.—In the United States National Museum.

Type localities.—Kaslo, British Columbia (*pallidella*); Silverton, Colo. (*terinella*); Pullman, Wash. (*serrae*).

Food plant.—*Senecio serra* Hook.

Distribution.—Western United States and southwestern Canada.

United States records

California: Warner Mountains, 3 miles east of Davis Creek, Modoc County, alt. 5,500 feet, 2 ♂♂ and ♀ (VII–8 to 15–22, A. W. Lindsey).

Colorado: Silverton, 3 ♂♂ and ♀ (August 24–30).

Utah: Stockton, 2 ♂♂ and ♀ (VII–8–07, VII–30–13, VII–21–07, Tom Spalding); Warner Ranger Station, La Sal Mountains, 9,000 feet, (July 1933, A. B. Klots).

Washington: Pullman, 31 ♂♂ and 37 ♀♀ (VI–15 to VII–3–1932–35, J. F. G. Clarke [reared]).

Canadian records

British Columbia: Kaslo, ♂ (Dyar and Cockle); Keremeos, 3 ♂♂ (VI–30 to VII–11–23, C. B. Garrett).

Remarks.—I do not hesitate to accept the above synonymy after carefully studying the types of all three species. It is not surprising that the three species should have been described because of the apparent differences. When carefully compared these differences are reduced to mere shades of coloration. The specimens of *terinella* are somewhat darker than the type of *pallidella*, and this is no doubt due to the fact that they are in better condition than the rubbed type of the latter species. A long reared series of *serrae* shows all but one or two decidedly darker than either of the two types above, but this depth of color is purely environmental. There are no differences in the genitalia of either the males or females.

Under this name a long series of both reared and captured specimens from British Columbia and California has previously been placed. Although the genitalia of these specimens are similar to *pallidella* they are amply different in other respects. They are described on an earlier page of this paper as *A. fusciterminella*, new species.

AGONOPTERIX ARNICELLA (Walsingham)

PLATE 33, FIGURE 186

Depressaria arnicella WALSINGHAM, Proc. Zool. Soc. London, 1881, p. 313, pl. 36, fig. 3.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5254, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 738, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5859, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6402 1903.—ANDERSON, Catalogue of British Columbia Lepidoptera, No. 1089, 1904.—KEARFOTT, Can. Ent., vol. 37, p. 296, 1905.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 174, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 307, 1939.

Agonopteryx arnicella (Walsingham) BUSCK, Proc. U. S. Nat. Mus., vol 35, p. 198, 1908.

Agonopterix arnicella (Walsingham) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera) No. 8414, 1939.

Agnopteryx arnicella (Walsingham) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6452, 1917.

Labial palpus pale whitish ochreous; second segment heavily overlaid with fuscous exteriorly and with a pink spot, about the middle of brush, inwardly; third segment with apex and subterminal annulus black and a poorly defined subbasal annulus fuscous. Antenna dark grayish fuscous. Face shining whitish. Head yellowish ochreous; tuft beneath eye brilliant carmine. Thorax and fore wing pale whitish

ochreous; thorax suffused and irrorated with fuscous; pale basal shade of fore wing with black suffusion on extreme base of costa, a black spot in fold and followed by a fuscous shade that does not reach costa; on the inner margin, at angle, an elongate black blotch in the fuscous shade; along costa and around termen a series of blackish-fuscous spots; apical third of costa roseate; at basal third two black discal spots, obliquely one above the other, followed by a fuscous shade; at end of cell a white discal spot edged with black; cilia grayish fuscous suffused with reddish. Hind wing shining gray; cilia concolorous, with strong reddish suffusion. Legs whitish ochreous strongly overlaid with fuscous except at joints; tip of tibia of first leg and the tips of tibia and first tarsal segment of second leg, carmine; tibia of hind leg with strong reddish suffusion.

Male genitalia.—Harpe broad, moderately sclerotized, sparsely clothed with fine hairs; sacculus slightly emarginate at base of clasper, otherwise parallel with costa; harpe not narrowing toward the broad, rounded cucullus; clasper very short and slender, scarcely reaching past the middle of the harpe. Anellus an oval plate constricted basally and produced posteriorly, with hairy, lateral lobes. Vinculum rounded. Transtilla a broad but lightly sclerotized band with small narrow, lateral lobes. Gnathos an oval, spined knob. Socii moderately clothed with fine hairs. Aedeagus slender, curved, pointed; dilated slightly basally and with a well developed sclerotized arm by which the aedeagus articulates with the anellus; vesica armed with numerous fine, weak cornuti.

Alar expanse, 22 mm.

Type.—In the British Museum.

Type locality.—Mount Shasta, Calif.

Food plants.—*Arnica angustifolia* (Vahl) (?); *Erigeron* sp. (Dr. Braun's record).

Remarks.—I have received a male and a female of this species from Dr. Annette F. Braun, of Cincinnati, Ohio. This is the first record of the occurrence of this species since its discovery at Mount Shasta, Calif., by Lord Walsingham in 1871. Dr. Braun's material was reared from larvae collected at Hoh Lake, Olympic Mountains, Wash., August 13, 1936. The moths emerged September 2, 1936. This record extends the known range of the species 1,000 miles northward.

Notes made in the field by Dr. Braun are as follows: "Larvae in the top of *Erigeron* shoot, webbing together the uppermost leaves and flowerbuds; very dark purplish in color, with paler tubercles."

The food plant, as recorded by Dr. Braun, casts some doubt on the correctness of Lord Walsingham's determination of the host of *arnicella.* Both food plants are Compositae, but I question Lord Walsingham's record.

The female submitted by Dr. Braun is the first I have seen. Lord Walsingham did not specify the sexes of the five specimens in his type series, and, although he probably had a female or two, the one before me is the only authentic one in this country. There are two male paratypes from Lord Walsingham's series in the National collection and one male in the Museum of Comparative Zoology at Cambridge, Mass. I have compared the genitalia of one of the National Museum paratypes with the genitalia of Dr. Braun's male and find them identical. The male genitalia of *arnicella* are unique in the genus so there can be no doubt about the identity of the Washington specimens.

I am greatly indebted to Dr. Braun for this interesting record and also for the male specimen she has deposited in the National collection.

AGONOPTERIX ROBINIELLA (Packard)

PLATE 29, FIGURES 169, 169a ; PLATE 44, FIGURE 259

Depressaria robiniella PACKARD, Guide to the study of insects, p. 349, pl. 8, fig. 14, 1869.—CHAMBERS, Can. Ent., vol. 4, p. 91, 107, 1872; Cincinnati Quart. Journ. Sci., vol. 1, p. 208, 1874.—WALSINGHAM, Proc. Zool. Soc. London, 1881, p. 312.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5278, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 745, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5882, 1903.—KEARFOTT, in Smith, List of the Lepidoptera of Boreal America, No 6425, 1903.—TRAVER, Psyche, vol. 26, p. 78, 1919.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 346, 1939.

Agonopteryx robiniella (Packard) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 199, 1908.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 241, 1923.

Agonopterix robiniella (Packard) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8448, 1939.

Agnopteryx robiniella (Packard) SMITH, Catalogue of the insects of New Jersey, p. 561, 1910.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6471, 1917.—BRIMLEY, The insects of North Carolina, p. 304, 1938.—PROCTER, Biological survey of the Mount Desert region, Part 6, The insect fauna, p. 273, 1938.

Depressaria hilarella ZELLER [not Coquillett, Papilio, vol. 3, p. 98, 1883], Verh. zool.-bot. Ges. Wien, vol. 23, p. 234, 1873.—WALSINGHAM, Proc. Zool. Soc. London, 1881, p. 312.—SMITH, Catalogue of the insects of New Jersey, p. 355, 1890.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5266, 1891.—DIETZ, *in* Smith, Catalogue of the insects of New Jersey, p. 474, 1900.

Agonopterix hilarella (Zeller) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8448, 1939. (As synonym of *robiniella* (Packard).)

Labial palpus whitish ochreous basally, gradually becoming more yellowish toward the apex; second segment mottled with brick red and fuscous exteriorly and in the brush; third segment with subbasal and subterminal annuli brick red and fuscous, respectively, the former redder, the latter more fuscous. Antenna fuscous with considerable

red scaling basally, especially above. Head, thorax, and ground color of fore wing yellow, mottled and overlaid with brick red and irrorated and shaded with fuscous and black; at basal third two black discal spots, the one nearer the inner margin less distinct than that toward costa; discal spot at end of cell absent or very indistinct; replaced by a subtriangular fuscous shade; before termen a poorly defined dark band not attaining costa; along costa and around termen a series of indistinct blackish spots; cilia light fuscous, tinged with red. Hind wing grayish fuscous with terminal edge narrowly blackish fuscous; cilia light fuscous with narrow subbasal and subterminal bands. Legs whitish ochreous suffused and mottled with brick red and fuscous. Abdomen whitish ochreous strongly overlaid with fuscous above; beneath sparsely irrorated with fuscous and black and with a row of black spots on each side.

Male genitalia.—Harpe elongate, clothed with fine hairs, cucullus pointed; clasper short, stout, straight. Anellus oval, slightly longer than broad, posterior edge truncated; lateral lobes weak, clothed with short hairs. Aedeagus stout, slightly curved; vesica with an elongate patch of fine, spiculate cornuti. Vinculum rounded. Transtilla a broad sclerotized band with large lateral lobes. Gnathos an elongate, oval, spined knob. Socii large, hairy, fleshy flaps.

Female genitalia.—Genital plate broad; area posterior to ostium with two small sclerotized patches. Ostium oval, near center of plate. Ductus bursae long, membranous, dilated at point of inception of ductus seminalis. Bursa copulatrix with minute signum.

Alar expanse, 14–20 mm.

Type.—Lost?

Type locality.—Massachusetts?

Food plants.—*Robinia pseudoacacia* L.; *Sanicula?*

Distribution.—Northeastern United States and eastern Canada.

United States records

Illinois: Oconee, ♂ (July 1–7).

Maine: Freedom, ♀ (J. C. Parlin); Salisbury Cove (July 27; acc. Procter).

Maryland: Plummers Island, 2 ♂♂ (August 1903, A. Busck; 2–VIII–20, H. S. Barber).

Massachusetts: Manchester, ♂ (Beutenmüller coll.); Marthas Vineyard, 5 ♂♂, 2 ♀♀ (July and August, F. M. Jones); Vineyard Haven, ♂ ("VII–13," F. M. Jones); Woods Hole (♂, 19–VII–1919; ♀, 15–VIII–1914, W. T. M. Forbes).

New Hampshire: Hampton, 3 ♀♀ (VII–2–05, VII–8–08, S. A. Shaw).

New York: Bedford, 2 ♀♀ (15–VII–34, A. B. Klots); Ithaca (5 ♂♂, July and August dates, W. T. M. Forbes; ♂, 8–VIII–33, E. C. Hodson; ♂, 11–VII–1928, ♂, 22–VII–1928, A. B. Klots; ♀, 27–VII–1929, A. G. Richards); Mattituck, Long Island, ♀ (4–VI–1933, Roy Latham); New Windsor, ♂ (June 1891); Orient, Long Island, 8 ♂♂, 8 ♀♀ (April to October dates, 1933–1934, Roy Latham); Rochester, ♀ (31–VII–33, A. B. Klots); Southold, Long Island, ♀ (August, Roy Latham).

North Carolina: Black Mountains, ♀ ("July 4").
Ohio: Cincinnati, ♂, ♀ (VII–11–04, A. F. Braun).
Pennsylvania: New Brighton, ♂, ♀ (VIII–9–07, VII–20–02, H. D. Merrick); Oak Station, Allegheny County, ♂ (26–VI–1911, Fred Marloff).

Canadian records

Nova Scotia: Bridgetown, ♀ (VIII–8–1912, "G. E. S."); Truro, ♀ (25–VII–1913, R. Matheson).
Ontario: Point Pelee, ♂, ♀ (26–VII and 11–VII–1927, F. P. Ide [reared from *Robinia pseudoacacia*]); Port Hope, 2 ♀♀ (one, 24–VII–1897; the other without date or collector); Toronto, ♀ (no date or collector); Trenton, ♂ (12–VII–1908, Evans); Vineland Station, 2♀♀ (5–VII–1938, W. L. Putnam [reared from *Robinia pseudoacacia*]).

Remarks.—This and the following three species have been confused repeatedly in collections because of the difficulty of separating them on superficial characters. The moths of all four intergrade to some extent, but *dimorphella*, and less so *lecontella*, can be distinguished rather readily. Under the respective species I have discussed their separation from *robiniella*.

I have described what I consider to be typical *robiniella*. It must be borne in mind that there is considerable variation between specimens and that many lack the red coloration found in the typical form. The characters I have used in the key, and those I have discussed in my remarks under the various species, should suffice to place any doubtful specimens.

AGONOPTERIX LECONTELLA (Clemens)

PLATE 44, FIGURE 260

Depressaria lecontella CLEMENS, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 174.—ROBINSON, Ann. Lyc. Nat. Hist. New York, vol. 9, p. 157, pl. 1, fig. 9, 1870.—CLEMENS, *in* Stainton, Tineina of North America, p. 137, 1872.—CHAMBERS, Can. Ent., vol. 4, p. 146, 1872; U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 138, 1878.—WALSINGHAM, Proc. Zool. Soc. London, 1881, p. 312.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5268, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 745, 1902; *in* Dyar, U. S. Nat. Mus Bull. 52, No. 5883, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6426, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 330, 1939.
Agonopteryx lecontella (Clemens) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 199, 1908.
Agnopteryx lecontella (Clemens) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6472, 1917.
Agonopterix lecontella (Clemens) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8447, 1939.

Labial palpus pale ochreous; second segment irrorated exteriorly with fuscous; third segment with subbasal and median bands fuscous. Antenna fuscous. Head, thorax, and ground color of fore wing light ochreous; the thorax, except collar, and fore wing, except base and basal third of costa, strongly overlaid and suffused with brown; fore wing sparsely irrorated with black scales, more so in distal half; a spot at extreme base of costa, one subcostally and another on inner angle near base, black; at basal third two conspicuous, black discal spots, one above the other, surrounded by a pale ochreous shade, the latter followed by a poorly defined fuscous cloud; at the end of cell a poorly defined whitish-ochreous spot; along costa, around termen to inner margin a series of small fuscous spots; cilia pale ochreous-fuscous edged outwardly with pale ochreous. Hind wing grayish fuscous; cilia somewhat lighter with ochreous-fuscous terminal band. Legs pale ochreous slightly irrorated and suffused with fuscous. Abdomen light ochreous, suffused with fuscous.

Female genitalia.—Genital plate moderately narrow with a strongly sclerotized, slightly produced anterior edge. Ostium large, occupying most of length of genital plate. Ductus bursae very long, gradually tapering into the large asymmetrical bursa copulatrix. Inception of ductus seminalis on right side of ductus bursae just before ostium. Bursa bulged out to the right, the evaginated part annulated with a series of concentric ridges; the signum is a moderately large, strongly sclerotized, toothed plate with well developed anterior and posterior points and is situated at the periphery of the evaginated portion of the bursa copulatrix.

Alar expanse, 18–25 mm.

Type.—In the Academy of Natural Science of Philadelphia.

Type locality.—"Pennsylvania."

Food plant.—*Baptisia tinctoria* R. Brown.

Distribution.—Known only from the type locality (presumably Pennsylvania) and one other specimen from Arendtsville, Pa. (7–4–29, S. W. Frost).

Remarks.—In the National collection there is a single female of this species. Aside from the type it is the only other specimen I have seen. Everything else I have seen in the collections under this name is referable to other species and is dealt with accordingly.

This species can be distinguished from the others with which it has been confused by the pale area surrounding the two conspicuous black discal spots at basal third, by the pale whitish-ochreous spot at the end of the cell, and by the strong signum of the bursa.

This species is not included in the key based on gentalia.

AGONOPTERIX THELMAE, new species

PLATE 44, FIGURE 259A

Depressaria lecontella SMITH [not Clemens], Catalogue of the insects of New Jersey, p. 355, 1890.—DIETZ, *in* Smith, Catalogue of the insects of New Jersey, p. 474, 1900.

Agonopteryx lecontella FORBES [not (Clemens)], Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 241, 1923.

Agnopteryx lecontella SMITH [not (Clemens)], Catalogue of the insects of New Jersey, p. 561, 1910.

Labial palpus whitish ochreous; second segment irrorated exteriorly with reddish fuscous; third segment with blackish-fuscous subbasal and supramedial bands. Antenna with basal segment whitish ochreous indistinctly annulated with fuscous basally, finally becoming fuscous in apical third. Head, thorax, and ground color of fore wing whitish ochreous. Thorax and fore wing irrorated with fuscous and suffused with dull reddish; beneath inner edge of tegula, on each side, a fuscous spot; extreme base of costa and a narrow line beyond light basal area, fuscous; at basal third two superposed blackish-fuscous spots; a similar one at end of cell preceded by an orange-red streak; between this streak and the costa a small fuscous shade; along costa and around termen a series of indistinct fuscous spots, those around termen more reddish; cilia whitish ochreous with a reddish tint. Hind wing fuscous; cilia whitish ochreous banded with fuscous. Legs whitish ochreous suffused and irrorated with reddish fuscous except at joints. Abdomen whitish ochreous heavily overlaid with fuscous above and with a row of black spots on each side beneath.

Male genitalia.—Similar to *robiniella* but with slightly narrower transtilla and with coarse, though small, cornuti.

Female genitalia.—Genital plate narrow, convexly produced anteriorly. Ostium large, broad, oval, about middle of genital plate. Ductus bursae membranous except for a strongly dilated, lightly sclerotized area near posterior third; inception of ductus seminalis near ostium. Bursa copulatrix moderately large, without signum.

Alar expanse, 17–25 mm.

Type.—U. S. N. M. No. 53175.

Type locality.—Oak Station, Allegheny County, Pa. (24–VIII–1910, Fred Marloff).

Food plant.—Unknown.

Remarks.—Described from the ♂ type, 16 ♂ and 14 ♀ paratypes as follows: ♀, "Connecticut"; 3 ♂ ♂, Plummers Island, Md. (July, August, 1903, A. Busck; 2–VII–1920, H. S. Barber); ♀ Marthas Vineyard, Mass. (September 1, F. M. Jones); ♀, Ithaca, N. Y. (2–IX–1924, W. T. M. Forbes); ♀, Lenox ([New York?]; Beutenmüller); 2 ♀ ♀ "New York"; ♂, Linwood Hill, N. Y. (14–VII–1888, H. G. Dyar); ♂,

Sea Cliff, Long Island, N. Y. ("August"); 12 ♂ ♂, ♀ Oak Station, Allegheny County, Pa. (July and August dates, 1908–1911, Fred Marloff); ♀, Lobo, Ontario (29–VIII–1924, H. F. Hudson); 2 ♀ ♀, Port Hope, Ontario (17–VIII–1896, 15–VIII–1897, no collector); 2 ♀ ♀, Toronto, Ontario (no date or collector); 2 ♀ ♀, Montreal, Quebec (10–IX–1904, no collector).

Paratypes in the United States National Museum, Canadian National, and Cornell University collections.

This species is difficult to separate, with certainty, from *robiniella* on superficial characters and on male genitalia. All the specimens I have seen, however, have a distinct orange-red bar or dash in the cell before the outer discal spot; all specimens of *robiniella* I have seen lack it. The females can be easily separated by genitalia. The genital plate of *thelmae* is narrow, that of *robiniella* broad.

In addition to the type series I have seen 2 ♀ ♀ from Massachusetts (Chilmark, "VIII–6" George D. Eustis; Vineyard Haven, VIII–10–36, F. M. Jones) and 1 ♀ from Maine (October 12, 1938, A. E. Brower).

AGONOPTERIX DIMORPHELLA, new species

PLATE 31, FIGURES 179, 179a; PLATE 40, FIGURE 229

A medium-sized species superficially resembling *lecontella* and *robinella* but darker and smaller than either.

Labial palpus with second segment creamy white irrorated with fuscous outwardly; third segment fuscous with each scale tip and a median, inner fascia creamy white. Antenna with basal segment and proximal fourth creamy white beneath and fuscous above; distal three-fourths fuscous with narrow, lighter annulations. Head, thorax, and fore wing reddish ochreous, suffused with fuscous. From costa a fuscous median shade extending almost to inner margin; well before termen a similar but narrower, less conspicuous outwardly curved shade; before middle of cell two small black discal spots, one above the other; at end of cell a conspicuous yellow discal spot; cilia fuscous, irrorated with creamy white, and with a distinct pink tinge; underside of fore wing blackish fuscous. Hind wing blackish fuscous; cilia a lighter shade of the same color. Fore leg with femur fuscous inwardly, creamy white outwardly; tibia creamy white overlaid or irrorated with fuscous outwardly; tarsi fuscous annulated with creamy white. Mid legs and hind legs creamy white with tibiae fuscous outwardly; tarsi fuscous with creamy white annulations. Abdomen fuscous above, creamy white beneath with a black lateral line on each side.

Male genitalia.—Harpe moderately clothed with hairs; cucullus pointed; clasper stout, short, scarcely exceeding middle of harpe,

bluntly pointed; sacculus moderately sclerotized. Annellus longer than broad, constricted basally; lateral edges convex; posterior edge concave; lateral lobes poorly developed. Aedeagus stout, slightly curved, bluntly pointed; vesica armed with a large patch of small cornuti. Vinculum rounded, with prominent dorsoanterior process. Transtilla a narrow sclerotized band with well developed, hairy lateral lobes. Socii moderately large hairy lobes. Tegumen pointed.

Female genitalia.—Genital plate moderately sclerotized, with produced, truncate anterior margin. Ostium small, round. Ductus bursae membranous; inception of ductus seminalis well before ostium. Signum absent.

Alar expanse, 11–18 mm.

Type.—U.S.N.M. No. 52947.

Type locality.—Henry, Putnam County, Ill.

Food plant.—Amorpha fruticosa L.

Remarks.—Described from the ♂ type, 78 ♂ and 65 ♀ paratypes all from the same locality. These are all reared specimens, bearing May and June dates, from larvae collected by Murray O. Glenn.

Paratypes in the collections of Murray O. Glenn, Magnolia, Ill.; H. H. Keifer, Sacramento, Calif.; Dr. Annette F. Braun, Cincinnati, Ohio.; Los Angeles Museum; and Canadain National Museum.

In this species the males are strikingly darker and smaller and the markings less contrasting than in the females.

I am indebted to Mr. Glenn for the long series of reared specimens which make up the type series. Some of the specimens were reared by Mr. Glenn while others were reared in Washington from larvae submitted by him. The specimens reared at Washington are identical with those reared in Illinois, although the emergence dates are earlier for the former than for the latter.

Of this species Mr. Glenn writes, "The first emergence was June 4 (1938), and the heaviest from June 10–13. Pupation in the field occurs immediately (after the larva matures) at the base of the plant. In many instances this is the only place available as the shrub is often completely surrounded by water, except for a small hummock, about a foot in diameter, formed by the plant roots."

This species may be separated readily from *robiniella* or *lecontella* by the yellow discal spot of the fore wing.

AGONOPTERIX ARGILLACEA (Walsingham)

PLATE 29, FIGURES 171, 171a; PLATE 44, FIGURE 255

Depressaria argillacea WALSINGHAM, Proc. Zool. Soc. London, 1881, p. 313, pl. 36, fig. 2.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5252, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 738, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5860, 1903; Proc. U. S. Nat. Mus., vol. 27, p.

763, 1904.—Anderson, Catalogue of British Columbia Lepidoptera, No. 1090, 1904.—Kearfott, *in* Smith, List of the Lepidoptera of Boreal America, No. 6403, 1903; Can. Ent., vol. 37, p. 296, 1905.—Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 174, 1922.—Gaede, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 306, 1939.

Agonopteryx argillacea (Walsingham) Busck, Proc. U. S. Nat. Mus., vol. 35, p. 199, 1908.—Forbes, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 238, 1923.

Agonopterix argillacea (Walsingham) McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8413, 1939.

Agnopteryx argillacea (Walsingham) Barnes and McDunnough, Check list of the Lepidoptera of Boreal America, No. 6459, 1917.

Agonopteryx blacella Barnes and Busck, Contr. Lepid. N. Amer., vol. 4, p. 232, pl. 38, fig. 2, 1920. (New synonymy.)

Agonopterix blacella (Barnes and Busck) McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8422, 1939.

Depressaria blacella (Barnes and Busck) Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 174, 1922.

Labial palpus, antenna, head, thorax, and fore wing pale grayish ochreous; labial palpus suffused and lightly irrorated exteriorly on second segment with fuscous; third segment with subbasal and subapical annuli (the former poorly defined) and tip blackish fuscous; antenna darker apically; face lighter than rest of head; pale basal patch of fore wing diffused along costa and bounded below it by an outwardly diffused but inwardly distinct blackish-fuscous shade; remainder of fore wing sparsely irrorated with black scales; along costa and around termen a series of indistinct fuscous spots; at basal third, in cell, two black discal spots (sometimes containing some brown scales) obliquely one above the other, followed by a blackish fuscous cloud above the middle of the wing and reaching a sordid-whitish discal spot at the end of cell; the spot at end of cell is narrowly edged with blackish fuscous and brown scales and usually preceded by a similar, brown-edged white spot; cilia concolorous with ground color of fore wing. Hind wing and cilia pale grayish ochreous, the latter with light-fuscous basal band. Legs pale grayish ochreous suffused with blackish fuscous except at joints. Abdomen light grayish fuscous above; beneath, pale grayish ochreous with a lateral row of black spots on each side.

Male genitalia.—Harpe ample, moderately sclerotized and clothed with hair; cucullus rounded; clasper slender, straight, reaching beyond center of harpe. Anellus broadly rectangular, somewhat narrower basally, longer than broad and with weakly developed lateral lobes. Vinculum rounded. Aedeagus moderately sclerotized; stout, curved with apex pointed and sometimes slightly dorsally upturned. Gnathos an elongate oval spined knob. Socii fleshy, hairy lobes.

Female genitalia.—Ostium spindle-shaped (transverse). Genital plate moderately broad, produced anteriorly, the production of the anterior margin as wide as the genital plate is long. Ductus bursae membranous, variable in length; inception of ductus seminalis just anterior to ostium. Bursa copulatrix not abruptly defined but formed by the gradual broadening of the ductus bursae. Signum a sclerotized, toothed, diamond-shaped plate.

Alar expanse, 19–24 mm.

Types.—In the British Museum (*argillacea*); in the United States National Museum (*blacella*).

Type localities.—Newville, Tehama County, Calif. (*argillacea*); Shasta Retreat and Truckee, Calif. (*blacella*).

Food plant.—*Salix* spp.

Distribution.—Western United States and western Canada and northeastern United States and eastern Canada.

United States records

California: Sacramento, 11 ♂♂, 2 ♀♀ (V–10 to 24–33, H. H. Keifer [reared]); Truckee, 8 ♂♂, 8 ♀♀ (August and October dates, Ximena McGlashan).
Idaho: Johnson's Bar, Snake River, ♀ (IV–10–26, J. F. G. Clarke).
Oregon: Fort Klamath, Fort Watson (Walsingham).
Pennsylvania: New Brighton, ♀ (VI–20–07, H. D. Merrick).
Washington: Dieringer, ♀ (VIII–1–32, W. W. Baker [reared]); Battleground, Clark County, ♂ (VIII–22–30, J. F. G. Clarke); Logan Hill, Chehalis, ♂, ♀ (II–5–30, III–28–30, T. M. Clarke); Pullman (4 ♂♂, 3 ♀♀, March to November dates, T. M. and J. F. G. Clarke [reared]).

Canadian records

British Columbia: Duncan, ♀ ("1–10–12", Hanham); Vancouver, ♂ (IV–6–03); Victoria, ♂, ♀ ("7–9–03"; "3–7–03"); Wellington, 2 ♂ ♂ (IV–30–02), ♀ ♀ ("2–5–02"; "20–4–07") 4 ♂♂ (April, G. W. Taylor).
New Brunswick: Frederickton, ♀ (Aug. 27, 1929, R. P. Gorham).
Ontario: Biscotasing, ♂ (VIII–4–31, Karl Schedl); Bobcaygeon, ♂ (VIII–16–32, J. McDunnough); Stittsville, ♂ (21–VIII–1939, E. G. Lester).

Remarks.—The study of 22 male and female genitalia slides, together with host records, convinces me that the above synonymy is correct.

A paratype of Walsingham's *argillacea* is before me. This specimen, in good condition, although somewhat faded, exactly matches specimens of *blacella*. All the male genitalia are identical except for slight variations in the harpe, a phenomenon frequently encountered in this group. The female genitalia show wide variation in the length of the ductus bursae, but a study of Busck's cotypes of *blacella* show this wide variation in length even in the type series. The length of the ductus bursae is not a reliable character for the separation of species of this group.

I have before me long bred series from various localities, all showing some variation. Specimens from Sacramento, Calif., match Walsingham's description of *argillacea*, while other bred specimens from Washington State match the types of *blacella*. The pattern of both is identical. The depth of color and the definition of the discal spots vary throughout the series. These characters cannot be used for differentiation of species since, in any long bred series, all degrees of depth of color or definition of spots may be found.

AGONOPTERIX NIGRINOTELLA (Busck)

PLATE 29, FIGURES 170, 170a; PLATE 45, FIGURE 265

Depressaria nigrinotella BUSCK, Proc. Ent. Soc. Washington, vol. 9, p. 88, 1908.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 334, 1939.

Agonopteryx nigrinotella BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.—BARNES and BUSCK, Contr. Lepid. N. Amer., vol. 4, p. 232, 1920.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 240, 1923.

Agonopterix nigrinotella (Busck) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8444, 1939.

Agnopteryx nigrinotella (Busck) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6444, 1917.

Labial palpus pale yellowish brown; second segment sparsely irrorated with blackish fuscous exteriorly; third segment with basal three-fourths and apex black. Antenna fuscous. Head light reddish brown. Thorax, base, and basal half of costa of fore wing light yellowish brown; anterior edge of thorax and tegula somewhat darker brown; posterior tip of thorax blackish fuscous. Fore wing brownish fuscous faintly irrorated with blackish fuscous; beyond light basal part of wing a blackish-fuscous shade, which fades rapidly into the lighter ground color; at basal third, in cell a black discal dot followed at end of cell by a yellowish-white discal spot; cilia brownish fuscous, more whitish at tornus. Hind wing shining light yellowish fuscous; cilia somewhat lighter with pale fuscous subbasal and subterminal bands. Legs pale yellowish brown, irrorated and suffused with blackish fuscous except at joints. Abdomen yellowish.

Male genitalia.—Harpe broad, pointed, clothed with long hairs; clasper moderately sclerotized, slender, reaching almost to costa. Anellus a rectangular plate longer than broad, with the posterior edge truncated; lateral lobes weak with only a few hairs. Vinculum rounded with a well developed dorsoanterior process. Aedeagus robust, curved, pointed. Transtilla a narrow sclerotized band with elongated lateral lobes. Gnathos an elongated cone armed with fine spines. Socii moderate, clothed with many long hairs.

Female genitalia.—Ostium large, round, near anterior margin of genital plate; anterior edge of genital plate produced, the production nearly as wide as the plate is long. Ductus bursae membranous, long; ductus seminalis entering well before ostium. Bursa copulatrix relatively small; signum a weakly sclerotized, oval, toothed plate.

Alar expanse, 20–23 mm.

Type.—In the United States National Museum.

Type locality.—Cincinnati, Ohio.

Food plants.—*Xanthoxylum americanum* Mill. and *Carya* (sp. ?).

Distribution.—Eastern United States and Canada and probably as far west as Texas in the South, following the distribution of the food plant.

United States records

Ohio: Cincinnati, 2 ♂♂, 4 ♀♀ (June and July dates, A. F. Braun).

Canadian records

Ontario: St. Davids, 2 ♀♀ (VII–16–34, W. L. Putnam).

Remarks.—Busck[21] recorded this species from *Ptelea trifoliata*, but the food plants of *nigrinotella* are *Xanthoxylum americanum* and *Carya* (sp. ?). The species referred to by Mr. Busck is an undescribed species, the description of which follows.

AGONOPTERIX COSTIMACULA, new species

PLATE 30, FIGURES 174, 174a; PLATE 45, FIGURE 261

Agonopteryx nigrinotella BARNES and BUSCK (not Busck), Contr. Lepid. North America, vol. 4, p. 232, 1920.

Superficially much like *nigrinotella* but lighter, less immaculate, and averaging larger with correspondingly wider wings.

Head light ochreous-fuscous; face whitish ochreous; labial palpus light ochreous-fuscous, lighter interiorly on second segment and irrorated with blackish fuscous exteriorly; terminal segment with blackish-fuscous subbasal and supramedial annuli and apex; antenna ochreous-fuscous, darker toward apex, narrowly annulated with blackish fuscous. Thorax light ochreous-fuscous mixed with fuscous anteriorly; ground color of fore wing ochreous-fuscous, the base and costa to about middle slightly lighter; light basal area followed by a blackish-fuscous shading; at basal third two obliquely placed black discal spots, the upper, inner one large, the outer, lower one small; at end of cell a light whitish-ochreous discal spot narrowly edged with fuscous; on costa, six or eight conspicuous fuscous spots and a series of smaller ones at ends of veins around termen; the whole

[21] Busck, Contr. Lepid. North America, vol. 4, p. 232, 1920.

wing is irrorated with black scales; cilia ochreous-fuscous with many lighter tipped scales. Hind wing light smoky fuscous, lighter basally, underside heavily shaded with black toward apex; cilia light fuscous with narrow, dark, subbasal band. Legs, except tarsi, yellowish ochreous shaded with blackish fuscous; tarsi blackish fuscous annulated with yellowish ochreous. Abdomen fuscous and whitish ochreous above and whitish ochreous below with broad, black, lateral lines.

Male genitalia.—Harpe long, moderately wide; cucullus pointed; clasper long, stout, straight, reaching costa; sacculus narrowly folded. Anellus oval, truncated on posterior edge; lateral lobes weak with few hairs. Vinculum rounded. Aedeagus long, curved, bluntly pointed; vesica with large spinulate patch in basal half. Transtilla a narrow sclerotized band with large, hairy, lateral lobes. Gnathos an oval spined knob. Socii large hairy flaps.

Female genitalia.—Genital plate long; anterior edge folded narrowly. Ostium near anterior margin of plate. Ductus bursae long, membranous; inception of ductus seminalis well before ostium. Bursa copulatrix large with small signum.

Alar expanse, 21–25 mm.

Type.—U. S. N. M. No. 52080.

Type locality.—Plummers Island, Md.

Food plant.—*Ptelea trifoliata* L.

Remarks.—Described from the ♂ type and 51 ♂ and ♀ paratypes as follows: 13 ♂ ♂ and 5 ♀ ♀, Plummers Island, Md. (March and April dates, H. S. Barber and August Busck); Decatur, Ill., ♂ and 2 ♀ ♀ (June 8–15, no collector); Cincinnati, ♂ and 2 ♀ ♀ (X–8–04, X–8–07, VI–25–08, A. F. Braun); Clermont County, Ohio, 2 ♀ ♀ (VI–14–14, A. F. Braun); Point Pelee, Ontario, 13 ♂ ♂, 8 ♀ ♀ (VII–15 to VIII–11–27, F. P. Ide; VII–30–31, G. S. Walley; VII–27–31, W. J. Brown); Pelee Island, Ontario, 2 ♂ ♂ (VII–30–31, G. S. Walley).

Paratypes in U. S. National Museum, Canadian National collection, and collection of Dr. A. F. Braun, Cincinnati, Ohio.

This species has been mixed in collections, being placed under *eupatoriiella* (=*plummerella*), *argillacea*, and *nigrinotella*. Obscurely marked specimens of any of these species might easily be confused. The long clasper which reaches the costa of harpe immediately distinguishes the present species from the others.

I am indebted to Dr. J. McDunnough for a long, reared series from Point Pelee, Ontario, which has greatly supplemented the material here.

AGONOPTERIX CANADENSIS (Busck)

PLATE 45, FIGURE 262

Depressaria canadensis BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 744, 1902; *in* DYAR, U. S. Nat. Mus. Bull. 52, No. 5878, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6421, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 174, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 311, 1939.

Agonopteryx canadensis BUSCK, Proc. U. S. Nat. Mus., vol. 35. p, 199, 1908.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 240, 1923.

Agonopterix canadensis (Busck) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8424, 1939.

Agnopteryx canadensis (Busck) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6467, 1917.

Labial palpus pale ochreous-white; second segment evenly springled with blackish fuscous exteriorly; third segment with broad subbasal and subapical annuli and tip black. Antenna fuscous with indistinct black annulations. Head, thorax, and fore wing pale yellowish gray; face creamy white; thorax with a few light-reddish scales mixed; pale base of fore wing diffused along costa, containing a small black spot in fold and bounded below with a rapidly fading blackish-fuscous shade; remainder of fore wing irrorated with blackish-fuscous and black; along costa and around termen to near middle of inner margin a pronounced series of well-defined black spots; on costa, in apical third of wing, and on basal half of inner margin a rosy tint; at basal third a pair of rather large black discal spots, obliquely one above the other and followed by a blackish-fuscous shade above the middle of the wing; at the end of cell a black discal spot; cilia yellowish gray, slightly darker than ground color of fore wing. Hind wing light fuscous; cilia sordid whitish with yellowish tint. Legs ochreous-white mottled and suffused with blackish fuscous except at joints.

Female genitalia.—Genital plate narrow, weakly sclerotized, produced anteriorly. Ostium occupying nearly all central portion of genital plate; inception of ductus seminalis well before ostium. Ductus bursae membranous, very long, slender, gently tapering to form the small bursa copulatrix. Signum of bursa a small, narrow, 4-pointed plate, with anterior point longer than posterior.

Alar expanse, 17 mm.

Type.—In the United States National Museum.

Type locality.—Winnipeg, Manitoba (A. W. Hanham).

Remarks.—The female type is the only specimen of this species I have seen. It is very distinct and should not be confused with any other described North American species.

Specimens from British Columbia and Ontario have been sent to me under this name, but all these are referable to other species (*klamathiana* or *sciadopa*) to which there is, in some cases, a superficial resemblance. The genitalia of *canadensis* show no close resemblance to those of the other species, and *canadensis* is further distinguishable from them by lacking discal spots that the others possess.

AGONOPTERIX FLAVICOMELLA (Engel)

PLATE 30, FIGURES 173, 173a; PLATE 45, FIGURE 267

Depressaria flavicomella ENGEL, Ent. News, vol. 18, p. 276, 1907.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 174, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 324, 1939.

Agonopteryx flavicomella (Engel) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 199, 1908.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 240, 1923.

Agonopterix flavicomella (Engel) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8420, 1939.

Agnopteryx flavicomella (Engel) SMITH, Catalogue of the insects of New Jersey, p. 561, 1910.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6463, 1917.—BRIMLEY, The insects of North Carolina, p. 304, 1938.

Labial palpus and head pale whitish ochreous; second segment of palpus strongly irrorated and suffused with blackish fuscous exteriorly and in brush; third segment immaculate; sides of head slightly darker. Antenna grayish fuscous narrowly annulated with fuscous. Thorax and basal part of fore wing (except costa) light ochreous; thorax suffused and lightly irrorated with reddish brown and with a blackish-fuscous spot on each side beneath inner edges of tegulae. Ground color of fore wing light ochreous heavily overlaid with reddish brown and fuscous and irrorated with black; beyond the light basal patch a dark blackish-fuscous shade, which rapidly fades to reddish, then to ochreous at apical part of wing; basal part of costa suffused with fuscous; costa and termen marked with a series of black spots, those around termen more conspicuous than those on costa; at basal third a conspicuous black discal spot followed by a similar but larger one at middle and another larger more diffused one at end of cell; between the first and second discal spots and the inner margin (on vein 1c) a somewhat diffused black spot; cilia fuscous, darker basally. Hind wing grayish fuscous with a series of blackish-fuscous dashes around apex and outer margin; cilia yellowish fuscous with an indistinct dark subbasal band. Legs light whitish ochreous strongly overlaid or suffused with shining sooty black except at joints and on posterior tibiae. Abdomen pale whitish ochreous irrorated with fuscous above; ventrally with a broad blackish-fuscous longitudinal line on

each side and two indistinct median longitudinal rows of similarly colored spots.

Male genitalia.—Harpe rather broad basally, tapering gently to the bluntly pointed cucullus, profusely clothed with coarse hairs; costa narrowly sclerotized; sacculus moderately sclerotized; clasper slender, gently excurved, bluntly pointed, with small basal protuberance, reaching well beyond center of harpe; distal end serrate; clasper and inner edge of sacculus heavily sclerotized. Anellus broader than long, convex laterally and slightly concave on posterior edge; lateral lobes large, sparsely hairy. Aedeagus stout, gently curved, pointed; vesica armed with a large elongate patch of strong but moderately small cornuti. Vinculum rounded with small dorsoanterior process. Transtilla a narrow lightly sclerotized band with large, hairy, lateral lobes. Gnathos rather long, slender. Tegumen pointed. Socii large, hairy, fleshy flaps.

Female genitalia.—Genital plate moderately narrow; weakly sclerotized around ostium with a broad convex anterior margin. Ostium round, slightly nearer to anterior than posterior edge; margin narrowly sclerotized except posteriorly. Ductus bursae long, membranous with entire inner surface studded with numerous minute stout teeth anterior to inception of ductus seminalis; ductus seminalis well before ostium. Bursa copulatrix rather small, inner surface also with numerous small teeth, but fewer than in ductus bursae; signum a moderately large irregularly shaped toothed plate.

Alar expanse, 15–17 mm.

Type.—In the United States National Museum.

Type locality.—New Brighton, Pa.

Food plant.—*Heracleum* sp.

Distribution.—Eastern United States and Canada west to British Columbia.

United States records

Illinois: Chicago, ♀ (no date or collector); Monee, 2 ♂♂ (VI–21–12, A. Kwiat).
New Jersey: Essex County Park, 5 ♂♂ (VII–2–06, W. D. Kearfott).
Pennsylvania: New Brighton, 22 ♂♂, ♀ (June and July dates, H. D. Merrick); Oak Station, Allegheny County, 16 ♂♂, 4 ♀♀ (June dates, Fred Marloff).

Canadian records

British Columbia: Rolla (5–VIII–1927, P. N. Vroom).
Manitoba: Riding Mountain Park, 2 ♂♂, 3 ♀♀ (25–VI–33, J. McDunnough).
Ontario: Trenton (VII–22–12, Evans).
Saskatchewan: Indian Head (VII–22–25, J. J. de Gryse).

Remarks.—The abdomen of the type is missing. The genitalia are figured from a "cotype" male and a typical female.

AGONOPTERIX SENICIONELLA (Busck)

PLATE 30, FIGURES 172, 172a; PLATE 45, FIGURES 263

Depressaria senicionella BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 742, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5875, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6418, 1903.—ENGEL, Ent. News, vol. 18, p. 276, 1907.

Depressaria senieiella BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 743, 1902.

Depressaria senecionella MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 174, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 350, 1939.

Agonopteryx senecionella BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 199, 1908.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 240, 1923.

Agonopterix senicionella (Busck) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8423, 1939.

Agnopteryx senicionella (Busck) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6464, 1917.

Labial palpus light ochreous; second segment irrorated with blackish fuscous exteriorly; third segment with subbasal and subterminal annuli and apex black. Antenna fuscous with grayish-ochreous annulations. Head and thorax light ochreous; face yellowish white; thorax with brownish-ochreous suffusion and irrorations. Fore wing dark ochreous-gray, strongly overlaid and suffused with brownish ochreous; light basal patch suffused on costa with fuscous, containing a blackish-fuscous spot in fold and bordered outwardly by a rapidly fading fuscous shade; at basal third, in cell, two black discal dots, obliquely one above the other; the lower one of these two is often lacking; at the end of cell an inconspicous black discal dot preceded by an indistinct fuscous shade; termen and costa indistinctly marked with poorly defined fuscous spots; cilia ochreous-gray with two narrow ochreous-white lines, one at middle and one around outer edge. Hind wing grayish fuscous, darker apically; cilia light yellowish fuscous with grayish-fuscous subbasal and subterminal bands. Legs light ochreous overlaid with fuscous except at joints. Abdomen grayish ochreous above; beneath light ochreous with a broad blackish-fuscous line on each side; between these two lines a pair of indistinct longitudinal rows of blackish-fuscous spots.

Male genitalia.—Harpe rather broad, well sclerotized along costa; clothed with fine hairs; cucullus rounded; clasper nearly straight, moderately sclerotized and reaching slightly beyond middle of harpe. Anellus oval, longer than broad, lateral lobes well developed, clothed with few fine hairs. Vinculum narrow, rounded, with well-developed dorsoanterior process. Aedeagus stout, slightly curved, bluntly pointed; ventral arm by which it is attached to anellus short, broad, and situated near base of aedeagus. Transtilla a narrow sclerotized

band with large, hairy, lateral lobes. Gnathos an oval spined knob. Socii very large flaps clothed with many fine hairs. Tegumen pointed.

Female genitalia.—Genital plate narrow, strongly sclerotized and produced anteriorly. Ostium round. Ductus bursae membranous, gradually becoming larger to form the large oval bursa copulatrix. Signum a large four-pointed plate, the anterior and posterior points of about equal length but smaller than the lateral points.

Alar expanse, 18–22 mm.

Type.—In the United States National Museum.

Type locality.—Cabin John, Md.

Food plant.—*Senecio aureus* L.

Distribution.—Eastern United States.

United States records

District of Columbia: Washington, 8 ♂♂, ♀ (May 28 to June 16, 1900, August Busck).

Maryland: Cabin John, 2 ♂♂ (IV–28 and 30–1900, August Busck); Plummers Island, 3 ♂♂, 11 ♀♀ (May and June dates, A. Busck and Chas. R. Ely).

Virginia: Great Falls, ♀ (May 28, 1900, no collector).

AGONOPTERIX ANTENNARIELLA, new species

PLATE 30, FIGURES 175, 175a; PLATE 45, FIGURE 264

A medium-sized red-brown species unlike any other described from North America.

Head dark reddish fuscous above mixed with carmine and whitish-ochreous-tipped scales; face shining whitish ochreous; second segment of palpus whitish ochreous tinged with carmine inwardly and irrorated with fuscous exteriorly; brush trumpet-shaped; terminal segment whitish ochreous with broad blackish-fuscous basal and subterminal annuli. Antenna fuscous, annulated with whitish ochreous.

Thorax, base of fore wing, and costa to well beyond middle cinereous; anterior portion of thorax and extreme base of costa suffused with rich brown; ground color of fore wing red-brown, scales lightly tipped with carmine; at basal third two small obliquely placed black discal spots followed by a few cinereous scales; at end of cell a third white discal spot edged with black; apical third of wing heavily shaded with cinereous; cilia reddish fuscous, tipped with carmine; a row of fuscous spots around termen at base of cilia. Hind wing light fuscous above; with much white scaling beneath in apical third and a black line at base of cilia; cilia light fuscous with distinct rosy hue, and darker subbasal band. Legs fuscous overlaid with whitish ochreous and strongly suffused with carmine; hind tibiae whitish, suf-

fused with carmine; tarsi annulated with whitish ochreous. Abdomen grayish fuscous above, whitish ochreous below; ventrolateral lines poorly defined, black; anal tuft yellowish ochreous, suffused with carmine.

Male genitalia.—Harpe moderately sclerotized and covered with hairs over entire inner surface; costa and sacculus parallel beyond middle then converging to form a narrowly rounded cucullus. Clasper heavily sclerotized, smooth, short, terminating in a blunt point. Anellus longer than broad, truncated on posterior edge; lateral lobes weak. Vinculum with a very short, small dorsoanterior process. Transtilla a very narrow, moderately sclerotized band with small lateral lobes. Aedeagus stout, rather short and evenly tapered, terminating in a sharp point. Armature consisting of many fine spinules. Gnathos a heavily spined cone.

Female genitalia.—Genital plate moderately sclerotized, broad, slightly produced anteriorly. Ostium near posterior margin of plate. Ductus bursae slender, gradually becoming larger till it merges with the bulbous bursa copulatrix. Signum a 4-pointed, moderately sclerotized small plate with strong teeth; lateral, anterior, and posterior points about equal in length.

Alar expanse, 17–24 mm.

Type.—U. S. N. M. No. 52081.

Type locality.—Kamiack Butte, Whitman County, Wash.

Food plant.—*Antennaria luzuloides* T. and G.

Remarks.—Described from the ♂ type, 7 ♂ and 4 ♀ paratypes, as follows: Kamiack Butte, 3 ♂ ♂, 2 ♀ ♀ (V–18 to 22–34); 4 ♂ ♂, 1 ♀ same (VI–15 to 19–35); ♂, Pullman, Wash. (I–28–31 [indoor record]); ♀, Godman Springs, Blue Mountains, Wash., 6,000 feet (VIII–1–35); all reared from larvae collected by the author.

Paratypes in collections of United States National Museum, Canadian National Museum, and H. H. Keifer, Sacramento, Calif.

Dr. J. McDunnough, of Ottawa, has sent me three specimens of this species from British Columbia. The larvae, from which these moths were reared, were collected by A. N. Gartrell at Shingle Creek Road, Keremeos. The adults emerged from 30–VI to 6–VII–35.

Mr. Gartrell has labeled his specimens as reared from wild red currant. The food plant record is rather surprising since most of the species of this group are host specific, and it will be noted that the type series was reared from *Antennaria.* I have carefully compared the genitalia of specimens of the two lots and find them identical.

AGONOPTERIX NEBULOSA (Zeller)

PLATE 32, FIGURES 185, 185a; PLATE 45, FIGURE 266

Depressaria nebulosa ZELLER, Verh. zool.-bot. Ges. Wien, vol. 23, p. 237, 1873.—CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 138, 1878.—WALSINGHAM, Proc. Zool Soc. London, 1881, p. 312.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5269, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 741, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5870, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6413, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 177, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 334, 1939.

Agonopteryx nebulosa (Zeller) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68 p. 239, 1923.

Agonopterix nebulosa (Zeller) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8452, 1939.

Agnopteryx nebulosa (Zeller) SMITH, Catalogue of the insects of New Jersey, p. 516, 1910.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6438, 1917.

Labial palpus shining creamy white; second segment sprinkled with black scales outwardly and with brush suffused with white-tipped fuscous scales; brush abruptly expanded, trumpet-shaped; third segment with broad subbasal and subapical annuli black; the black scales of these annuli white tipped. Antenna fuscous annulated with gray. Head, thorax, and fore wing lavender-gray, the scales white tipped; face creamy white, tegula with a bluish iridescence; along costa and around termen a series of poorly defined light fuscous spots; at basal third two black discal dots, the upper, inner one small, the outer, lower one dashlike and both bordered outwardly with white scales; at the end of cell a white black-edged discal spot preceded by a similar one; sometimes these two are confluent, forming a white and black longitudinal dash; cilia grayish fuscous with narrow median and terminal white lines. Hind wing and cilia light yellowish fuscous, the wing darker apically; cilia with several, somewhat darker bands. Legs ochreous-white, overlaid and irrorated with grayish fuscous above, ochreous-white beneath; the usual longitudinal lines or rows of dark spots lacking or only faintly indicated by a few blackish-fuscous scales.

Male genitalia.—Harpe moderately broad, entirely clothed with fine hairs; cucullus narrowly rounded; clasper stout, curved, slightly hooked, reaching two-thirds of distance to costa. Anellus broadly oval with poorly developed lateral lobes. Vinculum rounded. Aedeagus short, stout, straight, with a blunt point; vesica armed with numerous spinulate cornuti. Transtilla a very narrow sclerotized band with moderately large, hairy, lateral lobes. Gnathos an oval, spined knob. Socii hairy flaps.

Female genitalia.—Genital plate narrow, emarginate behind; anterior margin in the form of a narrow, sclerotized, curved bar; ostium occupying nearly whole ventral portion of genital plate and without sclerotized area posterior to it. Ductus bursae membranous, abruptly constricted before ostium. Bursa copulatrix oval; signum an elongate plate with posterior pointed process.

Alar expanse, 19–20 mm.

Type.—In the British Museum.

Type locality.—Cambridge, Mass.

Food plant.—Unknown.

Distribution.—Northeastern United States.

United States records

Maine: Monmouth, ♂ ("November 30, '05").
Massachusetts: Amherst, 2 ♂♂ (January 21, 1906).
New Hampshire: 2 ♂♂ without further data; Hampton, ♂, ♀ (III–26–05, III–22–05, S. A. Shaw).
New York: New Windsor, ♂ (June 24, 1903, E. L. Morton).

Remarks.—Differs from all other gray American species by the accentuated trumpet-shaped palpus.

AGONOPTERIX SABULELLA (Walsingham)

PLATE 32, FIGURES 181, 181a; PLATE 46, FIGURE 270

Depressaria sabulella WALSINGHAM, Proc. Zool. Soc. London, 1881, p. 313, pl. 36, fig. 1.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5279, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 743, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5876, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6419, 1903; Can. Ent. vol. 37, p. 296, 1905.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 174, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 348, 1939.

Agonopteryx sabulella (Walsingham) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 199, 1908.

Agonopterix sabulella (Walsingham) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8412, 1939.

Agnopteryx sabulella (Walsingham) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6465, 1917.

Agonopteryx callosella BARNES and BUSCK, Contr. Lepid. North America, vol. 4, p. 231, pl. 38, fig. 4, 1920. (New synonymy).

Agonopterix callosella (Barnes and Busck) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera) No. 8421, 1939.

Depressaria callosella (Barnes and Busck) MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 174, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 311, 1939.

Labial palpus pale ochreous; second segment with slight fuscous shading and blackish-fuscous irrorations exteriorly; third segment

with subapical annulus and apex blackish fuscous. Antenna blackish fuscous. Head, thorax, and fore wing pale ochreous; face ochreous-white; base of costa and spot in anal angle blackish fuscous; forewing sparsely irrorated with fuscous and shaded with reddish scales; at basal third two fuscous discal spots obliquely one above the other; at end of cell a fuscous spot preceded above by a less conspicuous one of the same color; between the outer and inner pairs of spots a poorly defined fuscous cloud in costal half of wing; apical half of costa and termen and the cilia with a reddish suffusion, cilia light ochreous. Hind wing grayish ochreous, cilia paler, with alternating light fuscous and whitish bands. Legs ochreous-white strongly suffused and overlaid with blackish fuscous except at joints; posterior tibia and tarsus hardly more than irrorated with fuscous. Abdomen grayish fuscous above, pale ochreous beneath; on each side ventrally, a black longitudinal line.

Male genitalia.—Harpe narrow, long, pointed, clothed with very fine hairs; clasper stout, slightly curved toward cucullus, and terminating in a knob. Anellus a roughly oval plate, longer than broad, truncated posteriorly, and with well developed, hairy, lateral lobes. Vinculum rounded. Aedeagus stout with a long slender upturned point and a large, spinulate patch in basal half. Transtilla a narrow, lightly sclerotized band with well-developed, hairy, lateral lobes. Gnathos a spiny cone. Socii broad flaps clothed with fine hairs.

Female genitalia.—Ovipositor naked except for a few strong long hairs at base and a few weak hairs distally. Genital plate moderately broad, slightly produced anteriorly. Ostium is posterior half of plate. Ductus bursae membranous, slender, widening abruptly to form the large oval bursa copulatrix. Signum a diamond-shaped plate, with the anterior point shorter than the posterior.

Alar expanse, 19–23 mm.

Types.—In the British Museum (*sabulella*); in the United States National Museum (*callosella*).

Type localities.—Mendocino County, Calif. (*sabulella*); San Bernardino, Calif. (*callosella*).

Food plants.—*Eriophyllum stachaedifolium* Lag. and *Eriophyllum lantanum typicum* Constance.

Distribution.—Western United States probably as far north as southern British Columbia in the interior.

United States records

California: Land's End, San Francisco, ♂ (VII–23–09, F. X. Williams); San Francisco, ♂ (VI–12–26, H. H. Keifer); Monachee Meadows, Tulare County, 8,000 feet, ♂ ("July 8–14"); Croville, ♂ (IV–14–28, H. H. Keifer); San Bernardino, ♀ ("June 1–7"); San Diego, ♂, ♀ ("May 24–30").

Idaho: Kamiah, ♀ (VI–27–35, L. Constance).

Remarks.—The above synonymy is based on a comparison of Walsingham's figure and description with the types of *callosella*. Although there is no authentic material of Walsingham's species here, there appears to be no doubt about the synonymy. Mr. Busck concurs with me in this opinion.

H. H. Keifer, of Sacramento, Calif., was kind enough to send me three specimens, which I associate with this species, two of which were reared by him from *Eriophyllum stachaedifolium*. These specimens are identical with the types of *callosella*, which are before me.

I have another specimen before me from Kamiah, Idaho, reared from *Eriophyllum lantanum typicum*, which was collected by my friend Dr. Lincoln Constance, of the Department of Botany, University of California. This specimen is close to the types of *callosella* but differs in details. I am placing it here, however, until more material can be obtained and its specific limits ascertained.

AGONOPTERIX COSTOSA (Haworth)

PLATE 32, FIGURES 184, 184a; PLATE 46, FIGURE 273

Depressaria costosa HAWORTH, Lepidoptera Britannica, vol. 3, p. 508, 1811.—WOOD, Index entomologicus, p. 172, pl. 38, fig. 1182, 1845.—STAINTON, Trans. Ent. Soc. London, vol. 5, p. 153, 1849; Insecta Britannica, p. 84, 1854.—ZELLER, Linn. Ent., vol. 9, p. 198, 1854.—STAINTON, A manual of British butterflies and moths, vol. 2 p. 320, 1859.—FREY, Die Tineen und Pterophoren der Schweiz, p. 82, 1856.—HEINEMANN, Die Schmetterlinge Deutschlands und der Schweiz, vol. 2, p. 143, 1870.—MEYRICK, Ent. Monthly Mag., vol. 13, p. 281, 1870.—FREY, Die Lepidopteren der Schweiz,. p. 351, 1880.—RÖSSLER, Jahrb. nassau. Vereins Naturk., vol. 33, p. 282, 1881.—SNELLEN, Die Vlinders van Nederland, vol. 2, p. 577, 1882.—STEUDEL and HOFMANN, Württemberg. Vereins vaterl. Naturk., vol. 38, p. 196, 1882.—JOURDHEUILLE, Mém. Soc. Acad. l'Aube, vol. 47, p. 176, 1883.—SORHAGEN, Die Kleinschmetterlinge der Mark Brandenburg, p. 175, 1886.—MEYRICK, A handbook of British Lepidoptera, p. 620, 1895.—REUTTI, Verh. Naturw. Vereins Karlsruhe, vol. 12, p. 228, 1898.—STANGE, Die Tineinen der umgegend von Friedland in Mecklenberg, p. 20, 1899.—STAUDINGER and REBEL, Catalog der Lepidopteren des palaearctischen Faunengebietes, vol. 2, No. 3177, 1901.—CARADJA, Bull. Soc. Sci. Bucarest, vol. 10, p. 149, 1901.—MALLOCH, Ent. Monthly Mag., vol. 37, p. 186, 1901.—DISQUÉ, Deutsche Ent. Zeitschr., Iris, vol. 14, p. 205, 1901.—LONGSTAFF, Ent. Monthly Mag., vol. 38, p. 28, 1902.—SCHÜTZE, Deutsche Ent. Zeitschr., Iris, vol. 15, p. 12, 1902.—CROMBRUGGHE, Mém. Soc. Ent. Belgique. vol. 14, p. 43, 1906.—GIBBS, Entomologist, vol. 39, p. 7, 1906 [as *D. costana*, nom. nud.].—MÜLLER-RUTZ, Bull. Soc. Ent. Suisse, vol. 11, p. 346, 1909.—SPULER, Schmetterlinge Europas, vol. 2, p. 333, pl. 89, fig. 13, 1910.—GIANELLI, Ann. Accad. Agr. Torino, vol. 53, p. 94, 1910.—SCHILLE, Kraków. Akad. Umiejetnosci Sprawozdania Komisyi fizyograficznej, vol. 45, p. 29, 1911.—SKALA, Int. Ent. Zeitschr., vol. 5, 303, 1912; Verh. naturf. Vereins Brünn, vol. 51, p. 312, 1913.—VORBRODT and MÜLLER-RUTZ, Schmetterlinge der Schweiz, vol. 2, p. 456, 1914.—BUXTON, Ent. Rec., vol. 27, p. 183, 1915.— GALVAGNI, Wien. Ent. Vereins Jahresb., vol. 25, p. 32, 1915.—MARTINI, Deutsche Ent. Zeitschr., Iris. vol. 30, p. 153, 1917.—REBEL,

Sitzungsb. Akad. Wiss. Wien, vol. 126, p. 808, 1917.—Galvagni, Wien. Ent. Vereins Jahresb., vol. 28, p. 63, 1918.—Strand, Archiv für Naturg. vol. 85A, pt. 4, p. 9, 1919.—Meyrick, Entomologist, vol. 55, p. 254, 1922; *in* Wytsman, Genera insectorum, fasc. 180, p. 173, 1922.—Zimmerman, Verh. zool.-bot. Ges. Wien. vol. 71, p. (43), 1922.—Preissecker, Wien. Ent. Vereins Jahresb., vol. 30, p. 187, 1924.—Blair, Entomologist, vol. 58, p. 10, 1925.—Stephan, Deutsche Ent. Zeitschr., Iris, vol. 39, p. 123, 1925.—Larsen, Ent. Meddel., vol. 17, p. 73, 1927.—Zerny, Eos, vol. 3, p. 480, 1927.—Wickham, Entomologist, vol. 60, p. 43, 1927.—Meyrick, A handbook of British Lepidoptera, p. 683, 1928.—Hayward, Entomologist, vol. 62, p. 50, 1929.—Lhomme, L'amateur de papillons, vol. 4, p. 209, 1929.—Uffeln, Westfalischer provinzial-Verein für Wissenschaft und Kunst, Münster, Abhandl., vol. 1, p. 76, 1930.—Amsel, Deutsche Ent. Zeitschr., Iris, vol. 44, p. 121, 1930.—Verbrodt, Deutsche Ent. Zeitschr., Iris, vol. 45, p. 126, 1931.—Chater, Bull. Ent. Res., vol. 22, p. 231, 1931.—Rebel and Zerny, Denkschr. Akad. Wiss. Wien, math.-nat. Kl., vol. 103, p. 150, 1931.—Hering, *in* Brohmer, Ehrmann, and Ulmer, Die Tierwelt Mitteleuropas, vol. 1, p. 142, 1932.—Eckstein, Die Kleinschmetterlinge Deutschlands, p. 118, pl. 5, fig. 213, 1933.—Sterneck, Prodromus der Schmetterlingsfauna Böhmens, vol. 2, p. 105, 1933.—Rapp. Beiträge zur fauna Thüringens, vol. 2, p. 131, 1936; Beiträge Schmetterlingsfauna Harz, p. 28, 1936.—Gaede, *in* Bryk, Lepidopterorum catalogus pt. 92, p. 318, 1939.

Agonopterix costosa (Haworth) Pierce and Metcalfe, The genitalia of the tineid families of the Lepidoptera of the British Islands, p. 35, pl. 19, 1935.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8410, 1939.

Agonopteryx blackmori Busck, Can. Ent. vol. 53, p. 277, 1921.

Depressaria blackmori (Busck) Meyrick, Entomologist, vol. 55, p. 254, 1922. (As synonym of *D. costosa* (Haworth).)

Depressaria dryadoxena Meyrick, Exotic Microlepidoptera, vol. 2, p. 315, 1920; Entomologist vol. 55, p. 254, 1922; *in* Wytsman, Genera insectorum, fasc. 180, p. 173, 1922. (As synonym of *D. costosa* (Haworth).)

Agonopterix dryadoxena (Meyrick) McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8410, 1939. (As synonym of *D. costosa* (Haworth).)

Agonopterix blackmori (Busck) McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8410, 1939. (As synonym of *D. costosa* (Haworth).)

Tinea depunctella Hübner, Sammlung Europäisher Schmetterlinge, vol. 5, pl. 56, fig. 378, 1816.

Pinaris depunctella (Hübner) Hübner, Verzeichniss bekannter Schmetterlinge, p. 411, 1825.

Depressaria depunctella (Hübner) Kollar, Linz. Oberosterreicher musealverein Jahresb., vol. 2, p. 92, 1832.—Zeller, Isis von Oken, 1839, p. 195.—Duponchel, Historie naturelle de lépidoptères . . . de France, vol. 8, p. 148, pl. 291, fig. 2, 1838.—Herrich-Schäffer, Die Schmetterlinge von Europa, vol. 5, p. 123, 1853.

Haemylis depunctella (Hübner) Treitschke, *in* Ochsenheimer, Die Schmetterlinge von Europa, vol. 9, p. 260, 1832; vol. 10, p. 185, 1835.

Haemylis costosa (Haworth) Stephens, Illustrations of British entomology, Haustellata, vol. 4, p. 203, 1835.

Labial palpus, head and face creamy white; second segment irrorated with blackish fuscous exteriorly; third segment with subapical

annulus and apex black; head frequently suffused above with fuscous; spot above base of antenna brown; tuft below eye pink. Antenna brown, darker basally than apically. Thorax and ground color of fore wing whitish ochreous; posterior tuft on thorax yellowish ochreous; light base of fore wing diffused along costa to apex, sparsely irrorated with black scales; beyond light base a dark ochreous shade, which covers posterior two-thirds of wing but becomes lighter toward termen. The whole surface of wing more or less irrorated with black scales; on costa, slightly beyond middle a sooty cloud; at basal third, two black spots obliquely one above the other sometimes edged by a few dark reddish-ochreous scales; between the outer of these two spots and inner margin a small dark reddish-ochreous spot; at the end of cell a cream-colored discal spot edged with dark reddish ochreous and preceded by a dark reddish-ochreous spot. Sometimes the latter spot and the reddish-ochreous scales of the outer discal spot are confluent, forming a dash; cilia whitish ochreous strongly suffused with reddish fuscous, especially toward apex. Hind wing light yellowish fuscous; cilia yellowish, banded with light fuscous. Legs whitish ochreous overlaid with fuscous and tinged with carmine. Abdomen light ochreous above, whitish ochreous beneath; a row of black spots on each side ventrolaterally.

Male genitalia.—Harpe long, slender, tapering into a long, pointed cucullus; moderately covered with hairs; clasper very stout, somewhat dilated distally, nearly reaching costa; sacculus short, strongly sclerotized. Anellus broader basally than apically, broader than long; posterior edge convex; hairy, lateral lobes well developed. Aedeagus stout, slightly narrower in middle, nearly straight, pointed; vesica armed with a large patch of spinulate cornuti. Vinculum rounded. Transtilla a narrow sclerotized band with large hairy lateral lobes. Gnathos a spined oval knob. Socii hairy, fleshy flaps.

Female genitalia.—Genital plate moderately broad, sclerotized; anterior edge slightly produced. Ostium round; situated about middle and occupying less than half the length of the genital plate. Ductus bursae membranous; inception of ductus seminalis just before ostium. Signum distinctly 4-pointed, with slender anterior and posterior points; teeth small and scattered.

Alar expanse, 18–22 mm.

Type.—In the British Museum.

Type locality.—"Europe."

Food plants.—*Genista*, *Quercus* (*?*), *Laburnum*, and *Cytisus scoparius* (L.) Link.

Distribution.—Extreme northwestern United States, southwestern and eastern Canada and Europe.

United States records

Washington: Bellingham, 3 ♂♂, ♀ (IX–1–29, VIII–4–31, IX–7–35, VIII–23–33, J. F. G. Clarke); Tacoma, ♀ (VII–15–28, T. M. Clarke).

Canadian records

British Columbia: Victoria, 19 ♂♂, 9 ♀♀ (July to October dates, E. H. Blackmore, W. Downes, W. R. Carter collectors); 2 ♂♂, ♀ (9–15–VII–1923, K. F. Auden).

Ontario: London, ♂, ♀ (19–26–IV–1933 [Good's Greenhouse]).

Note.—Well established in the Puget Sound region and no doubt wider spread than the above records indicate. May not have escaped at London, Ontario.

Remarks.—There appears to be no doubt of the synonymy as given above. Although I have not seen *dryadoxena*, Meyrick's description tallies with *costosa* and the locality for the former species agrees with that of *blackmori*. The food plant of *dryadoxena* (*Quercus*) is questionable, since the species of this genus rarely feed on such widely separated species of plants and are more frequently host specific as has already been pointed out.

The genitalia of the males and females are identical except for slight variation in the male harpes, a condition frequently encountered. Pierce [22] figures the genitalia of *costosa* showing the ostium opening near the anterior margin of the genital plate. In the specimens I have seen (4), both European and North American, the ostium opens slightly nearer to the posterior than to the anterior edge (see fig. 273). Furthermore, the signum as figured by Pierce lacks the anterior and posterior points, present in all specimens I have examined. The signum, it must be admitted, may be somewhat variable, but in this species it appears to be unusually constant.

AGONOPTERIX PERGANDEELLA (Busck)

PLATE 32, FIGURES 183, 183a

Depressaria pergandeella BUSCK, Proc. Ent. Soc. Washington, vol. 9, p. 89, 1908.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 174, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 339, 1939.

Agonopteryx pergandeella BUSCK, Proc. U. S. Nat Mus., vol. 35, p. 199, 1908.

Agnopteryx pergandiella BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6462, 1917.

Agonopterix pergandiella MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8417, 1939.

Labial palpus ochreous-white; second segment sparsely irrorated with fuscous exteriorly, brush suffused with brown [third segment of both palpi missing]. Antenna with basal segment fuscous above, whitish beneath [remainder of both antennae missing]. Head

[22] Pierce, F. N., The genitalia of the Tineina, pl. 19, 1935.

ochreous with a median fuscous band; face shining creamy-white. Thorax and fore wing light brown; thorax strongly suffused with brownish fuscous; surface of fore wing irrorated with poorly defined blackish-fuscous spots and with a series of similarly colored spots around termen; at basal third, in cell, two black discal spots obliquely one above the other; another similar spot at the end of cell preceded by a poorly defined blackish-fuscous cloud; extreme base of costa fuscous; a well-defined black spot in inner angle; cilia light brown suffused with fuscous. Hind wing shining light yellowish fuscous; cilia more whitish. Legs whitish ochreous overlaid and mottled with fuscous except at joints. Abdomen dark yellowish fuscous.

Male genitalia.—Harpe moderately clothed with long hairs [cucullus broken from each harpe]; sacculus only moderately sclerotized; clasper nearly straight, slightly dilated distally, reaching fully two-thirds of the distance toward the costa. Anellus broadly oval, posterior edge strongly convex, smooth; with very small lateral lobes. Vinculum rounded. Aedeagus nearly straight, stout, and deeply notched distally. Transtilla a broad, sclerotized band with large lateral lobes. Gnathos a finely spined cone. Socii small, weak, sparsely clothed with hairs. Tegumen produced into a moderately large broad flap.

Alar expanse, 21 mm.

Type.—In the United States National Museum.

Type locality.—"Nebraska."

Remarks.—The only specimen I have seen is the type male. This is very distinct from any other North American species.

AGONOPTERIX AMISSELLA (Busck)

PLATE 33, FIGURES 187, 187a; PLATE 46, FIGURE 269

Depressaria amissella BUSCK, Proc. Ent. Soc. Washington., vol. 9, p. 89, 1908.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 174, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 300, 1939.

Agonopteryx amissella BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 199, 1908.

Agonopterix amissella (Busck) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8425, 1939.

Agnopteryx amissella (Busck) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6460, 1917.

Labial palpus ochreous-white; second segment with the brush suffused with fuscous and sparsely irrorated with fuscous exteriorly; third segment with subbasal and subterminal annuli black. Antenna fuscous with light ochreous-fuscous annulations; basal segment ochreous-white beneath. Head, thorax, and fore wing light ochreous-brown; face shining ochreous-white; thorax suffused with fuscous; surface of fore wing irrorated with black and blackish-fuscous scales

and with a series of blackish-fuscous spots along costa and around termen; extreme base of costa fuscous; light basal patch bordered outwardly by a transverse fuscous dash, which contains some jet-black scales and does not reach costa; at basal third, in cell, two conspicuous jet-black spots of raised scales, obliquely one above the other and followed outwardly by a poorly defined fuscous shade; discal spot at end of cell inconspicuous or absent, but when present indicated by a few whitish scales; cilia light ochreous-brown the scales tipped with ochreous-white. Hind wing light fuscous, darker apically than basally; cilia light yellowish fuscous tipped with ochreous-white and with a narrow, fuscous subbasal band. Legs ochreous-white strongly suffused and overlaid with blackish fuscous except at joints. Abdomen ochreous-fuscous.

Male genitalia.—Harpe rather narrow, pointed, only sparsely clothed with hairs; clasper very stout, straight, reaching three-fourths of the distance to costa. Anellus roughly rectangular with truncated posterior edge; lateral lobes small. Vinculum rounded. Transtilla a narrow sclerotized band with large lateral lobes. Aedeagus stout, curved, with a heavily sclerotized band basally; vesica armed with a large patch of weak, spinulate cornuti. Gnathos an elongate, oval knob clothed with fine spines. Socii weakly sclerotized, small, with few hairs. Terminal portion of tegumen pointed.

Female genitalia.—Genital plate narrow; anterior edge in the form of a strongly sclerotized crescentic bar. Ostium broad, oval, with a small, strongly sclerotized area posterior to it. Ductus bursae membranous. Bursa copulatrix small; signum of bursa a small, oval, spined plate.

Alar expanse, 17 mm.

Type.—In the United States National Museum.

Type locality.—Kissimmee, Fla. (Wm. Beutenmüller).

Remarks.—The only specimens I have seen of this species are the type male and a paratype female. The species is quite distinct from any other North American species.

AGONOPTERIX LATIPALPELLA Barnes and Busck

PLATE 33, FIGURES 188, 188a; PLATE 46, FIGURE 268

Agonopteryx latipalpella BARNES and BUSCK, Contr. Lepid. North America, vol. 4, p. 233, 1920.

Agonopterix latipalpella (Barnes and Busck) McDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8432, 1939.

Depressaria latipalpella MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 330, 1939.

The entire insect presents a roughened appearance due to the raised scales that cover almost the whole surface. Labial palpus ochreous-

white; second segment irrorated with black and fuscous exteriorly and suffused with fuscous in the brush; third segment with broad, poorly defined blackish-fuscous basal and median annulations. Head, thorax, and fore wing light ochreous-brown, the scales suffused with fuscous and tipped with sordid whitish; collar narrowly black; base somewhat lighter than the rest of wing, the light color diffused for a short distance along costa and bordered outwardly by a strong black shade, the latter from the middle to inner margin of wing; at basal third an inconspicuous white discal spot (sometimes two) preceded by a few black scales, at the end of a cell a small white discal spot broadly edged with black; cilia light ochreous-brown with a narrow median fuscous band. Hind wing ochreous-fuscous, darker around margins; cilia ochreous with narrow fuscous subbasal and subterminal bands. Legs ochreous-white suffused and mottled with blackish fuscous and fuscous. Abdomen ochreous-fuscous edged laterally with numerous light ochreous-brown hairlike scales; beneath, two broad, black, longitudinal lines broken into spots in posterior half; between these two lines two indistinct parallel rows of spots.

Male genitalia.—Harpe elongate, moderately narrow; sparsely clothed with hairs; cucullus pointed; clasper long, slender, slightly enlarged in middle; sacculus broad. Anellus rectangular; posterior edge emarginate; lateral lobes well developed, hairy. Aedeagus stout, slightly bent, pointed; vesica with a weak spinulate patch of cornuti in basal half. Vinculum rounded. Transtilla a narrow sclerotized band, with large hairy, lateral lobes. Gnathos a spined, oval knob. Socii hairy flaps.

Female genitalia.—Genital plate broad, with a gently concave, narrow, sclerotized anterior edge. Ostium small, round, situated on posterior margin of genital plate. Ductus bursae sclerotized behind inception of ductus seminalis, short, membranous before, gradually widening into the very large bursa copulatrix; signum large, 3-pointed, with a few large teeth on posterior margin.

Alar expanse, 17–19 mm.

Type.—In the United States National Museum.

Type locality.—San Benito, Tex.

Remarks.—The species is represented only by the type series from Brownsville and San Benito, Tex.

AGONOPTERIX POSTICELLA (Walsingham)

PLATE 33, FIGURES 190, 190a; PLATE 46, FIGURE 274

Depressaria posticella WALSINGHAM, Proc. Zool. Soc. London, 1881, p. 315, pl. 36, fig. 5.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5274, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 744, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5880, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6423, 1903.—MEYRICK, *in* Wytsman, Genera in-

sectorum, fasc. 180, p. 173, 1922.—Gaede, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 340, 1939.

Agonopteryx posticella (Walsingham) Busck, Proc. U. S. Nat. Mus., vol. 35, p. 199, 1908.

Agonopterix posticella (Walsingham) McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8411, 1939.

Agnopteryx posticella (Walsingham) Barnes and McDunnough, Check list of the Lepidoptera of Boreal America, No. 6469, 1917.

Labial palpus dull whitish ochreous; second segment irrorated with fuscous exteriorly; third segment with apex fuscous and, in a few specimens, a faint indication of a fuscous subterminal annulus. Antenna fuscous. Head, thorax, and fore wing dull whitish ochreous; thorax with slight infuscation; fore wing irrorated with black and fuscous and suffused with reddish especially toward apex; on costa at base and on inner angle near base a blackish-fuscous spot; at basal third a black discal spot followed by a similar one at end of cell, the latter frequently obsolete; on inner margin, before tornus a fuscous blotch not attaining costal half; cilia fuscous with reddish tinge. Hind wing light grayish fuscous; cilia lighter with rosy tinge. Legs pale whitish ochreous heavily overlaid with fuscous except at joints and on posterior tibiae, the latter with faint rosy tinge. Abdomen pale ochreous, suffused with fuscuous above and with a row of more or less confluent spots on each side beneath; anal tuft usually with rosy tint.

Male genitalia.—Harpe slender, almost entirely clothed with long hairs; clasper reaching beyond costa, slightly narrowed about the middle and somewhat enlarged at the distal end, terminating in a sharp point. Anellus a sclerotized plate, posterior edge concave, and with weak lateral lobes. Vinculum rounded, broad, with well developed dorsoanterior process. Aedeagus slender, slightly curved, gradually tapering to a sharp, dorsally upturned point; at the base is a bifid sclerotized arm by which the aedeagus articulates with the anellus. Transtilla a narrow band, with well developed, hairy, lateral lobes. Gnathos a long, spined cone. Socii rather small, clothed with fine hairs.

Female genitalia.—Genital plate broad, with pronounced anterior median ventral evagination. Ostium large, oval, in posterior half of genital plate. Ductus bursae membranous, long; inception of ductus seminalis well before ostium. Bursa copulatrix large, oval; signum a small, oval plate, with serrate edges and a pointed process from the posterior margin.

Alar expanse, 17–21 mm.

Type.—In the British Museum.

Type locality.—Lake County, Calif.

Food plants.—*Psoralea physodes* Dougl., *P. macrostachya* DC., and *P. tenuiflora* Pursh.

Distribution.—Western United States.

United States records

Arizona: Yavapai County, ♂ (no date).

California: Fresno, ♂ (no date; E. A. Schwarz); Sacramento, 3 ♂♂ (V–11–53), and Applegate, Placer County, ♂ (VII–14–32), all reared and sent to me by H. H. Keifer.

Colorado: Boulder, ♀ ("May 14, Cockerell"); other specimens (Dyar and Caudell, labeled "Colorado"); Chimney Gulch, Denver, ♀ (6–13).

Oregon: McMinnville, ♂ (VII–9–22, S. E. Keen); Salem, ♀ ("March," E. Y. Lansing Jr.).

Remarks.—This far-western species seems to be confined to the area south of the Columbia River. A diligent search in the spring of 1934 by W. W. Baker, of Puyallup, Wash., failed to reveal the presence of this species in Washington State. Mr. Baker did, however, locate larvae of *psoraliella* (referred to in this paper), which is found feeding with *posticella* in California. The food plant (*P. physodes*) is rather widely distributed on the Pacific slope west of the Cascades in both Washington and British Columbia, so the species may eventually be found in both places.

AGONOPTERIX PSORALIELLA (Walsingham)

PLATE 31, FIGURES 177, 177a; PLATE 46, FIGURE 271

Depressaria psoraliella WALSINGHAM, Proc. Zool. Soc. London, 1881, p. 317, pl. 36, fig. 7.—RILEY, *in* Smith, List of Lepidoptera of Boreal America, No. 5275, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 740, 1902; *in* Dyar, U. S. Nat. Mus, Bull. 52, No. 5865, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6408, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 342, 1939.

Agonopteryx psoraliella (Walsingham) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.

Agonopterix psoraliella (Walsingham) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8449, 1939.

Agnopteryx psoraliella (Walsingham) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6442, 1917.

Labial palpus pale gray; second segment strongly suffused with fuscous and dull red exteriorly; third segment slightly tinged with red and with subbasal and subapical annuli and apex black. Antenna fuscous with reddish tint. Head gray, lightly suffused with fuscous and tinted with red laterally; face shining white. Thorax, base of wing, and basal fourth of costa gray irrorated with deep red-brown and black (thorax in one specimen wholly red-brown);

posterior tuft of thorax light red, beneath the inner edge of each tegula a small black spot; fore wing deep red-brown irrorated with blackish fuscous and gray, especially toward costa and along veins; at basal third two small yellowish discal dots, one above the other, followed by another at the end of cell; frequently there is a fourth, though smaller spot between the outer and inner discal spots; all spots edged with deep red; along costa and around termen a series of indistinct blackish-fuscous spots; cilia fuscous with a reddish tinge. Hind wing dark grayish-fuscous; cilia lighter, reddish tinged with a well-defined fuscous basal band and several less distinct subterminal ones. Legs gray overlaid with blackish fuscous, except at joints, and tinted with red. Abdomen gray, suffused with fuscous above; beneath, lightly suffused with red, irrorated with fuscous and with a row of black spots on each side.

Male genitalia.—Harpe broad and short (when compared with those of other members of the genus), clothed over most of the surface with fine hairs; cucullus rounded (in one specimen from California the cucullus is long and slender); clasper long and slender, reaching to, or slightly beyond, the costa; occasionally the clasper is slightly hooked at the distal end. Anellus an oblong-oval plate; posterior edge nearly straight with shallow median cleft; lateral lobes well developed. Vinculum rounded, with dorsoanterior process. Aedeagus slender, tapering distally to a point just past the middle, then becoming larger and finally terminating in a sharp point. At the base of the aedeagus is a bifid arm by which it articulates with the anellus. Transtilla a broad sclerotized band, with large, hairy, lateral lobes. Gnathos a slender spined cone. Socii large hairy flaps.

Female genitalia.—Genital plate broad. Ostium small, at extreme anterior margin of plate. Ductus bursae long, membranous; inception on ductus seminalis well before ostium. Bursa copulatrix scarcely larger than the ductus. Signum a lightly sclerotized, oval plate.

Alar expanse, 20–24 mm.

Type.—In the British Museum.

Type locality.—Sonoma County, Calif.

Food plants.—*Psoralea physodes* Dougl. and *Psoralea macrostachya* DC.

Distribution.—The Pacific slope of the United States.

United States records

California: Pope Creek, Napa County, ♂, 2 ♀♀ (V–27 to V–30–32, H. H. Keifer [reared]; Mills College, Alameda County (1 specimen in Dr. Braun's collection); Dry Creek, Sonoma County, ♀ (V–21–1871, Walsingham [reared]).
Washington: Puyallup, 4 ♂♂, 5 ♀♀ (V–7 to 17–34, W. W. Baker [reared]).

Remarks.—The species is easily recognizable from Walsingham's description and figure. There is one specimen from Washington State that has the head and thorax dark reddish brown instead of the usual gray.

AGONOPTERIX SANGUINELLA (Busck)

PLATE 33, FIGURES 189, 189a

Depressaria sanguinella BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 738, 1902.—*in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5861, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6404, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180 p. 176, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 348, 1939.

Agonopteryx sanguinella BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 199, 1908.

Agonopterix sanguinella (Busck) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8445, 1939.

Agnopteryx sanguinella (Busck) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6458, 1917.

Labial palpus pale grayish ochreous; second segment sparsely irrorated with black exteriorly; third segment with a small spot near base anteriorly, and apex black. Antenna dark fuscous. Face, head, and collar of thorax light straw color, the scales of the head with a grayish suffusion. Thorax and fore wing gray, sparsely irrorated with black and with a carmine tint, the carmine color more pronounced along costa and apex of fore wing; extreme base of wing and costa pale grayish ochreous, the former followed by and the latter narrowly edged with black; at basal third two obliquely placed black discal spots edged with a few carmine scales; at end of cell a white discal spot conspicuously edged with carmine; from the discal spot at end of cell an inwardly oblique, blackish dash not reaching costa; cilia gray with reddish suffusion and sparse black irrorations; termen without row of dark spots. Hind wing light ochreous fuscous; cilia concolorous with subbasal and two parallel fuscous bands and with whitish irrorations apically. Legs pale grayish ochreous irrorated and suffused with blackish fuscous except at joints. Abdomen pale grayish ochreous irrorated with black and with a row of black spots on each side beneath.

Male genitalia.—Harpe slender, clothed with long, fine hairs; cucullus pointed; clasper short, straight, bluntly pointed; sacculus moderately sclerotized. Anellus slightly longer than broad, with small lateral lobes; posterior margin with shallow cleft; basal portion constricted. Aedeagus stout, slightly curved, bluntly pointed; vesica armed with numerous strong spinulate cornuti. Vinculum rounded. Transtilla a sclerotized band with well-developed lateral lobes. Gnathos a spined knob. Socii fleshy, hairy flaps. Tegumen terminating in a blunt point.

Alar expanse, 21 mm.

Type.—In the United States National Museum.

Type locality.—Pinal Mountains, Ariz. (R. Kunze).

Remarks.—I have seen no specimens certainly referable to this species, although I have before me a series from White Mountains, Ariz., which may belong here. The specimens from this locality average considerably larger than the type of *sanguinella* but may be well within the range of variation for this species.

AGONOPTERIX AMYRISELLA (Busck)

PLATE 46, FIGURE 272

Depressaria amyrisella BUSCK, Proc. U. S. Nat. Mus., vol. 23, p. 233, 1901.—DYAR, Proc. Ent. Soc. Washington, vol. 4, p. 476, 1901.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 741, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5872, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6415, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 175, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 300, 1939.

Agonopteryx amyrisella BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.

Agonopterix amyrisella (Busck) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8427, 1939.

Agnopteryx amyrisella (Busck) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6446, 1917.

Labial palpus yellowish white; second segment with blackish-fuscous base and with black irrorations; third segment with apical third black, subbasal fourth light reddish fuscous; the whole palpus with a reddish tinge. Antenna dark metallic greenish brown. Face yellowish with a few brown scales. Head with erect scales, yellowish at bases, purplish black toward tips, tips white with reddish tinge. Thorax yellowish brown with violaceous scales intermixed and with a transverse crest of six tufts of scales. Fore wing dark violaceous-brown sparsely irrorated with black scales; extreme base yellowish, the color not extending to costa, and containing a black spot near inner angle; beyond this light basal patch a purplish-black fascia not attaining costa; at basal third, in cell, a few scattered purplish-black scales; at end of cell a small white discal spot broadly edged with black; on costa five rather large blackish spots, the fourth (from base of wing) the largest, extending into cell and confluent with the black-edged white discal spot; around termen six to eight small black spots; cilia yellowish brown with a narrow fuscous subbasal line and tinged with reddish. Hind wing yellowish brown, much darker apically; cilia light yellowish fuscous with a broad fuscous subbasal band. Legs pale yellowish brown irrorated and suffused with purplish black except at joints. Abdomen pale yellowish brown infuscated above and with a row of black spots on each side beneath.

Female genitalia.—Genital plate moderately sclerotized; anterior edge lobed. Ostium small, round, opening about middle of plate. Ductus bursae short, not much longer than bursa copulatrix; inception of ductus seminalis just before ostium. Bursa copulatrix large, oval, without signum.

Alar expanse, 16–17 mm.

Type.—In the United States National Museum.

Type locality.—Palm Beach, Fla.

Food plant.—*Amyris floridana* Nutt.

Remarks.—This species is represented only by the type series. These are females.

2. MARTYRHILDA, new genus

PLATE 2, FIGURE 17; PLATE 6, FIGURE 44; PLATE 10, FIGURES 67, 67a; PLATE 16, FIGURE 100

Genotype.—*Depressaria canella* Busck, Proc. U. S. Nat. Mus., vol. 27, p. 764, 1904.

Similar to *Agonopterix* but palpus more slender, smooth, brush on second segment poorly developed or absent. Fore wing narrow, elongate, bluntly pointed; costa straight. Hind wing with costa straight or slightly excavate. Abdominal wall strongly sclerotized.

Male genitalia.—Clasper divided, with transverse arm and longitudinal arm, the former sometimes with lateral process from inside; gnathos broadened, sometimes reniform; vesica usually armed with strong cornuti.

Female genitalia.—Signum always large, broadly oval to elongate, never diamond-shaped. Ductus bursae membranous or partly sclerotized, sometimes with strong thornlike processes from inner surface.

Larva.—As in *Agonopterix*.

Pupa.—Pubescent. Prothoracic femora exposed. Labial palpi not exposed. Cremaster absent.

Remarks.—This genus is closely related to *Agonopterix*, differing from it by the poor development or absence of the brush of the second segment of the labial palpus, the divided clasper of the harpe, the unusually large broadly oval or elongate signum, and the exposed prothoracic femora of the pupa.

With the genotype I associate ten other species, three of which I have described as new.

The larvae of only three species of this genus are known. The larva of *sphaeralceae* is a leaf miner; those of *umbraticostella* and *canella* are leaf tiers.

KEY TO THE SPECIES OF MARTYRHILDA BASED ON COLORATION

1. Ground color of fore wing white or whitish 2
   Ground color of fore wing otherwise 4
2. Costa with a large fuscous blotch at middle ..... **canella** (Busck) (p. 128)
   Costa without large dark markings 3
3. Basal segment of antenna sordid whitish; hind wing smoky fuscous ..... **sordidella**, new species (p. 132)
   Basal segment of antenna fuscous; hind wing white ..... **nivalis** (Braun) (p. 139)
4. Base of fore wing dark reddish brown or blackish fuscous 5
   Base of fore wing otherwise 7
5. Ground color of fore wing straw yellow ..... **gracilis** (Walsingham) (p. 133)
   Ground color of fore wing otherwise 6
6. Ground color of fore wing light reddish ochreous **umbraticostella** (Walsingham) (p. 130)
   Ground color of fore wing pale ochreous-gray. **thoracenigraeella** (Chambers) (p. 135)
7. Costa, to about middle, lighter than general color of wing 8
   Costa not contrastingly lighter than remainder of wing 10
8. Third segment of labial palpus immaculate ..... **hildaella**, new species (p. 140)
   Third segment of labial palpus maculate 9
9. Fore wing suffused or marked with reddish or brownish; alar expanse 20 mm. or more ..... **klamathiana** (Walsingham) (p. 142)
   Fore wing without reddish or brownish suffusions or markings; alar expanse 19 mm. or less ..... **sciadopa** (Meyrick) (p. 144)
10. Ground color of fore wing grayish fuscous strongly overlaid with whitish ochreous ..... **sphaeralceae**, new species (p. 138)
    Ground color of fore wing brownish fuscous sparsely irrorated with whitish ochreous ..... **thoracefasciella** (Chambers) (p. 136)

KEY TO THE SPECIES OF MARTYRHILDA BASED ON MALE GENITALIA

1. Gnathos reniform (figs. 100, 143) 2
   Gnathos not reniform (fig. 149) 4
2. Transverse arm of clasper extending beyond middle of harpe (figs. 67, 143) 3
   Transverse arm of clasper short, stout, not extending beyond middle of harpe (fig. 145) ..... **sordidella**, new species (p. 132)
3. Harpe slender; both arms of clasper of about equal length; transverse arm reaching costa of harpe (fig. 143) **umbraticostella** (Walsingham) (p. 130)
   Harpe short, broad; transverse arm of clasper longer than longitudinal arm but not attaining costal edge of harpe (fig. 67) **canella** (Busck) (p. 128)
4. Lobes of transtilla fused (figs. 146, 147) 5
   Lobes of transtilla not fused (figs. 148, 149, etc.) 6
5. Sacculus as broad as one-third width of harpe at base; transverse and longitudinal arms of clasper of about equal length; aedeagus about one-half length of harpe (fig. 146) **thoracefasciella** (Chambers) (p. 136)

Sacculus broader than one-third width of harpe at base; transverse arm of clasper appreciably longer than longitudinal arm; aedeagus longer than one-half length of harpe (fig. 147) **sphaeralceae**, new species (p. 138)

6. Transverse arm of clasper short, hardly extending beyond middle of harpe (fig. 148)---- **hildaella**, new species (p. 140)
Transverse arm of clasper long, at least extending beyond middle of harpe (figs. 142, 144, etc.)---- 7
7. Aedeagus sharply bent at middle (fig. 142a)--**gracilis** (Walsingham) (p.133)
Aedeagus slightly curved (figs. 149, 150, etc.)---- 8
8. Transverse arm of clasper arising at middle, or slightly before middle of harpe; aedeagus strongly compressed (figs. 149, 151)---- 9
Transverse arm of clasper arising well before middle of harpe; aedeagus not appreciably compressed (fig. 150)---- 10
9. Transverse arm of clasper reaching to or slightly beyond costa of harpe; free from below middle of harpe **klamathiana** (Walsingham) (p. 142)
Transverse arm of clasper not reaching costa of harpe; free from middle of harpe or beyond (fig. 149)----**sciadopa** (Meyrick) (p. 144)
10. Both arms of clasper very slender, sharply pointed; vesica armed with an elongate patch of fine cornuti (figs. 150, 150a) **nivalis** (Braun) (p. 139)
Arms of clasper otherwise; vesica armed with an elongate patch of strong cornuti (fig. 144)----**thoracenigraeella** (Chambers) (p. 135)

KEY TO THE SPECIES OF MARTYRHILDA BASED ON FEMALE GENITALIA

1. Ductus bursae partly sclerotized (figs. 100, 239)---- 2
Ductus bursae membranous (figs. 232, 233; etc.)---- 3
2. Sclerotized portions of ductus bursae consisting of one moderately large and one small area, the former bearing several thornlike teeth inwardly (fig. 239)--**thoracenigraeella** (Chambers) (p. 135)
Sclerotized portion of ductus bursae consisting of one large area armed inwardly with 17 or 18 short, stout teeth (fig. 100) **canella** (Busck) (p. 128)
3. Inner surface of ductus bursae armed with a group of 11 stout teeth (fig. 238)----**sordidella**, new species (p. 132)
Inner surface of ductus bursae unarmed (figs. 232, etc.)---- 4
4. Signum broadly oval (figs. 231, 233)---- 5
Signum elongate (figs. 232, 235, etc.)---- 6
5. Ostium with a strongly sclerotized area laterally (fig. 233) **gracilis** (Walsingham) (p. 133)
Ostium without such sclerotized area (fig. 231)----**nivalis** (Braun) (p. 139)
6. Signum with several long teeth projecting from posterior end (fig. 232)----**umbraticostella** (Walsingham) (p. 130)
Signum without such teeth (figs. 235, etc.)---- 7
7. Bursa copulatrix distinctly asymmetrical (figs. 234, 236)---- 8
Bursa copulatrix symmetrical (figs. 235, 237)---- 9
8. Genital plate with two narrow raised ridges posterior to ostium (fig. 234)----**klamathiana** (Walsingham) (p. 142)
Genital plate without such ridges (fig. 236)----**sciadopa** (Meyrick) (p. 144)
9. Ostium with sclerotized, cuplike structures laterally (fig. 235) **thoracefasciella** (Chambers) (p. 136)
10. Ostium without such structures (fig. 237)--**sphaeralceae**, new species (p 138)

MARTYRHILDA CANELLA (Busck)

PLATE 2, FIGURE 17; PLATE 6, FIGURE 44; PLATE 10, FIGURES 67, 67a; PLATE 16, FIGURE 100

Depressaria canella BUSCK, Proc. U. S. Nat. Mus., vol. 27, p. 764, 1904.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 311, 1939.

Agonopteryx canella BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 238, 1923.

Agonopterix canella (Busck) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8433, 1939.

Agnopteryx canella (Busck) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6437, 1917.

Agonopteryx cogitata BRAUN, Can. Ent., vol. 58, p. 47, 1926.

Agonopterix cogitata (Braun) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8433, 1939. (As. synonym of *canella* (Busck)).

Depressaria cogitata (Braun) GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 316, 1939.

Labial palpus white strongly irrorated with fuscous. Antenna, head, and collar of thorax fuscous to black; face whitish. Thorax and ground color of fore wing pure white, the latter marked with black, brown, and fuscous; basal third with a few inconspicuous black and fuscous spots and fine strigulae; from costa, at middle, a large fuscous blotch extending to near middle of cell edged above and below with brown and preceded by a black crescentic dash; around termen a series of black or fuscous spots; cilia whitish strongly suffused with fuscous. Hind wing light fuscous; cilia whitish. Legs white strongly mottled and overlaid with fuscous or black. Abdomen white with a black lateral stripe on each side beneath.

Male genitalia.—Harpe lightly sclerotized except for sacculus, which is heavily sclerotized and deeply folded; sacculus produced to form a broadly bifid clasper, transverse arm long, extending beyond middle of harpe, the other produced toward cucullus. Anellus a broad, sclerotized plate, dorsoventrally concave; two dorsal projections laterally produced. Aedeagus stout, blunt; vesica armed with several stout cornuti, the terminals (1–3) at right angles to the long axis of the aedeagus forming hook. Vinculum broad, rounded. Lobes of transtilla not fused. Gnathos a reniform, heavily spined knob.

Female genitalia.—Ostium round. Genital plate heavily sclerotized at edges of ostium; ductus bursae short, constricted just before bursa copulatrix; the posterior portion broad, heavily sclerotized; near the anterior edge of the sclerotized portion of the ductus a group of 18 short, stout spines (this probably varies). Signum of bursa copulatrix a large oval plate.

Larva.—Length 11–12 mm. Head light brown with a heavy suffusion of dark brown on the margins, epicranial sutures and, especially, beneath. Body subcylindrical, considerably thicker at middle and tapering toward each end. Thoracic and abdominal segments light yellowish green, lighter ventrally. Prothoracic shield light yellowish brown. Thoracic legs yellowish with joints edged with brown. Tubercles large, black; spiracles edged with brown.

The larvae of *canella* are often abundant, and their work is characteristic and easily recognized. Early in spring the tubes, formed by the larvae from tied terminal leaves, are conspicuous as "beaked" processes at right angles to the long axis of the stem. Frequently several tubes are constructed by one larva so that it becomes necessary to inspect several tubes before the larva is finally located. From the terminal portion of the tube the woolly covering of the leaves is ejected, this often forming a conspicuous mass. Pupation occurs in debris at the base of the plant. In the laboratory larvae pupated on April 24 and 25, and the moths emerged May 8, 1934.

The species is exceedingly difficult to rear. In the spring of 1935 nearly 400 larvae were collected but only 19 moths were obtained. This might suggest faulty rearing conditions but three systems were used with the same results. This and the fact that in nature the moths are scarce, although the larvae are abundant, suggest a natural high mortality.

Alar expanse, 16–20 mm.

Type.—In the United States National Museum (*canella*); A. F. Braun collection, Cincinnati, Ohio (*cogitata*).

Type localities.—Pullman, Wash. (*canella*) (Piper); Aweme, Manitoba (*cogitata*).

Food plants.—*Antennaria luzuloides* T. & I. (Clarke); *Gnaphalium* (J. McDunnough).

Distribution.—Western United States and Canada in the Rocky Mountain and intermountain areas; northeastern United States and eastern Canada.

United States records

California: Warner Mountains, 3 mi. E., Davis Creek, Modoc County, alt. 5,500 feet, ♂ (8–15–VII–1922, A. W. Lindsey).

Connecticut: New Haven, ♂ (Dr. Britton).

Idaho: Viola, Moscow Mountains, ♀ (12–VI–35, J. F. G. Clarke [reared]).

New Hampshire: Portsmouth, ♂ (VI–9–05, C. E. Montgomery).

New York: Big Indian Valley, Catskill Mountains, ♀ (IX–2–10, R. F. Pearsall); Ilion (♂, VI–25–13, 2 ♀♀, VI–25–13, VII–11–17, H. McElhose); also Wilmington and Ithaca (according to Forbes); Ithaca, ♀ (30–VI–31, A. B. Klots).

Washington: Kamiack Butte, Whitman County, 8 ♂♂ and 9 ♀♀ (May 8, 1934; May 16–June 18, 1935, J. F. G. Clarke [reared]); Pullman, ♂ (2 September '98).

Canadian records

Alberta: Waterton Lakes (12 July, J. McDunnough).
British Columbia: Chilcotin, ♂ (VIII–22–25, George V. Copley).
Manitoba: Aweme.
Quebec: Kazubeque, ♂ (VI–24–27, J. McDunnough [reared]).

Remarks.—There is no doubt about the synonymy of this species. Dr. Braun distinguishes her *cogitata* from *canella* on the basis of the absence of the black anterior border of the thorax and the white apical portion of the hind wing of the latter species. Although Busck did not mention the black anterior portion of the thorax in his description, all specimens I have seen, including the type, have it present. The use of a white apical portion of the hind wing to distinguish further between the two is impractical, no two specimens of this species having the same amount of black scaling at the apex of the hind wing and some lacking it entirely. The difference in the male genitalia is confined to the number of cornuti present on the vesica; but this character is useless since the number differs in different specimens.

This species closely resembles the European *alstroemeriana* but is easily distinguished from it by the black or very dark-brown collar.

MARTYRHILDA UMBRATICOSTELLA (Walsingham)

PLATE 24, FIGURES 143, 143a; PLATE 41, FIGURE 232

Depressaria umbraticostella WALSINGHAM, Proc. Zool. Soc. London, 1881, p. 318, pl. 36, fig. 8.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5283, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 736, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5855, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6398, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 27, p. 763, 1904.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 177, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 356, 1939.

Agonopteryx umbraticostella (Walsingham) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.—BRAUN, Trans Amer. Ent. Soc., vol. 51, p. 197, 1925.

Agonopterix umbraticostella (Walsingham) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8455, 1939.

Agnopteryx umbraticostella (Walsingham) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6434, 1917.

Labial palpus light ochreous suffused with light fuscous; third segment with median and basal bands, the latter poorly defined. Antenna fuscous. Head ochreous irrorated with fuscous. Thorax and base of fore wing blackish fuscous to black. Fore wing light reddish ochreous with small diffused blackish-fuscous spots on costa and around termen; on middle of costa a conspicuous, outwardly diffused blackish-fuscous shade preceded by two minute (sometimes inconspicuous) discal dots of the same color; from costal patch, around termen to near middle of inner margin, a light fuscous shade;

cilia light fuscous. Hind wing shining grayish fuscous. Legs whitish ochreous, the fore and mid legs strongly overlaid with fuscous; hind legs lightly so with their tarsi fuscous and annulated with whitish ochreous. Abdomen light fuscous above, whitish ochreous beneath with a lateral stripe on each side and irrorations blackish fuscous.

Male genitalia.—Harpe lightly clothed with hairs; costa heavily sclerotized; clasper divided, the arms long, of about equal length; one arm, parelleling the sacculus, stout and sharply pointed; the transverse arm curved, reaching costa and having a lateral thornlike process projecting toward the sacculus. Anellus a more or less shield-shaped plate, deeply excavated on the posterior margin, the excavation, in the main, being formed by two heavily sclerotized, winglike processes. Vinculum broad, rounded. Aedeagus stout, straight, bluntly pointed, with a large spinulate patch about the middle. Transtilla a broad sclerotized band. Gnathos reniform. Tegumen bifid. Socii rectangular flaps bearing a few hairs.

Female genitalia.—Genital plate narrow at the middle, the entire width being taken up by the rectangular ostium, then broadening laterally. Ductus bursae short, broad, and membranous. Bursa copulatrix large, oval; signum a large, elongate oval plate, slightly broader anteriorly than posteriorly, with long, spinelike projections at the posterior end.

Alar expanse, 16–19 mm.

Type.—In the British Museum.

Type localities.—Mount Shasta, Calif., and "North Oregon."

Food plants.—*Balsamorhiza sagittata* (Pursh) Nutt. and *Helianthus pumilus* Nutt.

Distribution.—Western United States and Canada.

United States records

Arizona: White Mountains, Apache Indian Reservation, alt. 7,000 ft., 5 ♂♂, 3 ♀♀ (June 1925, O. C. Poling); ♂, ♀ (July 5–15, 1925); ♀ (August 1–15, 1925).

California: Mount Shasta, ♂; Placer County, ♂ (September).

Colorado: Williams Range, ♂ (August 8, A. J. Snyder).

New Mexico: Fort Wingate, ♀ (July 16–23).

Oregon: "Camp Watson" 2 ♂♂ (III, IV, 1872, Walsingham).

Utah: Stockton, 2 ♂♂ (IX–6, IX–7–07, Tom Spalding); Eureka (♂, VII–13–11, ♂, VIII–14–11, ♀, VIII–29–11, Tom Spalding).

Washington: Almota, Whitman County, ♂ (IV–5–30, J. F. G. Clarke); Pullman, 2 ♂♂ (III–1–98, C. V. Piper), ♀ (II–17–30, D. H. Brannon), ♂ (VII–26–32, T. M. Clarke [reared]), ♂ (IV–13–26, J. F. G. Clarke), ♀ (III–26–30, J. F. G. Clarke); Snake River, Whitman County, opposite Clarkston, ♂ (IV–28–32, J. F. G. Clarke); Wenatchee, 2 ♂♂ (VI–5–30, VI–10–30, A. Spuler), ♀ (IX–5–29, A. Spuler).

Canadian records

British Columbia: Vernon (20–XI–1927, A. A. Dennys).

Remarks.—This species seems to be confined to far-western North America, where it is rather widely distributed. It was originally described from specimens collected by Lord Walsingham on Mount Shasta, Calif., and in North Oregon. Busck [23] also records specimens from Arizona. He further states that Dyar bred a specimen from *Helianthus pumilus* collected near Denver and Sedalia, Colo. Braun [24] bred three specimens from *Balsamorhiza sagittata* collected near Logan, Utah.

MARTYRHILDA SORDIDELLA, new species

PLATE 24, FIGURES 145, 145a; PLATE 41, FIGURE 238

Labial palpus, head, thorax, abdomen, and ground color of fore wing sordid whitish; second segment of labial palpus with sparse brown and fuscous irrorations exteriorly; third segment immaculate; antenna with basal segment sordid whitish; remainder of segments fuscous with dull golden-yellow scaling above. Thorax and fore wing irrorated with dull golden-yellow and brown; from apical third of costa around termen to inner margin a series of indistinct brownish spots, with a few dull golden-yellow scales mixed; at basal third a brown discal spot; below this spot in fold (vein 1c) an elongate dull golden-yellow patch; at end of cell a conspicuous brown discal spot; cilia white, rather shining; underside of fore wing fuscous, except around edges. Hind wing smoky fuscous; cilia white with a brown subbasal line. Legs sordid whitish, slightly overlaid and mottled with fuscous exteriorly; tarsi fuscous except at joints.

Male genitalia.—Harpe moderately broad, tapering gradually to the bluntly pointed cucullus, and lightly clothed with coarse hairs; sacculus broad and very heavily sclerotized; clasper divided, the longitudinal arm produced as a strong, long, bluntly pointed extension of the sacculus, the transverse arm as a short, stubby, moderately sclerotized projection about middle of harpe. Anellus a broad rectangular plate with concave posterior edge, moderately well developed hairy lateral lobes and a broad median process from basal edge. Aedeagus stout, moderately long, nearly straight, bluntly pointed; vesica armed with an elongate patch of strong cornuti. Vinculum broadly rounded. Transtilla a narrow sclerotized band with large, hairy, fleshy, lateral lobes. Gnathos reniform. Tegumen pointed. Socii large fleshy, hairy lobes.

Female genitalia.—Genital plate moderately broad, lightly sclerotized. Ostium large, round, with an elongate, strongly sclerotized

[23] Busck, A., Proc. U. S. Nat. Mus., vol. 24, p. 736, 1902.
[24] Braun, A. F., Trans. Amer. Ent. Soc., vol. 51, p. 197, 1925.

patch on each side inwardly; anterolateral edge narrowly but heavily sclerotized. Ductus bursae membranous, short, broad, with 10 or 11 short, stout, strongly sclerotized, thornlike teeth inwardly; inception of ductus seminalis adjacent to ostium. Bursa copulatrix moderately large, round; signum a large, round, toothed plate.

Alar expanse, 18–21 mm.

Type.—In the Canadian National collection.

Paratypes.—U. S. N. M. No. 53258; also in the Canadian National collection.

Type locality.—Shingle Creek, Penticton, British Columbia.

Food plant.—Unknown.

Remarks.—Described from the ♂ type, 10 ♂ and 3 ♀ paratypes from British Columbia as follows: Brent's Landing, Penticton, 3 ♂ ♂ (30–V–1935); Shingle Creek, Penticton, 6 ♂ ♂ (16–V–1936); Shingle Creek Road, Keremeos, ♂ (8–VI–1935); Summerland, 2 ♀ ♀ (25–V–1935); Vaseaux Lake, ♀ (18–V–1936), all collected by A. N. Gartrell; Penticton, ♂ (7–VI–1935, J. McDunnough). The entire type series was submitted by Dr. McDunnough.

This is the third species of the genus from North America with a white ground color to come to my attention.

The costa of the fore wing of the female is somewhat straighter than that of the male and is more nearly parallel to the inner margin, producing a wing that is narrower and of nearly equal width throughout its length.

MARTYRHILDA GRACILIS (Walsingham)

PLATE 24, FIGURES 142, 142a; PLATE 41, FIGURE 233

Depressaria gracilis WALSINGHAM, Ins. Life, vol. 1, p. 257, 1889.—BUSCK. Proc. U. S. Nat. Mus., vol. 24, p. 737, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5857, 1903.—KEARFOIT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6400, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 177, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 325, 1939.

Agonopteryx gracilis (Walsingham) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.

Agonopterix gracilis (Walsingham) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8457, 1939.

Agnopteryx gracilis (Walsingham) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6436, 1917.

Labial palpus straw yellow; second segment blotched with reddish brown outwardly; third segment with a reddish-brown subapical annulus. Antenna with basal segment dark brown, remainder brown. Head straw yellow with a light reddish-brown patch above the base of each antenna. Thorax and base of forewing dark reddish brown. Ground color of fore wing and cilia straw yellow; discal spots dark

brown, the first two, obliquely one above the other, before middle, the third at end of cell; from costa, just before apex, around termen a series of six or seven dark brown spots; cilia strongly mixed with dark brown. Hind wing pale grayish fuscous; cilia pale straw yellow with a faint, narrow, brown subbasal line. Legs straw yellow; anterior femora and tarsi strongly overlaid with brown; tarsi of middle and hind legs tinged with brown. Abdomen brownish above with posterior edges of segments and ventral surface straw yellow.

Male genitalia.—Harpe moderately broad; costa heavily sclerotized to a point just before cucullus; clothing of hairs confined to the apical half except for a group of coarse hairs on base just below the costa; clasper divided, one arm, paralleling the sacculus, short and acutely pointed, the other, long, reaching to a point just below the costa, with a short, blunt lateral projection. Anellus a broad, sclerotized plate with an elongated troughlike articulation on which the aedeagus rests. Vinculum rounded. Aedeagus stout, bent sharply at middle and tapering gently to a blunt point. Transtilla a narrow band with hairy lateral lobes. Gnathos an oval, spined knob. Tegumen rounded at apex. Socii fleshy flaps with a few hairs.

Female genitalia.—Genital plate broad, rather heavily sclerotized around the ostium. Ostium deeply concave. The edges immediately around the ostium and the posterior portion of the ductus bursae are spinulate. Just before the ostium the ductus bursae is constricted. Ductus bursae short, membranous, unarmed on inner surface, widening gently into the large bursa copulatrix. Signum a large, broadly oval, slightly sclerotized plate.

Alar expanse, 15-18 mm.

Type.—In the British Museum.

Type locality.—Texas.

Food plant.—Unknown.

Distribution.—Western United States.

United States records

California: Laguna Beach, ♀; Loma Linda, San Bernardino County, ♀ (Oct. 8–15); San Diego, 2 ♂♂ (Nov. 21, 1921, Karl R. Coolidge), 3 ♂♂ (May 24–30), ♀ (June 16–23), ♀ (April 16–23), ♀ (IV–26–08, Geo. H. Field).

Colorado: Colorado Springs (Fountain Valley School), 3 ♂♂ (20–31–VIII–32, A. B. Klots); Denver, ♂ (Oslar); 2 ♀♀ (no data).

Iowa: Iowa City, ♀ (G. G. Ainslie).

South Dakota: Elk Point, ♀ (Aug. 1918, C. N. Ainslie).

Texas: 2 ♂♂ (X–06, H. Lacey).

Remarks.—This very distinct species cannot be confused with any other described North American *Martyrhilda*, but it closely resembles the European *culcitella*.

MARTYRHILDA THORACENIGRAEELLA (Chambers)

PLATE 24, FIGURE 144; PLATE 41, FIGURE 239

Gelechia thoracenigraeella CHAMBERS, Cincinnati Quart. Journ. Sci., vol. 2, p. 246, 1875; U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 147, 1878.

Depressaria thoracenigracella (Chambers) RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5495, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 736, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5856, 1903.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6399, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 355, 1939.

Agonopteryx thoracenigraecla (Chambers) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.

Agonopterix thoracenigraecella (Chambers) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8456, 1939.

Agnopteryx thoracenigracella (Chambers) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6435, 1917.

Labial palpus whitish ochreous; second segment irrorated with fuscous; third segment with a broad, well-defined black subapical annulus and a narrower, poorly defined basal annulus of the same color. Antenna fuscous. Head, thorax, and ground color of fore wing pale ochreous-gray; fore part of thorax and base of fore wing blackish fuscous; from costa to middle of cell a fuscous shade edged above and below with brown and preceded by a conspicuous outwardly oblique black dash; on costa and around termen a series of grayish-fuscous spots; cilia light fuscous irrorated with whitish ochreous. Hind wing brownish fuscous; cilia somewhat lighter with a white terminal edge. Legs light grayish ochreous overlaid and mottled with fuscous; hind tarsi fuscous, annulated with whitish ochreous. Abdomen grayish ochreous above, beneath whitish ochreous with a black lateral line on each side.

Male genitalia.—Essentially like *gracilis*, differing chiefly in the characters of the aedeagus. Harpe moderately broad and clothed with fine hairs, especially in apical half; clasper divided, one arm paralleling sacculus, the other transverse, arising well before middle of harpe, reaching nearly to costa, and without lateral process; sacculus heavily sclerotized; anellus a sclerotized plate with median trough on which the aedeagus articulates; lateral hairy lobes present. Aedeagus stout, only slightly curved; cornuti numerous, strong, in an elongate patch. Vinculum rounded, broad. Transtilla a narrow sclerotized band with lateral hairy lobes. Gnathos an oval spined knob. Socii fleshy hairy lobes. Apex of tegumen with median cleft.

Female genitalia.—Ostium moderately large, located near anterior edge of genital plate. Ductus seminalis entering ductus bursae just anterior to ostium. Ductus bursae membranous except for two sclero-

tized patches, one large, the other small, each set with sharp thornlike projections. Signum of bursa very large, oval.

Alar expanse, 16–17 mm.

Type.—In the Museum of Comparative Zoology, Cambridge, Mass.

Type locality.—Behrens, Calif.

Food plant.—Unknown.

Distribution.—Known only from California.

United States records

California: Carmel, 4 ♂♂, ♀ ("June," A. H. Vachell).

Remarks.—The type of *thoracenigraeella*, in the Museum of Comparative Zoology, Cambridge, is in very poor condition. The right fore wing, in good condition, is still attached to the thorax, but the abdomen, most of the legs, and all the other wings are gone.

Despite the poor condition of the type I have been able to recognize five specimens as this species. The figures of the genitalia have been made from two of these specimens.

MARTYRHILDA THORACEFASCIELLA (Chambers)

PLATE 24, FIGURES 146, 146a; PLATE 41, FIGURE 235

Gelechia thoracefasciella CHAMBERS, Cincinnati Quart. Journ. Sci., vol. 2, p. 246, 1875; Can. Ent., vol. 10, p. 50, 1878; U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 147, 1878.

Depressaria thoracefasciella (Chambers) RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5494, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 740, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5867, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6410, 1903.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 354, 1939.

Depressaria thoracifasciella (Chambers) MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922.

Agnoptcryx thoracefasciella (Chambers) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6451, 1917.

Agonopterix thoracefasciella (Chambers) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8442, 1939.

Labial palpus with second segment ochreous-white, mottled with fuscous exteriorly; third segment blackish fuscous with a poorly defined ochreous-white median band and ochreous-white tip. Antenna blackish fuscous. Head, thorax, base and basal fourth of costa of fore wing whitish ochreous. Ground color of fore wing brownish fuscous sparsely irrorated with whitish ochreous; extreme base of costa, and shade beyond whitish-ochreous base, blackish fuscous; first two discal spots small, black, obliquely placed one above the other; at the end of cell a conspicuous white or whitish-ochreous discal spot surrounded by a blackish-fuscous suffusion; along costa and around termen a series of poorly defined blackish-fuscous spots; cilia fuscous, mixed with ochreous-white. Hind wing brownish

fuscous, lighter basally; cilia fuscous. Legs blackish fuscous irrorated with ochreous-white; tarsi annulated with ochreous-white. Abdomen fuscous above; beneath, ochreous-white overlaid and irrorated with fuscous.

Male genitalia.—Harpe moderately sclerotized; cucullus rounded and clothed with fine hairs. Transverse and longitudinal arms of clasper of about equal length, the former extending beyond the costa; sacculus as broad as one-third the width of harpe at base. Anellus a roughly rectangular sclerotized plate emarginate on the posterior edge; lateral lobes minute. Transtilla a narrow band with fused hairy lobes. Vinculum rounded, broad. Aedeagus slender, about one-half the length of harpe, slightly curved, unarmed; apex slightly recurved. Gnathos an oval spined knob; supporting arms moderately sclerotized. Socii small, clothed with few hairs; widely separated. Tegumen truncated, slightly emarginate.

Female genitalia.—Ostium large, rounded; on each side of the ostium the genital plate is produced into a strongly sclerotized pocket. Inception of the ductus seminalis slightly anterior to the sclerotized pockets. Ductus bursae membranous, unarmed on inner surface, tapering gradually into the symmetrical bursa copulatrix. Signum an elongate scobinate plate attenuated and broken posteriorly.

The abdominal wall of this species differs from that of *sphaeralceae* in being much less strongly sclerotized. The harpes of the male are broader and correspondingly shorter, and much less sclerotized. The aedeagus is shorter than that of *sphaeralceae* and the apex is more strongly recurved. The female genitalia show marked differences. The signum of *sphaeralceae* is smaller and less strongly sclerotized than that of *thoracefasciella* and the sclerotized pockets of the latter species are totally wanting in the former.

Alar expanse, 15–17 mm.

Type.—In the Museum of Comparative Zoology, Cambridge, Mass.

Type locality.—Behrens, Calif.

Food plants.—*Sidalcea malvaeflora* A. Gray (Keifer rearing) and *Malva?* (C. M. Dammers).

Distribution.—Southwestern United States.

United States records

Arizona: Hualapi Mountains, Mojave County, 2 ♂♂, ♀ (May 24–31, no collector).

California: Diamond Spring, Eldorado County, 3 ♂♂, 3 ♀♀ (V–26 to V–3–35, H. H. Keifer); Canyon Valley, San Bernardino County, ♂ (VII–1–32, no collector); Riverside, ♀ (June 1930, C. M. Dammers); Mill Valley, Marin County, 4 ♂♂ (5–12–III–20, E. P. Van Duzee).

Remarks.—I have examined the type of this species and have made a slide of the male genitalia. These agree exactly with specimens from our reared series.

MARTYRHILDA SPHAERALCEAE, new species

PLATE 24, FIGURES 147, 147a; PLATE 41, FIGURE 237

A small, gray, narrow-winged western species, closely related to the foregoing, but easily distinguished from it by the genitalia.

Head, palpus, and antenna dark grayish fuscous; face whitish ochreous; second segment of labial palpus whitish ochreous inwardly and above with a liberal sprinkling of whitish-ochreous scales outwardly; third segment whitish ochreous above, the color extending around middle to form an incomplete annulus; apex whitish ochreous; antenna with narrow fuscous annulations. Thorax and ground color of fore wing grayish fuscous, the tips of the scales narrowly whitish ochreous; basal part of fore wing, usually with more whitish-ochreous scaling, appearing lighter than ground color and followed by a dark fuscous shading; at basal third two black obliquely placed discal spots followed by white scales, the spots frequently confluent, forming an outwardly oblique discal dash; at end of cell a white discal spot surrounded by blackish-fuscous scales; along costa and around termen a series of indistinct fuscous spots; underside of costa whitish ochreous to apex; a row of black scales around termen; cilia gray mixed with fuscous and whitish-ochreous scales. Hind wing grayish fuscous with light fuscous cilia; a fuscous band around margin at base of cilia; a blackish-fuscous line around apex and termen beneath. Legs fuscous irrorated with whitish ochreous; tarsi annulated with whitish ochreous. Abdomen fuscous above with grayish at the posterior margin of each segment; grayish laterally and beneath with a row of black lateral spots.

Male genitalia.—Harpe ample, strongly sclerotized; cucullus blunt-pointed, clothed with fine hairs; transverse arm of clasper appreciably longer than longitudinal arm, reaching well beyond costa; sacculus broader than one-third the width of harpe at base. Anellus roughly rectangular, emarginate on the posterior edge; lateral lobes scarcely developed. Transtilla a narrow band with well-developed, fused, lateral hairy lobes. Aedeagus slender, slightly curved, longer than one-half the length of harpe, pointed, unarmed. Vinculum rounded. Gnathos an oval spined knob; supporting arms strongly sclerotized. Socii fleshy hairy lobes, well separated. Tegumen with the apex emarginate.

Female genitalia.—Ostium small, round at extreme anterior edge of genital plate. Genital plate broad, weakly sclerotized. Ductus bursae moderately stout, membranous, tapering gradually into bursa; inception of ductus seminalis just anterior to the ostium. Bursa copulatrix symmetrical, oval; signum a small, weakly sclerotized, elongate plate.

Alar expanse, 15–18 mm.

Larva.—Length 9–11 mm. Head and cervical shield light brown, the former broadly suffused laterally and posteriorly with dark brown; epicranial sutures dark brown; ocelli light brown surrounded by a blackish area. Underside of head yellowish brown. The shield is bisected by a narrow light-green or yellowish longitudinal line; posterior half of shield dark brown; beyond this, on dorsal half, prothorax whitish. Thoracic and abdominal segments apple green with a broad suffusion of whitish around the dark brown tubercles and on the posterior edges of the segments. Setae long, yellowish brown proximally, whitish distally. Anal plate pale green with whitish posterolateral edges. Thoracic legs yellowish brown with lighter annulations at the joints.

The larva is a leaf miner forming a blotch mine. In the early stages frass is ejected from the mine through a small silken tube, which is constructed at one edge of the mine, usually parallel to the midrib of the leaf. In the later instars the larva folds a leaf and completely mines out the spongy material between the upper and lower epidermal layers. The larva remains in this large, roomy mine until ready to pupate. Pupation occurs in sand or soil at the base of the plant.

The larvae are abundant in the Grand Coulee, where nearly all plants of *Sphaeralcea munroana,* which are numerous, are heavily infested. The leaves are badly discolored owing to the thoroughness with which they are mined.

Type.—U.S.N.M. No. 52076.

Type locality.—Park Lake, Grant County, Grand Coulee, Wash.

Food plant.—*Sphaeralcea munroana* (Dougl.) Spach.

Remarks.—Described from the ♂ type, 5 ♂ and 4 ♀ paratypes (V–15 to VI–12, 1935, J. F. G. Clarke). Paratypes in United States National Museum, Canadian National, and H. H. Keifer collections.

MARTYRHILDA NIVALIS (Braun)

PLATE 25, FIGURES 150, 150a; PLATE 40, FIGURE 231

Agonopteryx nivalis BRAUN, Proc. Acad. Nat. Sci. Philadelphia, vol. 73, p. 10, 1921.

Agonopterix nivalis (Braun) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8419, 1939.

Depressaria nivalis (Braun) GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 334, 1939.

Labial palpus white except for some light-brown scaling on the outside of second segment. Antenna fuscous. Head, thorax, and fore and hind wings white; slightly beyond base of fore wing, in inner angle and along inner margin, a faint light-brown shade; two discal spots, obliquely one above the other, at basal third, another, larger, white-centered discal spot at end of cell, a series of spots along costa and

around termen and sparse irrorations over entire surface of fore wing fuscous to blackish fuscous. Legs and abdomen white, the former strongly suffused with fuscous.

Male genitalia.—Harpe ample, gently tapering toward cucullus, the latter rounded. Sacculus strongly sclerotized; both arms of clasper very slender, sharply pointed, the transverse arm arising well before middle of harpe and reaching two-thirds distance toward costa. Anellus a weakly sclerotized broad plate with well developed, slightly hairy, lateral lobes. Transtilla a weakly sclerotized band with well developed lateral lobes. Aedeagus slender, slightly curved, not appreciably compressed, bluntly pointed with elongate, spinulate patch on vesica. Vinculum rounded. Gnathos an oval spined knob. Socii weakly sclerotized, sparsely hairy, fleshy lobes.

Female genitalia.—Ostium small, round, without strongly sclerotized area laterally. Ductus bursae membranous, slender, inception of ductus seminalis on right side just before ostium. Bursa copulatrix large, pear-shaped, with strongly sclerotized oval signum.

Alar expanse, 21–23 mm.

Type.—In collection of Dr. A. F. Braun, Cincinnati, Ohio.

Type locality.—Two Medicine Lake, Glacier National Park, Mont.

Food plant.—Unknown.

Distribution.—Western United States and Canada in Mountains.

United States records

Washington: Skyline Ridge, Mount Baker district, Whatcom County, alt. 6,000 feet, ♂, 3 ♀♀ (26–VII–25 and 16–VIII–30, J. F. G. Clarke).

Wyoming: Green River Lake, Wind River Range, 12 ♂♂, ♀ (July 24 to August 7, 1935, A. B. Klots).

Canadian records

Alberta: Lake Louise, ♂ ("VIII–1918").

Remarks.—This is one of three known white species in this genus from North America. The others, *canella* and *sordidella* (new species), cannot be confused with it.

Dr. Braun has compared a male with her type and has kindly verified my determination of the species.

The venation is subject to considerable variation, one female having, on the right side, an accessory cell in the fore wing between veins 9 and 11 that is included in the discal cell; vein 7 of the hind wing is forked.

MARTYRHILDA HILDAELLA, new species

PLATE 24, FIGURES 148, 148a

Labial palpus sordid whitish; second segment with sparse black and fuscous irrorations exteriorly, mostly confined to basal half, and with slight infuscation in the undivided slender brush; third segment im-

maculate. Antenna grayish fuscous with narrow fuscous annulations. Head, thorax, and base of fore wing sordid whitish, the latter diffused along costa to slightly beyond basal third; tegula with a pale brownish suffusion toward apex; fore wing strongly irrorated with contrasting black spots, especially along veins; in the light basal patch, slightly below costa, a conspicuous black spot; beyond basal patch a transverse dark fuscous dash, which does not reach costa and which rapidly fades to a pale brownish ochreous, becomes stronger in color from middle to apical third, where it is followed by sordid whitish or cinereous and is narrowly diffused along costa to apex; at middle of cell a conspicuous though small black discal spot; at end of cell a white discal spot edged with black; above and below the latter spot considerable black scaling fusing with the brownish-ochreous shade; from apical third of costa, around termen to inner margin a series of blackish dashes edged inwardly and narrowly with pale yellowish brown; whole surface of wing somewhat lustrous and appearing predominantly gray; cilia light fuscous, darker basally. Hind wing shining grayish fuscous; cilia brownish fuscous with a fuscous basal band. Legs ochreous-white strongly overlaid and suffused with fuscous except at joints. Abdomen light grayish fuscous with some cinereous and white scales mixed and with a median longitudinal fuscous shade beneath.

Male genitalia.—Harpe rather broad, clothed with coarse hairs in outer half; basal half heavily sclerotized except for a small membranous median area; costa and ventral margin parallel and evenly curved; cucullus rounded; sacculus rather narrow, very strongly sclerotized; clasper divided, the longitudinal arm produced as a strong pointed extension of the sacculus, the transverse arm a slender pointed process extending but slightly beyond middle of harpe. Anellus a broad, subrectangular plate with large hairy lateral lobes, concave posterior edge and broad sagittate basal process. Aedeagus stout, moderately long, gently curved; vesica armed with a large elongate patch of rather strong cornuti. Vinculum narrowly rounded. Transtilla a narrow sclerotized band with large hairy lateral lobes. Gnathos oval. Tegumen truncate. Socii fleshy, hairy lobes.

Alar expanse, 18–21 mm.

Type.—In the Canadian National Collection.

Paratypes.—U. S. N. M. No. 53259; also in the Canadian National Collection.

Type locality.—Cameron Bay, Great Bear Lake, Northwest Territories, Canada.

Food plant.—Unknown.

Remarks.—Described from the ♂ type and 5 ♂ paratypes all from the type locality (8–12–VII–1937, T. N. Freeman). I have seen no females.

MARTYRHILDA KLAMATHIANA (Walsingham)

PLATE 25, FIGURE 151; PLATE 41, FIGURE 234

Depressaria klamathiana WALSINGHAM, Proc. Zool. Soc. London, 1881, p. 314, pl. 36, fig. 4.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5267, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 740, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5868, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6411, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 27, p. 762, 1904.—DYAR, Proc. U. S. Nat. Mus., vol. 27, p. 934, 1904.—ANDERSON, Catalogue of British Columbia Lepidoptera, No. 1091, 1904.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 328, 1939.

Agonopteryx klamathiana (Walsingham) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.

Agonopterix klamathiana (Walsingham) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8435, 1939.

Agnopteryx klamathiana (Walsingham) BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6441, 1917.

Depressaria ciniflonella WALSINGHAM (not Zeller), Ins. Life, vol. 1, p. 256, 1889.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5259, 1891.—BUSCK (not Zeller), Proc. U. S. Nat. Mus., vol. 24, p. 740, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5869, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6412, 1903.—ANDERSON, Catalogue of British Columbia Lepidoptera, No. 1092, 1904.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922 (part).—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 314, 1939.

Agonopteryx ciniflonella Busck (not Zeller), Proc. U. S. Nat. Mus., vol. 35, p. 198, 1908.

Agnopteryx ciniflonella BARNES and MCDUNNOUGH (not Zeller), Check list of the Lepidoptera of Boreal America, No. 6440, 1917.

Agonopterix ciniflonella MCDUNNOUGH (not Zeller), Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8436, 1939.

Labial palpus gray; second segment strongly mixed with reddish fuscous; third segment with a broad, fuscous annulus before apex. Antenna reddish gray. Thorax, base of fore wing, and costa to about middle sordid whitish; anterior part of thorax suffused with reddish fuscous; ground color of fore wing reddish gray strongly suffused with reddish fuscous; at basal third two obliquely placed black discal dashes of raised scales followed by white or grayish scales; beyond this light patch a fuscous shade; at the end of cell a white discal spot margined by blackish fuscous; around termen a series of fuscous dots; cilia dull reddish with a narrow, fuscous median band; under side of costa narrowly edged with carmine. Hind wing grayish fuscous; cilia light fuscous with a rosy tinge and a fuscous basal band. Legs grayish overlaid with fuscous and strongly suffused with carmine. Abdomen grayish fuscous above; beneath sordid whitish with a broken, black lateral line on each side.

Male genitalia.—Harpe with the apical and basal portion just below costa clothed with coarse hairs; marginal hairs fine; sacculus heavily sclerotized; clasper divided; transverse arm straight, slender, arising at or before middle of harpe and reaching to or slightly beyond costa; at the base of the arm a sclerotized portion forming a short, sharp thorn (in some specimens this is scarcely noticeable); the other arm is short, sharply pointed and parallel to the sacculus; cucullus rounded. Anellus a rectangular plate, deeply cleft on the posterior edge; lateral lobes weak. Vinculum rounded. Aedeagus broad dorsoventrally and compressed laterally. The dorsal edge is strongly sclerotized; both ends slightly enlarged; vesica with a spinulate patch at middle. Transtilla a narrow sclerotized band; lateral lobes large, not fused. Gnathos a spined oval knob. The gnathos varies slightly in different specimens. Socii broad hairy flaps.

Female genitalia.—Genital plate broad, with two narrow, raised ridges posterior to ostium. Ostium small, round and situated at extreme anterior edge of plate. Ductus bursae membranous, short, and tapering into the bursa copulatrix. The latter is large, asymmetrical. Signum an elongate-oval, sclerotized, scobinate plate, extending almost the entire length of the bursa.

Alar expanse, 20–25 mm.

Type.—In the British Museum.

Type locality.—Fort Klamath, Oreg.

Food plant.—Apple?

Distribution.—Western United States and Canada as far east as Ontario.

United States Records

Montana: Ravalli County, 3 ♂♂, ♀ (1–29–33, from magpie nests).
Oregon: Fort Klamath, 2 ♂♂ (IX–20–71, Walsingham).
Washington: Bellingham, ♀ (VIII–22–26, J. F. G. Clarke); Logan Hill, Chehalis, 3 ♂♂, 2 ♀♀ (II–16 to III–28–30, T. M. Clarke).

Canadian records

British Columbia: Duncan, ♀ (Apr. 1–7, Hanham); Fraser Mills, ♀ (IX–5–20, L. E. Marmont); Hazelton, ♀ (IX, 14–21, W. B. Anderson); Kalso, ♀ (IV–24–15, J. W. Cockle); Marron Lake, ♂ (Apr. 1924, C. B. Green); Quamichan Lake, Vancouver Island, ♀ (IX–27–02); Vancouver, ♀ (III–18–96, Livingston); Victoria, ♂ (IV–18–17, E. H. Blackmore), ♂ (VIII–29–23, K. F. Auden), ♀ (III–10–23, W. R. Carter); Wellington, 3 ♂♂, 6 ♀♀ (V–25–07, April [3 specimens]; 3 specimens, III–22–03, G. W. Taylor).
Ontario: Hymers, 2 ♂♂ (no date or collector); Ottawa, ♀ (III–18–05, C. H. Young).

Remarks.—After studying 45 specimens and 29 wing and genitalia slides, I am convinced that all the above material is referable to this species. I admit that the series studied shows many minor superficial differences existing between specimens. In genitalia, however, even

though slight variations occur, there are no major differences and none which would separate one group of specimens from another.

In addition, some specimens are more gray than others, having little of the red scaling that is characteristic of the species; others possess a white, rather than gray, head.

The European *ciniflonella* is a gray species with very narrow wings. The costa is not strikingly lighter as in most specimens of *klamathiana*. One or two North American specimens I have seen approach *ciniflonella* very closely. The wing form appears to vary considerably due to the differences in length of veins 2–9 of the fore wing. In some specimens these veins are considerably longer than in others, and the fore wings are correspondingly longer. It is possible that what I consider *klamathiana* actually includes more than one species, or one in a state of flux, but this entire group (*klamathiana*, *sciadopa*, *ciniflonella*, and a fourth unnamed) represents a very difficult complex of species. Only careful rearing will determine the status of these.

MARTYRHILDA SCIADOPA (Meyrick)

PLATE 24, FIGURES 149, 149a; PLATE 41, FIGURE 236

Depressaria sciadopa MEYRICK, Exotic Microlepidoptera, vol. 2, p. 315, 1920; *in* Wytsman, Genera insectorum, fasc. 180, p. 176, 1922.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 348, 1939.

Agonopterix sciadopa (Meyrick) MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8434, 1939.

This species is like the foregoing, *klamathiana*, but lacks the red or brown scaling of that species, is without carmine suffusion, and averages smaller in size.

Labial palpus whitish gray; second segment irrorated and suffused with grayish fuscous exteriorly; third segment with broad supramedial grayish-fuscous annulus. Antenna grayish fuscous above, whitish gray beneath. Head, thorax, and ground color of fore wing whitish gray. Head lightly irrorated with grayish fuscous. Thorax strongly overlaid with grayish fuscous and irrorated with black, the darker colors almost obscuring the lighter ground color. Fore wing suffused with grayish fuscous and irrorated with black; extreme base of wing and basal half of costa whitish gray strigulated with grayish fuscous and with a small black spot near base slightly inside the costal edge; beyond the light costal and basal areas a strong blackish to grayish fuscous shade rapidly fading to the light ground color slightly beyond basal third; a similar, but smaller, dark shade at middle of wing; at basal third a pair of small black discal spots, one above the other, followed by white scales; sometimes these two spots are confluent, forming a short, outwardly oblique black dash; at the end of cell a small white spot edged with black; at apical fourth a

narrow, faint, outwardly curved grayish-fuscous shade; along costa and around termen a series of small black spots; cilia whitish gray irrorated with grayish fuscous. Hind wing whitish gray basally, grayish fuscous apically; cilia whitish gray with a grayish-fuscous subbasal band. Legs whitish gray overlaid and suffused with grayish fuscous except at joints. Abdomen whitish gray suffused with grayish fuscous above and with a poorly defined row of black spots on each side beneath.

Male genitalia.—Harpe rather heavily sclerotized except for the cucullus and a small area about the middle; cucullus and the sclerotized costal area moderately clothed with fine hairs (the cucullus of one male is considerably rounded while those of four other males are somewhat pointed); clasper strongly sclerotized; the free transverse arm originating about the middle of the harpe; longitudinal arm short, sharply pointed; sacculus heavily sclerotized. Anellus a narrow concave plate forming a trough on which the aedeagus articulates; lateral lobes weak. Vinculum rounded. Aedeagus stout, slightly curved, very much compressed, rather broad dorsoventrally, constricted at about the middle; dorsal edge heavily sclerotized; vesica armed with a patch of very small cornuti. Transtilla a narrow sclerotized band with well-developed lateral lobes. Gnathos an oval spined knob. Socii fleshy lobes clothed with fine hairs. Apex of tegumen bluntly pointed; ventral edges with rather well developed outgrowths. Abdomen of male heavily sclerotized.

Female genitalia.—Genital plate broad with the small round ostium situated at the extreme anterior edge. Ductus bursae short, membranous, stout, tapering into the large asymmetrical bursa copulatrix; signum an elongate sclerotized plate with small thornlike projections covering the surface.

Alar expanse, 15–19 mm.

Type.—In the British Museum.

Type locality.—Field, British Columbia, Canada.

Distribution.—Canada and northeastern United States.

United States records

New Hampshire: Jefferson, 2 ♀♀ (30–III–36, 21–X–1936, A. E. Brower).
New York: Oswegatchie, ♂, 2 ♀♀ (31–III–33, A. B. Klots).

Canadian records

Alberta: Edmonton, 2 ♂♂, 2 ♀♀ (IV–10–21, K. Bowman); 3 ♀♀ (IV–5 to 13–24, Owen Bryant); Red Deer, 7 ♂♂, 1 ♀ (VI–1 to 16–23, K. Bowman).
Manitoba: Aweme, 1 ♂, 5 ♀♀ (XI–9–05), ♂ (III–31–04), ♀ (IX–29–20), ♂, ♀ (X–16–20), all collected by N. Criddle; Cartwright, ♂ (XI–23–05, E. F. Heath); Winnipeg, ♂ (no date, A. W. Hanham).
Ontario: Ottawa, ♂ (X–17–07, C. H. Young).
Quebec: Chelsea, ♂ (IV–21–23, J. McDunnough).

Remarks.—This species, *klamathiana*, *ciniflonella*, and a few miscellaneous unnamed specimens form a very complex group in which the species are exceedingly difficult to separate. On genitalia it is difficult to separate one from the other, only one specimen, an unnamed unique female from the Moscow Mountains, Idaho, showing good specific characters in the genitalia. The harpes of *sciadopa* are clothed with seemingly finer hairs than those found in *klamathiana* or *ciniflonella*, but this character, even though probably sufficient to distinguish *sciadopa* from the others, fails in separating the latter two. The point of origin of the transverse arm of the clasper and the comparative lengths seem to be the safest characters for separating the males of the two species. The length of the wings of *ciniflonella* is proportionately greater than in *klamathiana*, but I am skeptical of the value of this character. In some long reared series of other species both long- and short-winged forms are found. In some specimens the lengthening of the wings seems to be retarded. The venation shows some variation in all species, thus eliminating venation as a means of specific separation.

On pattern and size it is possible, with exceptions, to distinguish the three; *sciadopa* may be separated from the other two by its much smaller size, grayer appearance, and total absence of brown or red scales. Under this name I place with some doubt the specimens listed above. Meyrick's description of *sciadopa* could actually fit any one of two or three species before me, but because of the type locality and the fact that Meyrick has placed *sciadopa* in the "*ciniflonella* group." I prefer to use his name instead of proposing another. An examination of the type will be necessary to determine definitely what the name really represents.

3. BIBARRAMBLA, new genus

PLATE 4, FIGURES 29, 30; PLATE 9, FIGURES 65, 65a; PLATE 18, FIGURE 109

Genotype.—*Semioscopis allenella* Walsingham, Trans. Amer. Ent. Soc., vol. 10, p. 174, 1882.

Similar to *Agonopterix* but the second segment of the labial palpus without furrow; socii and uncus fused to form hood.

Head with appressed scales; side tufts spreading; antenna simple in both sexes; basal segment short, with pecten. Labial palpus long, recurved, second segment much longer than third, without furrow. Thorax with two minute crests. Abdomen not flattened. Fore wing with arched costa; scale tufts present; 12 veins; 2 and 3 stalked from angle; 2 and 3, 4 and 5 closely approximate; 7 and 8 stalked, both to costa; stalk of 7 and 8 approximate to 9; 11 from well before middle; termen straight, oblique.

Hind wing as broad as fore wing; 8 veins; 3 and 4 connate; 6 and 7 subparallel.

Male genitalia.—With clasper. Anellus well developed, without lateral processes. Uncus and socii fused. Gnathos a spined knob.

Female genitalia.—Genital plate strongly sclerotized, signum present.

Remarks.—This genus is closely allied to *Agonopterix*.

BIBARRAMBLA ALLENELLA (Walsingham), new combination

PLATE 4, FIGURES 29, 30; PLATE 9, FIGURES 65, 65a; PLATE 18, FIGURE 109

Semioscopis allenella WALSINGHAM, Trans. Amer. Ent. Soc., vol. 10, p. 174, 1882.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5894, 1903; Proc. U. S. Nat. Mus., vol. 35, p. 201, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6489, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 186, 1922.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8464, 1939.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 369, 1939.

Agonopteryx allenella (Walsingham) FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 241, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat. Memoir 101, p. 545, 1928.—PROCTER, Biological survey of the Mount Desert region: The insect fauna, p. 273, 1938.

Labial palpus sordid whitish; second segment shaded with fuscous on basal half and irrorated distally; slightly before apex a narrow, incomplete, brownish-fuscous annulus; third segment with a spot anteriorly at base and a broad, supra-medial annulus brownish fuscous. Antenna sordid whitish, narrowly annulated with fuscous; basal segment fuscous above. Head, thorax, and fore wing grayish white, suffused and irrorated with fuscous; at basal third, in cell, two fuscous discal spots (sometimes confluent) of raised scales followed by some ochreous scaling and with a few scales of white mixed; at the end of cell a black-edged white discal spot of raised scales followed by some ochreous scaling; along costa, and around termen to inner margin, a series of fuscous spots; costa narrowly edged with pink (this pink tint is obscure in some specimens but is strongly continued through the cilia in others); cilia sordid whitish with a broad, pale grayish-fuscous subbasal band. Hind wing pale grayish fuscous, darker apically; cilia sordid whitish with a broad, pale grayish fuscous subbasal band. Legs sordid whitish suffused and annulated with fuscous except at joints and on hind tibia, the latter with pale ochreous suffusion and a faint pink tint. Abdomen pale ochreous suffused with fuscous above.

Male genitalia.—Harpe broad basally, tapering to the pointed cucullus, hairy; sacculus broad, strongly sclerotized, clasper stout, dilated distally, recurved. Anellus a large sclerotized plate, pointed anteriorly, slightly concave posteriorly and without lateral hairy lobes. Aedeagus long, slender, narrowly S-shaped; basally, on ventral side a small, flat protuberance; vesica armed with minute cornuti. Vinculum broad, rounded, with a well-developed dorsoanterior process.

Transtilla a narrow, weakly sclerotized band with small hairy lateral lobes. Gnathos a spined, oval knob. Socii small, hairy, fused with uncus to form a narrow hood.

Female genitalia.—Genital plate narrow, produced anteriorly, strongly sclerotized; anterior edge produced ventrally to form a small shelf. Ostium small, elongate; on each side a shallow, narrow cavity. Ductus bursae membranous, slender, gradually tapering into the large bursa copulatrix; ductus seminalis opening just before ostium. Signum a small, strongly sclerotized plate with two or three strong teeth.

Alar expanse, 19–22 mm.

Type.—In the British Museum.

Type locality.—Maine (?).

Food plants.—*Alnus* sp.; oak; birch.

Distribution.—Northeastern United States and eastern Canada.

United States records

District of Columbia: Washington, ♂ (May 1902, A. Busck).

Maine: Kingsfield, ♂ (10–VII–1936, no collector); Rangeley, ♀ (12–VII–1936, V. H. dos Passos); Sebec Lake, ♂, 2 ♀♀ (June and July; no collector); Wales, ♀ (21–VI–1907; no collector).

Maryland: Plummers Island, 3 ♂♂ (May and August 1903, 1919, A. Busck).

New Hampshire: Center Harbor, ♂ (July 27, 1902, H. G. Dyar); Dublin, 2 ♂♂ (no date; A. Busck); Hampton, ♀ (4–VII–1906, S. A. Shaw).

New Jersey: Essex County Park, ♂ (11–VI–1899, W. D. Kearfott).

New York: McLean, Rhinebeck, Lond Island, etc. (*teste* Forbes).

Pennsylvania: New Brighton, 19 ♂♂, 8 ♀♀ (May and June dates, 1901–1907, H. D. Merrick).

Virginia: Upton, ♀ (25–IV–1913, F. Johansen [Hopkins No. 9861d]).

Canadian records

Nova Scotia: Petite Riviere (July 11–18, 1935, J. McDunnough); S. Milford (June 29, 30, 1934, J. McDunnough); White Point Beach (July 1934 and Feb. 8, 1936 [indoor record?] J. McDunnough).

Ontario: Biscotasing (June 14–20, 1931, K. Schedl); Ottawa (June 3–24, 1906, C. H. Young; July 19, 1926, C. H. Curran).

Quebec: Alcove (July 8, 1936, F. A. Urquhart); Brome (June 4, 1936, G. S. Walley); Gracefield (June 16, 1937, O. Peck); Kazubazua (June 8, 1927, F. P. Ide); Knowlton (Feb. 13, 1930 [indoor record?], J. McDunnough); Meach Lake (July 20, C. H. Young); Mount Lyall (July 15, 16, 1933, W. J. Brown).

Remarks.—Forbes correctly removed *allenella* from *Semioscopis*, but I do not agree with him in placing it in *Agonopterix*. The genus is close to *Agonopterix*, but the absence of the furrow or brush on the labial palpus, absence of lateral lobes of the anellus, fused socii and uncus in the male, and the unique signum of the female indicate that this species is generically distinct.

The genotype is the only species I have seen referable to this genus.

4. Genus SEMIOSCOPIS Hübner

PLATE 2, FIGURE 15; PLATE 5, FIGURE 35; PLATE 11, FIGURES 73, 73a; PLATE 16, FIGURE 97

Semioscopis HÜBNER, Verzeichniss bekannter Schmetterlinge, p. 402, 1826.—WALSINGHAM, Trans. Amer. Ent. Soc., vol. 10, p. 174, 1882.—RILEY, *in* Smith, List of Lepidoptera of Boreal America, p. 99, 100, 1891.—DYAR, Can. Ent., vol. 34, p. 319–320, 1902.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, p. 523, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, p. 114, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 201, 1908.—KEARFOTT, *in* Smith, Catalogue of the insects of New Jersey, p. 562, 1910.—BUSCK, Journ. Ent. Zool., Claremont, vol. 5, p. 100, 1913.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, p. 161, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 186, 1922.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 234–244, 1923. (Genotype: *Phalaenae Tortrix steinkellneriana* Schiffermüller, Systematisches Verzeichniss der Schmetterlinge der Weiner Gegend, p. 130, 1776).—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 369, 1939.

Epigraphia STEPHENS, Catalogue of British insects, p. 304, 1872.—GROTE, North Amer. Ent., vol. 1, p. 53, 1880.—WALSINGHAM, Trans. Amer. Ent. Soc., vol. 10, p. 174, 1882.—BEUTENMÜLLER, *in* Smith, Catalogue of the insects of New Jersey, p 355, 1890.—DIETZ, *in* Smith, Catalogue of the insects of New Jersey, p. 473, 1900.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 185–186, 1922. (Genotype: *Tinea avellanella* Hübner, Sammlung europäischer Schmetterlinge, No. 8, fig. 27, 1796.)

Head smooth, side tufts somewhat spreading. Tongue developed but short. Antenna shortly ciliated in male, simple in female; basal segment without pecten. Labial palpus moderately long, curved; second segment with appressed scales which protrude at apex; terminal segment much shorter than second, slender, acute.

Fore wing ample, elongate; 12 veins; 2 and 3 approximate, connate or stalked, 7 and 8 stalked, 7 to costa or apex, 11 from well before middle.

Hind wing as broad as fore wing, ovate; 8 veins; 3 and 4 closely approximate or connate.

Male genitalia.—Harpe elongate; sacculus frequently produced. Anellus with lateral processes that are sometimes reduced. Transtilla membranous; lateral lobes usually slender, digitate but greatly reduced. Gnathos a spined, oval knob. Socii mainly indicated by hairs.

Female genitalia.—Ductus bursae membranous or partially sclerotized; signum present.

Remarks.—Meyrick [25] separates *Epigraphia* from *Semioscopis* on the condition of veins 2 and 3 of the fore wing (stalked or separate), yet he ignores this same character in the case of *Agonopterix* and *Depressaria* except to use it to divide *Depressaria* into two sections. In *Semioscopis* veins 2 and 3 are much more unstable than in *Agonopterix* and *Depressaria*, indicating that *Semioscopis* is in a state of flux and not

[25] Meyrick, *in* Wytsman, Genera Insectorum, fasc. 180, p. 185–186, 1922.

yet clearly definable into two genera. I have examined several hundred specimens and find that veins 2 and 3 of the fore wing vary from remote to stalked in every species, frequently differing on the two sides of a specimen. The genitalia support the view that in the case of the species of *Semioscopis* we are actually dealing with one genus. In *Agonopterix* and *Depressaria* their separation is supported by genitalic evidence.

Busck [26] recognized six species in this genus. Forbes [27] later removed *allenella* to *Agonopterix*. For this species I have erected a new genus. Two species, *mcdunnoughi* and *braunae*, are described as new in this paper bringing to a total of seven the number of species for the genus.

KEY TO THE SPECIES OF SEMIOSCOPIS BASED ON COLORATION

1. Fore wing with a dark, outwardly curved bar at end of cell 2
   Fore wing without such bar at end of cell; ground color gray or whitish, strongly irrorated with grayish fuscous and without large, conspicuous dark spots or dashes ..... **inornata** Walsingham (p. 155)
2. Discal mark continued toward base as a straight or curved bar or series of short lines 4
   Discal mark not continued toward base 3
3. Fore wing sordid whitish marked with small contrasting black irrorations ..... **braunae**, new species (p. 159)
   Fore wing whitish gray marked with small black irrorations and generally suffused with fuscous ..... **megamicrella** Dyar (p. 157)
4. Discal mark continued toward base as a strongly contrasted curved bar 5
   Discal mark not continued toward base as a curved bar 6
5. Discal bar reaching base of fore wing ..... **packardella** (Clemens) (p. 151)
   Discal bar sharply terminated at basal third of fore wing. **merriccella** Dyar (p. 153)
6. Second segment of labial palpus suffused with blackish on distal half; third segment contrastingly marked black and white **aurorella** Dyar (p. 160)
   Second segment of labial palpus almost wholly blackish exteriorly; third segment weakly mottled black and white **mcdunnoughi**, new species (p. 162)

KEY TO THE SPECIES OF SEMIOSCOPIS BASED ON MALE GENITALIA

1. Ventral margin of sacculus with prominent extension (figs. 137, 138, etc.) 2
   Ventral margin of sacculus without prominent extension (fig. 135) 6
2. Extension of sacculus slender, simple, pointed (fig. 137) **inornata** Walsingham (p. 155)
   Extension of sacculus otherwise 3
3. Extension of sacculus bifurcate (figs. 140, 141) 4
   Extension of sacculus otherwise (figs. 138, 139) 5

[26] Busck, A., Proc. U. S. Nat. Mus., vol. 35, p. 201, 1908.
[27] Forbes, W. T. M., Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 241, 1923.

4. Vesica with one or two slender cornuti (fig. 141) _ **merriccella** Dyar (p. 153)
   Vesica with cluster of slender cornuti (fig. 140)
   packardella (Clemens) (p. 151)
5. Outer dorsal edge of sacculus evenly curved (fig. 138)
   megamicrella Dyar (p. 157)
   Outer dorsal edge of sacculus sharply angulate (fig. 139)
   braunae, new species (p. 159)
6. Vesica armed with a stout, moderately short curved cornutus (fig. 135a)_____ **aurorella** Dyar (p. 160)
   Vesica armed with a stout, long, straight cornutus (fig. 136)
   mcdunnoughi, new species (p. 162)

KEY TO THE SPECIES OF SEMIOSCOPIS BASED ON FEMALE GENITALIA

1. Ductus bursae with a conspicuous, large sclerotized area (figs. 223, 224, 226)_____ 2
   Ductus bursae membranous or with a minute subtriangular sclerotized area adjacent to ostium (figs. 225, 227, 228)_____ 4
2. Ductus bursae sclerotized adjacent to bursa copulatrix (fig. 223)
   aurorella Dyar (p. 160)
   Ductus bursae membranous adjacent to bursa copulatrix (figs. 224, 226)___ 3
3. Ostial opening as narrow as or narrower than portion of genital plate posterior to it; loop of ductus bursae sclerotized for less than half its length (fig. 224)_____ **braunae**, new species (p. 159)
   Ostial opening wider than portion of genital plate posterior to it; loop of ductus bursae sclerotized for more than half of its length (fig. 226)_____ **megamicrella** Dyar (p. 157)
4. Ovipositor lobes armed with hooked macrosetae (fig. 225)
   inornata Walsingham (p. 155)
   Ovipositor lobes without hooked macrosetae_____ 5
5. Bursa copulatrix elongate, definitely asymmetrical; signum minute, in posterior part of bursa (fig. 228a)_ **packardella** (Clemens) (p. 151)
   Bursa copulatrix oval, not definitely asymmetrical; signum small, about middle of bursa copulatrix (fig. 227)_____ **merriccella** Dyar (p. 153)

SEMIOSCOPIS PACKARDELLA (Clemens)

PLATE 23, FIGURE 140, 140a; PLATE 40, FIGURES 228, 228a

Enicostoma packardella CLEMENS, Proc. Ent. Soc. Philadelphia, vol. 2, p. 125, 1863; *in* Stainton, The Tineina of North America, p. 231, 1872.—BUSCK, Proc. Ent. Soc. Washington, vol. 5, p. 214, 1903.

Semioscopis packardella (Clemens) DYAR, Can. Ent., vol. 34, p. 319, 1902.—Busck, *in* Dyar, U. S. Nat. Mus., Bull. 52, No. 5893, 1903; Proc. Ent. Soc. Washington, vol. 5, p. 214, 1903.—KEARFOTT, *in* Smith, Check List of the Lepidoptera of Boreal America, No. 6436, 1903.—Busck, Proc. U. S. Nat. Mus., vol. 35, p. 201, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6484, 1917.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 244, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat. Memoir 101, p. 546, 1928.

Epigraphia packardella (Clemens) WALSINGHAM, Trans. Amer. Ent. Soc. Philadelphia, vol. 10, p. 174, 1882.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 186, 1922.—MCDUNNOUGH, Check list of the Lepidoptera of Canada

and the United States of America (Part 2, Microlepidoptera), No. 8459, 1939 [cited as synonym of *Epigraphia steinkellneriana* (Schiffermüller)].

Epigraphia eruditella Grote, North Amer. Ent., vol. 1, p. 53, pl. 5, fig. 12, 1880.—Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 186, 1922.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8459, 1939 [cited as synonym of *Epigraphia steinkellneriana* (Schiffermüller)].

Labial palpus sordid white; second segment overlaid with blackish fuscous exteriorly, except at base and apex, and lightly suffused with pink; third segment with a small black spot at base anteriorly and a broad, black subapical annulus. Antenna light fuscous, narrowly annulated with gray. Head with the scales light brown, tipped with white and appearing gray. Thorax gray suffused with brown anteriorly and with a faint carmine tint. Fore wing light shining gray marked with numerous faint, short transverse strigulae; at the end of cell an outwardly curved transverse black bar continued as a longitudinal curved black line to extreme base of costa; between the bar at the end of the cell and the costa two longitudinal brown-edged black dashes (sometimes fused) followed on costa by a small, indistinct light brown shade; costa marked with poorly defined, light-brown spots and dashes and narrowly edged with pink to slightly beyond middle; around termen to inner margin a series of small black spots; cilia pale gray with a light-brown suffusion outwardly. Hind wing pale, shining gray, darker apically; cilia paler, with narrow light brown bands. Legs pale ochreous-white overlaid exteriorly, except joints and hind tibiae, with blackish fuscous; pale areas with a faint pink tint. Abdomen sordid ochreous with a slight fuscous suffusion beneath.

Male genitalia.—Very similar to *merriccella*, differing primarily in characters of the aedeagus.

Harpe long, rather narrow, slightly wider before cucullus; costa and cucullus sclerotized, area between membranous; cucullus narrow, rounded; sacculus produced to form a large forked process. Anellus long, strongly curved posteriorly to form a semicylinder; basolateral lobes reduced to slight swellings, chiefly indicated by hairs. Aedeagus long, sharply curved, pointed; vesica armed with an elongate patch of small straight cornuti. Vinculum rounded. Lobes of transtilla long, digitate, hairy, fused with anellus at base. Tegumen rounded. Socii reduced to small hairy lobes.

Female genitalia.—Much as in *merriccella* but differing by the longer bursa and minute signum. Genital plate narrow, broadened at middle to form the cup-shaped ostium. Ductus bursae a long, slender, convoluted tube with a small, subtriangular sclerotized area near ostium; inception of ductus seminalis at the sclerotized part.

Bursa copulatrix large, definitely asymmetrical, elongate; signum a minute toothed plate in posterior end of bursa.

Alar expanse, 21–28 mm.

Type.—In the Acadamy of Natural Sciences of Philadelphia.

Type locality.—Not stated; probably Massachusetts.

Food plant.—Unknown.

Distribution.—Northeastern United States and eastern Canada.

United States records

Maine: Bar Harbor, ♂ (2–V–1936, A. E. Brower).

Michigan: No specific locality, ♂, ♀ (male without date; ♀, 14–V–1885, Gillette).

New Jersey: Montclair, ♂, ♀ (13–V–1900, 1–V–1899, W. D. Kearfott).

New York: Ithaca, Big Indian Valley, Albany (acc. Forbes).

Ohio: Cincinnati, 2 ♂♂, ♀ (18–IV–1911, A. F. Braun).

Pennsylvania: Franconia, Montgomery County, ♀ (no date or collector); New Brighton, 3♂♂, 3♀♀ (April 1902–1908, H. D. Merrick); Oak Station, Allegheny County, 7♂♂, 5♀♀ (April and May dates, 1902–1915, Fred Marloff).

Canadian records

Manitoba: Cartwright, ♀ (no date; E. F. Heath).

Quebec: Burbridge (May 25, 1937, F. A. Urquhart); Meach Lake (April 27, 1899, C. H. Young).

Remarks.—This species will probably be found throughout the midwestern United States and Canada as far west as British Columbia.

SEMIOSCOPIS MERRICCELLA Dyar

PLATE 23, FIGURE 141; PLATE 40, FIGURE 227

Semioscopis merriccella DYAR, Can. Ent., vol. 34, p. 319, 1902.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6437, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 201, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6485, 1917.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 224, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat., Memoir 101, p. 546, 1928.

Epigraphia merrickella MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 186, 1922.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8459, 1939 [amended spelling for *S. merriccella* Dyar and cited as synonym of *Epigraphia steinkellneriana* (Schiffermüller)].

Labial palpus white; second segment suffused with blackish fuscous exteriorly; third segment with a fuscous spot at base anteriorly and a broad black subapical annulus. Antenna with basal segment blackish fuscous; remainder light fuscous, narrowly and indistinctly annulated with gray. Head and thorax gray, the latter rather strongly suffused with fuscous. Fore wing light, shining gray lightly shaded and strigulated with brown; costa, from base to middle of wing, lighter; at the end of cell an outwardly curved blackish-fuscous bar followed

by a rapidly fading and spreading brownish shade; between the discal bar and costa a short, poorly defined blackish-fuscous bar followed by a blackish-fuscous spot before apex; before the discal bar, in cell, a conspicuous, broad, curved, longitudinal, blackish-fuscous bar, which does not reach base of wing but is preceded by a similarly colored narrow dash and one or two spots from base of wing at costa; from apex, around termen, a series of blackish-fuscous spots; cilia pale gray lightly suffused with brown. Hind wing shining gray with a fine terminal brown line; cilia lighter, shining, with narrow subbasal and two subterminal, faint brown bands. Legs shining creamy white strongly overlaid with blackish fuscous except at joints and on hind tibiae. Abdomen sordid ochreous, faintly suffused with fuscous beneath.

Male genitalia.—Harpe long, narrow, slightly wider before cucullus; clasper absent, sacculus produced as a forked process; cucullus narrow, bluntly pointed; costa and sacculus sclerotized, with area between them membranous. Anellus a broad plate produced posteriorly as a semicylinder; basolateral lobes indicated by a few hairs. Aedeagus long, slender, curved, terminating in a slender, curved point; vesica armed with two, long, slender cornuti, one about half the length of the other. Vinculum rounded. Lobes of transtilla long, digitate, hairy, and fused with anellus at base. Tegumen rounded. Socii mainly indicated by a few hairs.

Female genitalia.—Genital plate narrow. Ostium cup-shaped. Ductus bursae a long convoluted tube with a small subtriangular sclerotized area near ostium; inception of ductus seminalis just before ostium. Bursa copulatrix large, oval; signum a small toothed plate about middle of bursa copulatrix.

Alar expanse, 24–31 mm.

Type.—In the United States National Museum.

Type locality.—New Brighton, Pa.

Food plant.—Unknown.

Distribution.—Northeastern United States and Canada to western British Columbia.

United States records

Maine: Bar Harbor, ♀ (13–V–1937, A. E. Brower).
New Hampshire: Hampton, ♀ (1–IV–1907, S. A. Shaw).
New York: Big Indian Valley, Albany (acc. Forbes).
Pennsylvania: New Brighton, 12 ♂♂, 4 ♀♀ (March and April dates, 1902–1904, H. D. Merrick).

Canadian records

British Columbia: Salmon Arm, ♂ (16–V–1922, W. R. Buckell).
Manitoba: Aweme, ♀ (15–V–1905, N. Criddle); Cartwright, ♂ (no date, E. F. Heath).

Remarks.—This species is very much like *packardella* but may be distinguished from it by the broken discal bar, its more striate appearance, and usually larger size. The genitalia of the two species are strikingly similar, but they can be distinguished by the characters given in the keys.

The single male from British Columbia is worn but undoubtedly belongs to this species. The distribution of the species indicates this specimen might be mislabeled or only a stray although further collecting may reveal that the species is well established in the far West.

SEMIOSCOPIS INORNATA Walsingham

PLATE 22, FIGURES 137, 137a; PLATE 40, FIGURE 225

Semioscopis inornata WALSINGHAM, Trans. Amer. Ent. Soc., vol. 10, p. 174, 1882.—DYAR, Can. Ent., vol. 34, p. 320, 1902.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5895, 1903.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6440, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 201, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6488, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 186, 1922.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 244, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat. Memoir 101, p. 546, 1928.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8460, 1939.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 372, 1939.
Semioscopis inornatella BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 201, 1908.

Labial palpus white; second segment black externally, especially in distal half except extreme apex; third segment with a subbasal spot and a subapical annulus black. Antenna blackish fuscous and broadly annulated with white on basal third, the color fading to a light yellowish fuscous, and the annulations disappearing, apically. Head and thorax sordid white suffused and clouded with grayish fuscous. Fore wing sordid white, profusely irrorated and suffused with grayish fuscous; outer discal mark reduced to two indistinct grayish-fuscous spots edged with whitish scales; at basal third two blackish-fuscous spots, one above the other; costa spotted with grayish fuscous especially before apex; around termen a series of poorly defined blackish-fuscous spots; cilia sordid white with basal and narrow subterminal bands light grayish fuscous. Hind wing shining grayish fuscous, cilia sordid white with subbasal and narrow subterminal bands light grayish fuscous. Fore and middle legs sordid white strongly overlaid with blackish fuscous except at joints; posterior leg pale ochreous-white; femur and tarsus suffused with fuscous. Abdomen dull ochreous above, whitish ochreous beneath with a poorly defined fuscous line on each side.

Male genitalia.—Harpe broad basally, narrowed beyond the ventral extension of the sacculus, sacculus moderately and narrowly sclero-

tized and produced as a long bluntly pointed process; cucullus narrow, rounded; clasper absent. Anellus an elongate sclerotized plate, convex laterally beyond middle and basolaterally produced to form small, hairy lobes; posterior edge deeply and broadly V-shaped. Aedeagus stout, long, twisted, terminating in a blunt point; vesica armed with a single, stout, forked cornutus. Vinculum rounded. Lobes of transtilla rather thick, clothed with thick, short hairs apically and fused to harpe. Tegumen rounded. Socii poorly developed, moderately hairy lobes.

Female genitalia.—Lobes of ovipostor with conspicuous, hooked macrosetae. Genital plate narrow, especially so at ostium where the sclerotized portion is no more than the narrow anterior edge of the ostium. Ductus bursae a long convoluted membranous tube; inception of ductus seminalis well before ostium. Bursa copulatrix large, oval; signum a small toothed plate.

Alar expanse, 25–35 mm.

Type.—In the United States National Museum.

Type locality.—Orono, Maine?.

Food plant.—Unknown.

Distribution.—Northeastern United States, Canada, west to British Columbia and Alaska. The species probably will be found in some of the Northwestern States.

United States and Alaskan records

Alaska: Rampart, 6 ♂♂ (no date or collector).
Illinois: Putnam County, ♂ (8–VI–1936, Murray O. Glenn).
Maine: Orono, 3 ♂♂ (April; no collector).
New Jersey: Essex County Park, ♂, ♀ (29–III–1905, 15–V–1906, W. D. Kearfott).
New York: Ithaca, Karner (acc. Forbes).
Pennsylvania: New Brighton, ♂ (25–IV–1908, H. D. Merrick).

Canadian records

Alberta: Calgary (April 24, 1908, F. H. Wolley-Dod); Edmonton, 5 ♂♂ (25–IV–1924, R. Aitcheson; IV–26–29–1924, Owen Bryant; 19–IV–28–IV–1921, no collector); Red Deer, ♂ (18–IV–1903, no collector).
British Columbia: Victoria, 3 ♂♂ (29–III–1920, 7–IV–1922, W. Downes).
Manitoba: Aweme, 7 ♂♂, 2 ♀♀ (April 3 to May 2, 1904–1905, N. Criddle; also April 14 to May 12, 1920–1924); Cartwright, 8 ♂♂ (3 ♂♂–11–13–IV–1913, no collector; 5 ♂♂, 7–IV–1905, E. F. Heath); Miniota, ♀ (18–IV–1903, no collector).
Ontario: Bells Corners (25–IV–1937, G. S. Walley); Biscotasing (16–V–1931, K. Schedl); Constance Bay (26–IV–1935, J. McDunnough); Ingersoll (1–V–1934, G. S. Walley); Merivale (2–V–1934, W. J. Brown; 1–V–1936, G. S. Walley); Ottawa, (21–IV–1906, C. H. Young; 18–IV–1927, G. S. Walley); Port Hope (H. Bowers); Toronto (no date or collector).
Quebec: Aylmer (3–V–1923, C. H. Curran); Wright (19–V–1932, J. McDunnough).

Remarks.—The British Columbia specimens, although larger and more contrastingly marked, are otherwise indistinguishable from the average specimens.

Walsingham did not state the type locality when he described the species, but it is presumably Orono, Maine; several specimens before me with serial numbers corresponding to that of the type bear that locality label. The type label bears an "O" (=Orono?) in Walsingham's handwriting.

The hooked macrosetae of this species are found on the European *strigulana* also. These and other similarities lead me to believe that *inornata* is only a race of *strigulana*. For the time being, however, I am retaining *inornata* as a distinct species.

SEMIOSCOPIS MEGAMICRELLA Dyar

PLATE 23, FIGURES 138, 138a; PLATE 40, FIGURE 226

Semioscopis megamicrella DYAR, Can. Ent., vol. 34, p. 320, 1902.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6439, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 201, 1908.—BARNES and McDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6487, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 186, 1922.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 244, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat. Memoir 101, p. 546, 1928.—McDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2. Microlepidoptera), No. 8461, 1939.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 372, 1939.

Labial palpus white; second segment blackish fuscous in apical two-thirds except for a narrow longitudinal area inwardly; third segment with a minute subbasal spot anteriorly and subapical annulus blackish fuscous. Antenna with basal segment blackish fuscous above, whitish beneath; remainder light fuscous, narrowly and indistinctly annulated with grayish fuscous. Head, thorax, and ground color of fore wing whitish gray irrorated with black and brown scales and lightly shaded with fuscous; at the end of cell a blackish-fuscous, outwardly curved, crescentic bar (sometimes inconspicuous or broken into a series of dots) preceded by some white scaling; at basal third a pair of superposed blackish-fuscous dots; in some specimens a longitudinal dash of the same color; costa narrowly edged with pink (this absent in some specimens) and spotted with blackish scales; a submarginal and terminal row of blackish-fuscous spots, the former usually poorly defined; cilia light gray, with pale fuscous subbasal and apical bands. Hind wing shining pale grayish fuscous, cilia somewhat lighter, with pale fuscous subbasal and apical bands. Legs sordid whitish overlaid with blackish fuscous except at joints and on hind tibiae. Abdomen light fuscous.

Male genitalia.—Harpe short, broad, sacculus produced as a broad truncate sclerotized process, cucullus bluntly pointed; clasper a small tooth about middle of harpe. Anellus a broad oval plate narrowly produced posteriorly, basolateral lobes small, sparsely hairy. Aedeagus long, slender, curved and terminating in a long, slender, curved point; vesica armed with a slender, curved cornutus. Vinculum narrowly rounded. Lobes of transtilla short, broad, hairy, and closely attached to the harpe. Tegumen rounded. Socii moderately well developed hairy lobes.

Female genitalia.—Genital plate moderately broad at ostium, narrower laterally. Ostium broad with a strongly sclerotized anterior edge. Ductus bursae convoluted, the loop of the ductus sclerotized for more than half its length; ostium preceded by a broadly dilated, sclerotized part of ductus bursae; before this a narrow membranous band, anterior to which is a longer sclerotized portion of the ductus bursae; inception of ductus seminalis at the dorsoposterior edge of the latter sclerotized part. Bursa copulatrix large oval with a moderately large toothed signum.

Alar expanse, 16–27 mm.

Type.—In the United States National Museum.

Type locality.—New Brighton, Pa.

Food plant.—Unknown.

Distribution.—Northeastern United States and Canada westward to Idaho and Alberta.

United States records

Idaho: Wallace, ♂ (17–IV–23, Otto Huelleman).

Massachusetts: Forest Hills, ♂ (25–III–1930, no collector); Newton, ♂ (25–IV–1909, William Reiff); Winchendon, ♂ (12–IV–1902, no collector).

New York: Ithaca, Long Island (acc. Forbes).

Pennsylvania: New Brighton, 72 ♂♂, 15 ♀♀ (March 1902–1907, H. D. Merrick); Oak Station, Allegheny County, ♂, ♀ (4–IV–1909, 23–III–1907, Fred Marloff).

Canadian records

Alberta: Edmonton, ♂, ♀ (2–V–1924, Owen Bryant).

Quebec: Aylmer, ♂ (9–V–1932, W. J. Brown); Meach Lake (April 28, 1903, C. H. Young).

Remarks.—In this species there is unusually great variation in the size of the specimens. This variation is not associated with sex or locality.

The Idaho and Alberta specimens are considerably darker than the types, but I can find no other external differences, and the genitalia are identical.

SEMIOSCOPIS BRAUNAE, new species

PLATE 23, FIGURES 139, 139a; PLATE 40, FIGURE 224

Semioscopis megamicrella FORBES (not Dyar), in part, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 244, 1923.

Labial palpus white, second segment suffused with blackish fuscous except for a narrow line inwardly and at tip; third segment with subbasal spot anteriorly and a subterminal annulus black. Antenna fuscous, spotted with white above on basal fourth. Head, thorax, and ground color of fore wing white; the head sordid, thorax strongly infused with grayish brown and with posterodorsal crests blackish fuscous, and the fore wing irrorated with blackish fuscous and black; at the end of cell an outwardly curved crescentic discal bar and at basal third two spots, one above the other, black; along costa and around termen a series of blackish-fuscous spots; before apex, subcostally, one or two conspicuous black spots; cilia pale grayish white, with light brown subbasal and subterminal bands. Hind wing shining grayish fuscous, with a narrow fuscous terminal line; cilia pale grayish white, with light fuscous basal band and pale brownish terminal suffusion. Legs light creamy white strongly suffused and overlaid with blackish fuscous except at joints and on hind tibiae. Abdomen pale shining ochreous-fuscous, suffused with fuscous beneath.

Male genitalia.—Harpe broad, short; cucullus long, narrowly rounded; sacculus narrow basally and with a broad, strongly sclerotized expansion distally; outer dorsal margin angulate; clasper minute, pointed. Anellus a moderately small oval plate, somewhat narrowed posteriorly; posterior edge convex; lateral lobes absent or indicated by a few hairs. Aedeagus long, slender, narrowed at middle, curved and terminating in a slender, curved point; vesica armed with a single slender, pointed cornutus. Vinculum narrowly rounded. Transtilla membranous; lateral lobes mainly indicated by a few hairs. Tegumen rounded. Socii small fleshy lobes.

Female genitalia.—Genital plate narrow, slightly broader posterior to ostium. Ostium as narrow as or narrower than portion of genital plate posterior to it, bordered anteriorly by a strongly sclerotized and dilated portion of the ductus bursae. Ductus bursae membranous except for less than half the length of a posterior loop, and the dilated part before the ostium; inception of ductus seminalis at anterior edge of dilated section. Bursa copulatrix large oval; signum a moderately large, narrow, transverse, toothed plate about middle of bursa.

Alar expanse, 22–26 mm.

Type.—U. S. N. M. No. 53118.

Type locality.—Cincinnati, Ohio.

Food plant.—Unknown.

Remarks.—Described from ♂ type and 5 ♀ paratypes all from the type locality (March and April dates, 1904–1908, Dr. Annette F. Braun). Paratypes in the Canadian National and Dr. A. F. Braun collections.

This species is much like *megamicrella* but is lighter in color, lacks the fuscous or brown suffusion, and is more contrastingly and more sparsely marked than that species. In male genitalia it differs from *megamicrella* in the stouter expansion and the angulate outer dorsal margin of the sacculus. In the female the ostium is smaller as is the posterior dilated portion of the ductus bursae adjacent to it. The posterior loop of the ductus bursae is less strongly sclerotized.

This is the species placed under *megamicrella* by Forbes.

I take pleasure in naming this species after Dr. Annette F. Braun, who collected the type series.

SEMIOSCOPIS AURORELLA Dyar

PLATE 22, FIGURE 135, 135a; PLATE 40, FIGURE 223

Semioscopis aurorella DYAR, Can. Ent., vol. 34, p. 319, 1902.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6438, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 201, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6486, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 186, 1922.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 244, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat. Memoir 101, p. 546, 1928.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8463, 1939.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 370, 1939.

Labial palpus white with a faint roseate tinge; second segment overlaid with blackish fuscous exteriorly on distal half except at apex; third segment with a black spot anteriorly above base and a black subapical annulus. Antenna light fuscous, with poorly defined, narrow, grayish annulations. Head and thorax gray, the former more whitish and with some brown intermixed, the latter suffused with fuscous and with fuscous posterior tufts. Fore wing shining gray suffused with brown, with a roseate tinge and variously marked with blackish fuscous; at the end of cell an outwardly curved blackish-fuscous bar preceded by a whitish or light-gray patch; in cell a pair of superposed dashes, sometimes fused to form an elongate V-shaped mark; a short basal subcostal dash and a basal dash following vein 1c to slightly beyond basal third, blackish fuscous; a subterminal row of five more or less well defined dashes between the veins and a series of spots from costa around termen, blackish fuscous; cilia pale grayish fuscous, darker apically and with a

roseate tinge. Hind wing shining grayish fuscous, darker toward margin and with a fine fuscous terminal line; cilia pale grayish fuscous, with subbasal and terminal bands fuscous. Legs yellowish white heavily overlaid with blackish fuscous except at joints and on hind tibiae. Abdomen light fuscous narrowly annulated with pale yellowish fuscous at posterior ends of segments; anal tuft yellowish fuscous.

Male genitalia.—Harpe narrow, long; costa gently and evenly concave; cucullus bluntly pointed; sacculus narrowly but strongly sclerotized; clasper long, slender, curved inwardly, attaining or slightly exceeding costa. Anellus a subrectangular plate with convex lateral edges; posterior edge concave, basolateral lobes indicated by a few hairs. Aedeagus stout, curved, moderately long, bluntly pointed; vesica armed with a single stout, curved cornutus. Vinculum broadly rounded. Transtilla indicated only by a weak membrane; lateral lobes absent. Tegumen rounded. Socii moderately well developed hairy lobes.

Female genitalia.—Genital plate moderately broad, strongly sclerotized. Ostium large, oval, with a narrow, strongly sclerotized anterior edge. Ductus bursae membranous in posterior half, strongly sclerotized, convoluted and broadened in anterior half; inception of ductus seminalis well before ostium. Bursa copulatrix large, round; signum a small toothed plate.

Alar expanse, 24–31 mm.

Type.—In the United States National Museum.

Type locality.—New Brighton, Pa.

Food plant.—Unknown.

Distribution.—Northeastern United States and eastern Canada.

United States records

New York: Ithaca, Big Indian Valley (acc. Forbes).

Ohio: Cincinnati, 2 ♀ (27–III–1903, A. F. Braun).

Pennsylvania: New Brighton, 20 ♂♂, 16 ♀♀ (March and April dates, 1901–1905, H. D. Merrick); Oak Station, Allegheny County, 9 ♂♂, 10 ♀♀ (March and April dates, 1908–1914, Fred Marloff).

Canadian records

Alberta: Red Deer, 4 ♂♂, 2 ♀♀ (16–24 April, 1922–1923, K. Bowman).

Manitoba: Aweme, ♂ (3–V–1924, N. Criddle); Cartwright, ♂ (no date, E. F. Heath).

Ontario: Constance Bay, 2 ♀♀ (26–IV–1935, W. J. Brown; 26–IV–1935, J. McDunnough); Ottawa, 5 ♀♀ (26–IV–1909, 1–V–1906, C. H. Young).

Remarks.—The specimens from Canada, which I have before me, are considerably darker and, for the most part, are less conspicuously marked than the specimens from the United States, owing to

a strong brownish or fuscous suffusion which appears to be characteristic of the northern specimens. The genitalia of the two forms are identical.

SEMIOSCOPIS MCDUNNOUGHI, new species

PLATE 22, FIGURE 136

Semioscopis aurorella BLACKMORE (not Dyar), Rept. Prov. Mus. Nat. Hist. British Columbia for 1921, p. 32, pl. 4, 1922.

Similar to *aurorella* but slightly broader winged, less distinctly marked and with a longer, straight cornutus.

Labial palpus white with a carmine tinge; second segment strongly overlaid with blackish fuscous exteriorly for its whole length; third segment with poorly defined blackish-fuscous subbasal spot and subapical annulus. Head whitish with some brown scales. Thorax cinereous strongly infused with fuscous and with median longitudinal streak and tufts blackish fuscous; tegula blackish fuscous, white-edged. Fore wing shining gray suffused with brown and with a roseate tinge; discal bar, reduced to a poorly defined crescentic dash or a spot, a dash in cell, a basal dash following vein 1c, and a basal shade, blackish fuscous; along costa and around termen a well-defined series of blackish-fuscous spots; cilia light fuscous with a median grayish band and a whitish pink-tinged terminal line. Hind wing grayish fuscous, darker toward margins and with a narrow fuscous terminal line; cilia pale yellowish fuscous with basal and subterminal fuscous bands. Legs yellowish white strongly overlaid with blackish fuscous except at joints and on hind tibiae where the lighter ground color is carmine tinted. Abdomen ochreous-fuscous lightly suffused with fuscous beneath.

Male genitalia.—Harpe narrow, long; cucullus rounded; clasper long, reaching almost or quite to costa, slightly curved, pointed; sacculus narrow, strongly sclerotized. Anellus a broad, oval plate, narrowed, produced, and curved posteriorly to form a semicylindrical articulation for the aedeagus; lateral lobes absent or at most only indicated by a few hairs. Aedeagus stout, moderately long; apex flattened, rounded; vesica armed with a single long, stout, straight, sharply pointed cornutus. Vinculum broadly rounded. Transtilla membranous; lateral lobes vestigial, mainly indicated by a few hairs. Tegumen bluntly pointed. Socii small hairy lobes.

Alar expanse, 28–29 mm.

Type.—U. S. N. M. No. 53117.

Type locality.—Bellingham, Wash.

Food plant.—Unknown.

Remarks.—Described from the ♂ type (Bellingham, Wash., 14–III–1923, J. F. G. Clarke, No. 573) and 1 ♂ paratype (Fraser

Mills, British Columbia, 14–III–1921, L. E. Marmont), the latter in the Canadian National collection.

This species is much like *aurorella* and is the one reported by Blackmore from British Columbia by that name. It can be distinguished from *aurorella* by the poorly defined markings of the third segment and the blackish-fuscous shading of the second segment of the labial palpus, the absence or only faint indication of the subterminal row of spots on the fore wing, the presence of a rather strong basal blackish-fuscous suffusion and the long straight cornutus.

There is another known specimen in the collection of the University of British Columbia, the one figured by Blackmore, from Millardville, British Columbia.

I have seen no females certainly referable to this species. There are before me, however, two females from southeastern Washington that may belong here, although they are considerably smaller and probably represent an undescribed species. Females must be obtained from the coastal region before these two can be definitely placed here or described as new.

5. Genus DEPRESSARIA Haworth

PLATE 2, FIGURE 11; PLATE 6, FIGURE 48; PLATE 10, FIGURES 68, 68a; PLATE 17, FIGURE 102

Depressaria HAWORTH, Lepidoptera Britannica, p. 505, 1812.—CHAMBERS (in part), Can. Ent., vol. 4, p. 91, 146–148, 1872.—WALSINGHAM, (in part), Proc. Zool. Soc. London, 1881, p. 311–319; Trans. Amer. Ent. Soc., vol. 10, p. 175, 1882.—BEUTENMÜLLER (in part), *in* Smith, Catalogue of the insects of New Jersey, p. 355, 1890.—RILEY (in part), *in* Smith, List of the Lepidoptera of Boreal America, p. 99, 1891.—DIETZ (in part), *in* Smith, Catalogue of the insects of New Jersey, p. 474, 1900.—BUSCK (in part), Proc. U. S. Nat. Mus., vol. 24, p. 731–749, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, p. 520–522, 1903.—KEARFOTT (in part), *in* Smith, List of the Lepidoptera of Boreal America, p. 114, 1903.—BUSCK (in part), Proc. U. S. Nat. Mus., vol. 27, p. 763–766, 1904.—DYAR (in part), Proc. U. S. Nat. Mus., vol. 27, p. 934, 1904.—ANDERSON (in part), Catalogue of British Columbia Lepidoptera, p. 54, 1904.—BUSCK (in part), Proc. Ent. Soc. Washington, vol. 9, p. 88–91, 1908.—KEARFOTT, *in* Smith, Catalogue of the insects of New Jersey, p. 561, 1910.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, p. 161, 1917.—MEYRICK (in part), Exotic Microlepidoptera, vol. 2, p. 223, 1918; p. 315, 1920; pp. 391–392, 1921; p. 513, 1922; *in* Wytsman (in part), Genera insectorum, fasc. 180, pp. 169–177, 1922.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 241–243, 1923.—PIERCE, The genitalia of the tineid families of the Lepidoptera of the British Islands, p. 33, 1935.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), p. 78, 1939.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 269, 1939. (Genotype: *Phalaena Tortrix heracliana* Linnaeus, Systema naturae, ed. 10, p. 532, No. 225, 1758.)

Siganorosis WALLENGREN, Ent. Tidskr., vol. 2, p. 94, 1881. (Genotype: *Phalaena Tortrix heracliana* Linnaeus, Systema naturae, ed. 10, p. 532, No. 225, 1758.)

Head with appressed scales; tongue developed; antenna simple or moderately ciliated; basal segment elongate, with pecten. Labial palpus long, recurved; second segment reaching base of antenna, with rough, projecting scales and furrowed beneath; terminal segment shorter than, or rarely as long as, second, acute. Thorax smooth or crested. Abdomen flattened.

Fore wing with 12 veins; 2 and 3 separate, 7 and 8 stalked; 7 to costa or apex, 11 from middle.

Hind wing as broad as or broader than the fore wing; 8 veins, 3 and 4 connate or short stalked; 6 and 7 subparallel.

Male genitalia.—Harpe with or without clasper and with or without process from base of sacculus. Anellus a well sclerotized plate without long lateral processes. Aedeagus stout with or without cornuti. Gnathos an oval, spined knob. Socii well developed.

Female genitalia.—Genital plate strongly sclerotized; ductus bursae frequently sclerotized for a considerable portion of its length; signum present (in all species seen) though frequently weak.

Larva.—Ninth abdominal segment with setae I and II well separated; seta VI not on the same pinaculum with IV and V, remote from VII. Setal group VII bisetose or trisetose on first abdominal segment, bisetose on seventh and eighth abdominal segments,[28] and unisetose on ninth abdominal segment. Ocelli normal. Submentum without pit.

GROUP A: Setal group VII on first abdominal segment *bi*setose.

heracliana
juliella
dracunculi

GROUP B: Setal group VII on first abdominal segment *tri*setose.

multifidae
leptotaeniae
angustati

Pupa.—Pubescent. Prothoracic femora exposed. Labial palpi not exposed. Cremaster absent.

Remarks.—The separation of *Depressaria* from *Agonopterix* is discussed under the latter genus.

In this genus there are five distinct species groups. The first, consisting of *atrostrigella* and *dracunculi*, and probably *palousella* (males not known), is characterized by the process from the costa of the harpe in the male and the broad, somewhat dilated sclerotized band in the ductus bursae of the female. The second group consists of

[28] Rarely unisetose on eighth segment and if so trisetose on first.

juliella, *eleanorae*, *heracliana*, and *cinereocostella* with the European *nervosa*. These have a strong basal process from the sacculus and no clasper in the male and an elongated, sclerotized section of the ductus bursae posteriorly. We have two species in the third group, *artemisiella* and *alienella*, in which the clasper is present but the basal process of the sacculus is absent in the male and the ductus bursae is wholly membranous. The fourth group, consisting of the *togata-angustatimultifidae* complex, forms a perplexing assemblage of species characterized by their similarity in coloration, by the peculiar spined process from the base of the sacculus in the male, and by the frequently present sclerites anterior to the genital plate in the female. The fifth and final group is composed of three broad-winged forms, *maculatella*, *betulella*, and *grotella*. In the males the divided clasper, extending beyond the ventral margin of the harpe, and the spiraled ductus bursae of the female are characteristic.

Although rather a large number of species have been reared, the larvae of only six were available for study. By a comparison of the larval characters it will be seen that the first two groups (Group A under larvae) are closely similar. The fourth group (Group B under larva) suggests generic separation, and I am inclined to believe that this group does represent a distinct genus. Likewise I believe that the fifth group should be given a separate generic designation, which would be consistent with other generic separations in this paper. Nevertheless I prefer to wait for the collection of more larvae before making the separations which are suggested or before concluding that the species all belong to one genus and merely represent species groups.

KEY TO THE SPECIES OF DEPRESSARIA BASED ON COLORATION

1. Thorax white ..... alienella Busck (p. 180)
   Thorax otherwise 2
2. Fore wing distinctly reddish 3
   Fore wing otherwise 5
3. Costa contrastingly lighter than ground color of fore wing ..... cinereocostella Clemens (p. 171)
   Costa not contrastingly lighter than ground color of fore wing 4
4. Alar expanse 21 mm. or more ..... juliella [20] Busck (p. 176)
   Alar expanse 20 mm. or less ..... eleanorae, new species (p. 178)
5. Ventral side of abdomen with two distinct rows of blackish spots or lines 6
   Ventral side of abdomen without such spots or lines 8
6. Fore wing with light discal spot at end of cell 7
   Fore wing without such spot ..... heracliana (Linnaeus) (p. 173)

[20] I have examined over 150 specimens of *juliella* none of which measures as small as 20 mm. The larger specimens of *eleanorae* approach the smaller specimens of *juliella* in size but none has been found exceeding 20 mm.

7. Fore wing with distinct elongate blackish dash between two discal spots ..... **grotella** Robinson (p. 192)
   Fore wing without such dash ..... **betulella** Busck (p. 195)
8. Second segment of labial palpus white irrorated with black and fuscous 9
   Second segment of labial palpus otherwise 11
9. Third segment of palpus white with blackish-fuscous subbasal annulus and apex ..... **maculatella** Busck (p. 194)
   Third segment otherwise 10
10. Third segment of palpus fuscous irrorated with whitish and with whitish apex ..... **yakimae**, new species (p. 185)
    Third segment whitish with black basal and subapical annulations ..... **palousella**, new species (p. 171)
11. Fore wing blackish fuscous or brownish fuscous, at least always dark 12
    Fore wing grayish or light brownish 14
12. [10] The two species of this couplet cannot be separated on characters of coloration; genitalia and food plant must be used.
    Costa of fore wing with a distinct pinkish cast on underside; Upper Sonoran or Arid Transition Zones.
    whitmani, new species (p. 182); **leptotaeniae** Clarke (p. 184)
    Costa without such pink color 13
13. The two species of this couplet (*angustati* and *multifidae*) cannot be separated by the use of superficial characters. Collected specimens may be separated as follows:
    (a) Hudsonian Zone, altitude about 6,000 feet, Cascade Range ..... **angustati**, new species (p. 189)
    (b) Upper Sonoran Zone to Arid Transition timbered Zone in "intermountain" area; altitude 1,000 to 5,700 feet **multifidae** Clarke (p. 187)
14. Alar expanse 19 mm. or less ..... **artemisiae dracunculi** Clarke (p. 169)
    Alar expanse over 20 mm 15
15. Fore wing with conspicuous blackish-fuscous streak in cell. **atrostrigella**, new species (p. 168)
    Fore wing without conspicuous blackish-fuscous streak in cell. **artemisiella** McDunnough (p. 181)

KEY TO THE SPECIES OF DEPRESSARIA BASED ON MALE GENITALIA

1. Harpe with process from base of sacculus (figs. 198–205) 8
   Harpe without such process (figs. 191–197) 2
2. Costa with prominent process before cucullus (figs. 194, 197) 3
   Costa without such process (figs. 191–193; 195, 196) 4
3. Vesica armed with two or three straight terminal cornuti and a cluster of stout curved ones near middle (fig. 194a). **atrostrigella**, new species (p. 168)
   Vesica armed with a cluster of straight, strong cornuti about middle (fig. 197a) ..... **artemisiae dracunculi** Clarke (p. 169)

[10] The species of this group are very difficult to separate and must be carefully examined for characters under the microscope. A careful examination of characters coupled with data on habitat will serve to distinguish them.

4. Clasper slender, armed with small spines and never projecting beyond ventral edge of harpe (figs. 195, 196)---------- 5
   Clasper broad, without spines and at least part of it extending beyond ventral edge of harpe (figs. 191–193)---------- 6
5. Lateral edge of anellus strongly produced (fig. 196) **artemisiella** McDunnough (p. 181)
   Lateral edge of anellus not strongly produced (fig. 195) **alienella** Busck (p. 180)
6. Transtilla roughly diamond-shaped (figs. 192b, 193b)---------- 7
   Transtilla roughly rectangular (fig. 191b)---------- **maculatella** Busck (p. 194)
7. Width of clasper half, or less than half width of harpe (fig. 193) **betulella** Busck (p. 195)
   Width of clasper more than half width of harpe (fig. 192). **grotella** Robinson (p. 192)
8. Clasper present (figs. 198–202)---------- 9
   Clasper absent (figs. 203–205)---------- 13
9. Aedeagus as long or longer than harpe (figs. 198a–200a)---------- 10
   Aedeagus much shorter than harpe (figs. 201a, 202a)---------- 12
10. Anellus longer than wide; spines of basal process of sacculus long, stout (fig. 199)---------- **multifidae** Clarke (p. 187)
    Anellus much broader than long; spines of basal process of sacculus fine, slender (figs. 198, 200)---------- 11
11. Posterior edge of anellus deeply cleft; transtillar lobes large, broad; harpe short, broad (fig. 200)---------- **whitmani**, new species (p. 182)
    Posterior edge of anellus not cleft; transtillar lobes large, narrow, harpe narrow (fig. 198)---------- **angustati**, new species (p. 189)
12. Basal process of sacculus curved toward cucullus; spines few, large; clasper sharply angulate; transtillar lobes weak (fig. 201) **yakimae**, new species (p. 185)
    Basal process of sacculus transverse; spines numerous, rather small; transtillar lobes strong (fig. 202)---------- **leptotaeniae** Clarke (p. 184)
13. Basal process of sacculus pointed (figs. 68, 205)---------- 14
    Basal process of sacculus not pointed (figs. 203, 204)---------- 15
14. Costa of harpe deeply excavated before cucullus (fig. 68) **heracliana** (Linnaeus) (p. 173)
    Costa of harpe not excavated before cucullus (fig. 205). **cinereocostella** Clemens (p. 171)
15. Basal process of sacculus armed with spines for most of its length (fig. 203)---------- **juliella** Busck (p. 176)
    Basal process of sacculus armed with spines only at distal end (fig. 204)---------- **eleanorae**, new species (p. 178)

KEY TO THE SPECIES OF DEPRESSARIA BASED ON FEMALE GENITALIA

1. Ductus bursae membranous (figs. 102, 275–278, 282)---------- 2
   Ductus bursae at least partly sclerotized (figs. 279–281; 283–289)---------- 7
2. Ductus bursae spiraled (fig. 275)---------- 3
   Ductus bursae not spiraled (figs. 102, 278, 282)---------- 5
3. Ostium a longitudinal slit between raised edges (figs. 275, 277)---------- 4
   Ostium nearly round, within triangular raised portion of genital plate (fig. 276)----------**betulella** Busck (p. 195)

4. Ostium considerably shorter than width of genital plate; genital plate with a long row of hairs posteriorly (fig. 277)—**grotella** Robinson (p. 192)
   Ostium as long as width of genital plate; posterior row of hairs reduced to about half a dozen (fig. 275)—**maculatella** Busck (p. 194)
5. Ductus bursae bulbous before ostium (fig. 102)—**heracliana** (Linnaeus) (p. 173)
   Ductus bursae not bulbous at any point (figs. 278, 282)—6
6. Anterior edge of ostium convex (fig. 278)—**artemisiella** McDunnough (p. 181)
   Anterior edge of ostium cleft (fig. 282)—**alienella** Busck (p. 180)
7. Ductus bursae sclerotized for at least two-thirds of its length (fig. 279)—**eleanorae**, new species (p. 178)
   Ductus bursae otherwise (figs. 280, 281; 283–289)—8
8. Sclerotized portion of ductus bursae limited to a narrow band (figs. 283, 284)—9
   Sclerotized portion of ductus bursae otherwise (figs. 196, 197, 285, 289)—10
9. Sclerotized portion of ductus bursae armed with small teeth (fig. 284)—**palousella**, new species (p. 171)
   Sclerotized portion of ductus bursae unarmed (fig. 283) **artemisiae dracunculi** Clarke (p. 169)
10. Sclerotized portion of ductus bursae strongly curved (figs. 286–288)—11
    Sclerotized portion of ductus bursae straight or only slightly curved (figs. 280, 281, 285, 289)—13
11. Genital plate with a pair of shallow, cupped sclerites on anterior margin (fig. 288)—**multifidae** Clarke (p. 187)
    Genital plate without such sclerites (figs. 286, 287)—12
12. Genital plate abruptly narrowed laterally; ostium a narrow slit (fig. 287)—**angustati**, new species (p. 189)
    Genital plate of nearly equal width throughout, ostium triangular (fig. 286)—**whitmani**, new species (p. 182)
13. Signum in posterior part of bursa copulatrix (figs. 285, 289)—14
    Signum in anterior part of bursa copulatrix (figs. 280, 281)—15
14. Sclerotized ventral sclerites of genital plate equal to length of sclerotized portion of ductus bursae (fig. 285) **yakimae**, new species (p. 185)
    Sclerotized ventral sclerites of genital plate shorter than length of sclerotized portion of ductus bursae (fig. 289) **leptotaeniae** Clarke (p. 184)
15. Ductus bursae sclerotized for less than half its length; a small protuberance from the side of the sclerotized part (fig. 281) **cinereocostella** Clemens (p. 171)
    Ductus bursae sclerotized for about half its length and without small protuberance from the sclerotized part (fig. 280) **juliella** Busck (p. 176)

DEPRESSARIA ATROSTRIGELLA, new species

PLATE 35, FIGURES 194, 194a

Labial palpus light ochreous-white; second segment suffused with fuscous in the brush; third segment immaculate. Antenna light fuscous somewhat mottled basally with gray; basal segment gray beneath. Head, thorax, and fore wing ochreous-white. The whole so strongly suffused with deep gray that the ground color is nearly obliterated. Vertex and the head behind the antennae infuscated.

Thorax lightly irrorated with fuscous. Inner angle of fore wing, veins, a strong longitudinal dash in cell and a series of poorly defined spots around termen, blackish fuscous. The veins are, for the most part, weakly marked, but vein 1c is marked with blackish fuscous for its entire length; cilia deep gray, tipped with ochreous-white. Hind wing pale smoky gray; cilia lighter. Legs ochreous-white, the fore and mid legs suffused with grayish fuscous exteriorly. Abdomen pale grayish fuscous, faintly annulated with dull ochreous-white.

Male genitalia.—Harpe moderately broad, clothed apically with numerous stout, straight hairs; cucullus rounded; on costa, before cucullus, a large flat process that terminates in a small hook; sacculus moderately broad and sclerotized, without basal process; clasper a minute papillate process about middle of harpe, with three or four strong hairs from surface. Anellus a large subrectangular plate constricted posteriorly; posterior edge truncate. Aedeagus rather long, stout, tapering gradually to a slender, curved point; vesica armed with two or three long straight cornuti and a cluster of short, stout, curved ones about middle. Vinculum rounded with well developed dorsoanterior process. Transtilla a broad, sclerotized, curved band; lateral lobes indicated chiefly by hairs and constituting the lateral extremities of the transtilla proper. Socii long digitate hairy lobes. Tegumen reduced, truncate.

Alar expanse, 21–24 mm.

Type.—In the Canadian National Collection.

Type locality.—Aweme, Manitoba.

Paratype.—U. S. N. M. No. 53299.

Food plant.—Unknown.

Remarks.—Described from the ♂ type and 1 ♂ paratype, both from the type locality (6–IX–1928, N. Criddle).

The genitalia of this species are nearest to *dracunculi* but differ from it chiefly by the cornuti and the transtilla. The figures of the two will show these differences adequately. I have seen no females of *atrostrigella*.

The paratype is not marked so contrastingly as the type male and is the larger of the two specimens.

DEPRESSARIA ARTEMISIAE DRACUNCULI Clarke

Plate 35, Figures 197, 197a; Plate 48, Figure 283

Depressaria dracunculi Clarke, Can. Ent., vol. 65, p. 90, pl. 5, 1933.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8395, 1939.—Gaede, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 282, 1939.

Labial palpus creamy white; second segment suffused and irrorated in the brush with fuscous; third segment with subbasal and supra-

medial annuli black, these sometimes poorly defined and almost wholly replaced by the lighter ground color. Antenna fuscous with grayish or white annulations. Head light fawn, the scales tipped with sordid white. Thorax light fuscous, the scales tipped with gray or white; anteriorly the fuscous is more pronounced. Fore wing with costal third fuscous mixed with gray, remainder light to dark fawn irrorated with fuscous and gray; toward apex the colors merge and are indistinguishable; at base, in anal angle, a small blackish-fuscous patch; in cell a series of three blackish-fuscous spots, sometimes confluent, forming a single longitudinal dash; cilia grayish fuscous with a broad, dark, subbasal band. Legs creamy white, strongly overlaid with fuscous except at joints. Abdomen silvery grayish above; creamy white beneath suffused with fuscous laterally.

Male genitalia.—Harpe broad, with very few coarse hairs; cucullus rounded, densely clothed with coarse, stiff hairs; before cucullus, from costa, a prominent dull-pointed projection; clasper minute; emitting a few long hairs; sacculus broadly folded and without basal process. Anellus a moderately small sclerotized plate, constricted at middle; anterior and posterior edges strongly convex. Vinculum broad, rounded. Aedeagus long, slightly curved, terminating in a long, attenuated point; vesica armed with a cluster of straight, strong cornuti. Transtilla a very broad, sclerotized band with well-developed hairy lobes, the whole fused with the posterior portion of the anellus. Socii small, narrow, hairy lobes.

Female genitalia.—Genital plate moderately broad. Ostium large, round, situated at the extreme anterior edge of the genital plate. A narrow area of the ductus bursae, just posterior to the bursa copulatrix, moderately sclerotized, unarmed; the remainder of the ductus membranous; inception of the ductus seminalis about midway between the sclerotized part of the ductus bursae and the ostium. Bursa copulatrix large with a very small signum in the anterior half.

Alar expanse, 12.5–19 mm.

Type.—In the United States National Museum.

Type locality.—Snake River, Whitman County, opposite Clarkston, Wash.

Food plant.—*Artemisia dracunculoides* Pursh.

Distribution.—Northwestern United States and southwestern Canada.

United States records

Washington: Almota, Whitman County, 12 ♂♂, 12 ♀♀ (5–23–IV–34); Snake River, Whitman County, opposite Clarkston, 5 ♂♂, 7 ♀♀ (February to May dates, 1931–32; the February and March dates are for specimens reared in a greenhouse); Truax, Whitman County, 7 ♂♂, 10 ♀♀ (4–12–V–35). (All these specimens were reared from larvae collected by the writer.)

Canadian records

British Columbia: Vernon (2 ♂♂, 6–VI–1926; ♀, 12–VII–1927, E. P. Venables).

DEPRESSARIA PALOUSELLA, new species

PLATE 48, FIGURE 284

A distinct, medium-sized moth resembling *yakimae* but smoother in appearance.

Labial palpus with second segment shining white with much black scaling exteriorly; the white scales show a faint pinkish iridescence; third segment white with black basal and subapical annulations. Antenna with basal segment blackish fuscous with a few whitish scales mixed; remainder grayish with blackish-fuscous annulations. Head light fuscous, the scales white tipped. Thorax, base of tegula, and base of fore wing black. The posterior two-thirds of tegula, the costa to middle of fore wing and the major portion of the thorax strongly marked with cinereous. Ground color of fore wing a light brownish fuscous, darker basally and faintly irrorated with cinereous; in the cell a strongly marked, longitudinal black dash edged anteriorly with cinereous; veins, especially 9, 10, and 11 strongly marked with black and around termen a series of indistinct, blackish spots at ends of veins; cilia light brownish fuscous. Hind wing light grayish-fuscous but darker at extreme apex and around termen; cilia light brownish fuscous, darker basally. Legs blackish fuscous irrorated with white. Abdomen grayish fuscous above, blackish fuscous with much white scaling below.

Female genitalia.—Genital plate broad, moderately sclerotized, not appreciably produced ventrally around ostium. Ostium oval, transverse. Posterior fourth of ductus bursae broadly expanded with the major portion of this section strongly sclerotized and armed with small teeth; the remainder of the ductus is membranous. Inception of ductus seminalis on the posterior margin of the sclerotized part of the ductus bursae. Bursa copulatrix moderately large with a small but well-defined signum.

Alar expanse, 19–20 mm.

Type and paratypes.—U.S.N.M. No. 52074.

Type locality.—Pullman, Wash.

Remarks.—Described from the ♀ type (26–VI–30) and 1 ♀ paratype (20–IX–30), both collected by the author.

DEPRESSARIA CINEREOCOSTELLA Clemens

PLATE 38, FIGURES 205, 205a; PLATE 48, FIGURE 281

Depressaria cinereocostella CLEMENS, Proc. Ent. Soc. Philadelphia, vol. 2, p. 422, 1864.—ROBINSON, Ann. Lyc. Nat. Hist. New York, vol. 9, p. 155, pl. 1, fig. 6, 1869.—CLEMENS, *in* Stainton, Tineina of North America, p. 245, 1872.—

CHAMBERS, Can. Ent., vol. 4, p. 91, 1872; U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 138, 1878.—WALSINGHAM, Ins. Life, vol. 1, p. 255, 1889.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5258, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 749, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5891, 1903; Proc. Ent. Soc. Washington, vol. 5, p. 217, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6434, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 200, 1908.—BARNES and McDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6482, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 172, 1922.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 242, 1923.—McDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8408, 1939.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 278, 1939.

Depressaria clausella WALKER, List of the lepidopterous insects in the collections of the British Museum, vol. 29, p. 564, 1864.—WALSINGHAM, Proc. Zool. Soc. London, 1881, p. 312.—McDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8408, 1939 (cited as synonym of *cinereocostella* Clemens).

Labial palpus pale cinereous; second segment with submedial and subterminal spots exteriorly blackish fuscous and with the brush suffused with reddish; third segment with a dull blackish-fuscous supramedial annulus. Antenna cinereous, narrowly annulated with fuscous basally and suffused with reddish; beyond middle strongly suffused with fuscous; extreme tip cinereous. Face, head, thorax, and ground color of fore wing cinereous; collar fuscous; head and thorax irrorated with fuscous and suffused with red, the thorax and tegula especially so anteriorly. Fore wing, except costa, heavily overlaid with dull brownish red, so much so that the wing appears red with a contrasting light costa, suffused with blackish fuscous in basal half and irrorated with black and cinereous scales; in fold and along veins a series of longitudinal black dashes; extreme base of costa and anal angle blackish fuscous; from middle of costa, around termen to inner margin, a series of poorly defined blackish-fuscous spots; cilia fuscous suffused with red. Hind wing grayish fuscous, lighter basally; cilia pale fuscous, white tipped, with rosy tinge and with dark fuscous subbasal and subterminal bands. Legs cinereous with dull blackish irrorations and suffusion except at joints. Hind tibia with a dull smoky streak exteriorly; outer pair of spurs dull black. Abdomen cinereous with fuscous suffusion dorsally and a blackish-fuscous longitudinal line on each side beneath.

Male genitalia.—Harpe broadest at middle, sparsely clothed with fine hairs; cucullus rounded; clasper absent; sacculus broadly folded, with long, pointed basal process; the basal process of the sacculus is clothed with short, stout spines over its entire length. Anellus rectangular, narrowed posteriorly; lateral edges concave in anterior part. Vinculum bluntly pointed. Aedeagus long, slender, and slightly curved; bluntly pointed; vesica with three to seven stout

cornuti. Transtilla a large rectangular plate, produced anteriorly at middle, with well-developed hairy lobes, the latter fused. Socii large fleshy, hairy flaps.

Female genitalia.—Genital plate broad. Ostium a long transverse slit. Posterior two-fifths of ductus bursae sclerotized, straight; a small protuberance from the side of the sclerotized portion of the ductus bursae; inception of ductus seminalis just before ostium. Bursa copulatrix small with well developed signum in the anterior end.

Alar expanse, 15–22 mm.

Type.—In the Academy of Natural Sciences of Philadelphia.

Type locality.—"Virginia."

Food plants.—*Carum carvi* L., *Sium lineare* Michx., and *Ligusticum scoticum* L.

Distribution.—Northeastern United States and eastern Canada.

United States records

District of Columbia: 2 ♂♂ (19–VII–99, A. Busck).
Iowa: Ames ♂ (22–VIII–1918; A. W. Lindsey); Iowa City, ♂ (15–IV–1917).
Missouri: St. Louis, ♂ (20–VIII–05, H. McElhose).
New Hampshire: Hampton, 9 ♂♂, 10 ♀♀ (February to August dates, 1906–1908, S. A. Shaw [reared]).
Pennsylvania: Philadelphia (no date or collector).

Canadian records

Manitoba: Cartwright, ♂ (no date; E. F. Heath).
Nova Scotia: White Point Beach, Queens County, 13 ♂♂, 11 ♀♀ (2–10–VIII–1934, J. McDunnough [reared]).
Ontario: Toronto, ♀ (2–III–95).

Remarks.—The number of cornuti on the vesica seems to be of no significance in this species. Such differences in the number of cornuti are usually specific but in the present case all intergrades may be found in any one group of specimens. It is also rather strange that *cinereocostella* should feed on so many species of plants, a habit which is unusual for species of this genus. The specimens reared from the different food plants exhibit no characters by which any one group can be separated from another.

This species is of some economic importance. Although it has not done great damage to crops of caraway, it is potentially dangerous because of its unusual habit of feeding on a number of food plants.

DEPRESSARIA HERACLIANA (Linnaeus)

PLATE 2, FIGURE 11; PLATE 6, FIGURE 48; PLATE 10, FIGURES 68, 68a; PLATE 17, FIGURE 102

Phalaena Tortrix heracliana LINNAEUS, Systema naturae, ed. 10, p. 532, No. 225, 1758; *ibid.*, ed. 12, p. 380, No. 326, 1767.—DE GEER, Mémoires pour servir a l'histoire des insectes, vol. 2, p. 407, No. 5, 1771.

Phalaena Tortrix heracleana LINNAEUS, Fauna Suecia, p. 347, No. 1334, 1761.
Phalaena heracliana (Linnaeus) MÜLLER, Natursystem, p. 731, No. 326, 1774.
Phalaena heracleana RETZIUS, Genera et species insectorum, p. 45, 1783.
Pyralis heracleana FABRICIUS, Systema entomologiae, p. 655, No. 56, 1775; Entomologia systematica, vol. 3, pt. 2, p. 286, No. 178, 1794.
Depressaria heracliana (Linnaeus) ZELLER, Isis von Oken, vol. 4, p. 305, 1839; Linnaea Ent., vol. 9, p. 312, 1854.—BETHUNE, Can. Ent., vol. 2, p. 19, 1870.—LINTNER, Can. Ent., vol. 5, p. 82, 1873.—ZELLER, Verh. zool.-bot. Ges. Wien, vol. 23, p. 235, 1873.—CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 138, 1878.—WALSINGHAM, Proc. Zool. Soc. London, 1881, p. 312.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5265, 1891.—DIETZ, *in* Smith, Catalogue of the insects of New Jersey, p. 474, 1900.—REBEL, *in* Staudinger and Rebel, Catalog der palaearctischen Lepidopteren, vol. 2, No. 3280, 1901.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 748, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5889, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6432, 1903.—PETTIT, Michigan Agr. Exp. Stat. Bull. 233, p. 189, 1906.—CHITTENDEN, Insects injurious to vegetation, p. 187, 1907.—JARVIS, Ontario Ent. Soc. Rept., vol. 37, p. 48, 1907.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 200, 1908.—BETHUNE, Ontario Agr. Coll. Bull., vol. 171, p. 28, 1909.—FULTON, WRIGHT, and GREGG, Pennsylvania Agr. Exp. Stat. Bull. 110, p. 29, 1911.—SANDERSON, Insect pests of farm, garden, and orchard, p. 417, 1912.—GOODERHAM, Proc. Ent. Soc. Nova Scotia, vol. 1, p. 94, 1915.—BRETTAIN and GOODERHAM, Can. Ent., vol. 48, p. 37, 1916.—DU PORTE, Ontario Ent. Soc. Rept., vol. 46, p. 50, 1916.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6478, 1917.—BETHUNE, Ontario Dept. Agr. Bull. 251, p. 24, 1917.—GIBSON, Ontario Ent. Soc. Rept., vol. 47, p. 16, 1917.—GOSSARD, Ohio Monthly Bull., vol. 4, p. 379, 1919.—MOSHER, Journ. Econ. Ent., vol. 12, p. 261, 1919.—TRAVER, Psyche, vol. 26 p. 77, 1919.—GIBSON, Can. Dept. Agr. Ent. Circ., vol. 14, p. 13, 1920.—LEONARD, Journ. Econ. Ent., vol. 13, p. 491, 1920.—HUDSON, Ontario Ent. Soc. Rept., vol. 21, p. 35, 1921.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 171, 1922.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 243, 1923.—ELLIS, Journ. Agr. Res., vol. 30, p. 789–790, 1925.—CAESAR, Ontario Dept. Agr. Bull. 325, p. 27, 1927.—BRETTAIN, Nova Scotia Dept. Nat. Res. Bull. 12, p. 86–87, 1927.—DRAKE and DECKER, Iowa Agr. Exp. Stat. Circ. 103, p. 16, 1927.—PETTIT, Michigan State Board Agr. Rept., vol. 66, p. 343–344, 1927.—CAESAR, Ontario Dept. Agr. Bull. 359, p. 29–30, 1931.—DUSTAN, Can. Dept. Agr. Ent. Bull., vol. 32, p. 51, 1932.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8404, 1939.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 283, 1939.
Phalaena heraclei RETZIUS, Genera et species insectorum, p. 45, 1783.
Pyralis umbellana FABRICIUS, Entomologica systematica, vol. 3, p. 286, No. 177, 1794.
Haemilis pastinacella DUPONCHEL, Histoire naturelle des Lepidoptères de la France, vol. 11, p. 153, pl. 291, figs. 4 and 5, 1838.—BRUAND, Ann. Ent. Soc. France (ser. 2), 1844, p. 189, pl. 6, fig. A, B, a, b.
Haemylis heraclcella ZETTERSTEDT, Insecta Lapponica, p. 999, 1840.
Depressaria ontariella BETHUNE, Can. Ent., vol. 2, p. 3, 19, 1870.

Labial palpus whitish ochreous; second segment suffused in the brush and irrorated exteriorly with fuscous and brown; third segment with subbasal and supramedial annuli blackish fuscous, the former

narrow and poorly defined. Antenna luteous annulated with fuscous; basal segment blackish fuscous above. Face pale, shining grayish fuscous. Head, thorax, and fore wing luteous shaded and streaked with brown and blackish fuscous; extreme base of costa, anal angle, discal spot at the end of the cell, and a series of spots from apex, around termen to inner margin, blackish fuscous; veins rather strongly indicated by blackish-fuscous scaling; apical area with whitish irrorations and an indistinct, narrow, outwardly curved fascia of the same color from apical third of costa; cilia grayish-fuscous. Hind wing pale yellowish-fuscous, darker apically and with a narrow, fuscous terminal line; cilia paler with a fuscous subbasal band. Legs luteous shaded and irrorated with fuscous except at joints. Abdomen luteous above, lightly infuscated; beneath, whitish-ochreous with a row of blackish-fuscous spots on each side.

Male genitalia.—Harpe with cucullus and distal half of ventral margin clothed with stout hairs; costa excavated before cucullus; clasper absent, sacculus moderately broad, strongly sclerotized, and with a long slender process from base. Anellus an elongate slightly sclerotized plate narrower at distal than at proximal end. Transtilla a broad band with well-developed hairy lobes. Aedeagus stout, elongate, pointed; vesica armed with eight or ten long slender cornuti, Vinculum rounded. Gnathos a spined knob. Socii elongate hairy lobes, widely separated. Tegumen truncated; uncus absent.

Female genitalia.—Lobe of ovipositor somewhat sclerotized basally. Genital plate broad, strongly sclerotized. Ostium round; anterior edge strongly sclerotized. Ductus bursae membranous, dilated at posterior three-fourths; inception of ductus seminalis just before ostium. Bursa copulatrix moderately large with small diamond-shaped signum.

Alar expanse, 21–29 mm.

Types.—Lost? [31]

Type localities.—Europe (*heracliana*, *heraclei*, *umbellana*, *pastinacella*); Ontario, Canada (*ontariella*).

Food plants.—Parsnip (*Pastinacea sativa* L.); *Angelica* sp. (boring in stem).

Distribution.—Throughout United States and southern Canada.

United States records

Arizona: Walton, Yuma County, ♀ (1–6–III–1925, O. C. Poling).

Illinois: Chicago, 3 ♂♂ (June, 1900; 12–VII–'02, W. D. Kearfott; one without date, K. Wyatt collector); Decatur, 2 ♂♂ (July 1–7).

Indiana: Morgan County, ♂ (10–VII–1931, B. E. Montgomery; "reared from wild parsnip").

[31] Dr. McDunnough states (*in litt.*): "Regarding the type of *ontariella* Bethune, I have no information. It is certainly not in Ottawa and I imagine that most of Bethune's types have been destroyed by *Dermestes*. . . . What remains of his collection has been scattered about, but Dr. Ide of the Royal Ontario Museum who went over the specimens stated that there were no types amongst them."

Massachusetts: Cliftondale, 2 ♂ ♂ (August 1920, J. D. Caffrey).
New Jersey: Caldwell, 3 ♂ ♂, 5 ♀ ♀ (August, W. D. Kearfott).
New York: Rye, 6 ♂ ♂, 10 ♀ ♀ (2–20–VIII–1939, J. F. G. Clarke); ♂ (no date or locality; Wm. Beutenmüller).
Oregon: Portland, ♂ (1–VIII–1914, L. Leland).
Pennsylvania: Bristol, 8 ♂ ♂, 8 ♀ ♀ (June to August dates, 1888, T. Pergande; reared from parsnip); New Brighton, 3 ♂ ♂, 2 ♀ ♀ (5–13–VIII–1907, H. D. Merrick); Oak Station, Allegheny County, ♂ (30–VII–'10, Fred Marloff); Pittsburgh, ♂, ♀ (10–IV–'06, 13–IV–'06, Henry Engel); West Chester, 2 ♂ ♂, ♀ (July, 1919, F. M. Trimble; reared from parsnip).
Rhode Island: Bristol, ♂ (15–VII–1920, no collector).
Utah: Logan, ♀ (10–VIII–1907, E. S. G. Titus; reared from wild parsnip); Murray, ♂ (12–VII–1913, Timberlake); Vineyard, ♀ (1–IX–1912, Tom Spalding).
Washington: Bellingham, 12 ♂ ♂, ♀ (4–VIII–1930, W. W. Baker; reared from parsnip); Oroville, ♂ (18–VII–1933, Judson Murray; reared from parsnip); Pullman, ♂ (29–IV–24, J. F. G. Clarke.)

Canadian records

British Columbia: Fraser Mills, ♀ (18–IX–1925, L. E. Marmont); Lillooet (2–VIII–1934, A. W. A. Phair); Summerland (12–IV–1934; 22–24–VII–1935, A. N. Gartrell).
Nova Scotia: Truro (17–VIII–1915, no collector).
Ontario: London (28–29–VII–1931, G. S. Walley); Ottawa (19–VIII–1903; 11–VIII–1908, J. Fletcher); Port Hope (8–IV–1895, no collector).
Quebec: Meach Lake (29–VII to 6–VIII–1903, C. H. Young).

Remarks.—This is the notorious "parsnip webworm," which has appeared so frequently in the literature in America and abroad.

The name has repeatedly been credited to De Geer (1771) but should be attributed to Linnaeus (1758). Sherborn (Index Animalium, 1902) credits the name to Linnaeus, but others have failed to acknowledge this authorship.

The species is undoubtedly more widespread in America than is indicated by the distribution given; but I have included in the distribution only the localities from which I have seen specimens. At New Castle, Del., however, I have seen abundant evidence of the work of this species.

I have been unable to locate any of the types, although some may be in existence.

DEPRESSARIA JULIELLA Busck

PLATE 38, FIGURES 203, 203a; PLATE 47, FIGURE 280

Depressaria juliella BUSCK, Proc. Ent. Soc. Washington, vol. 9, pl. 91, 1908; Proc. U. S. Nat. Mus., vol. 35, p. 200, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6475, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 171, 1922.—CLARKE, Can. Ent., vol. 66, p. 178, 1934.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8399, 1939.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 286, 1939.

Labial palpus ochreous; second segment with a dark reddish-fuscous spot near base externally and with the brush suffused with red and irrorated with reddish fuscous; third segment suffused with red anteriorly and with poorly defined reddish-fuscous subbasal and supramedial annuli. Antenna light reddish fuscous, narrowly and faintly annulated with fuscous; basal segment ochreous beneath. Face shining whitish ochreous. Head, thorax, and fore wing light ochreous suffused and mottled with red. Below antenna, in front, a vertical reddish-fuscous patch; from base of costa, following fold, a reddish-fuscous streak to about basal fourth; in anal angle a small reddish-fuscous patch; both of these dark markings mixed with black scales. Along costa and inner margin and in apical third numerous white scales; all the veins are more or less indicated by reddish fuscous and black mixed; discal spot at end of cell faintly indicated by a few red scales; cilia fuscous, strongly suffused with red and with a blackish-fuscous subbasal band. Hind wing fuscous, lighter basally; cilia red with a fuscous subbasal band. Legs ochreous suffused with red and mottled with reddish fuscous. Abdomen ochreous suffused with fuscous dorsally and with a blackish-fuscous line on each side ventrally.

Male genitalia.—Harpe gradually tapering to the rounded cucullus; clasper absent, sacculus broadly folded, with a large, elongate, truncated process from its base; this elongate process is more or less armed with spines over most of its length; at the distal end the spines are numerous. Anellus a sclerotized plate; broad anteriorly, narrow posteriorly; anterior edge with a shallow median cleft; posterior edge convex. Vinculum produced anteriorly. Aedeagus long, nearly straight, dilated at proximal end; vesica armed with 7–10 stout cornuti. Transtilla membranous, with small hairy lobes. Socii long, narrow, hairy flaps.

Female genitalia.—Genital plate broad, moderately sclerotized. Ostium transverse, elliptical, situated at anterior margin of the genital plate. Ductus bursae sclerotized, slightly curved and dilated in posterior half, without protuberance; membranous in anterior half; inception of ductus seminalis just anterior to ostium. Bursa copulatrix large with a small, but well developed signum near anterior end.

Alar expanse, 21–25 mm.

Type.—In United States National Museum.

Type locality.—Pecos, N. Mex.

Food plant.—*Cicuta occidentalis* Greene.

Distribution.—Western United States.

United States records

Colorado: Alamosa, ♀ (Oslar).
New Mexico: Pecos, ♂ (September, T. D. A. Cockerell).
Utah: Provo, 5 ♂♂, 3 ♀♀ (August and September dates); Vineyard, 16 ♂♂, 17 ♀♀ (September and October dates, Tom Spalding).
Washington: Pullman, 56 ♂♂, 52 ♀♀ (reared, July, August dates, 1933–1935, J. F. G. Clarke).

Remarks.—I have already given [32] a summary of the habits and have briefly described the larva of this species but it seems appropriate to give a brief description of the pupa at this time.

Pupa.—First day: Wing, antennal and leg sheaths, also dorsal part of head and thorax light lemon yellow. Abdominal segments light whitish ochreous except the last caudal segment which is strongly tinged with reddish brown. The last five segments are free and movable.

Second day: Pupa light reddish brown; last segment somewhat darker. From the second day on the color becomes progressively darker. The wing sheaths become very dark brown first. The abdominal segments gradually become darker until at the time of emergence the entire pupa is nearly black.

Busck's remark [33] concerning the close relationship of *juliella* to the European *nervosa* is borne out by a study of both the male and female genitalia. The differences in genitalia (although admittedly slight) and the difference in food plant will serve to distinguish the two. The coloration of *juliella*, as indicated by a reared and a collected series of over 150 specimens, is usually brighter and lighter than that of *nervosa*.

DEPRESSARIA ELEANORAE, new species

PLATE 38, FIGURES 204, 204a; PLATE 47, FIGURE 279

Similar to *D. juliella* Busck but smaller.

Antenna reddish ochreous above, lighter beneath and toward tip; narrowly annulated with reddish fuscous. Second segment of labial palpus whitish ochreous strongly suffused with red and reddish fuscous exteriorly; third segment whitish ochreous with broad reddish-fuscous basal and subapical fasciae. Head light reddish ochreous; face light yellowish ochreous. Thorax, tegula, and fore wing ochreous strongly overlaid with red, reddish fuscous, and white scales; at base of wing a black spot on costa and a similar one on dorsum; narrowly but strongly tinged with bright red; in middle of cell an indistinct longitudinal streak of reddish fuscous and white scales mixed; cilia light reddish fuscous. Hind wing light fuscous, lighter basally with a distinct reddish hue; cilia light reddish fuscous with a fuscous sub-

[32] Clarke, J. F. G., Can. Ent. vol. 66, p. 178, 1934.
[33] Proc. Ent. Soc. Washington, vol. 9, p. 91, 1908.

basal band. Legs: Femora whitish ochreous; fore and mid femora strongly marked with reddish fuscous exteriorly; tibiae and tarsi of fore and mid legs reddish fuscous with whitish ochreous inwardly. Hind tibia whitish ochreous strongly tinged with pink; tarsi strongly marked with fuscous. Abdomen whitish ochreous; basal segments suffused with light fuscous; underside with well-defined lateral row of fuscous spots on each side.

Male genitalia.—Harpe sparsely clothed with fine hairs; clasper absent; cucullus rounded; sacculus broadly folded and with a long, distally dilated, curved basal process; the latter armed with spines only at distal end. Anellus a broad, sclerotized plate abruptly narrowed in posterior half; posterior edge strongly convex; anterior margin indented. Vinculum with a strongly produced, acutely pointed anterior process. Aedeagus long, slender, nearly straight; vesica with 12 or more stout cornuti. Transtilla membranous with weakly developed, hairy lobes. Socii long, slender, hairy flaps.

Female genitalia.—Genital plate broad, moderately sclerotized; ostium transverse, slitlike; anterior edge of ostium slightly convex. Posterior two-thirds of ductus bursae strongly sclerotized. Bursa copulatrix large; signum small and situated at the anterior end.

Alar expanse, 18–20 mm.

Type.—U.S.N.M. No. 52082.

Type locality.—Hymers, Ontario (August 16–23).

Remarks.—Described from the ♂ type, 1 ♀ and 6 ♂ paratypes as follows: Ottawa, Ontario 3 ♂ ♂ (28–VIII–1906; 5–IX–1908, James Fletcher; 19–III–1933, C. H. Young); ♀ (20–V–1925, C. H. Curran); Trenton, Ontario, ♂ (9–IX–10, Evans). The other two paratype ♂ ♂ are without locality labels; one with "In office, 21–X–1903" and the other "23–X–04 J. F." (James Fletcher?). Paratypes in U. S. National and Canadian National collections. I am indebted to Dr. J. McDunnough for seven of the eight specimens of the type series.

This species is the eastern analogue of the western *juliella* but is immediately distinguished from *juliella* by its smaller size. The genitalia of the two are similar but differ as follows: In the male of *juliella* the vinculum is bluntly pointed, in *eleanorae* sharply pointed; the basal process from the sacculus of *juliella* is spiny over practically its entire length while that of *eleanorae* has spines only on the distal half; on the vesica of *juliella* there is one cornutus which is noticeably much larger than the rest, but in *eleanorae* the differences in the lengths of the cornuti are not so striking. The ductus bursae of the female genitalia of *eleanorae* exhibits a sclerotized portion of much greater length than that found in *juliella*.

I take pleasure in naming this species for Mrs. Eleanor A. Carlin, staff artist for the Bureau of Entomology and Plant Quarantine.

DEPRESSARIA ALIENELLA Busck

PLATE 35, FIGURES 195, 195a; PLATE 48, FIGURE 282

Depressaria alienella BUSCK, Proc. U. S. Nat. Mus., vol. 27, p. 765, 1904.—ANDERSON, Catalogue of British Columbia Lepidoptera, No. 1094, 1904.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 200, 1908.—BARNES and McDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6473, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 171, 1922.—McDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part. 2, Microlepidoptera), No. 8393, 1939.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 273, 1939.

Depressaria emeritella WALSINGHAM (not Stainton), Proc. Zool. Soc. London, 1881, p. 381.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5261, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 746, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5884, 1903.

Depressaria emeritella alienella (Busck) FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 243, 1923.

Labial palpus white; second segment irrorated exteriorly, and suffused in the brush, with reddish fuscous and with a distinct blackish-fuscous spot near base exteriorly; third segment with a broad blackish-fuscous supramedial annulus. Head and thorax white; thorax sparsely irrorated with reddish fuscous anteriorly; tegula dark reddish fuscous. Fore wing light fuscous strongly overlaid with red or reddish fuscous, irrorated with cinereous and fuscous and streaked with blackish fuscous; at the end of cell a white discal spot preceded and followed with fuscous; around termen a poorly defined row of fuscous spots. Legs white, suffused and irrorated with blackish fuscous except at joints. Abdomen pale fuscous above, ochreous-white beneath, irrorated with fuscous.

Male genitalia.—Harpe moderately clothed with long fine hairs, clasper long, pointed, not projecting beyond ventral edge of harpe, armed with numerous fine spines; sacculus narrowly folded, without basal process; cucullus bluntly pointed. Anellus broadly oval; lateral edge not strongly produced. Vinculum bluntly pointed. Transtilla a broad sclerotized band with hairy lobes moderately well developed. Aedeagus long, slender, gently curved. Tegumen truncated; socii small, hairy lobes.

Female genitalia.—Ostium slitlike transverse, with shallow median cleft on anterior edge; situated near the anterior edge of the genital plate. Ductus bursae membranous, straight; inception of the ductus seminalis well before ostium and anterior to the sclerotized portion of the ductus bursae. Bursa copulatrix large with well-developed toothed signum.

Alar expanse, 18–21 mm.

Type.—In the United States National Museum.

Type locality.—Kaslo, British Columbia, Canada.

Food plant.—*Artemisia* sp., yarrow.

Distribution.—Northeastern and Western United States and Canada from the Atlantic to Pacific.

United States records

California: Shasta Retreat, Siskiyou County, 2 ♂♂, 3 ♀♀ (July 1–7).
Maine: Bar Harbor, 4 ♂♂ (24–VIII–35; 26–IX–36, A. E. Brower).
Massachusetts: Worcester, ♂ (2–VIII–1902).
New York: Ilion, ♂, 2 ♀♀ (2–3–IX–11, H. McElhose).
Oregon: Rogue River, Josephine County (VI–1872, Walsingham).

Canadian records

Alberta: Nordegg, 3 ♂♂ (16–18–IX–1921, K. Bowman).
British Columbia: Kaslo.
Manitoba: ♂ (10–VIII–1905, L. E. Marmont); Rounthwaite, ♀ (10–VIII–06, L. E. Marmont).
New Brunswick: Fredericton, ♂ (22–VII–35, A. E. Brower).
Nova Scotia: Round Hill, ♂ (28–VII–1935, F. C. Gilliatt).
Ontario: Ottawa, 3 ♂♂ (30–VII–07, 11–VIII–1905, C. H. Young; 17–VII–1933 [reared from Yarrow] C. H. Young); Trenton, 3 ♂♂ (9–IX–11, 5–IX–04, 5–IX–12, Evans).
Quebec: Meach Lake, ♀ (16–VII–1902, C. H. Young).

Remarks.—The specimens I have placed under this name show considerable variation in coloration, but all have one character in common, white head and thorax. The variation in the color of the fore wings is of no value in distinguishing this species, and, further, the color forms cannot be separated on genitalia.

The only North American species with which *alienella* might be confused is *artemisiella*, to which it is very closely related, but the two may be easily distinguished on characters of the anellus, and *artemisiella* lacks the white head and thorax so characteristic of *alienella*.

The European *emeritella* has the thorax white as in *alienella*, but the two are easily distinguished by their genitalia.

DEPRESSARIA ARTEMISIELLA McDunnough

PLATE 35, FIGURES 196, 196a; PLATE 47, FIGURE 278

Depressaria artemisiella McDUNNOUGH, Can. Ent., vol. 59, p. 271, 1927; Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8402, 1939.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 273, 1939.

Labial palpus ochreous; base of second segment deep brown and the brush suffused and profusely irrorated with brown; third segment with poorly defined brown subbasal annulus. Head ochreous mixed with brown; anterior margin of front deep brown. Thorax deep purplish brown mixed with ochreous. Ground color of fore wing light wood brown, shaded with deep brown on costal half at base and streaked with white and black; subcostal vein black irrorated with white on outer half; veins 5 to 9 indicated by black scaling; at apical third a transverse, outwardly curved, crescentic, whitish fascia; at basal third, in cell, an indistinct black discal spot followed by a white streak, the latter confluent with the poorly defined white outer discal spot at the end of cell; vein 2 largely white with brown shading above and below; veins 3 and 4 liberally sprinkled with white, 5 sparsely so; from apical third of costa, around termen to middle of inner margin, a series of poorly defined blackish spots; cilia concolorous with slight pink tinge. Hind wing and cilia pale smoky; wing darker apically with blackish terminal line. Legs ochreous suffused and irrorated with fuscous except at joints. Abdomen ochreous.

Male genitalia.—Similar to *alienella* except that the lateral edges of the anellus of *artemisiella* are strongly produced (see key and fig. 196). The clasper of *artemisiella* appears to be armed with fewer and coarser spines than that of *alienella*, but I have not seen sufficient material to determine whether this character is constant.

Female genitalia.—Similar to *alienella* except that the anterior edge of ostial opening is convex in *artemisiella* but slightly cleft in *alienella*.

Alar expanse, 22 mm.

Type.—In the Canadian National Museum.

Type locality.—Seton Lake, Lillooet, British Columbia, Canada.

Food plant.—*Artemisia.*

Distribution.—Known only from the type locality.

Remarks.—In addition to the differences in genitalia the thorax in *artemisiella* is not white as it is in *alienella* and the fore wing lacks the red coloration of the latter species.

DEPRESSARIA WHITMANI, new species

PLATE 36, FIGURES 200, 200a; PLATE 48, FIGURE 286

A medium-sized dark species similar to *leptotaeniae*.

Labial palpus with tuft of second segment blackish fuscous below and outwardly; inwardly and above this segment is olive-buff; terminal segment blackish fuscous; apex olive-buff. Antenna blackish fuscous narrowly annulated with grayish fuscous; basal segment shining black above, olive-buff below. Head light fuscous, scales

gray tipped. Thorax and tegula blackish fuscous anteriorly, drab posteriorly. Fore wing blackish fuscous irrorated with drab and olive-buff scales; wing, at extreme base in angle, three short dashes at basal third, the bases of veins 9, 10, and 11, and a series of small spots at the ends of all veins around termen, black; at end of cell a well-defined olive-buff spot preceded by a few black scales; at apical third a poorly defined, narrow, outwardly curved olive-buff fascia; extreme edge of costa faintly pink; cilia grayish fuscous. Hind wing light fuscous, darker apically; cilia very light shining fuscous with a darker subbasal line. Legs fuscous strongly overlaid with olive-buff; tarsi annulated with olive-buff. Abdomen fuscous, the posterior edges of the segments dorsally grayish; under surface heavily overlaid with olive-buff.

Male genitalia.—Harpe broad, sparsely clothed with hairs; clasper stout, abruptly excurved just below middle; at base of clasper a series of four or five short, stout bristles; sacculus narrowly folded but strongly sclerotized; from base of sacculus an elongate, gently excurved process armed with fine, slender spines. Anellus a broad sclerotized plate broader than long; posterior edge narrowly produced to middle and deeply cleft. Aedeagus longer than harpe, slender, evenly curved; at base a broad, flat dorsal winglike expansion; opposite this a broad concave plate by which the aedeagus articulates with the anellus. Vinculum rounded with prominent ventroposterior ridge. Transtilla membranous with large, hairy, broad lateral lobes. Gnathos a spined, oval knob. Socii minute, mainly indicated by a few hairs.

Female genitalia.—Genital plate narrow, of nearly equal width throughout; ventroanterior edge produced into a narrow flap. Ostium small, somewhat triangular. Ductus bursae membranous except for a small, strongly sclerotized, curved section from middle to posterior three-fourths; entire posterior half rigid and slightly curved; inception of ductus seminalis just before ostium. Bursa copulatrix large; signum a large, sclerotized, toothed plate with prominent anterior and posterior points.

Alar expanse, 18–22 mm.

Type.—U.S.N.M. No. 52083.

Type locality.—Snake River, Whitman County, Wash., opposite Clarkston.

Food plant.—*Lomatium macrocarpum* (Hook. and Arn.) Coult. and Rose.

Remarks.—Described from the ♂ type, 2 ♂ and 1 ♀ paratypes all from the same locality. These specimens were reared from larvae which I collected. The moths issued 26–27–V–1935.

The species appears to be closest to *leptotaeniae* in coloration but nearest *angustati* on characters of the genitalia. In coloration it is inseparable from *leptotaeniae* but may easily be separated from *angustati* by the presence of the pink cast of the costa which *angustati* lacks. *D. whitmani* can be separated from *leptotaeniae* by its long slender aedeagus; from *angustati* by the more evenly curved aedeagus, the more strongly excurved spine cluster from the base of the sacculus, the series of four or five short bristles as the base of the clasper, and the deeply incised posterior margin of the anellus. The females are at once distinguishable by their genitalia. *D. leptotaeniae* lacks the curved, sclerotized posterior portion of the ductus bursae; *angustati* lacks the produced ventroanterior flap of the genital plate and the pronounced anterior and posterior points of the signum; the sclerotized portion of the ductus bursae is longer in *angustati* than in *whitmani*.

DEPRESSARIA LEPTOTAENIAE Clarke

PLATE 37, FIGURES 202, 202a; PLATE 48, FIGURE 289

Depressaria leptotaeniae CLARKE, Can. Ent., vol. 65, p. 87, pl. 4, 1933.—McDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8396, 1939.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 286, 1939.

Male genitalia.—Harpe rather short, broad, sparsely clothed with hairs; clasper stout, long, curved toward the cucullus; cucullus pointed; sacculus narrowly curved, with a prominent transverse, spinous basal process, the spines numerous, rather small. Anellus a long sclerotized plate; posterior and anterior edges deeply concave; lateral edges convex. Vinculum rounded. Aedeagus stout, pointed, curved. Transtilla a moderately broad sclerotized band with well-developed hairy lobes. Socii small, hairy.

Female genitalia.—Genital plate narrow with narrow, strongly sclerotized ventral sclerites, the latter narrower than the sclerotized part of ductus bursae. Ostium triangular. Posterior portion of ductus bursae broad, slightly curved, sclerotized; inception of ductus seminalis just anterior to ostium. Bursa copulatrix large with a well-developed signum near posterior end.

Alar expanse, 17–23 mm.

Type.—In the United States National Museum.

Type locality.—Pullman, Wash.

Food plants.—*Leptotaenia multifida* Nutt. and *L. salmoniflora* Coult. and Rose.

Distribution.—Northwestern United States and Canada in the intermountain area.

United States records

Idaho: Viola, Moscow Mountains (=Thatuna Hills), altitude 3,000 feet, 11 ♂♂, 7 ♀♀ (10-16-VI-35).

Utah: Eureka, ♂, ♀ (13-VII-1911, 28-VI-1911, Tom Spalding).

Washington: Almota, Whitman County, altitude, 2,000 feet, ♀ (11-VI-35); Cashmere (Hay Canyon), 2 ♂♂, 7 ♀♀ (24-V to 7-VI-35, I. W. Bales); Dry Falls, Grant County, 2 ♂♂, ♀ (14-V-35); Entiat, ♂ (9-V-1934, A. N. Gartrell); Grand Coulee City, 17 ♂♂, 10 ♀♀ (20-22-IV-34; 12-21-V-35); Kamiack Butte, Whitman County, altitude 3000 ft., 66 ♂♂, 63 ♀♀ (5-13-V-34; 27-V to 19-VI-35); Park Lake, Grant County, 15 ♂♂, 12 ♀♀ (9-21-V-35); Pullman, altitude 2,500 feet, 5 ♂♂, 8 ♀♀ (30-V to 16-VI-32).

(Unless otherwise stated all were reared from larvae collected by the writer.)

Canadian records

Alberta: Waterton Lakes, ♀ (18-VII-1923, J. McDunnough [rf. yellow flowered umbel]).

Remarks.—In this large series are two specimens (approximately 1 o/o) with short broad wings which otherwise are quite normal and apparently functional. These two are not crippled in any sense, and were reared under the same conditions as were the rest, which suggests that this short-winged form may be the result of a Mendelian factor such as has been demonstrated in experiments with *Drosophila.*

I mention these short-winged forms merely to show that if they were collected in nature they would undoubtedly be described as a distinct species (distinct from that to which they actually belong).

Since this species was described I have been able to rear a series of over 200 moths from various localities in the states of Idaho and Washington. The Utah specimens are somewhat smaller than those from Idaho and Washington and show slight variations in the genitalia but unquestionably belong here.

DEPRESSARIA YAKIMAE, new species

PLATE 37 FIGURES 201, 201a; PLATE 48, FIGURE 285

A very distinct, medium-sized, grayish species close to *leptotaeniae.*

Labial palpus with second segment white strongly irrorated with blackish fuscous; third segment blackish fuscous sparsely irrorated with white; apex white. Antenna with basal segment blackish fuscous with a whitish-ochreous patch beneath at apex; remainder of antenna brown above, whitish ochreous beneath, narrowly annulated with blackish fuscous. Head light brownish fuscous, the tips of the scales whitish. Thorax and ground color of fore wing brownish ochreous mixed with white scales. Bases of tegula and fore wing blackish fuscous; costa of fore wing fuscous mixed with white; an indistinct longitudinal dash, and streaks following

the veins, black; at apical third an indistinct outwardly curved, broken, white fascia formed by short series of white scales following the veins; around termen a series of seven indistinct black spots; cilia light smoky. Hind wing fuscous, lighter basally; cilia light brownish ochreous with a distinct fuscous subbasal line. Legs blackish fuscous outwardly, mixed with whitish ochreous inwardly; annulations of tarsi whitish ochreous. Abdomen grayish above, whitish ochreous beneath.

Male genitalia.—Harpe broad, sparsely clothed with hairs; cucullus broadly rounded; clasper stout, sharply and outwardly angled; distal end with small scobinations; sacculus narrowly folded, with spinous process from base curved toward cucullus; elements of spinous basal process long, stout, rather few in number. Anellus longer than broad; anterior margin deeply cleft; lateral edge convex, undulating; posterior margin concave. Aedeagus stout, gently curved, sharply pointed; base with large, winglike dorsal expansion and spoon-shaped ventral process by which the aedeagus articulates with the anellus. Vinculum rounded. Transtilla broad, narrowly hood-shaped; lobes of transtilla mainly indicated by hairs. Socii small, hairy.

Female genitalia.—Ostium large, oval; genital plate broad, strongly sclerotized, somewhat evaginated ventrally around ostium; anteriorly the ventral sclerites are produced to form two conspicuous, shallow, sclerotized pockets equal in length to the sclerotized part of the ductus bursae; ductus bursae strongly sclerotized in posterior third, the remainder membranous; inception of ductus seminalis just before ostium; bursa copulatrix large, with a conspicuous, strongly sclerotized, toothed signum in posterior part.

Alar expanse, 20–22 mm.

Type.—U.S.N.M. No. 52073.

Type locality.—Yakima, Yakima County, Wash. (18–V–31, Fred P. Dean, collector).

Food plant.—Unknown.

Remarks.—Described from the ♀ type, 3 ♂ and 3 ♀ paratypes as follows: Walla Walla, Wash., 3 ♂ ♂ and 3 ♀ ♀ (Clarke, No. 4731–4736; [8–14–VI–1931, D. H. Brannon]).

This very distinct species cannot be confused with any other described from North America. A few species (*leptotaeniae*, *multifidae*, and *angustati*) show a slight tendency toward the formation of the shallow anterior pockets of the genital plate but none has them so well developed as *yakimae*.

I suspect that the larva will be found on some species of *Lomatium* or a closely allied plant.

DEPRESSARIA MULTIFIDAE Clarke

PLATE 36, FIGURES 199, 199a; PLATE 48, FIGURE 288

Depressaria multifidae CLARKE, Can. Ent., vol. 65, p. 85, pl. 4, 1933; vol. 66, p. 179, 1934.—McDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8394, 1939.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 288, 1939.

Male genitalia.—Harpe broad, sparsely covered with fine hairs; cucullus pointed; clasper slender, fingerlike, curved toward cucullus; sacculus narrowly folded with a prominent basal process armed with long stout spines. Anellus a sclerotized plate longer than wide, with sides convex; posterior and anterior margins concave. Vinculum rounded. Aedeagus longer than harpe, slender, pointed; sharply curved at distal third, less strongly so at basal third; base of aedeagus with a small bulbous process dorsally and a long, broad, shovel-shaped process ventrally. Transtilla a broad, lightly sclerotized band with moderately developed hairy lobes. Socii very small, mainly indicated by hairs.

Female genitalia.—Genital plate narrow with a pair of shallow, cupped sclerites anteriorly. Ostium a longitudinal slit, wider at anterior end. Ductus bursae with a sharply curved sclerotized portion near its middle; inception of ductus seminalis just before ostium. Bursa copulatrix large with a well-developed signum near posterior end.

Alar expanse, 17–21 mm.

Type.—In the United States National Museum.

Type locality.—Snake River, Whitman County, opposite Clarkston, Wash.

Food plant.—Lomatium grayi Coult. and Rose.

Distribution.—Northwestern United States.

United States records

Idaho: Lapwai, Nez Perce County, 23 ♂♂, 20 ♀♀ (21–26–V–35).

Washington: Penawawa, Whitman County, 6 ♂♂, 4 ♀♀ (3–12–V–35); Snake River, Whitman County, opposite Clarkston, 6 ♂♂, 10 ♀♀ (May dates 1932–34); Truax, Whitman County, ♂, 2 ♀♀ (4–9–V–35); Godman Springs, Blue Mountains, Columbia County, altitude 5,700 feet, 2 ♂♂, 4 ♀♀ (23–31–VII–35).

(All the above specimens were reared from larvae collected by the writer.)

Remarks.—Although the male and female genitalia were characterized in the original description, it seems advisable to make necessary corrections at this time. They have been correctly redescribed above.

The name of this insect is unfortunate and resulted from a misidentification of the host. The plant, upon which the larva feeds, grows to a very large size on the sandy or gravelly bars of the Snake

River. Because of the large size of these individual plants they have, for many years, been considered conspecific with the true *Leptotaenia multifida* of the high plateau of the Palouse region around Pullman, Wash.

Suspecting some error in my rearing records of this and allied species, or in the identification of the hosts, I supplied larvae feeding on true *Leptotaenia* with food from the Snake River locality. They refused this substitute food. When this evidence was obtained further investigations were carried out which proved, beyond doubt, that the food plant is *Lomatium grayi.*

A long series of moths has been reared from larvae collected in several localities. These moths show some variation in structure and habits, but not enough, I think, to warrant separation. Superficially the moths cannot be distinguished, nor can the larvae or pupae.

The differences in habits are directly the result of the variations in the host plants themselves. As already pointed out, the plants growing in the sandy or gravelly bars of the river are unusually large, while those growing on the dry banks a few yards away are scarcely recognizable as the same species. This plant grows also in the Blue Mountains of Washington and Oregon up to altitudes of slightly over 6,000 feet. As might be expected it varies greatly in its different habitats there, from a small, sessile plant to one almost reaching the proportions of the individuals of the Snake River bars.

The moth, however, apparently does not go above 5,700 feet, although it is common at that altitude at Godman Springs, in the Blue Mountains.

The larvae collected at Godman Springs show some colorational differences but I think these unimportant specifically; one often finds such differences in larvae from one locality. The larvae from Godman Springs measured 12–14 mm. in length, 2 to 3 mm. smaller than the mature larvae from the Snake River. This difference, I believe, is purely the result of the different environments.

The larval habits of the mountain insects are much the same as those of the desert-inhabiting individuals. The former differ, however, in producing much more webbing of the parts of the plants affected, with pupation frequently taking place in the webbed leaf sheaths. I failed to find a pupa (living or dead) in the stalks of the mountain plants although I did find a few larvae in the flower stalks. All of the larvae found in the stalks were parasitized. Because of the small number of larvae and pupae found I suspect that many larvae pupate in debris at the base of the plant. A brief description of the pupa is as follows: Wing, antennal and leg sheaths bright green gradually becoming darker and duller, tinged with brown. Abdomi-

nal segments yellow-brown shaded with green. Just preceding emergence the wing, antennal and leg sheaths become very dark brown while the abdominal segments remain a deep reddish brown. Last five segments free. Pupation period 8–10 days.

DEPRESSARIA ANGUSTATI, new species

PLATE 36, FIGURES 198, 198a; PLATE 48, FIGURE 287

A medium-sized dark species close to *multifidae* and *whitmani*.

Second segment of labial palpus ochreous with much blackish scaling intermixed, especially exteriorly; third segment blackish fuscous, ochreous tipped. Antenna blackish fuscous, slightly lighter beneath, the whole becoming lighter toward the distal end. Head ochreous with much fuscous scaling above. Thorax and fore wing blackish fuscous with scattered ochreous scales. Tip of tegula and posterior portion of thorax ochreous. Discal spot at middle of cell black with some ochreous scales mixed; frequently this spot is very indistinct; at end of cell a usually conspicuous ochreous spot preceded and followed by black scales. From the costa, at the middle, to the center of the cell an indistinct broad ochreous fascia; at two-thirds from costa, outwardly to vein 6 then inwardly to inner margin, a similarly colored but narrower fascia; costa sprinkled with ochreous scales above and ochreous beneath mixed with fuscous scales; cilia light brownish fuscous. Hind wing fuscous, lighter basally; cilia light brownish fuscous with a narrow fuscous subbasal line. Legs with femora ochreous, strongly (usually) suffused with fuscous; tibiae and tarsi ochreous inwardly, fuscous outwardly; tarsi ochreous annulated. Abdomen grayish above with ochreous at posterior edges of segments; beneath fuscous except midventrally where it is ochreous; anal tuft ochreous.

Male genitalia.—Harpe narrow with the cucullus bluntly rounded; clasper strongly sclerotized, moderately slender and strongly curved outwardly in distal half; sacculus moderately broad with a prominent spinous basal process the elements of which are fine, slender and compactly associated, Anellus a very broad, sclerotized plate, broader than long; posterior edge not cleft; from each basolateral edge of the plate a pointed projection articulating with the sacculus of the harpe. Vinculum very broad and only slightly curved on its anterior edge. Transtilla scarcely sclerotized but with well-developed, narrow hairy lobes. Aedeagus about as long as harpe, slender, pointed and sharply curved at basal and distal ends; at the base are a small bulbous process dorsally and a broad spoon-shaped sclerotized portion ventrally by which the aedeagus articulates with the anellus. Tegumen broad, rather short. Socii small.

Female genitalia.—Genital plate narrow, more so laterally. Ostium small, elongate. Ductus bursae membranous except an elongate, curved, sclerotized area on one side about the middle; inception of ductus seminalis just before ostium. Bursa copulatrix large with well developed signum.

Alar expanse, 17–21 mm.

Type.—U. S. N. M. No. 52075.

Type locality.—Skyline Ridge, Mount Baker District, Whatcom County, Wash., altitude 6,200 feet.

Food plant.—Lomatium angustatum (Coult. and Rose) St. John.

Remarks.—Described from the ♂ type, 9 ♂ and 6 ♀ paratypes all from the type locality. All were collected by the author. Paratypes in the United States National, Canadian National, and H. H. Keifer collections.

The larvae, from which the type series was reared, were collected on August 17 and 18, 1933. From the larvae collected 25 pupae were obtained. From these pupae 16 moths emerged. Pupation began on August 21 and ended August 24; emergence of the moths began on August 31 and ended September 2.

The host of this species is a small plant growing on open gravelly slopes or on rock outcrops where considerable fracturing of the basic rocks has taken place. The basal leaves of the plant are frequently closely appressed to the ground and it is in these leaves that the larva does most of its feeding. Frequently, however, the more erect leaves are involved by the tubes and webs spun by the larva. The silken tubes in which the larva lives are constructed among the broken rocks and soil and frequently extend several inches down cracks in the rock, thus providing an excellent hiding place for the larva when not feeding.

This species is clearly related to *multifidae* but may readily be distinguished from that species by its genitalia.

DEPRESSARIA TOGATA Walsingham

PLATE 37, FIGURE 200B

Depressaria togata WALSINGHAM, Ins. Life, vol. 1, p. 254, 1889.—RILEY, *in* Smith, List of Lepidoptera of Boreal America, No. 5282, 1891.—BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 746, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5885, 1903.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6428, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 200, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6474, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 172, 1922.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 242, 1923.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8397, 1939.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 294, 1939.

"Antenna purplish-fuscous. Palpi cinereous, speckled with fuscous externally on the second joint; apical joint entirely suffused with fuscous, with the exception of the apex which is ochreous. Head, dull grayish-ochreous; face paler. Thorax, cinereous, speckled with fuscous. Fore wings pale grayish-ochreous, thickly suffused and streaked with purplish-fuscous, the markings ill-defined, consisting of a dark fuscous patch at the base of the dorsal margin, a dash of the same color immediately above the middle of the wing at one third from base, followed by some pale grayish-ochreous scales; a pale grayish-ochreous spot on the middle of the wing at about the end of the cell is preceded and followed by fuscous scales, and beyond and above it are several fuscous dashes radiating outwards to the costal and to the upper half of the apical margin, where is a row of obscure fuscous spots preceding the somewhat paler mottled cilia. Hind wings, pale shining whitish-gray, with the cilia scarcely darker in which a slight tinge of grayish-ochreous is traceable. Abdomen, grayish-ochreous."

Male genitalia.—Essentially like *angustati* but with the posterior margin of the anellus narrower and the lateral edge entire, convex. The clasper is outwardly angulate instead of evenly curved.

Alar expanse, 20 mm.

Type.—In the British Museum.

Type locality.—"Montana."

Food plant.—Unknown.

Distribution.—Known only from the type locality.

Remarks.—The above color description is taken from the original. I have drawn up the brief description of the male genitalia from a sketch (see fig. 200B) kindly submitted by Herbert Stringer, of the British Museum.

Mr. Stringer states (*in litt.*) that "*togata* is nearest to *angustati* but not that species," or any of the others included in this paper, and of which I submitted drawings of the genitalia.

The figure of the male genitalia is a copy of the sketch sent by Mr. Stringer and shows adequately the differences between *togata* and the other species.

In 1902 [34] Busck applied the name *togata* to specimens from Colorado and Vermont. The Colorado specimens, which are before me, are not this species, as the genitalia indicate, but represent an undescribed species. I am leaving this series undescribed until more and better material comes to hand, because the moths are now faded and were none too good when collected. The Vermont specimens were probably *betulella;* I know of no species in the *togata-angustati* complex east of the Rocky Mountains.

[34] Busck, A., Proc. U. S. Nat. Mus., vol. 24, p. 746, 1902.

In this complex the moths are so much alike superficially that it is almost impossible to separate the various species except by a comparison of genitalia. The species are widespread throughout the far west and each appears to be confined to its particular food plant and restricted geographical area.

I have not included *togata* in the keys because of my inadequate knowledge of the species and because of the uselessness of trying to separate the species of this group entirely on coloration.

DEPRESSARIA GROTELLA Robinson

PLATE 34, FIGURES 192–192b; PLATE 47, FIGURES 277, 277a

Depressaria grotella ROBINSON, Ann. Lyc. Nat. Hist. New York, vol. 9, p. 157, pl. 1, fig. 10, 1870.—WALSINGHAM, Proc. Zool. Soc. London, 1881, p. 312.—COQUILLETT, Papilio, vol. 3, p. 98, 1883.—BUSCK, Proc. U. S. Nat Mus., vol. 24, p. 748, 1902.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 172, 1922.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 242, 1923.

Depressaria groteella CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 138, 1878.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5264, 1891.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5890, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, No. 6433, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 200, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6479, 1917.—TRAVER, Psyche, vol. 26, p. 78, 1919.—BARNES and BUSCK, Contr. Lepid. North America, vol. 4, p. 233, 1920.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8405, 1939.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 283, 1939.

Depressaria symmochlota MEYRICK, Exotic Microlepidoptera, vol. 2, p. 223, 1918.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 242, 1923.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8405, 1939 (cited as synonym of *groteella* Chambers).

Labial palpus pale whitish ochreous; second segment irrorated with fuscous exteriorly and suffused with fuscous in the brush; third segment with blackish-fuscous subbasal and supramedial annuli, the former poorly defined. Head, thorax, and fore wing pale ochreous; head infuscated above; collar blackish fuscous; tegula suffused and thorax irrorated with fuscous; fore wing heavily overlaid with brown and streaked and irrorated with blackish fuscous, especially along veins; at basal third a whitish discal spot, followed at the end of cell by a similarly colored spot; between the two a prominent, longitudinal, blackish-fuscous streak; base of wing, in anal angle, blackish fuscous rapidly fading to brown; from middle of costa, around termen to inner margin, a series of blackish-fuscous spots; cilia light fuscous with a darker fuscous, median band. Hind wing very pale fuscous with considerable white scaling apically and with a narrow blackish-fuscous terminal line; cilia pale fuscous, white tipped and with a fuscous subbasal band. Legs pale whitish-ochreous overlaid

and mottled with fuscous except at joints. Abdomen pale ochreous slightly infuscated above and with a fuscous line (sometimes rather poorly defined) on each side beneath.

Male genitalia.—Harpe broad, sparsely clothed with long hairs; cucullus pointed; clasper very broad, wider than half the width of harpe, terminating in two widely separated points, one of which extends beyond ventral edge of harpe; sacculus short, narrowly folded. Anellus a moderately sclerotized plate abruptly constricted posteriorly; posterior edge concave; anterior edge convex, produced laterally; sides oblique; anterior end of anellus broader than posterior end. Vinculum rounded. Transtilla a diamond-shaped plate with moderately well-developed, hairy lobes. Aedeagus short, stout, with a slight twist; vesica armed with very fine spinules. Tegumen and socii greatly elongated, fused; socii with few hairs.

Female genitalia.—Genital plate broad, moderately sclerotized with a long row of hairs posteriorly; ostium a longitudinal slit between raised edges. Ductus bursae a long membranous spiral; inception of ductus seminalis just before the ostium. Bursa copulatrix large, with a well-developed signum.

Alar expanse, 20–22 mm.

Type.—In American Museum of Natural History.

Type localities.—"New York," "Pennsylvania."

Food plant.—*Corylus americana* Walt.

Distribution.—Northeastern United States and eastern Canada.

United States records

Maine: Sebec Lake, 2 ♂♂, 2 ♀♀ (July 16–23).
New York: (no data).
Pennsylvania: (no data).

Canadian records

Manitoba: Aweme (July 8, 1925, R. Bird [rf. *Corylus*]).
Ontario: Bobcaygeon (June 28, 1931, J. McDunnough [rf. *Corylus*]); Ottawa (July 27, 1905, July 21, August 16, 1906, C. H. Young; June 21, 1927, J. McDunnough).
Quebec: Aylmer (June 23, 1927, J. McDunnough [rf. Hazelwood]); Gracefield (no other data); Kazubazua (June 30–July 4, 1927, J. McDunnough).

Remarks.—This and the following species (*maculatella*) are very closely related. In superficial appearance *grotella* is much darker than *maculatella* and the males can be easily separated on genitalic characters. The female genitalia of *grotella* have a long row of hairs on the posterior edge of the genital plate and the ostium is considerably shorter than the width of the genital plate; in *maculatella* the row of hairs is reduced to about half a dozen and the ostium is much longer.

DEPRESSARIA MACULATELLA Busck

PLATE 34, FIGURES 191–191b; PLATE 47, FIGURE 275

Depressaria maculatella BUSCK, Proc. Ent. Soc. Washington, vol. 9, p. 90, 1908.—Proc. U. S. Nat. Mus., vol. 35, p. 200, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6481, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 172, 1922.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 242, 1923.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8407, 1939.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 287, 1939.

Labial palpus white; second segment irrorated with fuscous and black and suffused with fuscous in the brush; third segment with subbasal annulus and apex blackish fuscous. Antenna brown, broadly annulated with dull ochreous-white; basal segment ochreous-white beneath. Head, thorax, and ground color of fore wing ochreous-white suffused with brown and irrorated and streaked with blackish fuscous, with much ochreous scaling; at extreme base, from costa to inner angle a transverse blackish fuscous line interrupted at middle by the white ground color; at basal third a poorly defined white discal spot preceded by some blackish fuscous scales; at the end of cell a similar spot; between the two a conspicuous longitudinal, blackish-fuscous streak; veins 9 and 10 strongly marked with blackish fuscous; the bases of the other veins less conspicuously so; on costa, about middle, a blackish-fuscous spot; from apical third of costa, around termen to inner margin, a series of blackish-fuscous spots; cilia concolorous, white, with fuscous suffusion and irrorations. Hind wing whitish fuscous, darker apically; cilia white with fuscous subbasal band. Legs whitish ochreous suffused and mottled with fuscous except at joints; metatarsus of fore leg white. Abdomen ochreous, sparsely irrorated with blackish fuscous beneath.

Male genitalia.—Harpe broad, without process from base of sacculus or costal margin; sparsely clothed with long hairs; cucullus narrowly rounded; clasper wide, flattened, extending beyond ventral edge of harpe, terminating in one long and one short point; sacculus short, broadly folded. Anellus a flat plate, constricted posteriorly; sides strongly convex; posterior edge deeply concave; anterior edge produced laterally. Vinculum rounded. Transtilla roughly rectangular; without hairy lobes. Aedeagus short, stout, with a slight twist; vesica armed with small spinules. Tegumen and socii greatly produced posteriorly forming an elongated hood.

Female genitalia.—Genital plate broad, moderately sclerotized with a row of about half a dozen hairs posteriorly; ostium narrow, elongate, bordered on either side by a raised edge. Ductus bursae a long mem-

branous spiral; inception of ductus seminalis just before ostium. Bursa copulatrix large, with a well-developed, though small signum.

Alar expanse, 21–23 mm.

Type.—In the United States National Museum.

Type locality.—"Ontario," Canada.

Food plant.—?

Distribution.—Northeastern United States.

United States records

Connecticut: East River, ♂ (13–VIII–1910, Chas. R. Ely).

New York: Ithaca, 2 ♀♀ (36–IX–35, J. G. Franclemont); Onteora Mountain, ♀ (1927, L. O. Howard).

Ohio: Cincinnati, ♀ (19–IX–1903, A. F. Braun).

Pennsylvania: New Brighton, 5 ♂♂ (August and September dates; H. D. Merrick).

Remarks.—Although very close to *grotella* and *betulella*, this species is distinct from both in genitalia and coloration. From *grotella* it may be distinguished by the narrower clasper and from *betulella* by the rectangular transtilla in the males; in the female it may be distinguished from *grotella* by the small number of hairs on the posterior part of the genital plate and from *betulella* by the slitlike ostium.

DEPRESSARIA BETULELLA Busck

PLATE 34, FIGURES 193–193b; PLATE 47, FIGURES 276, 276a

Depressaria betulella BUSCK, Proc. U. S. Nat. Mus., vol. 24, p. 746, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5886, 1903; Proc. U. S. Nat. Mus., vol. 35, p. 200, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6480, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 172, 1922.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 242, 1923.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8406, 1939.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 275, 1939.

Labial palpus light ochreous; second segment irrorated exteriorly with black; third segment with indistinct subbasal and broad supramedial annuli, black. Antenna light ochreous with purplish-black annulations; basal segment black above. Face pale whitish ochreous. Head and thorax light ochreous, irrorated with brown; collar blackish fuscous; tegula blackish fuscous. Fore wing light ochreous suffused with fuscous and irrorated and streaked with black; extreme base of costa and base of wing in inner angle black, the latter rapidly fading to fuscous; at basal third, in cell, a whitish-ochreous discal spot preceded and followed by a few black scales; at the end of cell a similar discal spot. At apical third a poorly defined, outwardly curved,

narrow, pale ochreous fascia; from middle of costa, around termen to inner margin, a series of pronounced black spots; cilia pale ochreous strongly infuscated. Hind wing yellowish fuscous, darker apically and with a narrow, blackish-fuscous line before cilia; cilia whitish ochreous, banded with fuscous. Legs pale ochreous suffused and mottled with blackish fuscous except at joints. Abdomen ochreous suffused with fuscous above and with a blackish-fuscous line on each side beneath.

Male genitalia.—Harpe without process from base of sacculus or costa; moderately clothed with long hairs; cucullus bluntly pointed; clasper broad, less than half the width of harpe, flattened, extending beyond ventral margin and terminating in one long and one short point; sacculus short, narrowly folded. Anellus a sclerotized plate abruptly constricted posteriorly; posterior edge concave; anterior and lateral edges convex, the former more than the latter; posterior edge produced laterally. Vinculum rounded. Transtilla a diamond-shaped sclerotized plate with slightly developed hairy lobes. Aedeagus short, stout, with a twist; vesica armed with many small spinules. Tegumen and socii distinctly rounded, sparsely clothed with hairs.

Female genitalia.—Genital plate broad, moderately sclerotized except around the ostium where it is nearly membranous; the portion of the plate surrounding the ostium is raised and roughly triangular in shape (apex posteriorly). Ostium broadly oval. Ductus bursae a long membranous spiral; inception of ductus seminalis well before ostium. Bursa copulatrix large with well-developed signum.

Alar expanse, 20–23 mm.

Type.—In United States National Museum.

Type locality.—"Pennsylvania."

Food plant.—*Betula* (sp. ?); *Ostrya virginiana* (Mill.) Koch.

Distribution.—Northeastern United States and eastern Canada.

United States records

Connecticut: East River, 2 ♂♂ (14–VII–14; 2–VIII–10, Chas. R. Ely).

District of Columbia: ♀ ("11–VI–'84").

New Jersey: Greenwood Lake, 2 ♀♀ (26–VI, W. D. Kearfott).

Pennsylvania: New Brighton, 13 ♂♂, 8 ♀♀ (July to September dates, H. D. Merrick).

Canadian records

Ontario: Biscotasing (August 16, 1931, K. Schedl); Bobcaygeon (July 5, 1932, J. McDunnough); Ottawa (July 19–30, 1905 and 1906, C. H. Young).

Quebec: Meach Lake (July 23, 1933, C. H. Young); Otter Lake (August 6, 1931, G. S. Walley).

Remarks.—This species is close to *grotella* and *maculatella* but is amply distinct in genitalia (both male and female) and lacks the black discal dash so prominent in both the other species.

6. APACHEA, new genus

PLATE 2, FIGURE 16; PLATE 6, FIGURE 40; PLATE 13, FIGURES 86, 86a, 86b; PLATE 15, FIGURE 94

Genotype.—Depressaria barberella Busck, Proc. U. S. Nat. Mus., vol. 24, p. 747, 1902.

Similar to *Depressaria* but with broadly triangular brush on second segment of palpus, fused anellus and transtilla in the male genitalia and with the signum of the female genitalia a distinct cross.

Head with appressed scales; side tufts spreading; tongue developed; antenna simple in both sexes; basal segment elongate, with pecten. Labial palpus moderately long, recurved; third segment nearly as long as second, acute; brush of second segment broadly triangular, flared. Thorax with two small crests. Abdomen flattened. Fore wing with 12 veins; 2 and 3 closely approximate; 7 and 8 stalked, 7 to costa; 11 from before middle. Hind wing broader than fore wing; 8 veins; 3 and 4 short stalked, 5 separate from 4; 6 and 7 subparallel.

Male genitalia.—Harpe with clasper. Anellus and transtilla fused. Uncus distinctly wanting. Aedeagus armed. Gnathos a spined knob. Socii wanting.

Female genitalia.—Genital plate strongly sclerotized. Signum present.

Larva.—Ninth abdominal segment with setae I and II well separated; setae VI on the same pinaculum with IV and V, remote from VII. Setal group VII with multiple hairs (4 to 6) on abdominal segments 2 to 7, trisetose on eighth and unisetose on ninth abdominal segments. A few secondary hairs on anterior margin of prothoracic shield and on anal prolegs. Ocelli normal. Submentum without pit.

Pupa.—Pubescent. Prothoracic femora and labial palpi not exposed. Cremaster absent.

Remarks.—This genus is closely allied to both *Depressaria* and *Agonopterix* but appears to be a specialized offshoot from the former. It can be distinguished readily from both by the fused anellus and transtilla and armed aedeagus of male, the 4-pointed signum of female, and the proximity of veins 2, 3, and 4 of fore wing.

In the larval stage *Apachea* is distinguished from other genera of American Oecophoridae by the presence of secondary hairs in setal group VII, a character which otherwise distinguishes the family Ethmiidae. The pupa is typically oecophorid with essentially the same characters as the pupae of *Agonopterix* and *Hofmannophila.*

The genotype is the only species I have seen referable to this genus.

APACHEA BARBERELLA (Busck), new combination

Depressaria barberella Busck, Proc. U. S. Nat. Mus., vol. 24, p. 747, 1902.—Busck, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5887, 1903.—Kearfott, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6431, 1903.—Busck, Proc. U. S. Nat. Mus., vol. 35, p. 200, 1908.—Barnes and McDunnough, Check list of the Lepidoptera of Boreal America, No. 6477, 1917.—Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 171, 1922.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8401, 1939.—Gaede, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 275, 1939.

Male genitalia.—Harpe clothed with fine hairs; clasper broad basally, flat, sharply pointed and situated near cucullus; sacculus narrow, strongly sclerotized. Anellus consisting of a small sclerotized plate, which is deeply cleft on the anterior margin; a narrow lightly sclerotized band connecting the above plate with a strongly sclerotized rectangular part posteriorly; the posterior part consists of the transtilla and part of the anellus which form a ring through which the aedeagus passes; on the lateroposterior corner of the transtilla is a conical, fleshy lobe. Vinculum produced anteriorly into a point. Aedeagus stout, curved and sharply pointed, and armed with many sharp teeth in the middle portion. Gnathos a spined oval knob. Socii and uncus lacking (a few hairs indicate the position of the socii).

Female genitalia.—Genital plate moderately broad. Ostium large, protruding, round, lateral margins slightly produced, winglike; anterior margin very narrow. Ductus bursae stout, sclerotized posteriorly; inception of ductus seminalis well before ostium. Bursa copulatrix large, elongate with a large cross-shaped signum in posterior end.

Alar expanse, 21–31 mm.

Type.—In the United States National Museum.

Type locality.—Williams, Ariz.

Food plant.—*Prunus* sp.

Distribution.—Southwestern United States.

United States records

Arizona: Paradise, Cochise County, ♂; Santa Catalina Mountains, 4 ♂♂, 4 ♀♀ (June 10–24, 1913, Carl Heinrich [Hopkins No. 12114]); Huachuca Mountains, ♂.

Colorado: Boulder ♀ (April 15, T. D. A. Cockerell).

New Mexico: Jemez Springs, 2 ♂♂, 2 ♀♀ (April 8–15); Jemez Mountains, 6,600 feet, 4 ♂♂, 1 ♀ (June 28–September 13, 1915, John Woodgate).

7. Genus MACHIMIA Clemens

Plate 3, Figure 26; Plate 5, Figure 33; Plate 10, Figures 70, 70a; Plate 14, Figure 92

Machimia Clemens, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 211; Stainton, Tineina of North America, p. 147–148, 1872.—Zeller, Verh. zool.-bot. Ges.

Wien, vol. 23, p. 239, 1873; Hor. Soc. Ent. Ross., vol. 13, p. 258–259, 1877.—Chambers, U. S. Geol. Surv. Terr. Bull. 4, p. 156, 1878.—Butler, Trans. Ent. Soc. London, 1883, p. 50.—Walsingham, Ins. Life, vol. 2, p. 150–151, 1889.—Riley, *in* Smith, List of the Lepidoptera of Boreal America, p. 98, 1891.—Busck, *in* Dyar, U. S. Nat. Mus. Bull. 52, p. 520, 1903.—Kearfott, *in* Smith, List of the Lepidoptera of Boreal America, p. 113, 1903.—Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 79, 1922.—Fletcher, Mem. Dept. Agr. India (Ent. Ser.), vol. 11, p. 131, 1929.—Gaede, *in* Bryk (part), Lepidopterorum catalogus, pt. 88, p. 135, 1938. (Genotype: *Machimia tentoriferella* Clemens, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 212.)

Labial palpus long, recurved; terminal segment shorter than second, acute; second segment roughened beneath. Antenna strongly ciliated in male, simple in female; basal segment without pecten. Tongue well developed.

Fore wing with costa slightly arched, termen slightly oblique, weakly concave; 12 veins; 2 remote from 3; 3, 4 and 5 approximate, 7 and 8 stalked, 7 to termen just below apex; 11 from before middle.

Hind wing as broad as fore wing; apex rounded, termen oblique; 8 veins; 3 and 4 connate or short stalked, 6 and 7 parallel at base, divergent distally; discocellulars inwardly oblique between 3 and 7.

Male genitalia.—Clasper present. Anellus with lateral projections. Gnathos spined. Vesica armed (*tentoriferella*). Socii absent. Uncus well developed.

Female genitalia.—Signum absent. Ductus bursae partly sclerotized.

Larva.—Characters essentially as in *Agonopterix:* Ninth abdominal segment with setae I and II well separated; seta VI not on the same pinaculum with IV and V, remote from VII. Setal group VII bisetose on first and seventh, unisetose on eighth and ninth abdominal segments. Ocelli normal. Submentum without pit.

Pupa.—Smooth. Prothoracic femora and labial palpi not exposed. Cremaster absent.

Remarks.—The absence of the cremaster distinguishes the pupa of this genus from *Carcina.*

I agree with Meyrick [35] in separating *Machimia* from *Cryptolechia* but cannot agree with his synonymizing of *Hoplitica* with *Machimia.* The former does not agree with the latter at all on genitalia. Meyrick also places in synonymy the three following Australian genera:

Garrha Walker, List of the specimens of lepidopterous insects in the collection of the British Museum, vol. 35, p. 1835, 1866. (Genotype: *Garrha sincerella* Walker.)

Hoplomorpha Turner, Proc. Linn. Soc. New South Wales, vol. 41, p. 373, 1916. (Genotype: *Cryptolechia abaliencila* Walker, List of the specimens of lepidopterous insects in the collection of the British Museum, vol. 29, p. 762, 1864.)

[35] Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 79, 1922.

Lepidozancla TURNER, ibid., vol. 41, p. 375, 1916. (Genotype: *Lepidozancla zatrephes* Turner, ibid., vol. 41, p. 376, 1916.)

It does not seem likely that these genera and *Machimia* are congeneric, but until the genitalia of the genotypes are carefully studied we must accept Meyrick's classification.

Busck [36] and Walsingham [37] have correctly separated *Psilocorsis* from *Cryptolechia* and *Machimia*, on the distance of veins 2, 3, and 4 from each other, but have synonymized the latter two. As stated above, I follow Meyrick in the separation of *Cryptolechia* and *Machimia*, his contention being borne out by genitalic as well as palpal characters. Of the American species formerly included in this genus all but *tentoriferella* are referable to other genera.

MACHIMIA TENTORIFERELLA Clemens

Machimia tentoriferella CLEMENS, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 212; *in* Stainton, The Tineina of North America, p. 148, 1872.—CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, pp. 120, 156, 1878.—RILEY, *in* Smith, List of Lepidoptera of Boreal America, No. 5225, 1891.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5853, 1903; Proc. Ent. Soc. Washington, vol. 5, p. 205, 1903.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6396, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 82, 1922.—FLETCHER, Mem. Dept. Agr. India (Ent. Ser.), vol. 11, p. 131, 1929.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 88, p. 143, 1938.—McDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8383, 1939.

Machimia tentorifuella CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 83, 1878.

Cryptolechia tentoriferella (Clemens) ZELLER, Verh. zool.-bot. Ges. Wien, vol. 23, p. 238, 1873; Hor. Soc. Ent. Ross., vol. 13, p. 259, 1877.—CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 137, 1878.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 195, 1908.—BARNES and McDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6424, 1917.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 235, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat. Memoir 101, p. 544, 1928.

Depressaria fernaldella CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 83, 1878.

Depressaria confertella WALKER, List of the specimens of lepidopterous insects in the collection of the British Museum, vol. 29, p. 563, 1864.—WALSINGHAM, Proc. Zool. Soc. London, 1881, p. 312.

Machimia confertella (Walker) McDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8383, 1939 (cited as synonym of *M. tentoriferella* Clemens).

Machimia fernaldella (Chambers) McDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8383, 1939 (cited as synonym of *M. tentoriferella* Clemens).

Labial palpus pale yellowish white; second segment strongly suffused with blackish fuscous exteriorly on basal half; basal third,

[36] Busck, Proc. U. S. Nat. Mus., vol. 35, p. 194, 1908.
[37] Walsingham, Biol. Centr.-Amer. Lepidoptera-Heterocera, vol. 4, p. 122, 1912.

inwardly, irrorated with blackish fuscous. Antenna ochreous, annulated with fuscous. Head pale whitish ochreous. Thorax and fore wing reddish ochreous, sparsely irrorated with blackish fuscous; at basal third, in cell, a blackish-fuscous spot followed by a similar one at the end of cell; on vein 1c, about equidistant from both discal dots, a third blackish-fuscous spot; from costa, about middle, a row of blackish-fuscous spots to vein 7 then sharply angulated to inner margin at about two-thirds; around termen a series of small, blackish-fuscous spots; cilia ochreous. Hind wing fuscous with reddish cast; cilia ochreous with a fuscous subbasal band. Legs ochreous, heavily overlaid with fuscous except at joints. Abdomen ochreous, irrorated and suffused with blackish fuscous.

Male genitalia.—Harpe long, narrow, slightly clothed with hairs; cucullus rounded; clasper small, stout, pointed; sacculus narrowly folded. Anellus with lateral projections well developed. Gnathos large, spined. Aedeagus large, stout; vesica armed with numerous strong cornuti. Socii undeveloped; uncus broad, spoon-shaped.

Female genitalia.—Bursa copulatrix without signum. Ductus bursae membranous except just before ostium, there sclerotized.

Alar expanse, 19–28 mm.

Types.—In the Academy of Natural Sciences of Philadelphia (*tentoriferella*); in the Museum of Comparative Zoology, Cambridge, Mass. (?) (*fernaldella*); in the British Museum (*confertella*).

Type localities.—Unknown (*tentoriferella*); Maine (*fernaldella*); Nova Scotia (*confertella*).

Food plants.—*Castanea dentata* (Marsh.) Borkh., *Cephalanthus occidentalis* L., *Syringa vulgaris* L., apple, cherry, elm, hazel, hickory, oak.

Distribution.—Eastern United States and eastern Canada.

United States records

District of Columbia: Washington, 7 ♂♂ (17–IX–1884, no collector; 16–10–82, no collector; 1–6–XI–1914 and 27–IX–1933, A. Busck).

Iowa: Iowa City, ♀ (September 1917, A. W. Lindsey); Sioux City, ♂ (September 3, 1921, A. W. Lindsey).

Maine: 2 ♀♀ (one September 28, 1909; the other without date or collector).

Maryland: Plummers Island, 3 ♂♂ (29–IX–1905, A. Busck); ♂ (October 4, 1932, George P. Engelhardt).

Massachusetts: Cambridge, ♂ (no date or collector); Newton Highlands, ♂ (no date); Springfield, 2 ♀♀ (9–IX–1897 and 30–VII–1897, George Dimmock, Nos. 1204, 1208).

Michigan: St. Clair County, ♂ (September 1, 1927; no collector).

New Hampshire: Canobie Lake, ♀ (14–IX–1892, George Dimmock, No. 1054).

New Jersey: Elizabeth, ♀ ("9–19," A. J. Weidt); Essex County, 2 ♀♀ (27–IX–1902, W. D. Kearfott); Montclair, ♂, ♀ (10–IX–1899, 25–IX–1899, W. D. Kearfott); Woodside, ♂ ("9–19", A. J. Weidt).

New York: Ilion, ♀ (23–IX–1911, H. McElhose); Kendall, ♂, 2 ♀♀ (no date; H. S. Burnett); Onteora Mountain, Greene County, ♂ (1–IX–1929, L. O. Howard); Staten Island, 2 ♂♂ (17–IX–1902, no collector); Utica, ♀ (4–IX–1911, H. McElhose).

Ohio: Cincinnati, ♂ (20–IX–1909, A. F. Braun).

Pennsylvania: Arendtsville, 2 ♂♂ (2–IX–1918; 11–IX–1918, S. W. Frost); Hazelton, ♂ (no date; Dr. Dietz); New Brighton, 7 ♂♂, 4 ♀♀ (September and October dates, 1902–1905, H. D. Merrick); Oak Station, Allegheny County, 8 ♂♂, 4 ♀♀ (September dates, 1908–1911, Fred Marloff).

Rhode Island: Newport, 2 ♂♂ (no date; W. Barnes); Weekapaug, 2 ♀♀ (September 14, 1904, H. G. Dyar).

Virginia: Falls Church, 2 ♀ ♀ (19–IX–1913 and 1–X–1913, C. Heinrich [Hopkins No. 11132b]).

Canadian records

Ontario: Bobcaygeon (August 16–28, 1932, J. McDunnough); Ottawa (August 27, 1905; August 21–26, 1931, C. H. Young).

Remarks.—The habit of feeding on a large assortment of food plants is unusual for species of this family, and I know no other in North America that is such a general feeder.

8. HIMMACIA, new genus

PLATE 4, FIGURES 31, 32; PLATE 9, FIGURES 64, 64a; PLATE 18, FIGURE 110

Genotype.—*Cryptolechia huachucella* Busck, Proc. U. S. Nat. Mus., vol. 35, p. 195, 1908.

Labial palpus long, slender, recurved; terminal segment shorter than second, acute; second segment slightly roughened beneath. Antenna strongly ciliated in male, simple in female; basal segment without pecten. Tongue well developed.

Fore wing with costa slightly arched, termen slightly oblique, straight; 12 veins; 2 rather distant from 3; 4 and 5 closely approximate; 7 and 8 stalked; 7 to apex; 11 from before middle.

Hind wing as broad as fore wing, apex rather pointed, termen oblique, slightly convex; 8 veins; 3 and 4 connate; 6 and 7 subparallel; discocellulars strongly outwardly oblique between 4 and 6; inwardly oblique between 6 and 7.

Male genitalia.—Harpe with clasper. Gnathos broad, spined. Socii absent. Vesica armed. Uncus present.

Female genitalia.—Signum present. Ostium large.

Remarks.—This genus appears to be closely allied to *Machimia*, *Psilocorsis*, and *Inga*. It may be distinguished from all these genera by the direction of the discocellulars of the hind wing. The male genitalia differ from those of *Machimia* in lacking the lateral processes of the anellus, from *Inga* in having a spined gnathos, and from *Psilocorsis* in possessing a clasper. The female genitalia differ from those of *Machimia* and *Inga* in possessing a signum; from *Psilocorsis* in having a single bursa. The only species I have seen that is referable to this genus is the genotype.

HIMMACIA HUACHUCELLA (Busck), new combination

Cryptolechia huachucella Busck, Proc. U. S. Nat. Mus., vol. 35, p. 195, 1908.—Barnes and McDunnough, Check list of the Lepidoptera of Boreal America, No. 6421, 1917.

Machimia huachucella (Busck) Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 82, 1922.—Gaede, *in* Bryk, Lepidopterorum catalogus, pt. 88, p. 139, 1938.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8381, 1939.

Cryptolechia diligenda Meyrick, Exotic Microlepidoptera, vol. 3, p. 477, 1928. (New synonymy.)

Labial palpus ochreous-white with reddish tinge; second segment shaded with brown exteriorly on basal half and with an indistinct rose-red shade at apex; third segment with an indistinct, brown subbasal annulus and a narrow, indistinct, longitudinal blackish line anteriorly. Antenna ochreous-white suffused with salmon above; basal segment red above; in male the antenna is strongly cilate (about 4). Face shining ochreous-white. Head, thorax, and fore wing unicolorous salmon-ochreous; costa slightly more red. Cilia pale ochreous preceded by sparse, red irrorations. Hind wing light ochreous-fuscous slightly darker around margins; cilia ochreous. Legs ochreous-white suffused with dark brown exteriorly except at joints. Abdomen ochreous-white suffused with reddish-ochreous above.

Male genitalia.—Harpe slender, clothed with hairs; clasper long, slender, nearly attaining costa; cucullus rounded, narrow; sacculus broadly folded, strongly sclerotized. Anellus a simple V-shaped plate. Aedeagus long, slightly bent; vesica armed with 5 or 6 strong, sharply pointed cornuti and two triangular, sclerotized plates, each with a finely serrated edge. Vinculum broadly pointed. Transtilla membranous with well developed lateral, hairy lobes. Gnathos broad, armed with spines. Uncus moderately short, curved, pointed.

Female genitalia.—Genital plate simple. Ostium very large, nearly as wide as plate. Ductus bursae sclerotized just before ostium and also before the inception of the ductus seminalis; inception of ductus seminalis at posterior two-thirds of ductus bursae. Bursa copulatrix large, round; signum a simple, small, sclerotized plate with median keel, and situated in posterior part of bursa copulatrix.

Alar expanse, 21–25 mm.

Type.—In the United States National Museum (*huachucella*); in the British Museum (*diligenda*).

Type localities.—Huachuca Mountains, Ariz. (*huachucella*); "Texas" (*diligenda*).

Distribution.—Southwestern United States.

United States records

Arizona: Baboquivari Mountains, Pima County, 3 ♂♂ (15–30 July 1924, O. C. Poling); Huachuca Mountains, 3 ♂♂; Palmerlee, Cochise County, 5 ♂♂, 2 ♀♀; Redington, 2 ♂♂.

Texas: No further data.

Remarks.—The description of *diligenda* agrees in every detail with the type of *huachucella* so there appears to be no doubt about the synonymy.

9. Genus PSILOCORSIS Clemens

PLATE 3, FIGURE 24; PLATE 5, FIGURE 38; PLATE 8, FIGURES 59, 59a; PLATE 17, FIGURE 105

Psilocorsis CLEMENS, Proc. Acad. Nat. Sci. Philadelphia, vol. 12, p. 212, 1860; *in* Stainton, Tineina of North America, p. 149–151, 1872.—ZELLER, Verh. zool.-bot. Ges. Wien, vol. 23, p. 239, 1873.—BUSCK, Proc. Ent. Soc. Washington, vol. 5, p. 207, 1903; Proc. U. S. Nat. Mus., vol. 35, p. 196, 1908.—WALSINGHAM, Biol. Centr.-Amer., Lepidoptera-Heterocera, vol. 4, p. 118–119, 1912.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, p. 160, 1917.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 235–236, 1923.—BRIMLEY, The insects of North Carolina, p. 304, 1938. (Genotype: *Psilocorsis quercicella* Clemens, Proc. Acad. Nat. Sci. Philadelphia, vol. 12, p. 212, 1860.)

Hagno CHAMBERS, Can. Ent., vol. 4, p. 129–132, 191, 1872; Journ. Cincinnati Soc. Nat. Hist., vol. 2, p. 198, 1880. (Genotype: *Hagno faginella* Chambers, Can. Ent., vol. 4, p. 131, 1872.)

Labial palpus long, slender, smooth, always with conspicuous longitudinal stripes; terminal segment scarcely shorter than second. Antenna simple, without pecten on basal segment; tongue well developed.

Fore wing with costa arched, termen slightly oblique, straight; 12 veins; 2 from near angle, 3–5 approximate, 5 and 6 parallel, 7 and 8 stalked, 7 to apex, 11 from before middle of cell.

Hind wing as broad as fore wing; apex rounded, termen oblique; 8 veins; 3 and 4 connate or short stalked, 5 equidistant from 4 and 6; 6 and 7 nearly parallel, slightly divergent at tip.

Male genitalia.—Harpe long, narrow, without clasper, moderately clothed with hairs. Anellus membranous, with long, fingerlike lateral lobes. Aedeagus stout; vesica armed with one or more strong cornuti. Gnathos large, broad, spined. Uncus simple. Socii absent.

Female genitalia.—Signum large, many branched. Bursa copulatrix double.

Larva.—Ninth abdominal segment with setae I and II well separated. Seta VI closely associated and on the same pinaculum with setae IV and V. Setal group VII (as in *Agonopterix*) bisetose on first and seventh, unisetose on eighth and ninth abdominal segments. Ocelli normal. Submentum without pit.

Pupa.—Smooth. Prothoracic femora exposed. Labial palpi not exposed. Cremaster present (short but distinctly developed), straight (not hooklike).

Remarks.—This genus is remarkably homogeneous and the species, for the most part, are difficult to separate.

The larva is at once distinguished from larvae of other American oecophorid genera (studied) by the above association of setae IV, V, and VI of the ninth abdominal segment on a single pinaculum.

The pupa is characterized by exposed femora, developed cremaster and lack of exposed labial palpi and absence of pubescence.

The specific separation, based on genitalia, is especially difficult in the males. The simplicity of the genital structures and the similarity in the armature of the vesica prohibit the selection of suitable characters for keying out the larger part of the species. A key is presented, but when more preparations of the genitalia are made and larger series of bred specimens are studied the characters used may prove unstable.

The females appear to possess better characters for separation. Although the sclerotized portions of the ductus bursae are strikingly similar and, with few exceptions, useless for separating the species, I believe the number of branches on the signa are relatively constant within a species. With this in mind I have used the signa, in most cases, for separating the various species.

As good superficial characters for the separation of species are lacking, I have used alar expanse in several cases. This is admittedly weak but is the only tangible character available. Large bred series will, in some cases, render the use of alar expanse valueless, but for the present we must rely upon it.

Busck [38] placed seven species in the genus. Gibson [39] added *fletcherella* in 1909 and I have described one other (*caryae*) as new in this paper. I have made *ferruginosa* a synonym of *faginella* because I can find nothing except its lighter color on which to base separation. Two of the species are retained only because I do not feel justified in placing them in synonymy on present evidence, bringing to eight the total number of described species from North America.

Despite the fact that we have many food-plant records comparatively little is known of the larvae. Two species, *obsoletella* and *quercicella*, can be separated easily on larval characters, but we know nothing about the characters of the larvae of the other species. The larvae, with one or two exceptions, feed on the leaves of trees and shrubs and pupate between two tied leaves.

[38] Busck, Proc. U. S. Nat. Mus., vol. 35, p. 197, 1908.
[39] Gibson, A., Ottawa Nat., vol. 22, p. 226, 1909.

At present I have before me several species that appear to be distinct from those already described, but their description must await the receipt of more carefully reared material accompanied by larvae that have been properly associated with the moths.

The generic synonymy as given by Meyrick,[40] cannot be considered correct for our North American species. Until more careful study of all the genotypes can be made we must accept Meyrick's synonymy for the species outside of North American, but the American genera (*Psilocorsis* and *Inga*) certainly do not belong with *Cryptolechia*. The double bursa and the remarkable signum of the females of *Psilocorsis* immediately distinguish this genus from all other American oecophorids.

KEY TO SPECIES OF PSILOCORSIS BASED PRIMARILY ON COLORATION

1. Fore wing with a broad, dark, transverse fascia at outer two-thirds ..... obsoletella (Zeller) (p. 209)
   Fore wing without such fascia 2
2. Fore wing with distinct purplish luster; species dark colored 3
   Fore wing without purplish luster, or if this is present, it is only faintly indicated; light-colored species 4
3. Alar expanse 19 mm. ..... fletcherella Gibson (p. 216)
   Alar expanse 18 mm. or less ..... caryae, new species (p. 215)
4. Alar expanse 18 mm. or more 5
   Alar expanse 16 mm. or less [41] ..... quercicella Clemens (p. 207)
5. Fore wing with dark markings confined to the outer discal spot and a few spots around termen ..... faginella (Chambers) (part) (p. 213)
   Fore wing otherwise 6
6. Thorax much darker than head ..... reflexella Clemens (p. 212)
   Thorax and head nearly concolorous ..... faginella (Chambers) (part) (p. 213)

KEY TO SPECIES OF PSILOCORSIS BASED PRIMARILY ON MALE GENITALIA

1. First abdominal segment with hair pencil 2
   First abdominal segment without hair pencil 3
2. Vescica armed with one large cornutus and a patch of smaller ones (fig. 133) ..... obsoletella (Zeller) (p. 209)
   Vesica armed only with a patch of small cornuti (fig. 59a) quercicella Clemens (p. 207)
3. Base of large cornutus broad, strongly sclerotized; the cornutus short, stout, curved (figs. 131, 134) 4
   Base of large cornutus not appreciably broadened and weakly sclerotized; the cornutus straight, nearly as long as distal width of aedeagus (fig. 132) ..... caryae, new species (p. 215)
4. Vinculum broad ventrally ..... faginella (Chambers) (p. 213)
   Vinculum narrow ventrally ..... reflexella Clemens (p. 212)

[40] Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, pp. 195–196, 1922.

[41] In this couplet *dubitatella* (Zeller) and *cryptolechiella* (Chambers) should be included, but they have been omitted because of the lack of information concerning them.

KEY TO SPECIES OF PSILOCORSIS BASED ON FEMALE GENITALIA

1. Ductus bursae dilated before ostium (figs. 217, 220)---------- 2
   Ductus bursae not dilated before ostium (fig. 105)
   quercicella Clemens (p. 207)
2. Ostium and sclerotized portion of ductus bursae well separated (fig. 220)---------- obsoletella (Zeller) (p. 209)
   Ostium and sclerotized portion of ductus bursae contiguous (fig. 217)---------- 3
3. Branches of the signum 22–24 on each side (fig. 222)
   reflexella Clemens (p. 212)
   Branches of the signum 21 or less on each side (figs. 218, 221)---------- 4
4. Branches of the signum 15–16 on each side (fig. 221)
   fletcherella Gibson (p. 216)
   Branches of the signum 17–21 on each side---------- 5
5. Sclerotized anterior band of genital plate broad (fig. 217)
   faginella (Chambers) (p. 213)
   Sclerotized anterior band of genital plate narrow (fig. 219)
   caryae, new species (p. 215)

PSILOCORSIS QUERCICELLA Clemens

PLATE 3, FIGURE 24; PLATE 5, FIGURE 38; PLATE 8, FIGURES 59, 59a; PLATE 17, FIGURE 103

Psilocorsis quercicella CLEMENS, Proc. Acad. Nat. Sci. Philadelphia, vol. 12, p. 212, 1860; *in* Stainton, Tineina of North America, p. 147, 1872.—BUSCK, Proc. Ent. Soc. Washington, vol. 5, p. 206, 1903.—KEARFOTT, *in* Smith, Check List of the Lepidoptera of Boreal America, No. 6390, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 197, 1908.—WALSINGHAM, Biol. Centr.-Amer., Lepidoptera-Heterocera, vol. 4, p. 118, 119, 1912.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6425, 1917.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 235, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat., Memoir 101, p. 545, 1928.—FLETCHER, Mem. Dept. Agr. India (Ent. Ser.), vol. 11, p. 190, 1929.—BRIMLEY, The insects of North Carolina, p. 304, 1938.

Cryptolechia quercicella (Clemens) ZELLER, Verh. zool.-bots. Ges. Wien, vol. 23, p. 240, 1873.—CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 120, 137, 1878.—WALSINGHAM, Ins. Life, vol. 2, p. 151, 1889.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5223, 1891.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5851, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 197, 1922.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8473, 1939.

Psilocorsis quercicella CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 162, 1878.

Head and thorax dark yellowish brown. Second segment of labial palpus ochreous with the usual dark fuscous longitudinal stripe beneath; third segment fuscous with median and lateral longitudinal whitish stripes. Basal segment of antenna dark yellowish brown above with fuscous and white longitudinal stripes beneath; remainder of antenna whitish ochreous with longitudinal fuscous stripes, the latter breaking up into spots toward the distal end. Fore wing yellowish brown mottled with short fuscous lines and spots; at the end of cell a blackish-fuscous spot; around termen a narrow blackish fuscous line; before tornus, on inner margin, a fuscous shading; cilia

fuscous with a slightly darker subbasal band. Hind wing and cilia pale ochreous-fuscous. Legs whitish ochreous, the fore tibiae and tarsi shaded with fuscous. Abdomen yellowish brown above, whitish-ochreous beneath.

Hair pencil from first abdominal segment of male strongly developed.

Male genitalia.—Harpe slightly longer than twice its width; sacculus ill defined, narrow, weakly sclerotized. Anellus a broad, oval, weakly sclerotized plate with a small, broadly obtuse, strongly sclerotized base; lateral fingerlike lobes hardly exceeding central plate, broadly dilated distally. Aedeagus stout, acutely pointed. Vesica armed with a large patch of strong, but slender, cornuti.

Female genitalia.—Genital plate membranous except for a narrow sclerotized band at anterior edge. Ostium small, round. Ductus bursae slender, slightly sclerotized just before ostium and before ductus seminalis; inception of ductus seminalis well before ostium. Signum with 17 to 19 branches on each side.

Alar expanse, 13–16 mm.

Type.—In the Academy of Natural Sciences of Philadelphia.

Type locality.—Pennsylvania?

Food plant.—Oak.

Distribution.—Eastern United States and Canada.

United States records

District of Columbia: 6 ♂♂, 5 ♀♀ (April, July, and August dates, 1900 and 1910, A. Busck); 2♂♂ (July 31, 1885, C. V. Riley).

Illinois: Putnam County, ♂ (10–VIII–1939, M. O. Glenn).

Maryland: Hyattsville, 2 ♂♂ (7–VII–1913, 21–VII–1913, A. Busck).

New Jersey: Anglesea, 2 ♂♂, ♀ (V–30–1905, W. D. Kearfott); Essex County, Park, ♀ ("20 May," W. D. Kearfott).

New York: Bellport, ♂ (1–VI–1902, H. G. Dyar); Ramapo, ♂ (27–V–1900, W. D. Kearfott).

Ohio: Cincinnati, 2 ♀♀ (14–VIII–1907; 29–V–1907, A. F. Braun).

Pennsylvania: Beaver County, 2 ♂♂, 2 ♀♀ (May 1900, Kemp coll.); New Brighton, ♂, 2♀♀ (14–19–VIII–1903, H. D. Merrick).

Virginia: Great Falls, ♀ (25–IX–1914, A. F. Kneale).

Canadian records

Ontario: Ottawa (July 13–24, 1906; April 13–16, 1935, C. H. Young).

Remarks.—Although this and the following species closely resemble each other they may be distinguished quite easily. The transverse dark markings of *quercicella* are broken and in the form of small spots and there is usually a dark spot on the hind margin of the fore wing at two-thirds. The transverse markings of *obsoletella* are more evenly strigose and the dark suffusion of the fore wing at two-thirds is usually in the form of a band across the wing.

The larva of *quercicella* has the three thoracic segments darkened; in *obsoletella* only the prothorax is darkened.

PSILOCORSIS OBSOLETELLA (Zeller)

PLATE 22, FIGURE 133; PLATE 40, FIGURE 220

Cryptolechia obsoletella ZELLER, Verh. zool.-bot. Ges. Wien, vol. 23, p. 242, 1873.—CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 137, 1878.—WALSINGHAM, Ins. Life, vol. 2, p. 151, 1889.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5221, 1891.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5849, 1903; Proc. Ent. Soc. Washington, vol. 5, p. 206, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 197, 1922.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8471, 1939.

Psilocorsis obsoletella (Zeller) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 197, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6426, 1917.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 236, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat., Memoir 101, p. 545, 1928.

Psilocorsis quercicella KEARFOTT, part (not Clemens) *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6390, 1903.

This species is much like *quercicella*, but the fuscous shading before the tornus extends entirely across the wing in the form of a more or less conspicuous band. The fuscous markings of the fore wing are longer, narrower, and more numerous. The abdomen is light grayish fuscous above. All other characters practically as in *quercicella*.

First abdominal segment of male with well-developed hair pencil.

Male genitalia.—Harpe rather heavily clothed with hairs; sacculus narrow, ill defined, weakly sclerotized. Anellus a weakly sclerotized, more or less oval plate with a small crescent-shaped base; lateral fingerlike lobes slender, small. Aedeagus stout, sharply bent, acutely pointed; vesica armed with one long stout cornutus and a patch of small spiculate cornuti. Gnathos very broad, strongly spined laterally, weakly spined ventrally.

Female genitalia.—Genital plate membranous except for a narrow, sclerotized anterior band; ostium small, round. Ductus bursae membranous except for a narrow sclerotized band before ostium and a sclerotized, dilated portion well before the inception of ductus seminalis. Inception of ductus seminalis just before the sclerotized band which precedes the ostium. Branches of signum 19 to 20 on each side; the entire inner surface of the signum-bearing half of the bursa copulatrix strongly spiculate.

Alar expanse, 13–17 mm.

Type.—In the British Museum.

Type locality.—Ohio.

Food plant.—Oak; chestnut?

Distribution.—Eastern and southern United States.

286614—41——12

United States records

District of Columbia: 13 ♂♂, 9 ♀♀ (July and August dates, 1899–1900, A. Busck).

Illinois: Decatur, 2 ♂♂ ("May 16–23"); Putnam County, ♂ (14–VIII–1939, M. O. Glenn).

Maryland: Hyattsville, ♂, ♀ ("1907," A. Busck); Plummers Island, 6 ♂♂, 4 ♀♀ (May, June, July, September dates, A. Busck).

Massachusetts: Marthas Vineyard, 3 ♂♂ (VII–15 to VII–29–1931, F. M. Jones).

Missouri: St. Louis, ♂ (V–15–1904, H. McElhose); "central Missouri" ♀♀ ("4–14–84," "5–5–89").

New Jersey: Anglesea, ♀ (V–30–05, W. D. Kearfott); Essex County Park, ♀♀ (26–IX–02, W. D. Kearfott).

Ohio: Cincinnati, 3 ♂♂, 2 ♀♀ (V–29–06, V–21–07, VI–9–07, VIII–10–14, A. F. Braun).

Pennsylvania: Nicholson, ♂ (VII–4–1904, A. E. Lister).

Texas: Kerrville, 2 ♂♂, 2 ♀♀ (IV–11–1907, F. C. Pratt); ♂, "Texas" ("18–5," Belfrage).

Virginia: Cape Henry, ♀ (8–9–27, A. Busck); Falls Church (♂, 2 ♀♀, 22–29–VII–1914, Carl Heinrich); ♂ (June 2, 1920, Kneale and Heinrich).

Remarks.—The distinguishing characters of this and *quercicella* have been discussed under the latter.

Although *obsoletella* and *quercicella* cover much of the same range, the former appears to be the more widely distributed of the two. Much more rearing must be done to establish the limits of both.

PSILOCORSIS CRYPTOLECHIELLA (Chambers)

Depressaria cryptolechiella Chambers, Can. Ent., vol. 4, p. 91, 1872.—Busck, Proc. Ent. Soc. Washington, vol. 5, p. 206, 1903.

Hagno cryptolechiella (Chambers) Chambers, Can. Ent., vol. 4, p. 131, 1872.—Braun, Trans. Amer. Ent. Soc., vol. 49, p. 350, 1924.

Cryptolechia cryptolechiella (Chambers) Chambers, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 116, 1878.—Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 197, 1922.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8474, 1939.

Psilocorsis cryptolechiella (Chambers) Kearfott, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6391, 1903.—Busck, Proc. U. S. Nat. Mus., vol. 35, p. 197, 1908.—Barnes and McDunnough, Check list of the Lepidoptera of Boreal America, No. 6432, 1917.—Forbes, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 236, 1923.

Cryptolechia cryptolechiaeella Chambers, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 84, 137, 1878.

Cryptolechia quercicella Walsingham (part) (not Clemens), Ins. Life, vol. 2, p. 151, 1889.—Riley (part), *in* Smith, List of the Lepidoptera of Boreal America, No. 5223, 1891.—Busck (part), *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5851, 1903.

Alar expanse, 15 mm.

Type.—Lost.

Type locality.—Kentucky?

Food plant.—Holly?

Remarks.—This species is unknown to me, but I am retaining the name for the present in anticipation of the rediscovery of the species.

It appears to be nearest to, if not synonymous with, *obsoletella.* For the sake of completeness I give a copy of the original description:

"Third joint of the palpi black, with a narrow longitudinal white line on each side. Second joint pale yellow with a narrow longitudinal black line beneath. Antennae pale yellow, checkered above with black and with a narrow longitudinal black line on each side of the basal portion. Head, thorax and base of the anterior wings dull reddish-orange; anterior wings to the naked eye, pale golden, with the lustre of "watered" silk, produced by a multitude of transverse, narrow, wavy, dark brown lines, as seen under the lens; six small dark brown spots in a row around the apex, to the naked eye appearing like a narrow marginal line. Ciliae pale fuscous, with a silvery lustre and a somewhat darker hinder marginal line at their base. Hind wings yellowish-white with a silky lustre."

PSILOCORSIS DUBITATELLA (Zeller)

Cryptolechia (*Psilocorsis*) *dubitatella* Zeller, Hor. Soc. Ent. Ross., vol. 13, p. 262, 1877.

Cryptolechia dubitatella (Zeller) Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 197, 1922.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Mierolepidoptera), No. 8469, 1939.

Psilocorsis dubitatella (Zeller) Busck, Proc. Ent. Soc. Washington, vol. 5, p. 206, 1903.—Kearfott, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6393, 1903.—Busck, Proc. U. S. Nat. Mus., vol. 35, p. 197, 1908.—Barnes and McDunnough, Check list of the Lepidoptera of Boreal America, No. 6429, 1917.—Forbes, Cornell Univ. Agr. Exp. Stat. Memoir. 68, p. 236, 1923.

Cryptolechia quercicella Walsingham [not Clemens], Ins. Life, vol. 2, p. 151, 1889.—Riley, *in* Smith, List of the Lepidoptera of Boreal America, No. 5223, 1891.—Busck, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5851, 1903.

Alar expanse, 16 mm. (3¾″″).

Type.—Zoological Museum, Berlin.

Type locality.—"North America."

Food plant.—Unknown.

Remarks.—I do not know this species. Following is a copy of the original description:

"Capillis et thorace ochraceis, palpis linea longitudinali nigra signatis; alis ant. subelongatis, ochraceis, obsolete transverse strigulatis, puncto venae transversae obsoleto fusco, nebula cinerea inferius addita, punctis marginalibus nigris superius majusculus, ciliis fusco-cinereis. ♀."

There seems to be considerable difference of opinion regarding the proper placement of this species. Walsingham considers it a synonym of *quercicella* and Forbes suggests its synonymy with *obsoletella.* I

am inclined to believe that the latter view is correct, but we must wait for a more careful study of the type and the discovery of the larva to settle the matter.

PSILOCORSIS REFLEXELLA Clemens

PLATE 22, FIGURE 131; PLATE 40, FIGURE 222

Psilocorsis reflexella CLEMENS, Proc. Acad. Nat. Sci. Philadelphia, vol. 12, p. 213, 1860; *in* Stainton, Tineina of North America, p. 150, 1872.—BUSCK, Proc. Ent. Soc. Washington, vol. 5, p. 207, 1903.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6394, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 197, 1908.—WALSINGHAM, Biol. Centr.-Amer., Lepidoptera-Heterocera, vol. 4, p. 119, 1912.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6427, 1917.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 238, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat. Memoir 101, p. 545, 1928.—PROCTER, Biological survey of the Mount Desert region, Part 6, The insect fauna, p. 274, 1938.

Psilocorsis reflexa CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 162, 1878.

Cryptolechia reflexella (Clemens) CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 137, 1878.—WALSINGHAM, Ins. Life, vol. 2, p. 151, 1889.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5224, 1891.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5852, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 197, 1922.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8467, 1939.

Cryptolechia cressonella CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 86, 1878.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8467, 1939 (cited as synonym of *C. reflexella* (Clemens)).

Head ferruginous-brown. Labial palpus light ochreous with the usual dark stripes; second segment with some fuscous shading exteriorly.

Thorax and fore wing ochreous strongly overlaid and mottled with reddish fuscous; inner and outer discal spots usually ill defined, blackish fuscous; terminal row of spots confluent forming a narrow, poorly defined blackish-fuscous line; cilia yellowish fuscous with a dark subbasal band. Hind wing and cilia yellowish fuscous, the cilia with a dark subbasal line. Legs whitish ochreous suffused with dull fuscous. Abdomen fuscous above and whitish ochreous beneath.

First abdominal segment simple.

Male genitalia.—Harpe moderately clothed with hair; sacculus narrow, weakly sclerotized. Anellus a broad, oval, cupped plate, strongly sclerotized basally; lateral lobes greatly exceeding central plate, slender, no thicker distally than basally. Aedeagus stout, sharply bent, pointed; vesica armed with one large, stout cornutus and a patch of strong, but smaller ones. Vinculum with a pointed dorsoanterior process.

Female genitalia.—Genital plate narrow, membranous except for a broad, sclerotized, anterior band. Ostium round. Ductus bursae membranous except for a large dilated, partially sclerotized portion immediately preceding the ostium; ductus seminalis spiculate on inner surface and entering ductus bursae just anterior to ostium. Branches of signum 22–24 on each side; signum-bearing half of bursa copulatrix spiculate.

Alar expanse, 18–25 mm.

Type.—In the Academy of Natural Sciences of Philadelphia.

Type locality.—"Pennsylvania."

Food plant.—Unknown.

Distribution.—Eastern United States.

United States records

District of Columbia: ♂, ♀ ("1906," A. Busck); ♀ (May 19, 1902, A. Busck); ♂ (Sept. 20/34, no collector); ♀ (6–15–06, Charles R. Ely).

Illinois: Putnam County, ♂ (13–VI–1936, M. O. Glenn).

Maine: Mount Desert (May 24).

Maryland: Plummers Island, ♂ (June 1903, A. Busck); 2 ♀♀ (1903, 1904, Barber and Schwarz).

Massachusetts: Boston, ♀ (Beutenmüller); Cohasset, ♂ (July 6, 1909, Owen Bryant).

New Hampshire: Hampton, ♂ (6–9–1904, S. A. Shaw).

New Jersey: Anglesea, 6 ♂♂, 2 ♀♀ (3–30–V–1905, W. D. Kearfott); Essex County Park, 2 ♂♂ ("May 20" and "6–19–99," W. D. Kearfott); Greenwood Lake, ♂ ("V–30," W. D. Kearfott).

New York: ♂ ("1906," Walsingham); ♂ (Beutenmüller).

Pennsylvania: Beaver County, ♂, ♀ (May, 1900, Kemp); New Brighton, 13 ♂♂, 7 ♀♀ (May and June, 1902–1906, H. D. Merrick); Pittsburgh, ♂, 2♀♀ (VII–12–06; VI–11–05, Henry Engle).

Virginia: Mountain Lake, ♂ (June 14–21, 1907, A. F. Braun).

Remarks.—In addition to the above I have before me a single male from Putnam Company, Ill. (13 June 1936, M. O. Glenn), which appears to belong here. The specimen is, however, heavily overlaid with fuscous scales and may be another species.

This is the largest species of this genus from North America and is usually readily recognized by its size. It is the only described species for which we have no definite host record.

PSILOCORSIS FAGINELLA (Chambers)

PLATE 22, FIGURE 134; PLATE 40, FIGURES 217, 218

Hagno faginella CHAMBERS, Can. Ent., vol. 4, p. 131, 1872; vol. 6, p. 131, 232, 1874.

Cryptolechia faginella (Chambers) CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 84, 120, 137, 1878.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 197, 1922.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8472, 1939.

Psilocorsis faginella (Chambers) BUSCK, Proc. Ent. Soc. Washington, vol. 5, p. 206, 1903.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6392, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 197, 1908.—WALSINGHAM, Biol. Centr.-Amer., Lepidoptera-Heterocera, vol. 4, p. 118, 1912.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6428, 1917.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 236, 1923.—PROCTER, Biological survey of the Mount Desert region, Part 6, The insect fauna, p. 274, 1938.

Cryptolechia quercicella, WALSINGHAM, part (not Clemens), Ins. Life, vol. 2, p. 511, 1889.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5223, 1891.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5851, 1903.

Cryptolechia ferruginosa ZELLER, Verh. zool.-bot. Ges. Wien, vol. 23, p. 243, 1873.—CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 137, 1878.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5219, 1891.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5847, 1903; Proc. Ent. Soc. Washington, vol. 5, p. 205, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 197, 1922.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8468, 1939. (New synonymy.)

Psilocorsis ferruginosa (Zeller) KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6395, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol 35, p. 197, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6430, 1917.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 236, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat., Memoir 101, p. 545, 1928.

Labial palpus and head ochreous-yellow (typical dark stripes present on palpus). Thorax and fore wing brownish ochreous, the latter lightly irrorated with brown (some specimens lighter in color, with little or no brown irroration); inner and outer discal spots blackish fuscous, the former usually inconspicuous, the latter well defined; around termen a row of five or six small blackish-fuscous spots. Hind wing and cilia yellowish fuscous. Legs whitish ochreous, lightly suffused with brown. Abdomen light yellowish brown above, whitish ochreous beneath.

First abdominal segment simple.

Male genitalia.—Harpe moderately clothed with hairs; sacculus narrow, weakly sclerotized. Anellus an oval, deeply cupped plate; base strongly sclerotized; lateral lobes stout, exceeding the central plate. Aedeagus large, stout, sharply bent, pointed; vesica armed with one large cornutus and a long, narrow patch of strong slender ones. Vinculum with a prominent, broad, pointed dorsoanterior process.

Female genitalia.—Genital plate membranous except for a moderately broad, strongly sclerotized anterior band, which is slightly broader laterally than centrally. Ductus bursae dilated and strongly sclerotized at ostium. Inception of ductus seminalis at about middle of the sclerotized part of ductus bursae; inner surface of ductus seminalis finely spiculate. Signum with 19 to 21 branches on each side; signum-bearing half of bursa strongly spiculate.

Alar expanse, 18–23 mm.

Type.—In Museum of Comparative Zoology, Cambridge, Mass. (*faginella*); in British Museum (*ferruginosa*).

Type localities.—Kentucky (*faginella*); Ohio (*ferruginosa*).

Food plant.—*Fagus grandifolia* Ehrh.

Distribution.—Eastern United States.

United States records

Delaware: Lowes, ♂ (8–8–35, Donald McCreary).

Louisiana: East Baton Rouge Parish, 2 ♀♀ (24–VIII–1923, T. H. Jones and W. G. Bradley).

Maine: Augusta, 3 ♂♂, 2 ♀♀ (February 1931 [indoor record?]); Aurora, 3 ♂♂, 4 ♀♀ (13–16–VI–32; 6–4–31 [Gip. Moth Lab. No. 12164–S185]); Bar Harbor (June 2–12).

New Hampshire: Dublin, ♀ (A. Busck); Hampton, ♀ (VI–25–1907, S. A. Shaw).

Ohio: Cincinnati, ♀ (VIII–11–1917, A. F. Braun).

Vermont: One male; no further data.

Remarks.—I have placed *ferruginosa* as a synonym of *faginella*, since, aside from the coloration (*ferruginosa* is lighter than *faginella*) there are no differences between the two. Both have the same food plant and distribution.

PSILOCORSIS CARYAE, new species

PLATE 22, FIGURE 132; PLATE 40, FIGURE 219

Psilocorsis cryptolechiella BRIMLEY (not Chambers), The insects of North Carolina, p. 304, 1938.

Labial palpus with the second segment sordid whitish ochreous shaded with grayish fuscous exteriorly; a fuscous longitudinal line beneath, narrowly bordered laterally with whitish; third segment fuscous with a whitish tip, and a narrow whitish line on each side. Face, head, and basal segment of antenna above dark yellow-brown to light fuscous; underside of basal segment of antenna fuscous with two longitudinal whitish lines; remainder of antenna checkered with white and fuscous, less distinctly so and lighter toward the extremity. Thorax and base of fore wing deep brown. Fore wing light yellowish fuscous strongly overlaid with deep brown. Thorax and fore wing with a purplish luster; inner and outer discal spots and an indistinct row of spots around termen blackish fuscous; cilia light fuscous. Hind wing shining yellowish fuscous (with a brassy appearance), darker apically; cilia light fuscous with a darker subbasal band. Legs whitish ochreous suffused with light fuscous. Abdomen yellowish fuscous above, whitish ochreous beneath.

First abdominal segment simple.

Male genitalia.—Harpe long and slender, cucullus pointed. Anellus a lightly sclerotized plate with slender digitate lateral processes, the latter not exceeding the posterior edge of the central plate. Aedeagus stout, sharply bent, sharply pointed; vesica armed with one large, sharply pointed cornutus and a narrow, elongate patch of smaller ones. Vinculum rounded with a well-developed, pointed dorsoanterior process.

Female genitalia.—Ostium large, oval. Genital plate membranous except for a narrow, sclerotized anterior band. Ductus bursae dilated and strongly sclerotized before ostium, otherwise slender and membranous; inception of ductus seminalis just before ostium. Signum with 17–21 branches on each side; signum-bearing half of bursa copulatrix strongly spiculate.

Alar expanse, 15–18 mm.

Type.—U.S.N.M. No. 52866.

Type locality.—Cuero, Tex. (September 13, 1910, M. M. High).

Food plants.—*Carya pecan* Aschers. and Graebn. and *Carya ovata* (Mill.) Koch.

Remarks.—Described from the ♂ type and 17 ♂ and 11 ♀ paratypes as follows: Cuero, Tex., 8 ♂ ♂ and 8 ♀ ♀ (June, July, and September dates, 1910, M. M. High); San Antonio, Tex., 3 ♂ ♂ (July 14–24, 1908, McMillan); Norfolk, Va., ♂ (September 13, 1910, M. M. High), all reared from pecan; Winfield, La., ♂ (June 16–23); Monticello, Fla., 3 ♀ ♀ (June 23, 1914, A. I. Fabis; April 8–9, 1915, John B. Gill) reared from hickory.

Paratypes in the U. S. National Museum, Canadian National, and H. H. Keifer collections.

With the exception of *fletcherella* this is the darkest species of the genus described from North America. It may be distinguished from *fletcherella* by its smaller size and the larger number of branches on each side of the signum. In female genitalia *caryae* more closely resembles *faginella* from which it may be distinguished by the more strongly sclerotized portion of the ductus bursae.

PSILOCORSIS FLETCHERELLA Gibson

PLATE 40, FIGURE 221

Psilocorsis fletcherella GIBSON, Ottawa Nat., vol. 22, p. 226, 1909.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6431, 1917.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 236, 1923.

Cryptolechia fletcherella (Gibson) MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 197, 1922.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States (Part 2, Microlepidoptera), No. 8470, 1939.

Cryptolechia quercicella GIBSON (not Clemens), Can. Ent., vol. 40, p. 84, 1908.

Palpus, exclusive of the usual dark stripes, whitish ochreous. Head, thorax, and fore wing yellowish strongly overlaid with brown and

having a purplish tinge; inner and outer discal spots and a row of five or six terminal spots blackish fuscous; the first discal and the terminal row of spots sometimes ill defined. Hind wing and cilia light brown, the latter with a narrow yellowish basal line. Legs and underside of abdomen whitish ochreous. Abdomen brown above.

Female genitalia.—Genital plate membranous except for a narrow, sclerotized anterior band. Ostium round. Ductus bursae dilated near ostium; membranous except for a narrow sclerotized ring before ostium and a small sclerotized plate before inception of ductus seminalis; ductus seminalis and area of ductus bursae immediately surrounding its inception finely spiculate. Branches of signum 15 to 16 on each side; signum-bearing half of bursa copulatrix strongly spiculate on inner surface.

Alar expanse, 19 mm.

Type.—In the United States National Museum.

Type locality.—Ottawa, Ontario, Canada.

Food plant.—Populus tremuloides Michx.

Distribution.—Eastern Canada and probably northeastern United States.

Canadian records

Ontario: Ottawa, 2 ♀♀ (10–VI–1909, A. Gibson); Merivale (2–VII–1935, T. N. Freeman).

Quebec: Meach Lake (13–VI–1906, July 1906, 30–VI–1937, C. H. Young); Wakefield (13–VII–1925, F. P. Ide).

Remarks.—I have not seen the specimens, nor do I know the sexes of the specimens from Merivale, Meach Lake, and Wakefield, but the identification is presumably correct.

10. Genus INGA Busck

PLATE 1, FIGURE 7; PLATE 5, FIGURE 37; PLATE 12, FIGURES 80, 80a; PLATE 14, FIGURE 89

Inga BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 200, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6483, 1917.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 243, 1923.—BRIMLEY, The insects of North Carolina, p. 304, 1938. (Genotype: *Anesychia sparsiciliella* Clemens, Proc. Ent. Soc. Philadelphia, vol. 2, p. 430, 1864.)

Antenna slender, strongly ciliate in male, smooth in female; basal segment without pecten. Labial palpus long, slender, recurved, reaching well above apex; terminal segment slightly longer than second, the latter thickened with closely appressed scales, roughened in front.

Fore wing elongate; length nearly 3 times the width; costa slightly arched; apex blunt; termen oblique, straight; 12 veins; 7 and 8 stalked, both to costa or apex, or with 7 to termen scarcely below apex.

Hind wing as broad as forewing; 8 veins; 3 and 4 connate or stalked; 6 and 7 somewhat divergent; 5 approximate to 4. Abdomen not depressed.

Male genitalia.—Harpe with sacculus very broad, deeply folded, heavily sclerotized and clothed with long coarse hairs. Clasper long, reaching to or beyond costa, usually dilated distally with apex armed with short, stout spines. Cucullus narrow, lightly sclerotized, clothed with fine hairs; apex rounded. Anellus broad, without lateral processes; lateral lobes weakly developed, with few hairs. Aedeagus long, slightly curved, apex pointed. Vinculum broad, rounded. Transtilla membranous with weak lateral hairy lobes. Gnathos long, bluntly pointed. Uncus well developed, elongated, narrowly pointed, moderately clothed with hairs.

Female genitalia.—Ductus bursae membranous or narrowly sclerotized just before ostium. Signum present or absent.

Remarks.—Meyrick [42] has synonymized *Inga* with *Cryptolechia*, but the two are sufficiently distinct to justify their separation. The male genitalia of *Cryptolechia* show a tubular anellus, spined, broad gnathos and spoon-shaped uncus, together with minor differences. These characters, when compared with the description and figure of *Inga*, will serve to distinguish between the two.

As a means of separating the oecophorid genera, Busck, Meyrick, and others have used the direction of vein 7 of the fore wing (to termen, to apex, or to costa). For the most part this character serves for separating the genera into two groups, but in this genus we find all conditions existing. In *sparsiciliella*, *obscuromaculella*, *canariella*, and *concolorella* 7 is distinctly to costa but in *cretacea* and *ciliella* it goes to the termen scarcely below the apex. Normally veins 2 and 3 of the forewing are widely separated but in some specimens may be either connate or short-stalked.

In view of the fact that aberrations in venation occur here and that the genitalia indicate that the species are unmistakably congeneric, we may well associate them.

On the abdominal segments of the males of *concolorella* and *ciliella* and the females of *canariella* there are spines such as are commonly found in the Blastobasidae. The spines in *Inga*, however, differ from those found in the Blastobasidae by being dilated toward their extremities; those of the Blastobasidae (studied) are evenly tapered to a sharp point. The spines of *Inga* are, in most cases, readily deciduous, those of Blastobasidae more firmly attached.

Busck [43] erected this genus for *Anesychia sparsiciliella* Clemens. As already pointed out Meyrick considered the genus synonymous with

[42] Meyrick, E., *in* Wytsman, Genera insectorum, fasc. 180, p. 195, 1922.
[43] Busck, A., Proc. U. S. Nat. Mus., vol. 35, p. 200, 1908.

Cryptolechia. With this one exception *Inga* has been considered a valid genus with the genotype as the only species. From *Machimia* (*sensu* Meyrick) I am transferring *cretacea* (Zeller), *canariella* (Busck), *obscuromaculella* (Chambers), *concolorella* (Beutenmüller), *ciliella* (Busck), and *humata* (Meyrick) and from *Cryptolechia* (*sensu* Meyrick), *trigama* (Meyrick) to *Inga*, bringing to eight the total number of North American species referable to this genus.

KEY TO THE SPECIES OF INGA BASED PRIMARILY ON COLORATION

1. Fore wing yellow---- **canariella** (Busck) (p. 222)
   Fore wing otherwise---- 2
2. Fore wing white or whitish---- 3
   Fore wing otherwise---- 4
3. Costa of fore wing with a conspicuous black spot **sparsiciliella** (Clemens) (p. 222)
   Costa of fore wing without such spot---- **cretacea** (Zeller) (p. 225)
4. Antennal ciliations 5 [44]---- **humata** (Meyrick) (p. 220)
   Antennal ciliations otherwise---- 5
5. Antennal ciliations ½---- **trigama** (Meyrick) (p. 224)
   Antennal ciliations otherwise---- 6
6. Alar expanse less than 15 mm---- **obscuromaculella** (Chambers) (p. 226)
   Alar expanse more than 15 mm---- 7
7. Labial palpus whitish ochreous; basal three-fifths of second segment blackish fuscous---- **ciliella** (Busck) (p. 227)
   Labial palpus grayish fuscous---- **concolorella** (Beutenmüller) (p. 221)

KEY TO THE SPECIES OF INGA BASED PRIMARILY ON MALE GENITALIA

1. Abdomen spined---- 2
   Abdomen not spined---- 3
2. Clasper curved, very thick, heavily spined (fig. 128)---- **ciliella** (Busck) (p. 227)
   Clasper straight, slender basally, abruptly dilated and finely spined apically (fig. 129)---- **concolorella** (Beutenmüller) (p. 221)
3. Clasper slender, bluntly pointed, extending little beyond middle of harpe (fig. 127)---- **canariella** (Busck) (p. 222)
   Clasper slender or stout, dilated distally, and extending at least to costa (figs. 80, 126, 130)---- 4
4. Clasper strongly spined down to sacculus (fig. 130) **cretacea** (Zeller) (p. 225)
   Clasper with few or no spines as far down as sacculus (figs. 80, 126)---- 5
5. Clasper stout, hardly reaching costa (fig. 80)---- **sparsiciliella** (Clemens) (p. 222)
   Clasper slender, reaching beyond costa (fig. 126) **obscuromaculella** (Chambers) (p. 226)

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[44] The antennal ciliations of Meyrick (the relation of the length of the cilia to the width of the antennal shaft) are used here because both *humata* and *trigama* are known only from unique males and this character is the only one which can be used safely. None of the other species has antennal cilia as long as 5 or as short as ½.

KEY TO THE SPECIES OF INGA BASED PRIMARILY ON FEMALE GENITALIA

1. Signum present ---------- 2
   Signum absent ---------- 4
2. Signum minute[45]; a narrow sclerotized ring before ostium (fig. 206) ---------- **obscuromaculella** (Chambers) (p. 226)
   Signum well developed; ring before ostium broad or narrow ---------- 3
3. Sclerotized ring before ostium broad (fig. 209) ---------- **ciliella** (Busck) (p. 227)
   Sclerotized ring before ostium narrow (fig. 210) ---------- **cretacea** (Zeller) (p. 225)
4. Abdomen strongly spined ---------- **canariella** (Busck) (p. 222)
   Abdomen not spined ---------- 5
5. Sclerotized ring before ostium broad (fig. 208) **concolorella** (Beutenmüller) (p. 221)
   Sclerotized ring before ostium narrow (fig. 89) **sparsiciliella** (Clemens) (p. 222)

INGA HUMATA (Meyrick), new combination

Machimia humata MEYRICK, Exotic Microlepidoptera, vol. 1, p. 181, 1914; *in* Wytsman, Genera insectorum, fasc. 180, p. 82, 1922.—McDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8387, 1939.

Cryptolechia humata (Meyrick) BARNES and McDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6420, 1917.

Head whitish gray, somewhat sprinkled with light gray. Palpus ochreous whitish, second segment with the basal three-fifths gray externally. Antennal ciliations 5. Thorax gray irrorated with darker. Abdomen gray. Fore wing pale gray irrorated with dark fuscous; first and second discal spots and an outwardly curved row of spots from two-thirds of costa to two-thirds of inner margin, fuscous; cilia gray. Hind wing and cilia gray.

Alar expanse, 20 mm.

Type.—In the British Museum.

Type locality.—Palmerlee, Ariz.

Food plant.—Unknown.

Remarks.—I know this species from description only and am placing it here on the evidence presented in the description. The dark, lower portion of the second segment of the labial palpus and the pattern indicate that the species belongs in *Inga*. Until the type has been examined and a final disposition of the species has been made we can refer it to this genus.

[45] A single female of this species is available for study. The bursa of this specimen shows a minute, round signum, which may or may not be present on other specimens.

INGA CONCOLORELLA (Beutenmüller), new combination

PLATE 21, FIGURES 129, 129a; PLATE 39, FIGURE 208

Cryptolechia concolorella BEUTENMÜLLER, Ent. Amer., vol. 4, p. 30, 1888.—WALSINGHAM, Ins. Life, vol. 2, p. 152, 1889.—RILEY, *in* Smith, List of Lepidoptera of Boreal America, No. 5217, 1891.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5845, 1903.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6386, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 195, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6419, 1917.

Machimia concolorella (Beutenmüller) MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 82, 1922.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8386, 1939.

Head, palpus, thorax, abdomen, and fore wing grayish fuscous. Discal dots and an outwardly curved line of spots from two-thirds of costa to two-thirds of inner margin indistinct, fuscous. Legs grayish mottled with fuscous; the fore legs almost wholly overlaid by the latter color.

Male genitalia.—Cucullus broad, rounded; clasper slender basally, broadly dilated, obliquely pointed and reaching well beyond costa; distal surface clothed with fine spines. Anellus a broad sclerotized plate with a deep, median V-shaped excavation; from the posterodorsal edge a broad, flat process, broader distally than proximally; lateral, fleshy lobes moderately well developed, hairy. Aedeagus long, slender, slightly curved, bluntly pointed; dorsal third strongly sclerotized and armed with small teeth. Lateral lobes of transtilla stout, hairy.

Female genitalia.—Genital plate membranous. Ostium round, moderately large. Ductus bursae with a broad, sclerotized ring before ostium. Inception of ductus seminalis well before ostium. Bursa copulatrix sparsely and finely spiculate on inner surface.

Alar expanse, 20–22 mm.

Type.—In the United States National Museum.

Type locality.—Nevada.

Food plant.—Unknown.

Distribution.—Southwestern United States.

United States records

California: San Diego, 5 ♀ ♀ (June 16–July 23).
Nevada: ♂ (no date or collector).

Remarks.—With the type male I associate the five females from California. These agree well with the description and the type, although the latter is somewhat more suffused.

INGA CANARIELLA (Busck), new combination

PLATE 21, FIGURES 127, 127a; PLATE 39, FIGURE 207

Cryptolechia canariella BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 195, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6422, 1917.

Machimia canariella (Busck) MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 82, 1922.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8382, 1939.

Head, palpus, legs, thorax, fore wing, and abdomen yellow. Antenna, palpus and legs mottled with reddish yellow; base of costa of fore wing reddish yellow. Hind wing and cilia whitish yellow; cilia with a darker subbasal line.

Male genitalia.—Harpe slender, long; portion beyond clasper longer than that before; cucullus bluntly pointed; clasper slender, straight, not extending much beyond middle of harpe. Anellus large, triangular, broader distally than basally; lateral lobes near distal end minute. Aedeagus long, slender, gently curved; vesica armed with a small patch of weak spiculate cornuti and one bladelike distal one. Transtilla with small, hairy, papillate lateral lobes.

Female genitalia.—Genital plate membranous; ostium large oval, anterior edge narrowly sclerotized. Ductus bursae membranous; inception of ductus seminalis well before ostium. Bursa copulatrix large; inner surface finely spiculate.

Alar expanse, 21–24 mm.

Type.—In the United States National Museum.

Type locality.—Huachuca Mountains, Arizona.

Food plant.—Unknown.

Distribution.—Known only from the type locality.

United States records

Arizona: Huachuca Mountains, 2 ♂♂, 2 ♀♀ (no date or collector); Palmerlee, Cochise County, ♂ (no date or collector).

INGA SPARSICILIELLA (Clemens)

PLATE 1, FIGURE 7; PLATE 5, FIGURE 37; PLATE 12, FIGURES 80, 80a; PLATE 14, FIGURE 89

Anesychia sparsiciliella CLEMENS, Proc. Ent. Soc. Philadelphia, vol. 2, p. 430, 1864; *in* Stainton, The Tineina of North America, p. 255, 1872.—CHAMBERS, Can. Ent., vol. 12, p. 226, 1880.—BUSCK, Proc. Ent. Soc. Washington, vol. 5, p. 218, 1903.

Anesychia sparcicella CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 129, 1878.

Cryptolechia sparsiciliella (Clemens) BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5844, 1903.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 197, 1922.

Inga sparsiciliella (Clemens) Busck, Proc. U. S. Nat. Mus.,, vol. 35, p. 200, 1908.—Barnes and McDunnough, Check list of the Lepidoptera of Boreal America, No. 6483, 1917.—Forbes, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 243, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat. Memoir 101, p. 546, 1928.—Brimley, The insects of North Carolina, p. 304, 1938.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8466, 1939.

Machimia sparsiciliella (Clemens) Meyrick, Exotic Microlepidoptera, vol. 3, p. 471, 1928.

Cryptolechia contrariella Walker, List of the specimens of lepidopterous insects in the collection of the British Museum, vol. 29, p. 771, 1864.—Walsingham, Proc. Zool. Soc. London, 1880, p. 85.—Kearfott, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6385, 1903.

Inga contrariella (Walker) McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8466, 1939 (cited as synonym of *I. sparsiciliella* (Clemens)).

Inga atropicta (Zeller) McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8466, 1939 (cited as synonym of *I. sparsiciliella* (Clemens)).

Cryptolechia inscitella Walker, List of the specimens of lepidopterous insects in the collection of the British Museum, vol. 29, p. 772, 1864.

Cryptolechia atropicta Zeller, Verh. zool.-bot. Ges. Wien, vol. 25, p. 343, 1875.—Riley, *in* Smith, List of the Lepidoptera of Boreal America, No. 5216, 1891.

Ground color of labial palpus, basal fourth of antenna, head, thorax, and fore wing white. Basal half of labial palpus outwardly blackish fuscous. Outer three-fourths of antenna brownish fuscous. Base of costa, and extreme edge to beyond middle, inner angle, discal spot at basal third and a conspicuous large costal spot reaching middle of wing, black or blackish fuscous. From the middle outer edge of the large costal spot a broken, outwardly curved, narrow, blackish-fuscous line to vein 6, then the line is inwardly curved to inner margin at outer third; cilia with some brownish scales mixed. Hind wing and cilia brownish fuscous. Legs brownish fuscous.

Male genitalia.—Portion of harpe beyond clasper as long as that before; clasper dilated distally, nearly attaining costa and clothed with short stout spines in distal half. Anellus broad with a deep V-shaped median excavation; lateral lobes weak; a well developed, pointed, dorsoanterior process. Aedeagus long, slender; vesica with an elongate, narrow, weakly sclerotized bar.

Female genitalia.—Genital plate membranous; ostium round; ductus bursae membranous except for a narrow sclerotized band just before ostium. Inception of ductus seminalis well before ostium. Bursa copulatrix large, oval, with smooth or very finely spiculate inner surface.

Alar expanse, 14–19 mm.

Types.—In the Academy of Natural Sciences of Philadelphia (*sparsiciliella*); in British Museum (*contrariella*, *inscitella*, *atropicta*).

Type localities.—"Virginia" (*sparsiciliella*); ? (*contrariella*, *inscitella*); "North America" (*atropicta*).

Food plant.—Unknown.

Distribution.—New York south to Florida and west to Texas.

United States records

District of Columbia: 2 ♀♀ (no data).
Florida: Altamont, ♂ (21–IX–1924, F. R. Cole); St. Petersburg, 3 ♂♂, ♀ (April); Paradise Key, 2 ♂♂ (3–III–1919, E. A. Schwarz and H. S. Barber).
Georgia: Spring Creek, ♂ (18–V–1916, J. C. Bradley).
Maryland: ♀ (no data).
Mississippi: Ocean Springs, ♀ (29–VI–1921).
New York: ♀ (William Beutenmüller).
North Carolina: Southern Pines, 2 ♀♀ (July 8–15; Aug. 1–7).
Pennsylvania: York, ♀ (W. D. Kearfott).
Texas: Kerrville, ♂, ♀ (May, 1906, F. C. Pratt); Harris County, ♀ (no data); Victoria, ♂ (6–10–18, J. D. Mitchell).
Virginia: Fortress Monroe, ♂ (VII–19–03, W. D. Kearfott).

Remarks.—The white ground color and the contrasting black markings immediately distinguish this from all other species of the genus.

The species is widespread but apparently not common in any one locality. The specimen from Victoria, Tex., is the only reared example I have seen, but its host is not recorded on the label.

INGA TRIGAMA (Meyrick), new combination

Cryptolechia trigama Meyrick, Exotic Microlepidoptera, vol. 3, p. 476, 1928.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8475, 1939.

Head and thorax pale grayish. Palpus whitish with the basal two-thirds of the second segment and basal, median and subapical annuli of terminal segment dark fuscous. Fore wing light gray with some scattered black scales. On costa a black spot at base and before middle, some black scaling beneath and confluent with the latter; inner and outer discal spots black; two strongly angulated series of small black dots crossing wing outwardly; cilia pale gray, with dark basal line. Hind wing and cilia light gray.

Alar expanse, 20 mm.

Type.—In the British Museum.

Type locality.—Fort Davis, Tex., 5,000 feet.

Food plant.—Unknown.

Remarks.—This species is known to me only from the description. I place it here with some hesitation, but its proper assignment can be made only after an examination of the type. On pattern it appears to be near *sparsiciliella*.

INGA CRETACEA (Zeller), new combination

PLATE 21, FIGURES 130, 130a; PLATE 39, FIGURE 210

Cryptolechia cretacea ZELLER, Verh. zool.-bot. Ges. Wien, vol. 23, p. 243, 1873.—WALSINGHAM, Trans. Amer. Ent. Soc., vol. 10, p. 176, 1882.—RILEY, *in* Smith, List of Lepidoptera of Boreal America, No. 5218, 1891.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5846, 1903.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6387, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 195, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6417, 1917.

Machimia cretacea (Zeller) MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 83, 1922.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8388, 1939.

Labial palpus, head, and fore wing white to sordid whitish more or less sprinkled with small brown scales. Basal two-fifths of second segment of labial palpus brown outwardly. Eyes narrowly edged with brown in front. Antenna brown. Base of costa, first and second discal spots, and an outwardly curved subterminal line of spots brown. Hind wing and cilia brownish. Legs whitish strongly overlaid with brown. Abdomen whitish somewhat suffused dorsally with light brown and with more or less brown scaling ventrally.

Male genitalia.—Cucullus rounded, narrow; clasper gently curved, slightly dilated distally, heavily clothed with stout spines (the latter extending inwardly down to sacculus) and extending well beyond costa. Anellus a broad, strongly sclerotized plate with a deep V-shaped median excavation; from posterodorsal margin a broad, spatulate process; lateral lobes weakly developed, moderately hairy. Aedeagus long, slightly curved, pointed; vesica armed with a long, strongly sclerotized bar. Transtilla with long, digitate, hairy, lateral lobes.

Female genitalia.—Genital plate membranous. Ostium large, round. Ductus bursae with a narrow sclerotized plate ventrally just before ostium. Inception of ductus seminalis well before ostium. Bursa copulatrix oval, with few minute spicules on inner surface; signum well developed.

Alar expanse, 14–16 mm.

Type.—In the Museum of Comparative Zoology, Cambridge, Mass.

Type locality.—Texas.

Food plant.—Unknown.

Distribution.—Southern United States.

United States records

Arizona: Palmerlee, 4 ♂♂ (no data or collector).
Kansas: Onaga, ♂ (Crevecoeur, collector).
North Carolina: Southern Pines, 15 ♂♂, 10 ♀♀ (July 15 to August 15).

Texas: Brownsville, ♂ (no data or collector); Kerrville, 5 ♂♂, ♀ (April to August dates, F. C. Pratt); San Benito, ♂ and ♀ (March 16–23; Sept. 8–15); Victoria, ♀ ("3–20," E. A. Schwarz).

Remarks.—This species and *sparsiciliella* are the only two described species of this genus with white or whitish ground color. The black markings of *sparsiciliella* will immediately distinguish it from *cretacea.*

INGA OBSCUROMACULELLA (Chambers), new combination

PLATE 21, FIGURES 126, 126a; PLATE 39, FIGURE 206

Cryptolechia obscuromaculella CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 86, 1878.—RILEY, *in* Smith, List of Lepidoptera of Boreal America, No. 5220, 1891.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5848, 1903.—KEARFOTT, *in* Smith, Check List of the Lepidoptera of Boreal America, No. 6388, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 195, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6418, 1917.

Machimia obscuromaculella (Chambers) MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 82, 1922.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8385, 1939.

Labial palpus, face, and head whitish ochreous to ochreous. Basal three-fifths of second segment of palpus and front around eyes fuscous. Antenna whitish ochreous annulated with fuscous. Thorax and fore wing ochreous strongly irrorated with fuscous; first and second discal spots fuscous; an indistinct, outwardly curved subterminal row of small fuscous spots. Hind wing grayish fuscous. Legs fuscous.

Male genitalia.—Harpe moderately narrow; cucullus bluntly pointed; clasper slender, slightly dilated and clothed with fine spines distally, reaching slightly beyond costa. Anellus broad with a deep V-shaped, median excavation, and a large spatulate process from the dorsoposterior margin; the latter broader distally than proximally; lateral lobes small. Aedeagus long, slender, pointed; vesica armed with a large patch of fine cornuti and a long, strongly sclerotized, irregularly shaped band. Lateral lobes of transtilla moderately large, hairy.

Female genitalia.—Genital plate membranous. Ostium moderately large. Ductus bursae membranous with a narrow sclerotized ring before ostium. Inception of ductus seminalis well before ostium. Bursa copulatrix large, oval with a minute, round signum.

Alar expanse, 14–15 mm.

Type.—In the United States National Museum.

Type locality.—Basque County, Tex.

Food Plant.—Unknown.

Distribution.—This species is known only from Texas.

United States records

Texas: Kerrville, ♂ (IV–12–07, F. C. Pratt); San Antonio, ♀ (June 1899, O. C. Poling).

INGA CILIELLA (Busck), new combination

Plate 21, Figures 128, 128a; Plate 39, Figure 209

Cryptolechia ciliella Busck, Proc. U. S. Nat. Mus., vol. 35, p. 196, 1908.—Barnes and McDunnough, Check list of the Lepidoptera of Boreal America, No. 6423, 1917.

Machimia ciliella (Busck) Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 82, 1922; Exotic Microlepidoptera, vol. 3, p. 471, 1928.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8384, 1939.

Labial palpus, head, face, thorax, and fore wing light ochreous more or less suffused with fuscous scaling. Basal three-fifths of labial palpus blackish fuscous. Antenna blackish fuscous narrowly annulated with brown. Base of costa, first and second discal spots, a poorly defined spot near middle of inner margin, and a more or less well defined undulating, outwardly curved row of spots blackish fuscous; cilia concolorous with fore wing. Hind wing and cilia dark fuscous; cilia with a light basal line. Legs light ochreous strongly overlaid with fuscous, the fore legs more so than the others. Abdomen light ochreous suffused and irrorated with fuscous.

Male genitalia.—Harpe very short; cucullus small, bluntly pointed; clasper large, stout, reaching beyond costa, strongly spined. Anellus large, laterally produced, recurved, forming a semitubular articulation for the aedeagus; dorsoanterior spatulate process well developed; lateral lobes small, hairy, fleshy. Aedeagus slender, long, nearly straight; dorsodistal two-fifths scobinate; vesica armed with a long sclerotized band. Lateral lobes of transtilla well developed, fleshy, hairy.

Female genitalia.—Genital plate membranous. Ostium large round. Ductus bursae with a broad sclerotized band before ostium; ductus seminalis enlarged with its inception well before ostium. Bursa copulatrix with a well developed signum; inner surface finely spiculate.

Alar expanse, 16–23 mm.

Type.—In the United States National Museum.

Type locality.—Baboquivari Mountains, Pima County, Ariz.

Food plant.—Unknown.

Distribution.—Southwestern United States.

United States records

Arizona: Baboquivari Mountains, 9 ♂♂, 3 ♀♀ (July 1903, August 1923, October, November 1924, O. C. Poling; July, August 1916 [no collector]); Palmerlee 3 ♂♂ (no date or collector): Yavapai County, ♂, 3 ♀♀ (no date or collector).

New Mexico: Sapello Cañon, ♂ (7–27–02, Oslar).

Remarks.—Some specimens of this species are rather heavily infuscated and at first may be mistaken for *concolorella* but the genitalia will immediately distinguish the two.

The specimens from the Baboquivari Mountains are consistently lighter than specimens from the other localities.

11. Genus MARTYRINGA Busck

PLATE 1, FIGURE 10; PLATE 5, FIGURE 39; PLATE 11, FIGURES 72, 72a; PLATE 14, FIGURE 90; PLATE 17, FIGURE 107

Martyringa BUSCK, Journ. New York Ent. Soc., vol. 10, p. 96, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, p. 489, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, p. 107, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 190, 1908.—WALSINGHAM, Biol. Centr.-Amer., Lepidoptera-Heterocera, vol. 4, p. 120, 1913.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, p. 160, 1917.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 234, 1923.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 54, 1922.—FLETCHER, Mem. Dept. Agr. India (Ent. Ser.), vol. 11, p. 134, 1929.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 88, p. 96, 1938. (Genotype: *Oegoconia latipennis* Walsingham,Trans. Amer. Ent. Soc., vol. 10, p. 190, 1882.)

Antenna stout (thickened in the male); basal segment without pecten. Labial palpus long, recurved, reaching beyond vertex; second segment thickened and roughened beneath, slightly longer than third.

Fore wing slightly more than three times as long as wide; termen convex; apex rounded; inner margin straight; 11 veins; 1c strong at margin, weaker basally; 2 and 3 coincident; 4 stalked with 2+3; 5 connate or approximate to 4 and parallel to 6; 8 and 9 out of 7; 7 to termen just below apex.

Hind wing as broad as fore wing, costa slightly arched; termen oblique, straight; 7 veins; 3 and 4 coincident; 5 connate with 3+4; 6 and 7 slightly divergent.

Male genitalia.—Clasper absent. Gnathos not spined. Uncus well developed. Anellus membranous, not forming ring around aedeagus.

Female genitalia.—Genital plate sclerotized; ductus bursae strongly sclerotized posterior to inception of ductus seminalis; signum absent.

Remarks.—This genus is closely related to the Asiatic genus *Anchonoma* Meyrick (=*Santuzza* Heinrich). A marked difference, however, exists in the male genitalia. The anellus of *Anchonoma* is

moderately sclerotized basally, and terminates in two long, strongly sclerotized processes, the whole closely attached to the aedeagus. In *Martyringa* the anellus is membranous and the two sclerotized processes of the aedeagus, although closely resembling those of the anellus of *Anchonoma*, cannot be homologized with them. Only one species of *Martyringa* (*latipennis*) is at present recognized.

By the weakness of 1c of the fore wing the genus approaches the Gelechiidae, but on genitalic characters it clearly remains oecophorid.

MARTYRINGA LATIPENNIS (Walsingham)

PLATE 1, FIGURE 10; PLATE 5, FIGURE 39; PLATE 11, FIGURES 72–72a; PLATE 14, FIGURE 90; PLATE 17, FIGURE 107

Oegoconia latipennis WALSINGHAM, Trans. Amer. Ent. Soc., vol. 10, p. 190, 1882.—RILEY, *in* Smith, List of Lepidoptera of Boreal America, No. 5578, 1891.

Martyringa latipennis (Walsingham) BUSCK, Journ. New York Ent. Soc., vol. 10, p. 96, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5476, 1903.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6000, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 190, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6412, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 55, 1922.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 234, 1923; in Leonard, Cornell Univ. Agr. Exp. Stat., Memoir 101, p. 544, 1928.—FLETCHER, Mem. Dept. Agr. India (Ent. Ser.), vol. 11, p. 134, 1929.—BRIMLEY, The insects of North Carolina, p. 302, 1938.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 88, p. 96, 1938.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8380, 1939.

Labial palpus, antenna, head, thorax and legs, and ground color of fore wing pale ochreous. Second segment of labial palpus shaded with fuscous on basal two-thirds outwardly and irrorated basally inwardly; third segment with an indistinct fuscous, subbasal annulus; antenna narrowly annulated with fuscous basally and shaded with fuscous apically; basal segment fuscous above except at extreme tip. Thorax and base of tegula strongly overlaid with fuscous. Ground color of fore wing largely obscured by the fuscous shading; at basal third two large blackish-fuscous spots followed by a broad, pale ochreous dash; at the end of cell a large blackish-fuscous spot; from costa, at beginning of cilia, a transverse, pale ochreous fascia to vein 6, then outwardly angled and curved to inner margin slightly before tornus; termen pale ochreous; cilia grayish fuscous. Hind wing pale cinereous, shaded with fuscous toward apex; terminal edge pale ochreous; cilia grayish fuscous. Legs shaded and banded with fuscous except at joints. Abdomen ochreous, lightly suffused with pale fuscous above; below lighter, sparsely irrorated with fuscous.

Male genitalia.—Harpe elongate, without clasper, sparsely clothed with minute hairs. Anellus membranous. Vinculum produced anteriorly as a spatulate process. Transtilla a weakly sclerotized band. Gnathos bluntly rounded, roughly spoon-shaped. Uncus elongated,

recurved ventrally and terminating in a sharp point; aedeagus long, slender, heavier at the distal end than at the proximal end, terminating in two stout, sharp-pointed processes.

Female genitalia.—Genital plate heavily sclerotized, with a shallow cleft on the posterior margin; posterior part of ductus bursae flattened and broadened; ostium only a narrow horizontal slit; bursa copulatrix small, membranous.

Alar expanse, 15–21 mm.

Type.—In the British Museum.

Type locality.—Not stated.

Food plant.—Unknown.

Distribution.—Eastern United States.

United States records

Connecticut: East River, ♂ (July 7, 1908, Charles R. Ely).

Maryland: Cabin John, ♂ (August 1902, A. Busck); Plummers Island, 37 ♂♂, 5 ♂♂ (July and August dates, 1902–1924, A. Busck; July, 1924, L. J. Bottimer).

New York: Ithaca (*teste* Forbes).

North Carolina: Tryon, 2 ♂♂, ♀ (3–16–VII–1904, Fiske).

Pennsylvania: New Brighton, 5 ♂♂, 2 ♀♀ (July dates, 1903–1907, H. D. Merrick); Nicholson, 10 ♂♂ (July, August 1904, A. E. Lister).

Remarks.—This species is probably more widespread than indicated by present records. According to Mr. Busck the adults fly in the early morning hours after midnight and are, therefore, collected infrequently. Mr. Busck also states that the larva probably will be found in rotten wood.

12. Genus PLEUROTA Hübner

PLATE 1, FIGURE 6; PLATE 5, FIGURE 34; PLATE 12, FIGURES 76, 76a; PLATE 14, FIGURE 87

Pleurota HÜBNER, Verzeichniss bekannter Schmetterlinge, p. 406, 1826.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 191, 1908.—WALSINGHAM, Biol. Centr.-Amer., Lepidoptera-Heterocera, vol. 4, p. 134, 1912.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, p. 160, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 105, 1922; Revised handbook of British Lepidoptera, p. 674, 1928.—FLETCHER, Mem. Dept. Agr. India (Ent. Ser.), vol. 11, p. 180, 1929.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 88, p. 169, 1938. (Genotype: *Phalaena Tinea bicostella* Clerck, Icones insectorum rariorium cum nominibus eorum trivialibus, locisque e C. Linnaei syst. nat. allegatis, pl. 3, fig. 15, 1761.)

Eupleuris HÜBNER, Verzeichniss bekannter Schmetterlinge, p. 406, 1826.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 105, 1922. (Genotype: *Tinea honorella* Hübner, Sammlung europäischer Schmetterlinge, vol. 8, fig. 254, 1796.)

Holoscolia ZELLER, Isis von Oken, vol. 3, p. 190, 1839.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 105, 1922. (Genotype: *Tinea forficella* Hübner, Sammlung europäischer Schmetterlinge, vol. 8, fig. 343, 1796.)

Protasis Herrich-Schäffer, Systematisches Bearbeitung der Schmetterlinge von Europa, vol. 5, p. 40, 1853.—Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 105, 1922. (Genotype: *Protasis punctella* Costa, Fauna del regno di napoli, vol. 2, pl. 4, fig. 2, 1836.)

Head with loosely appressed scales; tongue well developed; antenna finely to strongly ciliated, basal segment with pecten; labial palpus long, porrect; second segment densely clothed with long spreading scales, especially beneath; third segment short, acute. Abdomen strongly spined.

Fore wing elongate, pointed or falcate; termen very oblique; 12 veins; 7 and 8 stalked, 7 to termen; 2–5 approximated, 11 from before middle.

Hind wing ovate, as broad as fore wing; 8 veins; 3 and 4 connate, 6 and 7 subparallel.

Male genitalia.—Harpe without clasper. Anellus with lateral processes well developed. Gnathos well developed, pointed. Uncus well developed.

Female genitalia.—Ductus bursae sclerotized for at least part of its length; inception of ductus seminalis at anterior third of ductus bursae. Signum of bursa copulatrix present.

Remarks.—At present only one recognized American species; *P. albastrigulella* (Kearfott).

Thema Walker (List of the specimens of lepidopterous insects in the collection of the British Museum, vol. 29, p. 802, 1864; genotype: *Thema brevivitella* Walker) and *Phryganeutis* Meyrick (Proc. Linn. Soc. New South Wales, vol. 9, p. 742, 1884; genotype: *Phryganeutis cinerea* Meyrick) have been synonymized with *Pleurota* Hübner, but it does not seem likely that these Australian genera are congeneric with *Pleurota.*

Pleurota can be distinguished from any other North American oecophorid genera by the porrect labial palpus.

PLEUROTA ALBASTRIGULELLA (Kearfott)

Plate 20, Figures 123, 123a; Plate 39, Figure 212

Dorata albastrigulella Kearfott, Can. Ent., vol. 39, p. 8, 1907.

Pleurota albastrigulella (Kearfott) Barnes and McDunnough, Check list of the Lepidoptera of Boreal America, No. 6413, 1917.—Gaede, *in* Bryk, Lepidopterorum catalogus, pt. 88, p. 170, 1938.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8389, 1939.

Pleurota albastrigilella Busck, Proc. U. S. Nat. Mus., vol. 35, p. 191, 1908.

Pleurota albistrigulella Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 107, 1922.

Labial palpus, antenna, head, thorax, and fore wing fuscous overlaid, strigulated, or otherwise marked with white. Second segment of labial palpus white beneath at base; from basal third irrorated and mixed with white scales; third segment white exteriorly. Antenna white beneath. Head and thorax almost entirely overlaid with white. Edge of costa of fore wing white from base to apical third; central portion and apex of wing strongly dusted and overlaid with white; at basal third, in cell, a blackish-fuscous spot followed by a similar one at the end of cell; on vein 1c an elongate, blackish-fuscous spot, slightly nearer the inner and outer discal spot; vein 7 marked with a more or less distinct longitudinal, blackish-fuscous streak; around termen a poorly defined series of blackish-fuscous spots; cilia white with a light fuscous median band. Hind wing grayish fuscous, darker apically; cilia pale fuscous with an indistinct, darker, subbasal band. Legs fuscous marked with silvery white; hind tibia and tarsus ochreous-white, the latter overlaid with fuscous exteriorly except at joints. Abdomen shining grayish fuscous.

Male genitalia.—Harpe slender, rather abruptly narrowed beyond middle; cucullus narrowly rounded. Anellus with a narrow, strongly sclerotized portion and long, slender, bluntly pointed lateral processes. Aedeagus slender, curved, somewhat dilated at each end; vesica armed with a few weakly sclerotized, short cornuti and with a small weakly sclerotized folded area. Vinculum narrowly rounded. Gnathos long, beaked, pointed, with a scobinate posterior surface. Uncus stout, pointed.

Female genitalia.—Genital plate membranous. Ostium large, oval, transverse. Ductus bursae depressed and sclerotized in posterior third; inception of ductus seminalis at anterior third. Bursa copulatrix large, oval, elongate; signa consisting of two slender, thornlike processes from posterior surface of bursa, and a transverse, lunate plate slightly posterior to middle of bursa; at right angles to the long axis of the plate, one third from each end of inner surface, two flattened, pointed processes.

Alar expanse, 15–20 mm.

Type.—In the United States National Museum.

Type locality.—Placer County, Calif.

Food plant.—Unknown.

Distribution.—Southwestern United States.

United States records

Arizona: Pinal Mountains, alt. 5,000 feet, ♀ (May 15, 1925, O. C. Poling).

California: Camp Baldy, San Bernardino Mountains, ♂, ♀ (June 24–30, July 16–23); Gavilan Hills, Riverside, ♂ (2–V–1935, C. M. Dammers); Havilah, 2 ♂♂ (June 1–7); Los Angeles, ♂ ("IV–22," O. Buchholz); San Diego, ♂, ♀ (8–12–V–1907, W. S. Wright), ♂ ("9–V–23," no collector), 2 ♂♂ (no date, Ricksecker); Shingle Springs, El Dorado County, 6 ♂♂ (16–V–1931, 7–V–1934, H. H. Keifer).

13. Genus CARCINA Hübner

PLATE 1, FIGURE 9; PLATE 5, FIGURE 36; PLATE 11, FIGURES 71, 71a; PLATE 14, FIGURE 88

Carcina HÜBNER, Verzeichniss bekannter Schmetterlinge, p. 410, 1826.—REBEL, *in* Staudinger and Rebel, Catalog der Lepidopteren des palaearctischen Faunengebietes, vol. 2, p. 175, 1901.—WALSINGHAM, Biol. Centr.-Amer., Lepidoptera-Heterocera, vol. 4, p. 126, 1912.—BUSCK, Can. Ent., vol. 53, p. 277, 1921.—BLACKMORE, Report of the Provincial (British Columbia) Museum of Natural History for the year 1920, pp. 23, 31, 1921.—MEYRICK, *in* Wytsman, Genera insectorum, fasc., 180, p. 159, 1922.—FLETCHER, Mem. Dept. Agr. India (Ent. Ser.), vol. 11, p. 40, 1929.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 251, 1939. (Genotype: *Pyralis quercana* Fabricius, Systema entomologiae, p. 652, 1775.)

Phibalocera STEPHENS, Illustrations of British entomology, Haustellata, vol. 4, p. 192, 1834. (Genotype: *Pyralis quercana* Farbricius, Systema entomologiae, p. 652, 1775.)

Head with appressed scales; tongue developed; antenna longer than fore wing, thick, simple; basal segment with pecten. Labial palpus long, recurved; second segment thickened with appressed scales; terminal segment shorter than second.

Fore wing broad, termen oblique, straight, 12 veins; 2 from well before angle, 3 and 4 stalked, 5 and 6 parallel, 7 and 8 stalked, 7 to termen, 11 from before middle.

Hind wing nearly as wide as fore wing; 8 veins; 3 and 4 stalked; 6 and 7 divergent toward apex.

Male genitalia.—Cucullus divided; clasper absent. Anellus with lateral processes. Vesica armed. Gnathos and uncus well developed, the former unspined.

Female genitalia.—Ductus bursae membranous. Inception of ductus seminalis adjacent to ostium. Signum present.

Larva.—Characters essentially as in *Agonopterix*: ninth abdominal segment with setae I and II well separated; seta VI not on same pinaculum with IV and V, remote from VII. Setal group VII bisetose on first and seventh, unisetose on eighth and ninth abdominal segments. Ocelli normal. Submentum without pit.

Pupa.—Smooth except for a fringe of hair on dorso- and laterocaudal margins of seventh abdominal segment. Prothoracic femora and labial palpi not exposed. Cremaster present but greatly reduced.

Remarks.—This genus may be distinguished from the other genera of North American oecophorids by the antenna which exceeds the length of the fore wing.

The presence of a short (vestigial) cremaster in the pupa will distinguish *Carcina* from *Machimia.*

CARCINA QUERCANA (Fabricius)

Pyralis quercana Fabricius, Systema entomologiae, p. 652, 1775; Entomologia systematica, vol. 3, p. 271, 1793.

Phalaena quercana (Fabricius) Donovan, The natural history of British insects, vol. 3, p. 93, pl. 106, fig. 3, 1794.

Tortrix quercana (Fabricius) Haworth, Lepidoptera Britannica, 1811.

Carcina quercana (Fabricius) Heinemann, Die Schmetterlinge Deutschlands und der Schweiz, vol. 2, p. 362, 1870.—Rössler, Jahrb. nassau. Vereins Naturk., vol. 33, p. 282, 1881.—Snellen, Die Vlinders van Nederland, vol. 2, p. 609, 1882.—Steudel and Hoffmann, Württemberg. Vereins vaterl. Naturk., vol. 38, p. 206, 1882.—Jourdheuille, Mém. Soc. Acad. l'Aube, vol. 47, p. 188, 1883.—Bau, Handbuch für Schmetterlings-Sammler, p. 358, 1886.—Sorhagen, Die Kleinschmetterlinge der Mark Brandenburg, p. 216, 1886.—Failla-Tedaldi, Nat. Siciliano, vol. 8, p. 186, 1889.—Rebel, Verh. zool.-bot. Ges. Wien, vol. 42, p. 530, 1893.—Meyrick, A handbook of British Lepidoptera, p. 613, 1895.—Reutti, Verh. Naturw. Vereins Karlsruhe, vol. 12, p. 237, 1898.—Seebold, Deutsche Ent. Zeitschr., Iris, vol. 11, p. 317, 1898.—Caradja, Deutsche Ent. Zietschr., Iris, vol. 12, p. 207, 1899.—Stange, Die Tineinen der umgegend von Friedland in Mecklenberg, p. 34, 1899.—Rebel, *in* Staudinger and Rebel, Catalog der Lepidoptern des palaearctischen Faunengebietes, vol. 2, No. 3323, 1901.—Caradja, Bull. Soc. Sci. Bucarest, vol. 10, p. 155, 1901.—Sorhagen, Allgemeine Zeitschr. Ent., vol. 7, p. 77, 1902.—Disqué, Deutsche Ent. Zeitschr., Iris, vol. 14, p. 213, 1902.—Schütze, Deutsche Ent. Zeitschr., Iris, vol. 15, p. 23, 1902.—Speiser, Konigsberg. Physikal-Oekonom. Ges. Beitr. Naturk. Preussens, No. 9, p. 148, 1903.—Rebel, Ann. Naturh. Hofmus., vol. 18, p. 336, 1903.—Mendes, Broteria, vol. 3, p. 248, 1904.—Crombrugghe, Mém. Soc. Ent. Belgique, vol. 2, p. 51, 1906.—Rebel, Verh. zool.-bot. Ges. Wien, vol. 58, p. (80), 1908.—Spuler, Die Schmetterlinge Europas, vol. 2, p. 343, pl. 89, fig. 35, 1910.—Griebel, Lepid. Fauna Rheinpfalz., vol. 2, p. 55, 1910.—Piquenard, Bull. Soc. Sci. Méd. Ouest. (Rennes), vol. 19, p. 79, 1910.—Gianelli, Ann. Accad. Agr. Torino, vol. 53, p. 96, 1911.—Rebel, Ann. Naturh. Hofmus., vol. 25, p. 417, 1911.—Holl, Bull. Soc. Hist. Nat. Afrique du Nord, vol. 3, p. 26, 1911.—Hauder, Ent. Zeitschr., vol. 25, p. 204, 1913.—Skala, Verh. naturf. Ver. Brünn, vol. 51, p. 316, 1913.—Rebel, Wien. Ent. Ver. Jahresb., vol. 23, p. 202, 1913.—Verebodt and Müller-Rutz, Die Schmetterlinge der Schweiz, vol. 2, p. 476, 1914.—Galvagni, Wien. Ent. Ver. Jahresb., vol. 25, p. 35, 1915.—Schawerda, Wien. Ent. Ver. Jahresb., vol. 26, p. 46, 1916.—Rebel, Ann. Naturh. Hofmus., vol. 30, p. 166, 1916; Sitzungsb. Akad. Wiss. Wien, vol. 126, p. 808, 1917.—Martini, Deutsche Ent. Zeitschr., Iris, vol. 30, p. 155, 1917.—Mittelberger, Wien. Ent. Ver. Jahresb., vol. 28, p. 66, 1918.—Turati, Soc. Italiana Sci. Nat. Mus. Civico, Pavia, vol. 58, p. 116, 1919.—Strand, Archiv für Naturg., vol. 85A, pt. 4, p. 9, 1919.—Blackmore, Report of the Provincial (British Columbia) Museum of Natural History for the year 1920, pp. 23, 31, pl. 2, 1921.—Busck, Can. Ent., vol. 53, p. 276, 1921.—Blackmore, Report of the Provincial (British Columbia) Museum of Natural History for the year 1921, p. 28, 1922.—Zimmerman, Verh. zool.-bot. Ges. Wien, vol. 71, p. (43), 1922.—Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 159, 1922.—Chrétien, *in* Oberthür, Études de Lépidoptérologie comparée, fasc. 19, p. 368, 1922.—Galvagni, Wien. Ent. Ver. Jahresb., vol. 30, p. 105, 1924.—Leonardi, Elenco delle specie di Insetti dannosi e

loro parassiti ricordati in Italia fino all' anno 1911, pt. 2, p. 281, 1927.—Zerny, Deutsche Ent. Zeitschr., Iris, vol. 41, p. 144, 1927.—Larsen, Ent. Meddel., vol. 17, p. 80, 1927.—Meyrick, A revised handbook of British Lepidoptera, p. 675, 1928.—Fletcher, Mem. Dept. Agr. India (Ent. Ser.), vol. 11, p. 40, 1929.—Amsel, Deutsche Ent. Zeitschr., Iris, vol. 44, p. 121, 1930.—Drenowski, Mem. Bulg. Akad. Wiss., vol. 26, No. 6, p. 75, 1930.—Verbrodt, Deutsche Ent. Zeitschr., Iris, vol. 45, p. 129, 1931.—Escherich, Die Forstinsekten Mitteleuropas, vol. 3, p. 202, fig. 162, pl. 1, fig. 22, 1931.—Rebel and Zerny, Denkschr. Akad. Wiss. Wien, math.-nat. Kl., vol. 103, p. 151, 1931.—Hering, Die Tierwelt Mitteleuropas (Die Schmetterlinge), p. 154, 1932.—Eckstein, Kleinschmet. Deutschlands, p. 123, pl. 6, fig. 223, 1933.—Sterneck, Prodromus der Schmetterlingsfauna Böhmens, vol. 2, p. 109, 1933.—Morley and Rait-Smith, Trans. Ent. Soc. London, vol. 81, p. 176, 1933.—Zerny, Deutsche Ent. Zeitschr., Iris, vol. 48, p. 25, 1934.—Ostheldeb, Mitt. Münch. Ent. Ges., vol. 24, p. 82, 1935.—Pierce and Metcalfe, The genitalia of the tineid families of the Lepidoptera of the British Islands, p. 32, pl. 18, 1935.—Rapp, Beiträge zur Fauna Thüringens, vol. 2, p. 140, 1936.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8392, 1939.—Gaede, *in* Bryk, Lepidopterorum catalogus, pt. 92, p. 251, 1939.

Phibalocera quercana (Fabricius) Stephens, A systematic catalog of British insects, pt. 2, p. 192, No. 7153, 1829; Illustrations of British entomology, Haustellata, vol. 4, p. 193, 1834.—Wood, Index entomologicus, p. 169, fig. 1160, 1845.—Stainton, Insecta Britannica, p. 81, 1854; A manual of British butterflies and moths, vol. 2, p. 319, 1859; The natural history of the Tineina, vol. 13, pp. 296, 297, pl. 7, fig. 1, 1873.

Phalaenae Tortrix fagana Schiffermüller, Systematisches Verzeichniss der Schmetterlinge der Wiener Gegend, p. 128, pl. 16, fig. 6, 1776.

Tortrix fagana (Schiffermüller) Hübner, Sammlung europäischer Schmetterlinge, vol. 7, pl. 24, fig. 153, 1830.

Carcina fagana (Fabricius) Herrich-Schäffer, Systematisches Bearbeitung der Schmetterlinge von Europa, vol. 5, p. 131, 1853.

Tinca cancella Hübner, Sammlung europäischer Schmetterlinge, p. 69, fig. 453, 1796.

Carcina cancrella Hübner, Verzeichniss bekannter Schmetterlinge, p. 410, 1826.

Lampros faganella Treitschke, *in* Ochsenheimer, Die Schmetterlinge von Europa, vol. 9, pt. 2, p. 67, 1833.

Labial palpus pale yellow; second segment irrorated with pink on apical third. Antenna pale yellow below, dull pink above. Face shining pale yellow. Head and thorax very pale, dull brownish ochreous. Fore wing dull pink overlaid and suffused with pale, dull brownish ochreous and sparsely irrorated in apical third with black; on basal third of costa a narrow, yellow patch fading to white on extreme costal edge; from middle to apical third of costa a quadrate yellow patch; edge of costa to apex and termen to tornus and the cilia dark yellow; cilia at tornus dull pink; from basal third to about middle of inner margin a subtriangular yellow patch extending well into cell; in this patch, which is ochreous in some specimens, some reddish-ochreous scales. Hind wing pale straw-yellow suffused with

pink at apex; cilia pale yellow. Legs creamy white; fore pair strongly overlaid exteriorly with dark pink. Abdomen light yellowish.

Male genitalia.—Harpe ample, hairy, without clasper; sacculus deeply folded; cucullus deeply cleft, lower point (extension of sacculus?) with tuft of strong, curved bristles. Lateral processes of anellus long. Vesica armed with 4 to 7 strong cornuti. Gnathos without spines. Uncus elongate, hooked, lateral edges infolded.

Female genitalia.—Genital plate dilated laterally; ostium slitlike; ductus bursae membranous; inception of ductus seminalis just before ostium; bursa copulatrix with small signum.

Alar expanse, 17–21 mm.

Type.—Lost?

Type locality.—Europe.

Food plants.—Quercus; Cotoneaster pyracantha L.; apple.

Distribution.—Europe, Asia Minor, and southern Vancouver Island, British Columbia, Canada.

Canadian records

British Columbia: Victoria, 14 ♂♂, 10 ♀♀ (July and August dates, 1920–1922, E. H. Blackmore; 19–VII–1922, W. R. Carter; 7–8–VIII–1929, J. F. G. Clarke).

Remarks.—The species is well established on southern Vancouver Island, British Columbia, and probably will be found in Washington State, across the Straits of Juan de Fuca, where oak is abundant.

There is considerable variation in this species, which probably accounts for some of the synonymy, but all figures of this species I have seen are readily recognizable.

14. MATHILDANA, new genus

PLATE 1, FIGURE 2; PLATE 7, FIGURE 50; PLATE 11, FIGURES 74, 74a, 74b; PLATE 19, FIGURE 118

Genotype.—Dasycera newmanella Clemens, Proc. Ent. Soc. Philadelphia, vol. 2, p. 428, 1864.

Head smooth, tongue developed; antenna thickened with scales; ciliated in male; basal segment without pecten. Labial palpus long, slender; second segment thickened with appressed scales; third segment shorter than second, slender, acute.

Fore wing narrow, costa straight or gently arched; apex narrowly rounded; 12 veins; 2 about as near to 3 as 4 is to 5; 7 and 8 stalked, both to costa; 11 from about middle of cell; cell not much longer than one-half the length of wing.

Hind wing about as wide as fore wing; costa gently convex; 8 veins; 3 and 4 connate; 5 nearer to 6 than to 4.

Male genitalia.—Harpe without clasper. Anellus with lateral processes. Vesica armed. Gnathos and uncus well developed.

Female genitalia.—Genital plate partly sclerotized. Ductus bursae with blind sac from ventral surface. Signum present.

Remarks.—The species *newmanella* has been placed in several different genera by various authors, but I have found it impossible to include our North American specimens in any of the established genera.

Walsingham [46] has discussed the confusion arising from the description of two species with the name *sulphurella* by Fabricius, and suppressed the genus *Oecophora* as a result. He was erroneous in this, as brought out by Meyrick,[47] who resurrected *Oecophora* and separated it from *Dasycera*. *Dasycera* Stephens (1829) is synonymous with *Dasycerus* Haworth (1828), the latter being preoccupied by *Dasycerus* Brongniart (1800). *Esperia* is therefore the proper generic name for the European species, as pointed out by Fletcher.[48] This name is not available for our American species since the two, *newmanella* and *sulphurella*, are not congeneric.

In *Esperia* the costa of the fore wing is concave, the cell reaches to outer two-thirds, vein 2 is remote from 3; 3, 4, and 5 are about equidistant at their bases. In the hind wing vein 5 is much nearer to 4 than to 6. In the male genitalia the clasper is present and the vesica is without armature. (I have not seen a female of *Esperia*.)

The genus *Mathildana* differs from *Esperia* by the straight or convex costa of fore wing, the short cell, which does not extend much past the center of the wing, and the approximation of vein 2 to 3. In the hind wing vein 5 is nearer to 6 than to 4. In the male the clasper is absent, and the vesica is strongly armed.

MATHILDANA NEWMANELLA (Clemens), new combination

Dasycera newmanella Clemens, Proc. Ent. Soc. Philadelphia, vol. 2, p. 428, 1864; *in* Stainton, Tineina of North America, p. 252, 1872.—Zeller, Verh. zool.-bot. Ges. Wien, vol. 23, p. 289, 1873.—Chambers, U. S. Geol. Geogr. Surv. Terr. Bull. 3, p. 145, 1877.—Beutenmüller, *in* Smith, Catalogue of the insects of New Jersey, p. 357, 1890.—Riley, *in* Smith, List of the Lepidoptera of Boreal America, No. 5545, 1891.—Dietz, *in* Smith, Catalogue of the insects of New Jersey, p. 476, 1900.—Busck, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5932, 1903.—Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 22, 1922.—Gaede, *in* Bryk, Lepidopterorum catalogus, pt. 88, p. 18, 1938.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8353, 1939.

[46] Walsingham, Biol. Centr.-Amer., Lepidoptera–Heterocera, vol. 4, p. 141, 1912.
[47] Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 20–21, 1922.
[48] Fletcher, Mem. Dept. Agr. India (Ent. ser.), vol. 11, p. 85, 1929.

Oecophora newmanella (Clemens) KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6478, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 203, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6499, 1917.—BARNES and BUSCK, Contr. Lepid. North America, vol. 4, pl. 38, fig. 6, 1920.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 249, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat., Memoir 101, p. 546, 1928.—BRIMLEY, The insects of North Carolina, p. 304, 1938.

Labial palpus orange-yellow; third segment with brownish suffusion. Tongue yellow. Face, tegula, collar, and basal segment of antenna brassy; remainder of antenna shining purplish black except for about eight terminal segments, which are silvery white. Head, thorax, and fore wing dusky black with a pronounced purple luster; from base of wing, along fold, an orange-yellow dash extending to basal fifth; in cell, a similarly colored, longitudinal dash reaching slightly past middle of wing (in some specimens the orange dashes are weak or absent, this is especially true of the southern examples); cilia fuscous, lighter apically. Hind wing dark fuscous; cilia lighter. Legs shining brassy. Abdomen fuscous above with a faint purple sheen; brassy below.

Male genitalia.—Harpe narrow; divided beyond sacculus; sacculus broad; cucullus sharply pointed. Anellus a small plate; lateral processes long, flattened, dilated distally. Aedeagus moderately short, stout; vesica armed with numerous long, straight cornuti. Vinculum narrowly rounded. Gnathos broad, thick, slightly excavated posteriorly and terminating in a long, sharply pointed process. Uncus long, pointed.

Female genitalia.—Genital plate narrow; sclerotized posteriorly. Ostium rather broad, oval, opening in membranous anterior part of genital plate. Ductus bursae narrowly sclerotized adjacent to ostium, with short blind sac from ventral surface anterior to sclerotized part; inception of ductus seminalis well before ostium. Bursa copulatrix large, asymmetrical; signum a lightly sclerotized elongate, weakly spined plate.

Alar expanse, 14–19 mm.

Type.—In the Academy of Natural Sciences of Philadelphia.

Type locality.—"Virginia."

Food plant.—Unknown.

Distribution.—Eastern United States and eastern Canada.

United States records

District of Columbia: Washington, ♂ (no date or collector).
Maryland: ♂ (May 30, 1916, A. Busck); ♀ (May 30, 1906, H. S. Barber).
New Hampshire: Hampton, 2 ♂♂ (10–11–VI–1911, S. A. Shaw).
New Jersey: Greenwood Lake, ♀ (June 10, 1900, Wm. Beutenmüller).
New York: Numerous localities (*vide* Forbes).

North Carolina: Black Mountains, 6 ♂ ♂, 4 ♀ ♀ (May 3–27, Wm. Beutenmüller); Mount Graybeard, ♂ ("V–26," Wm. Beutenmüller).
Ohio: Cincinnati, 4 ♂ ♂ (28–V–1904, A. F. Braun); ♀ ("5–23–03," no collector); Cuyahoga County, ♀ (9–VI–1898, W. D. Kearfott).
Pennsylvania: New Brighton, 2 ♂ ♂ (10–VI–1907, 10–21–1907, H. D. Merrick).
Vermont: 2 ♂ ♂ (no date or collector).
Virginia: Mountain Lake, 2 ♂ ♂ (June 14, 1907, A. F. Braun); Virginia shore, opposite Plummers Island, Md., ♂ (May 28, 1914, R. C. Shannon); Woodstock, ♀ (June 1, 1903; no collector).

Canadian records

Ontario: Bala (July 19, 1932, G. S. Walley); Fishers Glen (June 12, 1931, W. J. Brown); Georgian Bay (July 13, 1932, G. S. Walley); Leamington (June 8, 1929, G. S. Walley); Orillia (June 26, July 2, 1926, C. H. Curran); Ottawa, ♂ (19–VI–1905, C. H. Young); Point Pelee (July 22, 1927, F. P. Ide).
Quebec: Knowlton (June 24, 1929, G. S. Walley); Laval County (July 13, 1907); Mount St. Hilaire (July 1, 1909); Oka (June 12, 1911); St. Johns (June 19, 1911, G. Chagnon).

Remarks.—The specimens from North Carolina have little or no orange color in the center of the wing but otherwise agree with the specimens from more northern localities.

15. CAROLANA, new genus

PLATE 1, FIGURE 3; PLATE 7, FIGURE 49; PLATE 10, FIGURES 69, 69a, 69b; PLATE 16, FIGURE 96; PLATE 17, FIGURE 108

Genotype.—*Borkhausenia ascriptella* Busck, Can. Ent., vol. 40, p. 194, 1908.

Head with closely appressed scales; tongue well developed; antenna strongly ciliated in male, simple in female; basal segment with strong pecten; labial palpus long, slender, smooth; third segment nearly as long as second. Abdomen armed with peculiar, short, stout, truncated setae. Thorax smoothly scaled.

Fore wing elongate, costa gently arched; apex pointed; 12 veins; 2 distant from 3; 3, 4, and 5 equidistant; 7 and 8 long stalked, both to costa; 10 distant from 9; 11 from basal fourth of cell.

Hind wing narrower than fore wing; apex pointed; 3 and 4 stalked from angle of cell; 6 and 7 subparallel; cell shorter than one half the length of wing.

Male genitalia.—Clasper absent. Anellus without lateral processes. Vesica armed. Uncus and gnathos present. Socii absent.

Female genitalia.—Genital plate membranous. Ductus bursae partly sclerotized. Signum present.

Remarks.—This genus may be distinguished from *Borkhausenia* by the following characters: In *Carolana* vein 2 of the fore wing is distant from 3, 10 is distant from 9, 11 from basal fourth, and there is no internal cell. In the hind wing 3 and 4 are stalked and the cell

is shorter than one-half the length of the wing. The clasper is absent in the male genitalia, and the ductus bursae of the female is partly sclerotized. In *Borkhausenia* veins 2 to 5 of the fore wing are equidistant, 10 is near 9, 11 is from about middle of cell, and the internal cell is present. In the hind wing 3 and 4 are approximate and the cell is about half as long as the wing. In the male genitalia the clasper is present and in the female genitalia the ductus bursae is membranous.

The genotype is the only species I have seen referable to this genus.

CAROLANA ASCRIPTELLA (Busck), new combination

Borkhausenia ascriptella Busck, Can. Ent., vol. 40, p. 194, 1908; Proc. U. S. Nat. Mus., vol. 35, p. 204, 1908.—Barnes and McDunnough, Check list of the Lepidoptera of Boreal America, No. 6505, 1917.—Barnes and Busck, Contr. Lepid. North America, vol. 4, p. 235, 1920.—Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 40, 1922.—Forbes, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 249, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat. Memoir 101, p. 546, 1928.—Procter, Biological survey of the Mount Desert Region: The insect fauna, p. 272, 1938.—Gaede, *in* Bryk, Lepidopterorum catalogus, pt. 88, p. 51, 1938.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8369, 1939.

Labial palpus, antenna, face, head, thorax, and fore wing straw colored, shining. Second segment of labial palpus shaded with blackish fuscous exteriorly on basal half. Antenna indistinctly and narrowly annulated with fuscous. Fore wing irrorated with blackish fuscous; base of costa, a large spot at basal third, in cell, and one at end of cell, blackish fuscous; cilia straw colored, more ochreous basally. Hind wing pale light fuscous; cilia ochreous basally fading to straw color outwardly. Legs straw colored, strongly overlaid with blackish fuscous exteriorly except at joints and on hind tibia and tarsus. Abdomen shining whitish-ochreous.

Male genitalia.—Harpe narrow; cucullus rounded. Anellus deeply incised on posterior edge. Aedeagus large, stout, sharply pointed, sharply curved basally; vesica armed with a single, long, sharply pointed, strong cornutus. Vinculum narrowly rounded. Gnathos very broad, shovel-shaped and very closely approximated to the slender, pointed uncus.

Female genitalia.—Genital plate membranous. Ostium broad, anterior edge concave. Ductus bursae slender, twisted, sclerotized in posterior two-thirds, the sclerotized portion bearing numerous small teeth on inner surface; ductus seminalis entering well before ostium. Bursa copulatrix large, oval; signum a weakly sclerotized, toothed plate.

Alar expanse, 9–12 mm.

Type.—In the United States National Museum.

Type locality.—Oak Station, Allegheny County, Pa.

Food plant.—Unknown.

Distribution.—Eastern United States from Maryland northward to Maine.

United States records

Connecticut: East River, ♂ (July 8, 1909, Charles R. Ely).
District of Columbia: Anacostia, ♂, ♀ (7–VI–1910, P. R. Myers).
Maryland: Plummers Island, 4 ♂♂, 2 ♀♀ (June 1903, A. Busck).
New Hampshire: 2 ♂♂ (A. Busck).
New Jersey: Essex County Park, ♂, ♀ (June 24–30, W. D. Kearfott); Montclair, 2 ♂♂, 3 ♀♀ (June, July dates, 1913, 1920, W. D. Kearfott).
New York: Ithaca (*teste* Forbes).
Pennsylvania: New Brighton, 3 ♂♂ (June, July, 1907 and 1911, H. D. Merrick); Oak Station, Allegheny County, 14 ♂♂, 6 ♀♀ (June, July dates, 1911, Fred Marloff).

Remarks.—This species has been recorded [49] from Mexico and Costa Rica but the specimens I have seen, determined as this species, are referable to other genera.

16. Genus DECANTHA Busck

Plate 3, Figure 19; Plate 7, Figure 55; Plate 10, Figures 66, 66a; Plate 14, Figure 91

Decantha Busck, Proc. U. S. Nat. Mus., vol. 35, p. 202, 1908; vol. 47, p. 31, 1915.—Walsingham, Biol. Centr.-Amer., Lepidoptera-Heterocera, vol. 4, p. 422, 1915.—Barnes and McDunnough, Check list of the Lepidoptera of Boreal America, p. 161, 1917.—Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 24, 1922.—Forbes, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 248, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat. Memoir 101, p. 546, 1928.—Fletcher, Mem. Dept. Agr. India (Ent. Ser.), vol. 11, p. 64, 1929.—Gaede, *in* Bryk, Lepidopterorum catalogus, pt. 88, p. 23, 1938. (Genotype: *Oecophora borkhausenii* Zeller, Isis von Oken, vol. 3, p. 192, 1839.)

Head smooth; tongue developed. Antenna ciliated in male; basal segment with pecten. Labial palpus long, recurved; second segment roughened in front and thickened with appressed scales; terminal segment shorter than second, acute.

Fore wing elongate, pointed, 11 veins; 2 from toward angle, 3 from angle, 7 and 8 coincident, to costa; 11 from middle.

Hind wing narrower than fore wing, 8 veins; 3 and 4 remote, 4 from angle; 5 to 7 parallel.

Male genitalia.—Harpe without clasper. Anellus with elongate, strap-like, lateral processes. Gnathos not spined. Vesica with strong cornuti. Uncus pointed.

[49] Walsingham, Biol. Centr.-Amer., Lepidoptera-Heterocera, vol. 4, p. 143, 1912.

Female genitalia.—Ductus bursae lightly sclerotized posteriorly. Signum present.

Remarks.—This genus is similar to *Fabiola* in having veins 7 and 8 of the fore wing coincident. It may be distinguished, however, by the presence of pecten on the basal segment of the antenna, the presence of strong cornuti on the vesica of the male, and the presence of a signum in the female.

There is a single North American species belonging to this genus.

DECANTHA BOREASELLA (Chambers)

PLATE 20, FIGURES 125, 125a; PLATE 39, FIGURE 211

Oecophora boreasella CHAMBERS, Can. Ent., vol. 5, p. 189, 1873; Cincinnati Quart. Journ. Sci., vol. 2, p. 114, 292, 1875; U. S. Geol. Geogr. Surv. Terr. Bull. 3, p. 129, 141, 1877.—RILEY, *in* Smith, List of Lepidoptera of Boreal America, No. 5550, 1891.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5921, 1903.

Borkhausenia boreasella (Chambers) KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6468, 1903 (as a synonym of *Borkhausenia borkhausenii* [Zeller]).

Decantha boreasella (Chambers) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 202, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6497, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 24, 1922.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 248, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat. Memoir 101, p. 546, 1928.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 88, p. 23, 1938.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8358, 1939 (as a synonym of *Decantha borkhausenii* [Chambers]).

Borkhausenia borkhausenii (Zeller) DYAR, Proc. U. S. Nat. Mus., vol. 27, p. 934, 1904.

Labial palpus white overlaid and irrorated with black. Antenna checkered black and white. Head black, with a reddish luster and mixed with white posterodorsally. Thorax and fore wing shining golden; base of tegula and collar narrowly black; base of wing black, outer margin of the black basal patch concave and edged with white; the color of the basal patch is narrowly continued along the costal edge to apical fourth; at basal third a triangular area (broadest at costa) of black crosses the wing to the inner corner of a quadrate black spot on the inner margin; from middle of costa, to apical fourth, a rectangular black area extending past the middle of wing, and joined by its inner corner to the outer corner of the spot on the inner margin; the outer corner of the rectangular costal spot extends to tornus where it broadens and fades to reddish brown; all spots are edged outwardly with white and the spot on the inner margin is edged inwardly with white; at apex a black spot; cilia golden

ochreous. Hind wing dark fuscous; cilia shining yellowish fuscous. Legs black annulated with white at joints. Abdomen fuscous.

Male genitalia.—Harpe broad, short, cucullus rounded; sacculus rather strongly, though narrowly, sclerotized and produced as a pointed process slightly beyond cucullus. Anellus consisting of two long, flattened, truncated, lateral processes arising from a small basal plate. Aedeagus relatively long, stout, nearly straight, bluntly pointed; vesica armed with one long cornutus with lateral serrations and a smaller, stout, hooked distal one. Vinculum bluntly pointed. Gnathos truncate. Uncus long, pointed.

Female genitalia.—Genital plate lightly sclerotized posteriorly; ostium long, narrow, opening in anterior membranous part of genital plate. Ductus bursae strongly sclerotized in posterior two-thirds, posterior third somewhat narrower than anterior part; at middle, from inner surface several long slender spines; inception of ductus seminalis at posterior two-thirds. Bursa copulatrix small; signum a poorly developed, elongate plate.

Alar expanse, 10–15 mm.

Type.—In the Museum of Comparative Zoology, Cambridge, Mass.

Type locality.—Not stated.

Food plant.—Unknown.

Distribution.—Far-western United States and Canada and Northeastern United States.

United States records

Arizona: Huachuca Mountains, ♀ (no date); Pinal Mountains, ♂ (July 1900, Kunze).

California: Burney Falls, Shasta County, ♀ (20–VII–1871, Walsingham); Camp Baldy, San Bernardino Mountains, ♀ (June 24–30).

District of Columbia: ♂ (A. Busck).

Massachusetts: Cohasset, ♂ (July 6, 1907, Owen Bryant).

Canadian records

British Columbia: Kaslo, 2 ♂ ♂ (29–VI–1903; 25–VII–1903, H. G. Dyar); Seton Lake, Lillooet, ♂ (9–VI–1926, J. McDunnough).

Remarks.—In Chambers' description he gives the dark areas of the fore wing, head, palpi, etc., as "reddish-brown." In the fresh specimens before me these parts are distinctly black, but worn specimens are brownish. In view of this I feel that his description was written from a faded specimen.

This is the species that has been listed as a synonym of the European *borkhausenii* with which it is definitely congeneric; but a comparison of the figures will adequately show the differences.

17. Genus FABIOLA Busck

PLATE 3, FIGURE 25; PLATE 6, FIGURE 41; PLATE 8, FIGURES 61, 61a; PLATE 16, FIGURE 95

Fabiola BUSCK, Proc. U. S. Nat Mus., vol. 35, p. 202, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, p. 161, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 23, 1922.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 248, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat., Memoir 101, p. 546, 1928.—FLETCHER, Mem. Dept. Agr. India (Ent. Ser.), vol. 11, p. 96, 1929.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 88, p. 22, 1938.—BRIMLEY, The insects of North Carolina, p. 304, 1938. (Genotype: *Oecophora shaleriella* Chambers, Cincinnati Quart. Journ. Sci., vol. 2, p. 114, 1875.)

Head with smooth, appressed scales and spreading side tufts; tongue developed; antenna strongly ciliated in male; basal segment without pecten. Labial palpus long, slender, curved, smooth; terminal segment as long as second.

Fore wing elongate; 11 veins, 2 from well before angle, 7 and 8 coincident, to costa.

Hind wing narrow, ovate-lanceolate, 8 veins; 3 and 4 connate or approximate; 6 and 7 parallel.

Male genitalia.—Harpe without clasper. Anellus with lateral processes. Tegumen broad. Gnathos not spined. Socii absent. Uncus present.

Female genitalia.—Genital plate strongly sclerotized, protruding; ductus bursae membranous; signum absent.

Remarks.—A derivative of *Schiffermülleria*, differing from it in having veins 7 and 8 of the fore wing coincident, and a slender extension of the sacculus.

This genus contains two described North American species.

FABIOLA SHALERIELLA (Chambers)

Oecophora shaleriella CHAMBERS, Cincinnati Quart. Journ. Sci., vol. 2, p. 114, 1875.

Fabiola shaleriella (Chambers), MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 23, 1922.—FORBES, *in* Leonard, Cornell Univ. Agr. Exp. Stat., Memoir 101, p. 546, 1928.—BRAUN, Trans. Amer. Ent. Soc., vol. 61, p. 46, 1935.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8356, 1939.

Oecophora shalleriella RILEY, *in* Smith, List of Lepidoptera of Boreal America, No. 5557, 1891.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5928, 1903.

Borkhausenia shalleriella, KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6474, 1903.

Fabiola shallericella BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 202, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6498, 1917.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 248, 1923.—FLETCHER, Mem. Dept. Agr. India (Ent. Ser.), vol. 11, p. 96, 1929.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 88, p. 22, 1938.

Labial palpus shining white; second segment narrowly edged with fuscous anteriorly and at apex; third segment wholly overlaid with fuscous. Antenna shining greenish fuscous narrowly and faintly annulated with silvery white. Face shining white. Head and thorax iridescent greenish fuscous, this color continued to base of fore wing and narrowly around its edges; at basal forth of fore wing, from inner margin, a conspicuous, transverse, white fascia, which does not reach costa and is narrowly edged inwardly and outwardly with black; in costal half of the white fascia numerous metallic blue scales; between this fascia and the base of wing a large golden-ochreous spot, lighter centrally; slightly before apex, on costa, a white spot; from this spot a short, transverse, black-edged fascia extends almost to inner margin; between this fascia and that at basal fourth the ground color is golden-ochreous, this color also between the outer metallic fascia and apex; from costa, in the area between the two fasciae, an elongate greenish-fuscous shade streaked with white and extending nearly to middle of wing; on middle inner margin an elongate, irregular velvety black spot containing three small spots of metallic blue scales. Between this black spot and the fuscous costal shade a pale, yellowish longitudinal streak; extreme apex white preceded by fuscous; cilia shining fuscous except at tornus; there creamy white. Hind wing blackish fuscous except for a whitish baso-costal area; cilia shining fuscous. Legs silvery white shaded with fuscous. Abdomen greenish fuscous above, silvery white beneath.

Male genitalia.—Harpe broad, sparsely hairy; costa convex; cucullus sharply pointed. Anellus with long, curved, pointed lateral processes; lateral process with double row of minute setae for most of length. Aedeagus slender, slightly curved. Vinculum broadly rounded. Gnathos long, rugose toward distal end, which is truncated. Uncus long, sharply pointed. Tegumen produced laterally into a point.

Female genitalia.—Genital plate strongly sclerotized, convex, broader anteriorly than posteriorly. Ostium longitudinal, nearly spindle-shaped. Ductus bursae slender; ductus seminalis at posterior third of ductus bursae. Bursa copulatrix oval.

Alar expanse, 10–15 mm.

Type.—In the Museum of Comparative Zoology, Cambridge, Mass.

Type locality.—Camp Bee Spring, Ky.

Food plant.—Unknown.

Distribution.—Eastern United States and Canada.

United States records

Connecticut: Stamford, ♂ (June 10, 1930, B. T. R. Lab., coll.).
Kentucky: Camp Bee Spring.
Maryland: Plummers Island, ♂, ♀ (31–V–1908, A. Busck).

New York: Bear Mountain, 2 ♂♂, ♀ (13–VI–1925, F. M. Schott).
Pennsylvania: New Brighton, ♂ (24–VI–1907, H. D. Merrick); Oak Station, Allegheny County, 11 ♂♂, 3 ♀♀ (11–18–VI–1911, Fred Marloff); Ohio Pyle, ♂, 3 ♀ ♀, (10–VI–1906, Henry Engel); Pittsburgh, 2 ♂ ♂ ((6–10–VI–1906, Henry Engel); York, 3 ♂♂ 2 ♀♀ (11–VI–1901 and 10–VI–1902, W. D. Kearfott).
Virginia: Great Falls, 31 ♂♂, 2 ♀♀ (May dates, 1919–1922, A. Busck).

Canadian records

Ontario: Severn (June 17, 1925, C. H. Curran).

Remarks.—This and the following species are the only two, described from North America, referable to the genus *Fabiola.*

FABIOLA TECTA Braun

PLATE 20, FIGURES 119, 119a

Fabiola tecta BRAUN, Trans. Amer. Ent. Soc., vol. 61, p. 45, 1935.—BRIMLEY, Insects of North Carolina, p. 304, 1938.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8357, 1939.

Similar to *shaleriella* but smaller, with the golden-ochreous areas of the fore wing replaced by yellow, the median black area extending almost across the wing and containing three longitudinal metallic-blue streaks, and with the fuscous areas and cilia of both wings more blackish.

Male genitalia.—Similar to *shaleriella* but with the harpe broader, cucullus more acutely pointed and with the lobes of the tegumen shorter and more bluntly pointed.

Alar expanse, 9–10 mm.

Type.—In Dr. A. F. Braun collection, Cincinnati, Ohio.

Type locality.—Near Natural Bridge, McCreary County, Ky.

Food plant.—Unknown.

Distribution.—Known only from Kentucky.

United States records

Kentucky: Cumberland Valley, Letcher County, 2 ♂♂ (1–VII–1935, A. F. Braun).

Remarks.—The two males listed above were sent to me by Dr. Braun. I have seen no other specimens.

This species is amply distinct from *shaleriella* in markings and genitalia.

18. Genus SCHIFFERMÜLLERIA Hübner

PLATE 2, FIGURE 18; PLATE 7, FIGURE 56; PLATE 13, FIGURES 82, 82a; PLATE 16, FIGURE 98

Schiffermülleria HÜBNER, Verzeichniss bekannter Schmetterlinge, p. 421, 1826.—STEPHENS, Illustrations of British entomology, Haustellata, vol. 4, p. 423, 1835.—WALSINGHAM and DURANT, Ent. Monthly Mag., vol. 45, p. 156, 1909.—

Walsingham, Biol. Centr.-Amer., Lepidoptera-Heterocera, vol. 4, p. 421–422, 1912.—Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 26–27, 1922.—Forbes, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 246–248, 1923. (Genotype: *Phalaena Tinea schaefferella* Linnaeus, Systema naturae, ed. 10, p. 541, 1758.)

Chrysia Millière, Ann. Soc. Ent. France, ser. 3, vol. 2, p. 61, 1854. (Genotype: *Pancalia grandis* Desvignes, Entomologist, vol. 1, p. 342, 1842.)

Head smooth, side tufts slightly raised; tongue developed; antenna ciliated; basal segment without pecten. Labial palpus long, recurved, smooth or slightly roughened; terminal segment shorter or as long as second segment.

Fore wing elongate, apex pointed; 12 veins; 2 from well before angle; 3 and 4 approximate; 7 and 8 stalked, both to costa, 11 from before middle.

Hind wing narrower than fore wing, costa gently arched, 8 veins; 3 and 4 connate, 5 nearer to 4 than to 6; 6 and 7 subparallel.

Male genitalia.—Harpe ample. Anellus with lateral extensions. Gnathos a broad, unspined band. Socii absent. Uncus well developed.

Female genitalia.—Genital plate strongly sclerotized; ductus bursae wholly membranous or slightly sclerotized for part of its length; signum present or absent.[50]

Remarks.—Busck [51] recognized five species in this genus (but placed them under the name *Epicallima*). Of these I have synonymized one, *dimidiella*, with *quadrimaculella* and have placed *coloradella* in the Ethmiidae. The genus *Ethmia*, as it now stands, is not a homogeneous assemblage of species and will accommodate *coloradella*. The proper generic placement of this species must await a revision of the Ethmiidae, and for that reason no further treatment of *coloradella* is given in this paper. In 1912 [52] Busck added *lucidella;* Meyrick described *antidectis* in 1914 [53] and *rostrigera* in 1918.[54] The first, *lucidella*, belongs in *Schiffermülleria*, *antidectis* is referable to *Triclonella* in the family Cosmopterygidae, and *rostrigera* is a synonym of *coloradella* (new synonymy). In 1923 [55] Braun added *amplicincta* which is a synonym of *edithella*. I have retained the generic name *Epicallima* for *argenticinctella* (Clemens) and have associated the European *formosella* (Schiffermüller) with it. The latter has become established in the United States in recent years. This leaves three North American species referable to the genus *Schiffermülleria*.

[50] There is only a single female each of *edithella* and *lucidella* available for study. The bursa copulatrix of *edithella* is missing, and that of *lucidella*, although partly obscured, appears to lack a signum.

[51] Busck, A., Proc. U. S. Nat. Mus., vol. 35, p. 201, 1908 (*argenticinctella, edithella, coloradella, dimidiella*, and *quadrimaculella*.)

[52] Busck, A., Ent. News, vol. 3, p. 170, 1912.

[53] Meyrick, E., Exotic Microlepidoptera, vol. 1, p. 218, 1914.

[54] Ibid., vol. 2, p. 237, 1918.

[55] Braun, A. F., Trans. Amer. Ent. Soc., vol. 49, p. 117, 1923.

KEY TO THE SPECIES OF SCHIFFERMÜLLERIA BASED ON COLORATION

1. Ground color of fore wing dark brown to black with conspicuous white or whitish markings; no metallic scaling.
   quadrimaculella (Chambers) (p. 248)
   Ground color and markings otherwise 2
2. Median longitudinal streak of fore wing reaching apex; deep golden-yellow ..... **lucidella** (Busck) (p. 251)
   Median longitudinal streak of fore wing ending well before apex; light golden-yellow ..... **edithella** (Busck) (p. 250)

KEY TO THE SPECIES OF SCHIFFERMÜLLERIA BASED ON MALE GENITALIA

1. Lateral processes of anellus extending well beyond base of harpe 2
   Lateral processes of anellus short, not extending beyond base of harpe (fig. 122) ..... **quadrimaculella** (Chambers) (p. 248)
2. Costa of harpe slightly convex (fig. 121) ..... **lucidella** (Busck) (p. 251)
   Costa of harpe deeply concave (fig. 120) ..... **edithella** (Busck) (p. 250)

KEY TO THE SPECIES OF SCHIFFERMÜLLERIA BASED ON FEMALE GENITALIA

1. Anterior edge of genital plate straight or slightly concave; ostium deeply V-shaped (fig. 213) ..... **quadrimaculella** (Chambers) (p. 248)
   Anterior edge of genital plate not straight or concave; ostium not deeply V-shaped 2
2. Anterior edge of genital plate strongly convex (fig. 214)
   edithella (Busck) (p. 250)
   Anterior edge of genital plate broadly forked (fig. 215)
   lucidella (Busck) (p. 251)

SCHIFFERMÜLLERIA QUADRIMACULELLA (Chambers)

PLATE 20, FIGURES 122, 122a; PLATE 39, FIGURE 213

Oecophora quadrimaculella CHAMBERS, Cincinnati Quart. Journ. Sci., vol. 2, p. 292, 1877; U. S. Geol. Geogr. Surv. Terr. Bull. 3, p. 129, 1877; p. 159, 1878.—RILEY, *in* Smith, List of Lepidoptera of Boreal America, No. 5556, 1891.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5927, 1903.

Borkhausenia quadrimaculella (Chambers) KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6473, 1903.

Epicallima quadrimaculella (Chambers) BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 202, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6495, 1917.—BRAUN, Proc. Acad. Nat. Sci. Philadelphia, vol. 73, p. 12, 1921.

Schiffermuelleria quadrimaculella (Chambers) MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 27, 1922.

Schiffermülleria quadrimaculella MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8365, 1939.

Oecophora dimidiella WALSINGHAM, Ins. Life, vol. 1, p. 148, 1888.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5554, 1891.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5925, 1903.—ANDERSON, Catalogue of British Columbia Lepidoptera, No. 1098, 1904. (New synonymy.)

Borkhausenia dimidiella (Walsingham) Kearfott, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6471, 1903.—Busck, Proc. U. S. Nat. Mus., vol. 27, p. 767, 1904.

Epicallima dimidiella (Walsingham) Busck, Proc. U. S. Nat. Mus., vol. 35, p. 202, 1908.—Barnes and McDunnough, Check list of the Lepidoptera of Boreal America, No. 6493, 1917.—Treherne, Sci. Agr., vol. 1, p. 116–118, 1921.—Braun, Proc. Acad. Nat. Sci. Philadelphia, vol. 73, p. 12, 1921.—Essig, Insects of Western North America, p. 719, 1926.

Schiffermuelleria dimidiella (Walsingham) Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 27, 1922.

Schiffermülleria dimidiella (Walsingham) Forbes, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 247, 1923.—Braun, Trans. Amer. Ent. Soc., vol. 51, p. 197, 1925.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8364, 1939.

Palpus black; second segment with a white longitudinal streak inwardly; apex of third segment white. Head and basal segment of antenna white to yellowish; antenna black with white spot above on each segment. Thorax, fore wing and cilia, and abdomen dark brown to black. Fore wing with four white or yellowish spots, two on costa and two on inner margin. Hind wing fuscous; cilia concolorous. Legs dark brown to black with whitish to yellowish inwardly; tarsi annulated with white or yellowish.

Male genitalia.—Costa straight; cucullus pointed; sacculus broad, lightly sclerotized. Anellus with short, slender, lateral processes. Vinculum rounded. Aedeagus slender, weak. Gnathos truncated. Uncus bluntly pointed.

Female genitalia.—Genital plate rectangular, moderately sclerotized; ostium V-shaped. Bursa copulatrix oval, signum a single, strongly sclerotized curved thorn.

Alar expanse, 11–20 mm.

Types.—In Museum of Comparative Zoology, Cambridge, Mass. (?) (*quadrimaculella*); in British Museum (*dimidiella*).

Type localities.—Clear Creek, Colo. (*quadrimaculella*); Sonoma County, Calif. (*dimidiella*).

Distribution.—North-central and Western United States and Canada.

United States records

Arizona: Redington, 2 ♂♂, ♀ (no date or collector); Santa Catalina Mountains, ♀ (no date or collector).

California: Camp Baldy, San Bernardino Mountains, ♀ (July 16–23); Monache Meadows, Tulare County, 8,000 feet, ♀ (July 8–14); Sonoma County, ♀ (19–V–1871, Walsingham); Tuolumne Meadows, Tuolumne County, ♀ (July 16–23).

Colorado: Custer County, ♀ (Wm. Beutenmüller); Florissant, ♂ (July 8, 1907, S. A. Rohwer); Peaceful Valley, ♀ (July 5, W. P. and T. D. A. Cockerell); Silverton, 2 ♀♀ (July 24–31); ♂, labeled only "Colorado," Wm. Beutenmüller).

Minnesota: Duluth, ♂ (no date or collector).
Montana: ♂ (J. Brunner); Two Medicine Lake (15–VII–20); Going-to-the-Sun (18–21–VII–20 (*teste* Braun).
Oregon: Ashland, ♂ (7–XI–1917, A. J. Wagner; [rf. *Pinus ponderosa*]).
Utah: Bear Lake (29–VI–1924) (*teste* Braun).
Washington: Metaline Falls, ♂, ♀ (12–VI–31, W. D. Bedard [from pine slabs]); Pullman, 4 ♂♂ (14–V–1930, F. G. Hinman), 2 ♂♂ (11–V–1930, 19–VI–1930, J. F. G. Clarke), ♀ (19–VI–1930, T. M. Clarke); Tieton, ♂ (12–V–1931, Fred P. Dean).

Canadian records

Alberta: Bilby, 27 ♂♂, 8 ♀♀ (June 18 to July 4, 1924, Owen Bryant).
British Columbia: Kaslo, ♂ (30–IV–1905, J. W. Cockle); Victoria, 3 ♂♂, ♀ (June dates, W. R Carter); Wellington, ♀ (June 22, 1904, G. W. Taylor).

Remarks.—I have two specimens before me that were determined by Walsingham as his *dimidiella*. These do not differ in any detail from *quadrimaculella*. I therefore believe the synonymy is correct.

The life history of this species is imperfectly known, but the larva appears to feed on the refuse that collects in the cracks of bark.

SCHIFFERMÜLLERIA EDITHELLA (Busck)

PLATE 20, FIGURES 120, 120a; PLATE 39, FIGURE 214

Epicallima edithella BUSCK, Journ. New York Ent. Soc., vol. 15, p. 138, 1907; Proc. U. S. Nat. Mus., vol. 35, p. 201, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6491, 1917.
Schiffermuelleria edithella (Busck) MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 26, 1922.
Schiffermülleria edithella (Busck) FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 247, 1923.—BRAUN, Trans. Amer. Ent. Soc., vol. 61, p. 46, 1935.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8362, 1939.
Epicallima amplicincta BRAUN, Trans. Amer. Ent. Soc., vol. 49, p. 117, 1923. (New synonymy.)

Palpus yellowish white, with fuscous scaling outwardly on third segment and tip of second. Face whitish. Head, antenna, thorax, and abdomen dark brown to black. Tip of antenna silvery white. Fore and hind wings dark brown, the fore wing with median longitudinal light golden streak ending well before apex; base and a transverse band at basal third golden, margined with brown; between the base and the band a metallic, blue-tinged fascia; on costal edge of longitudinal golden streak two bluish metallic dashes separated by a costal lobe of the golden color. Cilia of fore and hind wings dark brown. Fore and middle legs yellowish; fore pair fuscous outwardly; middle tibia fuscous outwardly on distal half; hind legs grayish exteriorly, yellowish inwardly.

Male genitalia.—Costa of harpe deeply concave; cucullus truncate; sacculus broad but not strongly sclerotized; costa and sacculus clothed with strong hairs. Lateral extensions of anellus long, curved, pointed.

Vinculum rounded. Aedeagus slender, slightly dilated basally. Uncus pointed.

Female genitalia.—Genital plate broad, strongly sclerotized; anterior edge convex. Ostium margined posteriorly with broad, finely scobinate prominences. [Ductus bursa and bursa copulatrix missing in only specimen available for study.]

Alar expanse, 9–11 mm.

Types.—In United States National Museum (*edithella*); in collection of Dr. A. F. Braun, Cincinnati, Ohio (*amplicincta*).

Type localities.—Center Harbor, N. H. (*edithella*); Cincinnati, Ohio (*amplicincta*).

Food plant.—Unknown (probably lichens).

Distribution.—Eastern United States.

United States records

Kentucky: Powell River, ♀ (June 26, A. F. Braun).
New Hampshire: Center Harbor, ♂ (July 22, 1902, H. G. Dyar).
Ohio: Cincinnati, 2 ♂♂ (June 5, June 13, 1918, A. F. Braun).
Pennsylvania: Delaware Water Gap, ♀ (no date or collector).
Virginia: Great Falls, ♂ (June 13, 1919, A. Busck).

Remarks.—Through the courtesy of Dr. Braun I was able to obtain a paratype of her species. There is no doubt about the synonymy.

Although the species is rare in collections it is probably common.

SCHIFFERMÜLLERIA LUCIDELLA (Busck)

PLATE 20, FIGURES 121, 121a; PLATE 39, FIGURE 215

Epicallima lucidella BUSCK, Ent. News, vol. 23, p. 170, 1912.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6495, 1917.—BRAUN, Trans. Amer. Ent. Soc., vol. 49, p. 118, 1923.

Schiffermuelleria lucidella (Busck) MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 26, 1922.

Schiffermülleria lucidella (Busck) FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 247, 1923.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8359, 1939.

Much like the foregoing species, but with the median longitudinal streak much darker and wider and extending to apex of wing.

Male genitalia.—Costa of harpe slightly convex, with a sharp, tooth-like projection near apex; cucullus bluntly pointed; sacculus broad, lightly sclerotized. Lateral extensions of anellus very long, slender, sharply pointed. Vinculum rounded. Aedeagus slender, dilated basally.

Female genitalia.—Genital plate strongly sclerotized, broad, concave posteriorly and broadly forked anteriorly. Ostium small, round.

Alar expanse, 10–12 mm.

Type.—In the United States National Museum.

Type locality.—Oak Station, Allegheny County, Pa.
Food plant.—Unknown (probably lichens).
Distribution.—Known from the type locality only.

United States records

Pennsylvania: Oak Station, Allegheny County, 28 ♂♂, 4 ♀♀ (June 4 to 23, 1911, 1912, Fred Marloff).

19. Genus CHAMBERSIA Riley

PLATE 1, FIGURE 4; PLATE 6, FIGURE 46; PLATE 12, FIGURES 79, 79a; PLATE 19, FIGURE 115

Chambersia RILEY, *in* Smith, List of the Lepidoptera of Boreal America, p. 115, 1891.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, p. 526, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, p. 115, 1903.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, p. 162, 1917.—BARNES and BUSCK, Contr. Lepid. North America, vol 4, p. 235, 1920.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 88, p. 49, 1938 (as synonym of *Borkhausenia*). (Genotype: *Blepharocera haydenella* Chambers, U. S. Geol. Geogr. Surv. Terr. Bull. 3, p. 145, 1877.)

Blepharocera Chambers, U. S. Geol. Geogr. Surv. Terr. Bull. 3, p. 144, 1877 (preoccupied). (Genotype: *Blepharocera haydenella* Chambers, U. S. Geol. Geogr. Surv. Terr. Bull. 3, p. 145, 1877.)

Labial palpus long, slender; second segment roughened in front with appressed scales; third segment shorter than second, acute. Tongue developed. Antenna long, ciliated in male, serrate in female; basal segment with pecten. Thorax smooth.

Fore wing rather narrow, broadest at apical third; costa straight, apex bluntly pointed, termen oblique; 12 veins; 2 remote from 3; 3, 4, and 5 equidistant; 7 and 8 stalked, both to costa; 10 remote from 9; 11 from well before middle of cell; internal cell absent.

Hind wing narrower than fore wing; costa gently arched; apex pointed; 8 veins; 2 remote from 3; 3 and 4 connate; 5 strongly curved; 6 and 7 strongly divergent apically.

Male genitalia.—Clasper absent. Anellus with lateral processes. Vesica unarmed. Gnathos and uncus well developed.

Female genitalia.—Genital plate partly membranous. Ductus bursae membranous. Ductus seminalis from about middle of ductus bursae. Signum present.

Remarks.—I am resurrecting *Chambersia* for *haydenella*, which I am removing from *Borkhausenia*. This genus differs from *Borkhausenia* in having vein 2 of the fore wing remote from 3; 10 remote from 9 and the internal cell absent. The hind wing is narrower than the fore wing and veins 3 and 4 are connate. The male genitalia lack a clasper and the signum is present in the female.

CHAMBERSIA HAYDENELLA (Chambers)

PLATE 1, FIGURE 3

Blepharoccra haydenella CHAMBERS, U. S. Geol. Geogr. Surv. Terr. Bull. 3, p. 144, 1877; Bull. 4, p. 132, 1878.—FLETCHER, Mem. Dept. Agr. India (Ent. Ser.), vol. 11, p. 33, 1929.

Chambersia haydenella (Chambers) RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5547, 1891.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5931, 1903.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6477, 1903.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6503, 1917.—FLETCHER, Mem. Dept. Agr. India (Ent. Ser.), vol. 11, p. 44, 1929.

Borkhausenia haydenella (Chambers) BARNES and BUSCK, Contr. Lepid. North America, vol. 4, p. 235, 1920.—BRAUN, Proc. Acad. Nat. Sci. Philadelphia, vol. 73, p. 12, 1921.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 40, 1922.—MCDUNNOUGH, Can. Ent., vol. 59, p. 271, 1927.—GAEDE, *in* Bryk, Lepidopterorum catalogus, pt. 88, p. 59, 1938.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8370, 1939.

Labial palpus ochreous-white; second segment suffused with light fuscous outwardly and mottled inwardly; third segment suffused with fuscous outwardly. Antenna light fuscous; basal segment ochreous-white above. Head, thorax, and ground color of fore wing grayish-fuscous, strongly irrorated with white; a spot at base of costa, a large spot at the center of the wing and another at the end of the cell, fuscous; at apex a large fuscous spot connected with a similar, but smaller spot at tornus, by a narrow fuscous band around termen (all the dark markings are more or less indistinct and fused with the ground color); cilia grayish fuscous. Hind wing fuscous; cilia grayish fuscous. Legs ochreous-white strongly suffused with light grayish fuscous. Abdomen shining grayish fuscous; silvery beneath.

Male genitalia.—Harpe short, broad; costa strongly convex; cucullus rounded; sacculus moderately broad, lightly sclerotized. Anellus a small sclerotized plate with strong, curved, pointed, lateral processes; the lateral processes are very broad basally. Aedeagus slender, slightly curved, weak; vesica unarmed. Vinculum rounded. Gnathos broad, with a short, sharp point and median posterior protuberance. Uncus pointed.

Female genitalia.—Genital plate broad, membranous anteriorly and in middle. Ostium large, broadly oval. Ductus bursae short; inception of ductus seminalis slightly posterior to middle. Bursa copulatrix oval; signum a small, weakly sclerotized, toothed plate.

Alar expanse, 12–17 mm.

Type.—In the Museum of Comparative Zoology, Cambridge, Mass.

Type locality.—"Colorado."

Food plant.—Unknown.

Distribution.—From Colorado northward to Alberta and westward to Vancouver Island, British Columbia.

United States records

Colorado: Silverton, 3 ♂♂ (July 24–31).
Montana: (*teste* Braun).

Canadian records

Alberta: Waterton Lakes, 2 ♂♂, ♀ (11–14–VII–1923, J. McDunnough).
British Columbia: Kaslo, ♂ (7–VI–1908, J. W. Cockle); Mount McLean, Lillooet, alt. 4,000–5,000 feet, ♂, ♀ (26–VIII–1923, J. McDunnough); Salmon Arm, ♂ (2–VI–1922, W. R. Buckell); Seton Lake, Lillooet, ♂ (9–VI–1926, J. McDunnough).

Remarks.—Various authors have placed this species in one or another genus, but, as pointed out in the generic discussion, it is unique and cannot be confused with ony other described from North America. It probably will be found in other western States and Provinces.

20. Genus EPICALLIMA Dyar

PLATE 2, FIGURE 14; PLATE 6, FIGURE 47; PLATE 12, FIGURE 81, 81a; PLATE 16, FIGURE 99

Epicallima DYAR, U. S. Nat. Mus. Bull. 52, p. 525, 1903.—KEARFOTT, *in* Smith, List of the Lepidoptera of Boreal America, p. 115, 1903.—MEYRICK, Journ. Bombay Nat. Hist. Soc., vol. 17, p. 408–409, 1906.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 201, 1908.—KEARFOTT, *in* Smith, Catalogue of the insects of New Jersey, p. 562, 1910.—BUSCK, Ent. News, vol. 23, p. 170, 1912; Proc. Ent. Soc. Washington, vol. 14, p. 44, 1912; Proc. U. S. Nat. Mus., vol. 47, p. 33, 1914.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, p. 161, 1917. (Genotype: *Callima argenticinctella* Clemens.)
Callima CLEMENS, Proc. Acad. Nat. Sci., Philadelphia, vol. 12, pp. 166–167, 1860; *in* Stainton, Tineina of North America, p. 122–123, 1872. (Genotype: *Callima argenticinctella* Clemens.)

Head smooth, side tufts somewhat raised, tongue developed; antenna finely ciliated in male, simple in female; basal segment without pecten. Labial palpus long, slender, greatly exceeding vertex; second segment much longer than third, slightly roughened.

Fore wing elongate, apex pointed, termen oblique, 12 veins; 2, 3, and 4 approximate at base, from angle of cell; 7 and 8 stalked, both to costa; 11 from before middle of cell.

Hind wing narrower than fore wing; costa excavated; 8 veins; 3 and 4 connate or short stalked; 5 about equidistant from 4 and 6.

Male genitalia.—Harpe long and slender, with pointed extension of sacculus arising near cucullus. Anellus with lateral projections, fused or separate. Vesica armed. Gnathos and uncus well developed.

Female genitalia.—Ductus bursae partly sclerotized and armed on the inner surface with toothlike spines. Signum present.

Remarks.—Dyar[56] proposed the name *Epicallima* to replace *Callima* Clemens (1860) which he considered preoccupied by *Kallima*

[56] Dyar, U. S. Nat. Mus. Bull. 52, p. 525, 1903.

Westwood (1849). This has been generally accepted since the initial letter of each is identical. If the two names (*Callima* and *Kallima*) are ever considered separate terms then *Callima* will supersede *Epicallima.*

KEY TO THE SPECIES OF EPICALLIMA BASED ON COLORATION

Base of fore wing brown---------- **argenticinctella** (Clemens) (p. 225)
Base of fore wing not brown---------- **formosella** (Schiffermüller) (p. 257)

KEY TO THE SPECIES OF EPICALLIMA BASED ON MALE GENITALIA

Lateral projections of anellus divergent, not reaching gnathos (fig. 81)---------- **argenticinctella** (Clemens) (p. 255)
Lateral projections of anellus fused and reaching gnathos (fig. 124) **formosella** (Schiffermüller) (p. 257)

KEY TO THE SPECIES OF EPICALLIMA BASED ON FEMALE GENITALIA

Signum a small toothed plate (fig. 99)----- **argenticinctella** (Clemens) (p. 255)
Signa two large toothed plates (fig. 216)-- **formosella** (Schiffermüller) (p. 257)

EPICALLIMA ARGENTICINCTELLA (Clemens)

Callima argenticinctella Clemens, Proc. Acad. Nat. Sci. Philadelphia, vol. 12, p. 167, 1860; *in* Stainton, The Tineina of North America, p. 123, 1872.—Chambers, U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 134, 1878.—Busck, Proc. Ent. Soc. Washington, vol. 5, p. 201, 1903.

Oecophora argenticinctella (Clemens) Chambers, Cincinnati Quart. Journ. Sci., vol. 2, p. 114, 1875; U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 158, 1878.—Riley, *in* Smith, List of the Lepidoptera of Boreal America, No. 5549, 1891.

Epicallima argenticinctella (Clemens) Busck, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 5920, 1903.—Kearfott, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6467, 1903.—Busck, Proc. U. S. Nat. Mus., vol. 35, p. 201, 1908.—Barnes and McDunnough, Check list of the Lepidoptera of Boreal America, No. 6490, 1917.—Rhoads, New York State Coll. For. Techn. Publ. 17, p. 204, 1924.

Epicallina argenticinctella (Clemens) Blackman and Stage, New York State Coll. For. Techn. Publ. 10, p. 108, 1918.

Schiffermülleria argenticinctella (Clemens) Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 26, 1922.—Forbes, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 247, 1923; *in* Leonard, Cornell Univ. Agr. Exp. Stat. Memoir 101, p. 546, 1928.—Procter, Biological survey of the Mount Desert region: Part 6, The insect fauna, p. 273, 1938.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8361, 1939.

Labial palpus with second segment blackish fuscous; terminal segment and antenna black and white. Head pale to golden-yellow. Thorax yellowish brown. Fore wing pale to golden-yellow and brown; base of inner margin with narrow silver bar; from inner

margin an inwardly oblique, narrow, antemedian silvery line, which does not reach costa; from costa a postmedian outwardly oblique silvery bar reaching about one-half distance across wing; opposite it from inner margin a semicircular silver bar, the outer half of which is composed of lead colored scales; all the above silvery bars narrowly edged with black; cilia golden-yellow except a few before tornus which are fuscous. Hind wing and cilia fuscous. Fore and middle pair of legs chiefly black and white; hind pair lighter. Abdomen fuscous.

Male genitalia.—Harpe elongate, slender; cucullus bluntly pointed; sacculus broad with a terminal curved projection extending beyond cucullus. Anellus a more or less rectangular sclerotized plate with widely separated lateral processes; the processes about twice the length of the central plate. Aedeagus stout, slightly narrower at the middle than at the extremities; distal end terminating in a sharp, thorn-like point; vesica armed with one long straight cornutus. Gnathos drawn out into a blunt point medially.

Female genitalia.—Genital plate broad, moderately sclerotized. Ostium large, oval. Ductus bursae strongly sclerotized in posterior half and armed with 12–18 strong teeth inwardly. Signum a small, strongly sclerotized toothed plate.

Alar expanse, 10–13 mm.

Type.—In the Academy of Natural Sciences of Philadelphia.

Type locality.—"Pennsylvania."

Food plants.—Dead wood and bark of hickory, larch, elder, elm.

Distribution.—Eastern United States.

United States records

Illinois: Decatur, 3 ♂♂ (June 16–23).

Iowa: Sioux City, ♂ ("9–18," C. N. Ainslie).

Kentucky: ♀ (no data).

Maryland: Cabin John, ♂ (August 1902, A. Busck); Plummers Island, 2 ♂♂ (July 1903, A. Busck); ♀ ('07, Barber and Schwarz); ♀ (July 17, L. J. Bottimer).

New Hampshire: Central Harbor, ♀ (July 30, 1902, H. G. Dyar); ♂ (no locality; A. Busck).

New Jersey: 3 ♂♂ (no locality; A. Busck and Wm. Beutenmüller); Essex County, 6 ♂♂, 2 ♀♀ (July, W. D. Kearfott); Montclair, ♂ (8–6–99, W. D. Kearfott).

New York: Woodhaven, Long Island, ♀ (6–VI–21, G. P. Engelhardt); ♂ (no locality, Wm. Beutenmüller).

Ohio: Cincinnati, 3 ♂♂, ♀ (VII–2–5–1907, VIII–3–07, VI–16–08, A. F. Braun).

Pennsylvania: Arendtsville, ♂, ♀ (6–VII–1921, S. W. Frost); Harrisburg, ♀ (30–VII–1914, W. S. Fisher); New Brighton, ♂, 2 ♀♀ (16–VII–1907 and 28–VII–1907, H. D. Merrick); Oak Station, Allegheny County, 7 ♂♂, ♀ (June and July 1906 to 1908, Fred Marloff); Pittsburgh, ♀ (24–VI–06, Henry Engel).

Remarks.—This species undoubtedly will be found through much more of eastern North America than is indicated by present records, and its range may also extend west of the Rocky Mountains.

EPICALLIMA FORMOSELLA (Schiffermüller)

PLATE 20, FIGURES 124, 124a; PLATE 39, FIGURE 216

Phalaenae Tineae formoselle SCHIFFERMÜLLER, Systematisches Verzeichniss der Schmetterlinge der Wiener Gegend, p. 140, 1776.

Alucita formosella (Schiffermüller) FABRICIUS, Mantissa insectorum, vol. 2, p. 255, 1787.

Tinea formosella (Schiffermüller) HÜBNER, Sammlung europäischer Schmetterlinge, fig. 248, [1793–1827].

Oecophora formosella (Schiffermüller) TREITSCHKE, Die Schmetterlinge von Europa, vol. 9, p. 170, 1833.—FREY, Die Tineen und Pterophoren der Schweiz, p. 158, 1856.—HEINEMANN, Die Schmetterlinge Deutschlands und der Schweiz, p. 382, 1870.

Lamprus formosella (Schiffermüller) HERRICH-SCHÄFFER, Systematische Bearbeitung der Schmetterlinge von Europa, vol. 5, p. 141, 1855.

Acampsia formosella (Schiffermüller) MEYRICK, A handbook of British Lepidoptera, p. 635, 1895.

Borkhausenia formosella (Schiffermüller) REBEL, *in* Staudinger and Rebel, Catalog der Lepidopteren des palaearctischen Faunen-gebietes, vol. 2, p. 178, No. 3387, 1901.

Schiffermülleria formosella (Schiffermüller) MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 27, 1922; A revised handbook of British Lepidoptera, p. 667, 1928.—FORBES, *in* Leonard, Cornell Univ. Agr. Exp. Stat. Memoir 101, p. 546, 1928.

Rhinosia flammella DUPONCHEL, Histoire naturelle des lepidoptères ou papillons de France, Supplement, vol. 4, p. 253, pl. 72, fig. 4, 1842.

Much like *argenticinctella*, but with second segment of palpus ochreous and head brown. Basal third of fore wing ochreous followed by a brown median area, the latter in turn followed by a lighter color; on middle of inner margin a large ochreous spot bounded by a crescentic white line inwardly and followed by a narrow extension of the median brown shade; from middle of costa to end of cell a moderately broad white band narrowing toward end of cell.

Male genitalia.—Cucullus broadly rounded; sacculus well defined, moderately sclerotized; clasper absent. Anellus strongly sclerotized; lateral extensions reaching gnathos, fused for much of their length, pointed. Vinculum bluntly pointed. Aedeagus long, slender, straight; vesica armed with a single slender cornutus. Gnathos and uncus pointed.

Female genitalia.—Genital plate broad, somewhat rectangular, moderately sclerotized. Ductus bursae long, slender, sclerotized except for a dilated, membranous section near middle and the extreme anterior membranous part before the bursa copulatrix. Inception of ductus

seminalis between the two sclerotized portions of the ductus bursae; at anterior end of posterior sclerotized portion numerous small but strong teeth. Bursa copulatrix moderately large, oval; signa two large, sclerotized, finely toothed plates.

Alar expanse, 10–13 mm.

Type.—Lost (?) (*formosella*); Paris Museum (?) (*flammella*).

Type localities.—Europe (*formosella*, *flammella*).

Food plants.—Under bark of apple and red maple.

Distribution.—Eastern United States.

United States records

New Jersey: North Bergen, 3 ♂♂, 3 ♀♀ (11–X–1940, George Rau); Ramsey, ♂ (2–VIII–35, Dr. A. B. Klots).

New York: Flatbush, Long Island, ♀ (20–VII, G. P. Engelhardt); Woodhaven, Long Island, ♂ (9–VII–1930, G. P. Engelhardt).

Remarks.—This species has been introduced into the United States within recent years. So far as I am able to ascertain it is to be found only in New Jersey and New York. The habit of this and the preceding species of feeding under bark of various trees is very conducive to the spread of the insects. For this reason we should expect it to become rather widespread in this country.

The specimens from North Bergen, N. J., were reared from larvae found in association with the mealybug, *Pseudococcus comstocki* (Kuw.). It was assumed that the larvae were predacious on the mealybugs, but no conclusive evidence in support of this assumption has been obtained.

I have compared our American specimens carefully with a long series from Europe and there is no doubt about their specific identity.

21. Genus HOFMANNOPHILA Spuler

PLATE 2, FIGURE 12; PLATE 6; FIGURE 43; PLATE 12, FIGURES 78, 78a, 78b; PLATE 16, FIGURE 101

Hofmannophila SPULER, *in* Hofmann, Die Schmetterlinge Europas, vol. 2, p. 340, 1910.

Borkhausenia Auctorum, in part.

Head smooth, side tufts loosely appressed; tongue developed. Antenna ciliated; basal segment with pecten. Labial palpus long, recurved; second segment slightly roughened in front; third segment as long as second, acute.

Fore wing oblong-ovate with costa slightly convex; apex rounded; termen oblique; 12 veins; 2 from near angle; 2, 3, 4, and 5 approximate at bases; 5 and 6 parallel; 7 and 8 stalked, both to costa; 11 from well before middle of cell.

Hind wing as broad as fore wing, pointed; costa slightly convex before middle; 8 veins; 3 and 4 connate; 5 curved; 6 and 7 subparallel.

Male genitalia.—Harpe with clasper. Gnathos and uncus well developed.

Female genitalia.—Anterior apophyses branched. Ductus bursae partly sclerotized. Signum present.

Larva.—Ninth segment with seta I approximate to II (much closer to II than to III); seta VI not on the same pinaculum with IV and V, approximate to VII. Setal group VII essentially as in *Agonopterix:* bisetose on first and seventh, unisetose on eighth and ninth abdominal segments. Ocelli reduced (ocellus 1 more or less completely fused with 2 and ocellus 3 with 4). Submentum without pit.

Pupa.—Pubescent. Prothoracic femora and labial palpi not exposed. Cremaster absent.

Remarks.—Hofmannophila may be distinguished, in the larva, from other oecophorid genera (except *Endrosis*) by the approximation of seta I with II and VI with VII on the ninth abdominal segment; and from *Endrosis* by the absence of a submental pit and the presence of only two setae in group VII on the second abdominal segment.

Lepesme [57] has pointed out the differences between *Hofmannophila* and *Borkhausenia.* Although he has used *B. stipella* (Linnaeus) (a congener of *minutella* Linnaeus) for his comparisons with *pseudospretella*, the differences show adequately why *Hofmannophila* should be removed from *Borkhausenia* (Genotype: *Phalaena Tinea minutella* Linnaeus).

HOFMANNOPHILA PSEUDOSPRETELLA (Stainton)

Oecophora pseudospretella Stainton, Catalogue of the British Tineidae and Pterophoridae, p. 14, 1849; Insecta Britannica Tineina, p. 162, 1854; A manual of British butterflies and moths, vol. 2, p. 358, 469, 1859.—Tengström, *in* Förhandlingar, Pro fauna et flora Fennica, p. 346, No. 1052, 1869.—Heinemann, Die Schmetterlinge Deutschlands und der Schweiz, vol. 2, p. 377, 1870.—Wocke, *in* Staudinger and Wocke, Catalog der Lepidopteren des europaeischen Faunengebiets, vol. 2, p. 307, No. 2265, 1871.—Wollaston, Ann. Mag. Nat. Hist., ser. 5, vol, 3, p. 436, 1879.—Sorhagen, Die Kleinschmetterlinge der Mark Brandenburg, p. 333, 1886.—Walsingham, Ins. Life, vol. 1, p. 149, 1888.—Riley, *in* Smith, List of the Lepidoptera of Boreal America, No. 5555, 1890.—Disqué, Ent. Zeit. (Stettin), vol. 56, p. 244, 1895.—Reutti, Verh. Naturw. Ver. Karlsruhe, vol. 12, p. 238, 1898.—Seebold, Deutsche Ent. Zeitschr., Iris, vol, 11, p. 316, 1898.—Crombrugghe, Ann. Soc. Ent. Belg., vol. 42, p. 36, 1898.—Disqué, Deutsche Ent. Zeitschr., Iris, vol. 14, p. 214, 1902.—Busck, *in* Dyar, U. S. Nat. Mus. Bull. 52 ,No. 5926, 1903.—Anderson, Catalogue of British Columbia Lepidoptera, No. 1099, 1904.—Blair, Entomologist, vol. 58, p. 10, 1925.

Acompsia pseudospretella (Stainton) Meyrick, A handbook of British Lepidoptera, p. 634, 637, 1895.—Longstaff, Ent. Monthly Mag., vol. 38, p. 28, 1902.

[57] Lepesme, P., Bull. Soc. Ent. France, vol. 42, p. 284, 1937.

Gelechia pseudospretella (Stainton) HERRICH-SCHÄFFER, Systematische Bearbeitung der Schmetterlinge von Europa, vol. 5, p. 162, 181, fig. 627, 1855.

Lamprus pseudospretella (Stainton) RÖSSLER, Jahrb. nassau. Ver. Naturk., vol. 34, p. 281, 1881.

Lampros pseudospretella (Stainton) SNELLEN, Die Vlinders van Nederland, vol. 2, p. 725, 1882.

Borkhausenia pseudospretella (Stainton) REBEL, *in* Staudinger and Rebel, Catalog der Lepidopteren des palaearctischen Faunengebietes, vol. 2, No. 3358, 1901.—MALLOCH, Ent. Monthly Mag., vol. 37, p. 186, 1901.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6472, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 27, p. 766, 1904.— DYAR, Proc. U. S. Nat. Mus., vol. 27, p. 934, 1904.—CROMBRUGGHE, Mem. Soc. Ent. Belg., vol. 14, p. 54, 1906.— SICH, Entomologist, vol. 40, p. 42, 261, 1907.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 204, 1908.—SICH, Ent. Rec. vol. 20, p. 92, 1908.—MÜLLER-RUTZ, Mitt. Schweiz, Ent. Ges., vol. 11, p. 348, 1909.—PIQUENARD, Bull. Soc. Sci. Med. Ouest., vol. 19, p. 79, 1910.—KRULIKOWSKI, Rev. Russe Ent., vol. 9, p. 321, 1910.—GRIEBEL, Die Lepidopteren Fauna der bayerischen Rheinpfalz, vol. 2, p. 54, 1910.—SICH, Entomologist, vol. 43, p. 150, 1910.—SKALA, Int. Ent. Zeitschr., vol. 5, p. 303, 1912; Verh. Nat. Ver. Brünn, vol. 51, p. 317, 1913.— HAMPELT, Arkiv für Zoöl., vol. 10, No. 25, p. 9, 1917.—MARTINI, Deutsche Ent. Zeitschr., Iris, vol. 14, p. 214, 1917.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6504, 1917.—MITTERBERGER, Jahresb. Wien. Ent. Ver., vol. 28, p. 67, 1918.—HAWKSHAW, Entomologist, vol. 52, p. 82, 1919.—STRAND, Archiv für Naturg., vol. 85 A, pt. 4, p. 9, 1920.— CARADJA, Deutsche Ent. Zeitschr., Iris, vol. 34, p. 140, 1920.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 41, 1922.—HAUDER, Jahresb. Oberösterr. Musealver., vol. 80, p. 285, 1924.—CARADJA, Deutsche Ent. Zeitschr., Iris, vol. 40, p. 43, 1926.—ESSIG, Insects of western North America, p. 719, 1926.—WATERS, Ent. Monthly Mag., vol. 64. p. 177, 1928.—MEYRICK, A revised handbook of British Lepidoptera, p. 669, 1928.—HAYWARD, Entomologist, vol. 62, p. 50, 1929.—FORD, Entomologist, vol. 62, p. 261, 1929.—DALTRY, Entomologist, vol. 63, p. 115, 1930.—SCHÜTZE, Deutsche Ent. Zeitschr., Iris, vol. 44, p. 31, 1930.—NICHOLSON, Ent. Rec., vol. 43, p. 88, 1931.—FORD, Entomologist, vol. 64, p. 259, 1931.—CHRYSTAL, Ent. Monthly Mag., vol. 68, p. 9, pl. 2, figs. 1–5, 1932.—ADKIN, Ent. Monthly Mag., vol. 68, p. 40, 1932.—FRYER, Ent. Monthly Mag., vol. 68, p. 137, 1932.—AUSTEN and HUGHES, Brit. Mus. Econ. Ser. No. 14, p. 34, figs. 19, 20, 1932.—ECKSTEIN, Die Kleinschmetterlinge Deutschlands, p. 124, pl. 10, figs. 1, 2, 1933.—MORLEY and RAIT-SMITH, Trans. Ent. Soc. London, vol. 81, p. 178, 1933.—PIERCE and METCALFE, The genitalia of the tineid families of the Lepidoptera of the British Islands, p. 30, pl. 16, 1935.—RAPP, Die Natur der mitteldeutschen Landschaft Thüringen; Beiträge zur Fauna Thüringens, vol. 2, p. 142, 1936.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8376, 1939.

Borkhausenia pseudosprella AUSTEN, Ent. Rec., vol. 45, p. 16, 1933.

Hofmannophila pseudospretella SPULER, *in* Hofmann, Die Schmetterlinge Europas, ed. 3, vol. 2, p. 340, fig. 111; pl. 89, fig. 42, 1910.—VORBRODT und MÜLLER-RUTZ, Schmetterlinge der Schweiz, vol. 2, p. 464, 1914.—LINCK and WEBER, Schweiz. Ent. Anz., vol. 1, p. 59, 1922.—PETERSEN, Lepidopteren Fauna von Estland (Esti), p. 510, 1924.—GRÖNLEIN, Norsk. Ent. Tidsskr., vol. 2, p. 46, 1924.— HELLÉN, Notulae Ent., vol. 6, p. 31, 1926.—LARSEN, Ent. Meddel., ser. 2, vol. 11 (whole ser. 17), p. 79, 1927.—FLETCHER, Mem. Dept. Agr. India (Ent. Ser.),

vol. 11, p. 110, 1929.—Vorkbodt, Deutsche Ent. Zeitschr., Iris, vol. 45, p. 128, 1931.—Hering, *in* Brohmer, Ehrmann, und Ulmer, Die Tierwelt Mitteleuropas (Ergänzbd. 1), p. 151, 1932.—Lepesme, Bull. Soc. Ent. France, vol. 42, p. 283, fig. 1, pl. 1, figs. 1–4, 1937.

Labial palpus, head, thorax, and ground color of fore wing pale ochreous. Second segment of labial palpus dark fuscous exteriorly on basal half; third segment strongly overlaid with fuscous except posterior edge at middle. Antenna fuscous narrowly and faintly annulated with ochreous. Collar iridescent blackish fuscous; remainder of thorax, tegula, and fore wing irrorated and suffused with fuscous; in fold, from base, along vein 1c of fore wing, a series of two or three short, longitudinal, blackish-fuscous dashes; in cell, at basal third, an elongate blackish-fuscous discal spot; at the end of cell another conspicuous, large, similarly colored spot; extreme base of costa blackish fuscous; from apical third of costa, around termen to inner margin, a series of short, blackish-fuscous dashes; cilia pale ochreous-fuscous. Hind wing shining light yellowish fuscous; cilia yellowish fuscous. Legs pale ochreous strongly overlaid with blackish fuscous except on hind tibia. Abdomen pale ochreous, suffused with fuscous. Legs and underside of abdomen iridescent.

Male genitalia.—Harpe ample, strongly sclerotized except for an area between sacculus and costa; near base, at each end of the articulation with the transtilla, a profusely hairy, fleshy swelling; cucullus pointed; sacculus narrow; clasper very stout, extending past middle of harpe; distal end deeply excavated. Anellus an elongate plate with broadly V-shaped posterior edge and with long, papillate laterobasal lobes. Aedeagus stout, terminating in a short point; basal portion bandlike, coiled; vesica armed with a single, long, curved cornutus. Vinculum broadly rounded. Transtilla a narrow sclerotized band. Gnathos beaked, pointed; posterior surface excavated, scobinate. Uncus long, stout, pointed.

Female genitalia.—Ovipostor short; anterior apophyses branched. Genital plate sclerotized posteriorly, membranous anteriorly. Ostium rather broad oval, preceded by a short, sclerotized portion of the ductus bursae. Ductus bursae convoluted; sclerotized in posterior two-thirds except for a short membranous portion anterior to the sclerotized ring at ostium; sclerotized portion of ductus bursae armed with small teeth on inner surface; inception of ductus seminalis at posterior edge of the long sclerotized part of ductus bursae. Bursa copulatrix small, round with a moderately small, oval, sclerotized, toothed signum.

Alar expanse, 15–26 mm.

Type.—In the British Museum (?).

Type locality.—?

Hosts.—Furs, skins, museum specimens, including moths; seeds of many kinds, dried plants, live and dead lepidopterous pupae, figs, dates, stored cereals, upholstering, carpets, book bindings, corks of wine bottles, etc.

Remarks.—The above list of hosts will give some idea of the wide variety of substances attacked by this species.

Distribution.—Universal. In North America it is found in the Pacific Coast states, Nevada, southern British Columbia eastward to Manitoba and Pennsylvania.

United States records

California: Alameda County, 2 ♂♂, 2 ♀♀ (20–II–1908, 19–22–IX–1908, G. R. Pilate); Berkeley, 2 ♀♀ (May, June); Carmel, ♀ (June, A. H. Vachell); Eureka, 5 ♂♂, 3 ♀♀ (5–6–VI, H. S. Barber); Los Angeles, 2 ♀♀ (no date, Coquillett); Mills College, ♂ (7–VI–1908, G. R. Pilate); Mount Hermon, Santa Cruz County, ♂ (5–IX–1931, H. H. Keifer); Plumas County, ♀ ("July 24–31"); Santa Clara, ♀ (no date or collector).

Nevada: Glenbrook, 2 ♀♀ (August 25, 1915, H. G. Dyar).

Oregon: Albany, ♀ (12–VII–1940, S. M. Dohanian [rf. filbert nut]); Portland ♂, 2 ♀♀ (13–VII–1918, E. J. Newcomber [Quaintance No. 14101)]; ♂ (4–VII–1931, J. F. G. Clarke); Shedd, ♂, ♀ (June 1939, J. E. Davis); Tualatin, ♀ (15–VII–1919, L. R. Rockwood).

Pennsylvania: Norristown, 2 ♀♀ (17–V–1939, G. K. Schumaker [rf. *Thuja plicata* seed]).

Washington: Bellingham, 3 ♂♂, 2 ♀♀ (May to September dates, 1922–1931, J. F. G. Clarke); Blaine, ♂ (12–VI–1934, no collector); Chehalis, ♀ (no date, T. Kincaid); Friday Harbor, 3 ♂♂ (12–14–VII–1924, T. Kincaid); Pullman, ♀ (15–VI–1930, J. F. G. Clarke); Seattle (2 ♂♂, 19–VIII–1930, J. F. G. Clarke; ♀, September, 1898, C. V. Piper); Seaview, 4 ♂♂, 2 ♀♀ (23–V–1918; 16–VII–1918, H. K. Plank [Quaintance Nos. 15541, 15582]); Snoqualmie Pass, Kittitas County, ♀ (12–VIII–1930, J. F. G. Clarke).

Canadian records

British Columbia: Duncan, ♀ (June 1908, Hanham); Goldstream, ♀ (6–IX–1920, E. H. Blackmore); Kaslo, ♂ (8–VIII–1903, H. G. Dyar); Maillardville, ♂ (9–VI–1920, no collector); Malakatla (August 22, 1904, Rev. G. H. Keene); Maple Bay (13–VII–1933, J. McDunnough); Sandon, ♀ (13–VIII–1903, Currie); Sooke, ♂ (10–III–1922, no collector); Vancouver (12–IV–1903; 27–VII–1905, no collector); Victoria, 3 ♂♂ (30–V–1921, 5–VII–1921); ♀ (1–IX–1921, W. R. Carter); ♂ (6–VII–1920); 2 ♀♀ (14–VIII–1920, E. H. Blackmore); 2 ♀♀ (1–IX–1903, 5–IX–1903, H. G. Dyar); Wellington, (2 ♂♂, ♀, 15–VII–1902, G. W. Taylor; 2 ♀♀, June 1900, no collector).

Manitoba: Aweme, 3 ♀♀ (31–V–1904, 16–V–1905, N. Criddle).

22. Genus ENDROSIS Hübner

PLATE 1, FIGURE 5; PLATE 7, FIGURE 51; PLATE 8, FIGURES 60, 60a; PLATE 19, FIGURE 116

Endrosis HÜBNER, Verzeichniss bekannter Schmetterlinge, p. 401, 1825.—CLEMENS, Proc. Acad. Nat. Sci. Philadelphia, 1860 p. 165; *in* Stainton, Tineina of North America, p. 119, 1872.—CHAMBERS, Cincinnati Quart.

Journ. Sci., vol. 2, p. 244, 1875; U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 140, 1878.—Riley, *in* Smith, List of the Lepidoptera of Boreal America, p. 107, 1891.—Dyar, Journ. New York Ent. Soc., vol. 3, p. 19, 1895.—Dietz, *in* Smith, Catalogue of the insects of New Jersey, p. 477, 1900.—Busck, *in* Dyar, U. S. Nat. Mus. Bull. 52, p. 543, 1903.—Kearfott, *in* Smith, Check list of the Lepidoptera of Boreal America, p. 118, 1903.—Busck, Proc. U. S. Nat. Mus., vol. 27, p. 767, 1904.—Anderson, Catalogue of British Columbia Lepidoptera, p. 55, 1904.—Busck, Proc. U. S. Nat. Mus., vol. 35, p. 203, 1908.—Forbes, Ann. Ent. Soc. Amer., vol. 3, p. 132, pl. 20, fig. 143, 1910.—Kearfott, *in* Smith, Catalogue of the insects of New Jersey, p. 562, 1910.—Walsingham, Biol. Centr.-Amer., Lepidoptera-Heterocera, vol. 4, p. 126, 1912.—Barnes and McDunnough, Check list of the Lepidoptera of Boreal America, p. 162, 1917.—Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 33, 1922.—Forbes, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 250, 1923.—Fletcher, Mem. Dept. Agr. India (Ent. Ser.), vol. 11, p. 77, 1929.—Pierce and Metcalfe, The genitalia of the tineid families of the Lepidoptera of the British Islands, p. 29, 1935.—Gaede, *in* Bryk, Lepidopterorum catalogus, pt. 88, p. 43, 1938.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), p. 77, 1939. (Genotype: *Phalaenae Tineae lactella* Schiffermüller, Systematisches Verzeichniss der Schmetterlinge der Wiener Gegend, p. 139, 1776.)

Head smooth. Tongue developed. Basal segment of antenna with pecten. Labial palpus long, curved, smooth; second segment slightly thickened with appressed scales; terminal segment nearly as long as second.

Fore wing with 2 from before angle; 4 and 5 approximated at base; 7 and 8 stalked, both to costa; 11 from before middle.

Hind wing narrower than fore wing, ovate-lanceolate; 7 veins; veins 3 and 4 stalked; 5 absent; 6 and 7 subparallel.

Male genitalia.—Harpe with clasper. Anellus with elongated, lateral processes. Vinculum spatulate. Gnathos and uncus present, pointed.

Female genitalia.—Ovipositor very long, always extended. Anterior apophyses branched. Ductus bursae enlarged in posterior half; strongly sclerotized. Signum a few minute dots.

Abdomen spined.

Larva.—Ninth segment with setae I and II approximate; seta VI not on same pinaculum with IV and V, approximate to VII. Setal group VII trisetose on first, bisetose on seventh and unisetose on eighth and ninth abdominal segments. Ocelli reduced (ocelli 1, 2, 5, and 6 absent). Submentum with a large sclerotized pit.

Pupa.—Smooth. Prothoracic femora exposed. Labial palpi exposed and large. Cremaster absent.

Remarks.—Endrosis may be distinguished from one group of American oecophorid genera by the presence of pecten on the basal segment of the antenna, and from those genera with pecten by the absence of vein 5 of the hind wing. In the larval and pupal stages

it appears nearest to *Hofmannophila*, from which it is distinguished chiefly by the large pit in the submentum of the larva and the exposed labial palpi of the pupa.

ENDROSIS LACTELLA (Schiffermüller)

Phalaenae Tineae lactella SCHIFFERMÜLLER, Systematisches Verzeichniss der Schmetterlinge der Wiener Gegend, p. 139, 1776.

Endrosis lactella (Schiffermüller) DONISTHORPE, Ent. Rec., vol. 29, p. 33, 1917.—MEYRICK, Natural history of Juan Fernandez and Easter Island, vol. 3, p. 268, 1920; *in* Wytsman, General insectorum, fasc. 180, p. 33, 1922; A revised handbook of British Lepidoptera, p. 668, 1928.—FORD, Entomologist, vol. 62, p. 261, 1929.—MEYRICK, Anal. Mus. Buenos Aires, vol. 36, p. 390, 1931.—FORD, Entomologist, vol. 64, p. 259, 1931.—TURNER, Proc. Linn. Soc. New South Wales, vol. 57, p. 279, 1932.—AUSTEN and HUGHES, Brit. Mus. Econ. Ser., No. 14, p. 33, fig. 18, 1932.—FRYER, Ent. Monthly Mag., vol. 68, p. 137, 1932.—CURTIS, Ent. Monthly Mag., vol. 68, p. 166, 167, 1932.—AUSTEN, Ent. Rec., vol. 45, p. 16, 1933.—MORLEY and RAIT-SMITH, Trans. Ent. Soc. London, vol. 81, p. 178, 1933.—PIERCE and METCALFE, The genitalia of the tineid families of the Lepidoptera of the British Islands, p. 29, pl. 16, 1935.

Endrosis lacteella HERRICH-SCHÄFFER, Systematische Bearbeitung der Schmetterlinge von Europa, vol. 5, p. 262, 1853.—FREY, Die Tineen und Pterophoren der Schweiz, p. 168, 1856.—STAUDINGER, Ent. Zeit. (Stettin), vol. 18, p. 278, 1857.—Wocke, Ent. Zeit. (Stettin), vol. 23, p. 239, 1862.—TENGSTRÖM, *in* Förhandlingar, Pro fauna et flora Fennica, p. 346, No. 1053, 1869.—WOCKE, *in* Staudinger and Wocke, Catalog der Lepidopteren des europaeischen Faunengebiets, vol. 2, p. 323, No. 2703, 1871.—HEINEMANN and WOCKE, *in* Heinemann, Die Schmetterlinge Deutchlands und der Schweiz, vol. 2, p. 389, 1877.—WOLLASTON, Ann. Mag. Nat. Hist. ser. 5, vol. 3, p. 438, 1879.—FREY, Die Lepidopteren der Schweiz, p. 379, 1880.—SOHÖYEN, Arch. für Math. og Naturv. 1880, p. 245.—RÖSSLER, Jahrb. nassau, Ver. Naturk., vol. 34, p. 281, 1881.—SCHÖYEN, Tromsö Mus. Aarsh., vol. 4, p. 100, 1881; vol. 5, p. 57, 1882.—SNELLEN, De Vlinders van Nederland, vol. 2, p. 2, 729, 1882.—SCHÖYEN, Nyt Mag. Naturv., vol. 27, p. 53, 1882.—MASON, Ent. Monthly Mag., vol. 26, p. 199, 1890.—RILEY, *in* Smith, List of the Lepidoptera of Boreal America, No. 5758, 1891.—SPARRE SCHNEIDER, Tromsö Mus. Aarsh., vol. 15, p. 130, 1892; vol. 18, p. 85, 1895.—MEYRICK, A handbook of British Lepidoptera, p. 688, 1895.—BANG-HAAS, Dansk. Naturh. For., Vide. Medd., Copenhagen, 1896, p. 192.—REBEL, Verh. zool.-bot. Ges. Wien, vol. 45, p. 392, 1896.—SPARRE SCHNEIDER, Tromsö Mus. Aarsh., vol. 20, p. 155, 1897.—REUTTI, Verh. Naturw. Ver. Karlsruhe, vol. 12, p. 240, 1898.—JACOBSEN, Insecta Novaja-Zemljensia (Rossice conscr.) Petropoli, p. 45, 61, 1898.—SEEBOLD, Deutsche Ent. Zeitschr., Iris, vol. 11, p. 320, 1899.—REBEL, *in* Staudinger and Rebel, Catalog der Lepidopteren des palaearctischen Faunengebietes, vol. 2, p. 163, No. 3051, 1901.—STRAND, Nyt Mag. Naturv., vol. 39, p. 41, 1901.—MALLOCH, Ent. Monthly Mag., vol. 37, p. 186, 1901.—SPARRE SCHNEIDER, Bergens Mus. Aarbog No. 1, p. 215, 1901.—DISQUÉ, Deutsche Ent. Zeitschr., Iris, vol. 14, p. 221, 1902.—SCHÜTZE, Deutsche Ent. Zeitschr., Iris, vol. 15, p. 35, 1902.—LONGSTAFF, Ent. Monthly Mag., vol. 38, p. 28, 1902.—CARADJA, Bull. Soc. Sci. Bucharest, vol. 11, p. 617, 1902.—PAGENSTECHER, Die arktische Lepidopterenfauna, p. 390, 1902.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 6170, 1903.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, No. 6712, 1903.—SPEISER, Die Schmetterlings-fauna der Provinzen Öst- und West-preussen,

p. 117, 1903.—Busck, Proc. U. S. Nat. Mus., vol. 27, p. 767, 1904.—Dyar, Proc. U. S. Nat. Mus., vol. 27, p. 934, 1904.—Anderson, Catalogue of British Columbia Lepidoptera, p. 55, 1904.—Rebel, Ann. Hofmus. Wien, vol. 19, p. 357, 1904.—Crombrugghe, Mem. Soc. Ent. Belg., vol. 14, p. 39, 1906.—Gatnar, Jahresb. Wien. Ent. Ver., vol. 16, p. 49, 1906.—Rebel, Jahresb. Wien. Ent. Ver., vol. 16, p. 72, 1906.—Verity, Bull. Soc. Ent. Ital., vol. 38, p. 50, 1906.—Hormuzaki, Verh. zool.-bot. Ges. Wien, vol. 57, p. 86, 1907.—Sparre Schneider, Tromsö Mus. Aarsh., vol. 28, p. 147, 1907.—Busck, Proc. U. S. Nat. Mus., vol. 35, p. 203, 1908.—Krulikowski, Deutsche Ent. Zeitschr., Iris, vol. 21, p. 265, 1909.—Spuler, *in* Hofmann, Die Schmetterlinge Europa, ed. 3, vol. 2, p. 349, fig. 118, pl. 88, fig. 66, 1910.—Piquenard, Bull. Soc. Sci. Med. Ouest., vol. 19, p. 97, 1910.—Kearfott, *in* Smith, Catalogue of the insects of New Jersey, p. 562, 1910.—Rebel, Ann. Hofmus. Wien, vol. 25, p. 414, 1911.—Turati, Bull. Soc. Ent. Ital., vol. 43, p. 231, 1911.—Skala, Int. Ent. Zeitschr., vol. 5, p. 303, 1912.—Vorbrodt und Müller-Rutz, Die Schmetterlinge der Schweiz, vol. 2, p. 472, 1912.—Skala, Verh. Nat. Ver. Brünn, vol. 51, p. 310, 1913.—Rebel, Ann. Hofmus. Wien, vol. 27, p. 331, 1913.—Sparre Schneider, Tromsö Mus. Aarsh., vol. 35, p. 200, 1914.—Galvagni, Jahresb. Wien. Ent. Ver., vol. 25, p. 30, 1915.—Schawerda, Jahresb. Wien. Ent. Ver., vol. 26, p. 44, 1916.—Hamfelt, Arkiv für Zool., vol. 10, No. 25, p. 9, 1917.—Barnes and McDunnough, Check list of the Lepidoptera of Boreal America, No. 6502, 1917.—Philpott, Trans. Proc. New Zealand Inst., vol. 49, p. 229, 1917.—Martini, Deutsche Ent. Zeitschr., Iris, vol. 30, p. 144, 1917.—Mitterberger, Jahresb. Wien. Ent. Ver., vol. 28, p. 61, 1918.—Turati, Atti Mus. Civ. Milano, vol. 58, p. 160, 1919.—Hawkshaw, Entomologist, vol. 52, p. 82, 1919.—Caradja, Deutsche Ent. Zeitschr., Iris, vol. 34, p. 121, 1920.—Andres, Zeitschr. Angew. Ent., vol. 6, p. 406, 1920.—Sheldon, Entomologist, vol. 55, p. 78, 1922.—Zimmerman, Verh. zool-bot. Ges. Wien, vol. 71, p. 43, 1922.—Barca, Norsk. Ent. Tidsskr., vol. 1, p. 229, 1923.—Forbes, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 250, 1923.—Grönlien, Norsk Ent. Tidsskr., vol. 2, p. 46, 1924.—Petersen, Lepidopteren Fauna von Estland (Esti), p. 501, 1924.—Galvagni, Jahresb. Wien. Ent. Ver., vol. 30, p. 105, 1924.—Preissecker, Jahresb. Wien. Ent. Ver., vol. 30, p. 186, 1924.—Alfken, Anz. Schädlinsk, vol. 1, p. 95, 1925.—Stephan, Deutsche Ent. Zeitschr., Iris, vol. 39, p. 122, 1925.—Rebel, Deutsche Ent. Zeitschr., Iris, vol. 40, p. 146, 1926.—Larsen, Ent. Meddel., ser. 2, vol. 11 (whole ser. 17), p. 82, 1927.—Zerny, Eos, vol. 3, p. 479, 1927.—Leonardi, Elenco delle specie di insetti dannosi e loro parasiti ricordati in Italia fino all'anno 1911 (Part 2), p. 278, 1927.—Fletcher, Mem. Dept. Agr. India (Ent. Ser.), vol. 11, p. 77, 1929.—Rebel, Deutsche Ent. Zeitschr., Iris, vol. 43, p. 79, 1929.—Hayward, Entomologist, vol. 62, p. 50, 1929.—Wolff, Ent. Meddel, ser. 2, vol. 10 (whole ser. 16), p. 352, 1929.—Uffeln, Kleinschmetterlinge Westfalen, p. 75, 1930.—Graves, Ent. Rec., vol. 42, p. 97, 1930.—Drenowski, Mem. Bulg. Akad. Wiss., vol. 26, No. 6, p. 75, 1930.—Amsel, Deutsche Ent. Zeitschr., Iris, vol. 44, p. 122, 1930.—Vorbrodt, Deutsche Ent. Zeitschr., Iris, vol. 45, p. 131, 1931.—Rebel and Zerny, Denkschr. Akad. Wiss. Wien, math. nat. Kl., vol. 103, p. 149, 1931.—Turner, Entomologist, vol. 64, p. 191, 1931.—Nicholson, Ent. Rec., vol. 43, p. 88, 1931.—Hering, *in* Brohmer, Ehrmann and Ulmer, Die Tierwelt Mitteleuropas (Ergänzbd. 1) p. 138, 1932.—Eckstein, Die Kleinschmetterlinge Deutschlands, p. 126, pl. 5, fig. 204, 1933.—Rapp, Die Natur der mitteldeutschen Landschaf Thuringen; Beitrage zur Fauna Thüringens, vol. 2, p. 127, 1936.—McDunnough, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8368, 1939.

Endrosis lacteella DISQUÉ, Ent. Zeit. (Stettin), vol. 56, p. 244, 1895.

Anacampsis sarcitella STEPHENS, Illustrations of British entomology, Haustellata, vol. 4, p. 210, 1834.—WOOD, Index entomologicus, p. 175, pl. 39, fig. 1207, 1854.

Endrosis sarcitella (Stephens) MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 33, 1922 (as synonym of *lactella*).

Endrosis kennicottella CLEMENS, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 165; *in* Stainton, The Tineina of North America, p. 119, 1872.—CHAMBERS, Cincinnati Quart. Journ. Sci., vol. 2, p. 244, 1875.—BUSCK, *in* Dyar, U. S. Nat. Mus. Bull. 52, No. 6170, 1903.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, No. 6502, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 33, 1922.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8368, 1939 (as synonym of *lactella*).

Endrosis kennikotella CARADJA, Deutsche Ent. Zeitschr., Iris, vol. 34, p. 121, 1920.

Tinea betulinella HÜBNER, Sammlung Europäischer Schmetterlinge, vol. 5 (Tineen), pl. 67, fig. 448, 1801.

Endrosis betulinella HÜBNER, Verzeichniss bekannter Schmetterlinge, p. 401, 1825.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 33, 1922 (as synonym of *lactella*).

Scardia betulinella TREITSCHKE, *in* Ochsenheimer, Die Schmetterlinge von Europa, vol. 9, No. 1, p. 9, 1832; vol. 10, No. 3, p. 151, 1835.

Lita betulinella DUPONCHEL, Histoire naturelle des lepidoptères ou papillons de France, vol. 11, p. 298, pl. 297, fig. 8, 9, 1838.

Endrosis fenestrella SCOPOLI, Entomologica Carniolica, p. 252, 1763.—STAINTON, Insecta Britannica Tineina, p. 164, pl. 5, fig. 8, 1854; A manual of British butterflies and moths, vol. 2, p. 359, 469, 1859.—CLEMENS, *in* Stainton, The Tineina of North America, p. 119, 1872.—CHAMBERS, Cincinnati Quart. Journ. Sci., vol. 2, p. 244, 1875; U. S. Geol. Geogr. Surv. Terr. Bull. 4, p. 140, 1878.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 33, 1922.—BLAIR, Entomologist, vol. 58, p. 10, 1925 (as synonym of *lactella*).

Endrosis ferrestrella CHAMBERS, Cincinnati Quart. Journ. Sci., vol. 2, p. 244, 1875.

Gelechia subditella WALKER, List of the specimens of lepidopterous insects in the collections of the British Museum, vol. 29, p. 657, 1863.

Endrosis subditella MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 33, 1922 (as synonymn of *lactella*).

Endrosis lacteella antarctica STAUDINGER, Hamburg naturhistorisches Museum, Ergebnisse der Hamburger magalhaensischen Sammelreise, vol. 2, Arthropoda-Lepidoptera, p. 113, fig. 26, 1898.—ENDERLEIN, Vet. Akad. Handl., vol. 48, No. 3, p. 92, 1912.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 33, 1922 (as synonym of *lactella*).

Labial palpus, head, thorax, and extreme base of fore wing white. Basal half of second segment of labial palpus blackish fuscous exteriorly and anteriorly; third segment with narrow subbasal and broad subterminal annuli, dull black. Antenna, anterior part of thorax and base of tegula blackish fuscous. Ground color of fore wing sordid white strongly suffused and mottled with fuscous; at basal third two indistinct discal spots followed by a similar one at

end of cell, all blackish fuscous; costa, an elongate blotch on costa, joined to outer discal spot, and apex blackish fuscous; cilia pale yellowish fuscous irrorated with fuscous. Hind wing shining silvery fuscous, darker apically; cilia pale yellowish fuscous. Legs pale ochreous-white overlaid with blackish fuscous except at joints, and hind tibia and tarsus. Abdomen pale ochreous narrowly edged with silvery white on posterior margin of segments.

Male genitalia.—Harpe broad basally, gradually tapering to the pointed cucullus; clasper stout, flattened, pointed; sacculus broad, strongly sclerotized. Anellus an oval plate with strong, slightly curved, flattened, pointed lateral processes. Aedeagus long, stout, nearly straight; vesica armed with three large, toothlike cornuti and a long one with a deep lateral excavation near its distal end. Vinculum long, spatulate. Gnathos long, beaked, excavated and armed with small teeth on its posterior surface. Uncus strong, slightly curved, sharply pointed.

Female genitalia.—Ovipositor very long, segmented; anterior pair of apophyses branched. Ductus bursae strongly sclerotized and dilated in posterior half; membranous anteriorly; inception of ductus seminalis at junction of ductus bursae and bursa copulatrix. Bursa copulatrix large, oval; signum a few, small sclerotized points.

Alar expanse, 11–20 mm.

Types.—Vienna Museum (?) (*betulinella*, *lactella*); in the British Museum (?) (*fenestrella*, *sarcitella*, *subditella*); in the Academy of Natural Sciences, Philadelphia (*kennicottella*); in the Zoological Museum, Berlin (*antarctica*).

Type localities.—Vienna (*lactella*); England (*sarcitella*); North Westfield, Illinois (*kennicottella*); Carniola, Austria (*fenestrella*); Africa (*antarctica*); New Zealand (*subditella*); Europe (*betulinella*).

Hosts.—Stored cereals, fruits and other products; also reared from birds' nests and refuse, dried skins, dried flesh, and wool.

Distribution.—This species is generally distributed throughout most of the world. In North America it is found from coast to coast as far north as Alaska.

United States and Alaska records

Alaska: ♂ (August 1904, C. V. Piper).

California: Eureka, 5 ♀ ♀ (6–7–VI, H. S. Barber); Los Angeles, 3 ♀ ♀ (April, Coquillett); Mills College, 2 ♂ ♂, 2 ♀ ♀ (25–III–1908; 28–IX–1908, G. R. Pilate); Nevada County, 3 ♀ ♀ ("September"; no collector); Palo Alto, ♂ (October 1914); Pasadena, ♂ (7–10–24; no collector); Placer County, ♂, 4 ♀ ♀ (September; no collector); San Diego, ♂ (30–VI–1907, W. S. Wright); San Francisco, 16 ♂ ♂, ♀ (March; no collector); Saticoy, ♂ (January, 1926; no collector); Shasta Retreat, Siskiyou County, 5 ♂ ♂, 13 ♀ ♀ (June to September dates; no collector).

Nevada: Glenbrook, 2 ♂♂ (25–26–VIII–1915, H. G. Dyar).

New York: Two specimens apparently introduced.

Oregon: Allendale, 2 ♂♂, ♀ (7–6–1918, H. K. Plank); Corvallis, 3 ♀♀ (November and January; no collector).

Washington: Bellingham, 2 ♂♂, 2 ♀♀ (May, July, September 1922, 1923, J. F. G. Clarke); Friday Harbor, ♀ (June 8, 1924, T. C. Kincaid); Olympia, ♀ (5–13–1894; no collector); Pullman, ♀ (2–VI–1894, C. V. Piper); 2 ♀♀ (30–VI–1930; 28–VII–1932, J. F. G. Clarke); Seaview, ♂, ♀ (16–VII–1918; 6–IV–1919, H. K. Plank); Seattle, ♂ (19–VIII–1930, J. F. G. Clarke).

Canadian records

British Columbia: Ainsworth, ♀ (13–VII–1903, H. G. Dyar); Comox (22–VI–1933, J. McDunnough); Kaslo 5 ♀♀ (June and July dates, 1903, H. G. Dyar); Mount Cheam (August 15, 1901, J. Fletcher); Vancouver (April to September, G. R. Hopping); Victoria, ♂, 8 ♀♀ (May to September dates, 1917 to 1920, E. H. Blackmore); ♂, 2 ♀♀ (May to September 1922, W. R. Carter); ♀ (12–VIII–1909, A. J. Croker).

Remarks.—This widely distributed household insect is the only species referable to this genus.

In Europe and on the Pacific coast it does considerable damage, feeding on stored cereals, fruits, and other products.

GENERA AND SPECIES ERRONEOUSLY REFERRED TO THE OECOPHORIDAE

Family COSMOPTERYGIDAE

ANONCIA, new genus

PLATE 3, FIGURE 20; PLATE 7, FIGURE 52; PLATE 13, FIGURES 85, 85a; PLATE 19, FIGURE 114

Genotype.—Hypatopa conia Walsingham, Proc. U. S. Nat. Mus., vol. 33, p. 211, 1907.

Head smooth, side tufts slightly spreading. Antenna ciliated in male, simple in female, with pecten on basal segment. Labial palpus moderately long, curved, upturned; second segment roughened and thickened with scales; terminal segment stout, pointed, shorter than second.

Fore wing elongate, ovate, 12 veins; 1b furcate, 1c absent, 2 from near angle; 7 and 8 stalked, both to costa, 11 from before middle.

Hind wing narrower than fore wing, 8 veins; 3 and 4 connate or stalked, 6 and 7 parallel at base, divergent distally.

Male genitalia.—Asymmetrical; harpe roughly triangular, clasper absent; right harpe with basal process. Anellus with long, lateral processes. Elements of gnathos fused, naked, strongly sclerotized. Uncus and socii absent.

Female genitalia.—Ductus bursae membranous or only slightly sclerotized. Bursa copulatrix without signum.

The following species belong to this genus:

episcia (Walsingham), Proc. U. S. Nat. Mus., vol. 33, p. 211, 1907. (New combination).

conia (Walsingham), ibidem, vol. 33, p. 212, 1907. (New combination.)

fasciata (Walsingham), ibidem, vol. 33, p. 213, 1907. (New combination.)

orites (Walsingham), ibidem, vol. 33, p. 213, 1907. (New combination.)

diveni (Heinrich), Journ. Agr. Res., vol. 20, p. 814, 1921. (New combination.)

sphacelina (Keifer), Monthly Bull. Dept. Agr. California, vol. 24, p. 214, 1935. (New combination.)

marinensis (Keifer), ibidem, vol. 24, p. 215, 1935. (New combination.)

Genus TRICLONELLA Busck

PLATE 1, FIGURE 1; PLATE 7, FIGURE 57; PLATE 13, FIGURES 84, 84a; PLATE 19, FIGURE 112

Triclonella BUSCK, Journ. New York Ent. Soc., vol. 8, p. 236, 1900; *in* Dyar, U. S. Nat. Mus. Bull. 52, p. 525, 1903.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, p. 114, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 203, 1908.—WALSINGHAM, Biol. Centr.-Amer., Lepidoptera-Heterocera, vol. 4, pp. 136–137, 1912; p. 422, 1915.—BARNES and MCDUNNOUGH. Check list of the Lepidoptera of Boreal America, pp. 161–162, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 22–23, 1922.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 249, 1923.—FLETCHER, Mem. Dept. Agr. India (Ent. Ser.), vol. 11, p. 230, 1929.—GAEDE, in Bryk, Lepidopterorum catalogus, pt. 88, p. 21, 1938.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), p. 77, 1939. (Genotype: *Triclonella pergandeella* BUSCK, Journ. New York Ent. Soc., vol. 8, p. 237, pl. 9, fig. 2, 1900.)

Labial palpus long, smooth, recurved; second segment slightly thickened with appressed scales; terminal segment shorter than second, slender, acute. Antenna ciliated in male, simple in female, with pecten on basal segment. Tongue developed.

Fore wing elongate ovate; 12 veins, 1b furcate, 1c absent, 2 from well before angle, 3 and 4 separate, 7 and 8 stalked, both to costa, 11 from before middle.

Hind wing narrower than fore wing, 8 veins; 3 and 4 connate or stalked; 5 connate with or stalked from 4; 6 and 7 parallel basally, diverging distally.

Male genitalia.—Harpe roughly triangular, without clasper. Gnathos bifid. Uncus absent.

Female genitalia.—Ductus bursae membranous or sclerotized for at least some of its length; signum absent.

Triclonella, like the foregoing genus, is referable to the Cosmopterygidae. In the fore wing 1c, a vein always possessed by Oecophoridae, is absent, and the socii and uncus of the male genitalia are likewise missing. This is evidenced by the fact that the two elongate, lateral processes from the tegumen, which might be confused with

the uncus, are *in front of* the anal opening. These lateral processes cannot, therefore, be in any way homologized with the uncus.

Three American species are referable to this genus. They are:

pergandeella Busck, Journ. New York Ent. Soc., vol. 8, p. 237, pl. 9, fig. 2, 1900.
determinatella (Zeller), Verh. zool.-bot. Ges. Wien, vol. 23, p. 289, 1873.
antidectis (Meyrick), Exotic Microlepidoptera, vol. 1, p. 218, 1914. (New combination.)

ANTEQUERA, new genus

PLATE 4, FIGURES 27, 28; PLATE 9, FIGURES 63, 63a, 63b; PLATE 18, FIGURE 111

Genotype.—*Semioscopis acertella* Busck, Journ. Ent. Zool., Claremont, vol. 5, p. 100, 1913.

Head roughened with slender scales; antenna strongly ciliate in male, simple in female; basal segment without pecten. Labial palpus moderately long, slightly upturned; second segment roughened with coarse scales, longer than third. Thorax smooth.

Fore wing elongate; costa nearly straight; 12 veins; 1b furcate; 2–5 closely approximate at base, from or near angle of cell; 6 approximate to the stalk of 7 and 8; 7 to costa; termen convex, oblique.

Hind wing as broad as fore wing; 8 veins; 3 and 4 connate; 5 nearer to 4 than to 6; 6 and 7 parallel.

Male genitalia.—Slightly asymmetrical; anellus strongly developed; uncus and transtilla absent; socii vestigial; harpe weak.

Female genitalia.—Genital plate membranous; signum present.

ANTEQUERA ACERTELLA (Busck), new combination

Semioscopis acertella BUSCK, Journ. Ent. Zool., Claremont, vol. 5, p. 100, 1913.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 186, 1922.—McDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), No. 8462, 1939.

Male genitalia.—Harpe slender, weak, hairy, without clasper; cucullus rounded; sacculus poorly defined. Anellus strongly developed into two lateral processes each forming a half of a cylinder in which the aedeagus rests. Aedeagus long, slender; vesica armed with numerous strong cornuti. Vinculum produced, rounded, broad. Socii indicated only by a few hairs. Gnathos divided into two long, pointed processes.

Female genitalia.—Genital plate membranous. Ostium with a broad ventroanterior plate. Ductus bursae strongly sclerotized in posterior half; inception of ductus seminalis about middle of ductus bursae. Bursa copulatrix moderately large; signa two small sclerotized, scobinate plates.

Alar expanse, 17–19 mm.

Type.—In the United States National Museum.

Type locality.—San Diego, Calif.

Remarks.—I am tentatively placing this genus in the family Cosmopterygidae. It appears to be related to the genus *Macrobathra* Meyrick. The only species I have seen that is referable to this genus is the genotype.

Family ETHMIIDAE

Genus EUMEYRICKIA Busck

PLATE 1, FIGURE 8; PLATE 7, FIGURE 57A; PLATE 12, FIGURES 75, 75a; PLATE 17, FIGURE 104

Eumeyrickia BUSCK, Journ. New York Ent. Soc., vol. 10, p. 94, 1902; *in* Dyar, U. S. Nat. Mus. Bull. 52, p. 525, 1903.—KEARFOTT, *in* Smith, Check list of the Lepidoptera of Boreal America, p. 113, 1903.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 191–192, 1908.—KEARFOTT, *in* Smith, Catalogue of the insects of New Jersey, p. 561, 1910.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, p. 160, 1917.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, p. 234, 1923.—BRIMLEY, The insects of North Carolina, p. 303, 1938.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), p. 78, 1939. (Genotype: *Chactochilus trimaculellus* Fitch, Report on the noxious, beneficial, and other insects of the State of New York, vol. 2, p. 233, 1856.)

?*Eido* CHAMBERS, Can. Ent., vol. 5, p. 72, 1873.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 192, 1908. (Genotype: *Eido albapalpella* Chambers.)

Atheropla MEYRICK, Proc. Linn. Ent. Soc. New South Wales, vol. 9, pp. 758–759, 1884. (Genotype: *Atheropla melichlora* Meyrick.)

The genus *Eumeyrickia* is clearly ethmiid and is here transferred to that family. Vein 5 of the hind wing is closer to 6 than to 4, a good ethmiid character, which is supported by genitalic characters. In the male genitalia, as in other Ethmiidae, the harpe is distinctly segmented. This character is not found in the Oecophoridae.

Meyrick has synonymized *Eumeyrickia* with the Australian genus *Atheropla*, which synonymy seems unlikely. In his description of the genus [58] Meyrick states that veins 5–7 of the hind wing are nearly parallel. If this is true of his *Atheropla* (partially described from imperfect material), then *Eumeyrickia* immediately becomes separable on the character of vein 5, which is divergent from 6. In view of these facts I believe it advisable to retain *Eumeyrickia* for our American species.

The genotype is the only known North American species referable to this genus.

[58] Meyrick, *in* Wytsman, Genera insectorum, fasc. 180, p. 109, 1922.

Family BLASTOBASIDAE

Genus GERDANA Busck

PLATE 3, FIGURE 21; PLATE 6, FIGURE 42; PLATE 8, FIGURES 58, 58a; PLATE 19, FIGURE 117

Gerdana BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 193, 1908.—BARNES and MCDUNNOUGH, Check list of the Lepidoptera of Boreal America, p. 160, 1917.—MEYRICK, *in* Wytsman, Genera insectorum, fasc. 180, p. 191, 1922.—FORBES, Cornell Univ. Agr. Exp. Stat. Memoir 68, pp. 234–235, 1923.—MCDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), p. 79, 1939. (Genotype: *Gerdana caritella* Busck.)

Labial palpus short, reaching nearly to vertex; second segment somewhat roughened beneath; third segment slightly shorter than third. Tongue well developed. Antenna simple, with pecten on basal segment. Abdomen strongly spined.

Fore wing elongate-ovate, apex blunt; 12 veins; 1b furcate; 1c not preserved at margin; 2 from near angle; 3–5 approximate; 7–8 stalked; 7 to termen just below apex, 8 to costa; stalk of 7 and 8 approximate to or connate with 9; 11 from middle.

Hind wing as broad as fore wing with costa excised from middle; apex pointed, termen straight, oblique; 8 veins; 6 and 7 parallel but divergent toward tip; 3 and 4 connate or stalked; 5 nearest 4.

Male genitalia.—Symmetrical; harpe elongate, divided; clasper short, curved; anellus tubular; transtilla a narrow band; vinculum short, spatulate; aedeagus long, stout, straight. Gnathos a hook. Uncus fleshy, slightly hairy.

Female genitalia.—Bursa copulatrix without signum. Ductus bursae mebranous. Ostium small, with sclerotized plate ventrally.

Remarks.—I recognize only one species in this genus. The species is not oecophorid, partaking of both gelechiid and blastobasid characters. Likewise it does not clearly belong to either of these families but suggests both when certain characters are considered. The abdominal segments are heavily spinose, a good blastobasid character, but the costa of the fore wing is not thickened nor are veins 10 and 11 unusually distant as in that family. Vein 1c of the fore wing is not preserved at the margin as in Oecophoridae and the gnathos is distincity gelechiid. On the spinose character of the abdomen, the absence of vein 1c of the fore wing and the larval habit of living in refuse I transfer this genus to the Blastobasidae.

I have before me a series of 15 specimens reared from "witches'-broom." These were reared from larvae collected at Canaan, Maine, by Dr. A. E. Brower. Another series, reared from a long-eared owl's nest by W. L. Jellison, was collected in Beaverhead County, Mont.

In addition, I have had for determination the following: 1 male from Summerland, British Columbia (21–VII–1933, A. N. Gartrell); 4 females from Ottawa (8–VIII–1924, G. S. Walley; 16–VII–1906, C. H. Young) and Blackburn, Ontario (7–VII–1939, E. G. Lester); and 1 female from Putnam County, Ill. (14–IX–1939, M. O. Glenn).

Family HELIODINIDAE

Genus EUCLEMENSIA Grote

PLATE 3, FIGURE 23; PLATE 7, FIGURE 54; PLATE 12, FIGURES 77, 77a; PLATE 15, FIGURE 93

Euclemensia GROTE, Can. Ent., vol. 10, p. 69, 1878.—BUSCK, Proc. U. S. Nat. Mus., vol. 35, p. 202, 1908.—MEYRICK, *in* Wytsman, Genera Insectorum, fasc. 165, p. 20, 1914.—FORBES, Cornell Univ. Agr. Exp. Stat., Memoir 68, p. 357, 1923.—McDUNNOUGH, Check list of the Lepidoptera of Canada and the United States of America (Part 2, Microlepidoptera), p. 87, 1939. (Genotype: *Hamadryas bassettella* Clemens, Proc. Ent. Soc. Philadelphia, vol. 2, p. 423, 1864.)

Hamadryas Clemens, Proc. Ent. Soc. Philadelphia, vol. 2, p. 422, 1864 (preoccupied). (Genotype: *Hamadryas bassettella* Clemens.)

Head with smoothly appressed scales; antenna slightly rough-scaled, without pecten on basal segment. Labial palpus exceeding base of antenna; third segment slightly shorter than second. Tongue developed.

Fore wing narrow, elongate, costa very slightly concave at middle; 12 veins; 7 and 8 stalked, both to costa.

Hind wing nearly as broad as fore wing, 8 veins; 6 and 7 subparallel; 3 and 4 separate.

Male genitalia.—Harpe symmetrical, simple. Anellus with well-developed lateral processes; central plate absent. Gnathos bifid. Uncus absent.

Female genitalia.—Bursa copulatrix double, partly sclerotized; inception of ductus seminalis on bursa; two ducts. Ostium opening in median portion of genital plate.

Remarks.—Although this genus does not belong in the Heliodinidae, where both Meyrick and Forbes placed it, I am leaving it there until the family is revised and the genera are reallocated.

EXPLANATION OF PLATES

The illustrations for this paper were made by the author; the plates were composed by Mrs. Eleanor A. Carlin, Bureau of Entomology and Plant Quarantine. No attempt was made to adhere to a definite scale in making the drawings. Most of the male genitalia were drawn to one scale but the female genitalia were drawn to a convenient size.

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Explanation of symbols applied to heads

P=Palpus.
pt=Pecten.
E=Eye.

Explanation of symbols applied to genitalia

MALE

Cl=Clasper of harpe.
Tr=Transtilla.
Lbtr=Lobe of transtilla.
Hp=Harpe.
Sc=Sacculus.
Un=Uncus.
Gn=Gnathos.
Tg=Tegumen.
Si=Socii.
th=Terminal hook of aedeagus.
An=Anellus.
lbAn=Lobe of anellus.
lpAn=Lateral process of anellus.
extSc=Extension of sacculus.
V=Vinculum.
Ae=Aedeagus.
Vs=Vesica.
Cu=Cornuti.
ODM=Outer dorsal margin of sacculus.

FEMALE

Gp=Genital plate.
O=Ostium.
Bc=Bursa copulatrix.
S=Signum.
Db=Ductus bursae.
Ds=Ductus seminalis.
Op=Ovipositor.
SpOp=Spines of ovipositor.

PLATE 1

1. *Triclonella pergandeella* Busck: Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna with pecten.
2. *Mathildana newmanella* (Clemens): Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna without pecten.
3. *Carolana ascriptella* (Busck): Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna with pecten.
4. *Chambersia haydenella* (Chambers): Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna with pecten.
5. *Endrosis lactella* (Schiffermüller): Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna without pecten.
6. *Pleurota bicostella* (Clerck): Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna with pecten.
7. *Inga sparsiciliella* (Clemens): Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna without pecten.
8. *Eumeyrickia trimaculella* (Fitch): Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna without pecten.
9. *Carcina quercana* (Fabricius): Lateral aspect of head showing eye, labial palpus, and basal segment of antenna with pecten.
10. *Martyringa latipennis* (Walsingham): Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna without pecten.

PLATE 2

11. *Depressaria heracliana* (Linnaeus): Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna with pecten.

12. *Hofmannophila pseudospretella* (Stainton) : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna with pecten.
13. *Agonopterix ocellana* (Fabricius) : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna with pecten.
14. *Epicallima argenticinctella* (Clemens) : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna without pecten.
15. *Semioscopis steinkellneriana* (Schiffermüller) : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna without pecten.
16. *Apachea barbcrella* (Busck) : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna with pecten.
17. *Martyrhilda canella* (Busck) : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna with pecten.
18. *Schiffermülleria schaefferella* (Linnaeus) : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna without pecten.

PLATE 3

19. *Decantha borkhausenii* (Zeller) : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna with pecten.
20. *Anoncia conia* (Walsingham) : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna with pecten.
21. *Gerdana caritella* Busck : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna with pecten.
22. *Occophora bractella* (Linnaeus) : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna without pecten.
23. *Euclemensia bassettella* (Clemens) : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna without pecten.
24. *Psilocorsis quercicella* Clemens : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna without pecten.
25. *Fabiola shaleriella* (Chambers) : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna without pecten.
26. *Machimia tentoriferella* Clemens : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna without pecten.

PLATE 4

27. *Antequera acertella* (Busck) : Wings.
28. *Antequera acertella* (Busck) : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna without pecten.
29. *Bibarrambla allenella* (Walsingham) : Wings.
30. *Bibarrambla allenella* (Walsingham) : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna with pecten.
31. *Himmacia huachucella* (Busck) : Wings.
32. *Himmacia huachucella* (Busck) : Lateral aspect of head, showing eye, labial palpus, and basal segment of antenna without pecten.

PLATE 5

Wing Venation

33. *Machimia tentoriferella* Clemens.
34. *Pleurota bicostella* (Clerck).
35. *Semioscopis steinkellneriana* (Schiffermüller).
36. *Carcina quercana* (Fabricius).
37. *Inga sparsiciliella* (Clemens).
38. *Psilocorsis quercicella* Clemens.
39. *Martyringa latipennis* (Walsingham).

PLATE 6

Wing Venation

40. *Apachea barberella* (Busck).
41. *Fabiola shaleriella* (Chambers).
42. *Gerdana caritella* Busck.
43. *Hofmannophila pseudospretella* (Stainton).
44. *Martyrhilda canella* (Busck).
45. *Agonopterix ocellana* (Fabricius).
46. *Chambersia haydenella* (Chambers).
47. *Epicallima argenticinctella* (Clemens).
48. *Depressaria heracliana* (Linnaeus).

PLATE 7

Wing Venation

49. *Carolana ascriptella* (Busck).
50. *Mathildana newmanella* (Clemens).
51. *Endrosis lactella* (Schiffermüller).
52. *Anoncia conia* (Walsingham).
53. *Oecophora bractella* (Linnaeus).
54. *Euclemensia bassettella* (Clemens).
55. *Decantha borkhausenii* (Zeller).
56. *Schiffermülleria schaefferella* (Linnaeus).
57. *Triclonella pergandeella* Busck.
57A. *Eumeyrickia trimaculella* (Fitch).

PLATE 8

58–58a. *Gerdana caritella* Busck; 58, Ventral aspect of male genitalia; 58a, aedeagus, lateral view.
59–59a. *Psilocorsis quercicella* Clemens: 59, Ventral aspect of male genitalia; 59a, aedeagus, lateral view.
60–60a. *Endrosis lactella* (Schiffermüller): 60, Ventral aspect of male genitalia; 60a, aedeagus, lateral view.
61–61a. *Fabiola shaleriella* (Chambers): 61, Ventral aspect of male genitalia; 61a, aedeagus, lateral view.
62–62a. *Agonopterix ocellana* (Fabricius): 62, Ventral aspect of male genitalia; 62a, aedeagus, lateral view.

PLATE 9

63–63b. *Antequera acertella* (Busck): 63, Ventral aspect of male genitalia with aedeagus removed; 63a, lateral aspect of male genitalia with aedeagus removed; 63b, aedeagus, lateral view.
64–64a. *Himmacia huachucella* (Busck): 64, Ventral aspect of male genitalia with aedeagus removed; 64a, aedeagus, lateral view.
65–65a. *Bibarrambla allenella* (Walsingham): 65, Ventral aspect of male genitalia with aedeagus removed; 65a, aedeagus, lateral view.

PLATE 10

66–66a. *Decantha borkhausenii* (Zeller): Ventral aspect of male genitalia; 66a, aedeagus, lateral view.
67–67a. *Martyrhilda canella* (Busck): 67, Ventral aspect of male genitalia; 67a, aedeagus, lateral view.

68–68a. *Depressaria heracliana* (Linnaeus): 68, Ventral aspect of male genitalia; 68a, aedeagus, lateral view.
69–69b. *Carolana ascriptella* (Busck): 69, Ventral aspect of male genitalia; 69a, aedeagus, lateral view; 69b, gnathos and uncus, lateral view.
70–70a. *Machimia tentoriferella* Clemens; 70, Ventral aspect of male genitalia; 70a, aedeagus, lateral view.

PLATE 11

71–71a. *Carcina quercana* (Fabricius): 71, Ventral aspect of male genitalia; 71a, aedeagus, lateral view.
72–72a. *Martyringa latipennis* (Walsingham): 72, Ventral aspect of male genitalia; 72a, aedeagus, lateral view.
73–73a. *Semioscopis steinkellneriana* (Schiffermüller): 73, Ventral aspect of male genitalia; 73a, aedeagus, lateral view.
74–74b. *Mathildana newmanella* (Clemens): 74, Ventral aspect of right harpe and anellus; 74a, aedeagus, lateral view; 74b, gnathos and uncus, lateral view.

PLATE 12

75–75a. *Eumeyrickia trimaculella* (Fitch): 75, Ventral aspect of male genitalia; 75a, aedeagus, lateral view.
76–76a. *Pleurota bicostella* (Clerck): 76, Ventral aspect of male genitalia; 76a, aedeagus, lateral view.
77–77a. *Euclemensia bassettella* (Clemens): 77, Ventral aspect of male genitalia; 77a, aedeagus, lateral view.
78–78b. *Hofmannophila pseudospretella* (Stainton): 78, Ventral aspect of male genitalia; 78a, aedeagus, lateral view; 78b, gnathos and uncus, lateral view.
79–79a. *Chambersia haydenella* (Chambers): 79, Ventral aspect of male genitalia; 79a, aedeagus, lateral view.
80–80a. *Inga sparsiciliella* (Clemens): 80, Ventral aspect of male genitalia; 80a, aedeagus, lateral view.
81–81a. *Epicallima argenticinctella* (Clemens): 81, Ventral aspect of male genitalia; 81a, aedeagus, lateral view.

PLATE 13

82–82a. *Schiffermülleria schaefferella* (Linnaeus): 82, Ventral aspect of male genitalia; 82a, aedeagus, lateral view.
83–83a. *Occophora bractella* (Linnaeus): 83, Ventral aspect of male genitalia; 83a, aedeagus, lateral view.
84–84a. *Triclonella pergandeella* Busck: 84, Ventral aspect of male genitalia; 84a, aedeagus, lateral view.
85–85a. *Anoncia conia* (Walsingham): 85, Ventral aspect of male genitalia; 85a, aedeagus, lateral view.
86–86b. *Apachea barberella* (Busck): 86, Ventral aspect of male genitalia; 86a, aedeagus, lateral view; 86b, dorsal view of tegumen to show absence of uncus.

PLATE 14

87. *Pleurota bicostella* (Clerck): Ventral aspect of female genitalia.
88. *Carcina quercana* (Fabricius): Ventral aspect of female genitalia.
89. *Inga sparsiciliella* (Clemens): Ventral aspect of female genitalia.

90. *Martyringa latipennis* (Walsingham): Ventral aspect of female genitalia.
91. *Decantha borkhausenii* (Zeller): Ventral aspect of female genitalia.
92. *Machimia tentoriferella* Clemens: Ventral aspect of female genitalia.

PLATE 15

93. *Euclemensia bassettella* (Clemens): Ventral aspect of female genitalia.
94. *Apachea barbercella* (Busck): Ventral aspect of female genitalia.

PLATE 16

95. *Fabiola shaleriella* (Chambers): Ventral aspect of female genitalia.
96. *Carolana ascriptella* (Busck): Ventral aspect of female genitalia.
97. *Semioscopis steinkellneriana* (Schiffermüller): Ventral aspect of female genitalia.
98. *Schiffermülleria schaefferella* (Linnaeus): Ventral aspect of female genitalia.
99. *Epicallima argenticinctella* (Clemens): Ventral aspect of female genitalia.
100. *Martyrhilda canella* (Busck): Ventral aspect of female genitalia.
101. *Hofmannophila pseudospretella* (Stainton): Ventral aspect of female genitalia.

PLATE 17

102. *Depressaria heracliana* (Linnaeus): Ventral aspect of female genitalia.
103. *Agonopterix ocellana* (Fabricius): Ventral aspect of female genitalia.
104. *Eumeyrickia trimaculella* (Fitch): Ventral aspect of female genitalia.
105. *Psilocorsis quercicella* Clemens: Ventral aspect of female genitalia.
106. *Borkhausenia minutella* (Linnaeus): Abdominal spines (setae).
107. *Martyringa latipennis* (Walsingham): Abdominal spines (setae).
108. *Carolana ascriptella* (Busck): Truncated abdominal spines (setae).

PLATE 18

109. *Bibarrambla allenella* (Walsingham); Ventral aspect of female genitalia.
110. *Himmacia huachucella* (Busck): Ventral aspect of female genitalia.
111. *Antequera acertella* (Busck): Ventral aspect of female genitalia.

PLATE 19

112. *Tricloncella pergandcella* (Busck): Ventral aspect of female genitalia.
113. *Oecophora bractella* (Linnaeus): Ventral aspect of female genitalia.
114. *Anoncia conia* (Walsingham): Ventral aspect of female genitalia.
115. *Chambersia haydenella* (Chambers): Ventral aspect of female genitalia.
116. *Endrosis lactella* (Schiffermüller): Ventral aspect of female genitalia.
117. *Gerdana caritella* Busck: Ventral aspect of female genitalia.
118. *Mathildana newmanella* (Clemens); Ventral aspect of female genitalia.

PLATE 20

119–119a. *Fabiola tecta* Braun: 119, Ventral aspect of male genitalia with left harpe and tegumen removed; 119a, aedeagus, lateral view.
120–120a. *Schiffermülleria edithella* (Busck): 120, Ventral aspect of male genitalia with left harpe and tegumen removed; 120a, aedeagus, lateral view.
121–121a. *Schiffermülleria lucidella* (Busck): 121, Ventral aspect of male genitalia with left harpe and tegumen removed; 121a, aedeagus, lateral view.

122–122a. *Schiffermülleria quadrimaculella* (Chambers): 122, Ventral aspect of male genitalia with left harpe and tegumen removed; 122a, aedeagus, lateral view.

123–123a. *Pleurota albastrigulella* (Kearfott): 123, Ventral aspect of male genitalia with left harpe and tegumen removed; 123a, aedeagus, lateral view.

124–124a. *Epicallima formosella* (Schiffermüller): 124, Ventral aspect of male genitalia with left harpe and tegumen removed; 124a, aedeagus, lateral view.

125–125a. *Decantha borcasella* (Chambers): 125, Ventral aspect of male genitalia with left harpe and tegumen removed; 125a, aedeagus, lateral view.

PLATE 21

126–126a. *Inga obscuromaculella* (Chambers): 126, Ventral aspect of male genitalia with left harpe and tegumen removed; 126a, aedeagus, lateral view.

127–127a. *Inga canariella* (Busck): 127, Ventral aspect of male genitalia with left harpe and tegumen removed; 127a, aedeagus, lateral view.

128–128a. *Inga ciliella* (Busck): 128, Ventral aspect of male genitalia with left harpe and tegumen removed; 128a, aedeagus, lateral view.

129–129a. *Inga concolorella* (Beutenmüller): 129, Ventral aspect of male genitalia with left harpe and tegumen removed; 129a, aedeagus, lateral view.

130–130a. *Inga cretacea* (Zeller): 130, Ventral aspect of male genitalia with left harpe and tegumen removed; 130a, aedeagus, lateral view.

PLATE 22

131. *Psilocorsis reflexella* Clemens: Aedeagus, lateral view.

132. *Psilocorsis caryae*, new species: Aedeagus, lateral view.

133. *Psilocorsis obsoletella* (Zeller): Aedeagus, lateral view.

134. *Psilocorsis faginella* (Chambers): Aedeagus, lateral view.

135–135a. *Semioscopis aurorella* Dyar; Ventral aspect of male genitalia with left harpe and tegumen removed; 135a, aedeagus, lateral view.

136. *Semioscopis medunnoughi*, new species: Aedeagus, lateral view.

137–137a. *Semioscopis inornata* (Walsingham): Ventral aspect of male genitalia with left harpe and tegumen removed; 137a, aedeagus, lateral view.

PLATE 23

138–138a. *Semioscopis megamicrella* Dyar: 138, Ventral aspect of male genitalia with left harpe and tegumen removed; 138a, aedeagus, lateral view.

139–139a. *Semioscopis braunae*, new species: 139, Ventral aspect of male genitalia with left harpe and tegumen removed; 139a, aedeagus, lateral view.

140–140a. *Semioscopis packardella* (Clemens): Ventral aspect of male genitalia with left harpe and tegumen removed; 140a, aedeagus, lateral view.

141. *Semioscopis merriccella* Dyar: Aedeagus, lateral view.

PLATE 24

142–142a. *Martyrhilda gracilis* (Walsingham): 142, Ventral aspect of right harpe and anellus of male genitalia; 142a, aedeagus, lateral view.

143–143a. *Martyrhilda umbraticostella* (Walsingham); 143, Ventral aspect of male genitalia with left harpe removed; 143a, aedeagus, lateral view.

144. *Martyrhilda thoracenigraeella* (Chambers): Aedeagus, lateral view.

145–145a. *Martyrhilda sordidella*, new species: 145, Ventral aspect of male genitalia with left harpe and tegumen removed; 145a, aedeagus, lateral view.

146–146a. *Martyrhilda thoracefasciella* (Chambers): 146, Ventral aspect of right harpe and anellus of male genitalia; 146a, aedeagus, lateral view.

147–147a. *Martyrhilda sphaeralceae*, new species: 147, Ventral aspect of right harpe and anellus of male genitalia; 147a. aedeagus, lateral view.

148–148a. *Martyrhilda hildaella*, new species: 148, Ventral aspect of male genitalia with left harpe and tegumen removed; 148a, aedeagus, lateral view.

149–149a. *Martyrhilda sciadopa* (Meyrick): 149, Ventral aspect of male genitalia with left harpe removed; 149a, aedeagus, lateral view.

PLATE 25

150–150a. *Martyrhilda nivalis* (Braun): 150, Ventral aspect of male genitalia with left harpe removed; 150a, aedeagus, lateral view.

151. *Martyrhilda klamathiana* (Walsingham): Lateral view of aedeagus.

152–152a. *Agonopterix fulva* (Walsingham): 152, Ventral aspect of male genitalia with left harpe removed; 152a, aedeagus, lateral view.

153–153a. *Agonopterix gelidella* (Busck): 153, Ventral aspect of male genitalia with left harpe removed; 153a, aedeagus, lateral view.

154. *Agonopterix arcuella*, new species: Clasper and sacculus of right harpe of male genitalia.

155. *Agonopterix lythrella* (Walsingham): Clasper and sacculus of right harpe of male genitalia.

156–156a. *Agonopterix hyperella* Ely: 156, Ventral aspect of right harpe and anellus of male genitalia; 156a, aedeagus, lateral view.

PLATE 26

157–157a. *Agonopterix curvilineella* (Beutenmüller): 157, Ventral aspect of right harpe and anellus of male genitalia; 157a, aedeagus, lateral view.

158–158a. *Agonopterix muricolorella* (Busck): 158, Ventral aspect of right harpe and anellus of male genitalia; 158a, aedeagus, lateral view.

159–159a. *Agonopterix clemensella* (Chambers): 159, Ventral aspect of right harpe and anellus of male genitalia; 159a, aedeagus, lateral view.

160–160a. *Agonopterix atrodorsella* (Clemens): 160, Ventral aspect of right harpe and anellus of male genitalia; 160a, aedeagus, lateral view.

161–161a. *Agonopterix nubiferella* (Walsingham): 161, Ventral aspect of right harpe and anellus of male genitalia; 161a, aedeagus, lateral view.

PLATE 27

162–162a. *Agonopterix pteleae* Barnes and Busck: 162, Ventral aspect of right harpe and anellus of male genitalia; 162a, aedeagus, lateral view.

163–163a. *Agonopterix cupatoriiella* (Chambers): 163, Ventral aspect of right harpe and anellus of male genitalia; 163a, aedeagus, lateral view.

164–164a. *Agonopterix pulvipennella* (Clemens): 164, Ventral aspect of right harpe and anellus of male genitalia; 164a, aedeagus, lateral view.

PLATE 28

200B. *Depressaria togata* Walsingham; Male genitalia (drawn by Herbert harpe and anellus of male genitalia; 165a, aedeagus, lateral view.

166–166a. *Agonopterix rosaciliella* (Busck): 166, Ventral aspect of right harpe and anellus of male genitalia; 166a, aedeagus, lateral view.

167–167a. *Agonopterix fusciterminella*, new species: 167, Ventral aspect of right harpe and anellus of male genitalia; 167a, aedeagus, lateral view.

168–168a. *Agonopterix novi-mundi* (Walsingham): 168, Ventral aspect of right harpe and anellus of male genitalia; 168a, aedeagus, lateral aspect.

PLATE 29

169–169a. *Agonopterix robiniella* (Packard): 169, Ventral aspect of right harpe and anellus of male genitalia; 169a, aedeagus, lateral view.

170–170a. *Agonopterix nigrinotella* (Busck): 170, Ventral aspect of right harpe and anellus of male genitalia; 170a, aedeagus, lateral view.

171–171a. *Agonopterix argillacea* (Walsingham): 171, Ventral aspect of right harpe and anellus of male genitalia; 171a, aedeagus, lateral view.

PLATE 30

172–172a. *Agonopterix senicionella* (Busck): 172, Ventral aspect of right harpe and anellus of male genitalia; 172a, aedeagus, lateral view.

173–173a. *Agonopterix flavicomella* (Engel): 173, Ventral aspect of right harpe and anellus of male genitalia; 173a, aedeagus, lateral view.

174–174a. *Agonopterix costimacula*, new species: 174, Ventral aspect of right harpe and anellus of male genitalia: 174a, aedeagus, lateral view.

175–175a. *Agonopterix antennariella*, new species: 175, Ventral aspect of right harpe and anellus of male genitalia; 175a, aedeagus, lateral view.

PLATE 31

176–176a. *Agonopterix oregonensis*, new species: 176, Ventral aspect of right harpe and anellus of male genitalia; 176a, aedeagus, lateral view.

177–177a. *Agonopterix psoraliella* (Walsingham): 177, Ventral aspect of right harpe and anellus of male genitalia; 177a, aedeagus, lateral view.

178–178a. *Agonopterix clarkei* Keifer: 178, Ventral aspect of right harpe and anellus of male genitalia; 178a, aedeagus, lateral view.

179–179a. *Agonopterix dimorphella*, new species: 179, Ventral aspect of male genitalia with left harpe and tegumen removed; 179a, aedeagus, lateral view.

180–180a. *Agonopterix cajonensis*, new species: 180, Ventral aspect of male genitalia with left harpe and tegumen removed; 180a, aedeagus, lateral view.

PLATE 32

181–181a. *Agonopterix sabulella* (Walsingham): 181, Ventral aspect of right harpe and anellus of male genitalia; 181a, aedeagus, lateral view.

182–182a. *Agonopterix pallidella* (Busck): 182, Ventral aspect of right harpe and anellus of male genitalia; 182a, aedeagus, lateral view.

183–183a. *Agonopterix pergandeella* (Busck): 183, Ventral aspect of right harpe and anellus of male genitalia; 183a, aedeagus, lateral view.

184–184a. *Agonopterix costosa* (Haworth): 184, Ventral aspect of right harpe and anellus of male genitalia; 184a, aedeagus, lateral view.

185–185a. *Agonopterix nebulosa* (Zeller): 185, Ventral aspect of right harpe and anellus of male genitalia; 185a, aedeagus, lateral view.

PLATE 33

186. *Agonopterix arnicella* (Walsingham): Ventral aspect of right harpe and anellus of male genitalia.

187–187a. *Agonopterix amissella* (Busck): 187, Ventral aspect of right harpe and anellus of male genitalia; 187a, aedeagus, lateral view.

188–188a. *Agonopterix latipalpella* Barnes and Busck: 188, Ventral aspect of right harpe and anellus of male genitalia; 188a, aedeagus, lateral view.

189–189a. *Agonopterix sanguinella* (Busck): 189, Ventral aspect of right harpe and anellus of male genitalia; 189a, aedeagus, lateral view.

190–190a. *Agonopterix posticella* (Walsingham): 190, Ventral aspect of right harpe and anellus of male genitalia; 190a, aedeagus, lateral view.

PLATE 34

191–191b. *Depressaria maculatella* Busck: 191, Ventral aspect of right harpe and anellus of male genitalia; 191a, aedeagus, lateral view; 191b, transtilla, ventral view.

192–192b. *Depressaria grotella* Robinson: 192, Ventral aspect of right harpe and anellus of male genitalia; 192a, aedeagus, lateral view; 192b, transtilla, ventral view.

193–193b. *Depressaria betulella* Busck: 193, Ventral aspect of right harpe and anellus of male genitalia; 193a, aedeagus, lateral view; 193b, transtilla, ventral view.

PLATE 35

194–194a. *Depressaria atrostrigella*, new species: 194, Ventral aspect of right harpe, anellus, vinculum, and transtilla of male genitalia; 194a, aedeagus, lateral view.

195–195a. *Depressaria alienella* Busck: 195, Ventral aspect of right harpe, anellus and transtilla of male genitalia; 195a, aedeagus, lateral view.

196–196a. *Depressaria artemisiella* McDunnough: 196, Ventral aspect of right harpe, anellus, and transtilla of male genitalia; 196a, aedeagus, lateral view.

197–197a. *Depressaria artemisiae dracunculi* Clarke: 197, Ventral aspect of right harpe, anellus and transtilla of male genitalia; 197a, aedeagus, lateral view.

PLATE 36

198–198a. *Depressaria angustati*, new species: 198, Ventral aspect of right harpe, anellus and transtilla of male genitalia; 198a, aedeagus, lateral view.

199–199a. *Depressaria multifidae* Clarke: 199, Ventral aspect of right harpe, anellus and transtilla of male genitalia; 199a, aedeagus, lateral view.

200–200a. *Depressaria whitmani*, new species: 200, Ventral aspect of right harpe, anellus and transtilla of male genitalia; 200a, aedeagus, lateral view.

PLATE 37

200B. *Depressaria togata* Walsingham: Male genitalia (drawn by Herbert Stringer).

201–201a. *Depressaria yakimae*, new species: 201, Ventral aspect of male genitalia with left harpe and tegumen removed; 201a, aedeagus, lateral view.

202–202a. *Depressaria leptotaeniae* Clarke: 202, Ventral aspect of male genitalia with left harpe and tegumen removed; 202a, aedeagus, lateral view.

PLATE 38

203–203a. *Depressaria juliella* Busck: 203, Ventral aspect of right harpe and anellus of male genitalia; 203a, aedeagus, lateral view.

204–204a. *Depressaria eleanorae*, new species: 204, Ventral aspect of right harpe and anellus of male genitalia; 204a, aedeagus, lateral view.

205–205a. *Depressaria cinercocostella* Clemens: 205, Ventral aspect of hight harpe, anellus and transtilla of male genitalia; 205a, aedeagus, lateral view.

PLATE 39

206. *Inga obscuromaculella* (Chambers): Ventral aspect of female genitalia without ovipositor.

207. *Inga canariella* (Busck): Ventral aspect of female genitalia without ovipositor.

208. *Inga concolorella* (Beutenmüller): Ventral aspect of female genitalia without ovipositor.

209. *Inga ciliella* (Busck): Ventral aspect of female genitalia without ovipositor.

210. *Inga cretacea* (Zeller): Ventral aspect of female genitalia without ovipositor.

211. *Decantha boreasella* (Chambers): Ventral aspect of female genitalia without ovipositor.

212. *Pleurota albastrigulella* (Kearfott): Bursa copulatrix and signa of female genitalia.

213. *Schiffermülleria quadrimaculella* (Chambers): Ventral view of genital plate of female genitalia.

214. *Schiffermülleria edithella* (Busck): Ventral view of genital plate of female genitalia.

215. *Schiffermülleria lucidella* (Busck): Ventral aspect of genital plate of female genitalia.

216. *Epicallima formosella* (Schiffermüller): Ventral aspect of female genitalia without ovipositor.

PLATE 40

217. *Psilocorsis faginella* (Chambers): Ventral aspect of genital plate, ostium, and posterior portion of ductus bursae of female genitalia.

218. *Psilocorsis faginella* (Chambers): Signum of bursa copulatrix.

219. *Psilocorsis caryae*, new species: Ventral aspect of genital plate, ostium, and posterior portion of ductus bursae of female genitalia.

220. *Psilocorsis obsoletella* (Zeller): Ventral aspect of genital plate, ostium, and posterior portion of ductus bursae of female genitalia.

221. *Psilocorsis fletcherella* Gibson: Signum of bursa copulatrix.

222. *Psilocorsis reflexella* Clemens: Signum of bursa copulatrix.

223. *Semioscopis aurorella* Dyar: Ventral aspect of female genitalia without ovipositor.

224. *Semioscopis braunae*, new species: Ventral aspect of female genitalia without ovipositor.

225. *Semioscopis inornata* (Walsingham): Ventral aspect of ovipositor, showing hooked macrosetae, genital plate, ostium, and posterior portion of ductus bursae of female genitalia.

226. *Semioscopis megamicrella* Dyar: Ventral aspect of genital plate, ostium, and posterior portion of ductus bursae of female genitalia.

227. *Semioscopis merriccella* Dyar: Bursa copulatrix of female genitalia.

228–228a. *Semioscopis packardella* (Clemens): 228, Ventral aspect of genital plate, ostium, and posterior portion of ductus bursae of female genitalia; 228a, bursa copulatrix.

229. *Agonopterix dimorphella*, new species: Ventral aspect of female genitalia without ovipositor.

230–230a. *Agonopterix clarkei* Keifer: 230, Ventral aspect of ovipositor lobes of female genitalia showing spines (setae) of the ovipositor; 230a, ventral view of genital plate and ostium.

231. *Martyrhilda nivalis* (Braun): Ventral aspect of female genitalia without ovipositor.

PLATE 41

232. *Martyrhilda umbraticostella* (Walsingham): Ventral aspect of female genitalia without ovipositor.

233. *Martyrhilda gracilis* (Walsingham): Ventral aspect of female genitalia without ovipositor.

234. *Martyrhilda klamathiana* (Walsingham): Ventral aspect of female genitalia without ovipositor.

235. *Martyrhilda thoracefasciella* (Chambers): Ventral aspect of female genitalia without ovipositor.

236. *Martyrhilda sciadopa* (Meyrick): Ventral aspect of female genitalia without ovipositor.

237. *Martyrhilda sphaeralccae*, new species: Ventral aspect of female genitalia without ovipositor.

238. *Martyrhilda sordidella*, new species: Ventral aspect of female genitalia without ovipositor.

239. *Martyrhilda thoracenigraeella* (Chambers): Ventral aspect of female genitalia without ovipositor.

PLATE 42

240. *Agonopterix hyperella* Ely: Ventral aspect of female genitalia without ovipositor.

241. *Agonopterix oregonensis*, new species: Ventral aspect of female genitalia without ovipositor.

242. *Agonopterix clemensella* (Chambers): Ventral aspect of female genitalia without ovipositor.

243. *Agonopterix muricolorella* (Busck): Ventral aspect of female genitalia without ovipositor.

244–244a. *Agonopterix cajonensis*, new species: 244, Ventral aspect of genital plate, ostium and posterior portion of ductus bursae; 244a, bursa copulatrix.

245. *Agonopterix curvilineella* (Beutenmüller): Ventral aspect of female genitalia without ovipositor.

246. *Agonopterix arcuella*, new species: Ventral aspect of female genitalia without ovipositor.

247–247a. *Agonopterix gelidella* (Busck): 247, Ventral aspect of genital plate, ostium and posterior portion of ductus bursae; 247a, bursa copulatrix.

248. *Agonopterix fulva* (Walsingham): Ventral aspect of female genitalia without ovipositor.

PLATE 43

249. *Agonopterix eupatoriiella* (Chambers): Ventral aspect of female genitalia without ovipositor.

250. *Agonopterix scabella* (Zeller): Ventral aspect of female genitalia without ovipositor.

251. *Agonopterix pteleae* Barnes and Busck: Ventral aspect of female genitalia without ovipositor.

252. *Agonopterix atrodorsella* (Clemens): Ventral aspect of female genitalia without ovipositor.

253. *Agonopterix pulvipennella* (Clemens): Ventral aspect of female genitalia without ovipositor.

PLATE 44

254. *Agonopterix walsinghamella* (Busck): Ventral aspect of female genitalia without ovipositor.

255. *Agonopterix argillacea* (Walsingham): Ventral aspect of female genitalia without ovipostor.

256. *Agonopterix pallidella* (Busck): Ventral aspect of female genitalia without ovipositor.

257. *Agonopterix rosaciliella* (Busck): Ventral aspect of female genitalia without ovipositor.

258. *Agonopterix fusciterminella*, new species: Ventral aspect of female genitalia without ovipositor.

259. *Agonopterix robiniella* (Packard): Ventral aspect of genital plate of female genitalia.

259A. *Agonopterix thelmae*, new species: Ventral aspect of genital plate of female genitalia.

260. *Agonopterix lecontella* (Clemens): Ventral aspect of bursa copulatrix of female genitalia.

PLATE 45

261. *Agonopterix costimacula*, new species: Ventral aspect of female genitalia without ovipositor.

262. *Agonopterix canadensis* (Busck): Ventral aspect of female genitalia without ovipositor.

263. *Agonopterix scnicionella* (Busck): Ventral aspect of female genitalia without ovipositor.

264. *Agonopterix antennariella*, new species: Ventral aspect of female genitalia without ovipositor.

265. *Agonopterix nigrinotella* (Busck): Ventral aspect of female genitalia without ovipositor.

266. *Agonopterix nebulosa* (Zeller): Ventral aspect of female genitalia without ovipositor.

267. *Agonopterix flavicomella* (Engel): Ventral aspect of female genitalia without ovipositor.

PLATE 46

268. *Agonopterix latipalpella* Barnes and Busck: Ventral aspect of female genitalia without ovipositor.
269. *Agonopterix amissella* (Busck): Ventral aspect of female genitalia without ovipositor.
270. *Agonopterix sabulella* (Walsingham): Ventral aspect of female genitalia without ovipositor.
271. *Agonopterix psoraliella* (Walsingham): Ventral aspect of female genitalia without ovipositor.
272. *Agonopterix amyrisella* (Busck): Ventral aspect of female genitalia without ovipositor.
273. *Agonopterix costosa* (Haworth): Ventral aspect of female genitalia without ovipositor.
274. *Agonopterix posticella* (Walsingham): Ventral aspect of female genitalia without ovipositor.

PLATE 47

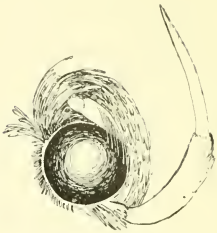
275. *Depressaria maculatella* Busck: Ventral aspect of female genitalia without ovipositor.
276–276a. *Depressaria betulella* Busck: 276, Ventral aspect of genital plate and part of ductus bursae of female genitalia; 276a, signum.
277–277a. *Depressaria grotella* Robinson: 277, Ventral aspect of genital plate of female genitalia; 277a, signum.
278. *Depressaria artemisiella* McDunnough: Ventral aspect of female genitalia without ovipositor.
279. *Depressaria eleanorae*, new species: Ventral aspect of female genitalia without ovipositor.
280. *Depressaria juliella* Busck: Ventral aspect of female genitalia without ovipositor.

PLATE 48

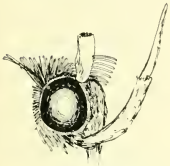
281. *Depressaria cinereocostella* Clemens: Ventral aspect of female genitalia without ovipositor.
282. *Depressaria alienella* Busck: Ventral aspect of female genitalia without ovipositor.
283. *Depressaria artemisiae dracunculi* Clarke: Ventral aspect of female genitalia without ovipositor.
284. *Depressaria palousella*, new species: Ventral aspect of female genitalia without ovipositor.
285. *Depressaria yakimae*, new species: Ventral aspect of female genitalia without ovipositor.
286. *Depressaria whitmani*, new species: Ventral aspect of female genitalia without ovipositor.
287. *Depressaria angustati*, new species: Ventral aspect of genital plate and part of ductus bursae of female genitalia.
288. *Depressaria multifidae* Clarke: Ventral aspect of genital plate and part of ductus bursae of female genitalia.
289. *Depressaria leptotaeniae* Clarke: Ventral aspect of genital plate and part of ductus bursae of female genitalia.

1. TRICLONELLA

2. MATHILDANA



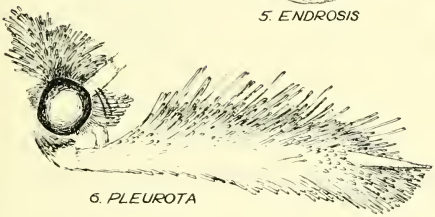
3. CAROLANA



4. CHAMBERSIA

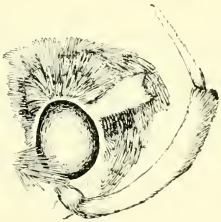
5. ENDROSIS

7. INGA

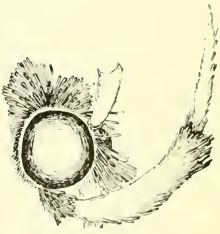


6. PLEUROTA

8. EUMEYRICKIA



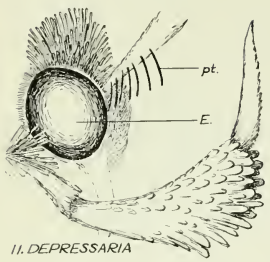
9. CARCINA



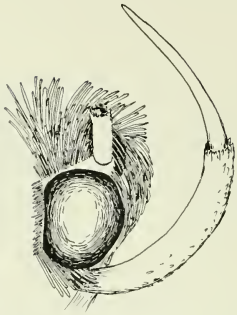
10. MARTYRINGA

NORTH AMERICAN OECOPHORIDAE, COSMOPTERYGIDAE, AND ETHMIIDAE.

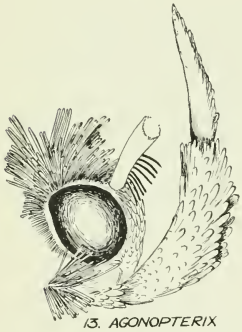
FOR EXPLANATION OF PLATE SEE PAGE 274.



11. DEPRESSARIA

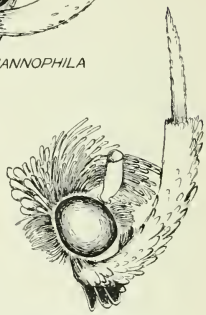


12. HOFMANNOPHILA

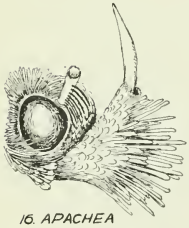


13. AGONOPTERIX

14. EPICALLIMA

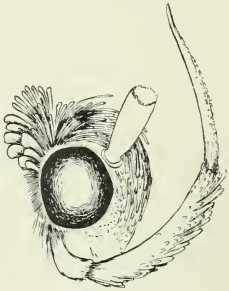


15. SEMIOSCOPIS



16. APACHEA

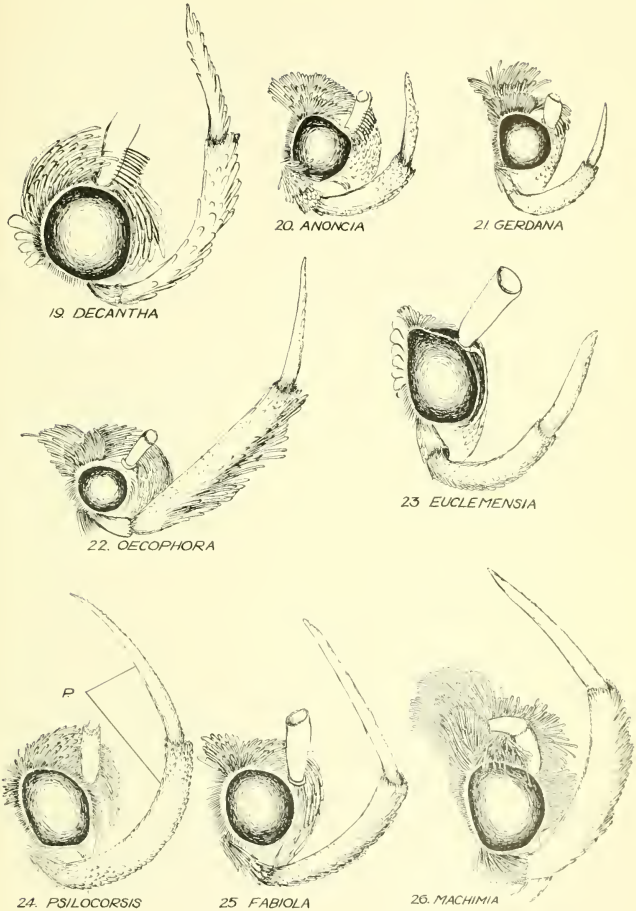
17. MARTYRHILDA



18. SCHIFFERMÜLLERIA

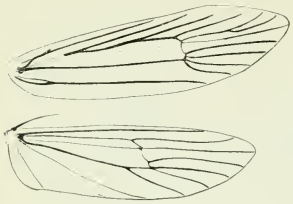
NORTH AMERICAN OECOPHORIDAE.

FOR EXPLANATION OF PLATE SEE PAGES 274–275



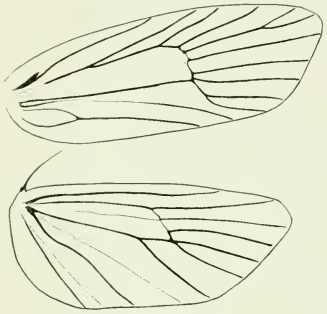
NORTH AMERICAN OECOPHORIDAE, COSMOPTERYGIDAE, BLASTOBASIDAE, AND HELIODINIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 275.



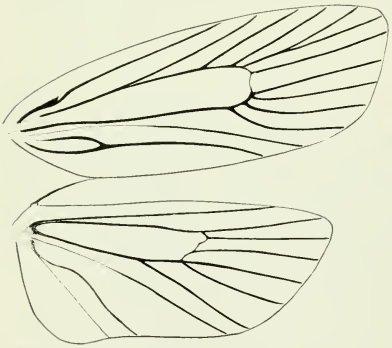
27. ANTEQUERA

28. ANTEQUERA

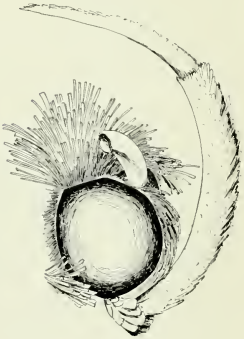


29. BIBARRAMBLA

30. BIBARRAMBLA



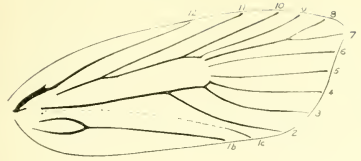
31. HIMMACIA

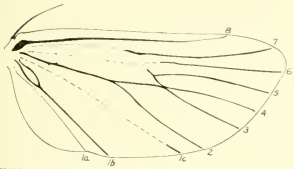


32. HIMMACIA

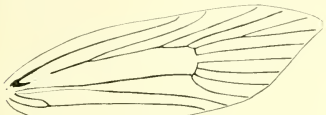
NORTH AMERICAN OECOPHORIDAE AND COSMOPTERYGIDAE

FOR EXPLANATION OF PLATE SEE PAGE 275.

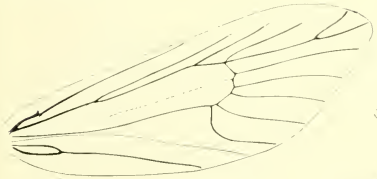


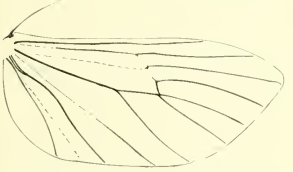


33. MACHIMIA

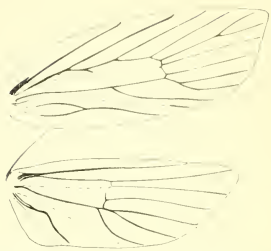


34. PLEUROTA

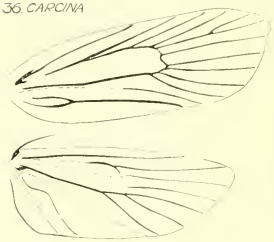




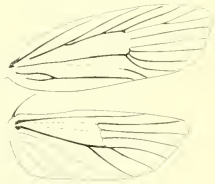
35. SEMIOSCOPIS



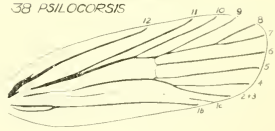
36. CARCINA

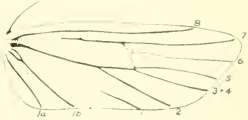


37. INGA



38. PSILOCORSIS

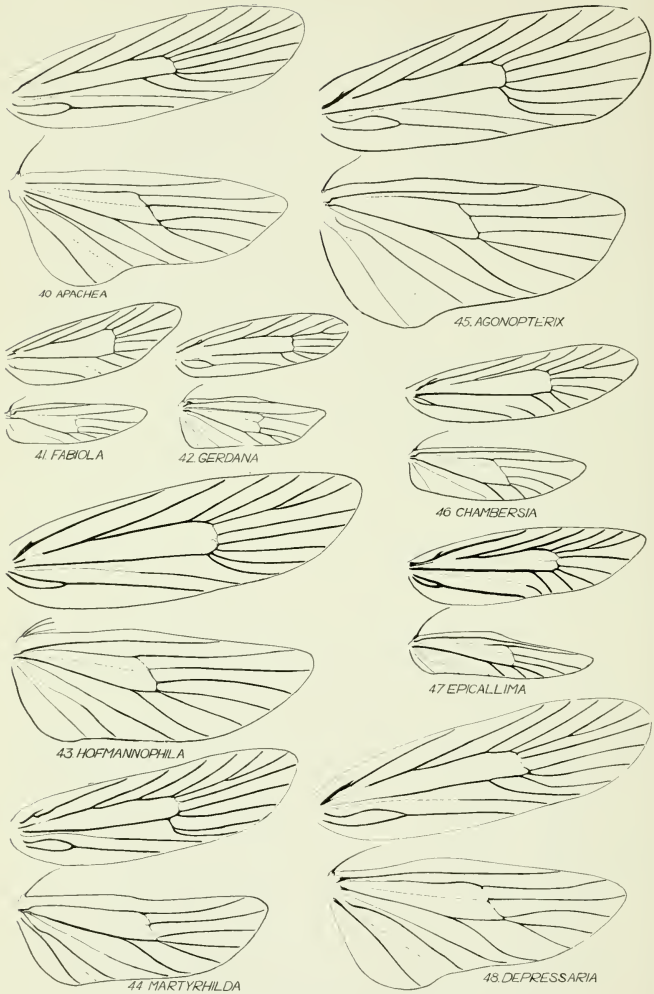




39. MARTYRINCA

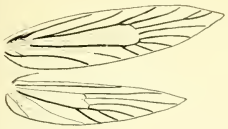
NORTH AMERICAN OECOPHORIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 275.

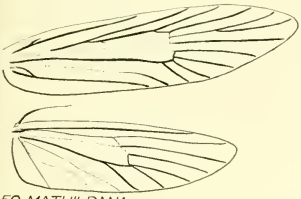


NORTH AMERICAN OECOPHORIDAE AND BLASTOBASIDAE.

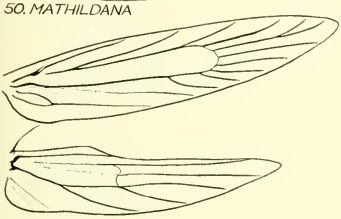
FOR EXPLANATION OF PLATE SEE PAGE 276.



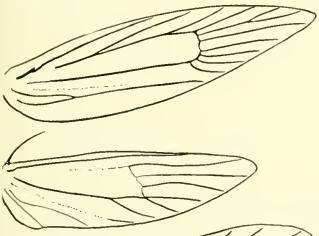
49. CAROLANA



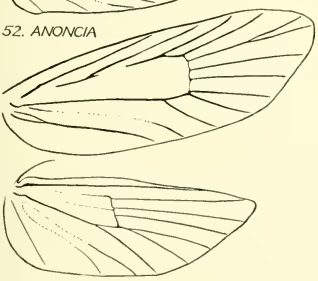
50. MATHILDANA



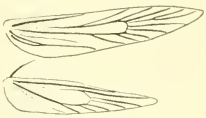
51. ENDROSIS



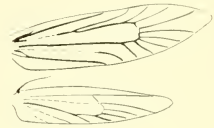
52. ANONCIA



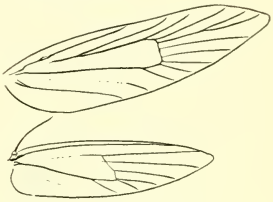
53. OECOPHORA



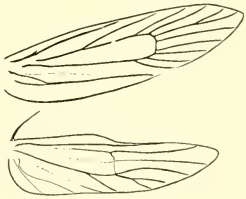
54. EUCLEMENSIA



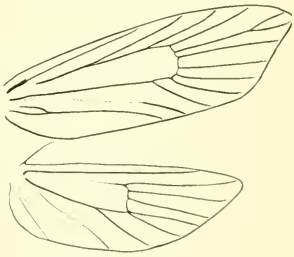
55. DECANTHA



56. SCHIFFERMÜLLERIA



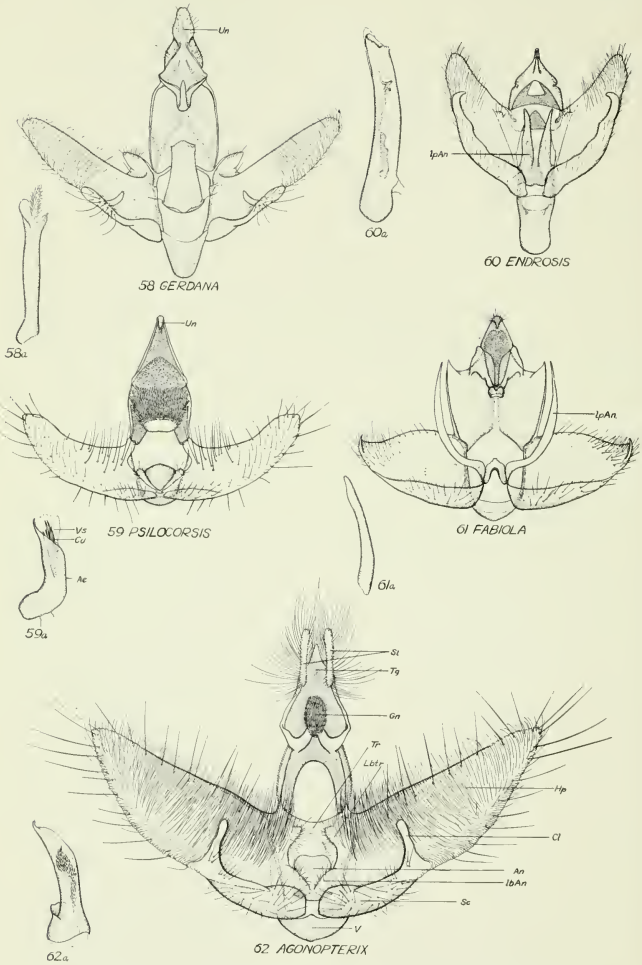
57. TRICLONELLA



57A. EUMEYRICKIA

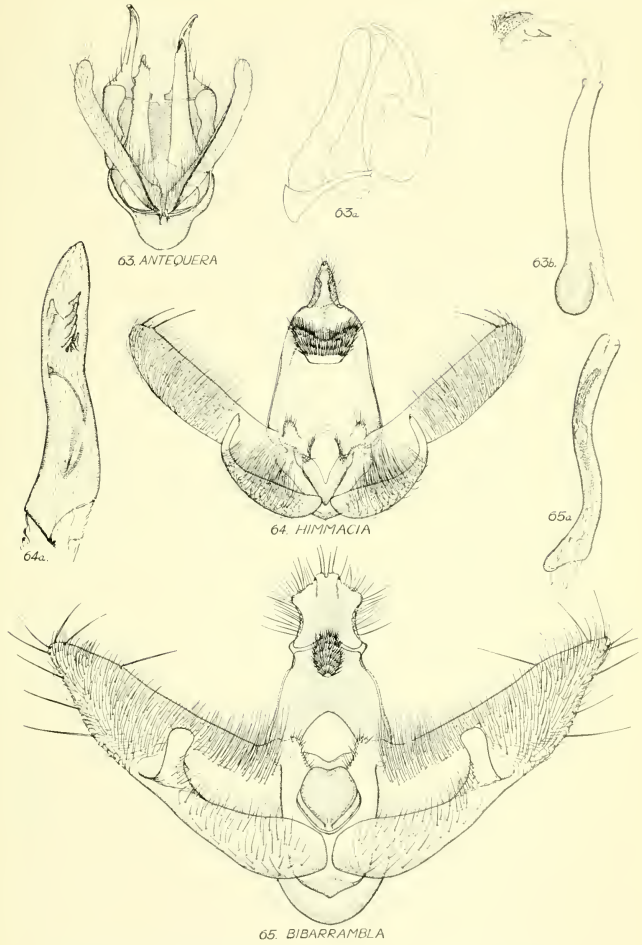
NORTH AMERICAN OECOPHORIDAE, COSMOPTERYGIDAE, ETHMIIDAE, AND HELIODINIDAE.

FOR EXPLANATION OF PLATE SEE PAGES 276.



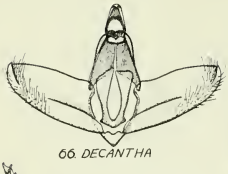
NORTH AMERICAN OECOPHORIDAE AND BLASTOBASIDAE

FOR EXPLANATION OF PLATE SEE PAGE 276.



NORTH AMERICAN OECOPHORIDAE AND COSMOPTERYGIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 276.

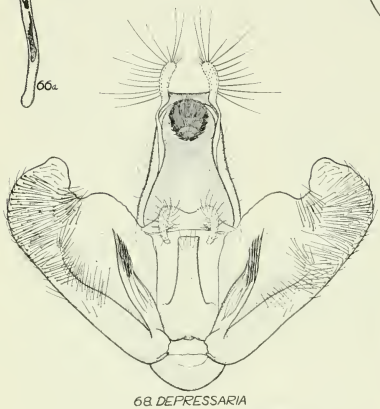


66. DECANTHA

67a

67. MARTYRHILDA

66a



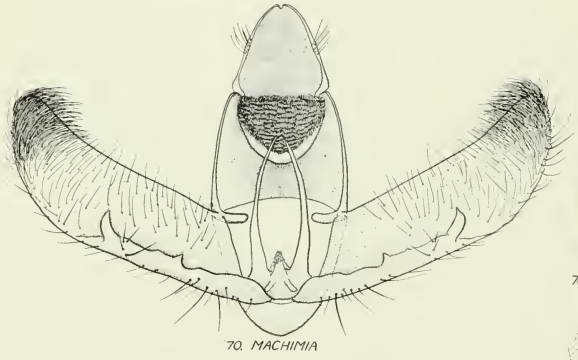
68. DEPRESSARIA

68a

69b

69a

69. CAROLANA



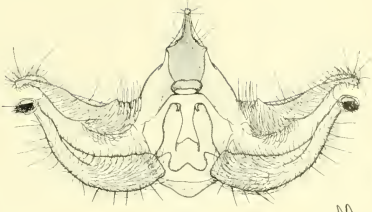
70. MACHIMIA

70a

NORTH AMERICAN OECOPHORIDAE.

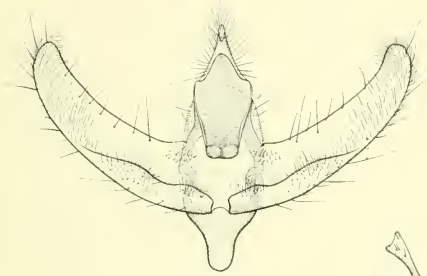
FOR EXPLANATION OF PLATE SEE PAGES 276–277.

71a



71. CARCINA

71b

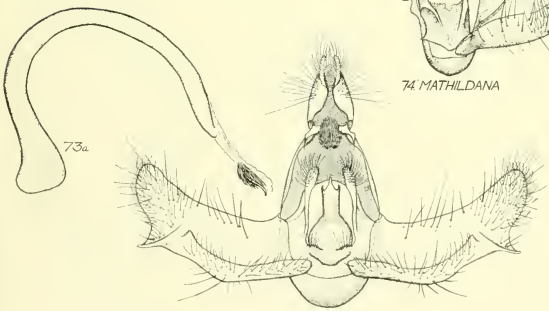


72. MARTYRINGA

72a

74a

74. MATHILDANA

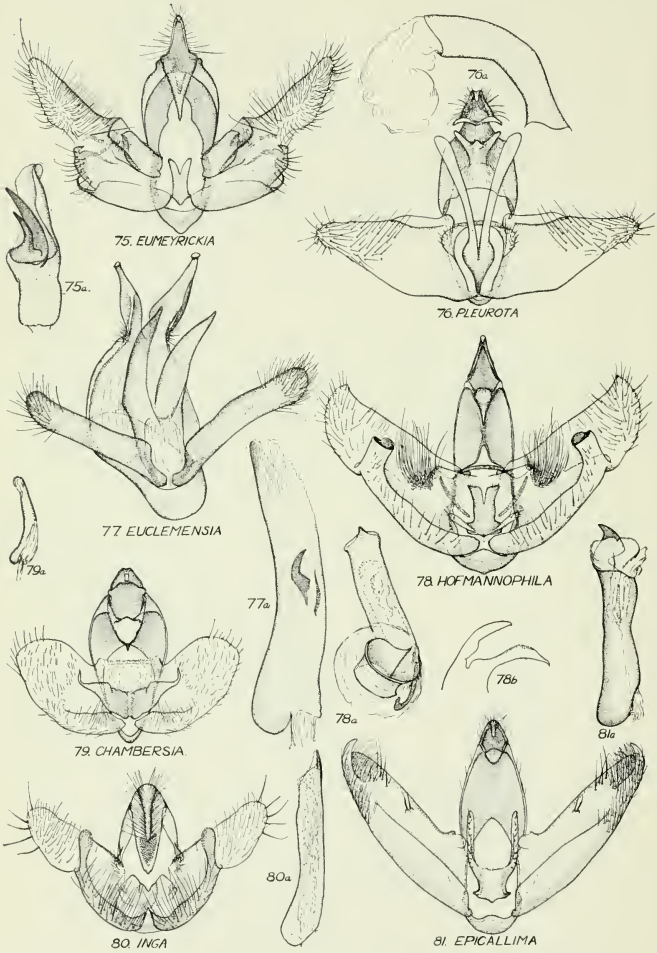


73a

73. SEMIOSCOPIS

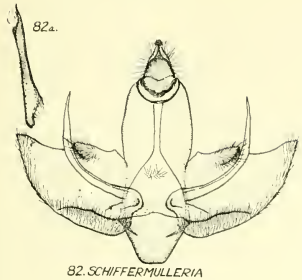
NORTH AMERICAN OECOPHORIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 277.



NORTH AMERICAN OECOPHORIDAE, ETHMIIDAE, AND HELIODINIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 277.

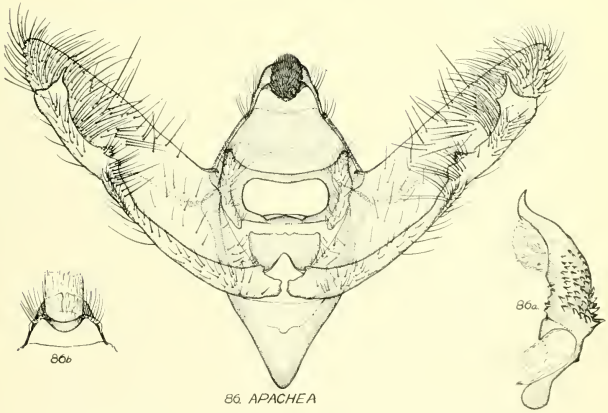


82. SCHIFFERMULLERIA

84. TRICLONELLA

83 OECOPHORA

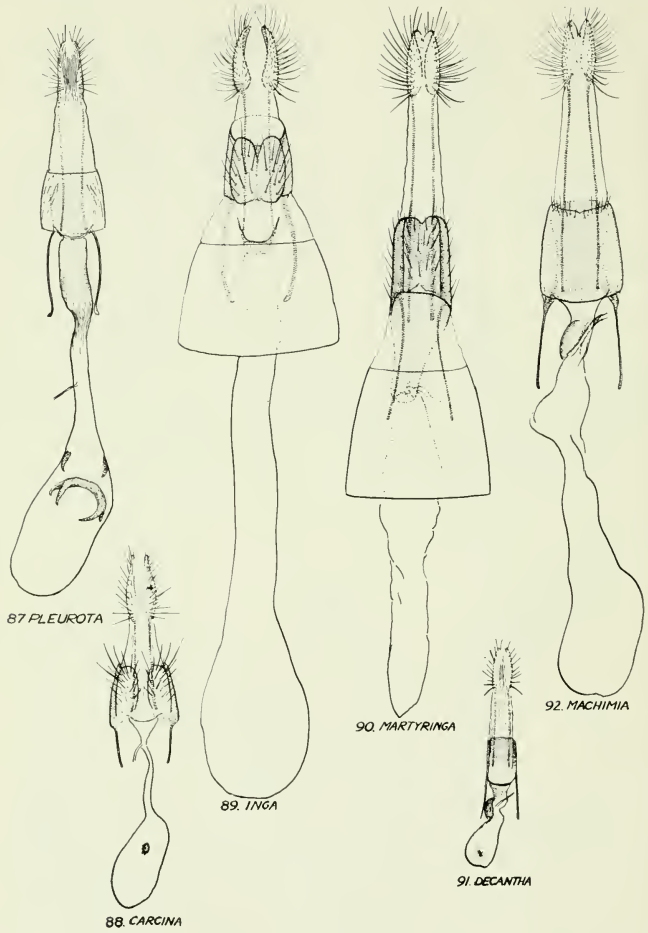
85. ANONCIA



86. APACHEA

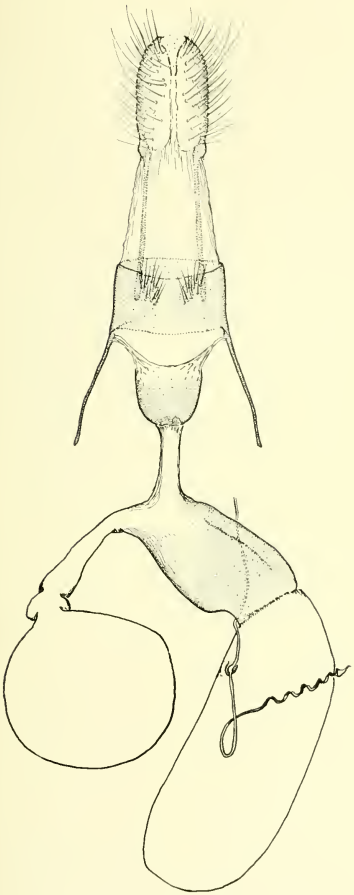
NORTH AMERICAN OECOPHORIDAE AND COSMOPTERYGIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 277.

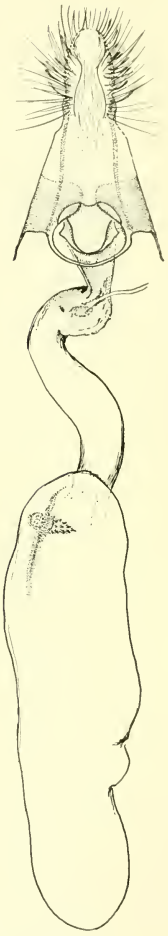


NORTH AMERICAN OECOPHORIDAE.

FOR EXPLANATION OF PLATE SEE PAGES 277–278.



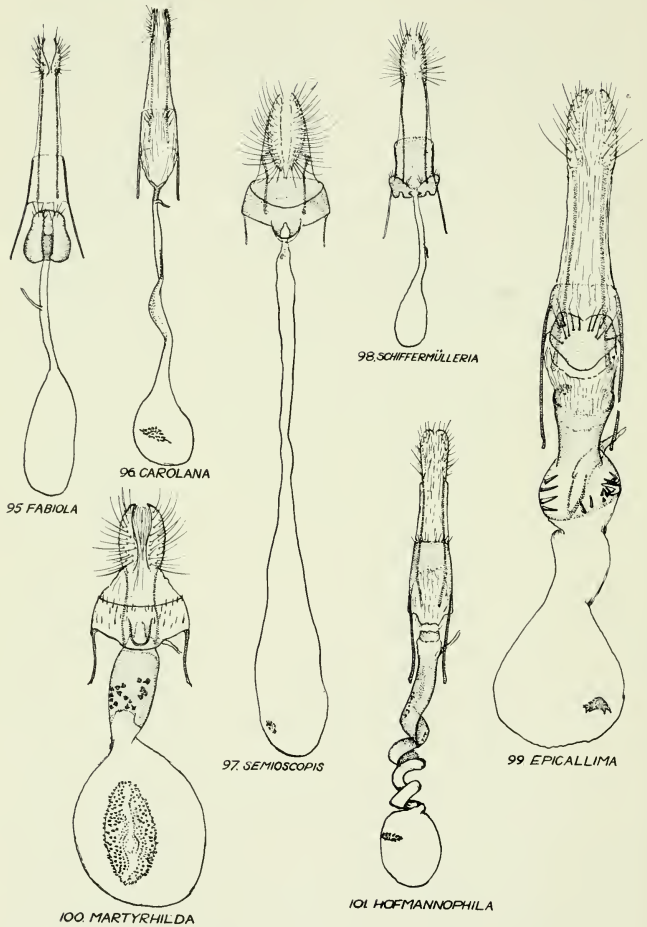
93. EUCLEMENSIA



94. APACHEA

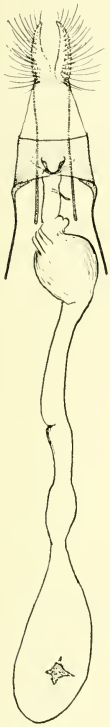
NORTH AMERICAN OECOPHORIDAE AND HELIODINIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 278.

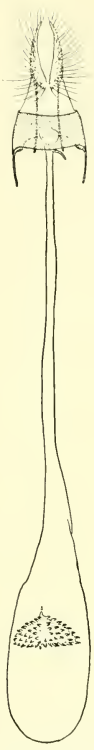


NORTH AMERICAN OECOPHORIDAE.

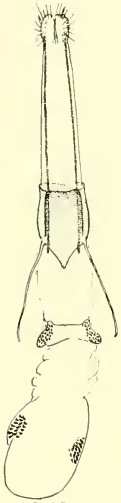
FOR EXPLANATION OF PLATE SEE PAGE 278.



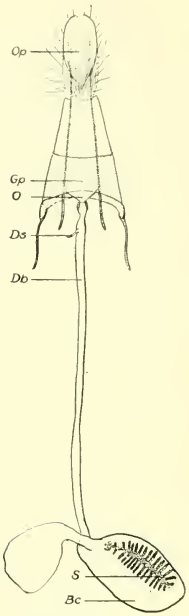
102 DEPRESSARIA



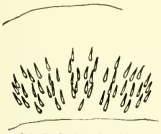
103 AGONOPTERIX



104 EUMEYRICKIA



105 PSILOCORSIS



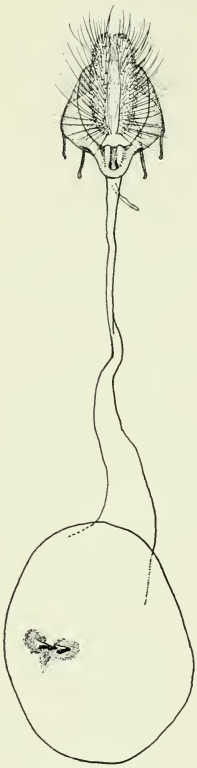
106 BORKHAUSENIA ♂

107 MARTYRINGA ♀

108 CAROLANA ♂

NORTH AMERICAN OECOPHORIDAE AND ETHMIIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 273.



109. BIBARRAMBLA

110. HIMMACIA

111. ANTEQUERA

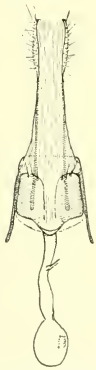
NORTH AMERICAN OECOPHORIDAE AND COSMOPTERYGIDAE

FOR EXPLANATION OF PLATE SEE PAGE 278.

112. TRICLONELLA

113. OECOPHORA

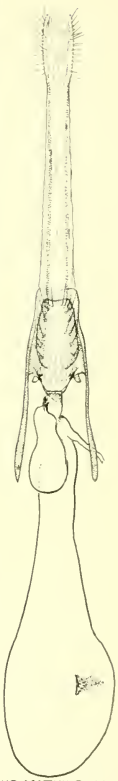
114. ANONCIA



115. CHAMBERSIA

116 ENDROSIS

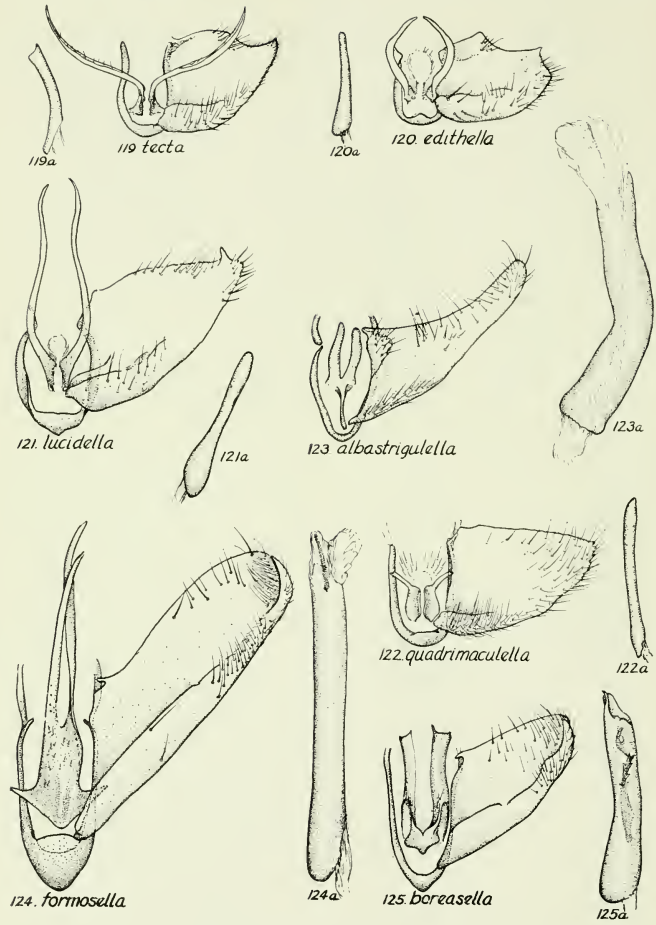
117. GERDANA



118. MATHILDANA

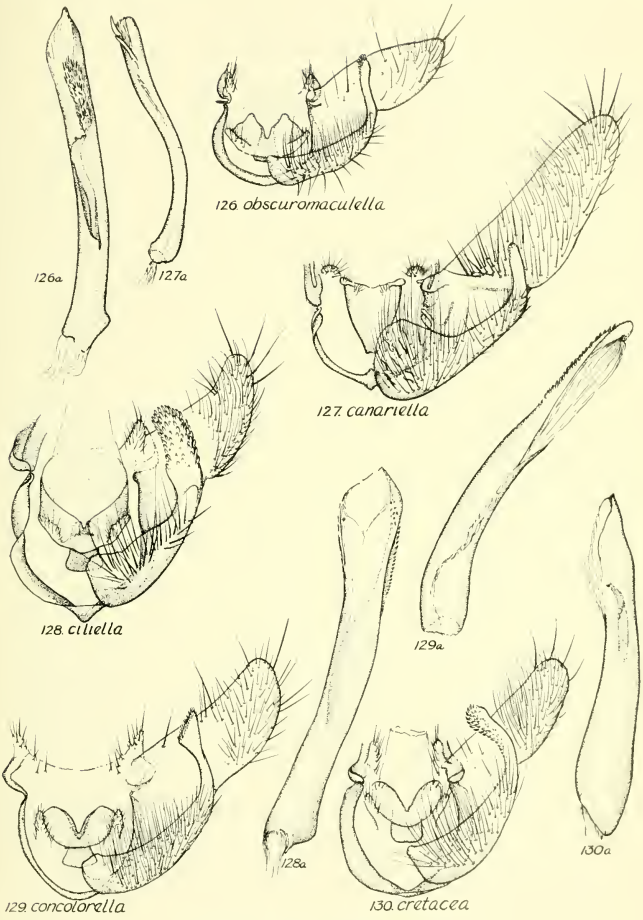
NORTH AMERICAN OECOPHORIDAE, COSMOPTERYGIDAE, AND BLASTOBASIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 278.



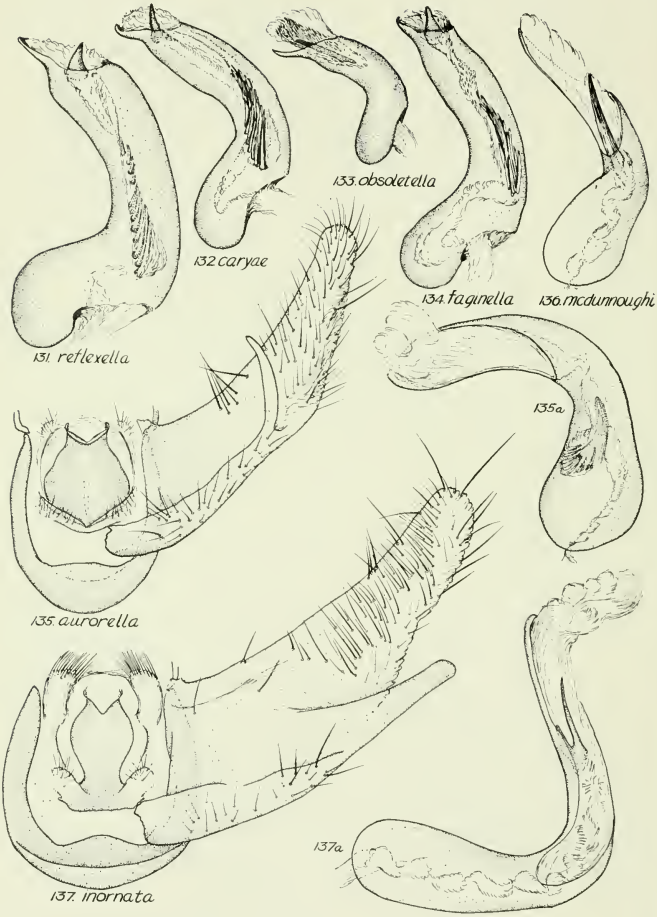
NORTH AMERICAN OECOPHORIDAE.

FOR EXPLANATION OF PLATE SEE PAGES 278–279.



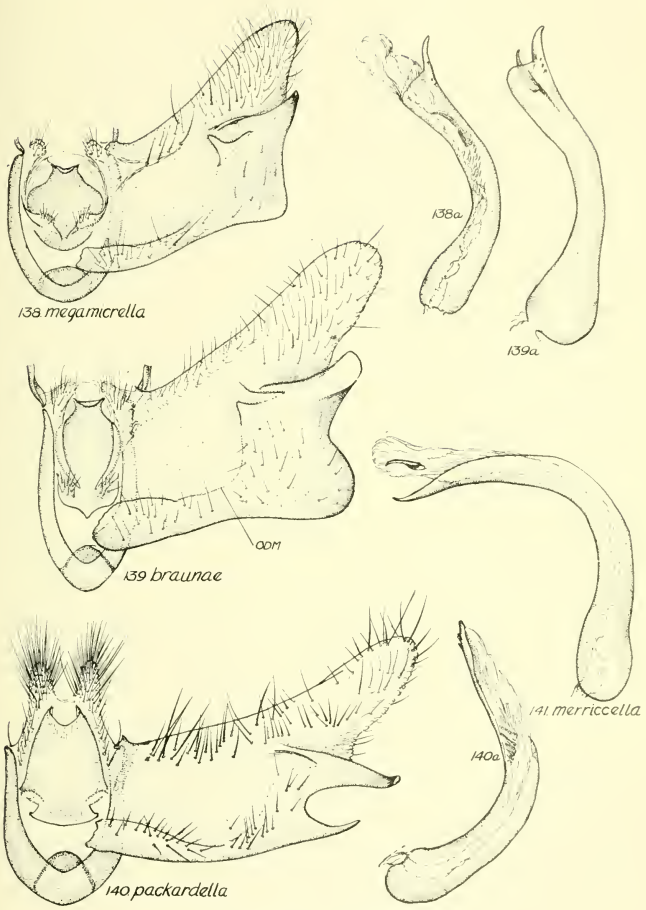
NORTH AMERICAN OECOPHORIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 279.



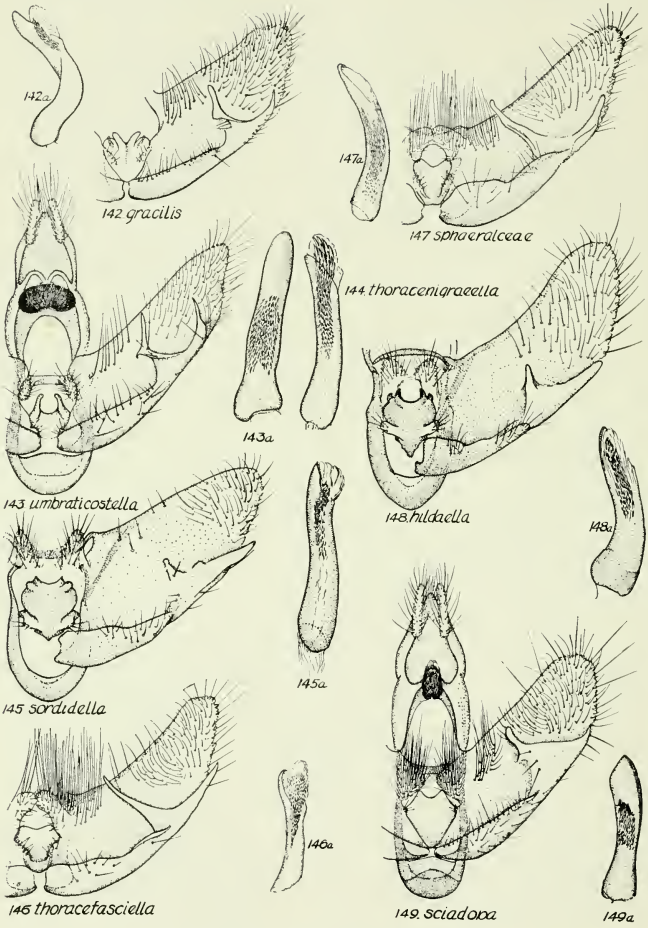
NORTH AMERICAN OECOPHORIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 279.



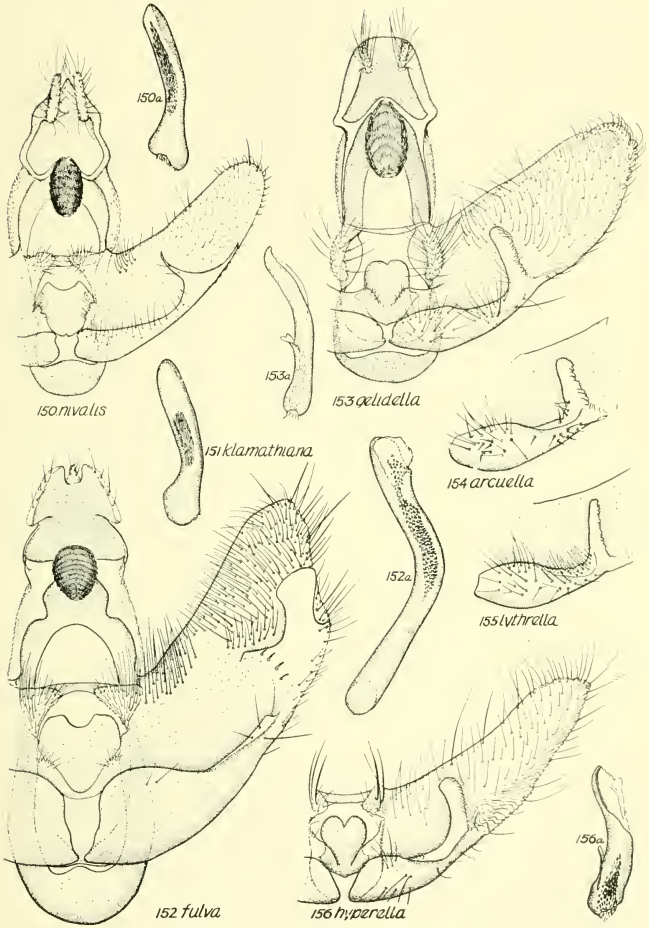
NORTH AMERICAN OECOPHORIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 278.



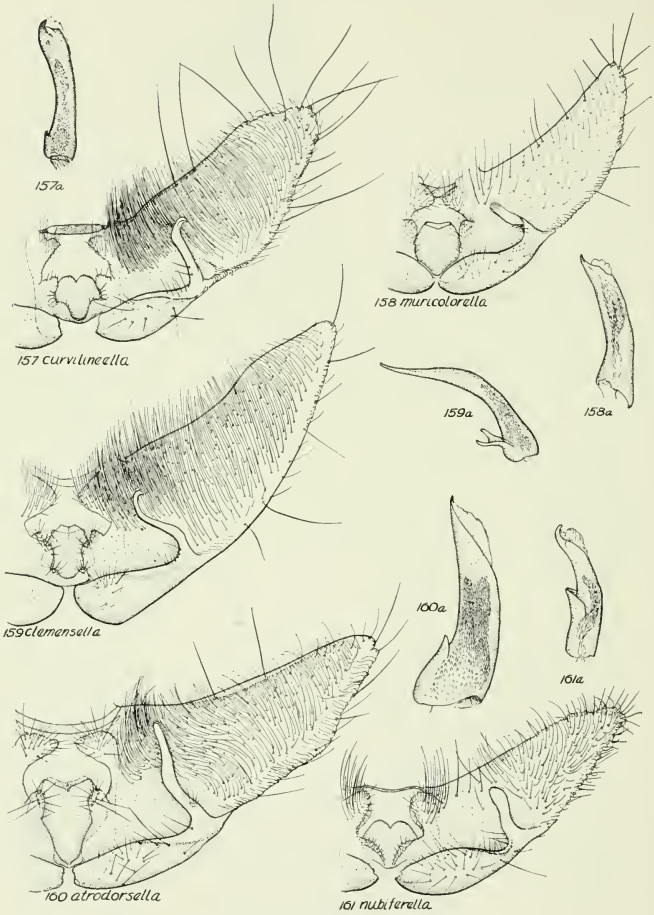
NORTH AMERICAN OECOPHORIDAE.

FOR EXPLANATION OF PLATE SEE PAGES 279–280.



NORTH AMERICAN OECOPHORIDAE.

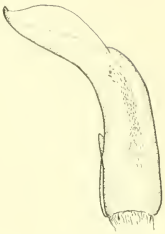
FOR EXPLANATION OF PLATE SEE PAGE 280.



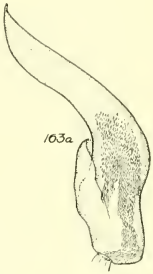
NORTH AMERICAN OECOPHORIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 280.

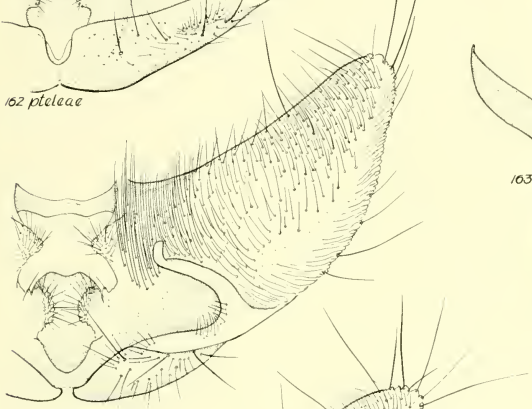
162 pteleae



162a

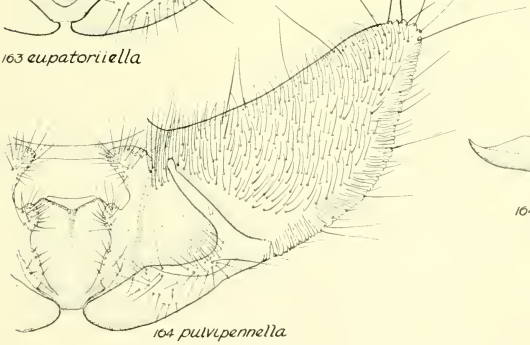


163a



163 eupatoriiella

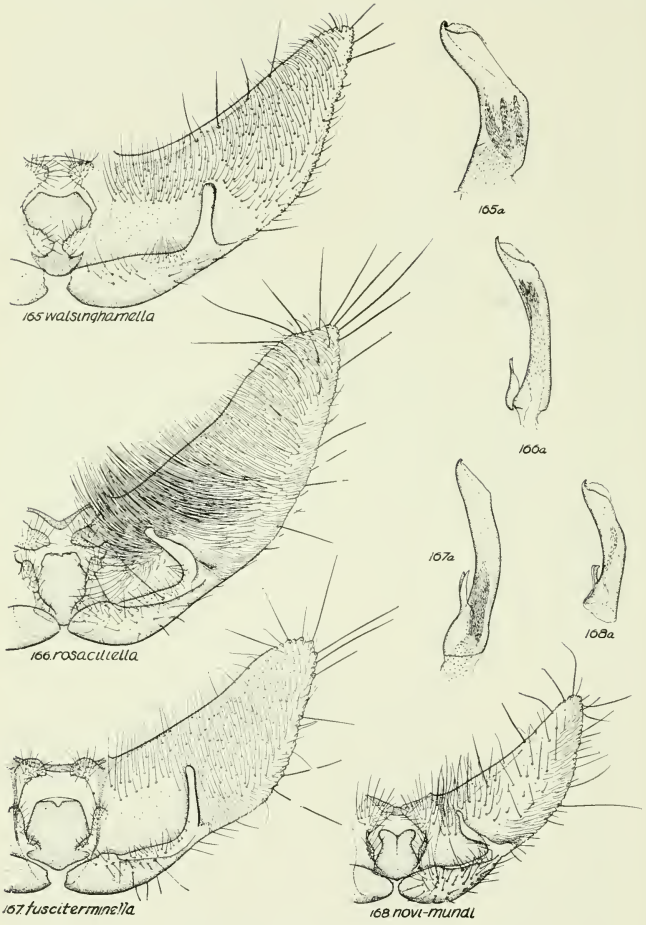
164a



164 pulvipennella

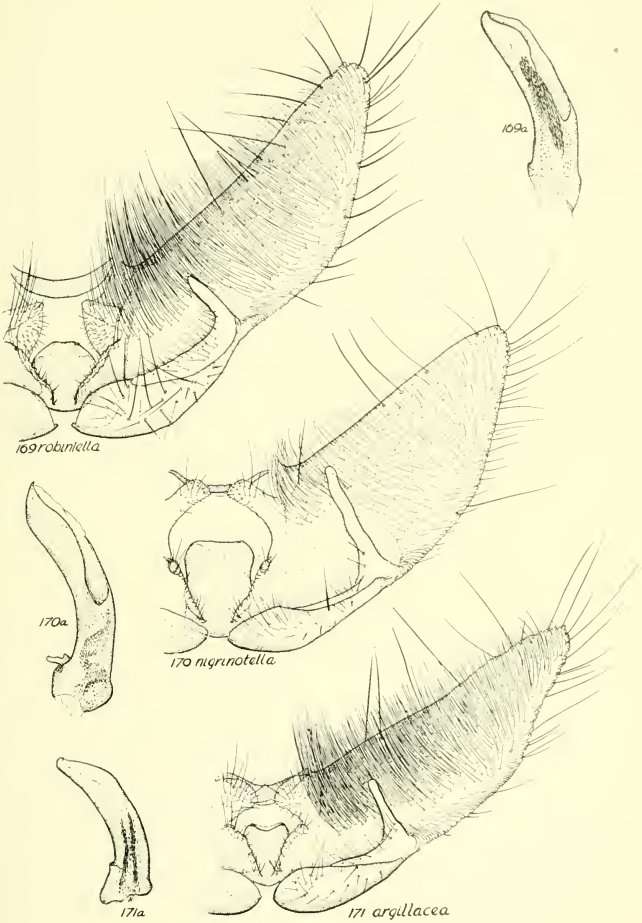
NORTH AMERICAN OECOPHORIDAE

FOR EXPLANATION OF PLATE SEE PAGE 280.



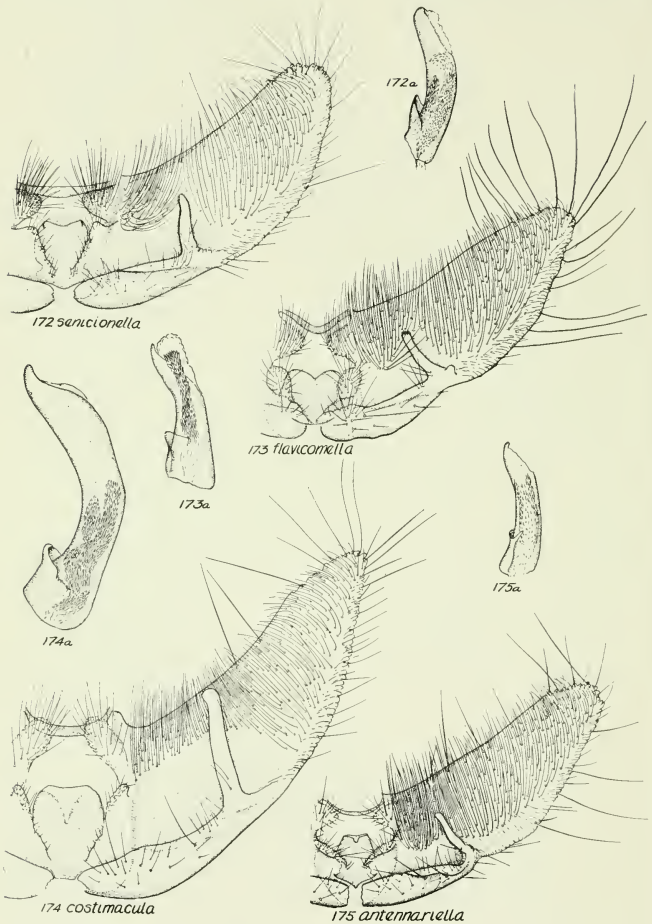
NORTH AMERICAN OECOPHORIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 281.



NORTH AMERICAN OECOPHORIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 281.



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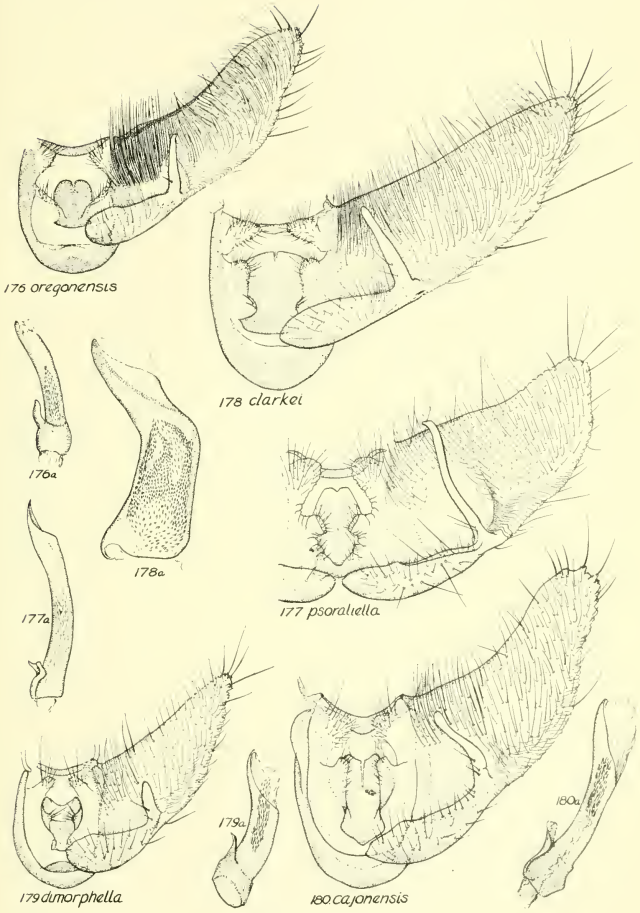

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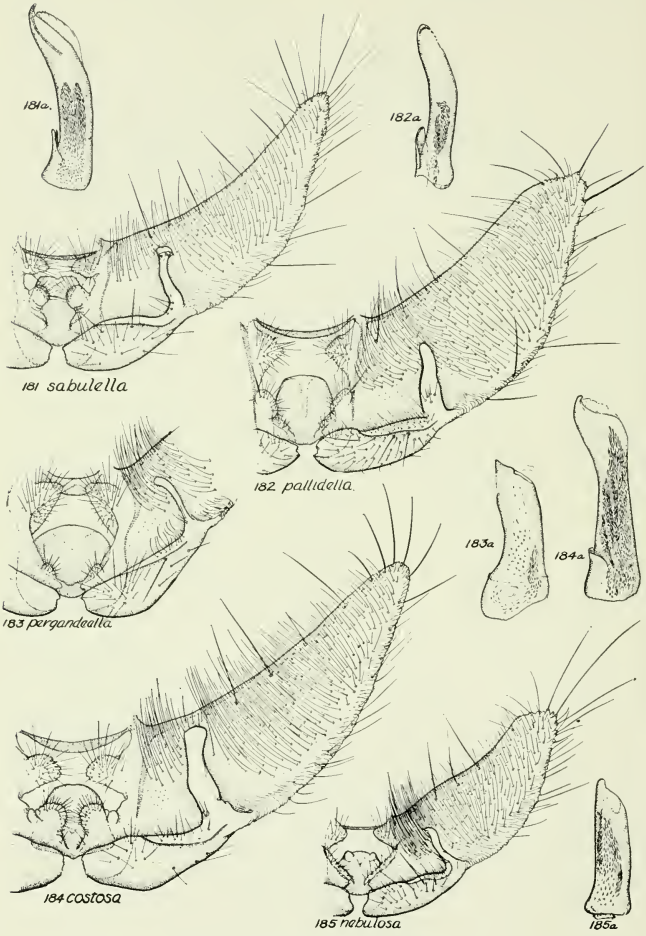

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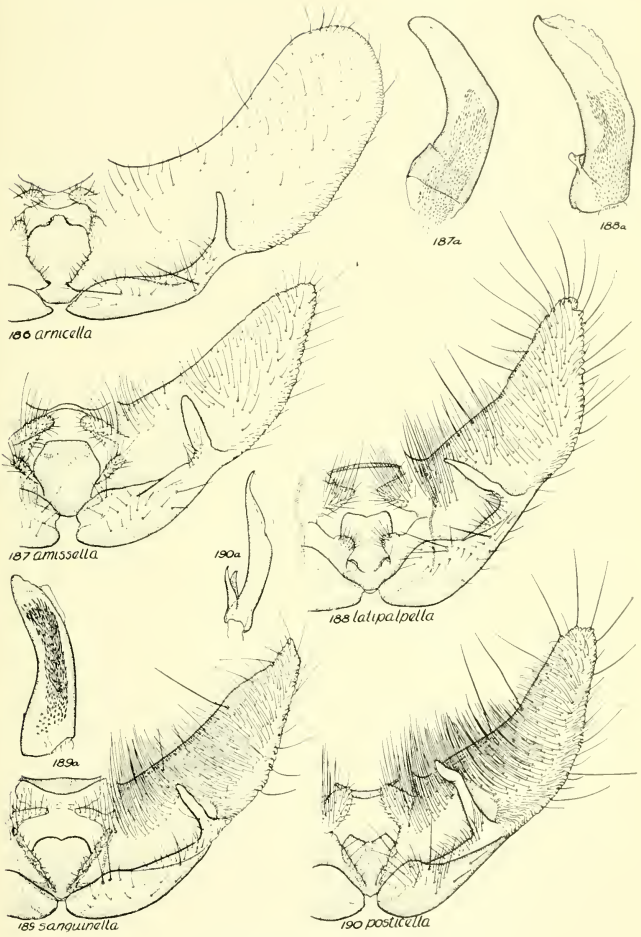

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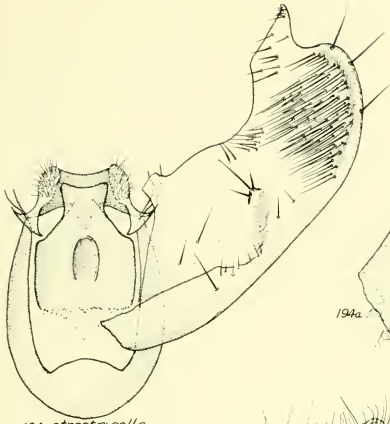

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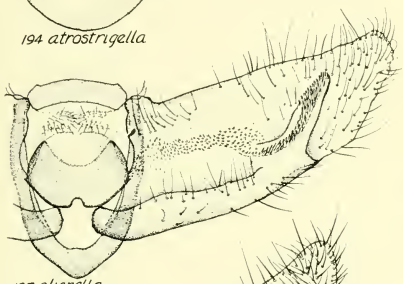

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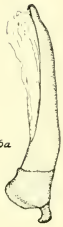

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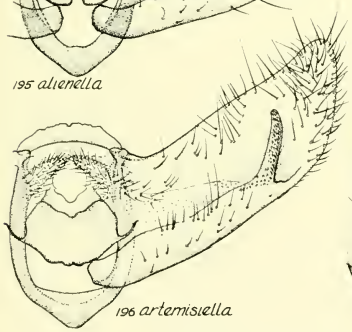
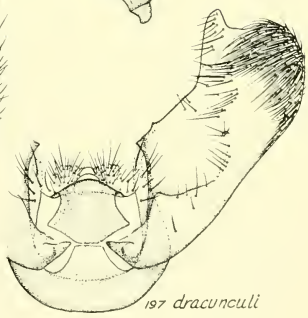


196 artemisiella



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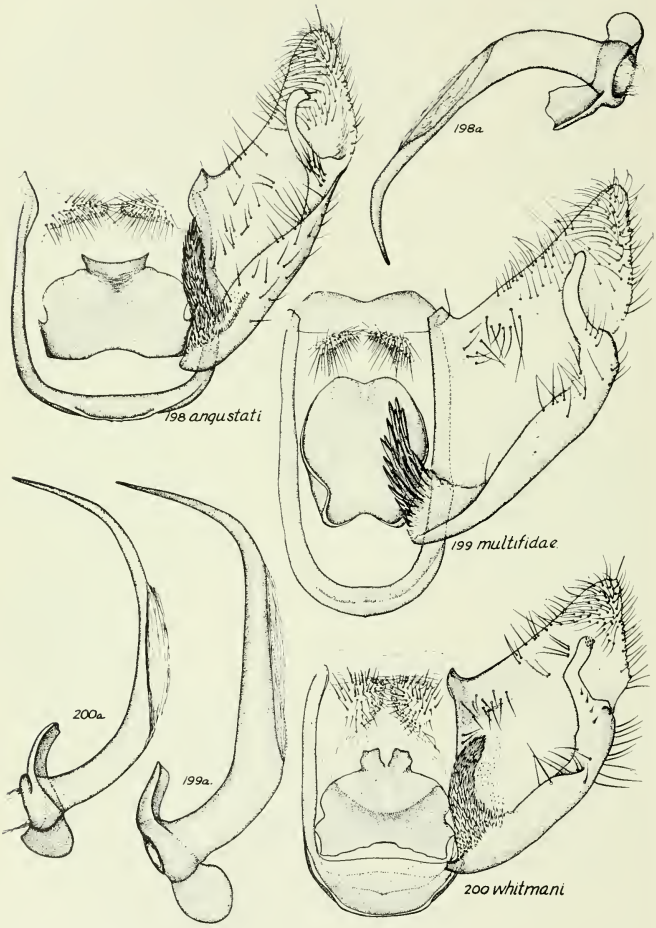

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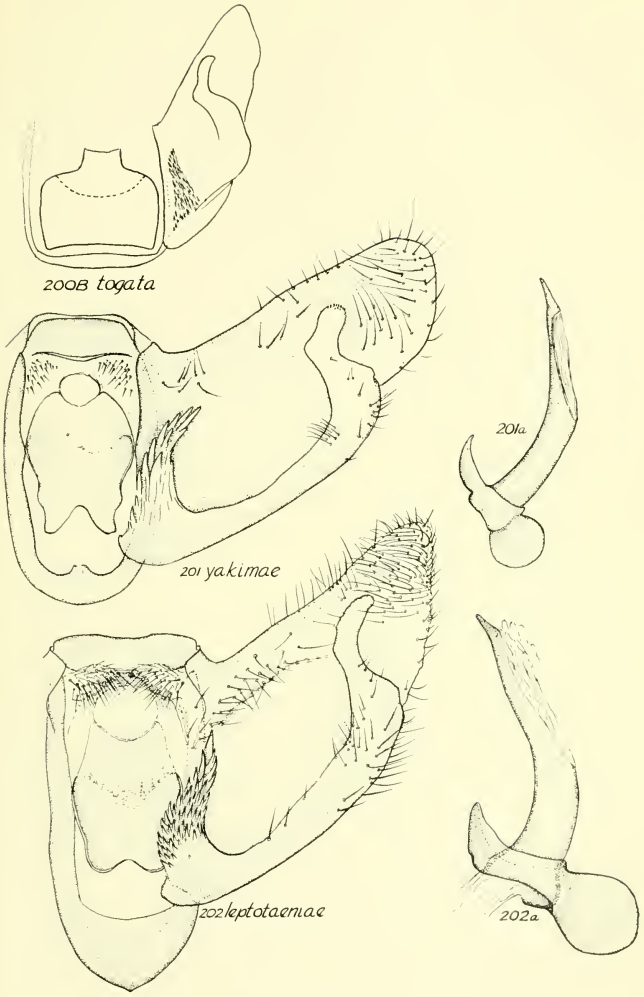

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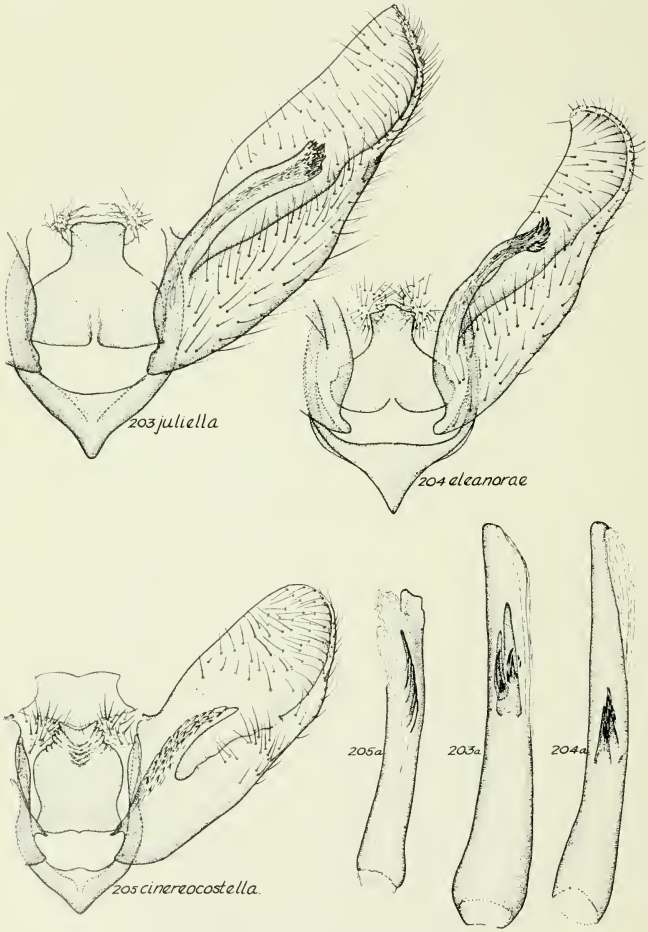

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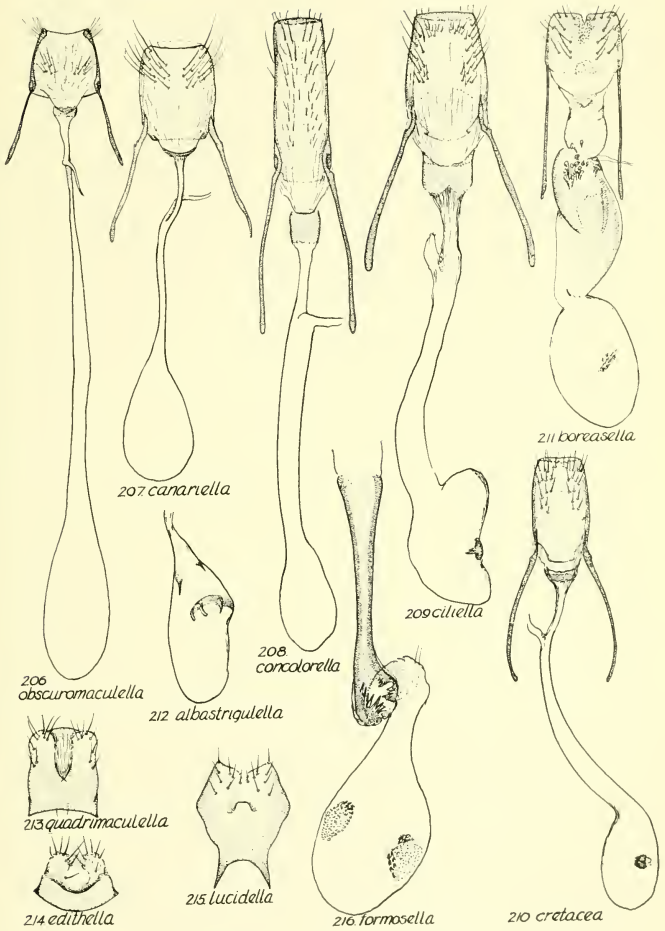

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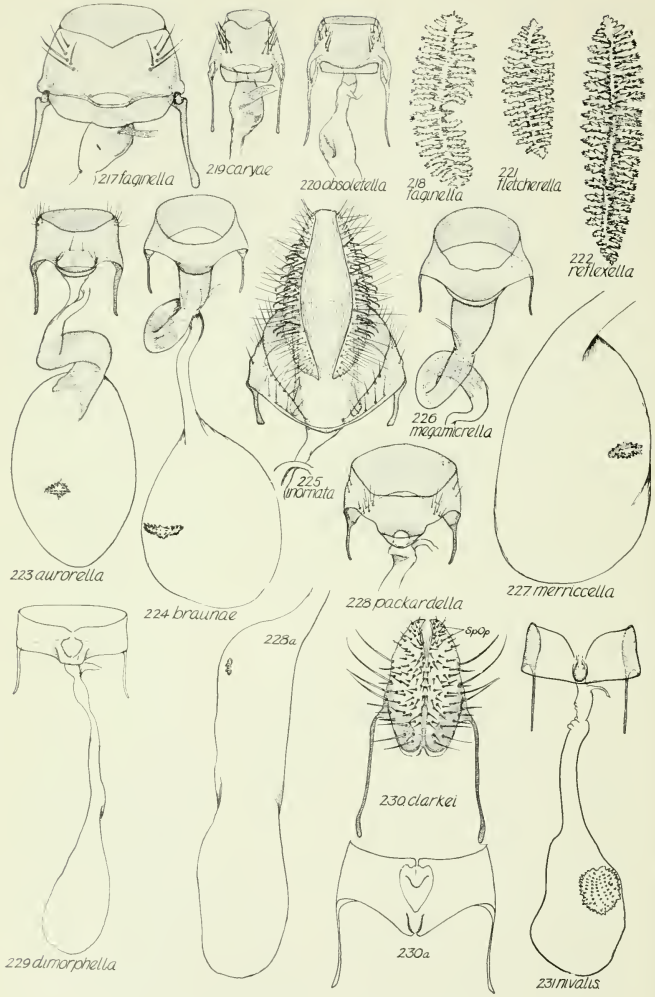

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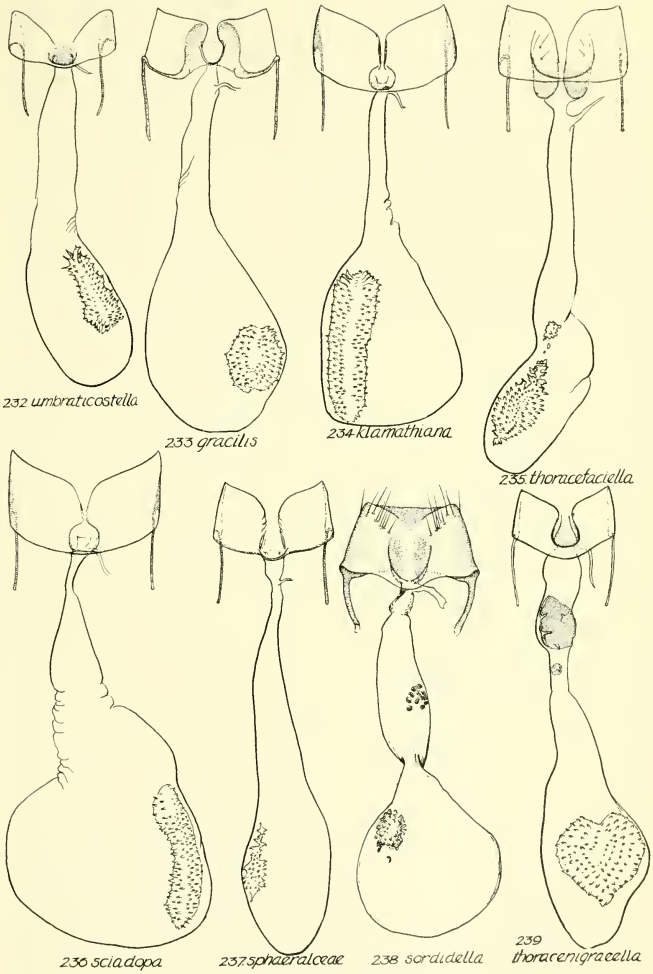

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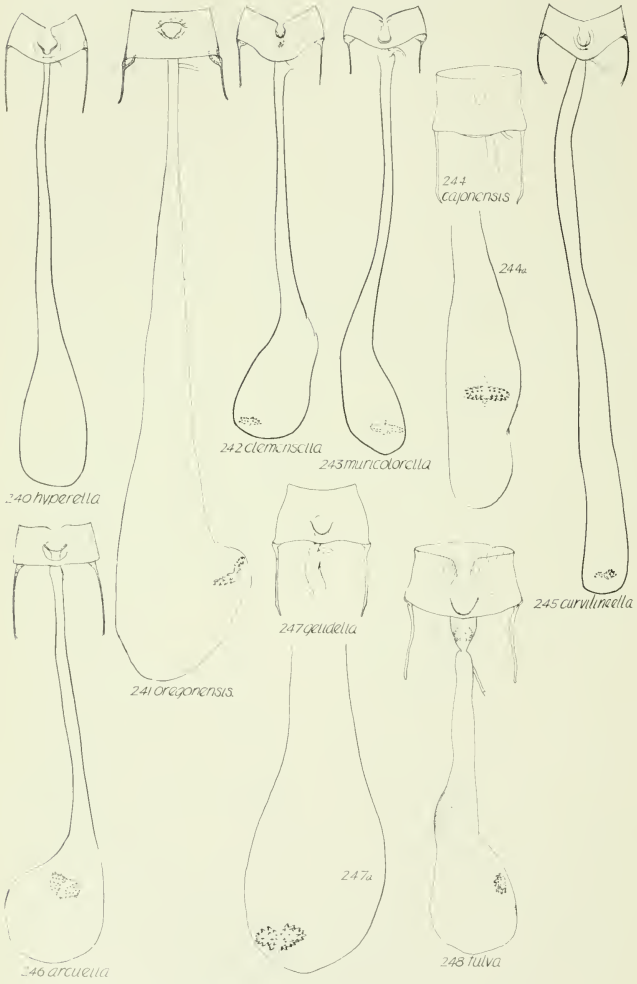

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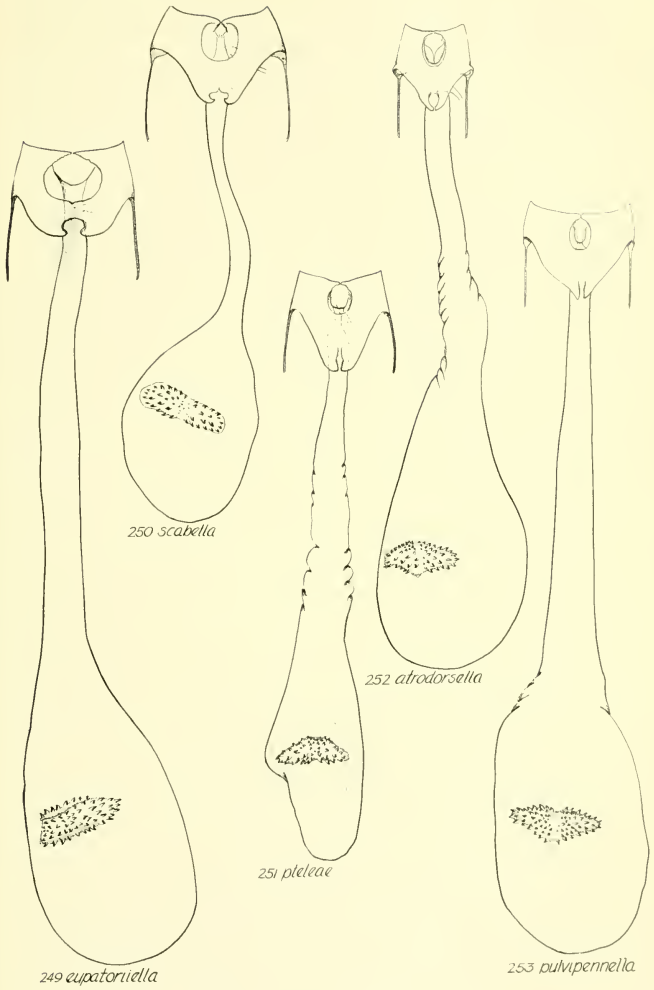

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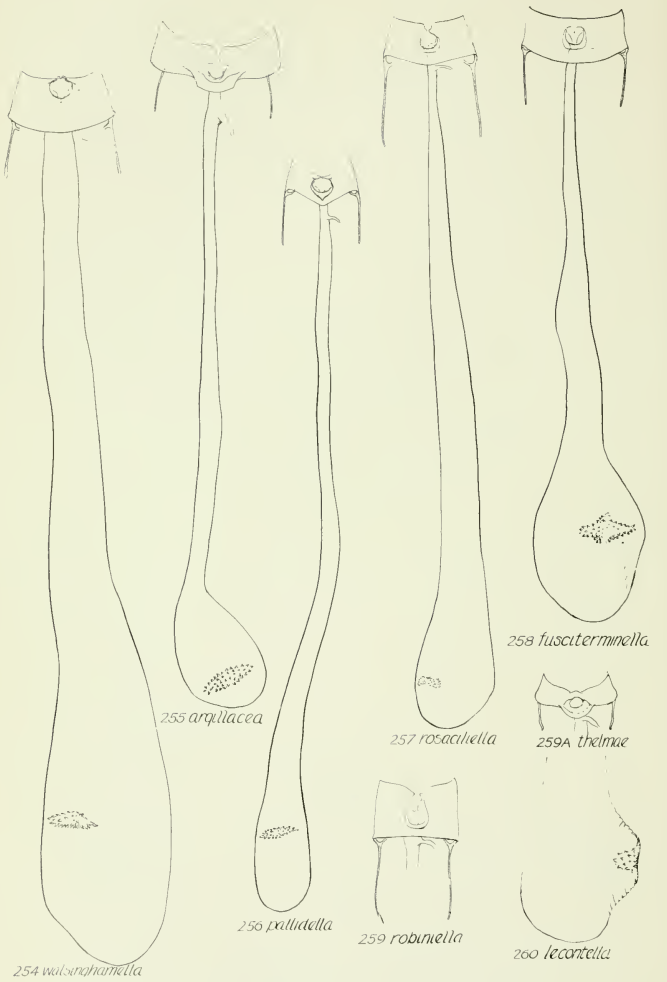

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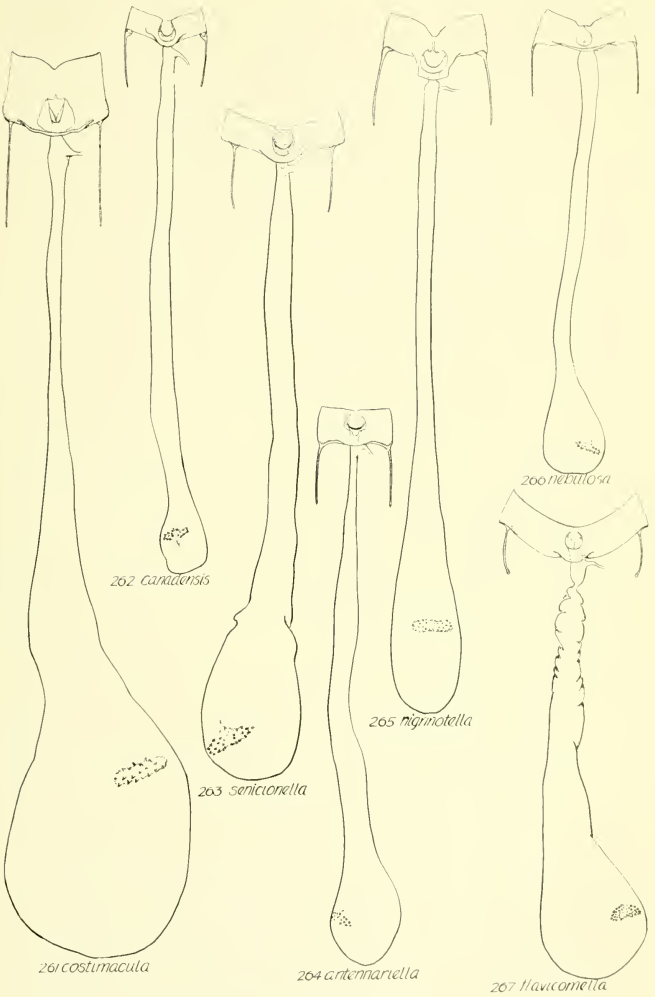

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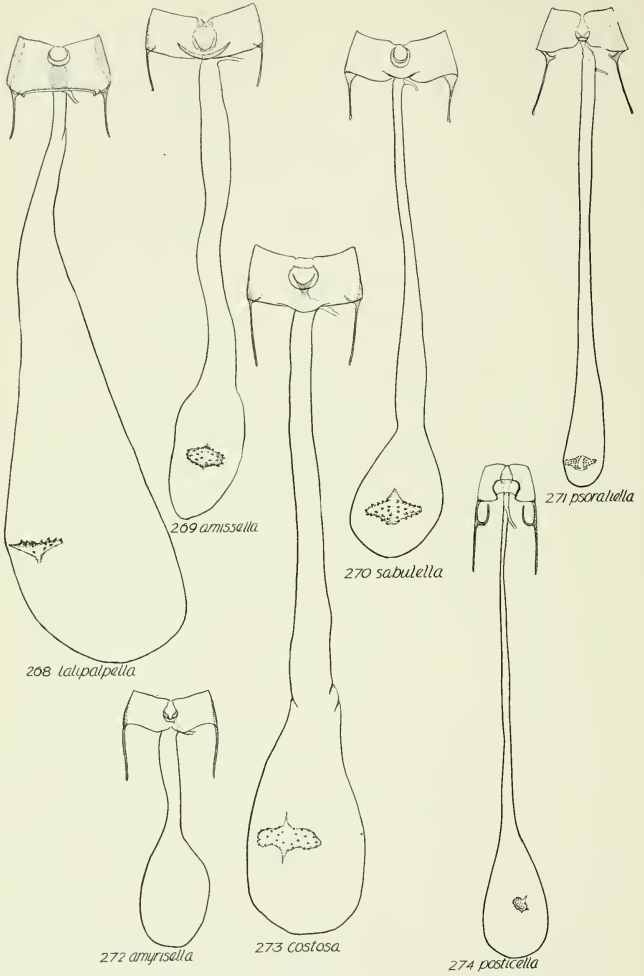

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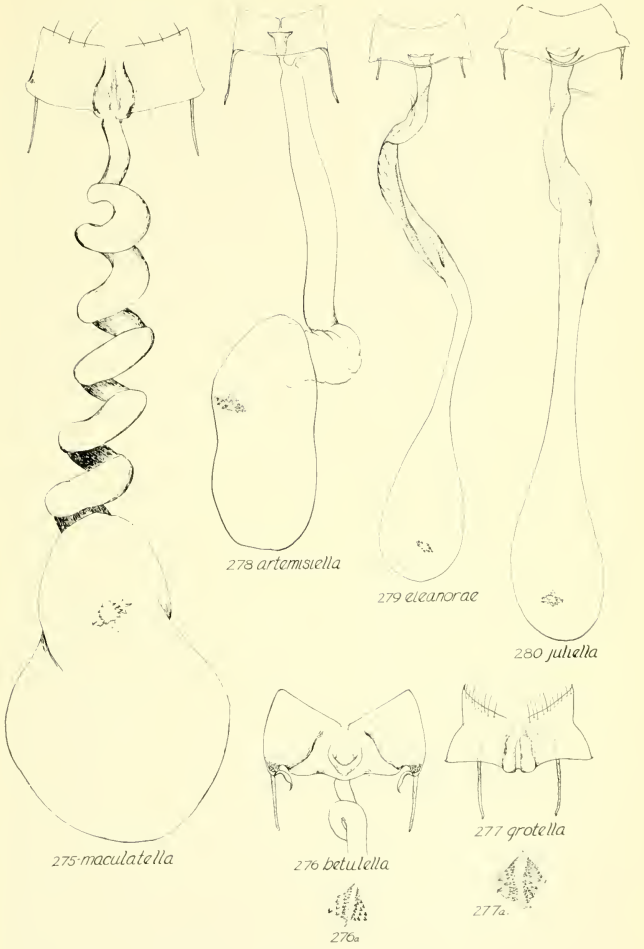

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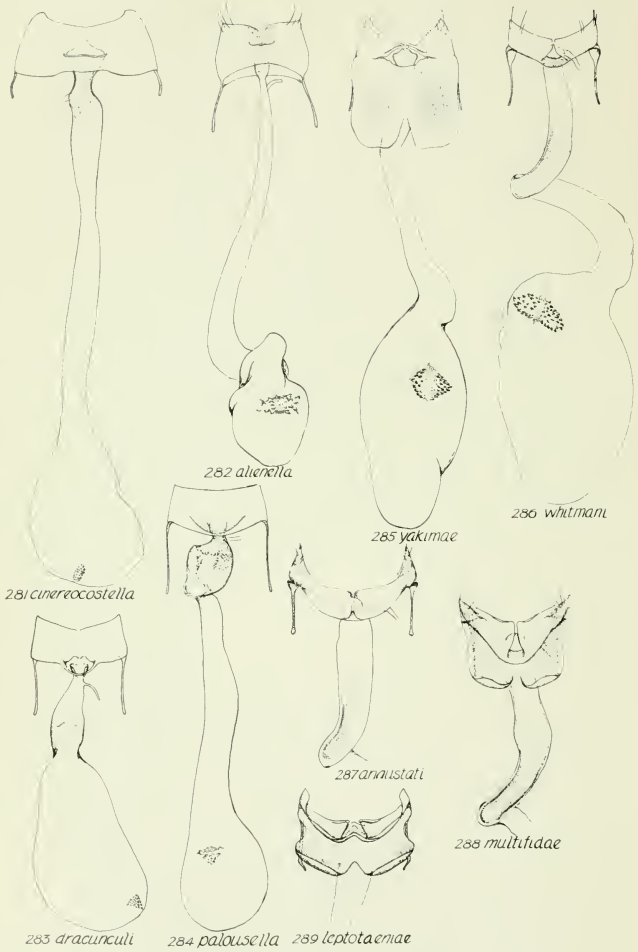

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SYNOPSIS OF THE TACHINID FLIES OF THE GENUS TACHINOMYIA, WITH DESCRIPTIONS OF NEW SPECIES

By Ray T. Webber

The genus *Tachinomyia* was erected by Townsend (1892, p. 96) for the reception of two new species, *robusta* and *floridensis*. He designated the former as genotype. Coquillett (1897, p. 118) considered the genus a synonym of *Tachina* (=*Exorista*), as also did Aldrich (1905, p. 469). According to Townsend (1908, p. 107), however, *Tachinomyia* "differs from *Tachina* in the vibrissae being inserted higher above oral margin, cheeks one-half eye height in width, and abdomen very elongate." Since these characters vary to some extent, more important, perhaps, is the structure of the genitalia, which, as pointed out by Curran (1926, p. 166), are entirely different from those of *Tachina*.

The writer wishes to acknowledge the assistance given him by the late Dr. J. M. Aldrich, who prior to 1926 made a study of the material at the United States National Museum and was prepared to recognize *Tachinomyia*, with new species included, but did not publish because of the appearance of Dr. C. H. Curran's paper (1926); to Miss Daphne Aubertin, of the Department of Entomology, British Museum, for the comparison of material with Walker's types; and to T. H. Jones for the use of material and notes of his making. Appreciation is expressed also to David G. Hall for his suggestions and advice. That which follows is the result of the writer's study of material at the United States National Museum, and at the laboratory of the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, formerly maintained at

Melrose Highlands, Mass., while it was under the direction of C. W. Collins.

The characters employed by Curran, particularly those pertaining to the genitalia and sternites, appear to be the most satisfactory ones for the separation of the species. In order that they may be given careful study the specimen must be relaxed and the genitalia exposed. Unless this is done considerable doubt remains as to the formation of the anal forceps and the lobes of the fifth sternite. In *panaetius* and *apicata* the lobes are smooth distally, their inner edges ridgeless except at base, where they unite in an abrupt, upwardly rounded flange. While there is no basal flange in any of the other species, except possibly *floridensis*, some of them have the distal portion of each lobe furnished with a more or less conspicuous ridge along its inner edge. It is not clearly understood how much importance should be attached to this structure. Obviously it is subject to considerable variation within the species, as shown in the case of *cana* and *acosta*. However, in nearly all the specimens of *variata* that have been seen the ridges are well developed and provide a good character for identification. The form of the anal forceps is best determined by the aid of a crosshatched eye-piece micrometer, which will forestall any imaginary concept. An additional character is found in the lengthened villosity of the inner surface of the hind tibiae, and while applicable only in the case of *panaetius*, *floridensis*, and *apicata* (fig. 17, *g*), it is of constant occurrence and readily recognized.

The females are identified with difficulty. With a few exceptions the species, even in the males, appear more or less similar, and frequently their identity is doubtful. Since several of them occur simultaneously in the same region, association of sexes has but little value.

Little is known regarding the biology of the species. Townsend (1911, p. 141) tentatively placed *Tachinomyia* in his meigeniine series, species that glue a flattened macrotype egg to the body of the host. Several of the species have been occasionally bred from lepidopterous larvae, but records of rearing are rare in comparison to the field abundance of the flies, which are among the earliest vernal tachinids. Aldrich regarded *T. panaetius*, *sensu lato*, as one of the commonest North American species. In New England there is a single generation, the species passing the winter as puparia.

The generic characters of *Tachinomyia* are as follows: Eyes bare, although frequently thinly pilose in freshly emerged specimens; facial ridges bristly on at least the lowest third, usually about two-thirds way, but in no instance meeting the lowest frontals[1]; ocellar

[1] *Allophorocera montana* Smith (1917, p. 140), which Aldrich (1927, p. 21) believed to be a *Tachinomyia*, can be excluded from the genus by this character as well as others.

bristles present, directed forward, no orbital bristles in male; antenna reaching lowest fourth of face, third segment at apex, outwardly truncate, inwardly rounded; second segment somewhat elongate, in female sometimes more than one-half length of third; arista bare, second segment short; frontal bristles extending below base of third antennal joint; front without evenly paired reclinate bristles outside of frontal row; no outer vertical bristle in male; parafacialia bare, at narrowest part ranging from less than one-half to more than one-half distance between vibrissae; face moderately to strongly receding; proboscis short, fleshy; cheeks usually broad, never less than one-fifth eye height; vibrissae situated on or usually above oral margin; palpi well-developed. Thorax with three or four dorsocentral and three sternopleural bristles; pteropleural bristle normal; apical scutellar bristles present; infrasquamal spinules absent. Abdomen black or brownish in ground color, pollinose, decidedly elongated in male, shorter and stouter in female; median marginal macrochaetae present on all segments, second segment never with more than four macrochaetae; discal macrochaetae absent in all except *dakotensis*; no ventral carina, male hypopygium prominent, anal forceps azygous; lobes of tenth sternite broad at base, each terminating in a small fingerlike process at each side of the hooklike anal forceps. Hind tibia irregularly ciliate, middle tibia with two or more strong bristles on outer front side, near middle; claws and pulvilli in male conspicuously long. Wings long, with the usual tachinid venation; first posterior cell open, ending considerably before apex of wing; bend of fourth vein destitute of a distinct appendage but frequently with a faint fold; last section of fifth vein less than one-half as long as the preceding; veins bare except base of third.

KEY TO SPECIES OF TACHINOMYIA

MALES

1. Abdomen without discal macrochaetae 2
   Abdomen with discal macrochaetae ..... dakotensis, new species
2. Abdomen black; two reclinate upper frontal bristles 3
   Abdomen broadly red at sides, fourth segment wholly red except at base; three reclinate upper frontal bristles; parafacialia at narrowest less than one-half width of third antennal segment (Florida) ..... floridensis Townsend
3. Hind tibiae inwardly with long villosity (fig. 17, *g*), the villi often over twice the tibial width in length; lobes of fifth sternite, at base, with conspicuous flange 4
   Hind tibiae inwardly with short villosity, the villi scarcely the tibial width in length; lobes of fifth sternite without basal flange, their inner edges smooth or with a conspicuous elongated ridge 5

4. Each half of anal forceps (fig. 17, *a*) viewed in profile straight on posterior edge for six-sevenths of its length, then gently curving inwardly and abruptly tapering to terminus-- **panaetius** (Walker)
   Each half of anal forceps (fig. 17, *e*) viewed in profile straight on posterior edge for about one-half its length, then strongly curved inwardly and tapering to a fine point---------- **apicata** Curran
5. Frontalia at middle of front about equal to or narrower than parafrontalia; hairs of cheeks predominantly pale; bristles of facial ridges often weak and depressed; face and front usually with a slight yellowish cast---------- 6
   Frontalia at middle of front at least as wide as parafrontalia; hairs of cheeks predominantly black, comparatively long; bristles of facial ridges strong and erect; face and front silvery; a comparatively black, thinly gray-pollinose, western species ---------- **similis** (Williston)
6. Second genital segment orange-red---------- 8
   Second genital segment black, usually reddish below---------- 7
7. Viewed from the side the anal forceps (fig. 17, *f*) strongly incurved, their posterior surfaces moderately to densely pilose and often obscured in outline---------- **acosta**, new species
   Viewed from the side the anal forceps (fig. 17, *b*) comparatively straight, tapering abruptly to terminus, their posterior surfaces moderately pilose and distinct in outline---- **nigricans**, new species
8. Parafacialia at narrowest part at least equal to if not wider than one-half distance between vibrissae; second antennal segment mostly reddish brown; lobes of fifth sternite usually smooth or with inconspicuous ridges on their inner edges- **cana**, new species
   Parafacialia at narrowest part less than one-half distance between vibrissae; second antennal segment mostly black; lobes of fifth sternite usually with conspicuous ridges on their inner edges---------- **variata** Curran

FEMALES

1. Abdomen without discal macrochaetae---------- 2
   Abdomen with discal macrochaetae---------- **dakotensis**, new species
2. Posterior border of fourth segment fringed with long bristles of unequal length---------- 3
   Posterior border of fourth segment fringed with closely set, short bristles of nearly equal length; front wider than eye and widening slowly to base of antennae---------- **apicata** Curran
3. Frontalia at middle of front narrower than parafrontalia, usually brownish; hairs of cheeks predominantly pale---------- 4
   Frontalia at middle of front at least as wide as parafrontalia, usually black; hairs of cheeks predominantly black, comparatively long; fourth abdominal segment black, mottled with gray-pollinose areas; face and front silvery pollinose without yellowish cast; western species---------- **similis** (Williston)
4. Posterior preintraalar bristle well-developed; front widening slowly to base of antennae; cheeks about one-third the eye height; usually four dorsocentrals---------- 5
   Posterior preintraalar bristle absent or vestigial; usually three dorsocentrals ---------- 6

5. Front at vertex over one-third the head width; sides of front with a few scattered pale hairs---------- panaetius (Walker)
   Front at vertex about or less than one-third the head width; sides of front with many fine hairs------ species near panaetius (Walker)
6. Front at vertex less than one-third the head width, with parallel margins; cheeks narrow, hardly one-fourth the eye height-- variata Curran
   Front at vertex over one-third the head width and widening slowly to base of antennae---------- species near variata Curran

TACHINOMYIA PANAETIUS (Walker)

FIGURE 17, *a*

Tachina panaetius WALKER, List of the specimens of dipterous insects in the collection of the British Museum, pt. 4, p. 767, 1849.
Tachina pansa WALKER, *ibid.*, p. 787.
Tachina violenta WALKER, *ibid.*, p. 788.
Tachina irrequicta WALKER, *ibid.*, p. 789.
Tachinomyia robusta TOWNSEND, Trans. Amer. Ent. Soc., vol. 19, p. 96, 1892.

Townsend (1936, p. 281) considers *Tachinomyia robusta* a synonym of *Tachina panaetius* Walker. In 1929 Aldrich (1931, p. 13) studied Walker's types at the British Museum and formed the same conclusions. The type of *panaetius* is a single female from Nova Scotia. Since the females of *robusta* are not readily recognized from other closely allied species, this synonymy may be questioned. Aldrich also believed that *Tachina irrequieta* Walker, *T. pansa* Walker, and *T. violenta* Walker were likewise synonymous with *panaetius* Walker. The type of *irrequieta* is a female, and the same doubt exists as in the case of *panaetius*. The types of *pansa* and *violenta* are males, and although the genitalia have not been relaxed, it is believed that Aldrich was correct in his synonymy. Furthermore, a cotype specimen of *pansa* is in the United States National Museum collection and it is identical with *robusta* Townsend.

In an attempt to clear up this synonymy, specimens of the various species, with a key for their separation, was sent to Miss Aubertin at the British Museum. The results of this correspondence, while not entirely satisfactory, were in effect that the preceding synonymy was justified.

A cotype of *Tachinomyia robusta* Townsend, from Brookings, S. Dak. (Aldrich), is in the United States National Museum collection. It is a male and characterized as follows: Inner side of hind tibia with long villi; lobes of fifth sternite with distinct basal flange; fourth sternite convexly produced; second genital segment reddish black; anal forceps as figured (fig. 17, *a*); fourth abdominal segment black, mottled with thin grayish pollen; four dorsocentrals; posterior preintraalar bristle [2] present; second segment of antenna brownish, about

[2] The posterior preintraalar bristle equals the posterior sublateral bristle of Curran.

one-half the length of third; parafacialia at narrowest part compared with distance between vibrissae as 11.0 : 19.8 (average of six); cheeks one-third or more of eye height.

Thirty-five other males, with the essential characters of the cotype, show a slight variation. In all but two specimens, in which there were three on one side, there were four dorsocentrals; the posterior preintraalar bristle was usually strong but sometimes only a hair. Twenty-nine specimens had the second genital segment black, tinged with red above and wholly red beneath. In the others it was either wholly red or black above. Thirty-two flies had the second antennal segment reddish or reddish brown and in three it was black, tinged with red. Thirty-three had the facial ridges bristly for two-thirds their way and in two on the lowest third. Length, 10–16 mm.

Female.—Front at vertex 0.37 and 0.36 of the head width in two specimens; parafrontalia lightly golden pollinose, sparsely beset with pale hairs; inner and outer verticals developed; orbitals strong; frontals nine in number, strong; parafacialia silvery pollinose with slight golden cast, at narrowest part compared with distance between vibrissae as 9.5 : 18.5 (average of two); cheeks one-third of eye height; second antennal segment mostly black, about one-half length of third; thorax black, grayish pollinose with brownish tinge above, pleurae more grayish; four dorsocentrals; posterior preintraalar bristle present; abdomen black, intermediate segments grayish pollinose with trace of brown, particularly at apices; last segment wholly chalky white pollinose. Abdominal macrochaetae as follows: One fly has a median pair on the basisegment; otherwise the first and second segments each has one marginal pair; third with a marginal row; fourth with a row of discal or submarginal ones besides the marginal row of moderately long bristles of unequal length.

Remarks.—The foregoing description of the female of *panaetius* is from two specimens captured *in coitu* at Melrose Highlands, Mass., in May 1934. Other descriptions of the female of *Tachinomyia panaetius* have been given by Townsend (1915, p. 103) and Curran (1926, p. 169).

Material examined.—At the United States National Museum there are 62 males from various localities in the United States and Canada east of the Rocky Mountains. There do not appear to be any specimens from the Southern or Southwestern States. Six males and two females of the Melrose Highlands laboratory collection are from Massachusetts and New Jersey localities.

Hosts.—The writer has not seen any bred specimens that could be positively identified as *panaetius*. There are, however, in the

Melrose Highlands collection,[3] females of species near *panaetius* bred by J. V. Schaffner, Jr., et al. from *Graptolitha antennata* Walker G. M. L. 12161 T1); *Orthosia hibisci* Guenée, form *insciens* Walker (G. M. L. 12164 R14); *Catocala* sp. (G. M. L. 11707 M3); noctuid (G. M. L. 11707 J8); *Acronycta betulae* Riley (G. M. L. 11707 M34).

TACHINOMYIA APICATA Curran

FIGURE 17, *e*, *g*, *h*

Tachinomyia apicata CURRAN, Trans. Roy. Soc. Canada, ser. 3, vol. 20, sect. 5, p. 171, fig. 16, 1926.

The species is readily recognized by the form of the anal forceps (fig. 17, *e*) and the conspicuous flange at the base of the fifth sternite (fig. 17, *h*). To these characters may be added the following: Last abdominal segment chalky white pollinose with narrow apical border of black, red, or reddish black; fourth sternite brownish, transversely flattened, not turned upward; second genital segment orange-red, rarely blackish; four dorsocentral bristles; posterior preintraalar bristle usually present, sometimes weak or wanting; first two segments of antenna, base of third, and apex of scutellum reddish; face and front silvery gray with yellowish cast of variable shades; parafacialia at narrowest part compared with distance between vibrissae as 10.8 : 20.5 (average of six); cheeks one-third of eye height; facial ridges bristly one-half to two-thirds way to antennae; frontals varying from 7 to 10; palpi gradually thickened toward tip; orbital hairs gray or yellowish gray. Length, 10–20 mm.

Female.—Essentially like male except more robust in form; last abdominal segment wholly chalky white-pollinose, posterior border fringed with closely set, short bristles of equal length; two pairs of orbital bristles and a wider front.

Material examined.—Sixty-nine males and 50 females in the Melrose Highlands laboratory collection taken during May and June from localities in Massachusetts and New Jersey. Also 7 males and 15 females in the United States National Museum from Ottawa, Canada, the District of Columbia, and the following States: New Hampshire, Massachusetts, Pennsylvania, Maryland, Indiana, and Missouri.

Host.—Unknown.

TACHINOMYIA FLORIDENSIS Townsend

Tachinomyia floridensis TOWNSEND, Trans. Amer. Ent. Soc., vol. 19, p. 97, 1892.

The species was described from one specimen, a male, from Florida (C. W. Johnson). Coquillett (1897, p. 82) included *floridensis* as

[3] The Melrose Highlands collection of Tachinidae is now housed in the Forest Insect Laboratory of the Bureau of Entomology and Plant Quarantine at New Haven, Conn.

a synonym of *Masiphya brasiliana* Brauer and Bergenstamm, which species he placed in *Biomyia*. Aldrich (1925, pp. 108-109), however, examined the type of *floridensis* and believed it to be "a distinct species strictly congeneric with the genotype *Tachinomyia robusta* Townsend."

The original description is brief and does not mention all the characters necessary for identification. The type has not been seen, but Aldrich's description (unpublished notes) verbatim follows:

"*Tachinomyia floridensis* Townsend.

One large male type with label as follows:

Florida

26

Jhnsn.

"16 mm. long. Parafacial at narrowest less than half the third antennal joint, or just about half (in *robusta* much more). Cheeks less than half the eye height. Acrostichal 3.3; dorsocentral 3.4; humeral 3; posthumeral 2; presutural 1; notopleural 2; supraalar 3 (front one small); intraalar 3; postalar 2; scutellar 3 lateral, 1 slender decussate slightly upturned apical, 1 discal (small); sternopleural 2.1; pteropleural small; postscutellum distinct.

"Abdomen largely red on sides, pollen not in perfect condition. First and second segments with one pair marginal, third segment with a row of eight, fourth segment with a stout row at last fourth and smaller on margin. First genital segment hardly visible but red; second segment red, hairy, the forceps darker, not spread; fourth sternite at edge with thin, upstanding, brownish margin, entirely different from that in *robusta*, and the inflexed tergites all with long hair, entirely different from *robusta* (I am comparing with type of *robusta*); fifth sternite about as in *robusta* but reddish. Legs black, all the tibiae villous on flexor side about as in *robusta*. A good species.
(Kansas University, June 4, 1924).

"J. M. Aldrich."

Remarks.—The female of *floridensis* has been described by Townsend (1915, p. 103), but the writer is unable to recognize the species from the description given.

TACHINOMYIA SIMILIS (Williston)

FIGURE 17, *c*

Prospherysa similis WILLISTON, North American Fauna, No. 7, p. 256, 1893.
Tachinomyia occidentalis CURRAN, Trans. Roy. Soc. Canada, ser. 3, vol. 20, sect. 5, p. 170, fig. 17, 1926.

Coquillett (1897, p. 119) places *similis* Williston as a synonym of *robusta* Townsend, but Aldrich (unpublished MS.) gave it specific status. According to him, and as verified by the writer, Curran's *occidentalis* is a synonym.

The following brief description is from a cotype, Sonoma County, Calif., now in the United States National Museum collection:

Male.—Front and face silvery gray pollinose without trace of yellow; fourth abdominal segment mostly black, mottled gray pollinose; cheeks nearly one-half of eye height, clothed with comparatively long hairs which are predominantly black; hind tibia with short villosity on inner side; frontalia wider than either parafrontal; bristles of facial ridges strong, reaching two-thirds way to antennae; lobes of fifth sternite reddish, without basal flange but with slight ridges; apex of fourth sternite convexly produced; three dorsocentral bristles; no posterior preintraalar bristle; anal forceps (fig. 17, *c*) somewhat as in *nigricans;* second genital segment orange-red; second antennal segment black.

Forty-one other males in the United States National Museum collection agree well with the cotype. There are usually three dorsocentral bristles although occasionally four are present; posterior preintraalar bristle absent in all but two specimens, in which case it is vestigial; facial ridges bristly two-thirds way to antennae, rarely less; vibrissae well above oral margin; scutellum wholly black, frequently with reddish apex; face and front silvery gray pollinose without trace of yellow; usually three strong bristles on anterior dorsal side of middle tibia.

Female.—Essentially like male except for the usual sexual differences.

Variations.—Twenty-one males and 27 females bred by the writer from *Stilpnotia salicis* Linnaeus, collected at Puyallup, Wash., in 1935, show the following variations: Three or four dorsocentrals, usually the latter, although very frequently the second from the suture is either weak or hairlike. When three bristles are present they are often irregularly spaced. Posterior preintraalar bristle absent in 39 and vestigial in 9. Second genital segment of male orange-red in all but two specimens, in which case it is obscurely so. Abdomen wholly black, gray pollinose or frequently, in the male, with sides of second segment reddish yellow; second antennal segment black. Face and front silvery gray pollinose in all specimens. Length, 12-13 mm.

Material examined.—About 90 specimens at the United States National Museum from localities in California, Washington, Idaho, Oregon, Colorado, and Arizona.

Hosts.—*Clisiocampa thoracia* Stretch; *Hemerocampa vetusta* Boisduval; *Stilpnotia salicis* Linnaeus; *Halisidota argentata* Packard.

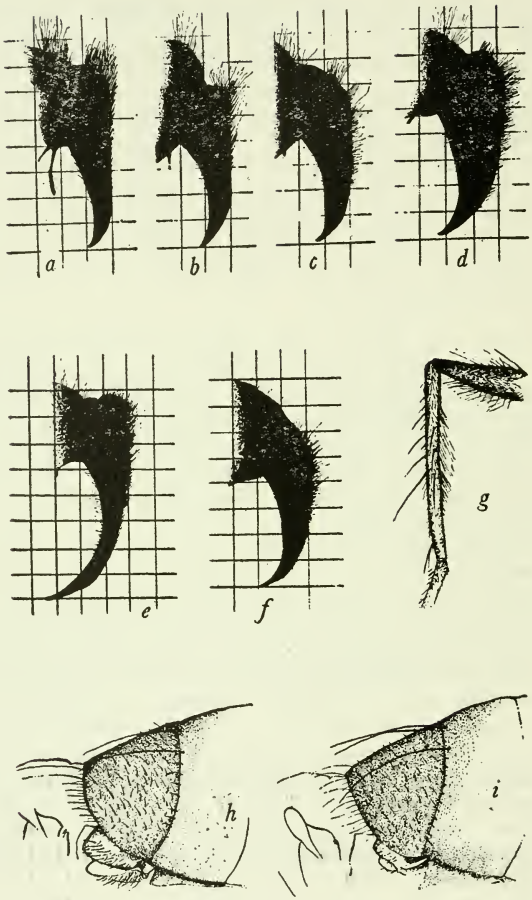

FIGURE 17.—TACHINOMYIA CHARACTERS

a-f, Lateral aspect of anal forceps of male genitalia: *a*, *T. panaetius* (Walker); *b*, *T. nigricans*, new species; *c*, *T. similis* (Williston); *d*, *T. variata* Curran; *e*, *T. apicata* Curran; *f*, *T. acosta*, new species.

g, Hind tibia of *T. apicata* viewed from behind.

h, *i*, Apex of abdomen with drawn genitalia showing formation of fourth and fifth sternites in lateroventral aspect: *h*, *T. apicata; i*, *T. variata*.

TACHINOMYIA VARIATA Curran

FIGURE 17, *d*, *i*

Tachinomyia variata CURRAN, Trans. Roy. Soc. Canada, ser. 3, vol. 5, sect. 5, p. 169, figs. 14, 15, 1926.

According to Curran (1926, p. 168) *variata* is characterized principally by the dense, bristly pile on the lower surface of the anal forceps, three or four dorsocentral bristles, and absence of ridges on the lobes of the fifth sternite.

In his description Curran omitted several characters which would have aided materially in the identification of the species. At the request of the writer more details concerning the type specimen have been furnished by G. H. Shewell, of the Canadian National Museum, where the type is deposited. His description is as follows:

"Length, 12 mm. Four posterior dorsocentrals, the second very fine; fourth abdominal segment black with reddish posterior border, thinly gray pollinose; fifth sternite lobes reddish with distinct ridges on their inner edge; second genital segment reddish; inner forceps pilose behind (about as in Curran's drawing); ratio of second to third antennal segment 1 : 2.5."

Tachinomyia variata differs slightly from *T. cana* as follows: The ridges on the inner edges of the lobes of the fifth sternite are better developed and apparently more constant in character; the second antennal segment is mostly black; the parafacialia are narrower; the anal forceps are somewhat stouter and usually more densely pilose on their posterior surfaces; and there are usually three dorsocentrals.

Redescription of male.—Hind tibiae inwardly with short villosity, villi scarcely the tibial width in length; inner edges of lobes of fifth sternite usually with a conspicuous ridge (fig. 17, *i*); anal forceps (fig. 17, *d*) with dense pilosity behind, stout at base and somewhat similar in outline to *acosta;* fourth sternite convexly produced; fourth abdominal segment black, moderately gray pollinose, with reddish-black apical border; first genital segment reddish black, second orange red, moderately pilose above; scutellum black, apex slightly reddish; three or four dorsocentrals; no posterior preintraalar bristle; cheeks hardly one-third the eye height, with pale hairs; second antennal segment mostly black, third segment scarcely three times its length. Front silvery gray pollinose, with slight yellowish cast, at narrowest part about one-fifth the head width; 10 or 11 frontal bristles, the last 2 reclinate; frontalia narrow, widening gradually to base of antennae; parafacialia nearly concolorous with front, at narrowest part compared with distance between vibrissae 7.6:17.5 (average of six); facial ridges bristly one-half way to antennae; vibrissae well above oral margin. Length 12–17 mm.

Female.—Essentially as in male. Front at vertex less than one-third of head width, with parallel margins; two pairs of orbital bristles; second antennal segment black, third about two and one-half times its length; cheeks narrow, less than one-fourth the eye height; palpi slender; four dorsocentrals, the second from suture weak; no posterior preintraalar bristle; middle tibia with three anterior dorsal bristles, the uppermost one shortest; hind tarsi slender; fourth abdominal segment black, thin gray pollinose, the posterior border fringed with moderately long bristles. Length 12 mm.

Material examined.—In the United States National Museum collection there are four paratypes, including both sexes, from Ontario, Quebec, and Alberta, Canada. There are also six males and one female from New Brunswick, Canada, and from the following States: New Jersey, Wisconsin, South Dakota, and Colorado. Also there are three specimens in the David G. Hall collection from Ohio, Kansas, and New Mexico.

The material representative of this species in the Melrose Highlands laboratory collection consists of 10 specimens collected at Lunenburg, Mass., from May 21 to June 29, 1914; 3 specimens collected at Melrose, Mass., June 1917, May 7, 1930, and May 26, 1934; 4 specimens bearing "G. M. L." numbers 9427d[1], 9427a[1], 9427a[2], and 9427b[1], which were bred from *Porthetria dispar*, collected in Massachusetts, July 1925. These flies emerged in June 1926 and were used in a successful reproduction experiment by T. H. Jones. No. 9427d[1] is the progeny of Nos. 9427a[2] (♂) and 9427b[1] (♀). There are also two other specimens from Morris County, N. J., collected May 19, 1936. Specimens of this material were submitted to Mr. Shewell for comparison with the type of *variata*, and according to him the anal forceps agree with those of *variata* in general outline, though they are smaller and more densely pilose behind.

Hosts.—*Nephelodes emmedonia* Cramer (W. A. Squires, Sackville, New Brunswick, Canada, June 2, 1929); *Porthetria dispar* Linnaeus (as preceding).

TACHINOMYIA CANA, new species

This species resembles *variata* but differs in having broader parafacialia, a brownish second antennal segment, and slenderer anal forceps.

Male.—Hind tibiae inwardly with short villosity, the villi scarcely the tibial width in length; lobes of fifth sternite orange-red, smooth at base and inconspicuously ridged on their inner edges; fourth sternite convexly produced; fourth abdominal segment mostly chalky white, with narrow apical border of orange-red: dorsum of scutellum broadly reddish at apex; first and second genital segments orange-

red; first, second, and base of third antennal segment brown or reddish brown. Anal forceps long; each half, viewed in profile, straight on posterior edge for two-thirds its length, hence strongly forwardly curved; viewed from behind, slender and moderately pilose; four dorsocentrals; no posterior preintraalar bristles; thorax black, gray pollinose with brownish tinge; front silvery gray pollinose with definite yellowish cast, at narrowest part about one-fourth the head width; parafacialia concolorous with front, at narrowest part compared with distance between vibrissae 10:19.6 (average of six); cheeks nearly one-third the eye height; facial ridges strongly bristly over halfway to antennae; third segment of antenna less than three times the second. Length, 14 mm.

Female.—Unknown.

Type.—Male, U. S. N. M. No. 53387.

Remarks.—The holotype is from Melrose Highlands, Mass., collected by the writer on May 24, 1932. The two paratypes are both males from the same locality as the type collected on May 21, 1932. Other material, in the Melrose Highlands laboratory collection, consists of 25 collected specimens from about the same locality as the type. Twenty-one of these have four dorsocentral bristles, one has three, and the remaining three have three on one side and four on the other; lobes of the fifth sternite smooth in five specimens and inconspicuously ridged in the rest; fourth sternite convexly produced; first two segments of antenna, and usually the base of the third, brown or reddish brown; second genital segment orange-red, posterior border of fourth abdominal segment orange-red in all but two specimens, in which it is mostly black; scutellum black, thinly gray pollinose, broadly reddish at apex. Length variable, 11–16 mm. Besides the above there are three specimens of this species in the David G. Hall collection from Kansas and Arkansas.

TACHINOMYIA ACOSTA, new species

FIGURE 17, *f*

In *acosta* the anal forceps are slenderer than in *variata*. The species also differs in having the first and second genital segments as well as the fifth sternite black and in characters of lesser importance.

Male.—Hind tibiae inwardly with short villosity, the villi scarcely the tibial width in length; lobes of fifth sternite black and without basal flange, their inner edges smooth or at most with low, inconspicuous ridges; fourth sternite black, convexly produced; fourth abdominal segment not densely gray pollinose but at most moderately gray pollinose with black apical border; scutellum black, faintly reddish apically; first and second genital segments black, the latter faintly

reddish beneath; second antennal segment mostly black, a little less than one-third length of third segment; anal forceps (fig. 17, *f*) strongly incurved, their posterior surfaces moderately pilose; four dorsocentral bristles; no posterior preintraalar bristle; front and upper part of face yellowish pollinose, paler below; parafacialia at narrowest part compared with distance between vibrissae 7.6 : 18.6 (average of six); cheeks about one-fourth of eye height, with a predominance of pale hairs; facial ridges bristly about one-third way to antennae, the uppermost ones very weak; vibrissae slightly above oral margin. Length 13 mm.

Female.—Doubtfully known.

Type.—Male, U. S. N. M. No. 53388.

Remarks.—The holotype is from Morris County, N. J., collected by the writer on May 10, 1936. The two paratypes are both males, from Reading Mass., May 26, 1916 (R. T. Webber), and Wellesley, Mass., June 1, 1909 (J. D. Tothill), respectively.

In 40 other males identified as *acosta* the lobes of the fifth sternite are smooth in 19, nearly so in 11, and slightly ridged in 10. All but one of them have four dorsocentrals. In only one instance is the posterior preintraalar bristle present. The fourth sternite is turned upward from the abdomen in all but eight, in which case it is flattened. Usually the fourth abdominal segment is black, moderately pollinose but occasionally thinly pollinose and indefinitely marked; posterior border of segment black. Second antennal segment usually black, in 3 specimens slightly reddish, scutellum wholly black in 16, slightly reddish at apex in 22, and black, conspicuously marked with yellow, in 2; second genital segment always black, sometimes reddish beneath, densely pilose above. The pilosity on the hind surface of the anal forceps is dense in 23 specimens and but moderately so in 17. The front and upper part of the face are pale yellow pollinose, in no instance distinctly golden. In some specimens the lower part of the face is silvery either with or without a pale yellowish cast. Length 10–17 mm.

Hosts.—*Graptolitha disposita* Morrison (G. M. L. 11705 J7); *G. innominata* Smith (G. M. L. 11705 M8); *G. antennata* Walker (G. M. L. 12161 J9); *Graptolitha* sp. (G. M. L. 11705 N2). All recorded at the Melrose Highlands laboratory by J. V. Schaffner, Jr., et al.

Material examined.—About 45 males, from Massachusetts and New Jersey localities, contained in the collection of the Melrose Highlands laboratory.

TACHINOMYIA NIGRICANS, new species

FIGURE 17, *b*

Resembles *acosta* but differs from that species in the structure of the anal forceps and their lack of dense pilosity.

Male.—Hind tibiae inwardly with short villosity, the villi scarcely the tibial width in length; lobes of fifth sternite black, without basal flange, their inner edges smooth or at most with low, inconspicuous ridges; fourth sternite convexly produced; fourth abdominal segment not densely gray pollinose but mostly black, mottled with thin grayish pollen, apical border shining black; scutellum black, thinly gray pollinose; second genital segment black above, reddish beneath; second antennal segment black with brownish apex; third segment hardly twice its length; anal forceps (fig. 17, *b*) moderately pilose behind, nearly straight, tapering abruptly to terminus; four dorsocentral bristles; no posterior preintraalar bristle; front and face silvery gray pollinose, with yellowish cast; parafacialia at narrowest part compared with distance between vibrissae 7.1:18.6 (average of six); cheeks about one-fourth of eye height, with pale hairs; facial ridges bristly about halfway to antennae; vibrissae slightly above oral margin. Length, 11–16 mm.

Female.—Doubtfully known.

Type.—Male, U.S.N.M. No. 53389.

Remarks.—The holotype is from Lunenburg, Mass., collected by H. W. Allen during 1916. The two paratypes are from Wellesley, Mass. (J. D. Tothill, June 1, 1909), and Morris County, N. J. (R. T. Webber, May 10, 1936). Other material, in the Melrose Highlands laboratory collection, consists of 60 males from localities in Massachusetts, some of which are bred specimens. All agree well with the type, particularly as regards the structure of the anal forceps; the lobes of the fifth sternite are black, practically smooth, or each bears an inconspicuous ridge; the anal forceps are moderately pilose behind, rarely more so. There is some variation in the number of dorsocentrals, 8 out of 60 males having 3 instead of the normal 4. Of all the specimens examined none had a posterior preintraalar bristle; the genital segments are black above, usually reddish beneath; the scutellum and second antennal segment are mostly black. Usually there are 11 or 12 frontal bristles, rarely less; the face and front are silvery gray pollinose with yellowish cast in all but two specimens, in which they are silvery.

Another lot of males from Massachusetts localities number slightly over 100 specimens. All have the vibrissae on or slightly above the oral margin; the first and second genital segments are entirely black, or black above and reddish beneath; normally there are four dorso-

central bristles; the second segment of the antenna and the scutellum are black in most part. Length, 6–12 mm.

Placed provisionally with this species is a series of approximately 200 flies bred at the Melrose Highlands laboratory from *Alsophila pometaria* Harris and other species of Geometridae. All these flies are much smaller in size than the type but there does not appear to be any other appreciable difference. Length, 6–10 mm.

In the United States National Museum there are specimens from New Jersey, 1924; J. F. King; Hartford, Conn., May 9, 1916, I. N. Gabrielson; ex *Alsophila pometaria*, Quaintance No. 16610, Wallingford, Conn., May 1, 1920, B. A. Porter; Browns Mills, N. J., July 9, 1926, H. G. Hallock. Also there are one male from Minot, N. Dak., June 18, 1918; one male from Lafayette, N. Dak., May 25, 1916; and one female from Big Stone City, S. Dak., June 8, 1918, Aldrich.

Hosts.—*Catocala micronympha* form *fratercula* Grote and Robinson (G. M. L. 11707 L4); *Graptolitha antennata* Walker (G. M. L. 12161 E14); *Porthetria dispar* Linnaeus (G. M. L. 9427); *Alsophila pometaria* Harris (G. M. L. 10076 and sub-nos.); *Phigalia titea* Cramer (G. M. L. 10007 C); *Physostegania pustularia* Guenée (G. M. L. 10016 B); *Erannis tiliaria* Harris (G. M. L. 10018 S3). All recorded at the Melrose Highlands laboratory by J. V. Schaffner, Jr., et al.

TACHINOMYIA DAKOTENSIS, new species

This species comes nearest to *nigricans*, particularly to the small forms reared from *Alsophila pometaria* Harris, from which it differs in having discal abdominal bristles, brownish legs, and more broadly curved anal forceps.

Male.—Hind tibiae inwardly with short villosity, the villi scarcely the tibial width in length; lobes of fifth sternite yellowish brown, without basal flange, their inner edges smooth; fourth sternite convexly produced; thorax and abdomen black, thinly gray pollinose with strong brownish cast; fourth segment not densely gray pollinose but mostly mottled with thin grayish pollen, the posterior border black, faintly brownish at sides; second antennal segment and most of scutellum brown; genital segments orange-red; anal forceps sparsely pilose behind, their apices strongly curved forward as in *acosta*; three dorsocentrals; facial ridges weakly bristled; vibrissae at or but slightly above oral margin; third antennal segment three times the length of second; parafacialia at narrowest part compared with distance between vibrissae 5.3:14.6 (average of six); cheeks one-fifth the eye height, with pale hairs; face and front concolorous, silvery gray pollinose with faint yellowish cast; third segment of abdomen with one pair of discal bristles; legs brownish black. Length, 9 mm.

Female.—Essentially as in the male, except for the usual sexual differences.

Type.—Male, U. S. N. M. No. 53390.

Remarks.—Described from 14 specimens. The holotype is from Big Stone City, S. Dak., collected on June 8, 1908 (Aldrich), and the allotype from Lake Metigoske, Turtle Mountains, N. Dak., June 20, 1918 (Aldrich). The paratypes are as follows: Two males, Lake Metigoske, Turtle Mountains, N. Dak., June 20; one female, Mandan, N. Dak., June 16; one female, Bottineau, N. Dak., June 20; one female, Minot, N. Dak., June 18; two males, Wanbay, S. Dak., June 6; one male, Turtle Mountains, near Bottineau, June 21 (all specimens collected by Aldrich in 1918); two males and one female, Algonquin, Ill. (Nason); one male, Oxbow, Saskatchewan, June 17, 1907 (Knab).

The paratypes agree well with the type, all having brownish legs, orange-red genitalia, three dorsocentral bristles, and weakly ciliated facial ridges. All but three have well-developed discal abdominal macrochaetae, and the scutellum is mostly brownish in all but two cases, in which black predominates.

Material examined.—Besides the above there are specimens in the United States National Museum from Idaho, Washington, and Manitoba, Canada; also a specimen from Kansas in the David G. Hall collection.

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A HISTORY OF THE DIVISION OF VERTEBRATE PALEONTOLOGY IN THE UNITED STATES NATIONAL MUSEUM

By Charles W. Gilmore

The National Museum's Division of Vertebrate Paleontology, a branch of the Department of Geology, has had a long and distinguished record of service to the Nation and to science. In the pages that follow there is presented for the first time an extended history of this Division, beginning with the establishment of the Smithsonian Institution in 1846 and covering a span of more than 90 years (including the year 1940). The account describes the beginnings and growth of the Division and shows to what extent it has fulfilled its mission as a national institution in assembling, caring for, and rendering available to both students and the general public the fossil specimens entrusted to its keeping.

The data included have been compiled from an exhaustive search of the early records of the Smithsonian Institution, as well as an examination of its published papers and annual reports, supplemented by information resulting from the writer's 37 years of service in the Division (1903–40). In order to make the record as complete as possible, all phases of its development, organization, personnel, explorations, exhibits, and records are discussed.

I wish to express my great appreciation for the assistance rendered by many members of the National Museum staff, and especially to thank Dr. Charles Schuchert, of the Peabody Museum, Yale University, for reading the manuscript and offering many helpful criticisms. As the only surviving member of the Department of Geology of the period

prior to 1900, he was able to furnish information that otherwise would have been irretrievably lost.

EARLIEST VERTEBRATE COLLECTIONS, 1846 TO 1886

The history of the Division of Vertebrate Paleontology may be said to date from the year 1846, when by act of Congress the custody of the National Cabinet of Curiosities, then in the Old Patent Office Building, was transferred to the Smithsonian Institution. The act provided that "all objects of natural history, plants, and geological and mineralogical specimens belonging or hereafter to belong to the United States," and which were then in the city of Washington, should be delivered to the Regents of the Smithsonian Institution, and together with new specimens obtained by exchange, donation, or otherwise, should be so arranged and classified as best to facilitate their examination and study. A subsequent act (Sundry Civil Act of March 3, 1879), decreed that "all collections of rocks, minerals, soils, fossils, and objects of natural history, archaeology, and ethnology, made by the Coast and Interior Survey, the Geological Survey, or by any other parties for the Government of the United States, when no longer needed for investigations in progress, shall be deposited in the National Museum."

The vertebrate paleontological material brought together under these acts prior to 1886 was relatively small in quantity and of a miscellaneous character, though of much scientific interest because of the number of type and figured specimens it contained. It consisted mainly of fossils collected by the early exploring expeditions, such as the surveys under the direction of the General Land Office, 1849–58; the surveys for the Pacific Railroads, 1854–55; the surveys west of the 100th meridian under the direction of the Engineer Corps of the United States Army, 1874; and the United States geological and geographical surveys under the direction of Dr. F. V. Hayden, 1856–72.

In 1849 Dr. John Evans, an assistant to the eminent geologist Dr. David Dale Owen, was directed to visit the *Mauvaises Terres* of South Dakota and make a collection of the fossil vertebrate remains that up to that time were known only to the Indians, trappers, and a few explorers. Among the fossils obtained, which were later submitted to Dr. Joseph Leidy for study, was the *Merycoidodon* (*Oreodon*) of that time.

In 1853 Dr. Evans, accompanied by Dr. B. F. Shumard, again visited the Badlands while on his way to Oregon for the purpose of making a geological survey of that territory. At this time he made a collection of fossil mammals and turtles, all of which were sent by the Commissioner of the Land Office to the Smithsonian In-

stitution, whence they were transferred to Professor Leidy in Philadelphia for study. Dr. Evans died in Washington in 1861 while engaged in the preparation of a report on the Badlands fossils that he and others had collected.

The vicissitudes attending the custody of vertebrate fossils by the Government in these early days are well illustrated by an account published in one of the early reports of the National Museum. Sometime between 1850 and 1860 an "enlightened" Commissioner of Patents, who was annoyed by the presence of a collection of fossil bones in one of the rooms of the Patent Office, without consulting anyone sent them to a mill at Georgetown, where they were transformed into commercial fertilizer. A contemporary commented, "Once for thought they there became food for the farmer's plants."

Among the early collections of fossil vertebrates received was a small one made under the auspices of the Smithsonian Institution by Thaddeus A. Culbertson on an expedition to the *Mauvaises Terres* (Badlands) and the Upper Missouri in 1850. He was allotted $200 by the Smithsonian Institution to cover the transportation costs of collections made.

Culbertson was a graduate of Princeton University, and he visited this region for his health. He was accompanied by his brother Alexander, who had long been connected with the American Fur Co. and so was familiar with the whole country, and had indeed sent valuable specimens of fossil mammals to the Academy of Natural Sciences of Philadelphia. Thaddeus A. Culbertson made collections of the recent fauna and flora of the regions visited, and, though he was constantly searching for fossils, he met with no success except in the Badlands at the locality where his brother had previously found the remains of the fossils sent to the Philadelphia Academy. According to his journal, published in the Annual Report of the Smithsonian Institution for 1851 (pp. 93–95), he spent only a few days collecting in the Badlands. The fossil portions of the collection were sent to Dr. Joseph Leidy for study, the results of whose investigations were published in volume 6 of the Smithsonian Contributions to Knowledge, 1854. Thaddeus A. Culbertson returned to his home from this expedition in August 1850 with renewed health, but soon afterward he succumbed to a prevalent disease after a few weeks' illness.

Secretary Henry pointed out in the Fifth Annual Report of the Smithsonian Institution that Dr. Joseph Leidy, in a study of the Oligocene collections made by Thaddeus A. Culbertson, was able to characterize the following animals: *Rhinoceros nebrascensis*, *Rhinoceros occidentalis*, *Palæotherium bairdii* (=*Mesohippus bairdi*), and *Agriochaerus antiquus*. The type specimens of the second and third

of these are now in the collections of the National Museum, but the fourth has never been definitely located.

A history of the type specimen of *Rhinoceros nebrascensis*,[1] Leidy (*Hyracodon nebrascensis* of modern nomenclature) by Drs. Horace and Albert Wood[2] is so interesting that it is worth incorporating here. I have extracted freely from their account as follows:

Abel (1926)[3] discusses and figures a skull of *Hyracodon "nebrascensis"* with badly worn teeth. This bears the "original" label:

"Skull of *Rhinoceros nebrascensis* (Leidy) Loc: Coryell County, Texas A. R. Roessler collected 1863."

Abel states that this is the original of Leidy's figured specimen (1853, Pl. 15, Figs. 1–2) from the "Big Bad Lands," and that the label as to collector and locality is, therefore, wrong. There have been unpublished intimations that this is not Leidy's specimen, belonging to the Smithsonian Institution (Leidy, 1853, p. 14), collected by Dr. D. D. Owen. However, comparison of the specimen with Leidy's figures, which are of his usual high standard of accuracy, leaves no possible doubt that they are the same, even the breaks being identical. This specimen was part of a shipment of allegedly Texas fossils sent to k. k. geologische Reichsanstalt of Vienna (now the geologische Bundesanstalt) by A. R. Roessler in 1868 (Schloenbach, 1868).

What happened may be summarized from the Wood brothers' account as follows:

Dr. B. F. Shumard, who had been on the Owen survey, was appointed State geologist of Texas in 1858, and among his subordinates was A. R. Roessler. In 1860 Shumard announced the discovery in Washington County, Tex., of fossil materials equivalent in age to those of the Big Bad Lands, and, as stated by the Wood brothers, "It is entirely reasonable to suppose that he borrowed typical Badlands material for comparison from the collection of the Owen survey with which he had been associated, although there is no direct proof that he did so." On the outbreak of the Civil War, Shumard, Roessler, and others went north. From the evidence presented it appears clear that Roessler removed certain specimens and maps from the Texas survey and that about October 1868 Roessler, who was an Austrian, sent a collection of vertebrate specimens to the Geologische Reichsanstalt, among which was the type of *Hyracodon nebrascensis*.

Professor Abel has since presented the *Hyracodon* skull to the American Museum of Natural History, where it bears the catalog number 22617.

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[1] Merrill, George P., Catalogue of the type and figured specimens of fossils, minerals, rocks, and ores in the Department of Geology, United States National Museum. U. S. Nat. Mus. Bull. 53, pt. 2 (Fossil vertebrates, etc.), p. 60, 1907. The type is listed, but there was some doubt that the specimen was the one that Leidy had described and figured. It is now known not to be the type.

[2] Wood, Horace Elmer, 2d, and Wood, Albert Elmer, Mid-Tertiary vertebrates from the Texas Coastal Plain: Fact and fable. Amer. Midl. Nat., vol. 18, pp. 129–146, illus., 1937.

[3] Abel, O., Paleont. Zeitschr., vol. 8, pp. 241–242, 1926.

These same authors (p. 141) call attention to two other Oligocene specimens of this same collection in the paleontological collections of Columbia University. Through the generosity of Prof. G. Marshall Kay, these have since been returned to the National Museum.

Other parts of these early collections were a very long time in reaching the national collections. In the Annual Report of the National Museum for 1888, it is recorded that a small collection of White River fossils, including the type of *Testudo culbertsoni* Leidy, was deposited by Indiana University. The record is not complete, but it appears quite certain that after these specimens had been studied by Leidy they were returned to Dr. David Dale Owen, who was then State Geologist of Indiana, where he died in 1860. Although it is clearly evident that these specimens were Government property, the following statement from the Report of the National Museum for 1891 (p. 10), is at least of interest.

"The Owen type specimens of fossils, mentioned on page 759 of the report of the National Museum for 1888 as having been 'presented' to the Museum by the Indiana State University through the courtesy of the university, will be retained in the National Museum as a 'deposit' subject to the order of the board of trustees of the university."

A fire that occurred in the Smithsonian Building in January 1865 burned some stored duplicate Museum materials belonging to other divisions, but nowhere in the records is it found that vertebrate fossils were destroyed. Nevertheless, this conflagration has for years served as a convenient explanation for the absence of certain specimens that were missing from the collections.

In 1858, Dr. James Deane, of Greenfield, Mass., made a request to Secretary Baird for the Smithsonian Institution to publish his manuscript on the fossil footprints of the Connecticut Valley. On account of the expense involved, and the fact that the manuscript was unfinished, the Secretary was unable to approve the project. Through the generosity of friends and the cooperation of the Smithsonian Institution, this work was privately published in 1861, shortly after Dr. Deane's death, under the title "Ichnographs from the Sandstone of Connecticut River."

In 1859, Dr. J. S. Newberry, as geologist, accompanied the topographic expedition for the exploration of the San Juan River and Upper Colorado under the leadership of Capt. J. N. Macomb, U. S. Army. The type specimen of the sauropod dinosaur *Dystrophaeus viaemalae* Cope was collected by Newberry in southern Utah, and it, with other vertebrate fossils obtained, was deposited in the Smithsonian paleontological collections.

The Museum's early records regarding the fossils collected by Dr. F. V. Hayden and his geological exploring parties are very in-

complete. In some instances it cannot now be determined whether the specimens recorded from this source were vertebrate or invertebrate fossils.

In 1856, Dr. Hayden accompanied Lt. Gouverneur K. Warren's expedition for the exploration of the Missouri and Yellowstone Rivers. It was on this journey that the first vertebrate materials were collected from the Judith River formation. These vertebrates were described and illustrated by Leidy under the title "Extinct Vertebrata from the Judith River and Great Lignite Formations of Nebraska".[4] A few of these specimens (*Thespesius occidentalis*, *Ischyrotherium antiquum*, *Compsemys victus*, and *Trionyx foveatus*) were deposited in the National Museum, but for some reason now unknown the others were retained in the Academy of Natural Sciences in Philadelphia.

In the Annual Report of the Smithsonian Institution for 1856 mention is made that Dr. Hayden revisited the *Mauvaises Terres* of the White River and "procured some forms of fossil mammals not previously discovered." In 1857 the Museum received two boxes of fossils collected by Dr. Hayden while acting as geologist for Lt. G. K. Warren's exploring expedition in the Niobrara Valley. Many of these specimens were later described by Dr. Joseph Leidy[5] and are now in the Museum's collections.

In 1858, Lieutenant Warren deposited 21 boxes containing collections of animals, plants, minerals, and fossils from the valley of the Platte, gathered chiefly by Dr. Hayden, but the records do not disclose whether vertebrates were included in this accession.

In 1870, Hayden collected some vertebrates along the Big and Little Sandy Creeks to Green River and from the Bridger formation in southwestern Wyoming. Cope and Leidy reported on these collections, all of which were finally transferred to the National Museum. So much of these materials was fragmentary that many of the specimens have subsequently been discarded as valueless.

The bulk of the collections of the National Institute were transferred to the Smithsonian Institution in 1858. The National Institute, known first as the National Institution, contained the earlier collections of the Columbian Institution for the Promotion of Arts and Sciences transferred to it in 1841. For a time it had custody of the governmental collections, assembled and exhibited in a large hall in the Old Patent Office Building, from which they were transferred to the Smithsonian Institution in 1858 and 1862, in accordance with the congressional act of 1846. No list of the vertebrate fossils that were transferred has been found in the archives of the National

[4] Trans. Amer. Philos. Soc., vol. 11, pp. 139–154, 1860.
[5] Leidy, J., Proc. Acad. Nat. Sci. Philadelphia, 1858.

Museum, but in a catalog of the National Institute the following vertebrate specimens were listed as being exhibited in case 18:

Vertebrae of fossil Cetacea.
4 specimens of fossil fish from near Astoria, Oreg. (fossil fish well worthy of the attention of the curious).
Mastodon tooth.
Fossil skull and fishes.
Bronze bust of Cuvier.
Mastodon tooth from Marianna, Fla. Walter Younge, N. C.
Large ox horn from Missouri.
Fossil remains of the Arctic or North American elephant or mastodon found in the State of Missouri, 1843.
Numerous tusks (10 to 12 feet long), good preservation.
100 teeth, many of them, weight being 20 to 30 pounds.

In addition to the specimens listed above Leidy[6] enumerated the bones of a *Megatherium* from Skidaway Island, Ga., which he examined in the National Institute collections.[7] They are as follows: Lower jaw (nearly complete) with teeth; isolated tooth; temporal portion of cranium; annular metacarpal bone; axis; cervical vertebra; 2 dorsal centra; spinous process of dorsal vertebra; 2 rib fragments; head of femur; proximal extremities of two tibia; os calcis and several tooth fragments.

It is assumed that all these specimens were transferred to the Smithsonian Institution in 1858, at the time the bulk of the other collections of the National Institute was received. These materials were incorporated in the private collections of the Institution in accordance with the terms of its charter, thus becoming the property of the Government. Now, however, only a few of the specimens can be recognized, and in all probability many of them have long since been discarded because of the lack of data as to their origin, locality, and geological occurrence.

One of the important specimens of this collection, which only recently reached the Smithsonian Institution, was the type of *Delphinus calvertensis*, for 90 years in the Museum of Comparative Zoology, Cambridge, Mass. Its history is as follows: In October or November 1841, Francis Markoe, Jr., corresponding secretary of the National Institute, made a geological excursion in Calvert and St. Marys Counties in Maryland. From a cliff in the vicinity of Cove Point, with the help of Dr. Tongue, a cetacean skull was collected. In 1842 this specimen was described by Richard Harlan,[8] who named it *Del-*

[6] Smithsonian Contr. Knowl., vol. 7, p. 51, 1855.

[7] Under date of April 2, 1851, a letter from Professor Baird to John Varden, curator of the National Institute, made a request for the *Megatherium* bones in case 18, presumably for Dr. Leidy.

[8] Description of a new extinct species of dolphin from Maryland. Proc. Nat. Inst., vol. 2, pp. 195–196, figs. 1–4, 1842.

phinus calvertensis. On April 29, 1846, the National Institute was directed by Congress to deposit its collections in the Smithsonian Institution. In 1850 Jeffries Wyman [9] announced that Louis Agassiz (who was appointed professor of natural history in Lawrence Scientific School of Harvard University in 1846) was commencing a study of the Cetacea. At a meeting of the American Academy of Arts and Sciences in October 1848 Professor Agassiz [10] exhibited skulls of fossil cetaceans, including the type of *Delphinus calvertensis.* In 1858 and 1862 the collections of the National Institute were transferred to the Smithsonian Institution. From this chronological record, it appears quite evident that the *Delphinus* skull was lent to Professor Agassiz for use in his studies of the Cetacea and was probably in his custody when the actual transfer of the National Institute collections to the Smithsonian took place.

Recently the chronologic events in the history of this specimen were laid before Dr. Thomas Barbour, director of the Museum of Comparative Zoology in Cambridge, by Dr. Alexander Wetmore, assistant secretary of the Smithsonian Institution, and the former acted promptly in having the specimen returned to the national collections. The type is in excellent condition and shows every evidence of careful handling throughout its unusual history. As an example of true scientific interest and generous cooperation this recovery of an important type, whose ownership was obscured by the lapse of time and by the passing of an earlier generation of naturalists, is an event of more than ordinary significance.

In 1868 a complete skeleton of *Megaceros hibernicus* ("Irish elk"), from the peat bogs of Ireland, was purchased from Thomas & Sons in Philadelphia, and a fine head with antlers of this animal was received as a gift from Prof. O. C. Marsh.

In 1872 Prof. E. D. Cope collaborated with the Hayden survey and explored the Bridger, Green River, Washakie, and Wasatch horizons in Wyoming, and large collections of fossil vertebrates were made. Some of these specimens reached the National Museum's collections, but I have been unable to learn from the published records what the precise arrangement was between the Interior Department and Professor Cope concerning the disposition of the fossils collected. In a letter to his father, dated May 24, 1872, Cope remarked: "I will have every facility furnished by the Interior Department, expenses paid, orders for men, wagons, beasts, provisions, etc." [11] This statement implies that, since the expenses for the trip were borne by the Government, all the specimens collected

[9] Amer. Journ. Sci., vol. 10, p. 230, footnote, 1850.
[10] Proc. Amer. Acad. Arts and Sci., vol. 2, p. 5, 1852.
[11] Osborn, H. F., Cope: Master naturalist, p. 183, 1931.

should have become its property. Schuchert, however, offers the information that Cope received no salary, and for that reason claimed the fossils as his own. This was not an unusual practice in those days, as I am told that some of the early ornithologists and biologists worked under similar arrangements. Some of the Bridger and Green River fossils of this year are in the National Museum's paleontological collections, but an unknown number were evidently retained by Cope and are now in the American Museum of Natural History, New York City.

After Cope's death, on April 12, 1897, his entire collection of vertebrate fossils was purchased and presented to the American Museum of Natural History. Included were many specimens collected by the Hayden survey that were in Cope's hands at that time. Obscurity in the proof of ownership led the National Museum authorities to accept a compromise settlement whereby in 1908 a selected collection of 99 duplicate specimens, including a mounted skeleton of the type of *Hoplophoneus robustus* and having an estimated value of $3,250, was sent by the American Museum of Natural History to Washington, D. C. This collection consisted of representative specimens from the following formations: Puerco, Torrejon, Bridger, Oligocene, Miocene, and Permian of North America; Pampean and Santa Cruz of South America.

In 1874, Prof. E. D. Cope was engaged by the War Department as paleontologist to accompany the United States geographical and geological survey west of the 100th meridian under the leadership of Lt. George M. Wheeler. It was on this expedition that he assembled the classic materials from the Upper Miocene and Lower Pliocene of the Santa Fe marls in the Rio Grande Valley and the Wasatch Eocene specimens from along the course of the Gallinas River in New Mexico. All these fossils were shipped to Philadelphia for Cope to study, but after publication of his report [12] they were transferred by the War Department to the custody of the National Museum. They formed a most important contribution to the paleontological collections of that time because of the considerable number of type and figured specimens included.

In 1877, Dr. A. C. Peale, who acted as geologist for the Green River division of the Hayden survey, was instrumental in bringing together a considerable collection of Eocene Green River fishes. These were transferred to the National Museum but later were sent to Professor Cope at Philadelphia for study and description.[13] The collection remained there until after his death, being returned to the National Museum by the executors of his estate in 1898.

[12] Rep. U. S. Geogr. and Geol. Surv. West of the 100th Meridian (Wheeler), vol. 4, pt. 2, 1877.

[13] Rep. U. S. Geol. Surv. Terr. (Hayden), vol. 3, 1884.

ORIGIN OF THE DEPARTMENT OF VERTEBRATE FOSSILS AND ITS LATER ORGANIZATION

In the formative years of the Smithsonian Institution there was no separate unit that dealt exclusively with vertebrate fossils, their custody apparently falling to the lot of workers interested in other subjects. With the establishment of the United States National Museum, however, vertebrate fossils were placed in the custody of the Department of Comparative Anatomy, and such preparatory and exhibition work as was carried on at that time was done by the osteologists of that department.

This arrangement persisted until 1887. In that year Prof. O. C. Marsh, of Yale University, was appointed honorary curator of the Department of Vertebrate Fossils.[14] Professor Marsh had been vertebrate paleontologist on the United States Geological Survey staff since 1882, and during that time, under liberal allotments from the Powell administration and with the aid of a large staff of assistants, he had made notable progress in collecting, preparing, and describing vertebrate materials. The first report of progress of the Department of Vertebrate Fossils appears in the Annual Report of the United States National Museum for 1891, p. 223, by Frederic A. Lucas, Assistant Curator.

A general reorganization of the department was inaugurated by Assistant Secretary G. Brown Goode in 1894, when all the fossil collections were administered under the title "Department of Paleontology," with Dr. Charles D. Walcott, Director of the United States Geological Survey, as honorary curator and Charles Schuchert as assistant curator.

The appointment of Mr. Schuchert was of more than passing importance, since for the first time in their history the paleontological collections were placed in charge of an official paid by the Museum. Mr. Schuchert, although primarily more occupied with invertebrate fossils, nevertheless made notable contributions to the upbuilding and care of the vertebrate collections during his administration of the section. The new Department was divided into three sections: (1) Vertebrate fossils, with O. C. Marsh as honorary curator and Frederic A. Lucas as acting assistant curator; (2) invertebrate fossils; and (3) fossil plants. On this reorganization Goode commented: "It will now also be possible to bring the work incident to installation of all paleontological material under one uniform system."

In 1897, with the advent of the head curator system, a further change in the Museum's organization placed all paleontology under the Department of Geology, Vertebrate Paleontology becoming a

[14] Ann. Rep. U. S. Nat. Mus. for 1887, p. 4, 1889.

section under the Division of Stratigraphic Paleontology, but with no change in personnel.

The rapid growth of the collection, incident to the receipt of the Marsh collections from New Haven, and the death of Professor Marsh in 1899 led to the appointment of F. A. Lucas as acting curator in 1901, a position he held until his resignation from the Museum staff in 1904. From that time until 1908 the collections were administered by Dr. George P. Merrill, head curator of geology.

In 1898 J. W. Coleman and in 1900 Alban Stewart were employed as preparators, being the first paid employees to devote all their time to the preparation of vertebrate fossils. On account of failing health Coleman resigned in June 1903, and Stewart severed his connection with the Museum in the spring of 1904. In the meantime, through the energetic interest of Dr. Merrill, James W. Gidley (1905) and Charles W. Gilmore (1903) were employed as preparators, and Norman H. Boss (1904) as assistant preparator. The first mentioned came from the American Museum of Natural History, New York City, the other two from the Carnegie Museum in Pittsburgh, Pa., all men with previous experience in paleontologic work.

In 1908 there was a further change in the organization of the Department of Geology, when three divisions corresponding to former sections were substituted for the Division of Stratigraphic Paleontology. The administration of the Division of Vertebrate Paleontology was divided, James W. Gidley becoming custodian of the mammalian collection and Charles W. Gilmore custodian of the reptilian collection.

On June 16, 1911, the Division of Vertebrate Paleontology again became a section of the Division of Paleontology, administered by Dr. Ray S. Bassler. In March of this same year Thomas J. Horne, an experienced preparator and ironworker from the American Museum of Natural History, was added to the staff.

On June 30, 1924, the final change was made in the organization, which has since been known as the Division of Vertebrate Paleontology, with Charles W. Gilmore as curator and James W. Gidley as assistant curator, Norman H. Boss as chief preparator, Thomas J. Horne as preparator, and John M. Barrett as junior scientific aide. This staff continued intact until the death of Dr. Gidley on September 26, 1931. He was succeeded by Dr. C. Lewis Gazin on March 1, 1932. Mr. Barrett reached retirement age on March 1, 1936, and was succeeded in August 1936 by Henry Comack, who resigned on June 30, 1937. This position was again filled by the appointment of William E. Moran in June 1938.

In the 42 years that paid personnel has been engaged in fossil vertebrate work in the National Museum, 28 persons have been employed, of which only 14 were on a permanent status. All others

were temporary employees engaged to do special items of work. In table 1 is given a complete list of these employees, with the dates of their appointment and separation:

TABLE 1.—*Employees of the Division of Vertebrate Paleontology and their terms of service*

Name	Title	Appointed or assigned	Separated
Amateis, Louis	Modeler	May 2, 1910	Sept. 30, 1910
Barrett, John M	Junior scientific aide	Spring 1919	Feb. 29, 1936
Boss, Norman H	Chief preparator	Apr. 1, 1904	
Boyd, W. P	Blacksmith	Nov. 4, 1910	Dec. 7, 1910
Bressler, C. V	Preparator	June 1, 1911	Mar. 12, 1915
Cole, John L	do	Jan. 8, 1913	June 11, 1917
Coleman, J. W., Jr	do	Feb. 1, 1898	June 30, 1903
Comack, Henry	Junior scientific aide	Aug. 1, 1936	June 30, 1937
Eastman, Charles R		1914	1914.
Giles, Gustavus B	Preparator	Jan. 13, 1913	July 14, 1916
Gazin, Charles L	Assistant curator	Mar. 1, 1932	
Gidley, James W	do	Feb. 15, 1905	[1] Sept. 26, 1931
Gilmore, Charles W	Curator	Nov. 2, 1903	
Goldberg, Louis	Preparator	July 16, 1916	Feb. 29, 1920
Hannan, E. Elmer	Modeler	Jan. 10, 1911	June 30, 1911
		Aug. 16, 1911	Jan. 23, 1912
		Feb. 8, 1913	June 30, 1913
Hatcher, John Bell	Assistant	Dec. 1, 1890	Jan. 31, 1891
Horne, Thomas J	Preparator	Mar. 27, 1911	
Hughes, J. T	Blacksmith	Mar. 13, 1911	Mar. 25, 1911
Lucas, Frederic A	Assistant curator	Oct. 1888	June 30, 1904
Marceron, William	Preparator	Mar. 23, 1914	June 30, 1914
Marsh, O. C	Honorary curator	May 10, 1887	Mar. 18, 1899
Millhauser, Samuel	Preparator	July 12, 1917	June 15, 1918
Moran, William E	Junior scientific aide	June 16, 1938	
Neeb, Paul	Preparator	Jan. 11, 1932	July 9, 1932
Nickles, Edward B	do	Feb. 11, 1913	Oct. 10, 1916
Schuchert, Charles	Assistant curator	1894	Sept. 8, 1904
Stewart, Alban	Preparator	Dec. 1, 1900	Mar. 12, 1904
Wade, William H	Blacksmith	Mar. 7, 1910	Sept. 6, 1910

[1] Died.

In addition to those of the regular staff there have been several volunteer collaborators who have rendered invaluable service in the development of the Government vertebrate collections. The earliest of these was Dr. Joseph Leidy. At intervals during the period from 1850 to about 1873, most of the vertebrate material brought together under governmental auspices was transmitted to him in Philadelphia for scientific investigation. These collections were later returned to the Smithsonian and, as many of the specimens had been described and illustrated, their importance was greatly enhanced.

In the early seventies Prof. E. D. Cope began his collaborative work with the Hayden survey. His entry into the western fossil fields in 1872 led to an immediate break in the hitherto friendly relations between Cope and Marsh, and eventually to the exclusion of Leidy from

further governmental work, Cope practically superseding him in that respect. Cope was a prodigious worker, as is attested by his many volumes and reports on vertebrate fossils published by various branches of the Government. As he also accompanied expeditions, the Government collections were greatly enriched by his specimens as well as by his paleontological studies and publications.

Cope was superseded by Prof. O. C. Marsh in 1882, who became vertebrate paleontologist for the United States Geological Survey, and for 10 years he brought together collections and described materials that together form the most notable contribution ever made to the development of the Division of Vertebrate Paleontology in the National Museum.

Dr. Oliver P. Hay, although never officially connected with the National Museum, nevertheless contributed much to the development of vertebrate paleontology in this Institution (1912–30). Appointed research associate in the Carnegie Institution of Washington in 1912, he was provided office space in the Division of Vertebrate Paleontology, which he occupied until his death on November 2, 1930. His bibliography contains no less than 29 papers that were based wholly on Museum specimens. In addition to his research, he made many gifts to the collections and was responsible for the acquisition of a number of unique specimens. It was during this period that he compiled his Second Bibliography and Catalogue of the Fossil Vertebrata of North America and the three volumes on the Pleistocene of North America and Its Vertebrated Animals.

Dr. Remington Kellogg, while still a member of the Biological Survey staff of the Department of Agriculture (1920–28), undertook the scientific investigation of the fossil cetacean collections of the National Museum, this work being done outside of his official duties and supported to some extent by grants from the Carnegie Institution of Washington. These studies have been continued since his affiliation with the Museum in 1928, and his energetic interest has been a very important factor in developing the marine fossil mammal collection to a point where it ranks first among American collections of these animals.

Dr. Charles R. Eastman, under the auspices of the Smithsonian Institution, spent a year (1914) in the study of the fossil fish collection, rendering valuable service in publication,[15] identification, and rearrangement.

Dr. Alexander Wetmore began the study of fossil birds prior to his appointment as Assistant Secretary of the Smithsonian Institution in 1925, and since then he has published continually, much of his work being based on the Museum's collections. Through his

[15] Proc. U. S. Nat. Mus., vol. 52, pp. 235–304, pls. 1–23, 1917.

interest there has been a steady growth of these rarest of fossil remains, until at the present time the collection ranks high among the fossil-bird assemblages in this country.

MARSH COLLECTION, PERIOD OF MOST RAPID EXPANSION, 1886–1900

The greatest impetus to the growth of the collections of vertebrate fossils in the National Museum was the transfer from the United States Geological Survey of the materials brought together under the direction of Prof. O. C. Marsh[16] and known as the "Marsh Collection." Professor Marsh, as United States paleontologist, worked under the auspices of the Survey from 1882 to 1892, and during that period he assembled the fossil materials that were destined to form a most important part in the development of a national collection of vertebrate fossils. According to Schuchert,[17] "the Powell survey was liberal in allotments for this work, and he (Marsh) was given about $15,000 each year to pay salaries for himself and his numerous assistants—collectors (about 35), preparators (9), scientific aides (8), and artists—and for field and laboratory expenses, including large freight bills."

The specimens as they were collected were sent from the field directly to Marsh at the Peabody Museum of Natural History of Yale University for preparation and study. The first consignment returned to Government custody consisted of 72 large boxes, shipped to the National Museum in 1886 and there placed in storage unopened; in July 1891 a second shipment, consisting of 380 prepared specimens in 33 boxes weighing 6,960 pounds, was received. These were placed on exhibition in a case especially made for them in preparation for the International Geological Congress meeting held that year in Washington.

In April 1896 a third consignment, consisting of 115 boxes of rhinoceros (*Teleoceras*) skeletal remains from Kansas, was received and placed in storage. In 1898, a fourth portion of this assemblage consisting of two carloads was transferred to Washington. At the time of Professor Marsh's death (March 18, 1899), the largest part of the collection still remained in New Haven. Shortly thereafter, the rest of the collections, five carloads in all, was packed and shipped to the National Museum, formal transfer being made by Dr. Charles D. Walcott, then Director of the United States Geological Survey, under date of December 8, 1899. His letter and that of Secretary Langley in reply are given herewith in abstract.

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[16] For full-length biography of Marsh, see Schuchert, Charles, and Le Vene, Clara M., "O. C. Marsh: Pioneer in Paleontology," 541 pp., illus. New Haven, 1940.

[17] Schuchert, Charles, Nat. Acad. Sci. Biogr. Mem., vol. 20, 1st mem., p. 26, 1939.

U. S. Geological Survey,
Washington, D. C., December 8, 1899.

Prof. S. P. Langley,
Secretary, Smithsonian Institute,
Washington, D. C.

Dear Sir: I have the honor to state that all the vertebrate collections of the late Prof. O. C. Marsh, belonging to the Government, have been shipped from New Haven, Conn., and are now transferred to the custody of the U. S. National Museum, subject only to the use of such material as may be necessary for study and illustration in the completion of the monographs that were in course of preparation by Professor Marsh at the time of his death.

The actual number of specimens represented in this collection cannot be stated. They range in size from minute teeth of fossil mammals to individual specimens weighing from 500 to 2,000 pounds each. The collections are rich in Dinosauria, especially in examples of *Triceratops* and *Stegosaurus*, while the series of Titanotherium skulls is one of the best, if not the best, in existence. It contains fifty or more complete examples cleaned, and a number in the rough, besides many hundred bones.

Among the specimens transferred are the types of forty or more species, including dinosaurs, of Jurassic, Cretaceous, and Tertiary mammals. Among the types are the following:[18]

Dinosaurs

Diplodocus longus[19]
Labrosaurus ferox
Camptosaurus nanus
Triceratops sulcatus
Triceratops calicornis
Triceratops obtusus
Pleurocoelus nanus
Ceratosaurus nasicornis
Ceratops montanus
Ceratops alticornis

Crocodiles

Rhytinodon rostratus

Snakes

Coniophis precedens

Jurassic Mammals

Paurodon valens
Menacodon rarus
Enneodon affinis
Enneodon crassus
Laodon venustus

Cretaceous Mammals

Priconodon crassus[19a]
Cimolodon agilis
Telacodon praestans
Oracodon conulus
Allacodon pumilus

The transfer of these great collections to Washington without the loss of any material, either through imperfect recording or through misunderstanding as to ownership of specimens, reflects the greatest credit on the businesslike methods and the integrity of Professor Marsh. The addition of the material to the National Museum places it in the front rank among museums in its collection of vertebrate fossils. It is necessary that some gaps in the collections be filled, and I sincerely trust that it will be possible for the museum to do this at an early date.

Yours respectfully,

(Signed) Chas. D. Walcott,
Director.

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[18] This list is incomplete, as there were 50 original types, of which 21 were reptilian and 29 were mammalian. Less than half of the types of the rare Jurassic and Cretaceous mammals are listed here, as there were 12 of the first and 10 of the second.

[19] An error, as the type is in the Peabody Museum of Natural History.

[19a] Wrongly listed, as this is a dinosaur, not a mammal.

SMITHSONIAN INSTITUTION,
December 22, 1899.

DEAR SIR:

I take pleasure in acknowledging the receipt of your letter of the eighth instant, advising me that you have transferred to the National Museum all the vertebrate fossils collected by the late Professor O. C. Marsh belonging to the United States Government, subject only to the condition that such material as is required may be used for study and illustration in completing the monographs which were in preparation by Professor Marsh at the time of his death.

The addition of this immense collection of the most important American fossil remains to the treasures already assembled in the National Museum will, I am sure, afford the greatest satisfaction to all workers in the field of paleontology both at home and abroad, and you will permit me to add a personal word in appreciation of your untiring efforts to facilitate in every way possible the great task connected with the removal of the collection from New Haven to Washington.

During the coming year I expect to have two preparators engaged in working out the matrix specimens still uncleaned, and confidently hope that it may be possible in a few years to have the entire collection made available for study and a selected series for public exhibition. From this latter series the public will be able to form a correct idea as to the number, variety and great size of these wonderful extinct creatures of the western country, and will undoubtedly be impressed with the extent and importance of the work of the paleontological divisions of the Geological Survey and the marvelous industry and intelligence displayed by Professor Marsh in bringing together this great collection.

Yours respectfully,

(Signed) S. P. LANGLEY.

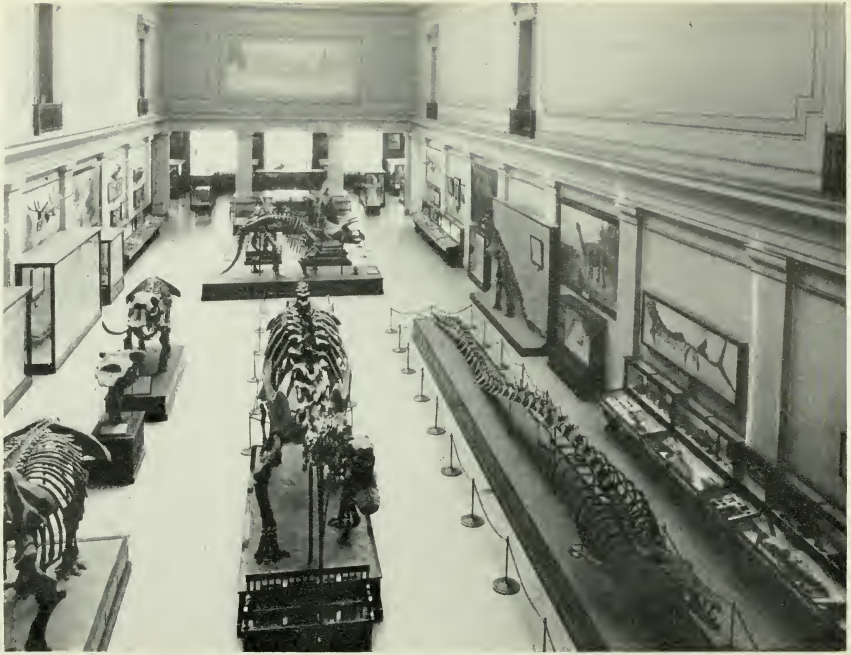
The Honorable CHAS. D. WALCOTT,
Director, U. S. Geological Survey.

The bulk of this collection consisted of specimens from the Jurassic (Morrison), Upper Cretaceous (Lance), Oligocene (Chadron), and Pliocene (Republican River) deposits of western North America. Lesser lots deemed worthy of special mention were from the Triassic of North Carolina, Cretaceous (Arundel) of Maryland, Upper Cretaceous of Montana (Judith River), Upper Cretaceous of Colorado (Denver and Arapahoe), Upper Cretaceous of Kansas (Niobrara), and Miocene and Oligocene of Oregon (John Day and Mascall), besides numerous other small miscellaneous lots.

Many of the specimens came to the Museum either fully or partially prepared, but the bulk of the material was in the same condition as when received from the field. In fact, three years' collections are still in the original field boxes (49) and have never been opened. In transmitting the fifth and final portion of the Marsh collection, Dr. Walcott in 1900 estimated it as comprising 15,000 specimens having a value of not less than $150,000.

The Jurassic part of the collections, which exceeded all others in bulk and weight, was especially rich in the remains of *Stegosaurus*,

Main exhibition hall for fossil vertebrates. Diagonal view from the southeast.



Main exhibition hall for fossil vertebrates. View from the west, second floor.

General view of the vertebrate paleontology laboratory.

Camptosaurus, *Ceratosaurus*, and *Antrodemus* (*Allosaurus*). These Morrison dinosaurs came from two widely separated regions: Garden Park in the vicinity of Canyon City, Colo., and near Como, Albany County, Wyo. In both instances fossil quarries were developed that produced specimens for several successive seasons. At Canyon City the fossils occurred in a thick sandstone layer, and this deposit was worked from 1883 to 1887, inclusive, under the direction of M. P. Felch. It was from this quarry that the articulated type specimens of *Ceratosaurus nasicornis* and *Stegosaurus stenops* and an articulated skeleton of *Antrodemus fragilis* were obtained.

In the Como region the famous Quarry 13 and Quarry 13½ were found by William H. Reed, in 1879. The former was worked for the Government for a part of 1882 by Mr. Reed; in 1883 by J. L. Kenney; and from 1884 to 1887 by Fred Brown. It is one of the few known quarries that have produced quantities of stegosaurian and camptosaurian bones. The following types were obtained here: *Stegosaurus sulcatus* Marsh, *Diracodon laticeps* Marsh, *Camptosaurus nanus* Marsh, and *C. browni* Gilmore, all in the National Museum.

Quarry 9 at Como Bluff, famous because of the occurrence of Jurassic mammals, was worked for a number of seasons by Professor Marsh's parties, but for the Government from 1883 to 1885 by Ed. Kennedy and W. Beck. The specimens obtained are, therefore, divided between the Peabody Museum of Natural History and the United States National Museum.

The Upper Cretaceous part of the collection was largely from the Lance Creek area of Converse (now Niobrara) County, Wyo., made under the direction of John B. Hatcher during the years 1889 to 1892, inclusive, and consisted principally of skulls and skeletal parts of the large horned ceratopsian and hadrosaurian dinosaurs. Even more valuable scientifically was the large series of teeth and jaws of the small mammals of this period, among which were many types.

Of lesser importance were small collections made by Mr. Hatcher in 1887 from the Upper Cretaceous of the Denver Basin, and in 1888 from the Upper Cretaceous Judith River formation in Montana and Arundel formation in Maryland, each of which contained several type specimens.

The Oligocene part of the collection made under the direction of Mr. Hatcher covered the period from 1886 to 1890, and the greater number of specimens came from the Chadron formation of western Nebraska (Sioux County) and the Badlands of Washington County, S. Dak. Of the Brontotheres alone there were 158 skulls and jaws representing many types, besides much skeletal material. The fauna of the Brule was scantily represented. The Miocene and Oligocene were represented by a season's collection of 15 boxes of materials

from the Mascall and John Day formations in eastern Oregon collected by L. S. Davis in 1882.

The lower Pliocene collections made by Hatcher in 1884 and 1885 near Long Island, Phillips County, Kans., consisted principally of *Teleoceras fossiger*, of which there were more than 10,000 bones representing all parts of the skeleton. Upper Pliocene was represented by small lots of material from Hay Springs, Nebr., and from Archer and Williston, Fla.

At the time of my affiliation with the National Museum in 1903, the bulk of the Marsh collection was stored in rented buildings in southwest Washington. The first floor of a three-story brick building on the west side of Tenth Street near C Street, SW., was then in use as a paleontological laboratory, the cellar and two upper floors being completely occupied by boxes and crated trays of vertebrate material. The study collections of this period were kept in standard trays arranged in tiers on a balcony in the southeast corner of the present Arts and Industries Building and in the lower parts of the A-topped exhibition cases in use at that time. These collections in storage from 1903 on were rapidly reduced in bulk through preparation and condemnation of worthless material, so that in 1910, with the occupancy of the New Natural History Building, the widely scattered storage collections were assembled as a unit for the first time. On this occasion the offices and laboratory were newly furnished and equipped, new exhibition cases replaced the old, and steel storage cases replaced the wooden racks of a previous period. These commodious quarters permitted a more systematic arrangement of the study collections, and for the first time the preparators were provided with a well-lighted, well-equipped, roomy laboratory (27 by 77 feet) (pl. 51). These improvements in facilities were almost immediately reflected in an improved quality as well as quantity of output.

The study collections have more than doubled in size since the Division moved into the Natural History Building in 1910. There are now 477 three- and six-foot storage units in use, but in addition their tops are covered with the larger specimens that cannot be cared for in standard trays. These storage cases now occupy practically every inch of case room that can be found in offices, laboratory, and adjoining corridors (pls. 52, 53), in addition to the gallery erected in 1930 in the main storage room, which practically doubled its capacity.

At the present time (1940) all the Marsh collection, except 49 boxes from the Morrison of Canyon City, have been prepared, and with this exception all the collection is now available.

EXPEDITIONS

Since the inception of the Division of Vertebrate Paleontology, it has profited from no less than 68 major [20] collecting expeditions, of which about 30 were financed and directed by the Smithsonian Institution or the National Museum. Funds for the others were furnished by private sponsors or by other Government agencies. Of the latter, the United States Geological Survey has been the outstanding contributor.

The first expeditions organized by the United States National Museum exclusively for the collection of fossil vertebrates were those of 1894 and 1896 to the Eocene of Alabama for *Basilosaurus* remains. Reports of an abundance of archaeocete remains in the Gulf States instigated the 1894 expedition, and Dr. Charles Schuchert was detailed to investigate these and to collect if possible a specimen for exhibition. He was successful in finding a much fragmented skull and a fine ramus of one and the forward half of the articulated skeleton of a second individual of *Basilosaurus*, together with other less important specimens. This material formed the basis for the restoration of the *Basilosaurus cetoides* skeleton exhibited at the Cotton States and International Exposition at Atlanta in 1895. In November 1896 Schuchert again visited the Eocene of Alabama and collected additional materials of *Basilosaurus*, including an articulated series of vertebrae of the hinder portion of the skeleton. From these specimens was assembled the mounted skeleton that for 28 years has formed a unique feature of the exhibition series.

In 1904, under A. G. Maddren, and again in 1907, under Charles W. Gilmore, expeditions were dispatched to Alaska by the Smithsonian in the hope of securing a mountable skeleton of the northern mammoth (*Elephas primigenius*). Although neither expedition was successful in getting an elephant skeleton, important collections of Pleistocene fossils resulted.

This quest for elephant remains was further pursued in 1915, when Benno Alexander was employed by the Smithsonian to accompany the Koren expedition to the Kolyma River Valley, Siberia. Mr. Alexander obtained a nearly perfect skull of *Elephas primigenius* and a large miscellaneous collection of Pleistocene bones.

Scarcely a year has passed since 1912 when there has not been at least one expedition in the field in quest of fossil vertebrates. Beginning in 1929, however, the Smithsonian Institution has provided the means for carrying on annual expeditions, and it has thereby been possible to plan a definite program. Geographically the ex-

[20] By major expeditions is meant those collecting parties that have spent 2 or more months in the field and whose energies were wholly devoted to the collection of fossil vertebrates.

peditions have covered a wide area, collections having been made in Alabama, Alaska, Arizona, Cuba, Florida, Idaho, Indiana, Maryland, Montana, Nebraska, New Mexico, Oklahoma, Siberia, South Dakota, Utah, Virginia, and Wyoming.

Although much of the exploratory work of later years has been done in well-known fossil-producing areas, these collecting activities have also resulted in the development of important new fossil areas and faunas. The more important of these are: Jackson, Eocene fauna, near Melvin, Choctaw County, Ala. (1894, 1896, 1929); the Cumberland Cave Pleistocene fauna near Cumberland, Md. (1912, 1913, 1914, 1915); Paleocene fauna from Sweet Grass County, Mont. (1908, 1909, 1910, 1911, 1934); Pliocene and Pleistocene faunas of the San Pedro Valley, Ariz. (1921, 1936); footprints from the Permian of the Grand Canyon, Ariz. (1924, 1926, 1927); fauna of the Upper Cretaceous, Two Medicine formation, Mont. (1913, 1928, 1935); Pliocene fauna and development of the famous *Plesippus* Quarry near Hagerman, Idaho (1929, 1930, 1931, 1934); fauna of the Upper Cretaceous, North Horn formation, and Paleocene, Dragon formation of the Wasatch Plateau region of central Utah (1937, 1938, 1939, 1940); Miocene fauna of the Chesapeake Bay area (1905–1940).

Although early collecting was intermittent and consisted largely in accepting opportunities as they arose, with the exception of the Marsh collecting parties for the Geological Survey the work of recent years has been planned with the idea of filling in gaps and of rounding out the permanent collections, so that they will be more fully representative of all the better-known North American faunas and fossil-producing areas. As a result of this planned collecting, the vertebrate collections of the National Museum are gradually reaching a standard that is in keeping with the national character of the Institution.

CHRONOLOGICAL LIST OF EXPEDITIONS, OUTSIDE OF THE SMITHSONIAN INSTITUTION AND NATIONAL MUSEUM, FROM WHICH THE DIVISION OF VERTEBRATE PALEONTOLOGY HAS BENEFITED

1849. U. S. Land Office. Oligocene (Brule), South Dakota, "Bad Lands," John Evans in charge.

1850. Thaddeus Culbertson (allotted $200 for freight by the Smithsonian). Oligocene, South Dakota, "Bad Lands," Thaddeus Culbertson in charge.

1853. U. S. Land Office. Oligocene (Brule), South Dakota, "Bad Lands," John Evans in charge.

1856. War Department, U. S. Geographical Exploration of the Yellowstone and Missouri Rivers. Upper Cretaceous (Judith River), Gouverneur K. Warren in charge. F. V. Hayden made the collections.

1857. War Department. Oligocene and Miocene, South Dakota and Nebraska, Niobrara River. Gouverneur K. Warren in charge. F. V. Hayden made the collections.

1870. U. S. Geological Survey, Hayden Survey. Eocene, Bridger, and other Tertiary deposits, Wyoming. F. V. Hayden made the collections.

1872. U. S. Geological Survey, Hayden Survey. Eocene, Bridger, and other Tertiary basins, Wyoming. E. D. Cope made the collections.

1874. War Department, U. S. Geographical Surveys West of the 100th Meridian. Eocene (Wasatch), Miocene and Lower Pliocene, New Mexico, G. M. Wheeler in charge. E. D. Cope, assisted by H. C. Yarrow, made the collections.

1882. U. S. Geological Survey. Jurassic (Morrison), Wyoming, Albany County, "Quarry 13," W. H. Reed in charge.

1883. U. S. Geological Survey. Jurassic (Morrison), Wyoming, Albany County, "Quarry 13," 6 miles from Como, J. L. Kenney in charge.

U. S. Geological Survey. Jurassic (Morrison), Colorado, "Garden Park," near Canyon City, M. P. Felch in charge.

1884. U. S. Geological Survey. Jurassic (Morrison), Wyoming, Albany County, "Quarry 13," 6 miles from Como, Fred Brown in charge.

U. S. Geological Survey. Jurassic (Morrison), Wyoming, Albany County, "Quarry 9," Como Bluff, Ed Kennedy in charge, assisted by W. Beck.

U. S. Geological Survey. Jurassic (Morrison), Colorado, "Garden Park," near Canyon City, M. P. Felch in charge.

U. S. Geological Survey. Lower Pliocene (Republican River), Kansas, Phillips County, Long Island, "*Teleoceros* Quarry," J. B. Hatcher in charge.

1885. U. S. Geological Survey. Jurassic (Morrison), Wyoming, Albany County, "Quarry 13," 6 miles from Como, Fred Brown in charge.

U. S. Geological Survey. Jurassic (Morrison), Colorado, "Garden Park," near Canyon City, M. P. Felch in charge.

U. S. Geological Survey. Lower Pliocene (Republican River), Kansas, Phillips County, Long Island, "*Teleoceras* Quarry," J. B. Hatcher in charge.

1886. U. S. Geological Survey. Jurassic (Morrison), Wyoming, Albany County, "Quarry 13," 6 miles from Como, Fred Brown in charge.

U. S. Geological Survey. Jurassic (Morrison), Colorado, "Garden Park," near Canyon City, M. P. Felch in charge.

U. S. Geological Survey. Oligocene (Chadron chiefly), Nebraska and South Dakota, J. B. Hatcher in charge.

1887. U. S. Geological Survey. Jurassic (Morrison), Wyoming, Albany County, "Quarry 13," 6 miles from Como, Fred Brown in charge.

U. S. Geological Survey. Jurassic (Morrison), Colorado, "Garden Park," near Canyon City, M. P. Felch in charge.

U. S. Geological Survey. Upper Cretaceous (Denver), Colorado, near Denver, J. B. Hatcher in charge.

U. S. Geological Survey. Oligocene (Chadron), South Dakota and Nebraska, J. B. Hatcher in charge.

U. S. Geological Survey. Cretaceous (Arundel), Maryland, near Beltsville, J. B. Hatcher in charge.

1888. U. S. Geological Survey. Jurassic (Morrison), Colorado, "Garden Park," near Canyon City, M. P. Felch in charge.

U. S. Geological Survey. Oligocene, South Dakota and Nebraska, vicinity of Chadron and Hermosa, J. B. Hatcher in charge.

U. S. Geological Survey. Cretaceous (Judith River), Montana, Cow Island and vicinity of Dog Creek and Judith River, J. B. Hatcher in charge.

U. S. Geological Survey. Cretaceous (Arundel), Maryland, near Beltsville, J. B. Hatcher in charge.

U. S. Geological Survey. Jurassic (Morrison), Wyoming, Albany County, "Quarry 9," Fred Brown in charge.

1889. U. S. Geological Survey. Triassic, North Carolina, Egypt, J. B. Hatcher in charge.

U. S. Geological Survey. Oligocene, South Dakota, J. B. Hatcher in charge.

U. S. Geological Survey. Upper Cretaceous (Lance), Wyoming, Niobrara County, Lance Creek, J. B. Hatcher in charge, assisted by C. E. Beecher and O. A. Peterson.

1890. U. S. Geological Survey. Upper Cretaceous (Lance), Wyoming, Niobrara County, Lance Creek, J. B. Hatcher in charge, assisted by W. H. Utterback, A. L. Sullins, and T. A. Bostwick.

U. S. Geological Survey. Oligocene (Chadron), South Dakota, "Bad Lands," J. B. Hatcher in charge, assisted by W. H. Utterback, E. B. Willson, O. A. Peterson, C. E. Beecher, and Gus Craven.

U. S. Geological Survey. Upper Cretaceous (Niobrara), Kansas, Handel T. Martin in charge.

U. S. Geological Survey. Triassic, North Carolina, J. B. Hatcher in charge.

U. S. Geological Survey. Pliocene, Florida, Levy County, near Archer and Williston, J. B. Hatcher in charge.

1891. U. S. Geological Survey. Upper Cretaceous (Lance), Wyoming, Niobrara County, J. B. Hatcher in charge, assisted by A. L. Sullins, W. H. Utterback, A. E. Burrell, and O. A. Peterson.

1892. U. S. Geological Survey. Upper Cretaceous (Lance), Wyoming, Niobrara County, J. B. Hatcher in charge.

1899. Union Pacific Railroad. Jurassic (Morrison), Wyoming, Albany County, Freeze Out Mountains, Charles Schuchert in charge.

1900. U. S. Geological Survey. Triassic (Chinle), Arizona, "Tanner's Crossing," Barnum Brown in charge.

1902. U. S. Geological Survey. Eocene (Bridger), Wyoming, W. D. Matthew and Walter Granger in charge.

1908. U. S. Geological Survey. Paleocene (Fort Union), Montana, Sweet Grass County, A. C. Silberling in charge.

1909. U. S. Geological Survey. Paleocene (Fort Union), Montana, Sweet Grass County, A. C. Silberling and J. W. Gidley in charge.

1913. U. S. Geological Survey. Upper Cretaceous (Two Medicine), Montana, Blackfeet Indian Reservation, C. W. Gilmore in charge, assisted by Floyd Strayer.

1914. U. S. Geological Survey. Upper Cretaceous (Judith and Claggett), Montana, vicinity of Judith P. O. C. W. Gilmore accompanied party.

1916. U. S. Geological Survey. Paleocene (Puerco and Torrejon) and Upper Cretaceous (Kirtland), New Mexico, San Juan Basin. J. B. Reeside made the collections.

1921. U. S. Geological Survey. Pliocene (Cochise) and Pleistocene, Arizona, San Pedro Valley, J. W. Gidley and Kirk Bryan.

National Park Service. Miocene (Santa Fe marl), New Mexico, near Espanola, C. W. Gilmore in charge.

1924. National Park Service. Permian (Coconino), Arizona, Grand Canyon, footprints, C. W. Gilmore in charge, assisted by A. Metzer.

1926. National Park Service. Permian (Coconino and Hermit), Arizona, Grand Canyon, footprints, C. W. Gilmore in charge, assisted by Glen Sturdevant.

1927. National Academy of Sciences. Permian (Hermit and Supai), Arizona, Grand Canyon, footprints, C. W. Gilmore in charge, assisted by Glen Sturdevant.

1929. Carnegie Institution of Washington. Eocene (Jackson), Alabama and Mississippi. Remington Kellogg in charge, assisted by N. H. Boss.

CHRONOLOGICAL LIST OF EXPEDITIONS ENGAGED IN THE COLLECTION OF FOSSIL VERTEBRATES FOR THE UNITED STATES NATIONAL MUSEUM AND SMITHSONIAN INSTITUTION

1894. Eocene (Jackson), Alabama, Choctaw County, *Basilosaurus* remains principally, Charles Schuchert in charge.

1896. Same.

1904. Pleistocene, Alaska, Old Crow and Yukon River Valleys, A. G. Maddren in charge.

1907. Pleistocene, Alaska, Yukon Valley, C. W. Gilmore in charge, assisted by Benno Alexander.

1912. Pleistocene, Maryland, "Cumberland Cave," J. W. Gidley in charge, assisted by Raymond Armbruster.

1913. Pleistocene, Maryland, "Cumberland Cave," J. W. Gidley in charge.

1914. Same.

1915. Same.

1914–15. Pleistocene, Siberia, Kolyma Valley, Benno Alexander in charge.

1915. Pleistocene, Indiana, Pulaski County, "Winamac Mastodon," J. W. Gidley in charge.

1921. Miocene (Harrison), Nebraska, "Agate Springs," slab of *Diceratherium* bones, J. W. Gidley in charge.

1923. Jurassic (Morrison), Utah, "Dinosaur National Monument," *Diplodocus* skeleton, C. W. Gilmore in charge, assisted by Norman H. Boss, J. A. Kay, E. M. York, and Golden York.

1924. Triassic, Virginia, Loudoun County, dinosaur tracks, C. W. Gilmore in charge, assisted by N. H. Boss.

1924. Pleistocene, Florida, Melbourne, in cooperation with the Bureau of American Ethnology, J. W. Gidley in charge.

1925. Pleistocene, Florida, Melbourne, investigation of occurrence of man with Pleistocene fossils, J. W. Gidley in cooperation with Amherst College.

Pleistocene, Oklahoma, Long Horn Spring deposit, J. W. Gidley in charge.

1927. Pleistocene, Florida, Melbourne, J. W. Gidley in charge, assisted by C. P. Singleton.

Pleistocene, Oklahoma, near Curtis, J. W. Gidley in charge.

1928. Upper Cretaceous (Two Medicine), Montana, Blackfeet Indian Reservation, C. W. Gilmore in charge, assisted by G. F. Sternberg and Edwin Cooke.

Pleistocene, Florida, Melbourne and New Smyrna, J. W. Gidley in charge, assisted by C. P. Singleton.

1929. Pliocene (Hagerman Lake beds) and Pleistocene, Idaho, American Falls beds, "*Plesippus* Quarry," J. W. Gidley in charge, assisted by C. P. Singleton, Elmer Cook, and F. V. Conklin.

Pleistocene, Florida, Melbourne, J. W. Gidley in charge, assisted by C. P. Singleton.

Pleistocene, New Mexico, Dona Ana County, Aden Crater, in cooperation with Peabody Museum of Natural History, F. W. Darby in charge, assisted by N. H. Boss.

Upper Cretaceous (Kirtland), New Mexico, San Juan Basin, C. W. Gilmore in charge, assisted by N. H. Boss, G. F. Sternberg, and C. W. Sternberg.

1930. Eocene (Bridger), Wyoming, Bridger Basin, C. W. Gilmore in charge, assisted by G. F. Sternberg and George B. Pearce.
Pliocene (Hagerman Lake beds), Idaho, "*Plesippus* Quarry," near Hagerman, J. W. Gidley in charge, assisted by C. P. Singleton, S. P. Welles, Elmer Cook, Frank Garnier, and Y. Young Rogers.
Pleistocene, Florida, Melbourne, evidence of association of man with Pleistocene fossils, J. W. Gidley in charge, assisted by C. P. Singleton.

1931. Eocene, Miocene, and Oligocene, Wyoming and Montana. Collections made from Eocene: Wasatch, Big Horn Basin; Oligocene: Pipestone Springs: Miocene: Canyon Ferry, White Sulphur Springs, and Deep River. C. W. Gilmore in charge, assisted by G. F. Sternberg and M. V. Walker.
Pliocene (Hagerman Lake beds), Idaho, "*Plesippus* Quarry," near Hagerman, N. H. Boss in charge, assisted by C. P. Singleton, C. W. Caldwell, Charles Brenner.

1932. Oligocene (Brule), Wyoming, Nebraska, and South Dakota, C. W. Gilmore in charge, assisted by G. F. Sternberg and M. V. Walker.

1934. Pliocene (Hagerman Lake beds) and Pleistocene, Idaho, "*Plesippus*" Quarry and American Falls, C. Lewis Gazin in charge, assisted by G. F. Sternberg, George B. Pearce, and Elmer Cook.
Paleocene (Fort Union), Montana, Sweetgrass County, George Gaylord Simpson in charge, assisted by A. C. Silberling.

1935. Upper Cretaceous (Two Medicine), Montana, Blackfeet Indian Reservation, and Eocene (Wasatch), Wyoming, Big Horn Basin, C. W. Gilmore in charge, assisted by G. F. Sternberg and George B. Pearce.

1936. Eocene (Wasatch), Paleocene (Puerco and Torrejon), and Pliocene, New Mexico and Arizona, C. Lewis Gazin in charge, assisted by G. F. Sternberg and H. R. Shepherd.

1937. Upper Cretaceous (North Horn), Paleocene (Dragon), and Triassic (Chinle), Utah, Emery County, and Arizona, vicinity of Petrified Forest, C. W. Gilmore in charge, assisted by G. F. Sternberg and G. B. Pearce.

1938. Upper Cretaceous (North Horn), Paleocene (Dragon), and Eocene (Uinta), Utah, Emery County, and Uinta Basin, C. Lewis Gazin in charge, assisted by G. F. Sternberg and H. R. Shepherd.

1939. Upper Cretaceous (North Horn) and Paleocene (Dragon), Utah, Emery County, C. Lewis Gazin in charge, assisted by G. F. Sternberg and Franklin Pearce.

1940. Upper Cretaceous (North Horn), Paleocene (Dragon), Utah, Emery County, and Eocene (Bridger), Wyoming, Uinta County, C. Lewis Gazin in charge, assisted by G. F. Sternberg and Franklin Pearce.

CHRONOLOGICAL LIST OF COLLECTING TRIPS FOR FOSSIL VERTEBRATES IN THE MIOCENE ALONG CHESAPEAKE BAY AND OTHER LOCALITIES NEAR WASHINGTON, D. C.

COLLECTING WAS CARRIED ON BY A CONSIDERABLE NUMBER OF INDIVIDUALS, WORKING FROM 1 TO 13 DAYS AT A TRIP. THE RECORD OF EARLY COLLECTING IS INCOMPLETE

1905–1914. Calvert Cliffs, Md.; F. W. True, collector.

1908: July 3, 7, 11, 18; August 1, 4, 12, 26; September 7. Plumpoint, Md.; William Palmer, D. B. Mackie, N. H. Boss, James W. Gidley, and Marcus W. Lyon, Jr.

1912: May 31. Plumpoint, Md.; William Palmer, A. C. Weed, and S. M. Gronberger.

1913: October. Dares Wharf and Plumpoint, Md.; William Palmer.

1914: June 2, 9–13. Dares Wharf and Plumpoint, Md.; N. H. Boss.
1916: March 4. South Chesapeake Beach, Md.; William Palmer.
1918: August 23–26, 30–31; September 4–7. South Chesapeake Beach, Md.; William Palmer and N. H. Boss.
1919: July 16–19. Willows, Md.; N. H. Boss.
1920: May 30–31; June 12, 27–29. South Chesapeake Beach, Md.; N. H. Boss.
1921: July 7–9. Willows, Md.; N. H. Boss.
1921: August 1–3, 8–12. South Chesapeake Beach, Md.; N. H. Boss.
1922: July 8–11, 13. Willows, Md.; N. H. Boss.
1922: July 12. Plumpoint, Md.; N. H. Boss.
1922: October 6–7; November 20–21. South Chesapeake Beach, Md.; N. H. Boss.
1923: December 30. Randle Cliffs to Camp Roosevelt, Md.; N. H. Boss and Remington Kellogg.
1925: June 7. Randle Cliffs, Md.; N. H. Boss and Remington Kellogg.
1925: July 26–27. Nomini Cliffs, Va.; Alexander Wetmore, E. A. Preble, and Remington Kellogg.
1925: August 15. Plumpoint to Governors Run, Md.; Remington Kellogg.
1925: August 22. Governors Run to Solomons Island, Md.; Remington Kellogg.
1925: August 30. Dares Wharf to Plumpoint, Md.; Remington Kellogg.
1925: September 6. Dares Wharf, Md.; Remington Kellogg.
1925: September 12–14. Dares Wharf to Plumpoint, Md.; Remington Kellogg.
1925: September 20. Camp Roosevelt, Md.; Remington Kellogg.
1925: September 27. Plumpoint, Md.; N. H. Boss and Remington Kellogg.
1925: November 22–23. St. Marys County, Md.; C. W. Gilmore, N. H. Boss, and Remington Kellogg.
1926: May 26. Plumpoint, Md.; N. H. Boss and Remington Kellogg.
1926: May 30. Plumpoint, Md.; Remington Kellogg.
1926: July 4. Fair Haven and Randle Cliffs, Md.; Remington Kellogg.
1926: July 18. Plumpoint, Md.; Remington Kellogg.
1926: August 8. Dares Wharf to Plumpoint, Md.; Remington Kellogg and W. Woodring.
1929: August. Governors Run, Md.; A. Lincoln Dryden, Jr., Willard Berry, William L. Jones, A. J. Poole, and Remington Kellogg.
1931: August 14–20. Governors Run. Md.; A. Lincoln Dryden, Jr., and Remington Kellogg.
1931: October 30. St. Marys County, Md.; A. Lincoln Dryden, Jr., and Remington Kellogg.
1933: August 9. Governors Run, Md.; Raymond M. Gilmore, C. Lewis Gazin, and Remington Kellogg.
1935: August 24–31. Governors Run, Md.; N. H. Boss and Remington Kellogg.
1936: July 13. Parkers Creek, Md.; W. F. Foshag, Ed. Mullins, and Remington Kellogg.
1936: July 25. Parkers Creek, Md.; W. F. Foshag, Ed. Mullins, and Remington Kellogg.
1936: July 29. Randle Cliffs, Md.; C. W. Gilmore, Ed. Mullins and Remington Kellogg.
1938: March 27. Spindle farm, Occupacia Creek, Essex County, Va.; Remington Kellogg and C. W. Gilmore. Examined skeleton *in situ*.
1939: July 15–23. Parkers Creek, Md.; W. F. Foshag and Remington Kellogg.
1940: June 6–8. Scientists Cliffs, Md.; W. F. Foshag, C. W. Gilmore, Remington Kellogg, and H. S. Bryant.
1940: August 3–17. Scientists Cliffs, Md.; W. F. Foshag and Remington Kellogg.

STUDY OR RESERVE COLLECTIONS

The collections designated as study or reserve comprise those specimens that have been filed away for study, comparison, and reference purposes. They constitute the bulk of the vertebrate fossils now assembled. They contain many early types of more than ordinary interest, since they are those that formed the basis for much of the scientific work of Leidy, Cope, and Marsh and thus constitute the primary foundation upon which much of modern paleontology of America is based. These types are constantly in demand for examination and comparison by paleontologists from other institutions of the country.

These collections now contain representative faunas of most of the more important fossil-bearing formations of North America, together with a sprinkling of foreign materials. Although some gaps still exist and many assemblages need strengthening, taken as a whole it is now one of the important fossil vertebrate collections in America.

In building up this collection, regular expeditions have been the most prolific source of materials, and the history of these has been covered under the heading "Expeditions," page 323. In the pages to follow, however, it is proposed to review some of the other sources of material in order to give a complete picture of the growth and development of the collection.

Gifts from individual donors have ever been an important source of materials, but next in importance to the specimens obtained by regularly organized expeditions are those received in exchange for duplicate materials with kindred institutions. Such exchanges have been made possible to a great extent by the large suites of duplicate materials of Brontotheres, *Teleoceras*, and *Plesippus* of which the Division of Vertebrate Paleontology is the fortunate possessor. Among the more improtant specimens thus obtained were the following:

DINOSAURIA:

Gorgosaurus libratus—articulated skeleton.
Camarasaurus lentus—articulated skeleton.
Edmontosaurus regalis—skull and lower jaws.
Prosaurolophus maximus—skull and lower jaws.

MAMMALIA:

Stenomylus hitchcocki—articulated skeleton.
Scelidodon capellina—articulated skeleton.
Diceratherium cooki—composite skeleton.
Trigonias osborni—composite skeleton.
Moropus elatus—composite skeleton.
Equus occidentalis—composite skeleton.
Mylodon harlani—composite skeleton.
Aenocyon dirus—two composite skeletons.
Smilodon californicus—composite skeleton.

Since 1911 the curator of the Division of Vertebrate Paleontology has endeavored to assemble in the National Museum as many of the

View of storage room for reserve or study collections of fossil vertebrates.

Storage cases and cupboards for vertebrate collections, showing utilization of corridor.

scattered type and figured specimens of fossil vertebrates as could be acquired by deposit, exchange, gift, or otherwise. Various institutions and individuals generously responded to the logic of having these important specimens centralized, their preservation guaranteed, and their availability to students assured. In all, 156 such specimens have now been assembled, of which 94 are original types as listed below.

The institutions and individuals that have contributed to the success of this undertaking are: Geological Survey of Florida, Geological Survey of Maryland, North Carolina Department of Agriculture, Goucher College, Indiana State University, Johns Hopkins University, Columbia University, Colorado Museum of Natural History, Colorado College, Buffalo Society of Natural Sciences, Peabody Museum of Natural History, Earle Sloan, Oliver P. Hay, W. Gardner Lynn, R. Lee Collins, Charles T. Berry, and Ermine C. Case.

PISCES:

Anomoedus latidens marylandicus Berry.
Berry, C. T., Amer. Midl. Nat., vol. 22, p. 746, fig. 1, 1939.

Carcharias incidens Eastman.
Eastman, C. R., Maryland Geol. Surv., Miocene, p. 87, pl. 32, fig. 8, 1904=*Carcharhinus*.

Felichthys stauroforus Lynn and Melland.
Lynn, W. G., and Melland, A. M., Journ. Washington Acad. Sci., vol. 29, pp. 14–20, figs. 1–3, 1939.

Istiophorus calvertensis Berry.
Berry, E. W., Amer. Journ. Sci., ser. 4, vol. 43, p. 461, figs. 1, 2, 1917.

Myliobatis copeanus Clark.
Clark, W. B., Johns Hopkins Univ. Circ., vol. 15, p. 4, 1895.

Squatina occidentalis Eastman.
Eastman, C. R., Maryland Geol. Surv., Miocene, p. 71, pl. 28, figs. 1a, 1b, 1904.

Synechodus clarkii Eastman.
Eastman, C. R., Maryland Geol. Surv., Eocene, p. 103, pl. 14, figs. 5a–c, 1901.

Xiphias (?) radiata Clark.
Clark, W. B., Johns Hopkins Univ. Circ., vol. 15, p. 4, 1895=*Ischyriza?*

AMPHIBIA:

Crossotelos annulatus Case.
Case, E. C., 2d Ann. Rep. Geol. and Nat. Hist. Terr. Oklahoma, p. 65, 1901.

REPTILIA:

Amyda virginiana Clark.
Clark, W B., Johns Hopkins Univ. Circ., vol. 15, p. 4, 1895.

Bystra nanus Hay.
Hay, O. P., 8th Ann. Rep. Florida Geol. Surv., pp. 53–55, pl. 1, 1916.

Champs denticulatus Gilmore.
Gilmore, C. W., Mem. Nat. Acad. Sci., vol. 22, pp. 26, 27, fig. 14, 1928.

Champs segnis Marsh.
Marsh, O. C., Amer. Journ. Sci., ser. 3, vol. 43, p. 450, figs. 2, 3, 1892.

Chelonia marylandica Collins and Lynn.
Collins, R. L., and Lynn, W. G., Proc. Amer. Philos. Soc., vol. 72, pp. 162–166, fig. 1, 1936.

Chelydra laticarinata Hay.
Hay, O. P., 8th Ann. Rep. Florida Geol. Surv., pp. 72–73, pl. 6, fig. 6, 1916.

Chelydra sculpta Hay.
Hay, O. P., 8th Ann. Rep. Florida Geol. Surv., pp. 73–75, pl. 6, fig. 8, 1916.

Cteniogenys antiquus Gilmore.
Gilmore, C. W., Mem. Nat. Acad. Sci., vol. 22, pp. 162–163, pl. 20, fig. 14, 1928.

Dryosaurus grandis Lull.
Lull, R. S., Maryland Geol. Surv., Lower Cretaceous, pp. 204–206, pl. 19, figs. 6, 7, 1911=*Ornithomimus affinis* Gilmore.

Goniopholis affinis Lull.
Lull, R. S., Maryland Geol. Surv., Lower Cretaceous, p. 210, pl. 20, fig. 7, 1911.

Glyptosaurus anceps Marsh.
Marsh, O. C., Amer. Journ. Sci., ser. 3, vol. 1, p. 458, 1871=*Ototriton anceps* (Marsh).

Glyptosaurus brevidens Marsh.
Marsh, O. C., Amer. Journ. Sci., ser. 3, vol. 4, p. 305, 1872.

Glyptosaurus nodosus Marsh.
Marsh, O. C., Amer. Journ. Sci., ser. 3, vol. 1, p. 458, 1871.

Glyptosaurus ocellatus Marsh.
Marsh, O. C., Amer. Journ. Sci., ser. 3, vol. 1, p. 458, 1871=*G. sylvestris* Marsh.

Glyptosaurus princeps Marsh.
Marsh, O. C., Amer. Journ. Sci., ser. 3, vol. 4, p. 301, 1872.

Glyptosaurus rugosus Marsh.
Marsh, O. C., Amer. Journ. Sci., ser. 3, vol. 4, p. 305, 1872.

Glyptosaurus sphenodon Marsh.
Marsh, O. C., Amer. Journ. Sci., ser. 3, vol. 4, p. 306, 1872.

Glyptosaurus sylvestris Marsh.
Marsh, O. C., Amer. Journ. Sci., ser. 3, vol. 1, p. 458, 1871.

Gopherus praecedens Hay.
Hay, O. P., 8th Ann. Rep. Florida Geol. Surv., pp. 55–56, pl. 4, figs. 1, 2, 1916.

Hadrosaurus tripos Cope.
Cope, E. D., Proc. Acad. Nat. Sci. Philadelphia, vol. 21, p. 192, 1869.

Hypsibema crassicauda Cope.
Cope, E. D., Proc. Acad. Nat. Sci. Philadelphia, vol. 21, p. 192, 1869.

Iguanavus exilis Marsh.
Marsh, O. C., Amer. Journ. Sci., ser. 3, vol. 4, p. 309, 1872.

Iguanavus teres Marsh.
Marsh, O. C., Amer. Journ. Sci., ser. 3, vol. 43, p. 451, 1892.

Oreosaurus gracilis Marsh.
Marsh, O. C., Amer. Journ. Sci, ser. 3, vol. 4, p. 307, 1872=*Xestops gracilis* (Marsh).

Oreosaurus lentus Marsh.
Marsh, O. C., Amer. Journ. Sci., ser. 3, vol. 4, p. 307, 1872=*Xestops lentus* (Marsh).

Oreosaurus microdus Marsh.

Marsh, O. C., Amer. Journ. Sci., ser. 3, vol. 4, p. 308, 1872=*Xestops microdus* (Marsh).

Oreosaurus minutus Marsh.

Marsh, O. C., Amer. Journ. Sci., ser. 3, vol. 4, p. 308, 1872=*Xestops minutus* (Marsh).

Oreosaurus vagans Marsh.

Marsh, O. C., Amer. Journ. Sci., ser. 3, vol. 4, p. 303, 1872=*Xestops vagans* (Marsh).

Palaeophis virginianus Lynn.

Lynn, W. G., Johns Hopkins Univ. Stud. in Geol., No. 11, pp. 245–249, pl. 17, fig. 6, 1934.

Peritresius virginianus Berry and Lynn.

Berry, C. T., and Lynn, W. G., Proc. Amer. Philos. Soc., vol. 76, pp. 176–183, pls. 1–4, 1936.

Polydectes biturgidus Cope.

Cope, E. D., Proc. Acad. Nat. Sci., Philadelphia, vol. 21, p. 192, 1869.

Pseudemys floridana persimilis Hay.

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Taphrosphys miocenica Collins and Lynn.

Collins, R. L., and Lynn, W. G., Proc. Amer. Philos. Soc., vol. 76, pp. 155–162, pl. 1, 1936.

Terrapene antipex Hay.

Hay, O. P., 8th Ann. Rep. Florida Geol. Surv., pp. 58–61, pl. 4, fig. 1; pl. 5, fig. 1, 1916.

Terrapene formosa Hay.

Hay, O. P., 8th Ann. Rep. Florida Geol. Surv., pp. 57–58, pl. 4, fig. 3, 1916.

Terrapene innoxia Hay.

Hay, O. P., 8th Ann. Rep. Florida Geol. Surv., pp. 61–64, pl. 6, figs. 1, 2, 1916.

Testudo culbertsoni Leidy.

Leidy, J., Proc. Acad. Nat. Sci., Philadelphia, vol. 6, p. 59, 1852=*Stylemys nebrascensis* Leidy.

Testudo distans Hay.

Hay, O. P., 8th Ann. Rep. Florida Geol. Surv., pp. 48–49, pl. 3, fig. 9, 1916.

Testudo ducateli Collins and Lynn.

Collins, R. L., and Lynn, W. G., Proc. Amer. Philos. Soc., vol. 76, pp. 166–171, pls. 3, 4, 1936.

Testudo equicornes Hay.

Hay, O. P., Kansas Univ. Sci. Bull., vol. 10, pp. 40–41, pl. 1, figs. 1–3; pl. 3, fig. 1, 1917.

Testudo hayi Sellards.

Sellards, E. H., Amer. Journ. Sci., ser. 4, vol. 42, p. 235, fig. 1, 1916.

Testudo incisa Hay.

Hay, O. P., 8th Ann. Rep. Florida Geol. Surv., pp. 46–48, pl. 3, fig. 5, 1916.

Testudo luciae Hay.

Hay, O. P., 8th Ann. Rep. Florida Geol. Surv., pp. 52–53, pl. 9, fig. 5. 1916.

Testudo ocalana Hay.
Hay, O. P., 8th Ann. Rep. Florida Geol. Surv., pp. 44–46, pl. 8, fig. 1; pl. 9, figs. 1–3, 1916.

Testudo sellardsi Hay.
Hay, O. P., 8th Ann. Rep. Florida Geol. Surv., pp. 49–52, pl. 8, figs. 6–8, 1916.

Thecachampsa marylandica Clark.
Clark, W. B., Johns Hopkins Univ. Circ., vol. 15, p. 4, 1895.

Thinosaurus agilis Marsh.
Marsh, O. C., Amer. Journ. Sci., ser. 3, vol. 4, p. 302, 1872=*Saniwa agilis* (Marsh).

Thinosaurus crassus Marsh.
Marsh, O. C., Amer. Journ. Sci., ser. 3, vol. 4, p. 301, 1872=*Saniwa crassa* (Marsh).

Thinosaurus grandis Marsh.
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PRIVATE COLLECTIONS

In addition to the Marsh collection of vertebrate fossils brought together under governmental auspices, the collections of the Division have been augmented by a number of private collections acquired either through gift or purchase. A brief history of the more important of these, arranged in chronological order, follows:

Lacoe collection.—The very large and valuable Lacoe collection, received as a gift in 1896 from the heirs of R. D. Lacoe, banker of Pittston, Pa., and collector of fossils through many years, consisted primarily of fossil plants and invertebrate (mainly insects of late Paleozoic and Cenozoic forms) fossils, but it also contained several hundred fish, amphibian, and reptilian remains. Some of them are in a rare state of preservation; others from the Linton, Ohio, coalfields, owing to the exhaustion of the coal mines, are unique. The Tertiary was represented by specimens from the Eocene (Green River shales) of Wyoming and from Switzerland; Triassic by specimens from Great Britain, France, and the coalfields of Ohio, Pennsylvania, and Mazon Creek, Grundy County, Ill. The collection contained many types and figured specimens, including the unique *Isodectus punctulatus*, thought to be the oldest known reptile.

Hambach collection.—The Hambach collection was acquired through purchase in 1908 by Frank Springer from Gustav Hambach, of St. Louis, Mo., and presented to the United States National Museum. The collection consisted principally of fossil Echinodermata (largely crinoids), but it contained also a considerable number of Paleozoic fish remains from this country and abroad, as well as a few from the Shumard collection, which Professor Hambach had previously acquired.

Orestes St. John collection.—The St. John collection of Paleozoic fishes was presented to the National Museum in 1922 by Frank Springer, to whom it was bequeathed upon the death of Mr. St. John. The collection consists of two parts: (1) A general collection of Devonian invertebrate fossils made during Mr. St. John's younger days in Iowa; and (2) his large and extremely valuable collection of selachian fish remains accumulated in connection with his special studies, chiefly from the Carboniferous of the Mississippi Valley. It contains numerous types and figured specimens of species described by him in Illinois Reports and also much original material forming the subject of further extensive researches never published. In addition to the product of his personal collecting during 40 years of diversified field work, there is included a large quantity of very choice cestraciont fish material obtained by Dr. Springer, largely from a fortunate discovery in the Burlington limestone in Iowa; and also two exceptionally fine collections from the Keokuk lime-

stone made, respectively, by Dr. G. A. Williams, of Booneville, Mo., and Lisbon A. Cox, of Keokuk, Iowa. These were purchased by Mr. Springer and turned over to Mr. St. John together with his own, for use in his researches.

Among other notable items in this important collection is a very exceptional specimen from the Coal Measures of Kansas, the complete dentition of a large Paleozoic shark in a more perfect state of preservation than has ever been found elsewhere. This type of *Campodus* (*Agassizodus*) *variabilis*, described in volume 4 of the Illinois Reports, is regarded by ichthyologists as without a parallel among its kind.

Teller collection.—The Teller collection of invertebrates and fossil fishes was assembled by the late Edgar E. Teller, of Milwaukee, Wis. The entire assemblage, with his library, was received as a gift in 1924 from Mrs. Edgar E. Teller. The fish remains, consisting of about 100 specimens, are all from the Devonian and all were collected in and around Milwaukee. Included in the collection are a number of figured specimens.

Palmer collection.—The Palmer collection consisted entirely of Miocene vertebrate fossils gathered by William Palmer, taxidermist and naturalist in the United States National Museum, from the Calvert formation along Chesapeake Bay, Md., It was purchased by the Smithsonian Institution from his widow shortly after his death in 1921. Throughout most of his life Mr. Palmer was an indefatigable collector of natural-history specimens, but from 1908 to the time of his death his interests were largely devoted to the collection of Miocene vertebrate fossils. Many of the specimens secured were at once turned over to the Division of Vertebrate Paleontology as gifts and were described by Dr. F. W. True, but a considerable accumulation of specimens, including several extinct porpoise skulls, most of them prepared, formed the basis of the purchase.

Certain assemblages are outstanding, not only because of the quantity of materials represented but more especially because of the high quality of the preservation. Among these is the fossil cetacean collection, which ranks first among aggregations of the kind in American museums. The bulk of this assemblage is from the prolific nearby Miocene deposits of the Chesapeake Bay area, but the Gulf and Pacific coasts are also represented by many well-preserved specimens. This collection has resulted from the enthusiastic volunteer work of a considerable number of collaborators of which the more active were: Head Curator Frederick W. True, who pioneered in this work, about 1905–14; William Palmer, 1907–19; Norman H. Boss, 1914–35; Remington Kellogg, 1923–40; and R. L. Collins, 1935–38.

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In recent years, Dr. Remington Kellogg, through his extensive researches on the Cetacea, has been the outstanding contributor to the building up and development of the collections in this important group of mammals.

INFLUENCE OF EXPOSITIONS

Although the Smithsonian Institution has participated in practically all the expositions of this country and many abroad, beginning with the Centennial in Philadelphia in 1876,[21] the Division of Vertebrate Paleontology was not called upon to contribute to these exhibitions until 1895. Since then, however, it has participated in the following: The Cotton States and International Exposition, Atlanta, Ga., 1895; the Trans-Mississippi and International Exposition, Omaha, Nebr., 1898; the Pan-American Exposition, Buffalo, N. Y., 1901; the Louisiana Purchase Exposition, St. Louis, Mo., 1904; the Lewis and Clark Exposition, Portland, Oreg., 1905; the Sesquicentennial Exposition, Philadelphia, Pa., 1926; and the Texas Centennial Exposition, Dallas, Tex., 1936–37.

Participation in these expositions of national and international scope has yielded noteworthy advantages in the fact that the work of the division was made known to the people at large and in the opportunities offered by direct appropriations that could be expended for the purchase of specimens, the making of models, restorations, and paintings illustrative of extinct life. This illustrative material and a considerable number of choice specimens (listed below) have thus been added to the permanent collections:

1895, Atlanta: A complete model restoration of the skeleton of *Basilosaurus cetoides*, life size.

1898, Omaha: Lisbon A. Cox collection of Paleozoic fish remains purchased.

1901, Buffalo: A restoration in oil (8 by 15 feet) of *Triceratops*, painted by Charles R. Knight, W. K. Stone, and Joseph Gleeson. Model restoration life size of *Triceratops* skeleton. Skeleton of *Hesperornis regalis* and *Dinornis crassus* purchased.

1904, St. Louis: Life-size restoration of *Stegosaurus stenops*. Skeleton of *Mastodon americanus*. Skeletons of *Ichthyosaurus quadricissus*, *Rhamphorhynchus phyllurus*, *Stenosaurus bollensis*, and many fishes of large size (*Aspidorhynchus*, *Caturus*, *Hypsocormus*, *Gyrodus*, *Pholidophorus*, *Squatina*) purchased.

1905, Portland: *Epyornis maximus* egg purchased.

1926, Philadelphia: 12-foot skeleton of *Portheus molossus* Cope. Three skeletons of *Protostega gigas* Cope and two partial skeletons of *Platyearpus* purchased. Restoration of *Protostega gigas* painted by R. Bruce Horsfall.

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[21] Dr. J. Leidy (Journ. Acad. Nat. Sci., Philadelphia, vol. 8, p. 213) stated that a last molar of *Elephas columbi* from Beaufort, S. C., was included in the exhibit made by the Smithsonian Institution at the Centennial in Philadelphia in 1876.

1936–37, DALLAS: Skeletons of *Diatryma gigas* Cope and *Glyptosaurus giganteus* Gilmore. Distal half of a hadrosaurian *Corythosaurus* skeleton with skin impressions and a complete tail of *Camarasaurus* all purchased. Life restoration (canvas 8 by 15 feet) and a model restoration of *Camarasaurus lentus* Marsh, painted by R. Bruce Horsfall. Restoration of Permian life, canvas 8 by 15 feet, with *Dimetrodon* as the dominant figure, painted by Garnet W. Jex, and a diorama illustrative of the dinosaurian life of the Morrison formation.

EXHIBITS

The earliest exhibition of extinct vertebrate animals made by the Smithsonian Institution consisted of plaster casts of the giant sloth *Megatherium cuvieri*, the large land tortoise *Colossochelys atlas*, and the South American glyptodon *Schistopleurum typus*, which were "set up" in the large room of the Smithsonian Institution in 1871. In 1872, a skeleton of the Pleistocene Irish elk (*Megaceros hibernicus*), which had been purchased from Thomas & Sons, of Philadelphia, in 1868, was mounted and placed on view, and this specimen thus has the distinction of being the first articulated skeleton of an extinct animal to be placed on public exhibition in the Smithsonian Institution.[22] At this same time a model restoration of the Irish elk was placed on deposit by Waterhouse Hawkins.

With the completion of the new building in 1881 (now known as the Arts and Industries Building), the Irish elk, the *Megatherium*, and other large casts were transferred to it from the Smithsonian. These, together with a few fragmentary specimens from the Western States, resulting from the early Government surveys, constituted for a time the principal part of the exhibition series. A skeletal restoration of the famous *Hadrosaurus foulkii*, from the original in the Academy of Natural Sciences of Philadelphia, also formed a part of this early exhibition of extinct animals. An old photograph taken some time after the occupancy of the new building shows the *Hadrosaurus* associated with the skeletal cast of the *Megatherium* and skeletons of recent animals. No record has been found of this specimen, but Dr. Schuchert, under date of May 18, 1939, writes: "This restoration of *Hadrosaurus* was made for the United States National Museum for the Centennial Exposition. When I joined the National Museum, Dr. Goode told me the *Hadrosaurus* had long stood in front of the Museum and had weathered so badly that it was destroyed a few years before my arrival in 1893." Following the organization

[22] A curious coincidence is the fact that the first skeleton to be exhibited (1844) in the British Museum was also a skeleton of *Megaceros hibernicus*. Skeletons of the "Irish elk" were the first to be exhibited in both the American Museum of Natural History, New York City, and the Carnegie Museum in Pittsburgh.

of the Department of Vertebrate Fossils in 1886, and the appointment of Prof. O. C. Marsh as honorary curator in 1887, the southeast court space was assigned to the exhibition of fossil vertebrates, invertebrates, and plants.

There was a small intermittent growth of the exhibition collections, the preparation and installation that was necessary being done by the osteologists under the direction of F. A. Lucas.

In December 1890 John B. Hatcher was given temporary appointment as assistant to Professor Marsh for the purpose of arranging and classifying the collections that had been assembled. The exhibition was given a fresh impetus in July 1891 with the arrival from New Haven of the second consignment of the Marsh collection. It consisted of 380 prepared specimens made up as follows: 3 ceratopsian skulls, including the type of *Triceratops elatus;* 10 titanothere skulls, representing several genera; skulls and other remains of *Teleoceras fossiger;* other Tertiary fossils and some rare plaster casts. Owing to the gradual growth of the exhibition series, especially augmented by the acquisitions from the Marsh collection, in 1898 the entire southeast court was given over to vertebrate fossils.

In 1899 a papier-mâché cast of the skeleton of *Dinoceras* presented by Professor Marsh was mounted and placed on exhibition. In 1902 a mounted skeleton of *Hesperornis regalis*, first shown at the Pan American Exposition in Buffalo, was returned to the Museum and placed in the permanent exhibition series. With the acquisition of the Marsh collection and the employment of trained preparators from 1900 onward, there was a slow but steady growth and improvement of the exhibition collections. In 1903 the type skeleton of *Thespesius* (*Trachodon*) *annectens* was mounted under the direction of Lucas, the first articulated skeleton of a dinosaur to be exhibited in the National Museum. This specimen has the further distinction of being the second dinosaur skeleton to be thus exhibited in North America, first honors going to a companion skeleton in the Peabody Museum of Natural History at Yale that was placed on exhibition in 1901.

When the writer came to the National Museum in November 1903, the ground floor of the southeast court in the Old National Museum Building was entirely occupied by an exhibition of vertebrate fossils. This exhibition was all arranged by Mr. Lucas as acting curator, although his main duties were elsewhere in the Museum. The outstanding specimens comprised skeletons of *Megaceros hibernicus*, *Thespesius* (*Trachodon*) *annectens*, *Hesperornis regalis*, and a skeleton of *Basilosaurus cetoides*, the bones of the last being laid out in order on a shelf in a wall case on the north side that extended entirely across the court. A modeled restoration of the skeleton (later sent to the

British Museum in exchange) was suspended from the underside of the balcony above the original. There were also plaster casts of *Dinoceras*, *Megatherium*, *Dinotherium*, and *Schistopleurum*, the original hind limbs and pelvis of *Triceratops*, and a hind leg and foot of *Apatosaurus* (*Brontosaurus*). The other wall cases and slope-top diaphragm cases that occupied the remaining floor space were filled with a various assortment of fossil skulls and other skeletal parts of mammals, reptiles, and fishes.

In 1904 the type skulls of *Triceratops calicornis* and *Triceratops* (*Diceratops*) *hatcheri*, a skeleton of *Mastodon americanus* (returned from the St. Louis Exposition), a life-size restoration of *Stegosaurus stenops*, and a skeleton of *Dinornis* were added to the exhibition series. In 1905 a composite skeleton of *Triceratops elatus*, the first of this genus to be thus displayed, was installed. The addition of these specimens brought about the retirement of several cases of inferior materials. These constituted the exhibition collections until the New Natural History Building was occupied in 1910. Here, for the first time in the history of the Division, adequate and commodious exhibition, storage, and laboratory space was provided. Show specimens were assigned to halls 2 and 3, which aggregated 13,950 square feet of exhibition room, besides much wall space.

When the Division moved into the new building many of the older specimens were renovated, most of the skeletal casts were retired, several new specimens were added, and, as a new style of case was provided, the exhibition took on a very much improved appearance (see pls. 49 and 50), although the specimens were far too few to fill the allotted space.

From 1910 up to the present time there has been a slow but steady growth of the exhibition collections, until at the close of the year 1940 there were more than 50 mounted skeletons, ranging in size from the small 14-inch horned rodent *Epigaulus hatcheri* to the 72-foot *Diplodocus longus*.

A complete list of the mounted skeletons is given later, but some of the more outstanding of these are worthy of special mention. The articulated skeleton of *Basilosaurus cetoides*, prepared under the direction of Charles Schuchert and mounted under the direction of the late James W. Gidley, is the only specimen of its kind thus far exhibited. The type skeleton of *Ceratosaurus nasicornis*, although discovered more than 50 years ago, is also unique in being the only known specimen of its kind. The assemblage of *Stegosaurus* specimens, consisting of an articulated skeleton in the rock as found, is the only one known that furnishes positive information as to the arrangement of the dermal plates; an articulated skeleton of this

same genus, together with a life-size restoration made for the St. Louis Exposition in 1904, constitutes a unique representation of this curious armored dinosaur.

Three skeletons of the mastodon race of proboscidians, a male and a female of *Mastodon americanus* from the Pleistocene, and a skeleton of *Stegomastodon arizonae* from the Pliocene of Arizona are adequate examples of this important group of animals.

The outstanding addition to the collection, especially as it relates to time and money expended, is the skeleton of *Diplodocus longus* from the Dinosaur National Monument in Utah. The work of collecting this specimen occupied the energies of 5 men for 4 months to quarry out, transport, box, and ship the 26 tons of rock-enclosed bones. From first to last, 2,545 working days were spent on this specimen, which, translated into Government time, means 1 man working steadily for nearly 9 years. It constitutes the most ambitious single piece of exhibition work ever attempted by this Division.

All classes of vertebrates are now represented in the exhibition series, which contains many well-preserved skeletons. Little attempt has been made to bring about a systematic arrangement of these materials, more stress being given to displaying the larger specimens, so as to make them as well as the exhibition halls appear to the best advantage.

With the acquisition of better-preserved specimens, the practice has been followed of retiring inferior materials from time to time. This has added greatly to the attractiveness of the exhibition as a whole, as well as increasing its educational value to the public.

To some extent the exhibition has been embellished by the addition of large canvases depicting the life appearance of various animals in their natural habitat. The more important of these are: A restoration (8 by 15 feet) of *Triceratops* by Charles R. Knight, W. K. Stone, and Joseph Gleeson; a restoration of *Camarasaurus* by R. Bruce Horsfall; and a restoration of *Dimetrodon* and other Permian reptiles by Garnet W. Jex. A diorama returned from the Dallas Exposition depicts some of the animals of the Jurassic period in their natural environment. Other illustrative materials consisting of model restorations of various animals, done by Knight, Lull, Gidley, and Gilmore, serve as an aid to visitors in visualizing the probable appearance in life of these long extinct animals.

TABLE 2.—*Chronological list of mounted fossil skeletons in the U. S. National Museum*

MOUNTED IN THE NATIONAL MUSEUM

Skeleton	Year	Mounted by—
1. *Megaceros hibernicus* Owen	1872	
2. *Hesperornis regalis* Marsh	1901	J. W. Scollick, remounted by N. H. Boss, 1911.
3. *Thespesius* (*Trachodon*) *annectens* Marsh (type).	1903	Alban Stewart.
4. *Mastodon americanus* (Kerr)	1903	Do.
5. *Triceratops elatus* Marsh	1905	C. W. Gilmore and N. H. Boss.
6. *Ursus spelaeus*	1905	N. H. Boss, remounted by T. J. Horne, 1913.
7. *Merycoidodon gracilis* Leidy	1906	C. W. Gilmore.
8. *Dinornis maximus* Geoffroy	1907	N. H. Boss.
9. *Ceratosaurus nasicornis* Marsh (type).	1910	C. W. Gilmore and N. H. Boss.
10. *Camptosaurus browni* Gilmore (type).	1911	C. W. Gilmore.
11. *Camptosaurus nanus* Marsh (type).	1911	N. H. Boss.
12. *Basilosaurus cetoides* (Owen)	1912	J. W. Gidley and W. H. Wade.
13. *Diceratherium cooki* (Peterson)	1912	T. J. Horne.
14. *Teleoceras fossiger* Cope	1912	Do.
15. *Stegosaurus stenops* Marsh (type)	1913	N. H. Boss and C. V. Bressler.
16. *Kentriodon pernix* Kellogg (type)	1914	N. H. Boss.
17. *Thescelosaurus neglectus* Gilmore (type).	1914	N. H. Boss and C. V. Bressler.
18. *Epigaulus hatcheri* Gidley (type)	1915	T. J. Horne.
19. *Gulo luscus* (Linnaeus)	1915	Do.
20. *Aenocyon dirus* (Leidy)	1915	Do.
21. *Platygonus cumberlandensis* Gidley.	1915	Do.
22. *Mastodon americanus* (Kerr)	1916	Do.
23. *Sinopa grangeri* Matthew (type)	1917	Do.
24. *Stegosaurus stenops* Marsh	1917	Do.
25. *Dimetrodon gigas* Cope	1918	Do.
26. *Tylosaurus proriger* Cope	1919	N. H. Boss.
27. *Brachyceratops montanensis* Gilmore (type).	1920	Do.
28. *Brontotherium hatcheri* Osborn	1920	T. J. Horne.
29. *Euarctos vitabilis* Gidley	1921	Do.
30. *Saniwa ensidens* Leidy (type)	1922	N. H. Boss.
31. *Glyptotherium arizonae* Gidley (type).	1922	T. J. Horne.
32. *Bison occidentalis* Lucas	1923	N. H. Boss.
33. *Diceratherium* (slab)	1923	Do.
34. *Stegomastodon arizonae* Gidley (type).	1924	T. J. Horne.
35. *Protostega gigas* Cope	1926	N. H. Boss.
36. *Portheus molossus* Cope	1926	T. J. Horne.
37. *Diplodocus longus* Marsh	1931	N. H. Boss, T. J. Horne, and J. M. Barrett.
38. *Hyrachyus eximius* Leidy	1934	N. H. Boss.
39. *Helaletes nanus* Marsh	1934	Do.
40. *Trigonias osborni* Lucas	1934	T. J. Horne.
41. *Moropus elatus* Marsh	1936	Do.
42. *Platygonus pearcei* Gazin (type)	1936	N. H. Boss.
43. *Scarritia canquelensis* Simpson	1937	Do.
44. *Plesippus shoshonensis* Gidley (stallion).	1938	T. J. Horne.
45. *Polyglyphanodon sternbergi* Gilmore.	1938	N. H. Boss.

TABLE 2.—*Chronological list of mounted fossil skeletons in the U. S. National Museum*—Continued

Skeleton	Year	Mounted by—
46. *Plesippus shoshonensis* Gidley (mare).	1939	T. J. Horne.
47. *Plesippus shoshonensis* (half grown).	1939	Do.
MOUNTED ELSEWHERE		
48. *Hoplophoncus robustus* Adams (type)		Adam Hermann, A. M. N. H.
49. *Stenomylus hitchcocki* Loomis	1919	A. Augustina, C. M.
50. *Gorgosaurus libratus* Lambe		Peter Kaisen, A. M. N. H.
51. *Merycodus necatus* Leidy		P. C. Orr, F. M. N. H.
52. *Ichthyodectes hamatus* Cope		G. F. Sternberg.
53. *Emeus crassus* Owen		
54. *Emeus crassus* Owen		
55. *Stenomylus hitchcocki* Loomis		Hugh Gibb, P. M. N. H.

CATALOGS

The catalog system first used by the Museum was that devised in April 1839 by Professor Baird at Carlisle, Pa., while engaged in work upon his private collection of birds. When he became Assistant Secretary of the Smithsonian Institution in 1850, his system was adopted for the Government collections.

When cataloging was first begun it was found more convenient to keep the records of the several collections in one book, although as pointed out by Mr. Geare [23] the catalog for the skeletons, including both recent and fossil, was started in 1840.

This double arrangement was continued through the first four volumes of this series as follows:

Vol. I, Nos. 1 to 3,500 original and copy in the Division of Mammals. Covers the period between 1840 and 1859.

Vol II, Nos. 3,501 to 8,850, original and copy in the Division of Mammals. Covers the period between March 12, 1859, to May 1869.

Vol. III, Nos. 8,851 to 15,800, original in the Division of Mammals. Covers the period between May 1869 to December 1877.

Vol. IV, Nos. 14,501 to 18,330, original in the Division of Mammals. Covers the period between December 1879 to October 26, 1888.

It will be noted that the entries in the fourth volume duplicate 1,299 numbers of the preceding volume. Examination of the original volumes shows that the entries also were repeated, so that there is no actual duplication of catalog numbers.

[23] Geare, R. I., Museum catalogues, Ann. Rep. U. S. Nat. Mus. for 1889, p. 8, 1891.

With the closing of this volume a new system was put into effect, the fossil specimens being entered in a separate book, designated as Volume VII. This was the current catalog for the "Department of Vertebrate Fossils." The entries begin at 30,701, and on March 26, 1891, when the book was discontinued, they had been carried as far as No. 31,025. This volume is now in the custody of the Division of Vertebrate Paleontology. Many of these numbers still remain on the specimens, in addition to the current catalog numbers.

In 1889 a card catalog was started by F. A. Lucas of all the vertebrate fossils belonging to the Museum collections that had been entered in the earlier volumes of this series.

On November 21, 1891, a new system of cataloging vertebrate fossils was inaugurated. The entries commenced with No. 1 and continued consecutively, with 5,000 entries to the volume. This method has been continued up to the present time, the numbers now reaching 16,591. All those specimens deemed worthy of retention in the collections that were entered in the earlier volumes were included here, but each was assigned a new catalog number.

Some time after 1903 (the exact date is not known), the entries in the catalog books were supplemented by duplicate cards for each entry; these cards were filed in an alphabetical and a zoological series under each class of vertebrates, as Pisces, Amphibia, Reptilia, Aves, and Mammalia. This arrangement makes it possible to get information regarding a specimen in different ways. If the catalog number only is available, the volume carrying the corresponding number should be consulted; if the name only is available then the alphabetical list is the most direct means. If information is desired as to available material in a group, the zoological series gives it.

The first entry to be made in the current system is "No. 1, *Mosasaur* tooth, collected by W. S. Yates, February 11, 1881, in Greene County North Carolina." The first entry of a vertebrate fossil in any of the catalogs was in Volume I, "No. 929, Fossil Seal, Cast of bone of hand, from Dr. Jeffries Wyman, entered in 1852."

Cards of type specimens have the original citation, and a red star is placed in the upper right corner; in the case of plesiotypes or figured specimens a blue star is similarly placed on the card with the citation.

THE PRINCIPAL ACCESSIONS TO THE DIVISION OF VERTEBRATE PALEONTOLOGY TO THE CLOSE OF THE YEAR 1940

The following list of accessions, arranged in chronological order, includes only those collections or specimens that have been of importance in building up the Division of Vertebrate Paleontology or

are associated with its history. The records of the early years are unfortunately incomplete, but most of the specimens of this period were inferior in quality of preservation. This list has been to a great extent compiled from the annual reports, and since the fiscal year (introduced in 1885) runs from July 1 to June 30 of the following year, many of the specimens and collections may have been collected or acquired in the calendar year preceding the annual report dates used here.

1850

A small lot of Oligocene Mammalia from the "Mauvaises Terres," or Badlands, of Dakota Territory was collected for the Smithsonian Institution by Thaddeus A. Culbertson. This collection, with other materials, formed the basis of Dr. Joseph Leidy's report "The Ancient Fauna of Nebraska" (Smithsonian Contr. Knowl., vol. 6, No. 58, 126 pp., 1853).

1851

A collection of fossil vertebrates from the Badlands of Dakota Territory was presented by Capt. Stewart Van Vliet, U. S. Army. Plaster cast of a fossil seal bone from Maryland was presented by Dr. Jeffries Wyman.

1853

Vertebrate remains from the exploring expeditions under the direction of Dr. David Dale Owen were deposited by the Commissioner of the United States Land Office. It is quite certain that these specimens were the ones collected by Dr. John Evans in 1849 and 1853 from the Oligocene of the Badlands of Dakota Territory.

1855

Shark teeth and mastodon bones from the Pleistocene of Florida were presented by Capt. John C. Casey, United States Army. Mrs. Mary Hereford presented bones of "Zeuglodon" from a marl bed in Calvert County, Md.

1858

The bulk of the collections of the National Institute was transferred to the Smithsonian Institution. See page 311 for list of fossil specimens.

1859

The type specimen of *Dystrophaeus viaemalae*, collected by Dr. J. S. Newberry of the Macomb Expedition from the Jurassic of southern Utah, was deposited by the War Department (Cope, E. D., Proc. Amer. Philos. Soc., vol. 16, p. 581, 1877).

1860

Pleistocene fossils from Canada were presented by Prof. J. W. Dawson. A horse tooth from Big Bone Lick was presented by the Hon. Robert Mallory.

1861

An important collection of fossil fishes from Mount Blanc was received from A. Repetti.

1864

Tooth of mastodon from Kansas was presented by Lt. Edwin T. Berthoud, United States Army. A box of Lias fossil ganoid fishes from Barrow, Leicestershire, England, was presented by E. D. Cope. An elephant tooth from Las Vegas, N. Mex., was presented by Andres Dold.

1866

A lower molar tooth of *Elephas columbi* from the Pleistocene, Petite Anse, Iberia Parish, La., was presented by J. F. Clew (Hay, O. P., Carnegie Inst. Washington Publ. 322a, p. 57, 1924).

1867

Col. C. S. Bulkley, Overland (Western Union) Telegraph Expedition, presented a tusk of the mammoth *Elephas primigenius* from Bering Strait, Alaska. Miocene fossils from Maryland were presented by O. N. Byron; a vertebra of a fossil saurian from Aquia Creek, Va., was presented by E. A. Dayton; and bones of a mastodon from Buenos Aires, Argentina, were presented by H. R. Helper.

1868

A complete skeleton of *Megaceros hibernicus*, "Irish elk," from the peat bogs of Ireland, was purchased, and a fine head with antlers of the same animal was received as a gift from O. C. Marsh.

1869

Among the donations were: One box of fossil bones and teeth from Wyoming Territory presented by Dr. Charles H. Alden, U. S. Army; one box of fossils and minerals from Fort Bridger, Wyoming Territory, from J. V. Carter; teeth of fossil horse from Illinois presented by Mr. Dille; one box of prehistoric remains from France sent by Prof. E. Lartet; saurian remains from New Mexico, presented by Dr. W. B. Lyons; teeth and bones of mastodon from the Pleistocene of Florida presented by Peter Nelson; tooth of *Equus complicatus* and bones of a young mastodon from Washington County, Va., presented by Wyndham Robinson (Hay, O. P., Carnegie Inst. Washington Publ. 322, pp. 113, 189, 1923). A collection of fossil bones from Mount Pikermi, Greece, was received from the Museum of Natural History, Athens, Greece.

1870

Prof. Charles F. Himes presented a collection of bones from Carlisle bone cave, Pennsylvania. Dr. Carl Hermann Berendt donated a fossil fish from Mexico. Dr. J. A. Fitzgerald presented teeth from Indian Territory (Oklahoma). Horatio N. Pease presented a tooth of fossil cetacean from Gay Head, Mass., and Andrew Sherwood presented Devonian fish remains from Pennsylvania.

1871

A cast of the giant sloth *Megatherium cuvieri* from South America was presented by Prof. Henry A. Ward. Casts of the gigantic turtle *Colossochelys atlas* and of a South American glyptodont (*Schistopleurum typus*) were purchased. The last mentioned is still on exhibition; the others have been discarded. George H. Lewis presented an incomplete turtle from Atlantic City, Montana Territory.

1872

One box of fossil bones from Sonora, Mexico, was presented by Gen. James H. Carleton. A model of the Irish elk was placed on deposit by Waterhouse Hawkins. A tooth of *Ptychodus* was presented by G. H. Kalteyer.

1873

The Canterbury Museum at Christ Church, New Zealand, through its director, Julius Haast, presented a collection of moa bones, among which were skeletons of *Dinornis giganteus* and *Palapteryx elephantopus* and leg bones of *Dinornis gracilis*, *D. casuarius*, and *D. didiformis*.

1874

A cast of the skull of *Odontopteryx toliapica* was presented by Bryce M. Wright. From the Wasatch and Miocene of New Mexico, an important collection of fossils was transferred by the War Department. These specimens were collected by H. C. Yarrow and E. D. Cope of the United States Geographical Survey West of the One-hundredth Meridian in charge of Lt. George M. Wheeler. The collections were described by Cope in the report of that expedition, vol. 4, 1877. The Heidelberg University Museum, through Professor Pagenstecher, presented a skeleton of *Halitherium schinzi*.

Fossil bones from Florida were presented by N. B. Moore. L. G. Yates presented a cast of the teeth of a mastodon from Solano County, Calif. (Hay, O. P., Carnegie Inst. Washington Publ. 322b, p. 11, 1927).

1875

Donations included specimens of fossil teeth and bones from Badito, Colo., by F. W. Fouch; cast of shark's tooth, by Clark Mills; cast of fossil tooth from Iowa, by Dr. C. A. White; and a fossil fish from Wyoming Territory, by J. W. A. Wright.

1876

A collection of fossil bones from the Miocene of Oregon was presented by S. S. Davis and William Day; a plaster cast of the Cahoes mastodon (lower jaw), New York, by Dr. James Hall; fossil bones and teeth from Nebraska by Sgt. J. A. Leigh, U. S. Army; and a fossil bone from Texas by Brownson & Co.

1877

The following donations were received: A collection of bones from a cave in Ohio from W. Anderson; portions of mammoth tusk from Seth Beach; jaw of fossil *Macropus* from Queensland from Dr. Bennett; a collection of bones from a cave near Hagerstown, Md., through Prof. Charles F. Himes; fossil bones from Wyoming from F. Hirst; a fossil fish from California from Otis T. Mason; tooth of *Equus occidentalis* from West Virginia from R. F. Taggart.

1878

Donations were as follows: Box of fossil fishes from Connecticut from J. H. Clarke; two fossil horse teeth from C. H. Horod; plaster cast of elephant tusk found near Copenhagen, N. Y., from Dr. F. B. Hough; teeth of fossil elephant, horse, and shark from Bull River, S. C., from J. W. Quinlion.

1879

Plaster cast of the femur of *Atlantosaurus immanis* was presented by O. C. Marsh.

1880

A large series of mammal and some reptilian materials collected in the Badlands of South Dakota were received from Capt. Emmet Crawford, U. S. Army. These were forwarded to O. C. Marsh for investigation. A skull of *Castoroides ohioensis* from the Pleistocene of Michigan was received in exchange with Prof. J. Kost, of Adrian College (Hay, O. P., Carnegie Inst. Washington Publ. 322, p. 275, 1923).

1881

An important collection of Pliocene Peace Creek fossils from near Arcadia, De Soto County, Fla., was presented by J. F. La Baron. The collection was described by Dr. J. Leidy (Trans. Wagner Free Inst., vol. 2, 1889). The type of *Procyon simus* from the Pleistocene of California was collected and presented by L. Stone (Gidley, J. W., Proc. U. S. Nat. Mus., vol. 29, pp. 553–554, 1906).

1882

Donations included: Vertebra of a whale, Miocene, Stafford Cliffs, Va., presented by H. C. Harmon; fossil bones and teeth from Beaufort, S. C., from Mrs. J. E. Jouett; plaster cast of *Rhamphorhynchus phyllurus* showing wing membrane was presented by O. C. Marsh; a box of fossil mammals, *Myodes* and *Lagomys*, from Germany from Prof. A. L. Nehring; and a vertebra of a whale from Patuxent River, Md., from T. J. Stone.

1883

A valuable collection of bones and relics from Kent's Cavern, near Lamorna Torquay, England, as a gift from Lord Holdon, received through William Pengelly, who was asked to prepare a treatise on this subject to be published by the Smithsonian Institution. Other donations were a tooth of *Equus caballus* from South Carolina, from J. P. Caldwell; two boxes of mastodon, *Equus*, and *Mylodon* bones from New Iberia, La., from William Crooks (Leidy, Joseph, Proc. Acad. Nat. Sci. Philadelphia, 1884, p. 22; Trans. Wagner Free Inst., vol. 2, pp. 35, 1889); fossil fishes from Ohio from R. N. Fearson; a fossil bone, tooth, and rib from Tampa Bay, Fla., from Elias Hempstead.

1885

A collection of 20 species of Pleistocene animals from near Whitesburg, Hamblen County, Tenn., collected by Ira Sayles (Hay, O. P., Proc. U. S. Nat. Mus., vol. 58, p. 85, 1921).

1886

A collection of 72 large boxes of fossil vertebrates, a portion of the Marsh collection, was transferred to the Museum by the United States Geological Survey. Bones and teeth of a *Mastodon* from the Pleistocene of Kansas were presented by Dr. A. G. Chase.

1887

A small collection of Pleistocene fossils from near Rogersville, Tenn., was presented by James W. Rogan (Hay, O. P., Proc. U. S. Nat. Mus., vol. 58, p. 83, 1921).

1888

A small collection of Oligocene vertebrates, including *Testudo oweni*, type of *Testudo culbertsoni*, *Archaeotherium mortoni*, *Rhinoceros* sp., and *Oreodon culbertsoni* (Owen's Report of the Geological Survey of Wisconsin, Iowa, and Minnesota, 1852) was deposited by Indiana State University.

A small collection of tortoise and bird bones from Mascarene Islands was received in exchange with the Museum of Cambridge University, Cambridge, England. A skull of *Thoracosaurus neocesariensis* from the Cretaceous, Aquia Creek, Va., was presented by Nelson C. Page.

1889

A plaster cast of the skeleton of *Phenacodus primaevus* was purchased from E. D. Cope; a collection of the fossil fish *Leuciscus turneri* from the Miocene of Esmeralda County, Nev., was transferred by the United States Geological Survey (Lucas, F. A., Proc. U. S. Nat. Mus., vol. 23, pp. 333–334, 1900).

1891

A partial skull of *Bison latifrons* from the Pleistocene of the Willalacoochee River, Fla., was presented by Gen. L. W. Colby (Hay, O. P., Proc. U. S. Nat. Mus., vol. 21, p. 767, 1898).

1892

A most important accession was a collection of 380 prepared specimens, a second consignment from the Marsh collection, transferred by the United States Geological Survey. It contained three ceratopsian skulls, including the type of *Triceratops elatus* (Marsh, O. C., Amer. Journ. Sci., vol. 42, p. 265, 1891), from the Lance, Upper Cretaceous, of Wyoming; a series of 10 titanothere skulls representing several genera from the Oligocene of Nebraska and South Dakota; skulls and other remains of *Teleroceras fossiger* from the Pliocene of Long Island, Kans.; and a few other Tertiary fossils and some rare casts.

A collection of mammalian fossils from the estate of Joseph Leidy was transmitted as a gift by the United States Geological Survey.

1893

A small collection of mammalian specimens collected by Frank Burns from the Miocene of Maryland and Virginia was transmitted by the United States Geological Survey.

1894

The most important accession was a collection of *Basilosaurus cetoides* specimens made for the Smithsonian Institution by Charles Schuchert from the Jackson, Upper Eocene, of Choctaw County, Ala.:

Skull and lower jaws; a series of 24 dorsal vertebrae, 15 dorsal ribs, sternal bones of a second individual, and numerous other bones (Kellogg, R., Carnegie Inst. Washington Publ. 482, pp. 7–20, 1938). A skull of *Castoroides ohioensis* from the Pleistocene near Logansport, Ind., was presented by L. S. McFadin (Lyon, Marcus W., Amer. Midl. Nat., vol. 17, No. 1, figs. 81, 82, 1936). The type skull and lower jaw of *Mesoteras kerrianus* (Cope, E. D., Amer. Nat., vol. 4, p. 128, 1870) were presented by the State Museum of North Carolina.

1895

A skull of *Portheus molossus* from the Niobrara, Upper Cretaceous, of Kansas was received in exchange from Edward E. Howell; a skull of *Bison* from the Pleistocene of Kansas was presented by Dr. A. G. Chase; a skeleton of *Ichthyosaurus quadricissus* from the Jurassic of Lyme Regis, England, was received in exchange with the Wagner Free Institute.

Other accessions for this year were: Cast of the skeleton of *Pelagosaurus typus*, in exchange with the University of Caen, France; plaster casts of the skull of *Ichthyosaurus platyodon;* a skull of *Elephas ganesa;* a skeleton of *Plesiosaurus dolichoderius;* a skeleton of *Plesiosaurus macrocephalus*, purchased from Ward's Natural Science Establishment; casts of vertebrate specimens received in exchange with the La Plata Museum, Argentina; skull of *Toxodon*, skull of *Trigodon*, skull and jaw of *Nesodon*, jaw of *Nesodon*, skull and jaw of *Propalaeohoplophorus*, skull of *Dasypotherium*, femur, tibia, and fibula of *Brontornis;* skull of *Onohippidium* and deformed skull of *Astrapotherium;* 22 casts of mammalian specimens from the Paris Basin, received in exchange with the Museum of Natural History, Paris; the sixth installment of the Lacoe collection contained three boxes of fossil fishes.

An important collection of 28 Triassic fishes from Massachusetts, collected by S. Ward Loper, was received as a gift from the United States Geological Survey.

1896

The most important accession acquired this year was the Lacoe collection of fossil plants and invertebrates, which included 408 fish, amphibian, and reptilian specimens received as a gift from the heirs of R. D. Lacoe. Among the vertebrates the Tertiary was represented by specimens from the Green River of Wyoming and from Switzerland; Triassic by specimens from the Appalachian region; Paleozoic by specimens from Great Britain, France, and the coal fields of Ohio, Pennsylvania, and Mazon Creek, Ill. Many of the Ohio specimens are now unique, since further specimens cannot be obtained because of the exhaustion of the coal mines.

An important lot of *Basilosaurus cetoides* remains, including the types of *Pterosphenus schucherti* (Lucas, F. A., Proc. U. S. Nat. Mus., vol. 21, p. 637, 1898) and *Hadrianus schucherti* (Hay, O. P., Proc. U. S. Nat. Mus., vol. 22, p. 22, 1899), was collected for the Museum from the Jackson (Eocene) of Alabama by Charles Schuchert. This material supplemented the collection made in 1894, and from the two collections a skeleton was mounted for exhibition (Gidley, J. W., Proc. U. S. Nat Mus., vol. 44, p. 649, 1913; also described by R. Kellogg, Carnegie Inst. Washington Publ. 482, 1936). In exchange with Dr. H. Credner, a collection of amphibians came from near Dresden, Germany.

1897

A fine example of a fossil ray, *Xiphotrygon acutidens*, from the Green River shales of Wyoming was purchased from R. L. Craig.

The types of *Heterodontosuchus ganei* from the Triassic of southern Utah, and of *Dinictis major* from the Oligocene of western Nebraska, described by F. A. Lucas (Amer. Journ. Sci., ser. 4, vol. 6, pp. 399–400, 1898), were transferred from the United States Geological Survey.

1898

An important collection of fossil fishes made by the Hayden surveys of 1870, 1872, and 1873 and by A. C. Peale in 1877, and retained by E. D. Cope for study and description, was returned by the executors of his estate. This collection of 175 specimens, principally from the Eocene, Green River, shales of Wyoming, contained a large number of type and figured specimens. These were described by Cope (principally in Rep. U. S. Geol. Surv. Terr., vol. 3, 1884).

A skull and lower jaws, with associated fore limbs and feet and skin impressions, of *Thespesius annectens*, from the Lance, Upper Cretaceous near Forsyth, Mont., were purchased from Robert Butler. The skin impressions were described by J. B. Hatcher (Ann. Carnegie Mus., vol. 1, p. 130, fig. 1, 1901) as *Claosaurus*.

The type specimen of *Hoplitosaurus marshi* collected by N. H. Darton from the Lakota sandstone, Upper Cretaceous, near Buffalo Gap, South Dakota, was transferred by the United States Geological Survey (Lucas, F. A., Proc. U. S. Nat. Mus., vol. 23, pp. 591, 592, pls. 23, 24, 1901).

Two carloads of vertebrate fossils (part of the Marsh collection) were received from the Marsh laboratories in New Haven, Conn., as a transfer from the United States Geological Survey.

An important collection of 138 Paleozoic shark spines and teeth from near Keokuk, Iowa, was purchased from Lisbon Cox.

1899

A well-preserved skull of *Hyracodon nebrascensis* from the Oligocene was presented by A. W. Barber. A small collection of mammalian specimens from the Oligocene, near Oelrick, S. Dak., made by N. H. Darton was transmitted by the United States Geological Survey. It contained a nearly complete skeleton of *Merycoidodon gracilis* (Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 31, pp. 513–514, 1907). A collection of fish remains from the Niobrara, Upper Cretaceous of Kansas, was presented by Dr. A. B. Baker. The type skull of *Ursus procerus* (Miller, G. S., Jr., Proc. Biol. Soc. Washington, vol. 13, pp. 53–56, 1899) from the Pleistocene of Ohio was presented by W. G. Roberts.

1900

Final consignment (5 carloads) of the Marsh collection of fossil vertebrates, consisting of 590 boxes and crates, having a total weight of 80 tons and a roughly estimated valuation of $150,000, was transferred by the United States Geological Survey. This consignment was received in 1899 but not accessioned until 1900. A skeleton of *Lepidosteus atrox* from the Eocene of Wyoming was presented by Charles Schuchert. A collection of phytosaurian materials made by Barnum Brown, including the types of *Placerias hesternus* and *Metoposaurus fraasi* (Lucas, F. A., Proc. U. S. Nat. Mus., vol. 27, pp. 193–195, 1904), from the Triassic of Arizona, was transmitted by the United States Geological Survey.

A skull of *Archaeotherium mortoni* from the Oligocene of South Dakota was purchased from L. W. Stilwell.

1901

A well-preserved skeleton of *Hesperornis regalis* from the Niobrara formation, Upper Cretaceous, of Kansas, was purchased from Handel T. Martin. This specimen was mounted for exhibition (Lucas, F. A., Smithsonian Misc. Coll., vol. 45, p. 95, 1903); a small collection of bird bones, including the types of *Puffinus eyermani* and *Tantalus milne-edwardsi* (Shufeldt, R. W., Proc. Acad. Nat. Sci. Philadelphia, 1896, p. 511), from the Middle Miocene of France, was presented by Robert W. Shufeldt.

A skeleton of *Mastodon americanus*, a female, from the Pleistocene found near Church, Hillsdale County, Mich., was purchased (Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 30, p. 610, 1906).

A skull and one tusk, the type of *Elephas roosevelti*, from the Pleistocene, found near Ashland, Cass County, Ill., were purchased (Hay, O. P., Proc. Biol. Soc. Washington, vol. 35, p. 101, 1922).

1902

Accessions included a collection of teeth of *Camelops*, *Symbos*, *Mammut americanum*, *Elephas columbi*, and *E. imperator* from the Pleistocene in a spring near Afton, Okla., made by W. H. Holmes (Hay, O. P., Proc. U. S. Nat. Mus., vol. 58, p. 117, 1921; Indiana Geol. Surv., vol. 26; Iowa Geol. Surv., vol. 23).

Plaster casts of five restorations of the heads of as many genera of Brontotheres were received in exchange with the American Museum of Natural History.

1903

Teeth of *Mastodon humboldti* and *M. cordillerum* and plaster casts of mandibular rami were received in exchange with the British Museum of Natural History.

A slab of sandstone showing Pennsylvanian footprints from Mount Carbon, Pa., was presented by Dr. H. J. Herbein. A tooth of *Cladodus formosus* from Needle Mountain quadrangle, collected by Dr. Whitman Cross, was transferred by the United States Geological Survey.

1904

A complete skeleton of *Rhamphorhynchus gemmingi* showing impressions of the wing and tail membranes (Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 30, 1906) and fossil fishes of the genera *Aspidorhynchus*, *Caturus*, *Squatina*, *Hypsocormus*, *Pholidophorus*, and *Gyrodus*, from the Upper Jurassic near Eichstatt, Germany, were purchased from Fritz Ehrensberger. Complete skeletons of *Stenosaurus bollensis* and *Ichthyosaurus quadricissus* from the Lias of Württemberg, Germany, were purchased from F. Krantz.

A skull of *Bison alleni* with horn and external sheaths, from the Pleistocene near Rampart, Alaska, was presented by D. McLean (Hay, O. P., Proc. U. S. Nat. Mus., vol. 46, p. 182, 1914).

1905

A small collection of mammalian specimens from the Wasatch, Eocene, of the Big Horn Basin, Wyo., made by Dr. C. A. Fisher was transferred by the United States Geological Survey. A collection of Pleistocene mammals from Alaska, made by A. G. Maddren, was transferred by the Smithsonian Institution (Maddren, A. G., Smithsonian Misc. Coll., vol. 49, pp. 1–117, 1908).

1906

The most important acquisition of this year was a beautifully preserved skeleton of *Sinopa grangeri* (Matthew, W. D., Proc. U. S. Nat.

Mus., vol. 30, pp. 203–233, 1906) and specimens of *Amyda aequa* (Hay, O. P., Carnegie Inst. Washington Publ. 75, pp. 517–519, 1908) from the Eocene, Bridger formation of Wyoming. These were transferred by the United States Geological Survey.

A musk-ox skull from the Pleistocene of Yukon Territory was presented by J. B. Terrell through Dr. W. H. Osgood, who subsequently described it as the type of *Symbos terrelli* (Smithsonian Misc. Coll., vol. 48, pp. 173–183, 1905).

A second musk-ox skull (*Gidleya zuniensis*) from the Pleistocene of New Mexico was presented by the Department of the Interior. It was originally described by Dr. J. W. Gidley as *Liops* (Proc. U. S. Nat. Mus., vol. 30, pp. 165–167, 1906).

1907

Plaster casts of the skeleton of *Pareiasaurus baini* and other reptilian skulls, all from the Karoo Beds of South Africa, were received in exchange from the British Museum of Natural History. A specimen of *Lepisosteus simplex* from near Cody, Wyo., was presented by Jeremiah Ahern. The type of *Echmatemys rivalis* (Hay, O. P., Proc. U. S. Nat. Mus., vol. 35, pp. 164-166, 1908) from Wasatch, Eocene of Wyoming was transferred by the United States Geological Survey.

1908

An important collection of 99 United States and South American vertebrate specimens was received in exchange with the American Museum of Natural History in settlement of a claim for certain Government-owned specimens that were retained in the Cope collection when it went to that institution. This collection contained many rare species, including the type mounted skeleton of *Hoplophoneus robustus* (Adams, G. I., Amer. Nat., vol. 30, p. 49, 1896) from the Oligocene of South Dakota, and a skull and jaws of *Uintatherium mirabile* from the Washakie (Eocene) of Wyoming.

The Hambach collection, assembled by the late Prof. Gustav Hambach, was presented by Frank Springer. Although consisting primarily of invertebrate fossils it also contained a considerable number of Paleozoic fish remains, some reptiles and mammals from this country and abroad, as well as a few from the Shumard collection, which Professor Hambach had previously acquired.

A collection of Pleistocene mammals made by Charles W. Gilmore for the Smithsonian Institution in Alaska in 1907 (Gilmore, C. W., Smithsonian Misc. Coll., vol 51, pp. 1-38, 1908); skulls of *Bison crassicornis* (Hay, O. P., Proc. U. S. Nat. Mus., vol. 46, pp. 179-183, 1914); and a musk-ox skull the type of a new species *Ovibos yukon-*

ensis (Gidley, J. W., Proc. U. S. Nat Mus., vol. 34, pp. 681-683, 1908) were the outstanding specimens.

A fossil turtle from the Niobrara (Upper Cretaceous) of Kansas was purchased from Charles H. Sternberg. It was subsequently described by O. P. Hay as the type of *Toxochelys stenopora* (Proc. U. S. Nat. Mus., vol. 36, p. 191, 1909).

A lower jaw of *Equus occidentalis* from the Pleistocene of Nevada was presented by C. A. Gaby. A natural cast of a chimaeroid egg case collected by N. H. Darton from the Montana, Upper Cretaceous of Wyoming, was transferred by the United States Geological Survey. Five fossil fishes from Ceara, Brazil, were presented by David Starr Jordan. A cast of the skull of *Zeuglodon hydrarchus* [= *Zygorhiza kochii*] was received in exchange with Teyler's Museum, Haarlem, Netherlands.

The types of *Delphinodon dividum* (True, F. W., Journ. Acad. Nat. Sci. Philadelphia, vol. 15, pp. 165-194, 1912) and *Psephophorus calvertensis* (Palmer, William, Proc. U. S. Nat. Mus., vol. 36, pp. 369-373, 1909) and other Miocene vertebrates from the Calvert formation of the Chesapeake Bay region were collected and presented by William Palmer.

1909

A collection of 300 specimens from the Fort Union (Paleocene) of Sweet Grass County, Mont., containing many new and little-known mammalian forms and the type of *Hoplochelys caelata* (Hay, O. P., Proc. U. S. Nat. Mus., vol. 35, pp. 163–164, 1908), was made for the Museum by A. C. Silberling. A woolly rhinoceros skull from the Pleistocene of Russia was purchased from E. Pfizenmayer. Two accessions comprising a very considerable and interesting series of Cretacean remains from the Miocene of Calvert Cliffs, Calvert County, Md., were presented by Frederick W. True.

The type specimen of *Lissoprion ferrieri* (Hay, O. P., Science, new ser., vol. 26, pp. 22–24, 1907) from the Upper Carboniferous of Idaho was presented by W. F. Ferrier. A partial skeleton of *Glyptodon petaliferus* from the Pliocene of Texas was presented by O. S. Shelton (Hay, O. P., Proc. U. S. Nat. Mus., vol. 51, p. 107, 1916).

1910

The Fort Union collections from Montana were augmented by 70 additional specimens, collected by James W. Gidley and A. C. Silberling, working under the auspices of the United States Geological Survey. A further contribution was made by the Geological Survey in a small collection of turtles made by James W. Gidley and James H.

Gardner from the Upper Cretaceous of the San Juan Basin of New Mexico (Hay, O. P., Proc. U. S. Nat. Mus., vol. 38, pp. 307–326, 1910).

A complete crocodile skull and lower jaws described by Charles W. Gilmore as the type of *Leidyosuchus sternbergi* (Proc. U. S. Nat. Mus., vol. 38, pp. 485–502, pls. 23–29, 1910) from the Lance, Upper Cretaceous, and a complete skull and neck of *Clidastes velox* from the Niobrara formation, Upper Cretaceous of Kansas were purchased from Charles H. Sternberg. A plaster cast of the rhynchocephalian reptile *Homoeosaurus maximiliani* was purchased.

1911

A third addition to the collection of Fort Union mammals was made by purchase of 55 specimens from A. C. Silberling. A second consignment of 20 mammal and reptile specimens from the American Museum of Natural History completed the exchange for the Cope materials; of the specimens transmitted a partial skeleton of *Dimetrodon incivius* and a skull of *Eryops* from the Permian of Texas are worthy of special mention. Plaster casts of the skull of *Camptosaurus nanus* and of the epidermis of a hadrosaurian "mummy" constituted a second exchange with this same institution. A molar tooth of *Elephas columbi* from Placita, N. Mex., was presented by E. D. Cope (Proc. Acad. Nat. Sci. Philadelphia, 1874, p. 221).

1912

Type and figured specimens described by E. D. Cope (Proc. Acad. Nat. Sci. Philadelphia, vol. 21, p. 192, 1869) constituted the outstanding accession of this year. The types were of *Polydectes biturgidus*, *Hadrosaurus tripos*, and *Hypsibema crassicauda*, all from the Upper Cretaceous of North Carolina. They were deposited by the North Carolina Department of Agriculture, through H. H. Brimley, curator of the State Museum. A unique type specimen consisting of the jaws and teeth of the extinct shark *Edestus mirus* (Hay, O. P., Proc. U. S. Nat. Mus., vol. 42, pp. 31–38, 1912) from the Carboniferous of Iowa was presented by the Smithsonian Institution.

A composite rhinoceros skeleton (*Diceratherium cooki*), now mounted and on exhibition, from the Lower Miocene of Nebraska was received in exchange with the Carnegie Museum of Pittsburgh. A plaster cast of the hind leg and foot of *Diplodocus carnegii* was received in exchange with this same institution. A turtle, *Stylemys nebrascensis*, from the Oligocene of Wyoming was purchased from Charles H. Sternberg. A lower right molar of *Elephas columbi* from Tama, Iowa, was presented by Fred Herschel (Hay, O. P., Iowa Geol. Surv., vol. 23, p. 447, 1912).

The type specimen of *Neurankylus wyomingensis* from the Upper Cretaceous of Wyoming was transferred by the United States Geological Survey (Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 56, p. 113, 1920).

1913

The Fort Union collection from Montana was further increased by the purchase of 400 specimens from the collector A. C. Silberling (Simpson, G. G., U. S. Nat. Mus. Bull. 169, pp. 1–279, 1937). A most important collection of Pleistocene mammals, representing 22 genera, several of which were new, was made by James W. Gidley from the "Cumberland Cave" near Cumberland, Md. A collection of Pleistocene fossils made by Copley Amory, Jr., for the Museum along the Old Crow River, Yukon Territory, was transferred as a gift from the Smithsonian Institution. It contained a unique specimen, the foot bone of a camel, the first evidence of the former occurrence of this animal north of the Arctic Circle (Gidley, J. W., Smithsonian Misc. Coll., vol. 60, pp. 1–2, 1913). C. P. Snyder presented a skull of *Equus niobrarensis alaskae* (Hay, O. P., Smithsonian Misc. Coll., vol. 61, No. 2, pp. 1–18, 1913) and a mastodon tooth, both from the Pleistocene of Alaska. Cetacean specimens, including the type of *Parietobalaena palmeri* (Kellogg, R., Proc. U. S. Nat. Mus., vol. 63, pp. 1–14, 1924) from the Calvert, Miocene, of the Chesapeake Bay region, were presented by William Palmer and A. C. Weed of the Museum staff.

An upper molar of a mastodon and a skull of *Symbos cavifrons*, both from the Pleistocene of Mason County, Ill., were presented by John Wiedmer (Hay, O. P., Carnegie Inst. Washington Publ. 322, pp. 103–104, 1923).

1914

The important accession of this year was a collection of dinosaur remains collected by Charles W. Gilmore, working under the auspices of the United States Geological Survey, from the Two Medicine formation, Upper Cretaceous, of Montana. Aside from filling an important gap in the collections, this assemblage furnished the type of a new genus and species (*Brachyceratops montanensis*) of the Ceratopsia (Gilmore, C. W., U. S. Geol. Surv. Prof. Pap. 103, pp. 1–38, 1917).

Another installment of Pleistocene fossils from the Cumberland Cave deposit was collected by James W. Gidley. The specimens included a mountable skeleton of *Platygonus cumberlandensis* (Gidley, J. W., Proc. U. S. Nat. Mus., vol. 57, pp. 651–678, 1920), and many good skulls and articulated limbs and feet, in part belonging to genera and species not previously recognized from this locality (Gidley, J. W., and Gazin, C. L., U. S. Nat. Mus. Bull. 171, pp. 1–99, 1938).

A small collection of Pleistocene animal remains from Saltville, Smyth County, Va., was presented by H. D. Mount (Hay, O. P., Carnegie Inst. Washington Publ. 322, pp. 145–352, 1923).

Collecting in the local Miocene field in the cliffs along Chesapeake Bay by William Palmer and Norman H. Boss yielded a complete skull and lower jaws with much of the articulated skeleton of the long-beaked porpoise *Eurhinodelphis bossi*, a beautifully preserved short-beaked porpoise skull (*Kentriodon pernix*), and many parts of these same animals.

Other noteworthy accessions for this year were a well-preserved skull of *Bison alleni* with the horn sheaths and five articulated cervical vertebrae from the Pleistocene of Alaska, purchased (Hay, O. P., Proc. U. S. Nat. Mus., vol. 46, pp. 183–189, 1913); the type of *Crossotelos annulatus*, a Permian amphibian from Oklahoma, received in exchange with Dr. E. C. Case (2d Ann. Rep. Geol. and Nat. Hist. Terr. Oklahoma, p. 15, 1902); and teeth and jaw fragments of the type of *Titanoides primaevus* from the Fort Union of North Dakota, received by transfer from the United States Department of Agriculture through Vernon Bailey (Gidley, J. W., Proc. U. S. Nat. Mus., vol. 52, pp. 431–435, 1917).

1915

A composite skeleton of *Aenocyon dirus* and three skulls and jaws of the same from the famous Rancho La Brea, Pleistocene asphalt deposits, California, were received in exchange with the University of California. A large mosasaur skeleton, consisting of the skull, jaws, 50 vertebrae, and portions of the paddles from the Bearpaw formation, Upper Cretaceous of Montana, was purchased from Guy L. Wait. A remarkably well-preserved skull of the rare *Desmostylus hesperus* from the Miocene of Oregon was purchased (Hay, O. P., Proc. U. S. Nat. Mus., vol. 49, pp. 381–397, 1915). A final consignment of Pleistocene mammals from the "Cumberland Cave," consisting of 15 skulls, was received. A partial skeleton of a very large *Mastodon americanus* from the Pleistocene of Indiana was presented by W. D. Pattison, with permission to unearth the remaining parts. The type skull of *Nothrotherium texanum* from the Pleistocene of Texas was received in exchange with Baylor University (Hay, O. P., Proc. U. S. Nat. Mus., vol. 51, p. 116, 1917).

A collection of 30 dermal plates of armored dinosaurs from the Lance, Upper Cretaceous, of Wyoming was presented by Dr. G. R. Wieland (Wieland, G. R., Amer. Journ. Sci., ser. 4, vol. 31, pp. 112–124, 1911). A small collection of Pleistocene mammals from the vicinity of Denver, Colo., was presented by Prof. George L. Cannon (Hay, O. P., Proc. U. S. Nat. Mus., vol. 59, pp. 599–603, 1922).

1916

The most valuable accession of the year was the remainder of the skeleton of a large *Mastodon americanus* from the Pleistocene of Indiana, presented by Maj. H. H. and W. D. Pattison. The skeleton is now mounted and on exhibition (Lyon, Marcus W., Amer. Midl. Nat., vol. 17, p. 336, fig. 116, 1936).

The Fort Union mammal collection from Montana was increased by the purchase of a small assemblage of specimens from A. C. Silberling. A collection of Pleistocene specimens made by Benno Alexander, who accompanied the 1914–15 Korean Expedition to the Kolyma River region in northern Siberia, was presented by the Smithsonian Institution. It included about 200 individual specimens, the most important being a fine skull of *Elephas primigenius*.

A skull of *Canis orcutti* from the Pleistocene of California was received in exchange with the California State Normal School of Los Angeles. The type specimen of the fossil fish *Evesthes jordani* from the Miocene of California was presented by Dr. J. Z. Gilbert (Bull. Dept. Geol. Univ. California, vol. 5, pp. 405–411, pls. 41–43, 1910). Plaster casts of the type of *Allosaurus fragilis* were received in exchange with the Peabody Museum of Natural History. The United States Geological Survey transferred some 30 vertebrate specimens, representing 9 species of fossil fishes and reptiles from the Upper Cretaceous of the San Juan Basin, N. Mex., including the types of *Baena nodosa* and *Neurankylus baueri* (Gilmore, C. W., U. S. Geol. Surv. Prof. Pap. 98-Q, pp. 290–295, 1916).

1917

A collection of Permian vertebrates made by Charles H. Sternberg in Baylor County, Tex., was purchased. It contained a good skeleton of *Dimetrodon gigas*, now mounted (Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 56, pp. 525–539, 1919), besides partial skeletons of three other individuals. Also worthy of special mention are skulls and partial skeletons of the following genera: *Cardiocephalus*, *Lysorophus*, *Diplocaulus*, *Seymouria*, *Labidosaurus*, and *Pariotichus*, as well as a great quantity of unidentified materials of lesser value.

A collection of fossil reptile and cetacean remains, including the types of *Goniopholis affinis*, *Cetotherium crassangulum*, and *Metopocetus durinasus*, from the Arundel formation, Cretaceous and Calvert, Miocene of Maryland, was deposited by Goucher College.

A collection of 400 small mammal specimens was made from the Pleistocene cave deposits of western Cuba by William Palmer.

A small collection of turtles from the Upper Cretaceous (Belly River), containing the types of *Aspideretes latus* and *Boremys albert-*

ensis, purchased from Charles H. Sternberg (Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 56, pp. 113–132, pls. 29–37, 1919).

The type skull and lower jaws of *Equus lambei* from the Pleistocene of Gold Run Creek, Yukon Territory (Hay, O. P., Proc. U. S. Nat. Mus., vol. 53, pp. 435–443, 1917), and a partial skull of *Symbos cavifrons* from the Pleistocene of Indiana were purchased.

1918

A collection made by Dr. John B. Reeside, Jr. (1916), from the Paleocene and Upper Cretaceous of the San Juan Basin of New Mexico was transferred by the United States Geological Survey. This is the most important contribution from this source of recent years, there being 50 identifiable turtle specimens, many of them complete, 16 of which were described as new species (Gilmore, C. W., U. S. Geol. Surv. Prof. Pap. 119, pp. 1–68, 1920).

The type specimen of *Terrepene whitneyi* from the Pleistocene of Texas was presented by Prof. F. H. Whitney (Hay, O. P., Univ. Texas Bull. 71, pp. 1–24, 1917). The type of *Agomphus alabamensis* (Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 56, pp. 123–125, 1919) from the Cretaceous of Georgia was presented by the Florida Geological Survey.

Additional remains of Pleistocene mammals from Siberia were presented by John Koren. These supplement the collection received from the Koren Expedition of 1914–15.

A collection of 76 fish scales from the Cretaceous of North America was transferred by the United States Geological Survey (Cockerell, T. D. A., U. S. Geol. Surv. Prof. Pap. 120, pp. 165–188, 1919).

A small collection of cetacean remains, including the type of *Eurhinodelphis bossi* (Kellogg, R., Proc. U. S. Nat. Mus., vol. 66, pp. 1–40, 1925), was made for the Museum by Norman H. Boss.

1919

The most important accession of this year was that received as a deposit from the Florida Geological Survey, consisting of 24 type specimens from the Miocene and Pleistocene of Florida.

A skull and lower jaws of *Monoclonius nasicornis* from the Belly River, Upper Cretaceous, of Alberta; a skull and partial skeleton of *Diplocaulus copei* from the Permian of Texas; and a partly articulated skeleton of *Tylosaurus proriger* and other mosasaurian specimens from the Niobrara formation, Upper Cretaceous of Kansas, were purchased from Charles H. Sternberg.

A partial skeleton including a well-preserved skull of a long-beaked porpoise from the Calvert, Miocene, of Chesapeake Bay, Md., was collected for the Museum by William Palmer and N. H. Boss. A consider-

able portion of the skeleton of a mastodon from the Pleistocene of Winona Lake, Ind., was presented by Frank L. Clark.

A cast of the type skeleton of *Diatryma steinii* was presented by the American Museum of Natural History.

1920

A valuable acquisition was a collection of 78 specimens placed on deposit by the Maryland Geological Survey of which 74 are either type or figured specimens, 13 being original types. These specimens come from the Pleistocene, Miocene, Eocene, and Cretaceous of Maryland.

A collection of 35 specimens from a cave near Bulverde, Bexar County, Tex., was presented by O. P. Hay (Hay, O. P, Proc. U. S. Nat. Mus., vol. 58, p. 129, 1921). A collection of 60 specimens from the Pleistocene, Cavetown, Md., was presented by Phillips Academy (Hay, O. P., Proc. U. S. Nat. Mus., vol. 58, p. 97, 1921). A small collection consisting chiefly of horse and camel remains from Washtucna Lake, Wash., collected by Dr. George M. Sternberg in 1877, was presented by Mrs. George M. Sternberg (Hay, O. P., Proc. U. S. Nat. Mus., vol. 59, pp. 607–608, 1922).

A beautiful articulated skeleton of *Stenomylus hitchcocki* from the Miocene of Nebraska was received in exchange with the Carnegie Museum. A humerus, the type of *Jabiru weillsi* (Sellards, E. H., 8th Ann. Rep. Florida Geol. Surv., p. 146, 1916), from the Pleistocene of Florida, was deposited by the Florida Geological Survey. Two sets of moa leg bones and one lot of crop stones from New Zealand were received in exchange with the Public School of Lake Bathhurst, Australia. A skull and two vertebrae, the type of *Megaptera miocaena* (Kellogg, R., Proc. U. S. Nat. Mus., vol. 61, pp. 1–16, 1922), from the Miocene, Lompoc formation of California, were transferred by the United States Geological Survey. A plaster model restoration of *Mastodon americanus* by Charles R. Knight was purchased.

The type skull of *Elephas boreus* from Mount Healthy, Hamilton County, Ohio, was purchased (Hay, O. P., Observations on some extinct elephants, p. 5, June 12, 1922; privately published).

A small collection of Pleistocene vertebrate fossils was made by James W. Gidley near Renick, Greenbrier County, W. Va. (Gidley, J. W., Proc. U. S. Nat. Mus., vol. 57, p. 669, 1920).

1921

An important collection of more than 100 specimens representing a new Pliocene fauna of 30 or more species was made by James W. Gidley and Kirk Bryan in the San Pedro Valley, Ariz. Among the more striking new forms were two described by Gidley (U. S. Geol. Surv. Prof. Pap. 140–B, 1926), *Stegomastodon arizonae* and *Glypto-*

therium arizonae, and one by Gilmore, *Kinosternum arizonense* (Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 62, art. 5, pp. 1–8, 1922). In another paper (Gidley, J. W., U. S. Geol. Surv. Prof. Pap. 131–E, 1922) 15 new species of rodents were described. The collection also contained the types of two new species of birds (Wetmore, Alexander, Proc. U. S. Nat. Mus., vol. 64, pp. 1–18, 1924).

A block of *Diceratherium* bones *in situ* from the Miocene of the famous Agate Springs Quarry, Nebr., was collected for the Museum by James W. Gidley. A collection of about 200 specimens of Pleistocene mammals from a cave in Coconino County, Ariz., was received in exchange with the University of Arizona (Hay, O. P., Proc. U. S. Nat. Mus., vol. 59, pp. 617–638, 1921). The type of *Bystra nanus* (Hay, O. P., 8th Ann, Rep. Florida Geol. Survey, p. 53, 1916), from the Dunnellon formation of Florida, was received in exchange with the Buffalo Natural History Society. A skull of *Lambeosaurus* from the Belly River of Alberta; a half skull and lower jaws of a Pleistocene elephant from an unknown locality; and an elephant tooth from Otranto, Italy, were received in exchange with Ward's Natural Science Establishment. A male and a female skull of *Diceratherium cooki* and plaster casts of the two skulls of the Permian reptiles *Edaphosaurus* and *Diadectes* were received in exchange with the Walker Museum of the University of Chicago. A jaw of *Edestus heinrichii* from the Mississippian of Illinois was presented by the Southern Coal, Coke & Mining Co.; a Pleistocene elephant skull from Ohio was purchased. Lower jaw of a mastodon from the Pleistocene of Mississippi was purchased.

1922

Further collections from the Calvert (Miocene) along Chesapeake Bay were made for the Museum by Norman H. Boss. Two outstanding specimens are the type skull and parts of skeleton of *Squalodon calvertensis* (Kellogg, Remington, Proc. U. S. Nat. Mus., 62, pp. 1–69, 1923) and skull and lower jaws and much of the skeleton of *Zarhachis flagellator* (Kellogg, Remington, Proc. U. S. Nat. Mus., 63, pp. 1–39, 1924). A second collection of Miocene materials from the Chesapeake Bay region, consisting of five porpoise skulls besides many individual bones, was purchased from Mrs. William Palmer.

A nearly complete hind limb of *Gorgosaurus*, a tail club of an armored dinosaur, and the fore limbs, feet, and pectoral girdle of a small trachodont dinosaur, all from the Belly River, Upper Cretaceous, of Alberta, Canada, were received in an exchange with the Victoria Memorial Museum. A series of articulated cervical and dorsal vertebrae of *Edaphosaurus* was received in exchange with the Walker Museum. A nearly complete shell of *Boremys* from the

Belly River, Upper Cretaceous, was received in exchange with the University of Alberta.

A collection of skulls and several hundred bones of *Bison occidentalis* from the Pleistocene of Minnesota was presented by John A. Savage & Co. A composite skeleton was assembled for exhibition from this lot (Hay, O. P., Proc. U. S. Nat. Mus., vol. 63, art. 5, pp. 1–8, 1923).

Parts of the famous Beresovka mammoth from the Pleistocene of Siberia, such as skin, hair, muscular tissue, and stomach contents, were purchased from E. W. Pfizenmayer.

A tarsometatarsus of *Parapavo californicus* from the Pleistocene of California was presented by the University of California. The type of *Alamosaurus sanjuanensis* from the Ojo Alamo formation, Upper Cretaceous, of New Mexico was transferred by the United States Geological Survey (Gilmore, C. W., Smithsonian Misc. Coll., vol. 72, pp. 1–9, 1922).

1923

The most important accession of many years was the collection of several thousand specimens of Orestes St. John presented to the Museum by Frank Springer, to whom it was left upon the death of St. John. The collection consists of a general collection of Devonian invertebrates, but more important is his large and extremely valuable collection of selachian fish remains, chiefly from the Carboniferous. It contains numerous types and illustrated specimens described by St. John in the Illinois reports, as well as a large amount of original unstudied material. There is also included a large quantity of very choice cestraciont fish material, much of it collected by Mr. Springer from the Burlington limestone of Iowa, as well as two exceptionally fine collections from the Keokuk limestone made by Dr. G. A. Williams and Lisbon A. Cox, which were purchased by Mr. Springer and turned over to St. John, together with his own, for use in his researches. Among other notable specimens in this collection mention should be made of the type of *Campodus* (*Agassizodus*) *variabilis* (Newberry, J. S., Ohio Geol. Surv. Rep., pt. 2, vol. 2, p. 50. 1870); this represents a complete dentition from the Coal Measures of Kansas in a state of preservation such as has not been found elsewhere.

Another most notable accession was the residuary portion of the collection of R. D. Lacoe, of Pittston, Pa., presented by his heirs. Besides the fossil plants and invertebrates, which formed the bulk of the accession of 10,000 specimens, it also contained several hundred fish, reptilian, and amphibian remains. The Tertiary is represented by specimens from the Green River and from Switzerland; Triassic

by specimens from the Appalachian region; Paleozoic by specimens from Great Britain, France, and the coal fields of Ohio, Pennsylvania, and Mazon Creek, Ill. It contains many types and figured specimens.

The type specimen of the physeteroid whale (*Ontocetus oxymycterus*) from Santa Barbara, Calif., was presented by Mrs. Charles O. Roe (Kellogg, R., Proc. U. S. Nat. Mus., vol. 66, art. 27, pp. 1–8, 1926).

1924

A notable accession was a skeleton of *Diplodocus longus* collected for the Museum from the Jurassic, Dinosaur National Monument, Utah. This specimen is now mounted and on exhibition (Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 81, art. 18, pp. 1–21, pls. 1–6, 1932).

Composite skeletons of *Smilodon californicus* and *Aenocyon dirus*, suitable for mounting from the Pleistocene of Rancho La Brea of California, were received in exchange with the University of California; a slab of dinosaur tracks from the Triassic shales of Virginia was presented by Frank C. Littleton. The types of *Trinacromerum bentonianum* from the Upper Cretaceous of Kansas (Cragin, F. W., Amer. Geol., vol. 2, pp. 404–407, 1888) and *Testudo equicomes* from the Pleistocene of Kansas (Hay, O. P., Kans. Univ. Sci. Bull., vol. 10, pp. 39–51, pls. 1–3, 1917) were received in exchange with Colorado College. Further cetacean specimens, a partial skull of *Zarhachis* (Kellogg, R., Proc. U. S. Nat. Mus., vol. 67, art. 28, pp. 1–18, 1926) and one of *Eurhinodelphis* collected by Norman H. Boss from the Miocene, Calvert formation, Chesapeake Bay, Md. The type of a fossil sculpin from Nevada presented by David Starr Jordan. A small collection of South American mammals was presented by Brother Ariste Joseph; a skeleton of *Elephas* lacking the skull from the Pleistocene of Franklin County, Wash., was transferred by the United States Geological Survey. Cast of the skull of *Baluchitherium* and cast of the type of *Griphodon peruvianus* were received in exchange with American Museum of Natural History, New York.

1925

The most important collection of the year was a series of fossil footprints from the Coconino sandstone, Permian of the Grand Canyon of Arizona, collected by Charles W. Gilmore in cooperation with the National Park Service (Gilmore, C. W., Smithsonian Misc. Coll., vol. 77, No. 9, pp. 1–41, 1926). This collection was supplemented by a smaller one made by Dr. J. C. Merriam and presented by the Carnegie Institution of Washington. Two very large dinosaurian

tracks from the Mesa Verde, Upper Cretaceous, Clear Creek, Utah, were transferred by the United States Geological Survey.

A collection of Pleistocene mammals from Melbourne, Fla., was presented by Charles P. Singleton. It included the skull and much of the skeleton of a mastodon. A small collection of mammalian fossils from Chihuahua, Mexico, was presented by Mrs. Bruce D. Brown. Three well-preserved turtles from the Upper Cretaceous, Kirtland of New Mexico were received in exchange with Ward's Natural Science Establishment.

The collection of fossil cetaceans was materially enriched by two sperm-whale skulls, the type of *Aulophyseter morricei* (Kellogg, R., Carnegie Inst. Washington Publ. 346, pp. 1–43, pls. 1–9, 1927) from the Temblor, Miocene of California, presented by Charles Morrice, and the type skull of *Xenorophus sloanii* (Kellogg, R., Smithsonian Misc. Coll., vol. 76, No. 7, pp. 1–7, pls. 1, 2, 1923) from the Oligocene of South Carolina was presented by Earle Sloan.

A collection of fishes from the Lompoc, Upper Miocene, of California was presented by David Starr Jordan. Skull and lower jaws of *Equus lambei* from the Pleistocene of Alaska were purchased.

Plaster casts of the type skulls of *Batrachosuchus browni*, *Dicynodon kolbei*, and *Struthiocephalus whaitsi* were received in exchange with the South African Museum. Casts of the types of *Andrewsarchus* and *Proamphicyon* were received in exchange with the American Museum of Natural History.

1926

A large collection of fossil tracks from the Coconino, Hermit, and Supai formations of the Grand Canyon was made for the Museum by Charles W. Gilmore (Gilmore, C. W., Smithsonian Misc. Coll., vol. 80, No. 3, pp. 1–78, pls. 1–21, 1927). Additional footprint material from the Triassic of New Jersey was received in exchange with Princeton University.

A collection of 38 species of Pleistocene mammals made by James W. Gidley from Melbourne, Fla., including a crushed human skull found intermingled with the animal remains, gave important evidence of their contemporaneity (Loomis, F. B., Nat. Hist., vol. 26, pp. 260–262, 1926). He also made a small collection of Pleistocene mammal remains from Long Horn Spring, Okla.

A further collection of cetacean remains from the Calvert, Miocene of Chesapeake Bay region was made by Remington Kellogg and Norman H. Boss. Two specimens of a well-preserved skeleton of *Priscodelphinus atropius* and a fine skull and partial skeleton of a smaller porpoise are deserving of special mention.

A partial skeleton of a long-snouted crocodilian from the Green River shales of Colorado was presented by Prof. O. M. Ball. Addi-

tional cetacean materials from the Sooke formation of British Columbia were presented by Ira E. Cornwall. Type specimen of *Bison sylvestris* (Hay, O. P., Proc. U. S. Nat. Mus., vol. 48, p. 515, 1915) from Huron County, Ohio, and a small collection of Pleistocene fossils from Vero, Fla., were presented by Oliver P. Hay. A well-preserved skull of *Stenosaurus bollensis* from Holtzmaden, Germany, was received in exchange with Ward's Natural Science Establishment. A collection of five turtles from the Upper Cretaceous of New Mexico was purchased from Charles H. Sternberg. A plaster cast of the skull of *Protoceratops* was received in exchange with the American Museum of Natural History.

1927

An articulated skeleton of *Portheus molossus*, three skeletons of *Protostega gigas*, and two partial skeletons of *Platecarpus coryphaeus*, all from the Niobrara, Upper Cretaceous, of Kansas, were purchased from George F. Sternberg. A collection of Pleistocene mammals from Sarasota, Zolfo Springs, and Venice, Fla., was assembled by James W. Gidley. It also includes a partial skeleton of *Elephas* presented by the Venice Co.

The type of *Hypsognathus fenneri* (Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 73, art. 7, pp. 1–8, pls. 1–3, 1928) from the Triassic of New Jersey, was presented by Dr. C. N. Fenner. Bones of *Hesperornis* and *Ichthyornis* from the Niobrara, Upper Cretaceous, of Kansas, were presented by George F. Sternberg. A lower jaw, the type of *Martes kinseyi* (Gidley, J. W., Journ. Mamm., vol. 8, pp. 239–242, 1927) from the Miocene of Montana, was presented by C. A. Kinsey. Skulls of *Equus alaskae* from the Pleistocene of Alaska were transferred by the United States Geological Survey. A plaster cast of the lower jaw of *Trilophodon angustidens*, the original of which is in the Lyon Museum, France, was received in exchange with the American Museum of Natural History.

1928

A further collection of Pleistocene vertebrates from Melbourne and New Smyrna, Fla., was made by James W. Gidley. A nearly complete shell of *Trachemys sculpta* (Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 77, art. 10, pp. 1–8, pls. 1–3, 1930) was one of the specimens secured.

A skeleton of *Clidastes* from the Niobrara, Upper Cretaceous, of Kansas and a partial skeleton of *Parahippus* from the Miocene of Wyoming were purchased from George F. Sternberg.

A small collection of fossil footprints from the Hermit and Supai formations of the Grand Canyon, Ariz., was made by Charles W.

Gilmore (Gilmore, C. W., Smithsonian Misc. Coll., vol. 80, No. 8, pp. 7–10, 1928). Types of four species of extinct birds from the Oligocene of Colorado were deposited by the Colorado Museum of Natural History (Wetmore, A., Proc. Colorado Mus. Nat. Hist., vol 7, pp. 3–14, 1927). Type of *Pteranodon oregonensis* (Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 73, art. 24, pp. 1–5, 1928) from the Cretaceous of Oregon was presented by the Carnegie Institution of Washington.

1929

A collection of dinosaur remains, made for the Museum under the direction of Charles W. Gilmore from the Two Medicine formation of Montana, was the most important accession of the year. A considerable portion of the skeleton of an armored dinosaur, the type of *Palaeoscincus rugosidens*, the type of *Styracosaurus ovatus* (Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 77, art. 16, pp. 1–39, pls. 1–10, 1930), and a skull of *Dyoplosaurus* are specimens worthy of special mention.

The Florida series of Pleistocene mammals was augmented by a collection made by James W. Gidley. It included the type of a new bear, *Arctodus floridanus* (Gidley, J. W., Journ. Washington Acad. Sci., vol. 18, pp. 430–433, 1928).

A small collection of mammals, made by Dr. Harold T. Stearns from the Pleistocene and Pliocene of Idaho, was transmitted by the United States Geological Survey; a skull of a fossil cetothere from the Miocene of California was presented by Dr. A. F. Ousdal. Four elephant teeth illustrated by Prof. Henry F. Osborn from North Carolina presented by the American Museum of Natural History. Nine slabs of fossil tracks from the Triassic of the Connecticut Valley, Mass., were received in exchange with Amherst College.

1930

A collection of horse remains made by James W. Gidley for the museum from the Upper Pliocene near Hagerman, Idaho, was an important contribution. It included the type of *Plesippus shoshonensis* (Gidley, J. W., Journ. Mamm., vol. 11, pp. 300–303, 1930), many skulls and other skeletal parts, and also Pleistocene specimens from the vicinity of Twin Falls, Idaho.

A collection of reptilian specimens from the Kirtland formation, Upper Cretaceous of the San Juan Basin, New Mexico, was made for the Museum by a party under the direction of C. W. Gilmore. This included the articulated tail of the hadrosaurian reptile *Parasaurolophus tubicen* and 20 well-preserved turtle specimens, several

of them representing new species (Gilmore, C. W.. Proc. U. S. Nat. Mus., vol., 83, pp. 159–188 pls. 13–18, 1935).

A group of eight articulated skeletons of *Mesohippus bairdi* from the Oligocene of western Nebraska and a skeleton of a small marsupial (*Peratherium*) from the Florissant of Colorado (Gazin, C. L., Journ. Pal., vol. 9, pp. 57–62, 1935) were purchased from George F. Sternberg.

A collection of zeuglodont remains from the Jackson, Eocene, of Alabama, was made by Remington Kellogg and Norman H. Boss under the auspices of the Carnegie Institution. It included a beautifully preserved skull and lower jaws with much of the skeleton of a small zeuglodont *Zygorhiza kochii* (Kellogg, R., Carnegie Inst. Washington Publ. 482, pp. 101–176, 1936). The cetacean collection was further enriched by a nearly complete skull and lower jaws with much of the skeleton of a large whalebone whale collected from the Calvert, Miocene, near Governors Run, Md.; this specimen was discovered and presented by the Maryland Geological Survey. A partial skull of *Schizodelphis*, also from the Calvert of Maryland, was presented by William Jones.

Two fossil amphibian skeletons on slabs, *Pelosaurus* and *Branchiosaurus* from the Permian of Germany, were purchased. A complete shell of *Amyda virginiana* (Lynn, W. Gardner, Proc. U. S. Nat. Mus., vol. 76, art. 26, pp. 1–4, 1929) from the Cretaceous of Virginia, was deposited by the Geological Survey of Maryland.

1931

The most important accession of the year was a collection of 350 specimens made by a party from the Museum under the direction of Charles W. Gilmore from the Bridger, Eocene, of Wyoming. Outstanding specimens in the collection were: A nearly complete articulated skeleton of *Hyrachyus eximius* and a skeleton of *Helaletes nanus* (both now mounted and on exhibition), two partial skeletons of *Palaeosyops*, a skeleton of *Crocodylus*, and 38 well-preserved turtle specimens representing no less than eight genera.

A second collection of the Pliocene horse *Plesippus shoshonensis*, from near Hagerman, Idaho, was made by a party working under the direction of J. W. Gidley. Many skulls and parts of skeletons, all in excellent preservation, were secured. Accessory material was later added to the collection by the work of Elmer Cook, who carried on independent collecting in these same deposits for the Museum.

The type skull of *Troödon wyomingensis* (Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 79, art 9, pp. 1–6. 1931) from the Lance, Upper Cretaceous, of Wyoming, and well-preserved skulls of *Ichthyodectes* and *Protosphyraena* from the Niobrara chalk of Kansas, where pur-

chased from George F. Sternberg. A slab of Triassic footprints from Loudoun County, Va., was presented by Frank C. Littleton. Fossil bird bones from the Wasatch Eocene of Wyoming were presented by Dr. E. L. Troxell; a skull of *Eurhinodelphis* from the Calvert formation of Chesapeake Bay, Md., was presented by Arlton Murray.

1932

A collection principally of mammal remains was made by a party under the direction of Charles W. Gilmore in the Wasatch, Eocene, of the Big Horn Basin, Wyo.; and in the Miocene and Oligocene of western Montana. In addition to a large number of skulls, jaws, and other parts of skeletons, specimens worthy of especial mention are a considerable part of the skeleton of the large creodont *Pachyaena gigantea*, three partial skeletons of *Coryphodon*, a skull and lower jaws of the rare *Ectoganus gliriformis* (Gazin, C. L., Proc. Amer. Philos. Soc., vol. 76, pp. 597–612, 1936), an articulated skeleton of one of the larger merycoidodonts, and a skull and parts of the skeleton of *Dromomeryx*, the two last mentioned from the Miocene of Montana.

A valuable addition to the collection of *Plesippus shoshonensis* remains from Hagerman, Idaho, was made by a field party working under the direction of Norman H. Boss. Four articulated skeletons, 32 skulls, 48 jaws, and a vast quantity of bones representing all parts of the skeleton were secured. This collection also contained the type of the fossil goose *Chen pressa* (Wetmore, Alexander, Smithsonian Misc. Coll., vol. 87, No. 20, p. 9, 1933).

A small collection of 60 specimens consisting principally of mammalian skulls from the Oligocene near Douglass, Wyo., was purchased from George F. Sternberg.

Through gifts from W. W. Holmes, of St. Petersburg, and J. E. Moore, of Sarasota, Fla., the avian collections were increased by many specimens from the Pleistocene of that State. A skull of *Hipparion minus* from the Miocene of Samos, Greece, was purchased.

1933

The most important accession was a collection from the Oligocene of Nebraska, South Dakota, and Wyoming, made by a field party under the direction of Charles W. Gilmore during the summer of 1932. Specimens worthy of special mention were the type of an extinct eagle, *Palaeoplancus sternbergi* (Wetmore, A., Smithsonian Misc. Coll., vol. 87, No. 19, pp. 1–9, 1933); two articulated skeletons of *Mesohippus bairdii;* articulated skeletons of *Merycoidodon;* skeleton of *Leptomeryx* and a skull and partial skeleton of *Eusmilus sicarius* (Jepsen, Glenn L., Proc. Amer. Philos. Soc., vol. 72, pp.

360–362, 1933); 120 skulls, many partial skeletons, and articulated limbs and feet, all representing more than 20 genera of fossil vertebrates.

A mountable skeleton of *Moropus elatus* from the Miocene of Nebraska and a mounted skeleton of *Gorgosaurus libratus* (Matthew, W. D., Amer. Mus. Nov., No. 89, fig. 1, 1923) from the Belly River, Upper Cretaceous, of Canada, were received through exchange with the American Museum of Natural History. Neither of these genera was previously represented in the collections. A composite skeleton of *Equus occidentalis* from the Rancho La Brea Pleistocene asphalt deposits of California was received in exchange with the Los Angeles Museum of History, Science and Art; a composite skeleton of the Oligocene rhinoceros *Trigonias osborni* from Weld County, Colo., was received in exchange with the Colorado Museum of Natural History. Two duck-billed dinosaur skulls, *Edmontosaurus regalis* (Parks, W. A., Univ. Toronto Studies No. 37, p. 6, pl. 2, fig. 1, 1935) and *Prosaurolophus maximus*, from the Upper Cretaceous of Alberta, Canada, were received in exchange with the Royal Ontario Museum of Paleontology.

Four skulls, limb, and foot bones of *Lystrosaurus* and *Dicynodon* from the Triassic of South Africa were received in exchange with the National Museum of South Africa.

A beautifully preserved skull of *Equus alaskae* from the Pleistocene of Alaska was collected for the Museum by James A. Ford. An articulated frog skeleton from the Miocene of Nevada was presented by R. M. Catlin. The skull of a large Miocene whale from California was presented by Dr. A. P. Ousdal.

A mounted skeleton of *Ichthyodectes hamatus* and a skeleton of *Platecarpus*, both from the Niobrara, Upper Cretaceous, were purchased from George F. Sternberg.

1934

A skull and mandible of *Equus andium* from the Pleistocene of South America and a skull, lower jaw, and vertebrae of *Nesodon imbricatus* from the Tertiary of South America were received in exchange with the Field Museum of Natural History. A skull and other bones of *Oxydactylus gibbi* from the Miocene of Nebraska were received in exchange with Amherst College. A small collection of Oligocene mammals from Wyoming was presented by the University of Wyoming.

The collection of marine mammals was enriched by the addition of several cetacean skulls from the Calvert, Miocene, of Maryland, collected by R. Kellogg, C. L. Gazin, and Raymond Gilmore. Perez Simmons presented a series of teeth of *Desmostylus* from the Miocene of California.

To the collections of fossil birds were added a partial skeleton of *Hesperornis* from the Upper Cretaceous of Kansas purchased from George F. Sternberg; limb bones of *Eogrus aeola* from the Eocene of Mongolia received as a gift from the American Museum of Natural History; and representative parts of the skeleton of *Bathornis celeripes* from the Oligocene of Wyoming, a gift from the Museum of Comparative Zoology.

1935

The most important accession of this year was a collection of mammalian fossils from the Pliocene, near Hagerman, Idaho, made by a field party under the direction of the assistant curator, Dr. C. L. Gazin. Remains of *Plesippus shoshonensis* formed the bulk of the collection, there being 65 skulls, a number of partially articulated skeletons, besides a vast number of bones of all parts of the skeleton (Gazin, C. L., Proc. U. S. Nat. Mus., vol. 83, pp. 281–320, 1936). Other specimens worthy of mention were three articulated skeletons of the peccary; *Platygonus pearcei*, a new species (Gazin, C. L., Journ. Washington Acad. Sci., vol. 28, pp. 41–49, 1938); a skull of *Stegomastodon;* the type of *Ceratomeryx prenticei* (Gazin, C. L., Journ. Pal., vol. 9, pp. 390–393, 1935); skulls and skeletal parts of beavers, otters, several birds, and many specimens of the microfauna.

An excellent articulated skeleton of *Camarasaurus*, representing an animal 30 feet in length from the Jurassic of the Dinosaur National Monument, Utah, was received in exchange with the Carnegie Museum.

The type specimen of *Palaeophis virginianus* (Lynn, W. G., Johns Hopkins Univ. Stud. in Geol., No. 11, pp. 245–49, 1934) from the Eocene of Virginia was presented by Dr. W. G. Lynn. Two fossil cetacean skulls from the Miocene of California were presented by T. V. Little and C. A. Pratt. A fine skull and lower jaws of *Archaeotherium* from the Oligocene of Nebraska was presented by Edward S. Tyler.

Five model restorations illustrating the evolution and development of the horse in North America were presented by Mrs. J. W. Gidley. This gift has a special significance since these were modeled by the late Dr. James W. Gidley, for many years connected with this division.

1936

The most important acquisition this year was a collection made by a party operating in Montana and Wyoming, under the direction of the curator, Charles W. Gilmore. Additional materials greatly augmented the collection from the Two Medicine, Upper Cretaceous.

Two articulated caudal series and other bones of *Procheniosaurus;* two incomplete specimens of *Leptoceratops;* and an incomplete but adult skull of *Brachyceratops* (Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 87, pp. 1–18, 1939), including skeletal parts, are worthy of special mention. Besides collecting the usual run of mamalian specimens from the Wasatch of the Big Horn Basin, this party secured a complete articulated skeleton of *Coryphodon.*

A complete articulated skeleton of *Scarrittia canquelensis* from the Tertiary of Argentina was purchased from the American Museum of Natural History. A skull and lower jaws of a large phytosaurian reptile from the Triassic of Arizona presented by Merl V. Walker. A skeleton of *Scelidodon capellina* from South America was received in exchange with the Field Museum of Natural History. A skull of *Glyptosaurus giganteus* (Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 86, pp. 16–21, fig. 5, 1938) from the Oligocene of Wyoming was purchased from George F. Sternberg. The type of *Sula avita* from the Miocene of Chesapeake Bay, Md. (Wetmore, A., Proc. U. S. Nat. Mus., vol. 85, pp. 22–24, 1938); the type of *Peritresius virginianus* from the Miocene of Virginia (Berry, C. T., and Lynn, W. G., Proc. Amer. Philos. Soc., vol. 76, No. 2, pp. 183–187, 1936); the type of *Pelycorhamphus pertortus* from the Miocene of Maryland? (Cope, E. D., Proc. Amer. Philos. Soc., vol. 34, p. 137, 1895); the type of *Prepotherium venezuelanum* (Collins, R. L., Johns Hopkins Univ. Stud. in Geol., No. 11, pp. 235–244, 1934) from Venezuela, South America, were all deposited by Johns Hopkins University.

A small collection of fossil fishes from the Devonian of Colorado was transferred by the United States Geological Survey. Another small collection of primitive Downtonian fishes from Spitsbergen was received as a gift from the Paleontologisk Museum, Oslo, Norway.

1937

The chief accession of this year was a collection of mammalian fossils made by the Smithsonian field party under the direction of Dr. C. Lewis Gazin in Arizona and New Mexico. About 600 identifiable specimens were collected from the Puerco, Torrejon, Wasatch, and Pliocene.

A composite skeleton of the giant ground sloth *Paramylodon harlani* from the Rancho La Brea Pleistocene, California, was received in exchange with the Los Angeles Museum of Natural History, Science and Art.

A mounted skeleton of *Merycodus necatus* from the Miocene of Montana was purchased from Phil C. Orr.

A musk-ox skull (*Symbos cavifrons*) from the Pleistocene of Indiana and a nearly perfect carapace and plastron of the turtle *Aspideretes superstei* from the Paskapoo of Alberta, Canada, were purchased. A plaster cast of the snake *Boavus idelmania* from the Eocene of Wyoming was received in exchange with the American Museum of Natural History. A plaster cast of a skeleton of *Eohippus* from the Big Horn Basin, Wyo., was presented by Dr. E. R. Troxell. Two perfectly preserved eggs of the extinct ostrich *Struthio andersoni* from the loess of China were purchased.

1938

Specimens resulting from a field expedition to central Utah and northern Arizona, under Charles W. Gilmore, benefited both the mammalian and reptilian collections. Those worthy of special mention were a partial skeleton of the large sauropod dinosaur *Alamosaurus sanjuanensis;* disarticulated skull and skeletal parts of a horned dinosaur; skeletal parts of six individuals of the extinct lizard *Polyglyphanodon sternbergi* (Gilmore, Charles W., Smithsonian Misc. Coll., vol. 99, No. 16, pp. 1–3, 1940) all from the North Horn formation, Upper Cretaceous; 15 mammalian specimens from the Dragon formation, Paleocene (Gazin, C. L., Journ. Washington Acad. Sci., vol. 28, pp. 271–277, 1938). From the Triassic of Arizona this same expedition collected three phytosaurian skulls and a skull of the amphibian *Buettneria.*

Through participation in the Dallas Exposition important specimens and illustrative materials were received as gifts from the United States Texas Centennial Commission. The more important of these were a skeleton of the Eocene flightless bird *Diatryma;* a unique specimen of *Glyptosaurus giganteus*, having the dermal armor of the skull and neck preserved *in situ* (Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 86, pp. 16–21, pl. 1, 1938); a nearly complete articulated tail of *Camarasaurus;* and the articulated pelvis, hind limbs, feet, and tail with large patches of skin impressions of a crested hadrosaurian dinosaur (*Corythosaurus*) from the Upper Cretaceous of Alberta, Canada. From this source also was a diorama, illustrating the fauna and flora of the Jurassic, and two canvases (8 by 15 feet), one a restoration of the sauropod dinosaur *Camarasaurus* by R. Bruce Horsfall, the other a restoration of *Dimetrodon* and other Permian animals by Garnet W. Jex.

A skull of *Merycoidodon gracilis* (Leidy, J., Smithsonian Contr. Knowl., vol. 6, p. 54, pl. 5; figs. 3–4, and pl. 6, figs. 6–7, 1853), of much historical interest since it originally belonged to the Evans collection, was received in exchange with Columbia University.

The type of *Tomarctus marylandica* from the Miocene of Maryland was presented by C. T. Berry (Berry, C. T., Proc. U. S. Nat. Mus., vol. 85, pp. 159–161, 1938). A tarsometatarsus of *Nesotrochis debooyi*, an extinct bird from Puerto Rico, was received as a gift from the Peabody Museum of Natural History. Three slabs of dinosaurian footprints from the Triassic of Pennsylvania were presented by the Highway Engineering and Construction Co.

1939

Specimens resulting from the field expedition to the Paleocene (Dragon) and Upper Cretaceous (North Horn) of central Utah and collections from the Uinta of the Uinta Basin, under the direction of C. Lewis Gazin, constituted the outstanding accession of this year. The Paleocene fauna was increased by a considerable number of new forms (Gazin, C. L., Journ. Washington Acad. Sci., vol. 29, pp. 273–286, 1939). Specimens worthy of special mention are a nearly complete articulated skeleton of the extinct lizard *Polyglyphanodon;* two well-preserved crocodile skulls; a complete skull of *Baena inflata.* The Uinta collection formed the bulk of the collection consisting of the usual run of skulls, jaws, and parts of skeletons.

An unusually well-preserved skull and lower jaw of *Trigonias* was received in exchange with the Colorado Museum of Natural History; a collection of mammalian specimens from the Pliocene of Pikermi, Greece, was received in exchange with the British Museum of Natural History; a skull and other bones of *Buettneria* was received in exchange with the Museum of Comparative Zoology.

Two incomplete cetacean skulls from the Miocene of Maryland were presented by Arlton Murray; and a partial skeleton of *Tursiops* from the Pleistocene of Maryland presented by Dr. S. F. Blake. A nearly complete type skull of *Felichthys* (Lynn, W. G., and Melland, A. M., Journ. Washington Acad. Sci., vol. 29, pp. 14–20, figs. 1–3, 1939) from the Miocene of Calvert County, Md., and 25 dental plates of *Phyllodus* from the Eocene of Virginia were presented by Dr. W. Gardner Lynn. A slab of fossil bird tracks was presented by V. H. Housholder.

1940

The most important accession of the year was a collection of 25 lizard specimens, all original types as follows: *Chamops segnis* Marsh, *C. denticulatus* Gilmore, *Glyptosaurus anceps* Marsh, *G. brevidens* Marsh, *G. nodosus* Marsh, *G. ocellatus* Marsh, *G. princeps* Marsh, *G. rugosus* Marsh, *G. sphenodon* Marsh, *G. sylvestris* Marsh, *Iguanavus exilis* Marsh, *I. teres* Marsh, *Thinosaurus agilis* Marsh. *T. crassus* Marsh. *T. grandis* Marsh, *T. leptodus* Marsh, *T. paucidens* Marsh,

Tinosaurus lepidus Marsh, *T. stenodon* Marsh, *Oreosaurus gracilis* Marsh, *O. lentus* Marsh, *O. microdus* Marsh, *O. minutus* Marsh, *O. vagans* Marsh, *Cteniogenys antiquus* Gilmore, received in exchange with the Peabody Museum of Natural History. This addition makes the United States National Museum preeminent in North American fossil Sauria. Of the 69 described species, 54 of the original types are now in the national collections.

The fossil materials resulting from the field expedition to central Utah contributed important specimens to both the mammalian and reptilian collections. They include additional specimens of Paleocene mammals with several forms new to the fauna; considerable portions of two skulls and other ceratopsian materials; and 22 lizard specimens (*Polyglyphanodon*), 8 of which are good portions of articulated skeletons.

A collection of 123 fossil fish specimens was received by transfer from the War Department. Noteworthy were many fine examples from the Solenhofen deposits of Bavaria.

Through exchange with the University of Kansas there came a composite skeleton of the Pliocene amphibian *Plioambystoma kansensis;* and with the Peabody Museum of Natural History a mounted skeleton of *Stenomylus hitchcocki*, skull and lower jaws of *Platygonus compressus*, and a skull of *Nimravus*.

The cetacean part of the collection was enriched by a cetothere and *Eurhinodelphis* skulls presented by Drs. R. Kellogg and W. F. Foshag; a vertebral series of *Priscodelphinus* presented by Dr. A. R. Barwick; and a cetacean skull presented by Arlton Murray, all from the Calvert formation of Maryland.

The type of *Delphinus calvertensis* (Harlan, Richard, Proc. Nat. Inst., vol. 2, pp. 195–196, 1842) originally belonging to the National Institute but lent to Prof. Louis Agassiz prior to 1852, was returned to the National Museum collections by the Museum of Comparative Zoology.

The types of *Paralbula marylandica* and *P. dorisiae* (Blake, S. F., Journ. Washington Acad. Sci., vol. 30, pp. 206–209, 1940) were presented by S. F. Blake; the type of *Anomoedus latidens marylandicus* (Berry, C. T., Amer. Midl. Nat., vol. 22, p. 746, 1939) from the Cretaceous of Maryland, was presented by Dr. Charles T. Berry.

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A NEW HARPACTICOID COPEPOD FROM THE GILL CHAMBERS OF A MARSH CRAB

By Arthur G. Humes

While studying the parasites of crabs at the Louisiana State University Marine Laboratory at Grand Isle, La., the writer collected specimens of a previously undescribed copepod belonging to the genus *Cancrincola* (Copepoda: Harpacticoida: Ameiridae). This genus was first recognized by Wilson (1913), who designated his newly described species, *Cancrincola jamaicensis*, from the gills of the white land crab, *Cardisoma guanhumi* Latreille, at Montego Bay, Jamaica, as genotype. In 1930 Pearse described a second species, *Cancrincola wilsoni*, from the gills of the red land crab, *Sesarma haematocheir* (de Haan), and of the littoral crab, *Sesarma pictum* (de Haan), at Aburatsubo, near Misaki, Japan. A few specimens of *C. jamaicensis* Wilson were collected by Pearse (in Wilson, 1935) from the branchial cavity of the spider crab, *Microphrys bicornutus* (Latreille), at the Dry Tortugas, Fla. The gill chambers of two adult marsh crabs, *Sesarma reticulatum* (Say), a male and a female, collected at Grand Isle, La., on June 14, 1940, contained about 50 copepods, named and described as follows:

CANCRINCOLA PLUMIPES, new species

Figure 18

Type material from the gill chamber of *Sesarma reticulatum*, at Grand Isle, La. Holotype, female, U. S. N. M. No. 79347; allotype, U. S. N. M. No. 79348; and 20 paratypes including both sexes, U S. N. M. No. 79349.

Female.—Body slender, between four and five times as long as wide, cylindrical, greatest diameter at the first thoracic segment, gradually tapering posteriorly (fig. 18, *d*). Thorax and abdomen arched ventrally in specimens preserved in alcohol. Cephalic segment nearly as long as the first three thoracic segments combined. Cephalon well developed laterally, smoothly truncate posteriorly, rather broadly rounded anteriorly, posterior half of dorsum with two pairs of very small setae, the posterior pair slightly larger; rostrum very small, elongated-oval, with two minute curved setae on the anterior end.

First segment of the 6-segmented thorax rather indistinctly separated from the cephalic segment, the dorsum shorter than either of the following two dorsa and bearing a pair of minute setae; another small seta at the origin of both basipods. Second thoracic segment with a pair of setae on the dorsum, two pairs laterally and two pairs at the origin of the basipods, all five setae on one side more or less linear and well separated from one another. Third segment with similar setae, but with one additional lateral pair, making six pairs in all; the dorsum a little shorter than that of the second segment. Fourth segment similar to second. Fifth segment with shortest dorsum of all body segments, located at the center of the body arch and often telescoped with the adjacent dorsa; three pairs of setae, one on the dorsum, one laterally, and one near the base of the fifth legs. Sixth segment of the thorax with a pair of setae on the dorsum and another pair on the posterior lateral areas; a single genital opening on the ventral side.

Abdomen 4-segmented, segments narrowed but of about the same length as the third and fourth thoracic segments, dorsa quadrangular rather than rectangular. First abdominal segment with two pairs of setae like those on the last thoracic (genital). Second with a pair of setae on the dorsum, a vertical row of about 11 setae on the lateral areas and a ventral transverse band of setae on the posterior half. Third segment with a pair of setae on the dorsum, on both sides a dorsolateral vertical row of seven setae and a lateral vertical row of six setae, with a ventral transverse row of setae on the posterior half. Fourth abdominal segment with slightly shorter dorsum than the preceding ones, segment deeply incised at the center, without anal operculum; a short transverse ventral row of setae on the anterior part, a pair of setae on the dorsum, and on both sides a row of setae on the dorsal, lateral, and ventral aspects of the posterior part of the segment, adjacent to the origin of the anal laminae.

Anal laminae much shorter than the terminal segment and stout, both armed on the lateral aspect with three large setae (the middle one one-half as long as the other two) in a vertical row, at the distal

lateral angle a seta bearing a comb of three teeth, on the medial distal angle two setae the dorsal one of which is set upon a single-jointed pedicel, and terminally a long anal seta, which is about three-quarters of the body length, curved distally toward the midline and finely plumose. At the ventral distal angle of the anal laminae one or two very minute setae and anterior to the base of the most ventral of the three lateral setae a vertical row of three very small setae.

Anterior antennae (fig. 18, *c*) with eight similar podomeres, joints not strongly chitinized, numerous setae ventrally, a tuft of setae terminally, two setae on the dorsal side of the seventh podomere. On the distal ventral angle of the fourth podomere a dimerous athetask slightly longer than the distal four podomeres, the distal part about one-third the length of the whole.

Posterior antennae (fig. 18, *b*) somewhat shorter than the anterior pair, with two podomeres and monomerous exopod; a single spine on the inner margin of the proximal podomere; cylindrical exopod attached near the center of the outer margin of the first podomere, terminating in three setae the longest of which is posterior and the shortest anterior. Distal podomere about two-thirds the length of the proximal one, armed on the inner side with two rows of four dentiform setae and on the outer side with two short setae; terminally with seven setae, the inner three pectinate on the distal two-thirds and shorter than the adjacent three outer ones, which are pectinate only at their centers; outer seta short, pectinate, with longer and finer teeth; an eighth spiniform seta at the base of the second inner seta.

Mandibles (fig. 18, *l*) minute, about 15μ long, the outer ramus very small, simple, monomerous, terminating in three short, blunt, spine-like processes; inner ramus flattened into a concave lamina or blade, armed distally with a row of minute setae. First maxillae (fig. 18, *m*) with a cylindrical monomerous exopod bearing two setae terminally and three filamentous setae on the inner side; endopod similar, with four setae terminally; a single seta on the basipod lateral to the base of the exopod. Second maxillae (fig. 18, *h*) with a thick-set exopod terminating in a long, curved claw pectinate on the distal half of its inner margin; two small setae on the outer side of the distal end of the exopod; endopod cylindrical, shorter than the exopod, with two setae on the distal end. Maxillipeds (fig. 18, *e*) with two podomeres, the first short and stout, the second longer and swollen with a long, slender terminal claw pectinate on the concave side and curved to fit the side of the second podomere; a longitudinal row of six to eight very fine setae near the distal end of the first podomere.

First four pairs of legs biramose, somewhat flattened, the first pair of legs adapted for clasping, the following three for swimming, the

fifth pair much modified. Basipod of the first pair armed on the outer side with a proximal transverse row of 11 minute setae, a central row of nine larger though similar setae, and at the base of the exopod a large pectinate seta and a row of much smaller ones; at the base of the endopod similar setae. Exopod (fig. 18, *h*) of three similar podomeres, each armed with a stout pectinate seta at the outer distal angle and more proximally on the outer side with a row of four shorter setae; at the distal borders of the first two podomeres a row of four or five dentiform setae; on the central inner edge of the second podomere two very small setae and distally a larger plumose seta; terminally on the third podomere a row of four setae, the inner two longer than the whole exopod and pectinate centrally, the outer two about half as long or less and pectinate over nearly the whole length. Endopod nearly twice the length of the exopod, with two podomeres, the proximal one a little more than four times the length of the distal one and armed on the inner side with a central row of six setae, distal to which a single much longer plumose seta, armed on the outer side with a central row of six setae and two minute setae at the outer distal angle; distal podomere with a row of seven minute setae on the inner side and a row of three larger setae terminally, the middle one being twice the length of the other two and pectinate centrally, the inner one plumose, the outer one pectinate throughout.

Basipod of the second pair of legs with only the distal rows of setae at the bases of the exopod and endopod. Exopod (fig. 18, *i*) a little longer than the endopod, both with three similar podomeres. Exopod with stout pectinate seta at the outer distal angles of the podomeres, proximal to which there is a row of four minute setae, with five or six additional very small setae along the distal border of the first two podomeres; second podomere having on the inner side two small setae, distal to which a much longer plumose seta; third podomere with five terminal setae, the inner three about twice as long as the exopod and plumose, except the outer one of the group, which is plumose on the inner side and pectinate on the outer side; the outer two pectinate setae only one-third or less the length of the inner ones. Endopod with four to six small setae on the outer sides and a longer plumose seta at the distal inner angles of the three podomeres; on the third podomere three terminal setae, the outer one short, stout and pectinate, the inner two a little more than twice the length of the endopod and plumose.

Third basipod like the second; both rami of the third pair of legs with three similar podomeres; exopod like that of the second pair of legs, except that it is longer than the endopod and the minute setae on the inner side of the second podomere are absent; endopod

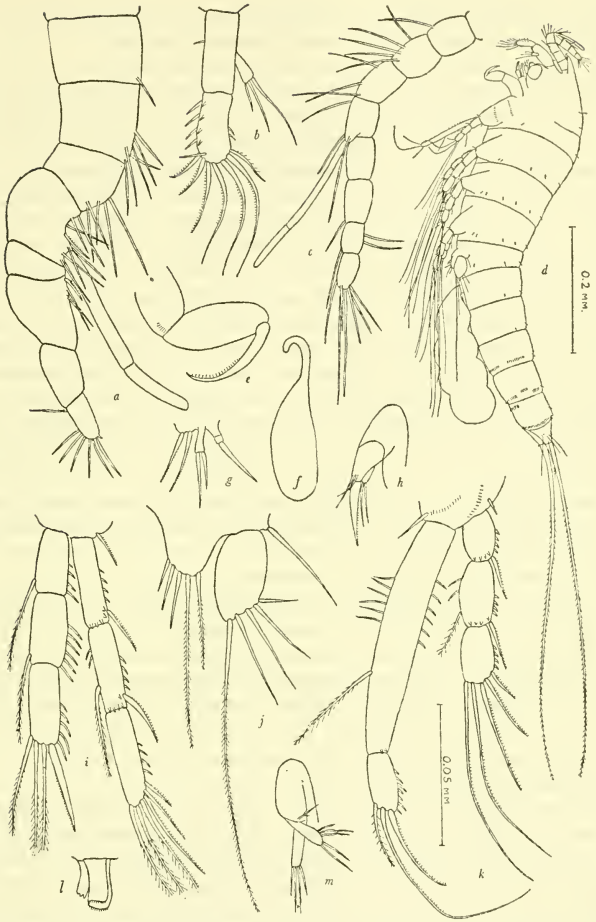

FIGURE 18.—*Cancrincola plumipes*, new species: *a*, Anterior antenna, male; *b*, posterio; antenna, female; *c*, anterior antenna, female; *d*, female, lateral view; *e*, maxilliped, female *f*, spermatophore, male; *g*, fifth leg, male; *h*, second maxilla, female; *i*, second leg, fer male; *j*, fifth leg, female; *k*, first leg, female; *l*, mandible, female; *m*, first maxilla, female. All figures were drawn with aid of a camera lucida. The 0.2 mm. scale applies only to *d;* the 0.05 mm. scale near *k* applies to all the other figures.

similar also to that of the second legs, but only three to four small setae on the outer sides of the podomeres and long plumose seta at the distal inner angle of the second podomere lacking.

Fourth basipod like the second; both rami of fourth legs with three podomeres; exopod about twice as long as the endopod with three similar podomeres; a stout pectinate seta at the distal outer angle of each podomere, proximal to which there is a row of three or four minute setae; no setae on the inner sides of the podomeres; four terminal setae in a row, the two inner ones plumose and greatly elongated, the two outer ones short and pectinate. Endopod with the first two podomeres shorter than the third; the inner distal angles of the first and third podomeres with a plumose seta; on the outer side of the first podomere one minute seta, of the second, two, and of the third, five; four terminal setae, the middle two longer than the endopod and plumose, the outer and inner setae half as long and pectinate.

Fifth legs (fig. 18, *j*) uniramose, lamellar, with two podomeres, the basal one with a single seta on the outer side and expanded on the inner side into a broad lamina terminated by a row of five setae; the plumose outer two of these are, respectively, about two and four times the lengths of the inner three, which in turn are about as long as the inner expansion of the podomere; distal podomere stout, longer than wide, with five setae terminally; innermost plumose seta over three times the length of the podomere; outer four setae only one-third or less the length of the innermost.

All females observed had single ovisacs attached, containing 2 to 11 eggs (measuring 70μ by 60μ) in a single layer.

Measurements based on 10 females are as follows: Total length, exclusive of setae, 0.626 mm. (0.586–0.659 mm.); greatest width (first thoracic segment), 0.131 mm. (0.091–0.158 mm.); length of anal setae, 0.476 mm. (0.428–0.500 mm.).

Color in preserved specimens a transparent white, with the ovaries and digestive tract a little darker.

Male.—General body form similar to that of the female. Length of body a little less, the anal setae, though of about the same size as in the female, relatively longer, about four-fifths of the body length. Setae on the thorax similar to those in the female. On the abdominal segments 1, 2, and 3 a pair of small setae on the dorsum and a lateral and ventral transverse row of still more minute setae in the posterior part of the segment; terminal segment and anal laminae with setae as in the female.

Anterior antennae (fig. 18, *a*) with eight podomeres of different sizes, joints more heavily chitinized than in the female, first two podomeres equal, third shorter on the dorsal side, fourth largest, rounded dorsally and concave ventrally, fifth shortest, rather indis-

tinctly demarcated, sixth about as long as the first, this and the last two podomeres gradually tapering in size; distal end of the eighth bearing a minute claw; ventral sides of podomeres 1 to 6 setose, a pectinate seta on 4 and 6, and an athetask similar to that in the female on the distal ventral angle of the fourth podomere; a few setae dorsally and terminally on the eighth podomere.

Second antennae, mouth parts, and first four pairs of legs all like those of the female. Fifth leg (fig. 18, *g*) very much smaller than in the female, reduced to a low lamellar process bearing two pectinate setae medially, then a long pedicel terminating in two setae of which the inner one is the longer, and outermost a seta set upon a single-jointed pedicel.

In about half of the male specimens a single yellowish-brown spermatophore (fig. 18, *f*) was seen, usually in the genital segment (sixth thoracic).

Measurements of 10 males: Total length, exclusive of setae, 0.583 mm. (0.545–0.621 mm.); greatest width (first thoracic segment), 0.219 mm. (0.104–0.147 mm.); length of anal setae, 0.470 mm. (0.400–0.524 mm.).

Color like that of the female.

Remarks.—This species differs significantly from the two previously known species of *Cancrincola* in the following respects:

(1) Anterior antennae in the male with eight podomeres; *wilsoni* has only three podomeres.

(2) Fifth leg of male with five terminal setae; in *jamaicensis* there are two and in *wilsoni* four.

(3) Fifth leg of female with six setae on the proximal podomere and five on the distal podomere; in *jamaicensis* there are six on the proximal and six on the distal podomeres, and in *wilsoni* seven on the proximal and two on the distal podomeres.

There are many other minor differences in setal arrangements and in the mouth parts that may be used to separate *C. plumipes* from the other two species. *C. plumipes* appears to be more closely related to the Jamaican species than to the Japanese form. The number of minute setae on the body and appendages was found to vary slightly in different individuals of the same sex, and hence the numbers given above should not be regarded as absolute.

Members of this genus have been found in the gill chambers of both terrestrial and aquatic crabs. They show little modification for a parasitic way of life and have retained the ability to swim freely. The life cycles of these species, though unknown at present, are probably intimately connected with the molting of the crabs and their migrations into the sea for food getting or for development and hatching of their eggs.

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THE CHICORA (BUTLER COUNTY, PA.) METEORITE

By F. W. Preston, E. P. Henderson, and James R. Randolph

THE CHICORA METEORITE

By F. W. Preston

On June 24, 1938, at 6 p. m., eastern standard time, the weather over western Pennsylvania from the West Virginia border (*1*)[1] north to Oil City (*2*) was fair. Over the central area, the southern part of Butler County, the sky was blue and cloudless (*3*); north and west were cumulus clouds (*4*), which in the west approximated thunderheads (*5*, *6*) and in the north, a few miles from Butler City, the ceiling was low and apparently somewhat solidly overcast (*7*). At Pittsburgh, 2 hours earlier, the sounding balloons from the county airport had been lost to sight a little above 4,000 feet (above sea level) by reason of cloud (*8*). The winds were light, both at ground level and aloft (*8*).

The crows had already assembled for their nightly roost in the hemlock woods of the overcast area a few miles north of Kaylor, Pa. (*9*), but the chickens near Chicora were still scratching in the fields (*10*), and the geese near Cooperstown were still swimming on a pond (*11*).

The sun was fairly well up in the sky (*12*), but it was past business hours: In Butler it was 6 p. m.; in Pittsburgh and the valley towns nearby it was 7 p. m. by daylight saving time. People were gardening, golfing, swimming, playing baseball or tennis, or sitting on their porches listening to the news broadcast over the radio, and some were just sitting. A few seconds before 6 p. m., as the broadcast was changing (*5*, *6*, *13*), a brilliant fireball flashed across the sky from

[1] The italic numbers in parentheses refer to the list of observers on pp. 401–402.

southwest to northeast; and a few seconds past the hour Butler City and the northern part of Pittsburgh were rocked by a terrific explosion, like a long-drawn thunder roll.

The flash was seen sidelong by some who did not actually witness the meteor; they took it for a lightning flash, though a queer one, and glanced at the western thunderheads. Then the roll came in: the ground seemed to shake as one sat upon it in the garden (*14*); windows on the east side of the building rattled as if they would never stop (*15*); at Pittsburgh windows were reported broken (*16*), though the writer has not verified this. It was realized that this was not thunder. Some thought the boilers in their cellars had exploded; others concluded that a dynamite truck had blown up, as happened a few years earlier just outside the town; then since neither the one nor the other could account for such a massive sound, the rumor spread that the powder magazine at West Winfield had exploded. The rumor was shortly killed by the testimony of eyewitnesses that a great meteor had shot across the sky, in brilliance rivaling the sun (*17*), which was still high enough in the heavens, and leaving behind it a trail of smoke far whiter than the cumulus clouds beyond it in the north (*4*).

The sound of the explosion caused some to believe that the meteor broke into two pieces over Bakerstown (*18*), and there were reports that a part was actually seen to break off and go in another direction; but the most trustworthy evidence is that there was only one smoke trail, and the "explosion" is naturally accounted for by the sudden expansion of the air in the hot trail and not by a shrapnel-like explosion of rending rock.

Toward the end of its trajectory the meteor passed into the overcast area and was observed as a great swirling in the clouds (*7*) or as something ripping the clouds to pieces (*19*). The country is here sparsely populated, rough, and forested, with deep rocky ravines. Just to the west lies the oil-refining country of Petrolia, and people supposed at first that the oil tanks were blowing up. The main mass of the meteorite has not been located in spite of much searching. The probable point of impact as determined from the trajectory seems to agree well with the testimony of witnesses busy near the spot, and with the absence of testimony from the river valley towns just beyond, but in spite of much searching nothing has been found, for the country is densely covered with forest and other vegetation, and the hillsides are so steep that one must hang onto the trees in places in order to keep upright. What has been found are two small pieces (pl. 54) shed from the main body several miles ahead of the theoretical impact point, and really "discovered" by the chickens. These are the pieces reported upon in detail in the other sections of this paper.

The belt of country over which the meteor was observed is a long, narrow one. The southernmost point reporting is Nineveh, Pa. (see map, pl. 55), and the northernmost is Titusville. From these points the meteor was *seen*, but not *heard*. At Washington, Pa., the meteor was observed by several people but was not heard, although a powerful smell of sulphur was reported 15 or 20 minutes after the apparition.

Most of the observers were somewhat directly on the track of the meteor, i. e., under it to the south or beyond it at the north end, and only a few were sufficiently to one side of it to provide good intersecting shots upon the trajectory. However, a couple of good observations were obtained from eastern Ohio, and there were some, a little less accurate, from points east of the trajectory.

The time of day and year and the climatic conditions were favorable for the phenomenon to be observed by many witnesses. A considerable number of them have been interviewed in order to get the best possible estimate of the trajectory, in hope of locating more pieces of the meteor, and also to get the most accurate description possible of the phenomenon, for it will surely be rare for a great meteor to fall so obligingly in full view of thousands of witnesses spread over so wide an expanse of fairly well populated country.

From their reports, the trajectory has been reconstructed (let us hope without too great inaccuracy) as described later, and illustrated (map, pl. 55). Some of the observers add interesting details.

The meteor passed like a flash, leaving behind it a very narrow trail of smoke like a pencil mark on the blue sky (*17*); almost instantly (the observer estimated 1½ seconds) this expanded sideways until it was about wide enough to block out the moon (the moon was not visible then). Another observer reports a spiraling (*11*) of the smoke. Two independent observers report the smoke as drifting slightly to the northwest. In these latitudes, the upper air currents are somewhat persistently *from* the northwest. The "winds-aloft" report from the United States Weather Office in Pittsburgh fails to indicate any such drift, and either observers are in error or some local disturbance affected the smoke, or the Weather Bureau observations are incomplete. At noon and at 4 p. m. on June 24 the Bureau's observations were obstructed by cloud at 4,000 feet.

After the fireball passed Cooperstown, and before the sound arrived, a large flock of geese, swimming on a pond, all left the water, climbed onto the land, flapped their wings, and honked furiously (*4, 11, 20*).

At Chicora, a farmer (*10*) was sitting on his porch when there came a sound like an approaching airplane, and a great gust of wind. The chickens in a nearby paddock were wildly excited and objected to something in their midst, but a search failed to disclose what it was all about. Next day, hearing of the meteorite, the farmer searched

again and discovered two pieces of it, the larger about half the size of a man's clenched fist, the smaller, half that size. They were stony meteorites, the outer skin melted, resolidified, and slightly cracked, and they were buried 2 or 3 inches in the grass roots. The impression fitted the stone well, and the stone appeared to have fallen vertically. The farmer reports no flash of light or roar of thunder, but only a noise like an airplane and a great gust of wind. In a neighboring field a cow was discovered to have its hide torn downward as if struck a glancing blow by a falling stone, and it was necessary to have a veterinarian tend to it.

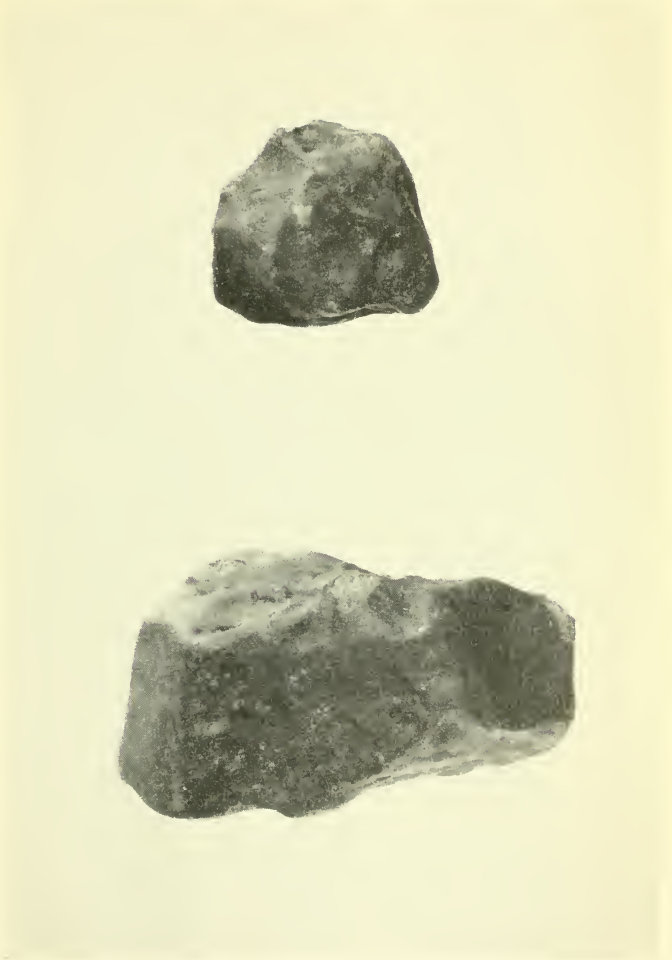
Other observers in the neighborhood of Chicora and just north of it heard no thunder roll, but some report hissing sounds. One observer, however, an 8-year-old child (*21*), spoke of the meteor as "the wheels of the thunder wagon."

Twenty miles farther on, at Oil City, a group was playing tennis. A foreigner yelled "Starfire!" and several observers saw the fire approaching, but falling short of them behind the housetops. The compass observations of their reports place the object rather remarkably west of most of the other "shots" and extraordinarily high in the sky. At present neither of these facts can be accounted for (*22*).

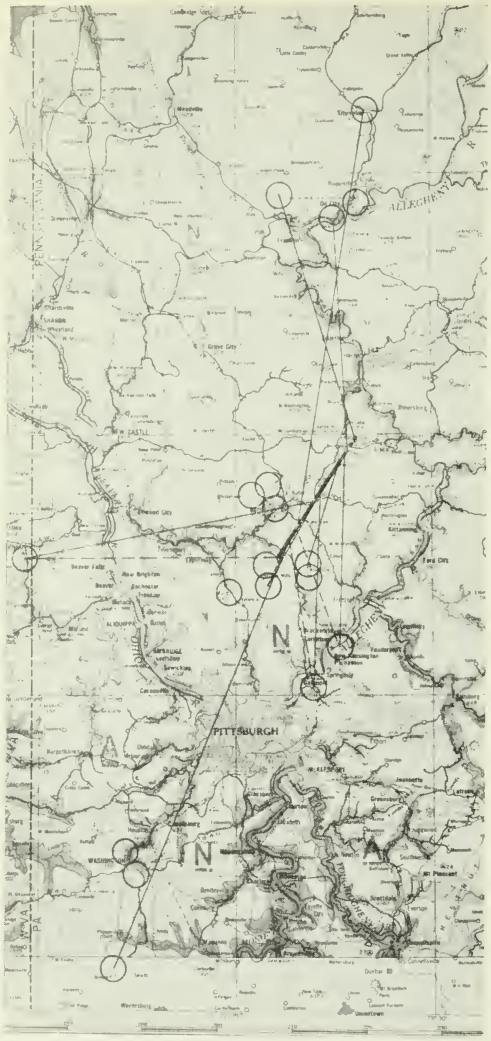
At Reno, a few miles west of Oil City, a jeweler (*23*) observed the fireball approach. It fell, he said, just across the Allegheny River in a deeply wooded ravine. It left a trail of smoke, which slowly drifted away. Nothing was heard, but the azimuth of the "shot" traces a line to Chicora. At Franklin also (*24*) the thing was observed in the direction of Chicora. Still farther north, at Titusville, a business man (*25*) in his office happened to notice it, and his observations place it over northeastern Butler County.

In the west, on the East Palestine golf links across the Ohio border, golfers (*26*, *27*) saw the streak across the eastern sky. On the lower Allegheny, around Oakmont and New Kensington, observers (*28*, *29*, *30*) saw it in the north. But so far practically no one has been found who saw it against the western sky; east of the trajectory we get no reports. This is unfortunate for the accurate locating of the trajectory. The explanation probably is that the sun was low in the west (18° above the horizon), and if the sky was clear in the west the meteor would not be seen against the sun. And where the thunderheads, black and threatening (*5*, *6*), obstructed the western view, the cloud of smoke would not be visible because the sun would not be shining on it, while the flash would be taken for lightning in the west.

The smoke trail, of vaporized rock, lasted in a clear form for at least half a minute. Yet observers differ greatly in their accounts of it. One man (*34*) thought it was airplane skywriting and spent his time looking for the airplane in front of the smoke. Another (*32*) did



The two individuals of the Chicora fall. The larger weighs 242 grams, the smaller 61 grams.



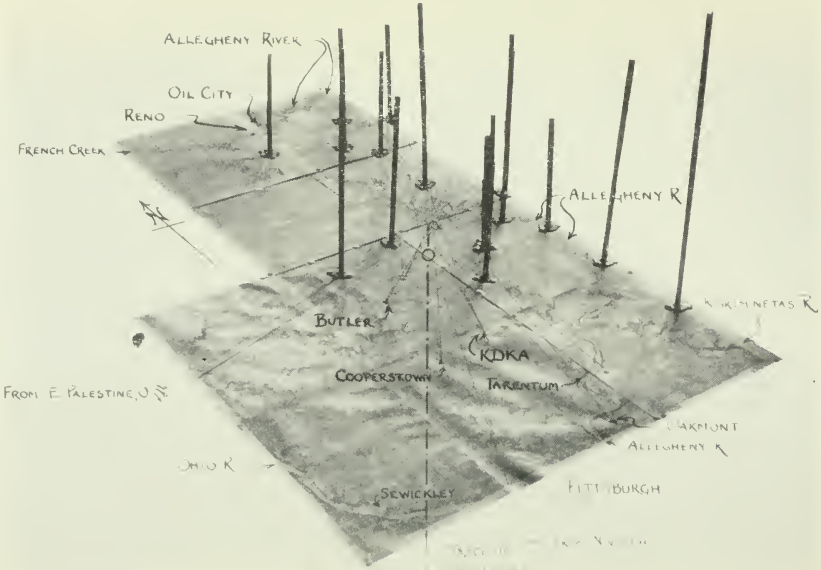
(See opposite page for explanation.)

PLATE 55

Terrain covered by witnesses. Circles represent locations of some of the witnesses; thin black lines represent their observations onto the trajectory; broken black lines represent estimates of the top of the visible smoke trail. Thick black line represents estimated path of meteor as seen in plan from top of visible trail to its end. Broken continuation of line to northeast represents reports of "swirling clouds," "clouds torn apart," "crows deserting roost," etc., up to the point where in the absence of atmosphere it is estimated that the meteor would have hit and where parts of it may be.

Observations from the north are nearly all lofted into the air and are too high in elevation as compared with those from the south, east, and west.

Scale: $\frac{1}{2}$ inch = 10 miles.



Map showing observations in three dimensions. The photograph is taken obliquely downward along that direction that causes the crossing of the threads to appear closest and on that basis is assumed to be the direction of the trajectory as nearly as it can be reconstructed. The circle on the trace of the trajectory is the place where the two Chicora fragments were found, just south of Chicora.

not notice it till it was all there, and since it reached the ground in the north, but not in the south, he concluded it was some sort of rocket that started in the north and traveled southwest into the sky. One witness (*11*) reports that the trail had a spiral track in it, and others (*7*, *19*) describe it as "twisting clouds" or a "swirling streak in the clouds." One (*5*) reports that the track was confined to a narrow strip near the zenith and did not go anywhere near the horizon, while others (*6*, *13*) in his immediate neighborhood traced it to the horizon. However, the former is not alone, for from other points an airplane pilot (*34*) reports the trail as stopping short of the northern horizon as seen from the Butler Airport, while an observer near Chicora insists that the trail broke up and did not descend to the ground. One observer (*31*) insists that the trail crossed the sky completely but was intermittent. Observers near Mars, Pa. (*18*), thought the meteor broke up near them, but so did people in Pittsburgh. This variance is probably due to the effect of the roar of the "explosion," which they were psychologically unable to dissociate from the notion that the thing must have blown to fragments. The roar comes from the sudden expansion of the very much heated air and boiling stone, not from an explosion of solid matter.

The meteor, as shown by its track, had passed around the sun and was now receding from it, when it overtook the earth. The difference in the two planetary velocities was presumably a few miles a second, from astronomical considerations. This is roughly 10 times the velocity of sound in air. The meteor was not spherical, but flat or irregular, and rotating rapidly, if we can judge by the spiraling of the trail.

The resistance of the air slowed it down and raised its surface temperature to brilliant incandescence "like the sun." The limit is set by the melting and boiling of the stone, which would probably be in the neighborhood of 2,000° C. This likewise sets a limit to the temperature attained by the surrounding air.

The pitch of the sound near Butler was a deep roar like thunder; at Chicora, a sound like an airplane; at Kaylor, a hiss. A proper interpretation of the sound might yield interesting results. (See section by Randolph.)

The meteor passed completely unobserved at the Pittsburgh County Airport. It was, however, observed at the Butler (Alameda) Airport by several persons. The Pittsburgh–Butler Airport was not checked. A pilot (*34*) in a small open plane was flying over Butler when the meteor went by, but he had his back toward it and saw nothing till he landed, when the smoke was still visible in the sky. This was probably a minute or two later, at the earliest. Such a result is to be expected, with the calm air conditions reported at lower levels.

The pilot of a Pittsburgh–Buffalo plane, which should have taken off at 6 p. m. sharp from Pittsburgh, reported no observations of the meteor, though if visible at all it should have been conspicuous from the copilot's seat, particularly if the trail endured for a couple of minutes.

Pittsburgh proper, however, turned in several reports of the meteor, though the Pittsburgh Airport, 6 or 8 miles to the south, missed it completely. These Pittsburgh reports, some of which are excellent, did not reach me till Feburary 1, 1939, half a year after the event. They had been sent to Canada or to Philadelphia and were finally forwarded to me by Dr. Charles P. Olivier, of the Flower Astronomical Observatory and director of the American Meteor Society.

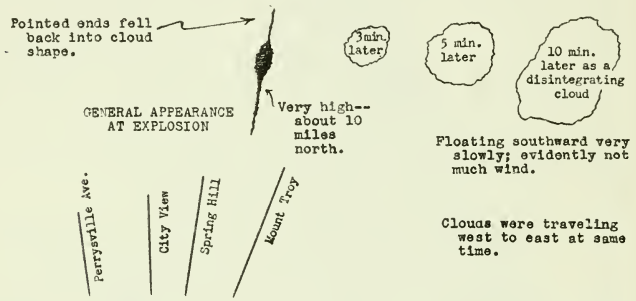


FIGURE 19.—Sketch of clouds and explosion as noted from "north side" Pittsburgh.

An observer (*36*) on the "north side" of the city (i. e., north of the Allegheny River) reports on June 26: "Myself and young son witnessed this phenomena. We usually watch for an airplane that flies over each night shortly after 7 o'clock (D. S. T.). Scanning the skies we saw this flash, then a puff of smoke, thin-pointed skyward, much thicker in the center with a jagged-edge appearance, and smooth thin-pointed earthward; called wife from house who witnessed and verified belief in smoke theory instead of cloud. About 1 or 1½ minutes later heard explosion much louder and higher than fireworks bomb, and watched smoke assume appearance of a cloud drifting slowly southward and disintegrating over a vast space; smoke was a vivid white." Figure 19 is a copy of his sketch. The time interval (1–1½ minutes) is probably somewhat underestimated. The sketch shows the smoke moving eastward, but reports it moving southward. It also mentions clouds.

From Oakmont, which is about 10 miles from downtown Pittsburgh in a direction somewhat north of east, the wife of a science teacher

reports a time delay of 1 minute. The explosion shook houses, and people ran into the street to see where the explosion was. The time is reported as 7:30 p. m. (E. S. T. no doubt, but in any case half an hour in error).

Leo J. Scanlon, secretary of the Valley View Observatory, Pittsburgh, obtained information from John Dengler, of north side Pittsburgh: "Time of passage (about) 7:10 p. m., D. S. T., June 24, 1938. Direction: Headed 30° east of north (from compass bearing by Scanlon). Altitude about 40° when first seen, extremely brilliant head (about as bright as 200-watt lamp at 50 feet), leaving a bright train of white smoke, which persisted for at least a minute and a half. (Others reported it as being visible for about 20 minutes.) Noise: Sharp and loud report, followed by a rumble, which began at about the same pitch as the explosion, gradually growing fainter. Noise heard about 2 to 2½ minutes after passage of fireball, which was moving at a speed of about 45° of arc in 3 seconds (estimated by Leo J. Scanlon from rehearsal of observer)." The time interval appears to be getting reasonably close.

An observer at the North Park, some distance out of Pittsburgh, reports the smoke trail as vertical and in the northeast. This seems correct, for according to our evidence the meteor passed almost over the Park before reaching the atmosphere, and was headed more or less northeast.

Prof. Charles Williamson and W. H. Bessey, of the physics department of Carnegie Institute of Technology, observed the phenomenon from the parking lot northwest of the engineering hall on the campus. Writing to Dr. Jordan, of Allegheny Observatory, on June 27, Williamson says: "At 6:58, E. D. S. T., the trail was seen by W. H. Bessey of this department and myself, from the parking lot northwest of our engineering hall. We can fix the time with some precision because I looked at my watch and checked it by an electric clock 3 minutes later. Mr. Bessey, who witnessed the flash, says it was of astonishing brilliance. It appeared in an unclouded part of the sky.

"Today, I took the bearings of some structures belonging to the United States Bureau of Mines above which the trail appeared. Its direction was approximately N. 30° E. The trail was almost exactly vertical as seen in projection; it extended from about 40° to about 25° above the horizon, widening from the top to, say, 30° above the horizon, and tapering below. This surprised me and made me infer wrongly that it might be a tracer bullet from some airplane. At its widest point the trail had a breadth of perhaps 30 seconds of arc. It persisted for upwards of 30 seconds and showed no noticeable drift.

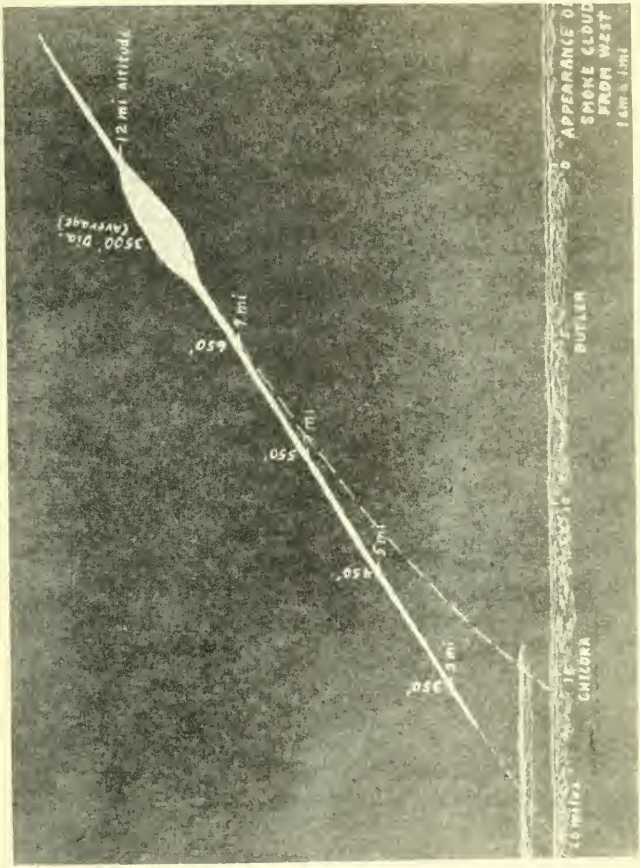
"We heard the burst at approximately 7:05, but unfortunately I did not look at my watch."

These observations are among the most accurate we have, except that the trajectory should have sloped somewhat, and not have been vertical. For the rest it agrees with our general conclusions. Note Williamson's agreement with Heyl, as to a wide part on the trail. Thirty seconds of arc is the width of the moon's disk and was about 25 miles from the observer. This implies a trail about 2,000 feet wide at this point.

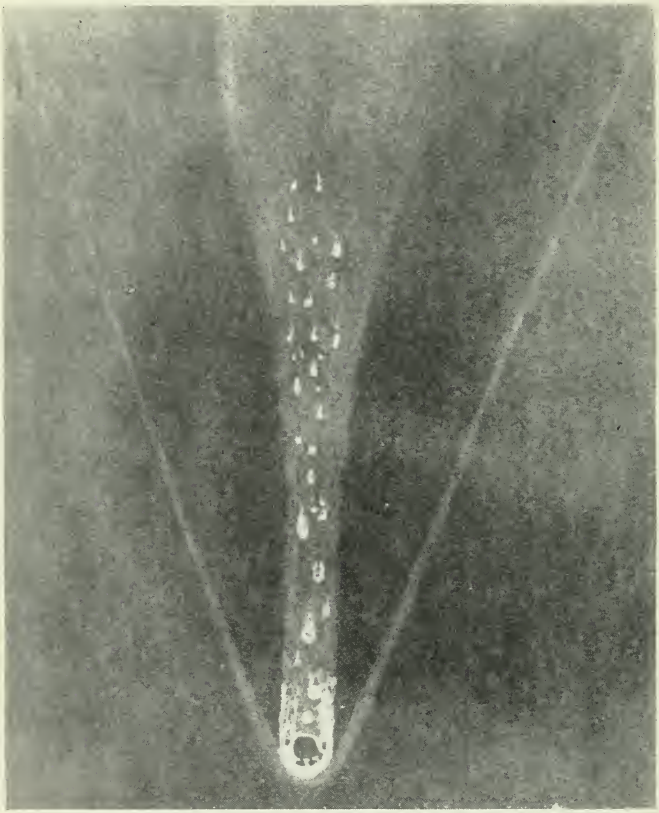
R. V. Bergvall, assistant to manager of engineering, Westinghouse Electric & Manufacturing Co., writing to the Royal Astronomical Society of Canada, on June 27, says: "I observed a meteor on June 24, 1938, at *about* 6:00 p. m., E. S. T., from 24 Hillcrest Road, Forest Hills, near Wilkinsburg, Pa. Thinking that a reasonably accurate reference might be of value, I spotted the center of the smoke in line with two landmarks that happened to be available and later measured the angle, using the location of the North Star as a reference. The measurements were made with a protractor. The central line of the smoke appeared 7° east of north and was exactly 40° up from the horizontal. The smoke subtended about a 15° angle, as closely as I could judge from memory after having obtained the protractor. The smoke trail tilted about 5° from vertical, the downward point being toward the east. The smoke drifted slowly toward the west. My wife observed the actual flash and reports that it did not reach ground. I believe that this observation is correct because of the limited length of the smoke line. The sound of the explosion was heard in about 2 minutes, but this time observation is not at all accurate."

Bergvall notes the slope of the track and places the meteor fairly accurately in the Chicora region. Mrs. Bergvall's report that the flash did not reach ground also is true, and the timing is not so far out. There is the mystery of the smoke drifting toward the *west*, also reported from Cooperstown and Butler, while Heyl reports it drifting south, and the clouds drifting east. Possibly the apparent motion is due, in part at least, to the settling of the smoke.

William A. Knoch writes: "I was sitting on the porch of my house, 7220 Hermitage Street in Homewood, with my sun glasses on just looking up at the sky, when I was amazed to see a long streak of fire going across the sky toward the earth at an angle. After going so far it stopped like something bursting. It continued with another streak and then ceased. After this bursting there was a small quantity of smoke which continued to hang in the sky. If you had not known it was caused by this meteor, you would have thought it was a small cloud. I thought at first it was a skyrocket that might have been shot from an airliner, but there was none around. I remained in this position watching the smoke. About 5 minutes later the whole window behind me shook until I thought the glass would break. I never



The appearance of the smoke cloud as seen from the west at an infinite distance.



Drawing illustrating the absorption of kinetic energy of the meteorite by the air.

connected the two as coming from this source. I thought there had been an explosion somewhere, and as I had my police radio on I listened for a fire call. About 5 minutes later there was a report of a fire on Melwood Street. Once before I had heard an explosion in a garage on Melwood Street, which had caused a fire alarm to be turned in. I thought this was a similar case and did not know differently until I read your account in the paper. Some of the people in the neighborhood thought the Italians on Larimer Avenue were having a celebration. This meteor was directly north of my home, seemingly up above Aspinwall."

This confirms the observation from Saxonburg that the smoke trail gave the impression of being intermittent. It agrees well with the other observations.

One other report comes from Oil City, beyond the north end of the track. An observer at Oil City golf course saw both flash and trail in the southwest, *more west than south*, but heard no sound. The smoke trail persisted for about 15 minutes. The observer thought the meteor might have fallen as far off as West Virginia. This observation agrees with other Oil City observations in placing the meteor much too far west. There was apparently something queer about the atmosphere near Oil City that day.

See plate 57 (drawing of meteor track) and section hereinafter by Randolph. The thin upper cloud in this drawing would be missed by Butler observers, and its top might be missed in Pittsburgh, but to Oil City observers this would be the most conspicuous part of the track, the lower parts being hidden by terrain features. Oil City observations give the best indications of the height at which the meteor first became visible.

The time of the meteor's passing is fixed with considerable precision at Station KDKA, where the broadcast was just signing off. The streak was first noticed at 7 seconds before 6 p. m., E. S. T., and the roar of the "explosion" came in at 24 seconds past 6 p. m. The fireball itself was not observed by these observers (*5*, *6*). One observer (*13*) also reports the radio broadcast program as in process of changing when the meteor passed.

A large number of observers who believed they could indicate the track of the meteor in the skies, or its point of disappearance below the horizon, have been interviewed, and transit observations taken of azimuth and altitude. The azimuth is obtained from magnetic north but is corrected to true north before entry in the table. Some of these observations are much more accurate than others, owing in some cases to more careful observers but often to topographical features that preclude serious errors, either as to the position of the observer or as to the features on the horizon. Accordingly, we have tried to label the

observations as of A, B, C, and D grade, in respect of either azimuth or altitude. An A grade means that we think the probable error lies within ±1°; B, within ±3°; C, within ±10°; D means we think the observations qualitative only, or in serious error. In attempting to rate the observations this way, we may ourselves be in error or prejudiced.

TABLE 1.—*Transit observations of the track of the Chicora (Pa.) meteorite*

Observer	Location	Azimuth	Elevation	Grade of observation
		Degrees	*Degrees*	
Mrs. Meyers [1]	Home of Moody, Kaylor	7	25	B
		209	16	C
A. E. Reiber	Butler	65	Above 33½	B
		86½	Above 45	B
		132¾	Above 43	B
Martin Reiber	do	78½	Above 41	
C. B. (Bud) Williams [1]	Kaylor	214	21	C
		34	20	C
W. H. Knoch	Saxonburg	194	24	D
		28	26	D
Dale Rudert	do	80	75	C
		16	17½	C
		23	63	D
		12	29	C
Pete Weiland	½ mile southwest of Woodbine (Butler).	31	20	C
		255	22	C
Richard Williams	Lat. 40°54′ N., long. 79°49.2′ W	76	50	D
		60	15	C
Paul Williams	do	220	52	D
Harold Miles	Lat. 40°46¾′ N., long. 80°32′ W	90	25	C
		84½	6¾	B
Don Miles	do	103	32	C
		79	11	D
Carmen Curcio	Lat. 40°52′ N., long. 75°57′ W	117	67	D
		43	36	D
Mat Whitlock	Haffey P. O., near Oakmont	21½	27¼	C
Frank Kuba	½ mile north of Oakmont, lat. 40°31.2′ N., long. 79°48.5′ W.	21¼	10	B
		351	33	C
		7	9	D
Mrs. Frank Kuba	do	7	9	D
Mrs. J. A. Llewellyn	Near Cooperstown	261½	50½	C
		30	9	B
Dr. J. A. Llewellyn	do	34½	31½	C
Mr. Honzo	Station KDKA, Saxonburg	6	50	C
		17	12	C
Kenneth Walborn	do	17	61	C
		17	7	B
Mrs. William Clarkin	Lat. 40°35.5′ N., long. 79°43.5′ W	340	24	C
		21½	13	C
Thomas Monks	Oil City	206		
S. B. Dengler	Reno	176		D
Dean Bell	Home of Henry Weil, R. F. D. No. 1, Karns.	351	31	
		282	43	
	Titusville	188	50±5	
	Wyattsville	162½	15±5	
Jay Sproul	Nineveh, lat. 39°59′ N., long. 80°21′ W			

[1] Did not see actual meteor, but swirling clouds.

Having obtained these bearings of the smoke trail, reconstructed from memory after a lapse of some weeks, we have plotted them on the United States topographical survey, 1/62,500 scale (roughly 1 inch to the mile), by means of strings stretched in the air above the maps, and in this way have tried to locate the correct trajectory (pl. 56). It is to be assumed that the trajectory will be nearly a straight line, and quite straight as seen in plain view.

The first sound of the "explosion" reaches a given spot on the ground, from the nearest point of the trajectory, or very nearly, since the meteor is traveling many times as fast as the velocity of sound. The succeeding sustained roar is due to the expansion of the air in both earlier and later parts of the trajectory. If the time interval were known with precision in any case, the length of the radius vector to the nearest point on the trajectory would be known with fair accuracy.

Around Chicora the time delay is reported as very slight. At Butler it was reported as about 8 seconds after the track was seen to expand (*17*), but that is probably an underestimation. At Station KDKA (Saxonburg), where the radio operators are extremely "time-conscious" and know exactly at what stage the signing-off of the program stood, the delay was at least 31 seconds. At Cooperstown one observer (*11*) saw the flash, and then the trail, and immediately called wildly for another (*35*) to come and look. The latter young lady was in the locker room, getting dressed for swimming, and ran out as soon as she could. She arrived ahead of the thunder peal by at least several seconds. I had her reenact the scene from the same degree of dishabille in the locker room, and she was out in 24 seconds. This sets a minimum limit, but the general belief of the four persons present was that the explosion was delayed a good many seconds beyond the 24. This places the trajectory at least 5 or 6 miles away. Beyond agreeing with the KDKA reports, these observations are of little help.

PROBABLE TRAJECTORY

Plate 56 shows a map of the central part of the terrain in which the phenomenon was observed, and the thin black lines are black threads representing observations, with a "transit" (theodolite) from various places on the ground, of the line of sight to some point on the smoke trail. Each thread arises from a thumbtack representing the position of the eyewitness, who was then asked to set the instrument on the highest point of the smoke trail and on the lowest point, as nearly as he could remember.

If every observer had been accurate, or if each could have had a transit all set up and ready to take the observations when the meteorite

appeared, then all the "shots" would cross on a straight line sloping down from southwest to northeast. Since all observers, under the actual circumstances, are in error by greater or less amounts, the problem is to get as good an intersection as possible from a great number of "shots," none of which are exact. This was done by first rejecting observations that did not fit at all, and then sighting among the remaining threads till they appeared to cluster into a small bunch. The photograph (pl. 56) is taken down this line of sight, which we assume to be the approximate trajectory. This trajectory descends at an angle of 31° to the horizontal and bears 33° east of true north. The horizontal trace of this trajectory is shown in the figure; the trajectory itself, since we are looking down on it, is a single spot marked by the north end of the trace. The small circle, on the trajectory trace, represents the place near Chicora where the fragments were recovered.

It will be observed that, with one exception, the threads do cluster fairly well when seen from this position. However, moderate shifting of the point of view and moderate changes of azimuth and angle of descent give intersections nearly as good, so there is some substantial uncertainty on all these points.

POINT OF IMPACT

According to the map, the meteor, unless entirely fragmented, should have passed a good many miles beyond the place where the two fragments were found, and should have landed within a short distance of the Allegheny River, in wild wooded country with precipitous ravines. A canvass of every farmhouse in this district indicates that very likely it did reach this region.

It appears that in this district the sky was overcast, presumably with clouds not higher than 5,000 feet above sea level or about 3,500 feet above the ground. A party of young baseball players (7) report hearing a hissing sound and, on looking up, noticing a great swishing in the clouds. Not far away two women report seeing the clouds ripped to pieces.

In a precipitous valley clothed largely with hemlock trees a flock of crows is accustomed to roost, and they had already assembled that evening by 6 o'clock. One woman noticed that on the arrival of the meteor the crows all were protesting and flew away, and another farmer's wife observed where the birds spent the night some distance away. They returned to their usual haunt next evening and have been there since.

Beyond this point, in the main river valley, there are no reports of the meteor, and there is every reason to believe it did not cross the Allegheny River.

On the evidence of the crows, and the apparent trajectory, Mr. McCormick has spent many hours searching the ravine in question. He reports that it is scarcely possible to stand without hanging on to the trees, and that it takes one man a day to search an acre or two. His searches have so far proved fruitless. Mr. Aderhold chartered a small plane and flew over the woods in this district looking for evidence of damaged trees, but he was also unsuccessful. Obviously a meteor or collection of fragments weighing many hundreds of pounds and perhaps tons could fall in such a place and except by accident never be discovered.

The evidence, however, of the two fragments actually recovered is that fragments falling nearly vertically were shed miles ahead of the theoretical impact point. Since we cannot assume that two small fragments of stone, weighing a few ounces each and traveling with a normal terminal velocity, could have created a sound like an airplane or a great rush of wind, it is clear the main meteor lies northeast of the recovered fragments. But since there are some miles of territory between Garing's farm and the theoretical impact point, and the country is mostly under dense vegetation, the prospects of recovery are not bright.

Theoretical impact point is about latitude 41°1′ N., longitude 79°40′ W.

Recovered fragments are from approximately latitude 40°56′ N. longitude 79°44′ W.

TOP OF SMOKE TRAIL

This is probably a fairly definite point physically and represents the place at which incandescence reached the boiling or vaporizing point. Obviously, as this was at a high altitude, the true "boiling point" would be low, but what is here meant is a point at which the stone had fused to a glass of low enough viscosity to be ripped into a vapor or dust by the rush of air. This is a fairly definite point, and observers ought to be able to agree on the position of the top of the trail, whereas they will not agree on the bottom of it, because this is usually settled for each observer by obstructions on his horizon.

Unfortunately, while it would have been easy to sight on the top of the smoke trail with a "transit" at the time of the phenomenon, it would not be easy in most cases to mark the position for future reference, as the open sky rarely has landmarks. A few observers saw the trail through the treetops, or past gable ends of houses, but while these could have been good markers, the observer rarely knew his own position to within a few feet, and this makes a significant error of angle.

Taking account of the various situations of the observers, it appears to us likely that the top of the smoke column actually observed was

in about latitude 40°45′N., longitude 79°50′W., and at a height of about 12 miles.

The horizontal trace of the trajectory passes within 4 miles of downtown Butler, but the meteor was then about 10 miles up in the air, and perhaps 11 miles away in a straight line. The sound of the meteor (the thunder roll) should therefore have begun approximately 1 minute after the flash. All observers estimate a shorter time, but the best of them seem to feel their estimates are underestimates.

WIDTH OF THE SMOKE TRACK

Several observers near Butler report the track to have been, in their opinion, slightly greater in width than the full moon. As the full moon is very nearly ½°, we may take their estimates of the width as being ⅝°. With the meteor 11 miles distant, this makes the track, after adiabatic expansion, one-eighth of a mile wide, or about 650 feet.

The observer at Nineveh reported the track about half the width of the new moon or less. This would make the track a good deal wider, for Nineveh is far away. Williamson (p. 394) makes it 2,000 feet wide. Heyl's sketch (fig. 19) shows it nearly a mile wide. But these latter observers were viewing the cloud from the south, and the part to which their estimates apply is probably not the same as the part that was most conspicuous at Butler. (See section by Randolph.)

THE SEARCH FOR FURTHER FRAGMENTS

No other fragments than the two small pieces found by Adam Garing were reported by any of the residents of the area. A few large lumps of ordinary slag were offered us from south of Butler, and were even exhibited in a local store window as possible fragments of the meteorite. A number of scientifically inclined or adventurous helpers undertook to search the region by every available means.

J. M. McCormick and L. G. Ghering, both of the Preston Laboratories, traveled every back road of the critical areas and made a house-to-house canvass for information. This produced some interesting stories but no fragments. McCormick flew over the area in a small plane, looking for craters or broken trees, and searched the woods on foot wherever he saw anything suspicious from the air, but without result.

George Aderhold, of the Saxonburg Potteries, to whom we are indebted for the recovery of the two fragments from Adam Garing, stationed himself on open hilltops and directed aerial search by two young aviators (*37*, *38*). These boys flew over the valleys at so low an altitude that they located most of the groundhog holes, apparently, and almost skimmed the treetops. They reported that the ice storm

of the previous spring had broken off so many trees and branches of trees, that anything the meteor might have done was indistinguishable. Aderhold, like McCormick, tried to search the area on foot, with equally little result.

The evidence at Garing's farm is that the fragments are comparatively small and fell vertically. If they are all alike, the fragments could do little damage, would not break trees except in the rarest of instances, and would just about bury themselves in the forest floor.

THE RECOVERED FRAGMENTS

Thus it comes about that from the welter of confused and sometimes conflicting reports the only tangible objects available are two small black pebbles, the larger not 3 inches long. The material in the smoke trail may have weighed tons, and tons of fragments may have reached the earth, but all we have, or are ever likely to have, for detailed examination, are a few ounces now in the United States National Museum. It seems strange that the whole countryside could be rocked from Pittsburgh to Petrolia, a distance of 50 miles, and that startled observers should see the flaming apparition from points 200 miles apart, and yet all that should be recovered be so small a matter. Big noises evidently produce little by way of result.

Small as the fragments are, however, they probably tell us substantially as much as if we had the whole meteor, for it seems reasonable to assume that the rest of the meteor was like the samples.

AUTHORITIES CITED

(*1*) Jay Sproul, Nineveh, Pa.
(*2*) Thomas Monks, Oil City, Pa.
(*3*) Numerous observers.
(*4*) George Bottcher, architect, observing from Cooperstown, Pa.
(*5*) G. E. Sadlon
(*6*) Kenneth Walborn } KDKA broadcasting station, Saxonburg, Pa.
(*7*) Group of ball players near Kaylor, Pa., C. B. Williams reporting.
(*8*) U. S. Weather Bureau, Pittsburgh Municipal and County Airport, 10 miles south of Pittsburgh, R. W. Carey reporting.
(*9*) Farmer's wife.
(*10*) Adam Garing, Chicora, Pa.
(*11*) Mrs. J. A. Llewellyn, Butler, Pa.
(*12*) T. C. Baker, Butler, Pa.; checked by calculation. See page 387.
(*13*) Mrs. William Clarkin, New Kensington, Pa.
(*14*) Miss Kate Black, Butler, Pa.
(*15*) Mrs. F. H. Hayes, Butler, Pa.
(*16*) Pittsburgh Post-Gazette, June 25, 1938.
(*17*) Martin Reiber, Butler, Pa.
(*18*) Butler Eagle, June 25, 1938.
(*19*) Mrs. Meyers, near Kaylor.
(*20*) Dr. J. A. Llewellyn.
(*21*) Dean Bell, Karns City.

(22) The only explanation so far advanced is the possibility of a mirage lifting the apparent positions considerably above the true one.
(23) S. B. Dengler, Reno, Pa.
(24) Mrs. E. C. Ifft, Franklin, Pa.
(25) Charles McCurdy, Tuscaloosa, Ala., reported the information given.
(26) Harold Miles, East Palestine, Ohio, golf course, 2 miles south of Nesley,
(27) Donald Miles, Ohio.
(28) Frank Kuba, Oakmont, Pa.
(29) Mrs. Frank Kuba, Oakmont, Pa.
(30) Mat Whitlock, Oakmont, Pa.
(31) W. H. Knoch, Saxonburg, Pa.
(32) Charles Walters, near the Stepp Inn, Pennsylvania Route 8, about 7 miles south of Butler, Pa.
(33) Mr. Honzo, KDKA broadcasting station, Saxonburg, Pa.
(34) Carmen Curcio.
(35) Miss Mary Campbell, Butler, Pa.
(36) Harry C. Heyl, North Side Pittsburgh, Pa.
(37) W. H. Knoch, Saxonburg, Pa.
(38) Dale Rudert, Saxonburg, Pa.

CALCULATIONS OF THE SIZE OF THE METEOR FROM CONSIDERATIONS OF ENERGY

By James R. Randolph

Kinetic energy from a meteor is absorbed by the air in two ways: Part of it goes into the production of the sound waves, and part goes into heating the air through which the meteor passes, and at the higher speeds into evaporating the material of which the meteor is composed.

No attempt has been made to compute the energy transformed into sound. But in the case of the Chicora meteorite it has been possible to compute the nonsonic, or heat, energy with what is believed to be a fair degree of accuracy, and from this to compute the weight of that portion of the meteor whose kinetic energy may be assumed as wholly transformed into heat.

This is possible in this case because there is reason to believe that the velocity of approach of the meteorite was small compared to the velocity given it by the earth's attraction, and because its velocity, which in the upper air may have amounted to about 45,000 feet a second, had been reduced to less than 1,000 feet a second by the time the remains of the meteor struck the ground. Thus the kinetic energy per pound is known. And a way is developed for computing the total nonsonic energy from the size of the smoke cloud. This permits an approximate computation of the weight of the meteor.

Observers west of the path of the meteorite describe it as leaving a smoke trail that looked at first like a white pencil mark in the sky, then expanded in about 1½ seconds to a width that has been computed as approximately 650 feet. After this it expanded and diffused more

slowly until it disappeared. Since most of these observers were in the vicinity of Butler, the estimate applies primarily to the width at that point.

Observers south of the meteor path, in the northern suburbs of Pittsburgh, describe the meteorite as forming a very much larger cloud than was seen at Butler. Williamson's estimates give it a width of about 2,000 feet, while Heyl's (*36*) show it more nearly a mile in greatest width. Both these agree in showing a cloud rather thick in its midheight and tapering off above and below.

This discrepancy may be understood by reconstructing the probable reactions of the observers, and what they saw and what they missed. Observers at Butler saw the brilliant meteor flash across the sky. Their eyes followed it into the north and then traveled back along the smoke cloud, which was here about 5 miles away and 9 miles up in the air. Their eyes would then linger on the larger cloud and would fail to see the smaller cloud above it, which soon disappeared. And the large upper cloud would be taken for a simple expansion of an extension of the lower cloud.

Observers to the south, on the other hand, came nearer to seeing the whole thing at once. They could see it all without turning their heads. It was greatly foreshortened to them, so that the bigness of the upper cloud would be more conspicuous. Also the thin-pointed cloud above it would be more noticeable.

Plate 57 is an attempt to reconstruct the meteor trail as it would be seen from the west by an observer at an infinite distance. Heyl's proportions are used, as these have come in the form of a sketch (fig. 19) and hence are possibly more reliable than an estimate of a narrow angle made after the cloud had disappeared.

The cloud thus has two more or less distinct sections. There is the upper section extending from the 12-mile level to the 10-mile, having a length of about 4 miles and an average diameter of 3,500 feet. And there is the lower cloud, tapering down from a maximum of about 650 feet. The path makes an angle of 31° with the horizontal. The dotted line shows the probable trajectory of the small pieces that fell in the chickenyard at Chicora and suggests that they were detached in this big cloud. As they were not seen coming down, it is probable that by the time they emerged from the cloud their velocity had already fallen to less than a mile a second, which makes this trajectory about right.

Observers south of Chicora describe the sound made by the meteorite as a thunderclap, very prolonged and violent.

Observers at Chicora compare it to an airplane, or to "the wheels of the thunder wagon."

Observers north of Chicora call it a hiss.

An airplane propeller used for a wind tunnel makes the characteristic airplane sound when at full speed. But this is due to the driving of the propeller tips at a velocity close to that of sound, since the electric motor driving it is silent.

The most conspicuous difference between the thunder sound and an airplane sound is that the latter starts low and rises as the plane draws nearer, since the plane's speed is substantially less than that of sound. But thunder starts with the loudest noise, since it is made by something that is going a great deal faster than sound.

An unstreamlined body traveling at a speed less than that of sound makes a hissing noise.

From these facts we may conclude that when the meteor reached Chicora its speed was approximately that of sound, or about 1,000 feet a second. Its speed when it struck the atmosphere was probably about 45,000 feet a second. Gravity alone would give it 36,900, to which its velocity of approach must be added vectorially. At this speed its kinetic energy would be:

$$\frac{1}{2} MV^2 = 31.4 \times 10^6 \text{ foot-pounds per pound.}$$

Plate 58 shows the way in which the kinetic energy is absorbed by the air. As the meteor's velocity is far above that of sound, the air in front of it is very highly compressed and is heated by the compression to white heat, probably to well over 2,000° C. Then a sound wave spreads out from it, like the waves from the bow of a boat. And this sound wave may be white hot near the meteor. As before mentioned, this sound wave accounts for part of the energy, which is neglected in the present computation. It also accounts for the thunderclap heard by observers south of Chicora.

Between the sound wave and the meteor the intensely compressed hot air rushes back into the vacuum behind the meteor and forms a turbulent wake. Except for its incandescence, this whole appearance is similar to that observed in a spark photograph of a bullet in flight.[2]

But heat from the air is transferred to the meteor, causing its surface to melt. The molten matter is carried back into the turbulence, where it is atomized to form smoke and its heat given up to the air. An iron meteor loses weight through this melting. But a stony meteor, through at least a part of its course, does not merely melt. It spalls. Pieces of the surface are broken off by rapid expansion and are carried back into the turbulence, where they act as independent small meteors until finally disintegrated and turned into smoke or slowed to the point where further disintegration ceases. The latter is what happened to the two small pieces that were found.

[2] See National Bureau of Standards Scientific Paper No. 508.

This action is complicated, so that the result we are after can be obtained more simply by applying the box theorem to the process. In this case we put the box around the front part of the turbulence, so that at the front the nonsonic part of the meteor's kinetic energy is going into the box, and at the rear there is coming out a smoke cloud, expanded to atmospheric pressure and completely stopped, but not yet diffused into the surrounding air. As no energy or matter of any consequence goes in or out elsewhere, and as there is no storage, then the energy going into the box, in the form of kinetic energy, must equal the energy coming out, in the form of increased PV energy of the smoke cloud.

$$\text{Energy}=PV\frac{T_2-T_1}{T_2},$$

where P is the atmospheric pressure, V the volume of the smoke cloud, T_2 the absolute temperature of the smoke cloud at this stage, and T_1 the absolute temperature of the atmosphere.

In this computation the product PV is computed first, and the temperature brought in later as a correction term. The smoke cloud is divided into two parts: The "upper" cloud, extending from the 12-mile level down to the 10-mile, and having an average diameter, from Heyl's sketch (fig. 19) of 3,500 feet, and the "lower" cloud, extending from there to Chicora. Because it runs through a wide pressure range, the lower cloud is computed as a series of cylinders, while a single computation suffices for the upper cloud.

For both computations the formula, in English units, is:

$$PV=LD^2\frac{\pi}{4}\times 144\ P=\frac{144\ \pi\ L}{4}\times D^2P.$$

From top to bottom of the upper cloud the difference in altitude is 2 miles, and the lower cloud is divided into sections of the same length. Hence $L=\frac{2\times 5{,}280}{\sin 31^\circ}=20{,}700$ feet.

For the lower cloud the product D^2P is computed separately for each section; then these are added and multiplied by the rest of the equation, which has a value of 2,330,000.

Average altitude (miles)	D	D^2	P	D^2P
3	350	122,500	8.16	1,000,000
5	450	202,500	5.30	1,072,000
7	550	302,500	3.19	966,000
9	650	422,500	2.03	858,000
Total lower cloud				3,896,000
11	3,500	12,250,000	1.22	14,950,000

For the lower cloud $PV=3{,}896{,}500\times2{,}330{,}000=9.3\times10^{12}$.

For the upper cloud $PV=14{,}950{,}000\times2{,}330{,}000=34.8\times10^{12}$.

Dividing each by 31,400,000 we get the amount of material whose energy is required to produce each cloud. This is:

For the lower cloud 296,000 pounds = 148 tons.

For the upper cloud 1,108,000 pounds =554 tons.

We can now apply the temperature correction. Temperatures of the air along the path of the meteor are −51° C., or 222° abs., for the upper cloud, and about 230° abs. on the average for the lower. The temperature of the cloud after expansion is roughly estimated at 900° abs. But the error is much greater than the difference between 222° and 230°. Hence 230° is used for both, and the temperature correction factor becomes

$$\frac{900-230}{900}=0.74.$$

Hence the weights become, for the lower cloud:

$$148\times0.74=109 \text{ tons.}$$

For the upper cloud:

$$554\times0.74=410 \text{ tons.}$$

Total_____519 tons.

The shape of the cloud can also give us some idea as to the structure of the meteor. The lower cloud appears to have been formed by a single solid, about as compact as the fragments recovered, melting and spalling at a fairly uniform rate. And that high extension of the upper cloud, which has not been computed, may be of the same nature.

But the shape of the upper cloud, and its "jagged-edged appearance" as described by Heyl, suggest that it is of a different nature. Something seems to have happened at the 12-mile level, which can best be described as a sudden crushing of a loose outer structure surrounding the more compact central core. This outer structure weighed 410 tons to 109 for the inner core, which probably gives the proportionate size of the two, even if we could add the mass required to produce the sonic energy.

What was this loose outer structure?

At the Bureau of Standards is a cross section of a pot of optical glass that has been allowed to cool rapidly. The whole outer portion has cracked up, leaving only a few large lumps at the center. And a large stony meteor, passing near the sun, would probably be similarly cracked. It would have at least a slow rotation. The side toward the sun would be heated, and the side away from it cooled, through tem-

perature ranges comparable to those found on the moon or Mercury. And because the material is a poor conductor of heat, this alternate heating and cooling would set up temperature stresses and form cracks extending deeply into the mass, even as they do into a pot of optical glass.

If this big meteorite had come straight down instead of at this long slant, it would have reached the earth with a lot of its structure still intact and a lot of its energy still in it. And if it had landed on Pittsburgh there would have been few survivors. Its kinetic energy of 31,400,000 foot-pounds per pound is more than 20 times as great as the explosive energy of TNT.

At least its capacity for destruction would have compared favorably with that of the shipload of TNT that blew up in Halifax Harbor in 1917. And such a catastrophe, or even a very much larger one, can happen at any time, with no more warning than the observers of the Chicora meteorite had. But fortunately the energy of this meteorite had all been absorbed by the air before it reached the ground.

MINERALOGICAL DESCRIPTION OF THE METEORITE

By E. P. Henderson

Only two specimens of the Chicora meteorite have so far been recovered, the larger one weighing 242 grams and the smaller 61 grams; both are deposited in the United States National Museum (No. 1326). The latitude of the place of discovery is 40°56′ N. and the longitude 79°44′ W. Both individuals are covered with a thin film of black fused crust, and neither shows any evidence of being orientated through much of its flight. Shallow and irregular depressions (thumb marks) are noticeable on each, but no unusual physical features are present.

When the crust was removed a fine-grained texture was found exhibiting a rather uniform gray color. All the component minerals are so small that none could be recognized by the unaided eye, unless it be an occasional inclusion of bronze-colored troilite. On the freshly broken surface no conspicuous evidence was observed of the chondritic nature of this meteorite, and not until a thin section was prepared could positive proof of this be given. From the smooth surface, made by cutting away a portion for the thin section, a dappled-gray pattern is noticeable. The darker gray material is in rounded, as well as slightly elongated, chondrules or portions of chondrules, each being separated by a thin zone of lighter gray material. The texture is just firm enough to make it slightly difficult to break apart by the use of a steel tool.

PREPARATION OF SAMPLE FOR CHEMICAL ANALYSIS

Material for study was taken from the smaller specimen. The fused crust was removed by using a steel dental pick, and by this same instrument the central portion was found to be rather easily broken apart. The material selected was carefully examined to free it from the crust and then partly crushed and sized by screening through a 140-mesh sieve, and divided it into two portions, one of which was less than 140 mesh and the other coarser, but still less than 80 mesh. This step was taken in the hope that it would be possible to separate the metallic portion from the silicates by using an electromagnetic separator. There was enough iron dust or magnetic particles associated with both fractions to prohibit satisfactory separation by the electromagnet.

A small portion of the magnetic material was removed from one of the samples and unfortunately lost. This made it dangerous to combine the samples again; hence each portion, the coarse and the fine, was analyzed as a separate sample. The author does not recommend this procedure for stony meteorites, and if there had been a greater quantity of material available from which to select a new sample these two portions would have been discarded and a new one prepared.

The samples taken for analyses were digested in mixed nitric and hydrochloric acids for 12 hours. This treatment took into solution all the metallic minerals, except a grain or so of chromite, and completely decomposed the olivine. The silica from the olivine along with the insoluble material was filtered off and the separated silica subsequently removed from the insoluble residue by digestion in sodium-carbonate solution. Very little of the silica separated from the olivine was present in the acid filtrate; apparently the silica is largely separated out if the acid stands in contact with the olivine for some time. After the removal of the silica the insoluble portion was carefully ignited at low temperature necessary to burn off filter paper and preserved in order that it might be separately analyzed chemically and mineralogically.

Table 2 gives the results of the analysis on both the fine-grained portion and the coarse.

OLIVINE

The composition of the olivine was determined from the analysis of the soluble material. It had to be assumed that the silica, soluble in the sodium carbonate, together with the small portion recovered in the acid filtrates was entirely derived from the olivine. Several side experiments, of a qualitative nature, were conducted, and it was found that olivine is very easily attacked by acids, even weak organic ones such as tartaric. The magnesium in the soluble portion was also

TABLE 2.—*Analysis of the acid-soluble portion of the Chicora meteorite*

E. P. HENDERSON, analyst

Substance	Fine-grained material, less than 140 mesh				Coarse material, more than 140 mesh, less than 80 mesh		
	Sample 1	Sample 2	Sample 3	Average	Sample 1	Sample 2	Average
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Insoluble	32.30	32.80	32.74	32.61	39.93	39.07	39.50
SiO_2	21.04	21.74	21.90	21.56	19.39	19.56	19.47
Fe [1]	18.15	18.14		18.14	16.99	16.44	16.71
Ni	.49	.48		.49	.79	.83	.81
CaO	.80	.78	.50	.69	.50	.49	.49
MgO	20.16	19.99		20.07	Lost	17.89	17.89
P	.11			.11	.06		.06
S	2.49	2.43		2.46	2.02	2.11	2.06
Co		.19		.19	.22	.45	.33
				[2] 96.32			[2] 97.32
Insoluble				32.61			39.50
Olivine	MgO 20.07 FeO 14.90 CaO 0.69 SiO_2 21.56			57.22	17.89 14.04 0.49 19.47		51.89
Troilite	S 2.46 Fe 4.33			6.79	2.06 3.67		5.73
Schreibersite [3]	P 0.11 Fe 0.58			.69	0.06 0.31		.37
Metallic portion	Fe 1.66 Ni 0.49 Co 0.19			1.66 .49 .19	1.83 0.81 0.33		1.83 .81 .33
Total				99.65			100.46

[1] Includes acid sol. FeO.

[2] Low summation due to calculating all FeO as Fe.

[3] Phosphorus could be present as merrillite, but neither schreibersite nor merrillite was recognized.

TABLE 3.—*Analysis of the insoluble material in the Chicora meteorite*

E. P. HENDERSON, analyst

Substance [1]	Sample 1	Sample 2	Average	Substance [1]	Sample 1	Sample 2	Average
	Percent	*Percent*	*Percent*		*Percent*	*Percent*	*Percent*
SiO_2	55.97	55.21	55.59	MgO	18.55	19.13	18.84
FeO	13.82	13.36	13.59				
Al_2O_3	4.61	4.93	4.77	Total	98.10	97.16	97.63
CaO	5.15	4.53	4.84				

[1] Cr and Ti were found present but not determined. Na was not determined, but it must be present in the feldspar molecule.

considered as being entirely derived from the olivine. Hence, if we know the magnesium and the silica content, the necessary quantity of iron can be calculated and deducted from the total amount present. Traces of calcium were also found, and as several tests for aluminum gave negative results it seemed logical to consider the calcium as a component of the olivine rather than as belonging to a soluble feldspar molecule such as anorthite.

Table 2 shows that the finely divided material contains 57.22 percent olivine, while in the coarser samples 51.89 percent was found. Since the relative proportion of these two fractions was not determined, a weighted average of the olivine content in the meteorite cannot be established, so the amount of olivine in the Chicora meteorite is expressed by averaging the results obtained by recalculating the analysis of these two groups.

TABLE 4.—*Olivine in the Chicora meteorite (recalculated to 100 percent from the results in table 2)*

Substance	Coarse	Fine	Average	Ratio
	Percent	*Percent*	*Percent*	
MgO	34.47	35.07	34.72	0.8611
FeO	27.05	26.04	26.545	.3694
CaO	.96	1.20	1.08	.0192
SiO_2	37.52	37.69	37.605	.6235

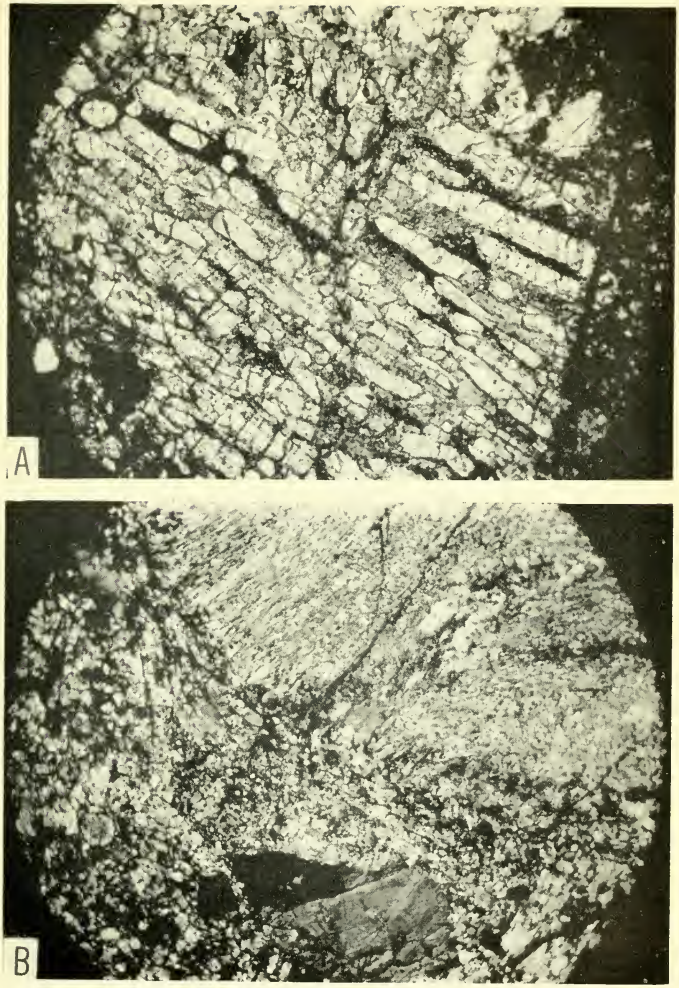
The olivine composition expressed in weight percentages of the various molecules is Mg_2SiO_4, 60.67; Fe_2SiO_4, 37.63; Ca_2SiO_4, 1.65. If this olivine is compared with that found in terrestrial rocks it will seem to be unusually high in iron. It is well above the average iron content for olivines in pallasites, although the olivines in stony meteorites sometimes run as high in iron as this one.

The indices of refraction determined by the immersion method gave values agreeing very well with the composition of this olivine:

Specimen	α	β	γ	Determined by—
Olivine from Chicora	1.695	1.712	1.735	J. J. Glass.
Synthetic olivine (Mg_2SiO_4, 60; Fe_2SiO_4, 40)	1.705	1.730	1.748	Bowen and Schairer.[1]

[1] Bowen and Schairer, The system MgO-FeO-SiO_2. Amer. Journ. Sci., vol. 29, p. 197, 1935.

The olivine in this meteorite has two different modes of occurrence: (*a*) There are fragments of a banded chondrulitic olivine structure (see pl. 59, A) but no complete chondrules. The banded or barred



A, Fragment of the banded olivine chondrule (× 50).

B, The fibrous upper half of the field contains a fragment of a pyroxene chondrule. The subhedral dark inclusion at the bottom is olivine.

olivine is made up of alternating zones of olivine and a granular, fine-grained, crystalline aggregate. The olivine bands in a given chondrule fragment will extinguish under cross Nicols as a crystallographical unit. The origin of this banded structure of the olivine must have taken place when the original chondrules were formed. These were broken up and their fragments added to this mineral aggregate.

(*b*) There are a number of subhedral olivines present, and their outer areas have been badly granulated, while the central portion, although fractured, is not nearly so badly broken up or shattered. It appears that this shattering of the outer zones of the olivine has taken place after the consolidation of this mineral aggregate.

FELDSPAR

Oligoclase was found in the insoluble residue, and as several tests were made for aluminum in the acid-soluble portion and none found, it seems certain that no anorthite is present. The grains are small and free from twinning, and no evidence of any internal strains could be detected. The quantity present was obtained by recalculating the analysis of the insoluble residue, assuming that all the aluminum belonged to the oligoclase molecule. Oligoclase was found to make up 7.20 percent of the total meteorite.

TABLE 5.—*Compositions of the pyroxenes in the Chicora meteorite, obtained by correcting the analysis of the insoluble material for ogligoclase*

Substance	Insoluble material	Oligoclase to be deducted	Pyroxene	Pyroxene calculated 100 percent	Ratio	
	Percent	*Percent*	*Percent*	*Percent*		
SiO_2	55.59	11.47	44.12	54.88	0.9101	1.009
FeO	13.59		13.59	16.90	.2352	
Al_2O_3 [1]	4.77	4.77				1.0
CaO	4.84	.99	3.85	4.79	.0854	
MgO	18.84		18.84	23.43	.5811	

[1] Thus if all the Al_2O_3 found in the insoluble portion is assumed as belonging to oligoclase, the analysis of the insoluble portion can be corrected for the obligoclase present.

TABLE 6.—*Optical properties of hypersthene in the Chicora meteorite*

J. J. GLASS, Observer

Variety	α	β	γ	Birefringence	Sign	Angle	Remarks
A	1.685	1.695	1.699	0.014	(−)	$2V$=50°–55°	$R<V$. Polysynthetic twinning seldom observed.
B	1.681	1.690 1.691	1.695	.014	(−)	$2V$=about 70°	$R<V$. No twinning observed.

The indices of refraction, determined by Miss J. J. Glass, are: $\alpha=1.535$, $\beta=1.539$, $\gamma=1.544$, which correspond to an oligoclase of about $Ab_{80}\ An_{20}$. Such a feldspar would have a composition, according to the Winchells,[3] of SiO_2, 63.3; Al_2O_3, 23.1; CaO, 4.3; Na_2O, 9.3.

PYROXENE

From the chemical composition of the pyroxene shown in table 5, it is evident that the composition is closely related to the hypersthene series. Recalculating the results into their respective molecular compounds gives the following percentages: $FeSiO_3$, 31.03; $MgSiO_3$, 58.34; $CaSiO_3$, 9.92; the sum of these is 0.71 percent low, and this may mean that there is a trace of tridymite present in the meteorite. None was noted.

In the optical analysis made by Miss J. J. Glass, table 6, two slightly different sets of indices were found. Although the indices for each are very close she has been able to verify the results repeatedly on subsequent examinations of additional samples. The physical nature of this material is very uniform, and the two varieties marked A and B in the table can be recognized only by carefully determining their optical properties, as there is no visible difference between the two varieties.

The material for this portion of the optical examination was obtained from the insoluble residue after the silica had been removed by sodium carbonate as previously stated, but it is believed that such a treatment would not affect a mineral of the enstatite-hypersthene series. Miss Glass reports that all the grains are more or less rounded and seldom show a definite straight edge.

The extinction angles were measured on what appeared to be cleavage edges, and angles of 6° to 7°, some 11° to 16°, and a few as high as 35° to 40° were found. A very limited number of grains exhibited fine lamellar twinning, and an indistinct positive sign was found on two grains.

By calculation it was found that 28.24 percent of the Chicora meteorite is made up of pyroxenes, and by far the majority of the hypersthene is the variety marked as B in table 6.

The indices of refraction for the Chicora hyperstene are lower than those given by the Winchells [4] for a hypersthene with 31 percent of iron metasilicate. The indices found when referred to Winchells' table indicates an iron content of only about 22 percent. The birefringence of the Chicora hypersthene agrees closely with the values reported in the Winchell tables. Since the indices of the Chicora are lower than they should be for such an iron content, perhaps the pres-

[3] Winchell, N. H., and Winchell, A. N., Elements of optical mineralogy, ed. 2, pt. 2, p. 280, 1927.
[4] Op. cit., p. 177.

ence of about 10 percent of $CaSiO_3$ is responsible for the lowering of the indices.

The finding of so much calcium metasilicate might suggest that perhaps a member of the diopside-clinohypersthene series was present rather than hypersthene. However, the optical properties completely disagree with diopside-hedenbergite.

There are certain differences observed when one attempts to relate the optical and chemical properties of this Chicora hypersthene. It should be remembered that the optics were determined directly on the grains present in the meteorite, while the composition expressed for this mineral had to be obtained indirectly after deducting feldspar and removing silica from the insoluble portion. Hence, less confidence should be placed on the composition expressed for this hypersthene than for any of the other minerals reported in this meteorite.

The finding of two sets of indices and optical angles in this hypersthene is difficult to explain properly. Their optical as well as their physical properties are very closely similar, so that it is more than likely there are not two distinctly and unrelated generations of hypersthene present in this meteorite. It may be that at some time this meteorite has been reheated to near the critical temperature for the orthorhombic hypersthene and that a certain amount of inversion has developed. Had the temperature reached much above 1,130° C., the clinohypersthene should have formed and would have been detected by the optical study.

Plate 59, *B*, shows the boundary of a fragmental hypersthene chondrule. There is a noticeable zone around the chondrule that has a slightly different granular texture. This suggests that some adjustment or reaction has taken place after the hypersthene chondrule was added to this mineral aggregate. The fragmental nature of hypersthene chondrules lends support to the suggestion that this mineral aggregate has originated similar to terrestrial volcanic tuffs.

METALLIC PORTION

The largest inclusion of iron seen on a smooth surface, whose area is about 6.5 square centimeters, is one with an over-all dimension of about 1 millimeter and its outline is more irregular than round. A few smaller specks of iron can be detected. The percentage of metallic

TABLE 7.—*Metallic content of the Chicora meteorite*

Metal	Fine	Coarse	Average	Ratios	
	Percent	*Percent*	*Percent*		
Fe	1.66	1.83	1.74	0.0311	2.68
Ni	.49	.81	.65	.0116	1.0
Co	.19	.33	.26	.0044	

iron in the Chicora was determined by recalculating the analysis of the acid-soluble portion and averaging the results. The metallic iron present was so determined to be 2.65 percent of the total.

It is difficult to understand why the coarse material should contain more nickel than the fine-grained portions. Nevertheless, table 7 shows that in each case two determinations were made and the results agree very nicely for each portion. Confidence can be placed in the figure given for the nickel, but, since iron is difficult to separate from cobalt, there may be a large analytical error in cobalt values. The ratio of nickel to iron is 1 to 2.68, an unusually high nickel content. The nickel content of hexahedrite irons is about 5.5 percent, while octahedrites average from 6 to about 12 percent. Farrington [5] lists 22 analyses of taenite, and the range in composition is so great that little satisfaction can be had by referring to his table. The range of taenite extends from Fe, 86.44 percent, and Ni, 13.02 percent, to Fe, 50.73 percent, and Ni, 47.8 percent.

Prior,[6] in discussing the relationship between the nature of the nickel-iron to the magnesium silicates in meteorites, says: "It was found that a progressive change in the chemical composition of the nickel-iron and of the magnesium silicates could be traced from chondritic stones like Daniel's Kuil containing over 20 percent of nickel-iron to those like Soko-Banja containing only small amounts." He further states: "The less the amount of nickel-iron in chondritic stones, the richer it is in nickel and the richer in iron are the magnesium silicates." The Chicora meteorite agrees with this observation of Priors.

There are now a number of different observations on record that many stony meteorites are apparently of clastic origin. There are also indications that the metallic portions of meteorites are later introductions. If that be true, the agreement in the mineralogy of the Chicora meteorite with Prior's suggestion may be nothing more than accidental. It will require the compilation of much data before this point can be properly settled. The Chicora meteorite certainly supports Prior's statement.

TEXTURE OF THE CHICORA

Olivine and hypersthene are present in sizable masses, distributed through a fine-grained crystalline ground mass. The hypersthene has a fibrous habit and is present as fragments of chondrules. The olivine is also present in fragments of chondrules, but some of it is encountered in subhedral inclusions.

The structure of this meteorite seems to indicate a clastic origin, and very little can be interpreted from the structure. Some evidence

[5] Farrington, O. C., Meteorites, p. 134, 1915.
[6] Prior, G. T., Min. Mag., vol. 18, No. 83, p. 26, 1916.

of adjustment or movement is noticed since the mass was consolidated, as shown by the granular zones around some of the olivine as well as a portion of the texture of the fragment of hypersthene chondrule.

The opaque inclusions noticed in the thin section are assumed to be largely iron and occur on the outside of some of the olivine and hypersthene. This suggests their introduction later than the minerals they surround. Although it is difficult to account for the origin of the metal, the distribution and association of these opaque spots, assumed to be a metal, are normal and are identical with their occurrence in other meteorites.

CLASSIFICATION OF CHICORA

Although only a single thin section was made, good evidence of chondrite structures was found. Table 8 gives the mineral content of this meteorite.

The Chicora is far less chondritic in texture than the Soka Banja type, to which the Chicora is very similar chemically. Table 9 compares the composition of these meteorites.

TABLE 8.—*Mineral content of the Chicora meteorite*

Mineral	Percent	Remarks
Olivine	54.55	Gray color, chondrule fragments and euhedral inclusions, cleavage lacking. Numerous opaque dustlike inclusions.
Hypersthene	28.84	Two varieties, intimately associated together. Chondrules and fragments of chondrules.
Oligoclase	7.20	Untwinned, no crystals.
Troilite	6.26	Minute inclusions.
(Schreibersite?)	0.53	Not observed, assumed present from analyses.
Metal	2.65	Small irregular inclusions very rich in nickel.
	100.03	

TABLE 9.—*Comparison of the Chicora and Soka Banja meteorites*

Characteristic	Chicora	Soka Banja
Percentage of nickel-iron in meteorite	2.65	4
Ratio of Ni to Fe in nickel-iron	1 : 2.68	1 : 3
Ratio of FeO to MgO in olivine	1 : 2.33	1 : 2.5
Ratio of FeO to MgO in pyroxene	1 : 2.4	1 : 3

Hence the Chicora is classified as an olivine-hypersthene chondrite of the Soka Banja type.

The mineralogical and analytical work has all been done on material obtained from the smaller of the two Chicora stones. Externally they are both similar, and it seems a reasonable assumption to think that they are alike.

This meteorite when only a few miles above our earth was very large, probably weighing a hundred tons or more, and to suppose that the entire mass was composed of the same minerals and in the same proportions as found in the smaller specimen would be a broad assumption. Very likely there were no large concentrations of metal in the mass, because, if so, a sizable chunk of metal should have survived the flight to the earth and made a scar on the countryside that would have been detected by this time.

This is the first stone and the sixth meteorite reported from Pennsylvania. Stony meteorites are very rare in the States surrounding Pennsylvania. Ohio is credited with 2, New York only 3, Maryland 2, New Jersey 1, and West Virginia none.

No attempt has been made to determine the age of this meteorite, because the sample is small and the results from such a study are not highly accurate. Neither have we tried to determine whether the Chicora meteorite is magnetically polarized, to indicate solidification in a magnetic field. In fact, there are a great many questions that should be put to these celestial visitors from space, and thereby gradually enough evidence will be accumulated not only to classify the different kinds but perhaps to reach some conclusion as to their source. Had the hundred-ton mass of the Chicora meteorite reached the earth it is difficult to imagine the havoc it would have produced. At any rate, the people domiciled in Butler County, Pa., should be very thankful that falling meteorites have such great difficulty in penetrating the thin layer of air immediately overhead.

ACKNOWLEDGMENTS

We are indebted to John L. Stewart, editor of the Washington, Pa., *Observer*, for his efforts in locating for us observers in the extreme south part of the terrain.

In connection with the petrographic work, much valuable assistance was given by Miss J. J. Glass, who made a careful optical study; Prof. H. H. Hess, who also confirmed the optical examination; Dr. L. G. Henbest, who made the microphotographs; Prof. S. J. Shand, who prepared the thin section of the meteorite; and Dr. W. F. Foshag, who offered many helpful suggestions.

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CESTODE PARASITES OF TELEOST FISHES OF THE WOODS HOLE REGION, MASSACHUSETTS

By Edwin Linton*

Only those cestodes that pass their adult stage in teleosts are considered in this report. For records of encysted and larval stages of cestodes whose final host is a selachian, see a previous paper of mine.[1] While the encysted stage of selachian cestodes is found in both teleosts and selachians, the encysted stage of teleost cestodes has not been found in selachians. In a few instances teleost cestodes have been found in the stomachs of selachians, but the evidence in such cases pointed to their recent introduction with the food, and the usually more or less macerated condition of the strobilae showed that the selachian could not be regarded as the true final host.

The cestodes of selachian habitats belong to widely different family groups from those passing the adult stage in teleosts. Further, so far at least as their mature cestode parasites may be considered to figure, the groups of selachians and teleosts are as distinct from each other as either of them is distinct from the other classes of vertebrates.

This account is based on collections of the late Vinal N. Edwards, of the United States Bureau of Fisheries, which were made in each month of the year for many years, and upon collections made by me in the summer months over a long series of years at the Woods Hole laboratory of the Bureau of Fisheries. The authority for the scientific names of fishes used is Jordan, Evermann, and Clark's check list.[2]

* Died June 3, 1939.

[1] Notes on cestode parasites of sharks and skates. Proc. U. S. Nat. Mus., vol. 64, art. 21, pp. 1–114, pls. 1–13, 1924.

[2] Check list of the fishes and fishlike vertebrates of North and Middle America north of the northern boundary of Venezuela and Colombia. Rep. U. S. Comm. Fish. for 1928, pt. 2, 670 pp., 1930.

TABLE 1.—*Teleost cestodes and their hosts, Woods Hole region*

Cestode	Host
Caryophyllaeus terebrans (Linton)	*Notropis rubrifrons* (?).
Glaridacris catostomi Cooper	*Catostomus commersonii.*
Ligula chilomycteri Linton	*Chilomycterus schoepfi.*
Ligula sp.	*Palinurichthys perciformis.*
Spathebothrium simplex Linton	*Liparis liparis, Microgadus tomcod.*
Bothrimonus intermedius Cooper	*Acanthocottus octodecimspinosus, Microgadus tomcod, Morone americana, Tautoga onitis.*
Fistulicola plicatus (Rudolphi)	*Xiphias gladius.*
Bothriocephalus scorpii (Müller)	*Anguilla rostrata, Clupea harengus, Hemitripterus americanus, Hippoglossoides platessoides, Lophius piscatorius, Lophopsetta maculata, Menticirrhus saxatilis, Merluccius bilinearis, Oligoplites saurus, Palinurichthys perciformis, Paralichthys dentatus, P. oblongus, Pollachius virens, Pomolobus pseudoharengus, Poronotus triacanthus, Seriola zonata, Trachurops crumenophthalmus, Urophycis chuss, Zygonectes diaphanus.*
Bothriocephalus claviceps (Goeze)	*Acanthocottus aeneus, A. octodecimspinosus, Apeltes quadracus, Cyclopterus lumpus, Gladiunculus bispinosus, Limanda ferruginea, Pseudopleuronectes americanus.*
Bothriocephalus manubriformis (Linton)	*Istiophorus americanus.*
Bothriocephalus restiformis (Linton)	*Tylosurus caribbaeus.*
Bothriocephalus sp.	*Exocoetus volitans.*
Bothriocephalus sp. Immature (plerocerci), usually encysted.	*Acanthocottus aeneus, Boiridella chrysura, Centropristes striatus, Clupea harengus, Decapterus macarellus, D. punctatus, Hemitripterus americanus, Lagocephalus laevigatus, Lophopsetta maculata, Menticirrhus saxatilis, Microgadus tomcod, Paralichthys dentatus, P. oblongus, Pepritus paru, Pneumatophorus grex, Pomatomus saltatrix, Pomolobus pseudoharengus, Poronotus triacanthus, Remora remora, Sarda sarda, Scomber scombrus, Seriola lalandi, Sphoeroides maculatus, Stenotomus chrysops, Syrictes fuscus, Tautogolabrus adspersus, Urophycis chuss.*
Clestobothrium crassiceps (Rudolphi)	*Fundulus majalis, Hippoglossus hippoglossus, Lophius piscatorius, Merluccius bilinearis, Pomatomus saltatrix, Sphoeroides maculatus, Squalus acanthias, Urophycis chuss, U. tenuis.*
Abothrium rugosum (Batsch)	*Gadus morrhua, Melanogrammus aeglefinus, Microgadus tomcod, Pollachius virens, Urophycis tenuis.*
Ancistrocephalus microcephalus (Rudolphi)	*Mola mola.*
Ancistrocephalus aluterae (Linton)	*Ceratacanthus schoepfi.*
Proteocephalus macrocephalus (Creplin)	*Anguilla rostrata.*
Proteocephalus sp.	*Zygonectes diaphanus.*
Corallobothrium fimbriatum Essex	*Ameiurus nebulosus.*

Since this paper is based on material not heretofore reported upon, data that have already been published, relating to habitats, frequency of occurrence, degree of parasitism, and the like, have not been included in the summaries.

Family CARYOPHYLLAEIDAE Leuckart

Genus CARYOPHYLLAEUS Gmelin

CARYOPHYLLAEUS TEREBRANS (Linton)

PLATE 60, FIGURES 1–3

Monobothrium terebrans LINTON, Rep. U. S. Fish Comm. for 1889–91, pp. 548–552, figs. 1–21, 1893 (from *Catostomus ardens*).

Caryophyllaeus terebrans (Linton) HUNTER, Illinois Biol. Mon., vol. 11, pp. 399–408, figs. 1, 30, 31, 51, 72, 1930.

Specimen from Notropis rubrifrons (?).—Collected June 14, 1916, by Vinal N. Edwards at Waquoit Bay (U.S.N.M. No. 8852). Maximum length 6 mm., breadth 0.6 mm., thickness 0.3 mm.

Nearly linear, slightly narrowed at anterior end, which is thickish and rounded. The vitellaria, in a specimen 6 mm. long, begin about 0.7 mm. from the anterior end and extend to the posterior end, except where interrupted by the uterus and ovary. The testes, about 25, occupy a relatively broad area along the median region from a point about 0.8 mm. back of the anterior end nearly to the anterior folds of the uterus, a distance of about 4.7 mm. They are surrounded dorsally, ventrally, and laterally by the vitellaria. The many-lobed ovary, 1.25 mm. from the posterior end, appears to be symmetrical and extends from margin to margin. One division of the uterus lies behind the ovary, and another and larger division lies in front of the ovary. Ova 0.039 to 0.048 by 0.03 to 0.039 mm.

In a series of sagittal sections, the cirrus bulb, with the vagina at its posterior border, is seen to lie at the anterior edge of the uterus. The cirrus bulb is only moderately muscular, its length about one-third the thickness of the body. The uterus appears to enter the vagina near the base of the cirrus bulb (pl. 60, fig. 3).

Genus GLARIDACRIS Cooper

GLARIDACRIS CATOSTOMI Cooper

For a full account of this species, see Hunter, 1930.[3]

Specimens from Catostomus commersonii.—Collected on two dates by Vinal N. Edwards:

June 4, 1913—8 specimens, 6 to 17 mm. long in formalin; 25 fishes examined.

May 13, 1914—9 specimens from 4 fishes, 10 to 18 mm. long in formalin; 9 fishes examined.

Ova, average of five, 0.071 by 0.041 mm.; maximum 0.075 by 0.024 mm., minimum 0.069 by 0.039 mm.

U.S.N.M. No. 8853.

[3] Hunter, G. W., Illinois Biol. Mon., vol. 11, pp. 419–430, figs. 2, 25, 44, 45, 1930.

Family DIPHYLLOBOTHRIIDAE Lühe

Genus LIGULA Bloch

Cooper [4] refers all members of this genus to the one species: *Ligula intestinalis* (Linnaeus). Cestodes apparently belonging here have been found in two species of fishes of the Woods Hole region.

LIGULA CHILOMYCTERI Linton

Ligula chilomycteri LINTON, Proc. U. S. Nat. Mus., vol. 19, pp. 788–789, pl. 1, fig. 1, 1897.

From *Chilomycterus schoepfi*.

LIGULA species

PLATE 60, FIGURE 4

Specimen from Palinurichthys perciformis.—Collected August 17, 1904; three fragments of strobila, 27, 18, and 10. 5 mm. long, respectively; maximum breadth 5.5 mm.; maximum thickness 4 mm.; minimum breadth 2 mm.; from intestine, somewhat macerated. This specimen (U.S.N.M. No. 8854) is represented in the collection by two slides of transverse sections, the median and larger of which measures 3.71 by 2.45 mm. There is a thin layer of delicate longitudinal muscles next to the cuticle, followed in turn by a conspicuous layer of longitudinal muscles surrounding the inner, parenchymatous area. Thickness of cuticle about 0.005 mm., of outer parenchymatous layer 0.63 mm., of longitudinal muscle layer 0.36 mm., of inner parenchymatous area 0.63 mm. The muscle bundles of the conspicuous longitudinal muscle layer are, for the most part, flat and thin; cross sections of larger bundles are about 0.18 by 0.012 mm.

What appears to be a unique feature of these sections is the occurrence of a band of longitudinal muscle fibers at each lateral margin of the inner parenchymatous area extending from the region of the nerve cord to a point corresponding to the marginal limit of the layer of longitudinal muscles. These bundles are more or less elliptical in cross section; dimensions of one of the larger cross sections, 0.06 by 0.021 mm. (pl. 60, fig. 4).

Family CYATHOCEPHALIDAE Nybelin

Genus SPATHEBOTHRIUM Linton

SPATHEBOTHRIUM SIMPLEX Linton

PLATE 60, FIGURE 5

Spathebothrium simplex LINTON, Trans. Amer. Micr. Soc., vol. 41, p. 118–121, pl. 15, 1922 (from *Liparis liparis*).

Specimen from Microgadus tomcod.—Collected April 23, 1920, by Vinal N. Edwards (U.S.N.M. No. 8856). Measurements in formalin:

[4] Illinois Biol. Mon., vol. 4, pp. 306–318, 1919.

Length 34 mm., breadth 2.5 mm., narrowing to 2 mm. at posterior end; without bothria and unsegmented. Measurements in balsam: Length 30 mm., maximum breadth about 2.2 mm., tapering anteriorly, posterior end bluntly rounded. The vitellaria begin 1 mm. from the anterior end and continue to a point about 0.4 mm. from the posterior end. The strobila is mature, the uterus occupying the greater part of the median region, the first ova appearing 1.3 mm. from the anterior end. The ovaries, which have the appearance of clusters of distinct lobes, are crowded by the gravid uterus to one side or other of the median line. The vitellaria lie in an unbroken line along each lateral margin of the strobila. The characteristic sphincter muscle at the orifice of the vagina could be distinguished, but details of cirrus and vagina were masked by the accumulation of ova in the uterus.

Measurements of ova in specimens from *Liparis liparis* and in specimen from *Microgadus tomcod*, about 0.033 by 0.018 mm.

Genus BOTHRIMONUS Duvernoy

BOTHRIMONUS INTERMEDIUS Cooper

PLATE 60, FIGURES 6, 7

Bothrimonus intermedius COOPER, Journ. Parasit., vol. 4, p. 35, 1917; Illinois Biol. Mon., vol. 4, pp. 351–357, figs. 6–8, 45, 81, 94, 1919.

Specimen from Acanthocottus octodecimspinosus.—Collected April 21, 1916, by Vinal N. Edwards; one strobila and fragments (U.S.N.M. No. 8857). Aggregate length in formalin 15 mm., maximum breadth in balsam 0.7 mm., breadth of scolex 0.53 mm.

Specimens from Microgadus tomcod.—Collected by Mr. Edwards on three dates in April in three different years, 1 on one date, 2 on another, and 17 on another. Lengths in formalin 4 to 50 mm., maximum breadth 1.4 mm. in balsam (U.S.N.M. No. 8858).

Specimens from Morone americana.—Collected by Mr. Edwards on two dates in April and one in May (U.S.N.M. No. 8859) in two different years, 1 strobila on date in May, 7 on one of the dates in April, and 51 from one fish on the other April date. Lengths 12 to 53 mm., breadths 0.5 to 2 mm. Measurements of longest strobila in formalin: Length 53 mm., maximum breadth 1.65 mm., at point about 0.5 mm. from posterior end 0.6 mm., scolex length 0.75 mm., breadth 1.35 mm. In formalin scolex opaque, strobila translucent bluish, genitalia ivory white.

Specimens from Tautoga onitis.—Collected by Mr. Edwards on two dates in April, 1 on one date and 2 on the other. Lengths 8, 18, and 20 mm. in formalin, maximum breadth 2 mm. Measurements in balsam: Length 18 mm., breadth (anterior) 0.36 mm., breadth (maximum) 1.31 mm., length of scolex 0.5 mm., breadth 0.67 mm. (U.S.N.M. No. 8860).

Family TRIAENOPHORIDAE Lönnberg

Genus FISTULICOLA Lühe

FISTULICOLA PLICATUS (Rudolphi)

Bothriocephalus plicatus Rudolphi, Entozoorum synopsis cui accedunt mantissa . . ., pp. 136, 470, 1819.

Dibothrium plicatum (Rudolphi) Linton, Rep. U. S. Fish Comm. for 1887, pp. 746–750, pl. 3, figs. 1–6, 1890; Proc. U. S. Nat. Mus., vol. 20, pp. 430–431, 1897; Bull. U. S. Fish Comm., vol. 19, pp. 278, 448, 1901; vol. 31, pt. 2, p. 586, 1911.

Fistulicola plicatus (Rudolphi) Cooper, Illinois Biol. Mon., vol. 4, pp. 377–380, 1919.

Specimens from Xiphias gladius.—My record shows that 13 swordfishes were examined for Entozoa on seven dates in July in five different years, and this cestode was present in practically every one, 1 to 9 strobilae present in each, 44 in all. The smallest strobila noted measured 22 mm. in length and 1.5 mm. in breadth; the largest 240 mm. in length and 12 to 15 mm. in breadth throughout the greater part of the length. The greatest breadth noted in any strobila was 20 mm. (U.S.N.M. No. 8861).

The usual habitat of this cestode is the rectum of the host. The younger specimens are simply attached to the mucous membrane and are easily detached. The older strobilae are, as a rule, permanently affixed, the anterior ends penetrating the intestinal wall. Thus, in an example collected July 13, 1911, it was noted that the part that lay free in the rectum of the host measured 70 mm. in length and 11 mm. in maximum breadth. The anterior end of the strobila, after passing through the intestinal wall, continued in an elongated encysted portion in the body cavity. When dissected out, this portion, which had a diameter of 1 mm. in the intestinal wall and 1.5 to 3 mm. in the portion that lay in the body cavity, measured 90 mm. long. It was not complete, since a portion had been cut off and left in the fish when the viscera were removed.

Cooper (loc. cit., p. 380) records one specimen in the collection of the University of Illinois, taken by Vinal N. Edwards from *Mola mola* at Woods Hole.

Genus ANCISTROCEPHALUS Lühe

ANCISTROCEPHALUS MICROCEPHALUS (Rudolphi)

Dibothrium microcephalum Rudolphi, Linton, Rep. U. S. Fish Comm. for 1887, pp. 736–745, pl. 2, figs. 5–18, 1890; Bull. U. S. Fish Comm., vol. 19, pp. 282, 465, 1901; Bull. U. S. Bur. Fish., vol. 31, p. 586, 1911.

Ancistrocephalus microcephalus (Rudolphi) Linton, Fisheries and marine biological survey, Union of South Africa, Rep. No. 3, for 1922, pp. 12, 13, figs. 35–40, 1924.

For references to literature see Stiles and Hassall, Hyg. Lab. U. S. Public Health Serv. Bull. 85, pp. 101, 102, 198 (*Anchistrocephalus microcephalus*, *Ancistro-*

cephalus microcephalus, and *Dibothrium microcephalum*), 1912; for correct spelling of generic name see Lühe, Centralbl. Bakt. Parasit., vol. 27, p. 209, 1900.

Specimens from Mola mola.—Three sunfishes have been examined for Entozoa since the last report was made. The first and third of these came from a trap at Menemsha Bight, the second from a trap at Buzzards Bay, near Woods Hole. Each had been kept alive in the Bureau of Fisheries pool for about a week. Cestodes of this species found as follows:

September 23, 1923: 7 strobilae, young and adult, and a few fragments from intestine. Straightened in 70 percent alcohol the strobilae relaxed and became longer than they had been in sea water. The two largest measured: Lengths 725 and 650 mm., breadths 8 and 9 mm. (U.S.N.M. No. 8903).

July 19, 1926: 9 from anterior end of alimentary canal; maximum length 350 mm., minimum 30 mm.; all immature.

July 13, 1927: 28 slender, immature, most of them in a tangled mass.

ANCISTROCEPHALUS ALUTERAE (Linton)

PLATE 62, FIGURES 20–22

Dibothrium aluterae LINTON, Rep. U. S. Fish Comm. for 1886, pp. 458–459, pl. 1, figs. 5–8, 1889; Bull. U. S. Fish Comm., vol. 19, p. 464, 1901.—STILES and HASSALL, Hyg. Lab. U. S. Public Health Serv. Bull. 85, p. 196, 1912.

Specimens from Ceratacanthus schoepfi.—Five strobilae collected July 28, 1920, from intestine of one fish examined; maximum length 115 mm. These strobilae appeared to be immature, but transverse sections, 200 or more, contained sections of three ova, the largest of which measured 0.072 by 0.042 mm. The testes in these sections are conspicuous, 0.06 to 0.09 mm. in greatest diameter, with developed sperm. The aperture of the cirrus and vagina is marginal (U.S.N.M. No. 8904).

Larval stage (pl. 62, fig. 22): Plerocerci (U.S.N.M. No. 8905), presumably of this species, are of frequent occurrence in the filefish, encysted, sometimes free, usually in enormous numbers, especially in the walls of the stomach and intestine, but also often in the muscular tissue in all parts of the body, in the kidneys and on the viscera generally, in the pericardial cavity, and on the outside of the ventricle.

Thirteen filefishes were examined on four dates in July, eight in August, and one in September in 11 different years. To these may be added the intestine of a filefish containing numerous encysted plerocerci that was brought to my laboratory by Dr. E. B. Krumbhaar on August 17, 1929.

Following are a few extracts from notes made at the time of collecting Entozoa from the filefish:

Numerous in wall of stomach and intestine, contractile, 1 to 3 mm., numerous coarse granules in parenchyma, characteristic vase shape when at rest or under pressure.

Very numerous, some encysted, some free, serous coat of stomach and intestine, mostly slender, chalky white, very contractile.

Numerous in walls of stomach and intestine and muscles in vicinity of backbone.

July 28, 1920: Filefish, 30 cm. long, in very poor condition. A large number of transparent cysts on the viscera, approximating in bulk that of the viscera proper (see Proc. U. S. Nat. Mus., vol. 64, art. 21, p. 79, 1924). The muscular tissue in all parts of the body was peppered thickly with these plerocerci. Surrounding many of the larvae in the muscle tissue were thickish cysts that yielded bubbles with acid. Larvae very active wavelike enlargements beginning at anterior end and passing to posterior end. Length variable, extending to 4 mm. or more, in which case they became very thin, 0.03 to 0.05 mm. in breadth. These cysts were very abundant in the wall of the alimentary canal, especially on and in the wall of the esophagus.

Family PTYCHOBOTHRIIDAE Lühe

Genus BOTHRIOCEPHALUS Rudolphi

BOTHRIOCEPHALUS SCORPII (Müller)

PLATE 60, FIGURE 8; PLATE 61, FIGURES 9, 10

An extensive synonymy of *B. scorpii* is given in Cooper's account of the species: Illinois Biol. Mon., vol. 4, pp. 384–400, 1919.

Cestodes belonging to the genus *Bothriocephalus* and referable to *B. scorpii* or *B. claviceps* were found in many species of fishes of the Woods Hole region.

When, on account of the immaturity of the strobila or the unsatisfactory condition of the material, determination of the species depended upon the character of the scolex and of the anterior portion of the strobila, those with more or less elongate scolex, bothria shallow posteriorly, first segments slender, and usually as long as or longer than broad were referred to *scorpii*. Those with scolex variously contracted, usually short and broad, bothria extending to base of scolex, and first segments crowded together and much broader than long were referred to *claviceps*.

Specimens from Anguilla rostrata.—Collected on three dates in July and one in November, 1 to 9 strobilae on each date. Maximum length in alcohol 175 mm., maximum breadth 2 mm. (U.S.N.M. No. 8862).

Measurements in balsam

Scolex:			
Length	0.65	1.33	1.05
Maximum breadth	.19	.30	.35
First segment:			
Length	.12	.14	.28
Breadth	.12	.25	.11
Ova	.05 by .03	.054 by .036	.062 by .032

Specimen from Clupea harengus.—One immature (U.S.N.M. No. 8863) collected May 11, 1916; segments not yet developed; scolex in balsam, length 1.05 mm., maximum breadth 0.21 mm.

Specimens from Hemitripterus americanus.—Cestodes (U.S.N.M. No. 8864) referred to this species were collected on two dates in January, one in February, two in April, eight in May, four in June, two in July, three in October, five in November, and three in December in 13 different years. Sixty-one fishes were examined on 32 dates, and this cestode was found in 46 of them on 30 of the 32 dates. All examinations, except those of July, were made by Vinal N. Edwards. In January he examined seven fishes and noted: "Worms in all, some of them 5 feet long." In one bottle that contains worms from one fish collected in January there were 14 strobilae with scoleces, maximum length 700 mm. On another date 3 strobilae were found in one fish, aggregate length 300 mm., maximum breadth 4.5 mm. On one date in February five fishes were examined, and Mr. Edwards noted: "Stomach contained tautog and cunners, very many tapeworms, some 6 feet when stretched." In a bottle containing worms from one fish collected on this date there were 43 strobilae, which, together with fragments, aggregated a total length of 1,223.5 cm., or 40 feet.

On one date in April three fishes yielded 6 strobilae, maximum length 540 mm., aggregate length 156.5 cm.; from one fish on another date fragments of strobilae were obtained aggregating 354 mm. in length. In May nine fishes were examined, each on a different date and in seven different years. One to three strobilae were found on each of eight dates, maximum length 1,045 mm., maximum breadth 5 mm. On one date 210 strobilae were collected from one fish, maximum length 175 mm., maximum breadth 2 mm., a very few with ripe segments.

In June, fishes were examined on three dates in different years, one fish on each date. Three strobilae were found on one date and one on each of the others, maximum length 500 mm., aggregate length 2,490 mm.

In July, two fishes were examined on different dates in different years. Several cestodes were obtained on one date and one on the other, maximum length 250 mm., maximum breadth 2 mm.

In October, six fishes were examined in separate years. Two strobilae from one fish, aggregate length 945 mm., maximum breadth 2 mm.; no ripe segments. Two strobilae and a fragment from one fish, maximum length 115 mm. Three strobilae from four fishes, maximum length 440 mm., maximum breadth 6.5 mm.

In November, 17 fishes were examined on five dates in three different years: (1) Two from one fish, length 155 and 215 mm., breadth 1.5 and 6.3 mm.; (2) eight fishes, one from one fish and four and fragments from others, maximum length 275 mm., maximum breadth 3.5 to 5 mm.; (3) one from one fish, length 290 mm., breadth 3.25 mm.; (4) three and fragments from three fishes, maximum length 630 mm., aggregate length 234.2 cm.; (5) one and fragments from four fishes, maximum length 272 mm., aggregate length 850 mm.

In December, seven fishes were examined on three dates: (1) Fragments aggregating 151 mm. from three fishes, breadth 2 mm.; (2) three from three fishes, lengths 182, 210, and 652 mm., maximum breadth 4.5 mm., and two small slender strobilae, lengths 35 and 58 mm., maximum breadth 0.5 mm.; (3) 11 strobilae with scoleces and fragments from one fish, aggregating 265 cm.; largest strobila, nearly linear, length 435 mm., maximum breadth 3 mm.

Cross sections of these cestodes from the sea raven show the longitudinal muscles to be fascicled. Ova 0.066 to 0.072 mm. by 0.033 to 0.039 mm., average of ten 0.067 by 0.037 mm.

Specimens from Hippoglossus platessoides.—The only record I have of these cestodes from the sand-dab is that of two strobilae, lengths 100 and 64 mm., maximum breadth 3 mm., collected by Mr. Edwards on November 12, 1898 (U.S.N.M. No. 8865). There are, however, in the collection three scoleces mounted in balsam and a series of sections. The scoleces agree with *B. scorpii;* the first segments are a little broader than long. Measurements in balsam: Scolex, length 1.29 mm., breadth 0.28 mm.; first segment length 0.15 mm., anterior breadth 0.24 mm., posterior 0.29 mm. Ova 0.054 to 0.066 mm. by 0.03 to 0.036 mm. (pl. 61, fig. 9).

Specimens from Lophius piscatorius.—Collected May 6, 1913, by Vinal N. Edwards from seven fishes examined, two strobilae. Lengths 90 and 130 mm., maximum breadth 3 mm.

Specimens from Lophopsetta maculata.—I have recorded this species under the name *Dibothrium punctatum* (Rudolphi) from this fish previously.[5]

My unpublished records show that 140 windowpanes have been examined for Entozoa on 54 dates in 14 different years. This cestode was found on one date each in June, July, September, October, and

[5] Rep. U. S. Fish Comm. for 1887, pp. 731–736, pl. 2, figs. 1–4, 1890; Proc. U. S. Nat. Mus., vol. 20, p. 430, 1897; Bull. U. S. Bur. Fish., vol. 31, pt. 2, p. 586, 1911.

November in 8 different years. Examinations were made in every month of the year except March and December. The collection consisted of 12 strobilae and fragments. Maximum length 360 mm., maximum breadth 2.5 mm. Measurements in balsam: Scolex length 2.52 mm., breadth 0.36 mm.; first segment length 0.28 mm., anterior breadth 0.14 mm., posterior 0.21 mm. Ova 0.054 to 0.06 mm. by 0.03 to 0.033 mm. (U.S.N.M. No. 8866).

Specimens from Menticirrhus saxatilis.—Immature strobilae (U.S. N.M. No. 8867) collected on four occasions are here recorded. June 29, 1910, many from one fish; June 19, 1910, three; July 21, 1910, ten; July 21, 1926, one, length 8 mm. Maximum length in balsam 35 mm., maximum breadth 0.56 mm. (pl. 60, fig. 8).

Measurements in balsam

Scolex:				
Length	1.96	1.68	1.19	1.54
Breadth	.28	.25	.22	.22
First segment:				
Length	.49	.24	.32	.18
Breadth	.14	.24	.25	.14

Specimens from Merluccius bilinearis.—I have recorded this species under the name *Dibothrium angustatum* (Rudolphi) previously from this fish[6] (U.S.N.M. No. 8868).

Specimens from Oligoplites saurus.—Four small immature strobilae were taken from one fish July 14, 1924. Measurements in balsam: Length 7 mm.; breadth 0.31 mm.; scolex length 1.4 mm., breadth of terminal disk 0.14 mm., near anterior end 0.2 mm., near posterior end 0.13 mm., at posterior end 0.14 mm.; first segment length 0.14 mm., anterior breadth 0.14 mm., posterior 0.15 mm. (U.S.N.M. No. 8869).

Specimens from Palinurichthys perciformis.—Recorded from this fish by me under the name *Dibothrium punctatum* (Rudolphi).[7] It has also been recorded from Woods Hole by Cooper.[8] Two slender immature specimens were taken from this fish on August 17, 1904; maximum length 115 mm., maximum breadth 1.6 mm.; most of the segments longer than broad (U.S.N.M. No. 8870). Also two, each about 12 mm. long, segments irregular, on August 20, 1910.

Specimens from Paralichthys dentatus.—This species under the name *Dibothrium punctatum* (Rudolphi) has been recorded by me[7] and by Cooper.[8] It was collected on three dates in August in two different years. On one date the record is one and fragments; on another, one, length 40 mm.; and on the other, one, length not given. Fragments, apparently of the same strobila, have an aggregate length of 150 mm.; maximum breadth 3 mm.; first segments slender, longer than wide; ova 0.06 by 0.03 mm. (pl. 61, fig. 10) (U.S.N.M. No. 8871).

[6] Bull. U. S. Fish Comm., vol. 19, p. 474, fig. 269, 1901; Bull. U. S. Bur. Fish., vol. 31, pt. 2, p. 585, 1911.
[7] Bull. U. S. Bur. Fish., vol. 31, p. 586, 1911.
[8] Illinois Biol. Mon., vol. 4, p. 387, 1919.

Specimens from Paralichthys oblongus.—Specimens from this fish have been recorded by me [9] under the name *Dibothrium punctatum* (Rudolphi).

Collected on one date in May, four in June, three in August, in six different years; 17 strobilae obtained, maximum length noted 70 mm. One of the two slides in the collection contains two scoleces and fragments of immature strobilae aggregating a length of 85 mm., maximum breadth 0.77 mm.; scoleces, lengths 1.33 and 1.61 mm., breadths 0.22 and 0.26 mm.; first segments, lengths 0.3 and 0.24 mm., breadths 0.16 and 0.17 mm. The other slide contains one scolex and fragments evidently belonging to the same strobila, total length 65 mm., maximum breadth 3 mm.; scolex length 2.31 mm., breadth 0.34 mm.; first segment length 0.21 mm., anterior breadth 0.33 mm., posterior 0.42 mm.; ova 0.064 to 0.06 by 0.03 to 0.033 mm. (U.S.N.M. No. 8872).

Specimens from Pollachius virens.—Collected August 19, 1908, one scolex and fragments of strobila, 10 and 25 mm. long, breadth 0.4 mm.; scolex length 0.7, breadth 0.28 mm.

Specimen from Pomolobus pseudoharengus.—One immature collected November 3, 1913. Length in formalin 14 mm.; scolex length 2.15 mm., breadth anterior 0.19 mm., maximum 0.52 mm., at base 0.21 mm.; first segment length 0.6 mm., breadth 0.25 mm.; length of scolex in balsam 2 mm. The segments show a tendency to divide at middle of length (U.S.N.M. No. 8873).

Specimens from Poronotus triacanthus.—Previously recorded from this fish by me under the name *Dibothrium angustatum* (Rudolphi).[10]

Specimens from Seriola zonata.—Immature strobilae collected September 16, 1913, lengths 2, 16, and 22 mm. in formalin (U.S.N.M. No. 8874).

Measurements

Scolex:		
Length	1.19	1.50
Breadth	.21	.28
First segment:		
Length	.28	.18
Breadth	.08	.14
Average length of first 5 segments	.11	.21

Specimens from Trachurops crumenophthalmus.—Recorded from this fish as *Dibothrium punctatum* (Rudolphi) by me [11] and by Cooper.[12]

Collected on two dates in August, four in September (U.S.N.M. No. 8875), and one in October, 1 to 12 on each date; immature strobilae with elongate scolex, segments usually longer than wide, associated with vase-shaped plerocerci. Measurements in balsam:

[9] Bull. U. S. Fish Comm., vol. 19, p. 484, 1901; Bull. U. S. Bur. Fish., vol. 31, p. 586, 1911.
[10] Bull. U. S. Fish. Comm., vol. 19, p. 454, 1901; Bull. U. S. Bur. Fish., vol. 31, p. 585, 1911.
[11] Bull. U. S. Fish Comm., vol. 31, p. 586, 1911.
[12] Illinois Biol. Mon., vol. 4, p. 388, 1919.

Scolex length 1.54 mm., breadth 0.25 mm.; first segments, average of five, length 0.41 mm., breadth of fifth segment 0.22 mm.; another scolex, length 1.65 mm., anterior breadth 0.19 mm., middle 0.3 mm., base 0.018 mm.

Specimens from Urophycis chuss.—Recorded from this fish under the name *Dibothrium punctatum* (Rudolphi) by me [13] and by Cooper.[14] A large number of hakes were examined by Edwards through a long series of years. Cestodes here noted were collected on 26 dates in nine different years: 14 on seven dates in May, 81 fishes examined; 1 on one date in June, 10 fishes examined; 5 on three dates in August, 14 fishes examined; 23 on seven dates in October, 44 fishes examined; 11 on eight dates in November, 195 fishes examined. The largest number recorded from one fish is eight. Largest strobila, length 108 mm., breadth 2 mm. In most cases the strobilae were immature. In one specimen, collected October 3, 1915, mounted in balsam, length 32 mm., breadth 1.6 mm., there are segments with ova, 0.06 by 0.03 mm. Measurements in balsam: Scolex length 1.33 mm., breadth, marginal view, 0.28 mm.; first segment length 0.28 mm., anterior breadth 0.15 mm., posterior 0.19 mm. (U.S.N.M. No. 8876).

Specimens from Zygonectes diaphanus.—Two collected August 22, 1916, lengths 6 and 12 mm. Measurements in balsam: Scolex length 0.7 mm., breadth 0.22 mm., anterior disk 0.21 mm.; first segment length 0.15 mm., anterior breadth 0.14 mm., posterior 0.18 mm.; posterior segments, average length of eight, 0.42 mm., breadth 1 mm.; ova 0.048 to 0.057 by 0.03 to 0.036 mm. (U.S.N.M. No. 8877).

BOTHRIOCEPHALUS CLAVICEPS (Goeze)

PLATE 61, FIGURES 11–13

For full account of this species, including synonymy, see Cooper, Illinois Biol. Mon., vol. 4, pp. 402–410, 1919.

To this species are referred cestodes of the genus that are characterized by having the first segments usually crowded and much broader than long, with the scolex assuming a variety of shapes from elongate to nearly spherical, the bothrial pits extending to the base of the scolex. The ova are thin-shelled and often collapsed and show but faintly through the body wall, in contrast with *B. scorpii*, in which the shells of the ova are thicker, the masses of ova showing as dark-brown blotches in strobilae with ripe segments.

Specimens from Acanthocottus aeneus.—Recorded by me [15] from this fish under the name *Dibothrium punctatum* (Rudolphi).

A large number of sculpins were examined for Entozoa over a long series of years. Cestodes of this species were found on 20 dates in

[13] Bull. U. S. Bur. Fish., vol. 31, p. 586, 1911.
[14] Illinois Biol. Mon., vol. 4, p. 388, 1919.
[15] Bull. U. S. Bur. Fish., vol. 31, p. 586, 1911.

January, when 335 fishes were examined and 64 strobilae found; on five dates in February, 40 fishes examined, 10 strobilae; four dates in March, 110 fishes, 10 strobilae; four dates in April, 110 fishes, 16 strobilae; four dates in May, 45 fishes, 11 strobilae; one date in June, one fish, 6 strobilae; one date in July, 1 fish, 3 strobilae; one date in October, 20 fishes, 3 strobilae; two dates in November, 9 fishes, 5 strobilae; 11 dates in December, 649 fishes, 54 strobilae. On a few dates the number of fishes was not recorded, in which cases one fish was counted.

Maximum length noted 300 mm., maximum breadth 5 mm. Measurements of four scoleces in formalin:

Length	*Breadth*
0. 70	0. 38
. 52	. 48
. 38	. 34
. 35	. 35

Ova thin-shelled, many collapsed, 0.072 by 0.042 mm. (U.S.N.M. No. 8878).

Specimen from Acanthocottus octodecimspinosus.—Recorded by me [15] from this fish under the name *Dibothrium punctatum* (Rudolphi).

The common sculpin was examined for Entozoa by Edwards on many dates over a long series of years. On a few dates the number of fishes examined was not recorded. In such cases one fish was counted in preparing the following summary. The record then shows that 7 fishes were examined in January on three dates; 6 in February on one date; 10 in March on two dates; 182 in April on 32 dates; 70 in May on 17 dates; 5 in June on one date; one in July on one date; 767 in October on 39 dates; 846 in November on 45 dates; 32 in December on five dates.

Following is a summary of collections of cestodes (U.S.N.M. No. 8879) made by Edwards from this fish: 2 on one date in February, 6 fishes examined; 6 on two dates in March, 10 fishes; 50 on 20 dates in April, 123 fishes; 15 on eight dates in May, 52 fishes; 12 on 10 dates in October, 436 fishes; 20 on 12 dates in November, 251 fishes; 3 on two dates in December, 23 fishes.

Strobilae with ripe segments were found in all the months in which these cestodes were collected except January. Following are the maximum measurements of strobilae noted:

	Length	*Breadth*
February	160	4
March	235	4. 5
April	375	6. 55
May	86	(Not recorded.)
October	170	4. 25
November	115	4
December	275	4

[15] Bull. U. S. Bur. Fish., vol. 31, p. 586, 1911.

There is considerable variation in the proportions of the scolex. Thus, the length, breadth, and thickness of two in formalin were 0.75, 0.72, 0.55 and 0.9, 0.97, 0.73 mm.; another in glycerin: Length 1.65, breadth 0.43 mm. Following are lengths and breadths of scoleces in balsam: 0.3 by 0.19, 0.31 by 0.25, 0.42 by 0.28, 0.5 by 0.32, 0.5 by 0.36, 0.7 by 0.38, 0.98 by 0.28, 1.4 by 0.28, 1.7 by 0.25 mm. Measurements of the first segment in a typical strobila: Length 0.07 mm., breadth 0.56 mm. In an immature strobila with maximum breadth about 1 mm., the length of the first segment was 0.15 mm., anterior breadth 0.22 mm., posterior 0.35 mm. Ova thin-shelled and in most cases collapsed in sections and balsam mounts; average of 10: 0.068 by 0.039 mm.; largest 0.075 by 0.045 mm.; smallest 0.06 by 0.036 mm.

Specimen from Apeltes quadracus.—One collected April 21, 1911; 12 fishes examined. Length in formalin 31 mm., breadth 2.8 mm. Measurements in balsam: Length 16 mm., breadth 2.4 mm.; scolex length 0.84 mm., anterior breadth 0.24 mm., posterior 0.35 mm.; first segment length 0.24 mm., anterior 0.48 mm., posterior 0.58 mm.; ova thin-shelled, average of 19: 0.063 by 0.036 mm. (U.S.N.M. No. 8880).

Specimen from Cyclopterus lumpus.—One collected May 6, 1913; 7 fishes examined. Length in formalin 90 mm. Measurements in balsam: Scolex length 0.6 mm., thickness 0.3 mm.; first segment length 0.06 mm., breadth 0.24 mm.; posterior segments, length 0.56 mm., breadth 1.4 mm.; median segments, length 0.21 mm., breadth 1.96 mm.; ova 0.054 by 0.03 (pl. 61, fig. 13) (U.S.N.M. No. 8881).

Specimens from Gladiunculus bispinosus.—Recorded from this fish by Cooper.[16]

Cestodes (U.S.N.M. No. 8882) referred to this species were collected by Edwards from the stickleback as follows: April: 12 on four dates, 450 fishes examined; 23 on two dates, number of fishes examined not recorded. May: 7 on two dates, 120 fishes examined; 25 on three dates, number of fishes examined not recorded. June: 4 on two dates, 80 fishes examined; 1 on one date, number of fishes examined not recorded. Collections made in five different years. Maximum length 75 mm., maximum breadth 2.7 mm. Scoleces elongate to very short; bothrial pits extend to base of scolex; first segments, except in immature strobilae, short, crowded, much broader than long. Ova thin-shelled, about 0.51 to 0.63 by 0.3 to 0.42 mm.

Measurements in balsam: Length 18 mm.; maximum breadth 2.1 mm.; scolex length 0.21 mm., breadth 0.28 mm.; first segment length 0.08 mm., breadth 0.35 mm.; last segment length 0.28 mm., breadth 0.91 mm.; ova 0.051 by 0.033 mm. Ova appear about 4.27 mm. from anterior end.

[16] Illinois Biol. Mon., vol. 4, p. 404, 1919.

Specimens from Limanda ferruginea.—Recorded previously by me [17] from this fish under the name *Dibothrium punctatum* (Rudolphi).

Four strobilae and fragments collected December 10, 1904, from three of five fishes examined; length of longest 72 mm., maximum breadth 5 mm. Three collected April 19, 1910, by Vinal N. Edwards from two fishes examined (worms in each); maximum length 133 mm., breadth 4.5 mm.

Measurements in balsam: Scolex length 1.68 mm., maximum breadth 0.55 mm.; first segment length 0.07 mm., breadth 0.6 mm.; ova 0.06 to 0.072 by 0.033 to 0.039 mm.; average of 10: 0.065 by 0.036 mm. (pl. 61, fig. 11) (U.S.N.M. No. 8883).

Specimens from Pseudopleuronectes americanus.—Recorded by me [18] from this fish under the name *Dibothrium punctatum* (Rudolphi).

Collected from the winter flounder on one date in January, two fishes examined, one strobila, immature, length 7 mm.; 8 on six dates in February, 92 fishes examined, maximum length 80 mm.; 2 on one date in April, 2 fishes examined, maximum length 60 mm.; 1 on one date in August, 7 fishes examined, length 84 mm.; 1 on two dates in December, 14 fishes examined, length 267 mm. Collections, except in August, by Vinal N. Edwards.

Measurements in balsam: Scolex length 0.6 mm., anterior breadth 0.22 mm., middle 0.3 mm.; first segment length 0.14 mm., breadth 0.66 mm.; posterior segment length 0.21 mm., breadth 2.24 mm.; ova, average of 10 sections, 0.069 by 0.034 mm. (pl. 61, fig. 12) U.S.N.M. No. 8884).

BOTHRIOCEPHALUS MANUBRIFORMIS (Linton)

Dibothrium manubriforme Linton, Rep. U. S. Fish Comm. for 1886, pp. 456–458, pl. 1, figs. 1–4, 1889 (from *Tetrapterus albidus*); Rep. U. S. Fish Comm. for 1887, pp. 728–731, 1890 (from *T. albidus* and *Histiophorus gladius*); Proc. U. S. Nat. Mus., vol. 20, p. 429, 1897 (from *Tetrapterus*); Bull. U. S. Fish Comm., vol. 19, pp. 447–448, 1901; Bull. U. S. Bur. Fish., vol. 31, p. 586, 1911 (from *Istiophorus nigricans* and *T. imperator*).

Bothriocephalus manubriformis (Linton) Ariola, Arch. Parasit., vol. 3, p. 410, 1900.—Cooper, Illinois Biol. Mon., vol. 4, pp. 421–433, 1919.

Specimens from Istiophorus americanus [19].—Fifty strobilae, young and adult, collected August 17, 1913, by Dr. G. A. MacCallum; 77 strobilae collected August 8, 1927, from intestine near pyloric caeca, length 10 to 135 mm., maximum breadth 4 mm.

BOTHRIOCEPHALUS RESTIFORMIS (Linton)

Dibothrium restiforme Linton, Rep. U. S. Fish Comm. for 1887, pp. 722–728, pl. 1, figs. 1–16, 1890 (from *Tylosurus caribbaeus:* U.S.N.M. No. 8885).

[17] Rep. U. S. Fish Comm. for 1887, p. 732, 1890; Proc. U. S. Nat. Mus., vol. 20, p. 430, 1897; U. S. Bur. Fish., vol. 31, p. 586, 1911.

[18] Bull. U. S. Bur. Fish., vol. 31, p. 586, 1911.

[19] According to Jordan, Evermann, and Clark's Check List, the Istiophoridae recorded as hosts of this species of cestode represent but one species: *Istiophorus americanus.*

Bothriocephalus restiformis (Linton) Ariola, Boll. Mus. Zool. Anat. Comp. Univ. Genova, 1896, p. 20; Arch. Parasit., vol. 3, pp. 422–423, 1900.

One slide (U.S.N.M. No. 8885).

BOTHRIOCEPHALUS species

Plate 62, Figure 23

Record is here made of an immature strobila (U.S.N.M. No. 8886), collected August 9, 1928, from a flyingfish (*Exocoetus volitans*).

Measurements in balsam: Length, including two fragments, 6.9 mm.; anterior breadth 0.42 mm., posterior 0.5 mm.; scolex length 1.18 mm., breadth 9.87 mm. The scolex, in dorsoventral view, is bluntly sagittate, the bothrial pits marginal, with thickened and irregularly sinuous border. The strobila appears to be unsegmented. Rudiments of the genitalia begin about 1.5 mm. back of the scolex. They lie along the median line as rather conspicuous granular clusters, staining strongly with haematoxylin; about 12 of them in the posterior 2 mm. of the strobila.

A note on this pseudophyllidean cestode from a flyingfish was published in 1934.[20]

BOTHRIOCEPHALUS species

Larval (plerocercoid) stage, usually encysted, probably for the most part belonging to the genus *Bothriocephalus*, is here recorded.

Specimens from Acanthocottus aeneus.—Previously recorded by me.[21]

Specimens from Bairdiella chrysura.—Vase-shaped larvae with abundant calcareous bodies, collected September 29, 1903.

Specimen from Centropristes striatus.—One plerocercus from a 9-mm. fish, June 30, 1919.

Specimen from Clupea harengus.—Cyst, about 1 mm. long, containing a plerocercus, collected by Dr. Hahn, July 11, 1914.

Specimens from Decapterus macarellus.—Previously recorded by me.[22]

Specimen from Decapterus punctatus.—One, actively contractile, collected August 17, 1906. Length 1.2 to 1.6 mm.; anterior half, more contractile than posterior, length 0.4 to 0.8 mm., breadth 0.14 mm., diameter of posterior half, 0.07 mm.

Specimens from Hemitripterus americanus.—Two, collected by Vinal N. Edwards April 12, 1913. Length in formalin 3.5 mm., breadth 1 mm.; plump, vase-shaped, yellowish.

[20] Trans. Amer. Micr. Soc., vol. 53, p. 66, 1 fig., 1934.

[21] Bull. U. S. Fish Comm., vol. 19, p. 467, 1901; Bull. U. S. Bur. Fish., vol. 31, p. 586, 1911.

[22] Bull. U. S. Fish Comm., vol. 19, p. 449, fig. 228, 1901.

Specimens from Lagocephalus laevigatus.—A few small cysts, habitat not recorded but probably from intestinal wall, collected July 17, 1906; plerocercus removed from cyst, length 1.54 mm., breadth 0.38 mm.

Specimen from Lophopsetta maculata.—One collected by Vinal N. Edwards September 22, 1905. Length 5 mm., breadth 2 mm., in formalin.

Specimens from Menticirrhus saxatilis.—Two small flask-shaped plerocerci collected July 19, 1910; length 2.1 mm., breadth 0.7 mm.

Specimens from Microgadus tomcod.—Two slender larvae collected by Vinal N. Edwards April 8, 1910 (U.S.N.M. No. 8887); length 8 mm., breadth 0.6 mm., in formalin.

Specimens from Paralichthys dentatus.—Collected on two dates in July and two in August 1905. Of the 15 fishes examined, numerous cysts containing plerocerci were found in the intestine wall of one and on the ovary of another; one cyst was noted in each of two fishes.

Specimens from Paralichthys oblongus.—Cysts on intestine and mesentery, 1 to 4 mm. in diameter, were collected on one date in May, two in June (U.S.N.M. No. 8888), and two in August; few on each date. These cysts contained plerocercoidlike larvae of a maximum length of 4.5 mm., some of which, however, are larval tetrarhynchs.

Specimens from Peprilus paru.—Collected on three dates in July (U.S.N.M. No. 8889), two in August, and one in September, few to numerous, on viscera in three different years. The plerocerci are small, white, slender, actively contracting, from 8 mm. or less to 5 mm. when fully extended, often assuming a vase shape; calcareous bodies rather large. Measurements in formalin: Length 1.05 mm., breadth 0.29 mm.; scolex length 0.1 mm., breadth 0.21 mm. Measurements in balsam: Length 0.88 mm., breadth 0.27 mm.; scolex length 0.08 mm., breadth 0.17 mm.; length of bothrial pit 0.08 mm. Scolex covered with minute spines.

Specimens from Pneumatophorus grex.—Small plerocerci collected from intestine on three dates in July and one in August; three fishes examined on each date; 5 to 12 plerocerci found on each date, most of them macerated, evidently lately introduced with food.

Specimen from Pomatomus saltatrix.—One small, slender, linear specimen collected August 27, 1906.

Specimen from Pomolobus pseudoharengus.—One collected October 9, 1914. Length 5 mm., breadth 0.6 mm., in formalin. Filled with relatively large glandular bodies, 0.03 by 0.07 mm., similar to those noted in a larval cestode from *Sarda sarda*.

Specimens from Poronotus triacanthus.—Small, vase-shaped plerocerci are recorded from this host on two dates in July and two in August in four different years; under serous coat of stomach, extending

and contracting at anterior end, which is occasionally invaginated; many calcareous bodies in parenchyma. Measurements under slight pressure: Length 1.4 mm., breadth 0.18 mm., nearly linear.

Specimen from Remora remora.—One larval cestode collected July 22, 1919, resembling cestode larvae from *H. americanus, M. tomcod,* and *C. schoepfi.* Length 13 mm., breadth 2 mm., in balsam.

Specimens from Sarda sarda.—Previously recorded by me.[23]

Specimens from Scomber scombrus.—Previously recorded by me.[24]

Numerous cysts, 1 to 3 mm. long, each containing a plerocercus, were found in washings from viscera August 3, 1906.

Collected on 24 dates in August 1918 from 192 small mackerel, 108 to 185 mm. long, examined for stomach contents. On five dates cysts containing plerocerci were found in eight fishes, one to few in each fish. In one fish the cysts were on the viscera; in the other cases they appeared to have been introduced with the food (U.S.N.M. No. 8890).

Specimen from Seriola lalandi.—One vase-shaped plerocercus from stomach wall, actively contracting and extending from 5 to 6 mm., collected August 14, 1906. Diameter, anterior, 0.5 mm.; maximum, near anterior end, 0.84 mm.; posterior end 0.21 mm. For a distance of 3.5 mm. from the anterior end of the body filled with coarse granules, for the most part oval-elliptical but assuming various shapes where closely crowded together, about 0.084 to 0.105 by 0.039 to 0.06 mm. (U.S.N.M. No. 8891).

Specimens from Sphoeroides maculatus.—Six puffers, two on each of three dates in August, and nine on one July date, out of a large number of puffers examined, had from a few to rather numerous larval cestodes encysted on the wall of the intestine. Length of one cyst 2.5 mm., diameter 0.35 to 0.56 mm.

Specimens from Stenotomus chrysops.—One plerocercus from young scup collected August 9, 1916, by Dr. G. A. MacCallum.

A small scup, 10 mm. long, with white cysts showing through the body wall was brought to my attention by Miss Cable, July 27, 1933. The cysts contained plerocerci with calcareous bodies. Three, compressed slightly, measured: 1.33 by 0.46, 1.4 by 0.42, and 1.89 by 0.7 mm.

Specimen from Syrictes fuscus.—One from a 45-mm. fish collected July 15, 1919. Length 0.37 mm., breadth 0.15 mm., thickness of cuticle 0.006 mm., diameter of calcareous bodies 0.012 mm. (U.S.N.M. No. 8892).

Specimen from Tautogolabrus adspersus.—One vase-shaped plerocercus, active, the anterior end, with short spines, capable of consider-

[23] Proc. U. S. Nat. Mus., vol. 19, p. 789, pl. 9, figs. 2, 3, 1897; Bull. U. S. Fish Comm., vol. 19, pp. 278, 300, fig. 100, 1901.

[24] Bull. U. S. Fish Comm., vol. 19, p. 445, 1901; Bull. U. S. Bur. Fish., vol. 31, p. 586, 1911.

able alterations, frequently invaginated, full of rather large calcareous bodies, collected July 21, 1904. Length 2 mm., breadth 0.6 mm. (pl. 61, fig. 14) (U.S.N.M. No. 8893).

One plerocercus, encysted, collected August 11, 1906.

Specimens from Urophycis chuss.—Plerocerci in cysts under serous coat of intestine collected November 1, 1904.

Genus CLESTOBOTHRIUM Lühe

CLESTOBOTHRIUM CRASSICEPS (Rudolphi)

PLATE 61, FIGURES 15–18

An extensive account of this species, including synonymy, is given by Cooper.[25]

The species is readily recognized by the more or less globose scolex, with conspicuous dorsoventral bothria, the segmentation of the strobila beginning immediately behind the scolex; the mature proglottides often partly divided by false articulations; genital cloaca median, dorsal. It will be noted that strobilae have been collected from the whiting (*Merluccius bilinearis*) that are nearly double the maximum length of 92 mm. recorded by Cooper.

Although this cestode is recorded from nine specific hosts in the Woods Hole region, its occasional or rare occurrence in most of them, and the evidence of recent introduction of mature strobilae along with food in at least one host (*Lophius piscatorius*), reduce the species that may regarded as true host to one—*Merluccius bilinearis*.

Specimens from Fundulus majalis.—One strobila and fragments (U.S.N.M. No. 8894), aggregating 32 mm. in length, collected September 6, 1913; bluish-transparent; fragments slightly macerated. The killifish, along with specimens of whiting that were found to harbor *C. crassiceps*, came from a fishtrap at Menemsha Bight. The condition of the cestode fragments suggests that they had been discharged from the whiting while confined in the trap and eaten by the killifish.

Measurements in balsam: Scolex length 0.73 mm., breadth 0.62 mm.; first segment length 0.16 mm., breadth 0.58 mm.; maximum breadth 0.92 mm.

Specimen from Hippoglossus hippoglossus.—One (U.S.N.M. No. 8895) collected June 14, 1906; length in formalin 15 mm. The scolex is typical of the species, but the strongly contracted strobila shows but little of the anatomy. Measurements in balsam: Length 13 mm.; scolex length 0.7 mm., breadth 0.84 mm.; first segment length 0.07 mm., breadth 0.81 mm.; middle segments, length 0.14 mm., breadth 1.4 mm.; posterior segment length 0.56 mm., breadth 0.47 mm.

[25] Illinois Biol. Mon., vol. 4, pp. 442–458, 11 figs., 1919.

Specimens from Lophius piscatorius.—Vinal Edwards' notes yield many dates, extending over a long series of years, on which whiting were recorded in the stomach contents of the goosefish. Since *C. crassiceps* is of frequent occurrence in the whiting, it would be surprising if this cestode were not found in the goosefish. Following is the record of finds of this cestode in the goosefish:

November 24, 1905: 1 fish examined, 4 with scoleces, longest 70 mm.

July 6, 1910: 5 fish examined, 3 cestodes, maximum length 45 mm.

May 15, 1913: 10 fish examined, 1 with scolex, length 18 mm. Stomach of fish full of shad, hake, whiting, dogfish, and squid. Vinal N. Edwards.

June 6, 1914: 1 fish examined, 2 scoleces and fragments, each about 8 mm. long, one with ripe segments.

June 15, 1914: 3 fish examined, 4 cestodes, maximum length 72 mm., breadth 2 mm.; scolex breadth 1.12 mm. Measurements in balsam: Length 42 mm.; maximum breadth 1.75 mm.; scolex length 0.98 mm., breadth 0.94; first segment length 0.07 mm., breadth 0.98 mm.; median segments, length 0.09 mm., breadth 1.75 mm.; posterior segment length 0.63 mm., breadth 0.77. Ova thin-shelled and collapsed, best examples about 0.072 by 0.033 (pl. 61, figs. 17, 18) (U.S.N.M. no. 8896).

Specimens from Merluccius bilinearis.—Recorded previously by me [26] under the name *Dibothrium crassiceps* (Rudolphi) from this fish. This cestode was collected from whiting at Woods Hole in all the years except one from 1903 to 1928, inclusive, as follows:

Month	Number of dates	Number of fishes examined	Strobilae
May	6	25	260
June	1	2	25
July	10	34	60
August	12	64	114
September	1	1	2
October	16	132	141
November	29	272	391
Whiting were examined but no cestodes found, as follows:			
August	1	1	----------
September	1	3	----------
October	2	7	----------
November	5	31	----------

[26] Bull. U. S. Fish Comm., vol. 19, p. 473, figs. 266-268, 1901; Bull. U. S. Bur. Fish., vol. 31, p. 585, 1911.

Dimensions, in millimeters, balsam mounts:

Length	30. 00	16. 00	113. 00	138. 00
Scolex:				
Length	. 84	. 49	1. 20	1. 26
Breadth	. 84	. 49	1. 00	1. 26
First segment:				
Length	. 07	. 05	. 08	. 14
Breadth	. 68	. 42	. 63	1. 05
Median segment:				
Length	. 25	. 35	. 24	. 15
Breadth	1. 05	. 81	2. 24	2. 50
Posterior segment:				
Length	. 35	. 30	. 50	. 49
Breadth	. 70	. 63	1. 20	1. 56

Maximum length of strobila, in formalin, 180 mm.; ova 0.07 by 0.03 to 0.04 mm.

Specimens from Pomatomus saltatrix.—Recorded by me [27] under the name *Dibothrium crassiceps* (Rudolphi).

Specimens from Sphoeroides maculatus.—Three strobilae, with scoleces (U. S. N.M. No. 8898), collected June 6, 1914, length of each about 15 mm.; one, scolex missing, length 30 mm.; 10 fishes examined by Vinal N. Edwards, who reported worms in 4. Measurements in balsam: Length of first segment 0.11 mm., breadth 0.23 mm.; posterior segments, length 0.28 mm., breadth 1.12 mm. False articulation of segments, giving the appearance of their arrangement in the strobila by twos, is a conspicuous feature.

Specimens from Squalus acanthias.—Two strobilae (U.S.N.M. No. 8899) collected September 22, 1913, from one of eight dogfishes examined by Edwards. Aggregate length of strobilae and fragments in formalin 72 mm. Length of longest strobila in balsam 35 mm. Ova 0.063 to 0.075 by 0.033 to 0.039 mm. These worms were doubtless introduced with food.

Specimens from Urophycis chuss.—Two strobilae with scoleces and fragment collected May 9, 1913, from 15 fishes examined by Edwards. Lengths in formalin 18, 24, and 14 mm. Breadth of scolex 0.42 mm., maximum breadth about 0.65 mm. (U.S.N.M. No. 8900).

Specimens from Urophycis tenuis.—Two strobilae collected May 9, 1913, fromt hree fishes examined by Edwards; lengths 7 and 24 mm. A few fragments from one fish June 30, 1924, no scolex seen; whiting among the stomach contents.

[27] Bull. U. S. Fish Comm., vol. 19, p. 451, 1901; Bull. U. S. Bur. Fish., vol. 31, p. 585, 1911.

Family AMPHICOTYLIDAE Ariola

Genus ABOTHRIUM van Beneden

ABOTHRIUM RUGOSUM (Batsch)

PLATE 62, FIGURE 19

Taenia rugosa BATSCH, Naturgeschichte der Bandwurmgattung überhaupt und ihrer Arten insbesondere . . ., p. 208, 1786.

Dibothrium rugosum (Batsch) DIESING, Systema helminthum, p. 591, 1850.—LINTON, Rep. U. S. Fish Comm. for 1887, pp. 750–754, pl. 3, figs. 7–10, 1890; Proc. U. S. Nat. Mus., vol. 20, p. 431, pl. 28, figs. 1–4, 1897; Bull. U. S. Fish Comm., vol. 19, p. 476, 1901; Bull. U. S. Bur. Fish., vol. 31, p. 586, 1911.

For extended synonymy and account of this species see Cooper, Illinois Biol. Mon., vol. 4, pp. 460–473, 9 figs., 1919.

The adult strobila of this cestode is usually found with the anterior end impacted in the pyloric caeca, where it is surrounded by waxy degenerate tissue.

Specimens from Gadus morrhua.—Concerning the distribution by months in the following summary it should be remarked that, with the exception of the two dates in June, all the fish had been kept for some time in a live-car. On one of the June dates the fish was taken off Nantucket, the other 20 miles east of Great Round Shoal. All collections, except those of July, were made by Vinal N. Edwards in the years from 1903 to 1916, and on four dates in earlier years reference to which was not included in previous publications.

Month	Number of dates when examined	Number of fishes examined	Number of dates on which found	Maximum aggregate in one fish	Maximum length of strobila
January	23	253	15	959	400
February	5	20	2	575	
April	2	2			
May	13	57	6	1, 849	355
June	2	2	1	1, 130	416
July	2	5			
October	6	13	2		100
November	52	396	17	1, 685	400
December	58	1, 014	35	1, 018	322

Specimens from Melanogrammus aeglefinus.—Thirty-eight haddock were examined on 14 dates in six different years. Examinations were made in every month except January, February, and March. *A. rugosum* was found as follows:

April: 1 fish examined; 1 strobila, length 250 mm, breadth 4 mm.

August: 16 fishes examined on one date; 2 strobilae, length 60 and 36 mm, breadth 2 and 3.5 mm.

October: (1) 1 fish examined; 8 strobilae, maximum length 122 mm. (2) 4 fishes examined on one date; 6 strobilae and fragments aggregating 1,358 mm, maximum length 210 mm.

The anterior ends of the strobilae are imperfect on account of their permanent fixation in the pyloric caeca (U.S.N.M. No. 8901).

Specimens from Microgadus tomcod.—Tomcod were examined for Entozoa by Edwards in nearly every month and over a long series of years. Cestodes that appear to belong to this species were found twice:

January 1, 1904: 30 fish examined; 1 strobila, length 50 mm.

April 26, 1910: 1 fish examined; fragments of strobilae.

Specimens from Pollachius virens.—Three fragments belonging to two strobilae were collected May 28, 1913; lengths 25, 145, and 242 mm., thickish; segment of maximum breadth, in balsam, length 0.84 mm., breadth 3.7 mm.; ova in sections, about 0.044 by 0.033 (U.S.N.M. No. 8902).

Specimens from Urophycis tenuis.—Collected as follows:

December 15, 1904: 1 strobila, length 140 mm, breadth 4 mm; scolex missing.

November 5, 1910: 1 strobila, length 23 mm.; no scolex.

August 4, 1911: 1 strobila, with scolex and numerous fragments.

May 7, 1913: 2 strobilae, lengths 10 and 14 mm.

Family PROTEOCEPHALIDAE LaRue

Genus PROTEOCEPHALUS Weinland

PROTEOCEPHALUS MACROCEPHALUS (Creplin)

PLATE 62, FIGURES 24–28

Taenia dilatata LINTON, Rep. U. S. Fish Comm. for 1886, p. 488, 1889; Proc. U. S. Nat. Mus., vol. 20, p. 429, 1897; Bull. U. S. Fish Comm., vol. 18, p. 435, 1901.

For full synonymy and description see La Rue, Illinois Biol. Mon., vol. 1, pp. 129–143, 1914.

Specimens from Anguilla rostrata.—My notes show that 106 eels were examined for parasites on one date in January, two in March, six in April, three in May, one in July, two in August, four in September, three in October, and nine in November in 12 different years from 1903 to 1924, inclusive. *Taenia* referred to this species were found on two dates in April, nine eels examined, one strobila and fragments, longest 4 mm.; on one date in June, six eels examined, one strobila, length 350 mm., breadth 2 mm.; on one date in July, 9 eels examined, 10 strobilae and fragments, longest 140 mm.; on one date in August, two eels examined, one strobila and fragments, longest 90 mm.; on four dates in November, 43 eels examined, six strobilae and fragments, longest 295 mm., maximum breadth 2 mm.

Diameter of scolex in balsam, average of 10, 0.24 mm., minimum 0.35 mm.; ripe proglottids in different strobilae, lengths 1.47 and 1.96 mm., breadths 1.33 and 1.12 mm. (U.S.N.M. No. 8906).

Specimens from Zygonectes diaphanus.—On July 22, 1905, 52 fresh-water killifishes were examined, and three scoleces with rudimentary strobilae were found. Measurements in balsam: Length 2.2 mm., breadth 0.24 mm., diameter of scolex 0.18 mm., diameter of sucker 0.11 mm.

Genus CORALLOBOTHRIUM Fritsch

CORALLOBOTHRIUM FIMBRIATUM Essex

PLATE 62, FIGURES 29, 30

Corallobothrium fimbriatum ESSEX, Illinois Biol. Mon., vol. 11, pp. 275–283, 33 figs., 1927.

The genus *Corallobothrium* as defined by Essex: With characteristics of family. Scolex bears four suckers situated on anterior surface surrounded by many irregular folds and lappets of tissue. Rostellum, hooks, and spines absent. Neck broad, short. Vagina inconstant in position, anterior or posterior to cirrus pouch. Habitat: In Siluridae. Type species, *C. solidum* Fritsch.

Essex described two new species of *Corallobothrium: C. giganteum* and *C. fimbriatum*, from anterior portion of intestine of *Ictalurus punctatus, Leptops olivaris*, and *Ameiurus melas*.

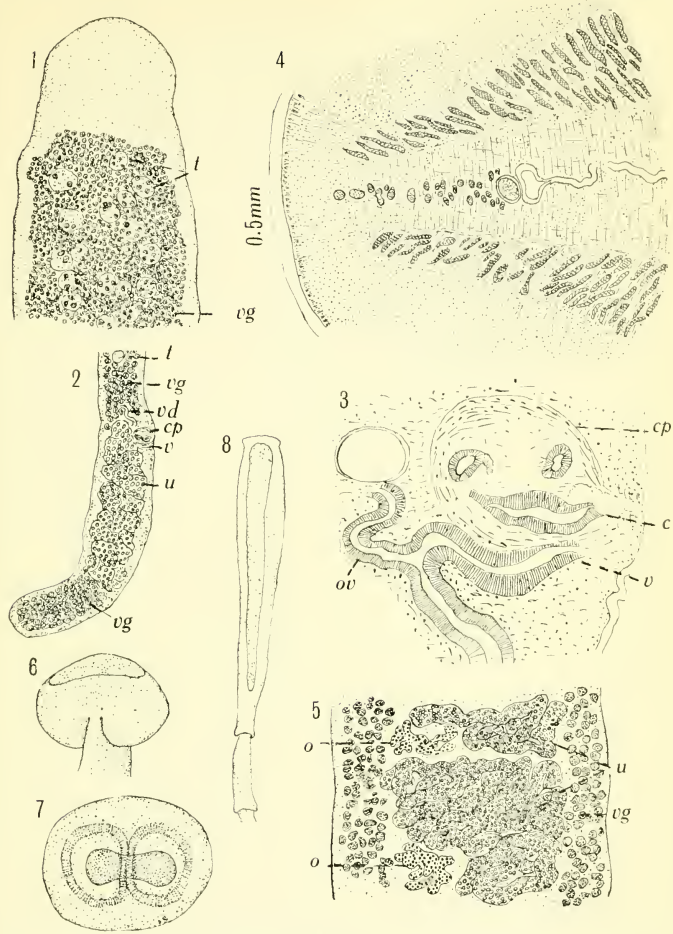
Specimens from Ameiurus nebulosus.—This cestode (U.S.N.M. No. 8907) was collected by Mr. Edwards, Dr. MacCallum, and the author on 10 dates from 1913 to 1918, inclusive, from horned pout taken in fresh-water ponds near Quisset and Waquoit.

May 9: 10 fishes examined, 70 cestodes found, maximum length 35 mm. May 11: 31 fishes examined, 60 cestodes, maximum length 50 mm. May 14: Number of fishes not recorded, 106 cestodes, maximum length 12 mm. May 24: 5 fishes examined, 27 cestodes, maximum length 20 mm. June 6, number of fishes not recorded, 12 cestodes, maximum length 5 mm. June 15: 1 fish examined, 3 cestodes, maximum length 3 mm. July 1: 15 fishes examined, many cestodes, maximum length 4 mm. July 7: 5 fishes examined, 8 cestodes, 2 to 18 mm. long. August 13: 38 fishes examined, many cestodes, 3 to 10 mm. long. September 29: Number of fishes not recorded, 5 cestodes, maximum length 4 mm.

Measurements in balsam: Length 32 mm.; breadth near scolex 1.05 mm.; segment 1 mm. back of scolex, length 0.16 mm., breadth 1.2 mm.; posterior segment, length 2.45 mm., breadth 1.4 mm.; scolex breadth 1.54 mm., length 0.91 mm.; diameter of sucker 0.35 mm. Ova thin-shelled, somewhat variable, circular outline, in life 0.028 to 0.035 mm.

ABBREVIATIONS USED ON PLATES

c, cirrus	*u*, uterus
cp, cirrus pouch	*v*, vagina
o, ovary	*vd*, vas deferens
ov, oviduct	*vg*, vitellaria
t, testes	



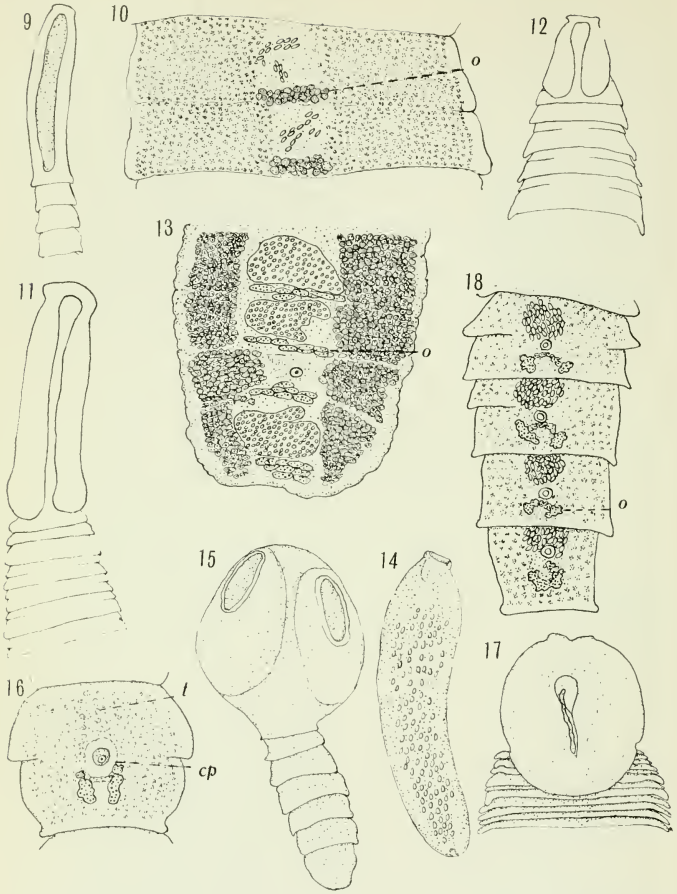
1–3. *Caryophyllaeus terebrans* (Linton): 1, Anterior end; 2, posterior end; 3, section showing cirrus pouch with retracted cirrus and oviduct joining vagina. (From *Notropis rubrifrons*.?)

4. *Ligula* sp.: Transverse section showing longitudinal muscles between nerve and lateral margin. (From *Palinurichthys perciformis*.)

5. *Spathebothrium simplex* Linton: Portion of strobila. (From *Microgadus tomcod*.)

6, 7. *Bothrimonus intermedius* Cooper: 6, Scolex; 7, front view of scolex. (From *M. tomcod*.)

8. *Bothriocephalus scorpii* (Müller): Scolex. (From *Menticirrhus saxatilis*.)

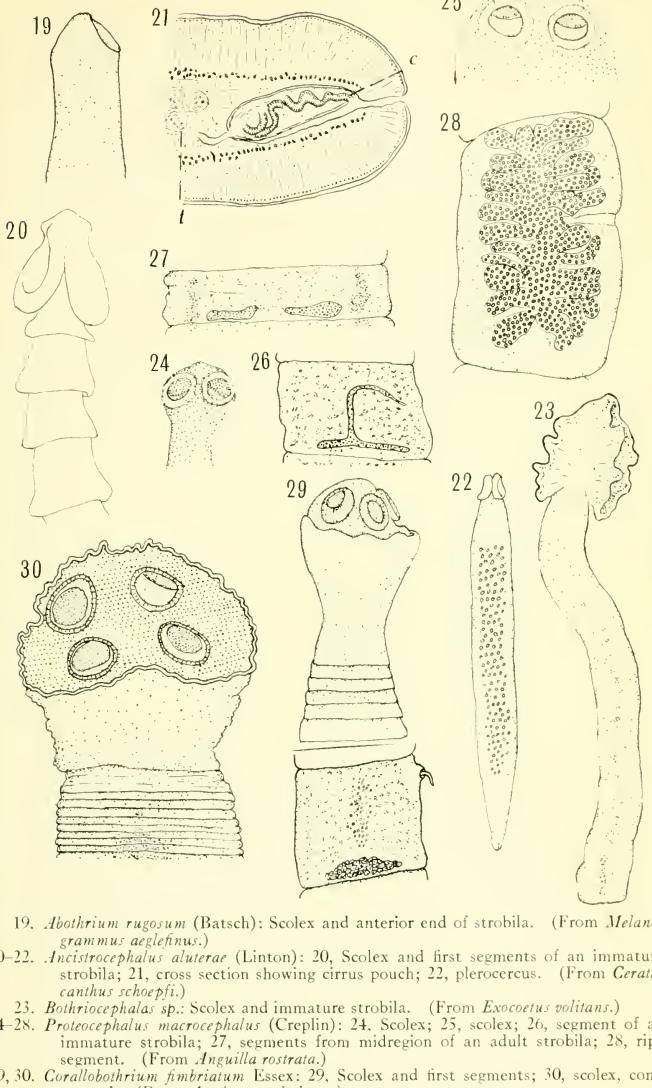


9, 10. *Bothriocephalus scorpii* (Müller): 9, Scolex (from *Hippoglossus platessoides*); 10, ripe segments (from *Paralichthys dentatus*).

11–13. *Bothriocephalus claviceps* (Goeze): 11, Scolex and first segments (from *Limanda ferruginea*); 12, scolex and first segments (from *Pseudopleuronectes americanus*); 13, posterior end of strobila (there are no ova in the penultimate segment) (from *Cyclopterus lumpus*).

14. *Bothriocephalus* sp.: Plerocercus (from *Tautogolabrus adspersus*).

15–18. *Clestobothrium crassiceps* (Rudolphi): 15, Scolex with young strobila (from *Merluccius bilinearis*); 16, proglottis, testes median, nearly hidden by vitellaria (from *M. bilinearis*); 17, scolex and anterior end of strobila (from *Lophius piscatorius*); 18, posterior segments (from *L. piscatorius*).



19. *Abothrium rugosum* (Batsch): Scolex and anterior end of strobila. (From *Melanogrammus aeglefinus.*)

20–22. *Ancistrocephalus aluterae* (Linton): 20, Scolex and first segments of an immature strobila; 21, cross section showing cirrus pouch; 22, plerocercus. (From *Ceratacanthus schoepfi.*)

23. *Bothriocephalus* sp.: Scolex and immature strobila. (From *Exocoetus volitans.*)

24–28. *Proteocephalus macrocephalus* (Creplin): 24, Scolex; 25, scolex; 26, segment of an immature strobila; 27, segments from midregion of an adult strobila; 28, ripe segment. (From *Anguilla rostrata.*)

29, 30. *Corallobothrium fimbriatum* Essex: 29, Scolex and first segments; 30, scolex, compressed. (From *Ameiurus nebulosus.*)

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PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM

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PAMLICO FOSSIL ECHINOIDS

By Willard Berry

H. G. Richards, in his report on the Pamlico formation of the Southern Atlantic Coastal Plain,[1] records the occurrence of *Mellita quinquiesperforata* (Leske) from the Inter-Coastal Waterway between Pungo and Alligator Rivers, Hyde County, N. C.; Core Creek Canal, Carteret County, N. C.; 15 miles northwest of Myrtle Beach, Horry County, S. C.; Waverly Mills, Georgetown, S. C.; and Cooper River, Charleston County, S. C. More detailed collecting has revealed this species to be present in considerable numbers and well preserved in Cane Patch Bay on the Inter-Coastal Waterway about 6 miles east of Myrtle Beach, Horry County, S. C. Here in addition to adult specimens there occur the immature forms shown on plate 65, figures 3, 5, and 6. These are not so abundant as the adult specimens, but ones of 50 to 75 mm. are fairly common.

Associated with this species is an allied form that is referable to *Encope michelini* L. Agassiz, which, so as far as I know, has not previously been found fossil. Both this species and the *Mellita* are rather abundant and easily distinguished from each other. The heavy, rounded anterior margin and the posteriorally located apex set it apart from its associated form. The immature forms are also readily distinguished from the others, as the somewhat polygonal

[1] Richards, H. G., Fauna of the Pleistocene Pamlico formation of the Southern Atlantic Coastal Plain. Bull. Geol. Soc. Amer., vol. 47, pp. 1611–1656, 1936.

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adult outline is taken on early in life. Their habitat seems to have been the same as the present members of this species, just under the surface of the sand.

Comparison of the fossil forms with the recent material in the United States National Museum leaves no doubt as to the identity, at least of the adults. As regards the smaller stages, these are similar to the modern forms but seem somehow not very well differentiated from *Mellita* except in the appearance of the lunules, those in the *Mellita* appearing much earlier than those in the *Encopes*.

The *Mellita* is not uncommon in the Pleistocene, and its occurrence in the section here is not surprising. The *Encope*, on the other hand, does not now inhabit the present seas east of the Gulf of Mexico and is not known from the Atlantic coast of North America; and has not been previously reported fossil. Hence, it is of interest to report it from northern South Carolina and from Pleistocene deposits.

Fragments of either *Mellita* or *Encope* have been collected from similar deposits as far north as Alligator Cut of the Inter-Coastal Waterway in Hyde County, N. C., but so far I have been unable to identify them definitely to genus and species; they appear to be only *Mellita*. Definite specimens of *Mellita* occur in Carteret County, N. C., on the spoil piles along the Inter-Coastal Waterway in Brunswick County, N. C., near the "Sand Cut," but no definite specimens of *Encope* have been found. Since no specimens or definite fragments resembling *Encope* appear north of Cane Patch Bay, Myrtle Beach, the northern extension of *Encope michelini* in the Pamlico would seem to reach only to northern South Carolina.

The description follows:

Genus ENCOPE L. Agassiz

Encope L. Agassiz, Monographie des scutelles, p. 45, 1841.

ENCOPE MICHELINI L. Agassiz

Plate 63, Figures 1–8; Plate 64, Figures 1–6; Plate 65, Figures 1–4, 6

Encope michelini L. Agassiz, Monographie des scutelles, p. 58, pl. 6a, figs. 9, 10, 1841.—A. Agassiz, Revision of the Echini, p. 329, pl. 12d. fig. 1, 1872.—H. L. Clark, Ann. Mag. Nat. Hist., ser. 8, vol. 7, p. 599, 1911; Mem. Mus. Comp. Zool., vol. 46, No. 1, p. 75, 1914; Papers Dept. Marine Biology, Carnegie Inst. Washington, vol. 13, No. 3, p. 73, 1919; Sci. Surv. Porto Rico and Virgin Islands, New York Acad. Sci., vol. 16, pt. 1, p. 87, 1933.—Grant and Hertlein, Publ. Univ. California at Los Angeles, Math. and Phys. Sci., vol. 2, pp. 96, 99, 1938.

Specimens somewhat pentagonal in outline, with the more nearly straight portion posterior, anterior margin rounded and fairly thick,

posterior margin about one-half thickness of anterior and somewhat sharper. Margin cut by five reentrant marginal ambulacral notches, deep and narrow, which occasionally have been observed to make a lunule (pl. 64, fig. 6). All the ambulacra are, except in the young, deep narrow notches, but the posterior notches are the deepest. The apical disk is central. The peristome is prominent and central and on the aboral surfaces rises *posterially* to the greatest thickness of the test about two-thirds of the distance from anterior margin and at the anterior end of the lunule of the posterior interambulacrum 5, and just above the periproct, which is confluent with the lunule. The ambulacral petals are fairly narrow and the posterior ones are longer than the others. The oral ambulacral furrows are deep and branch toward the margin. The apical disk is well preserved, showing the pores very distinctly. The entire surface is covered with small tubercles, those on the oral surface most pronounced.

In the young the marginal ambulacra notches are shallow, although the poterior ones are more pronounced and the ambulacral furrows are indistinct. Tubercles are present over entire surface; they are more pronounced on the young ones.

The fossil specimens range in size from 23 mm. long and 21 mm. wide to 146 mm. long and 144 mm. wide, with maximum thickness 19 mm.

For purposes of comparison I have figured a recent *Encope michelini* from *Albatross* station 2609, plate 63, figures 2, 5, and 8, and a series of fossil specimens ranging in size from 13 mm. long (pl. 65, figs. 3, 6), to a large adult, 146 mm. long (pl. 64, figs. 1, 3). The figured specimens are in the collection of the U. S. National Museum.

I wish to express my thanks to Austin H. Clark, of the U. S. National Museum, and to Dr. Robert T. Jackson, of Peterborough, N. H., for advice and help in arriving at the identification of these fossils.

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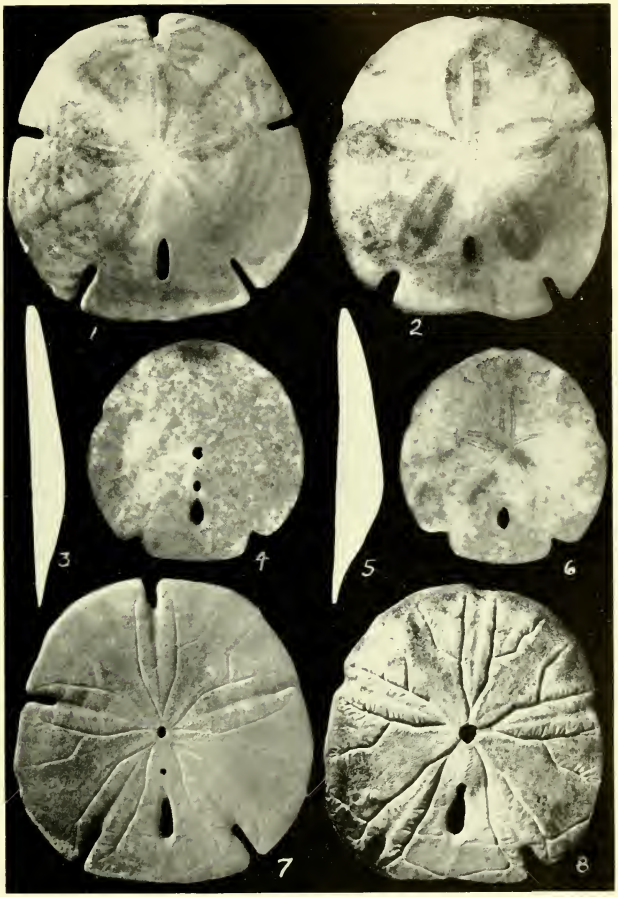


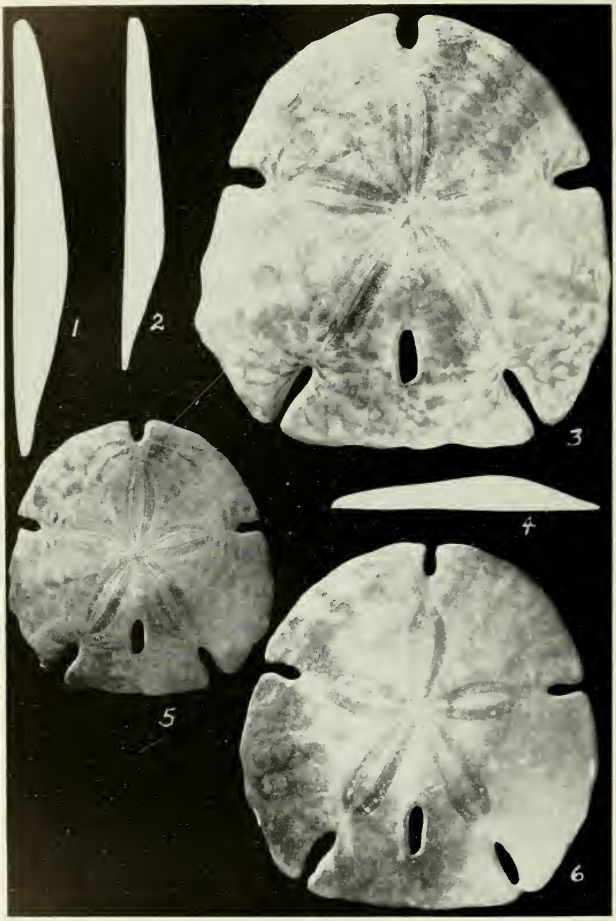
ENCOPE MICHELINI L. AGASSIZ.

1, 3, 7, Fossil specimen, 107 mm. long, 106 mm. wide.

2, 5, 8, Similar views of a recent specimen from *Albatross* station 2609, 107 mm. long, 100 mm. wide.

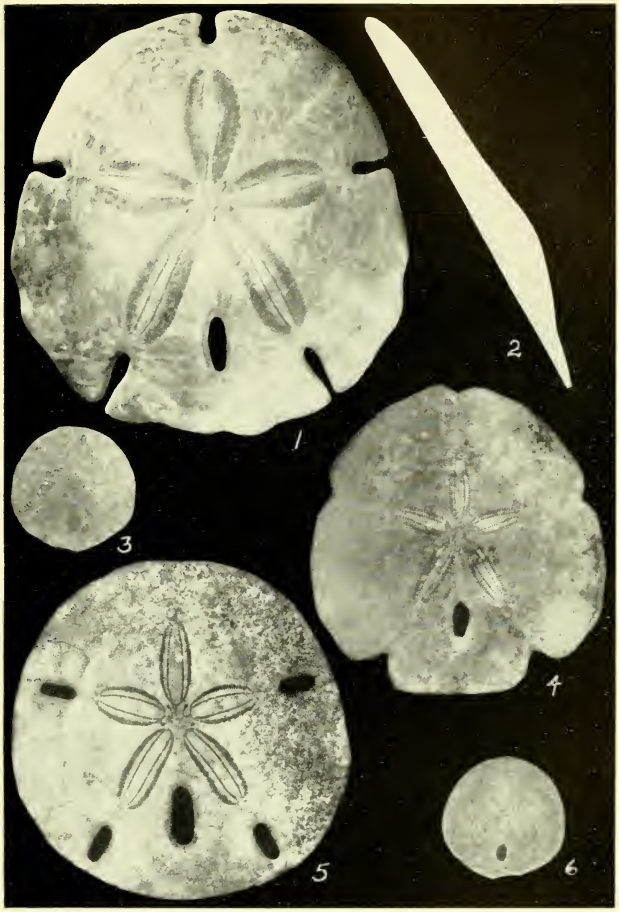
4, 6, Similar views of young fossil form, 23 mm. long, 21 mm. wide.

(All figures $\times$ $^1/_2$ except 4 and 6, which are $\times$ $1^1/_2$.)



ENCOPE MICHELINI L. AGASSIZ.

1, 3, Fossil specimen, 146 mm. long, 144 mm. wide.
4, 5, Fossil specimen, 93 mm. long, 91 mm. wide.
2, 6, Fossil specimen, 122 mm. long, 122 mm. wide.
(All $\times \frac{1}{2}$.)



ENCOPE MICHELINI L. AGASSIZ AND MELLITA QUINQUIESPERFORATA (LESKE).

1, 2, Fossil specimen of *E. michelini*, 133 mm. long, 138 mm. wide.
4, Fossil specimen of *E. michelini*, 33 mm. long, 32 mm. wide.
3, 6, Young fossil specimen of *E. michelini*, 13 mm. long, 13 mm. wide.
5, Fossil specimen of *M. quinquiesperforata*, 36 mm. long, 36 mm. wide.
(All figures × ½ except 3, 5, and 6, which are × 1½.)

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Vol. 90 Washington : 1941 No. 3114

A NEW GENUS OF SEA STARS (PLAZASTER) FROM JAPAN, WITH A NOTE ON THE GENUS PARASTERINA

By Walter K. Fisher

Dr. Tohru Uchida (1928) described a new sea star from Mutsu Bay, Honshu, as *Labidiaster borealis*, which appeared to refute the belief that the highly specialized *Labidiaster* is confined to Antarctic and sub-Antarctic regions. Of this genus, described by Lütken (1871, p. 289), there are two species: *L. radiosus* Lütken (synonym *L. crassus* Koehler), distributed over the Falkland Plateau and off the southern end of South America, 0–183 m.; and *L. annulatus* Sladen (1889, p. 595, pl. 108, fig. 1), an Antarctic species found at Kerguelen and Heard Islands, Antarctic Archipelago, South Orkneys, South Sandwich Islands, and South Georgia, 93–44 m.

Through the kindness of Dr. R. Hayashi, Department of Zoology, Hokkaido Imperial University, Sapporo, Japan, I have received two dried specimens of *Labidiaster borealis* Uchida from Hokkaido. One of these is larger than any recorded by Dr. Uchida, R being about 180 mm. and r 30 mm. The specimen had 35 rays of which 10 remain.

This species is not a *Labidiaster*, nor does it appear to be closely enough allied to be included in the Labidiasterinae. The various polybrachiate genera of Asteriidae are not very closely related, for the development of numerous rays seems to have arisen independently in all sorts of places. We have such divergent genera, for instance, as *Heliaster* (usually accorded family rank), *Pycnopodia*, *Coronaster*, *Rathbunaster*, *Labidiaster*, and *Saliasterias*. I have recently described a rather anomalous sub-Antarctic genus, *Psalidaster*, distantly allied to *Notasterias;* and the condition in a more restrained form exists in

genera having predominantly 5- and 6-rayed species such as *Diplasterias*, *Lysasterias*, and *Cryptasterias*.

The new genus, which may be called *Plazaster*, has crossed pedicellariae entirely different from those of *Labidiaster*, best understood by a comparison of figures. The pedicellariae of *Labidiaster annulatus* may reach enormous size. Figure 2, plate 67, if enlarged as much as figure 1, plate 66, would occupy the entire plate. They occur thickly on transverse cushions of tissue, as illustrated by Sladen (1889, pl. 108); and while those of *radiosus* are somewhat smaller they are still very large and of the same type as in *annulatus*. The shank teeth are relatively large and occur in a single series. Those of *Plazaster* are small and in several series. In *Labidiaster* much smaller pedicellariae (pl. 67, fig. 4) of several sizes occur on the thick spine sheaths, including the outer of the two adambulacral spines. In *Plazaster* there are no adambulacral spine pedicellariae, and none of the spinelets has a fleshy sheath, but a thin one. The absence of pedicellariae attached to one or more adambulacral spines is important in connection with their presence in *Labidiaster*. Adambulacral spine pedicellariae are found only in the following genera: *Asterias*, *Evasterias*, *Leptasterias*, *Stenasterias*, *Perissasterias*, *Labidiaster*, and sometimes in *Urasterias* as a variation. The majority of genera of Asteriidae have no adambulacral spine pedicellariae, although pedunculate straight pedicellariae, attached to adambulacral plates, are of common occurrence.

The skeleton of *Plazaster* is different from that of *Labidiaster*. The very numerous small plates form an extensive irregular net to the tip of ray, without a differentiated carinal and superomarginal system, and the inferomarginal plates alternate with an interpolated secondary ossicle. In *Labidiaster* the skeleton of the outer half or two-thirds of ray undergoes reduction to widely spaced transverse arches, which in old specimens degenerate to the rudiments of the marginals and a few tiny abactinals. The thick ruffs of giant pedicellariae overlie these disappearing or vanished skeletal arches. The rays of *Labidiaster* like those of *Pycnopodia* are very flexible. Both animals can catch active prey.

It is difficult to name the genus to which *Plazaster* is most closely related and therefore to place it satisfactorily in the system. It differs from the Labidiasterinae in the type of reticulate skeleton, in the inferior status of the marginal plates, and in lacking prominent stoles of pedicellariae on the principal spines. At the same time the ambulacral plates are rather too primitive and uncrowded for the Asteriinae. The genus is in fact very isolated. The weak but complete skeleton, in conjunction with the primitive ambulacrals, suggests the Pedicellasterinae. All known species in this subfamily have five or six rays and lack an adoral carina, the first pair of adam-

bulacrals behind mouth plates being at least partly separated. But no species with numerous crowded rays can very well be constructed on the plan of the asteriid actinostomial skeleton and at the same time dispense with a strong adoral carina such as *Plazaster* possesses.

Plazaster has a stout pillar of plates extending from the odontophore to the dorsal wall, and involved in the partly membranous interbrachial septum. Such a buttress might seem to be an adaptation required by the broader disk. *Psalidaster* and *Labidiaster* have such a buttress, although *Rathbunaster* with a smaller disk and deciduous rays has not. The ordinary small Pedicellasterinae do not need a buttress to support the disk. The dorsoventral pillar is characteristic of the Coscinasteriinae also, without relation to size of disk; but in this group the ambulacrals become increasingly crowded and the carinal and marginal systems of plates are strongly developed, with voluminous stoles of pedicellariae on the spines. Nor is *Plazaster* close to the Pycnopodiinae (*Lysastrosoma*, *Pycnopodia*), which have very compressed ambulacrals like the Asteriinae.

Possibly the best disposition of *Plazaster* is to regard it as a polybrachiate offshoot of the Pedicellasterinae, differing principally in having a long adoral carina.

PLAZASTER, new genus

Rays 22 [1] to 35; skeleton reticulate with very numerous irregular meshes extending to end of rays; plates small, usually with one small acicular spinelet; superomarginals not differentiated or joined in longiseries; inferomarginals small, monacanthid or diplacanthid, alternating with a secondary spineless plate and joined directly to adambulacrals; no rudimentary actinals; adambulacrals diplacanthid or triplacanthid, without spine pedicellariae; integument thin and crossed pedicellariae attached in circles at base of spinlets; crossed pedicellariae with jaw expanded distally bearing two enlarged lateral teeth; shank teeth numerous, small, in several longiseries; gonads two to a ray, opening dorsolaterally at about diameter of disk distant from base; a membranous interbrachial septum with strong dorsoventral pillar of plates from odontophore.

Type, *Labidiaster borealis* Uchida.

PLAZASTER BOREALIS (Uchida)

PLATES 66, 68, 69

Labidiaster borealis UCHIDA, 1938, p. 800, fig. 9, pl. 33, figs 1, 2 (young).

Description.—R 180 mm., r 30 mm., R=6r, 35 rays. R 60 mm., r 12 mm., R=5r, 33 rays. The skeleton is an irregular net of very numerous small plates, usually 3-lobed at the nodes, elsewhere irregu-

[1] Specimen with R 30 mm., r 5.5 mm. (Uchida).

larly oblong. On the disk the skeletal intervals are very small—about the size of the primary lobed plates—but on the rays they are more open, especially above the inferomarginals where they are very large. The inferomarginals, which are applied to the outer end of the adambulacral plates, are 3-lobed and not directly imbricated: There is a secondary elliptical ossicle between any two. The inferomarginals proximally often have two acicular spines the length of three adambulacral plates but usually there is one. Applied to upper lobe of inferomarginals is an oblong plate, not different from others above it, which probably represents the superomarginal. But there is no clearly differentiated series of superomarginals or of carinal plates. The latter can not be distinguished from among the numerous abactinal plates.

Most of the abactinal plates carry a slender, sharp spinelet 1 to 1.5 mm. long, surrounded at the base by four or five crossed pedicellariae, 0.35 to 0.45 mm. long, having one prominent tooth on each side of the tip of jaw and very numerous shank teeth in several longiseries. In the aggregate these pedicellariae are very numerous, but thin out on the sides of ray, proximally. The proximal inferomarginal spinelets usually carry basally only one or two small lanceolate straight pedicellariae but beyond middle of ray are equipped with a circlet of crossed pedicellariae. The straight pedicellariae are also scattered over the surface of the body, usually on papular areas, and are one-half to three-fourths the length of spinelets. Papulae numerous but difficult to determine accurately because the specimens have been dried. On the disk each small mesh has one papula.

The adambulacral plates are short, rather broad, and characteristically curved. They carry three slender spines, obviously longer than the inferomarginals and without any attached pedicellariae. However, on the furrow face of the plate, near base of the furrow spine, one or more pedunculate straight pedicellariae of different sizes usually occur. The adambulacral and oral spines are the longest of the body and form a dense cheval-de-frise on either furrow margin. The small mouth plates each carry one prominent suboral and two often flattened actinostomial spines, as well as a variable number of pedunculate lanceolate straight pedicellariae. The adoral carina is composed of the first seven pairs of adambulacral plates; the first five may carry three, two, or occasionally only one spine.

In *Labidiaster* the mouth plates of good-sized specimens become so crowded that the inner or actinostomial angle meets and fuses with that of the opposite side of furrow in such a manner that the radial nerve has to pass through a hole arched over by these fused plates. In *Plazaster* there is no fusion of the mouth plates. For one thing the actinostomial border of the plates is not so expanded as in *Labidiaster*.

The madreporite, 4.5 mm. in diameter, is situated at mid-r.

There are two gonads in each ray. Each consists of a bunch of branched slender lobes attached to the dorsolateral body wall 35 mm. from the base of ray.

A short pillar of plates unites the odontophore with the abactinal skeleton as an obvious support. From and including this pillar a membranous septum passes interradially to the margin of disk, where it again becomes fortified by a short septum of plates proceeding inward from the margin. These plates are continuous with the skeleton of side of ray, the lowermost elements of the septum being marginal plates.

The ambulacral plates are not particularly thin or compressed, and the ambulacral pores form a straight, not zigzag, series. The tube-feet, arranged in two series, are apparently fairly large and crowded in the narrow ambulacral grove. The ampullae are simple, not bilobed.

Type locality.—Mutsu Bay, northern Honshu, Japan.

Specimen described, Hokkaido, Japan, U.S.N.M. No. E. 5952.

Distribution.—Northern Honshu and Hokkaido, Japan.

NOTE ON THE GENUS PARASTERINA

In the literature on sea stars there have been two quasidistinct genera bearing the name *Patiria.* They started as follows:

1. *Patiria* Gray, 1840, type *P. coccinea* Gray, monotypic. In 1847 Gray enlarged the genus to include *granifera* Gray, *ocellifera* Gray, *obtusa* Gray, and *crassa* Gray.

2. *Patiria* Perrier, 1875. "En adoptant ici le genre *Patiria* de Gray nous changeons notablement les limites et la charactéristique de ce genre." Perrier discarded Gray's type, *coccinea,* and included only *ocellifera* and *crassa,* the last obviously different from *coccinea* and *granifera.* Sladen (1889, p. 384) adopted Perrier's genus, omitting *coccinea* from the list of included species, to which he added a new one, *bellula* from Cape of Good Hope.

Gray's *Patiria* became submerged in the more extensive *Asterina* of Nardo, 1834.

Perrier's *Patiria* was stated to differ from *Asterina* in having the dorsal ossicles convex, nearly circular and touching one another, not imbricated as is ordinarily the case in *Asterina.* Sladen (1889, p. 376) differentiated the two groups as follows:

Abactinal plates not imbricated; covered with spines: *Patiria.*
Abactinal plates imbricated throughout the abactinal area, or only in definite regions: *Asterina, Nepanthia, Disasterina.*

This seemed to be a sound distinction; and, as *Patiria* Perrier was obviously invalidated by *Patiria* Gray, I renamed Perrier's group *Parasterina,* type *Patiria crassa* Gray (Fisher, 1908, p. 90).

In 1913 Verrill subdivided *Asterina* and resuscitated *Patiria* Gray for the common Pacific coast *Asterina miniata* (Brandt). Mortensen (1933, p. 257) has ascertained that Gray's *Patiria coccinea* is actually this *P. miniata* (Brandt) and has published a photograph of one of the types. Even if the type should prove to be a specimen of the Japanese *P. pectinifera* it will make no difference, as the two species are closely related.

I recently examined specimens of *Patiria granifera* Gray and *P. bellula* Sladen from the Cape region, South Africa (pl. 70, fig. 1). Both belong to Gray's *Patiria* (not to *Parasterina*) and are probably two formae of the same species. *Callopatiria* Verrill, 1913, type *Patiria bellula* Sladen, is a synonym of *Patiria* Gray.

Now I have discovered that the alleged distinctive character of *Parasterina* does not exist in the type species! Through the kindness of Dr. H. L. Clark I have been able to study a specimen of *Patiria crassa* from near Fremantle, Western Australia. This specimen has R 45 mm., r 10 mm., br 11–12 mm., and the abactinal aspect resembles superficially that of *Nardoa variolata*, as the convex primary plates are spaced and the spinelets extremely fine, close-set, and visible only under strong magnification. The species is quite unlike a true *Patiria* but resembles *Nepanthia*. In fact the actinal surface does not differ from that of *Nepanthia* (e. g., *N. belcheri*) in any important particular. The actinal plates are covered with coordinated groups of very numerous spinelets. There are 15–18 similar subambulacral spinelets, and 8 or 9 furrow spinelets. The inner longiseries of actinal plates extends to three or four inferomarginals short of the end of ray; the next two series nearly as far; the fourth series about three-fifths length of ray measured on side; while a fifth and a sixth series constitute a small additional chevron in the interbrachial angle.

The two series of marginal plates are quite regular, and correspond, plate to plate; they are obviously larger than the adjacent abactinals and actinals, which are small.

There are two differentiated areas on the abactinal surface: (1) A lateral triangular area reaching at interradius, one-half r toward center of disk and distally nearly half length of ray; from this point it extends usually as a double series of plates nearly to tip of ray. The plates of this area, in regular longiseries, strongly imbricate, and the upper margin is excavated to accommodate a papula (fig. 21). Around this papular opening are two to four small superficial plates. Nearly all the plates carry a spiniform pedicellaria. (2) The other area, that of the convex primary plates, comprises the central part of disk and rays. It broadens distally to include most of the sides of ray also (pl. 70, fig. 2). The roundish and irregular, convex, almost tuber-

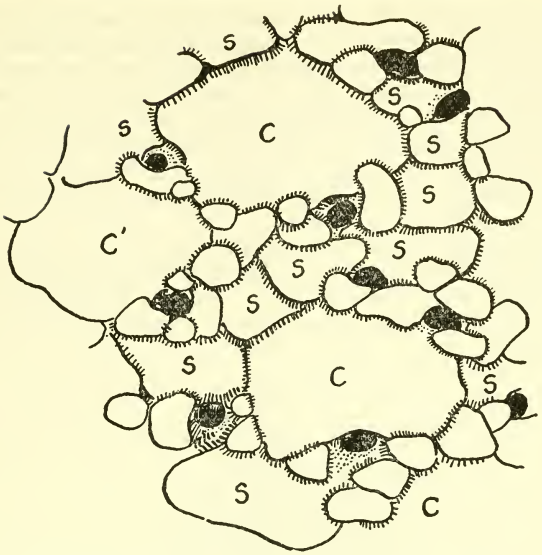

FIGURE 20.—*Nepanthia crassa* (Gray): Abactinal plates near base of ray, × 20. *C*, carinals; *S*, secondary plates; tertiaries not lettered. Black areas are papular pores. Hatching indicates border of plate overlapped by adjacent plate. When hatching is on both sides of boundary line there is no overlapping.

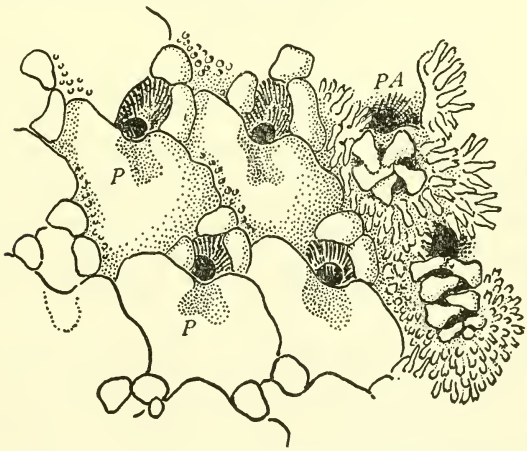

FIGURE 21.—*Nepanthia crassa*, × 20: Six lateral plates of the third and fourth series above superomarginals near base of ray, to show pedicellariae (right). Four plates are denuded to show their shape and the pedicellaria pits (*P*, *P*). *PA*, papular pore.

cular primary plates for a short distance at base of ray imbricate irregularly but over rest of area are joined by smaller and lower secondary plates. These are irregular in shape and imbricate irregularly. Sometimes the end of these plates extend under the large primaries, sometimes they slightly overlap their edges—in short, imbricate. A multitude of small superficial tertiary plates of variable size fortify the joints of the primaries and secondaries and help define the papular pores. These are the same as the superficial platelets of lateral area (fig. 20).

The exposed surface of the plates is covered by a multitude of very small spinelets with microscopically thorny tips (length 0.22–0.28 mm.) of nearly uniform thickness (0.04–0.05 mm.) on the secondary and tertiary plates, but more robust (0.08–0.12 mm.) on the center of the primaries.

FIGURE 22.—*Nepanthia variabilis* Clark, × 40: A plate from lateral area near base of ray to show pedicellaria. *PA*, papular pore.

The pedicellariae (fig. 21) of the lateral abactinal plates are rather remarkable. There is a conspicuous pit usually near or at the upper excavate margin of plate. Extending over this are five to eight minutely thorny, sharp spinelets tapering from a rather broad base and conspicuously larger than the other spinelets of plate. They form a U-shaped series or sometimes a circle and resemble the circular spiniform pedicellariae of the Benthopectinidae. The pits probably contain a sense organ.

I find precisely similar pedicellariae in *Nepanthia variabilis* Clark (1938, p. 176, pl. 10, figs. 4, 5, pl. 20, figs. 4, 5) from Broome, Western Australia. Nearly every plate of the lateral areas is provided with one, and a scattering of the larger crescentic plates of the abactinal area, are similarly armed (fig. 22).

The adambulacral, actinal, and the lateral abactinal plates of *Parasterina crassa* are in no way different from those of *Nepanthia.* This leaves only the enlarged plates of the median abactinal area with the numerous intervening secondary plates and superficial tertiary plates upon which to base a new genus. But *Parasterina occidentalis* Clark (1938, p. 180, pl. 21, fig. 5) has no secondary abactinals. It is questionable, therefore, whether we can place too much reliance for generic characters upon these median abactinal plates. The behavior of the abactinal plates of *Nardoa* furnishes reason for caution. In *N. pauciforis* the plates are numerous, small, and most nearly uniform in size. Somewhat larger and progressively more diverse as to size are those of *N. mollis, N. tuberculata,* and *N. novaecaledoniae,* while in *N. tumulosa* and *N. frianti* the large primary plates are hemispherical and the secondaries small and much more numerous (Fisher, 1919, pls. 108–110). The possibility must be considered that in *Nepanthia* species exist with overdeveloped primary abactinal plates. They are not a rare occurrence in the Asteroidea, and in certain species of the Asteriidae (e. g. *Leptasterias polaris, Pisaster ochraceus*) are of less than specific value. Both *Parasterina crassa* (Gray) and *P. occidentalis* Clark must be regarded with suspicion. I think the former is an aberrant *Nepanthia,* and that *Parasterina* should consequently be discarded.

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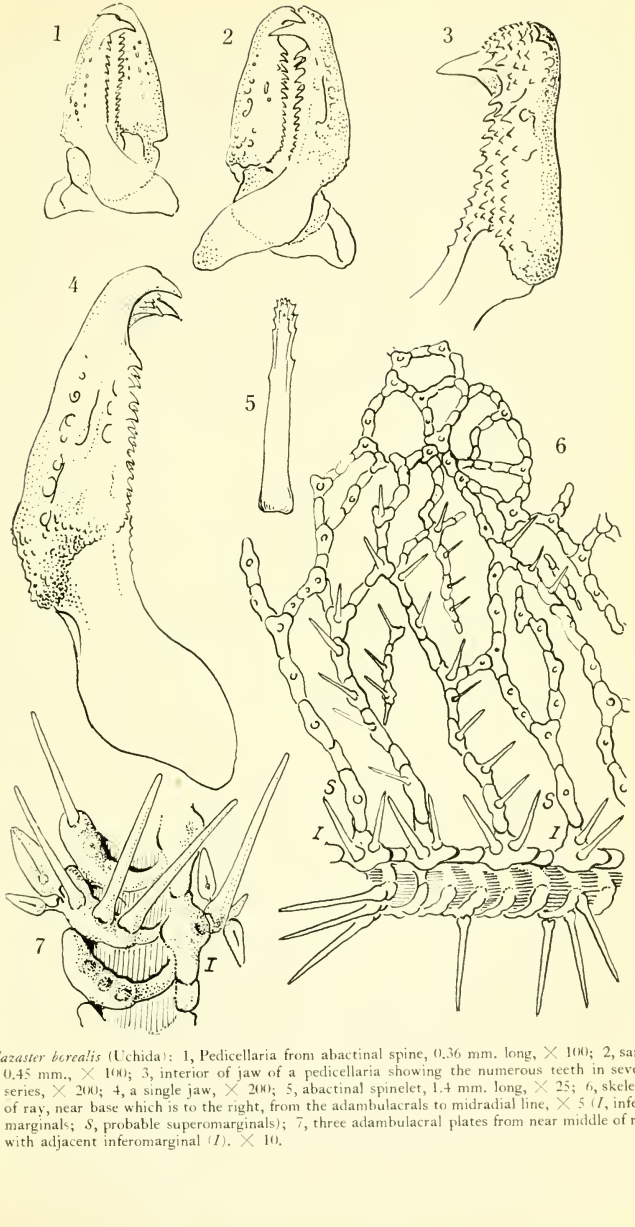
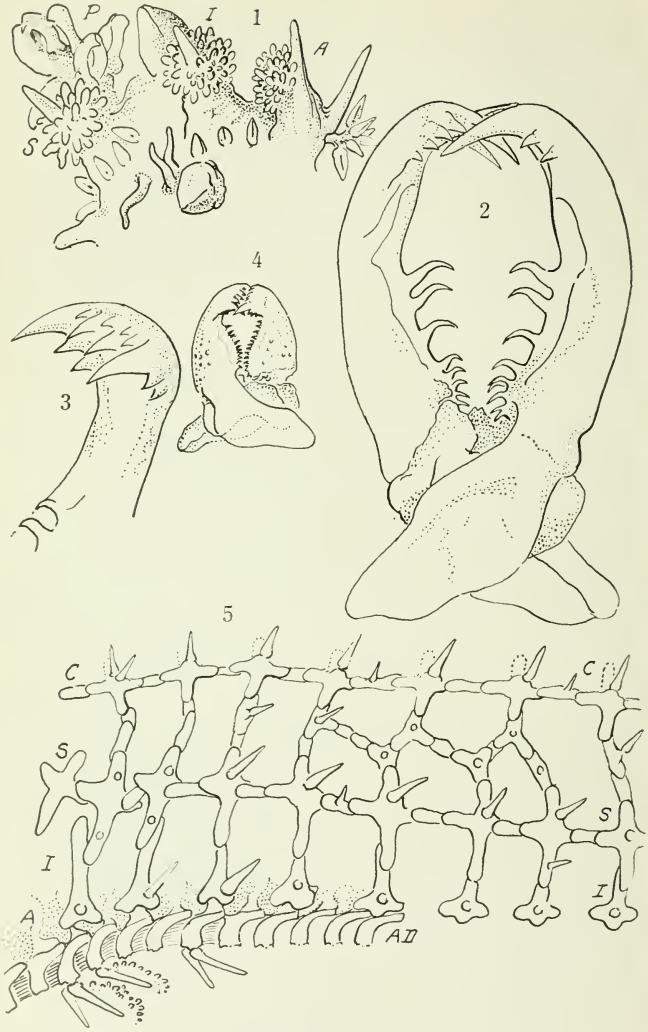
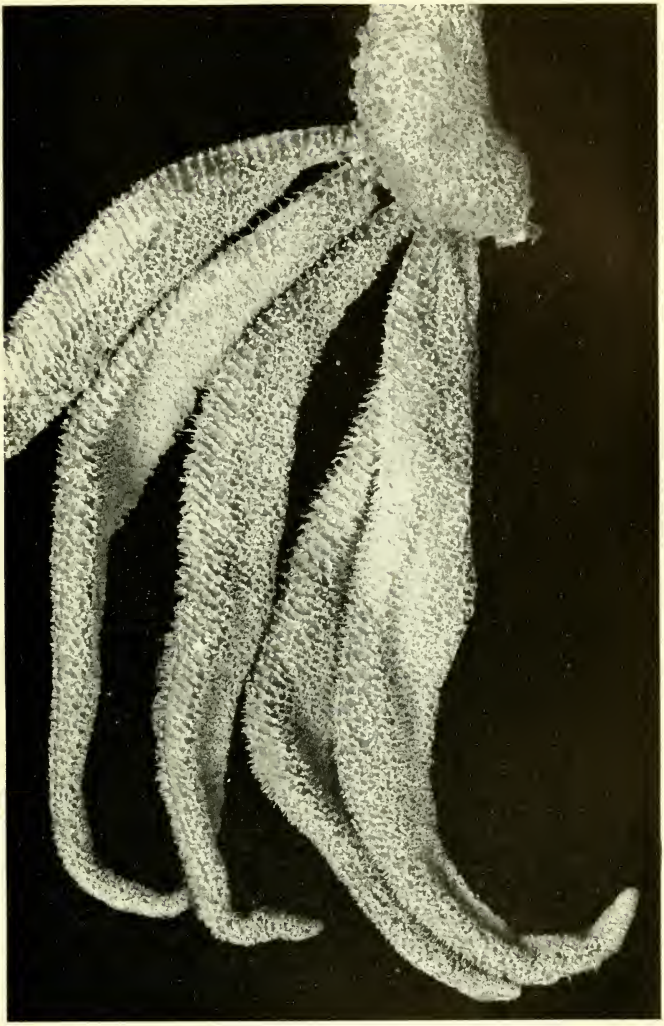


Plazaster borealis (Uchida): 1, Pedicellaria from abactinal spine, 0.36 mm. long, × 100; 2, same, 0.45 mm., × 100; 3, interior of jaw of a pedicellaria showing the numerous teeth in several series, × 200; 4, a single jaw, × 200; 5, abactinal spinelet, 1.4 mm. long, × 25; 6, skeleton of ray, near base which is to the right, from the adambulacrals to midradial line, × 5 (*I*, inferomarginals; *S*, probable superomarginals); 7, three adambulacral plates from near middle of ray, with adjacent inferomarginal (*I*). × 10.

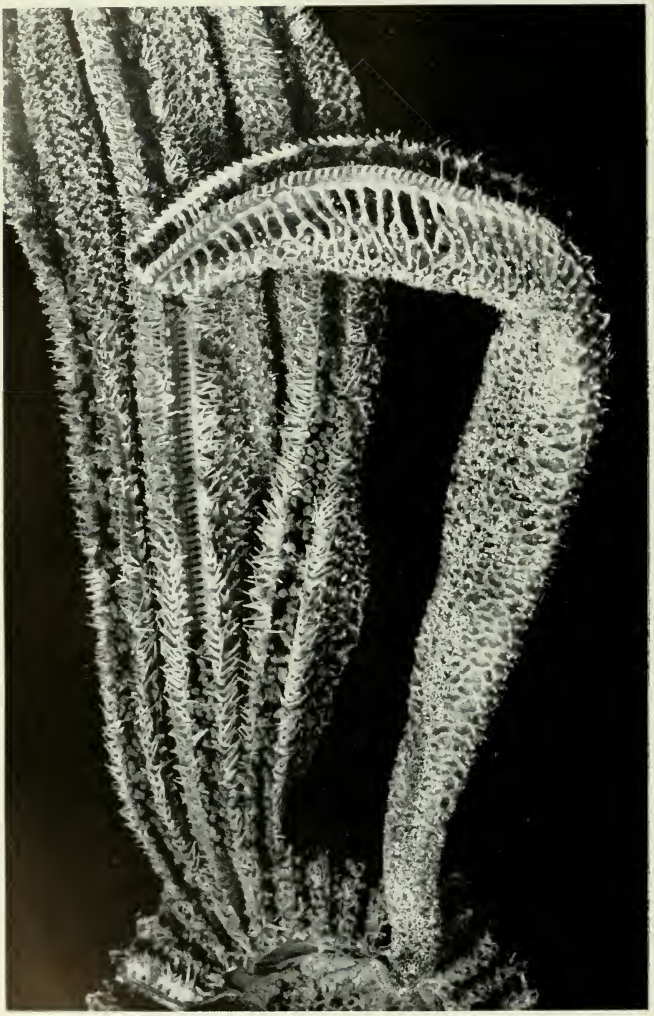


1–4, *Labidiaster annulatus* Sladen: 1, Adambulacral and marginal plates, proximal third of ray, × 5 (*A*, outer adambulacral spine carrying pedicellariae shown in fig. 4; *I*, inferomarginal spine; *P*, giant pedicellariae; *S*, superomarginal spine); 2, 3, one of the numerous giant pedicellariae from the annular pads of tissue, two views, 1.7 mm. long, × 50; 4, a pedicellaria from outer of the two adambulacral spines, 0.27 mm. long, × 100.

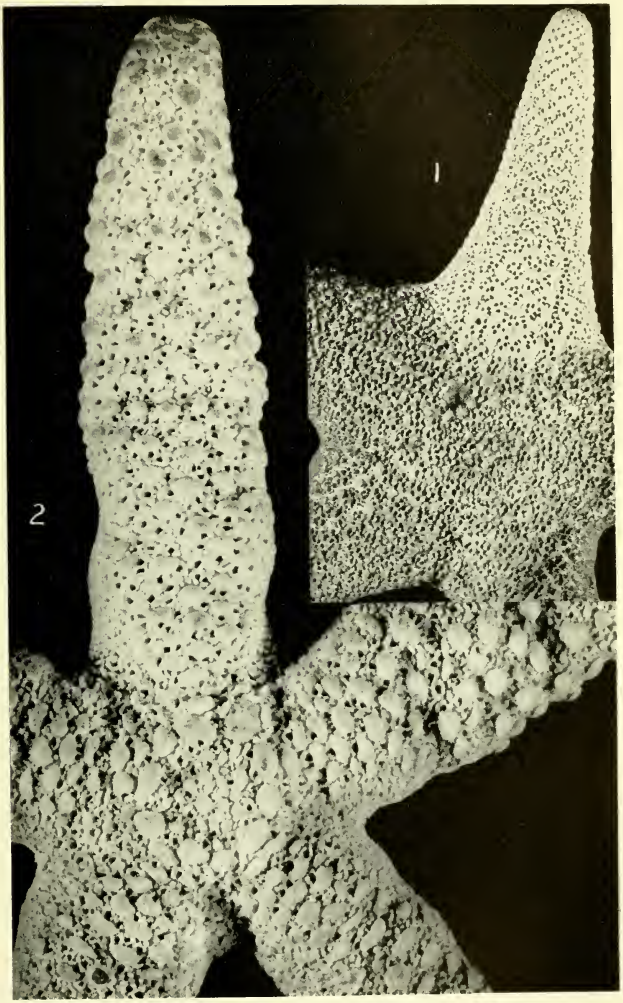
5, *L. radiosus* Lütken: Plan of skeleton of ray, the base to left, × 5 (*A*, outer end of ambulacral plates, dotted; *AD*, adambulacral plates; *C*, carinals; *I*, inferomarginals; *S*, superomarginals).



Plazaster borealis (Uchida): Abactinal and lateral surfaces of five rays and about half of disk. Natural size.



Plazaster borealis (Uchida); Actinal surface of three rays and part of disk. A detached ray to show skeleton, slightly enlarged.



1, *Patiria granifera* Gray, from Simonstown, False Bay, South Africa. The abactinal skeleton of one ray has been cleaned to demonstrate the secondary plates characteristic of *Patiria*.
2, *Nepanthia crassa* (Gray), × 2¾. The spinelets have been removed from the plates of one ray to show secondary and tertiary plates.

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NOTES ON MEXICAN TURTLES OF THE GENUS KINOSTERNON

By Leonhard Stejneger

When changes of nomenclature become necessary it is desirable that the painful operation be performed as soon as possible; hence the preparation of this paper. At the same time the opportunity is taken to publish the description of a hitherto unnamed geographic race of a long-recognized species, the result of a study of the genus *Kinosternon* Spix still in progress.

KINOSTERNON ACUTUM Gray

1831. *Kinosternon scorpioides α acuta* Gray, Synopsis reptilium, p. 34 (pl. 7, fig. 1) (no locality; type in British Museum); Cat. Tort. Brit. Mus., 1844, p. 33 (Central America); Cat. Shield Rept. Brit. Mus., pt. 1, March 8, 1856, p. 44 (Central America); Hand-list Shield Rept. Brit. Mus., 1873, p. 61 (Central America).

1865. *Cinosternum berendtianum* Cope, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 189 (type locality, Tabasco, Mexico; cotypes, U.S.N.M. No. 6517; C. H. Berendt, collector).

1869. *Swanka maculata* Gray, Proc. Zool. Soc. London, 1869, p. 162 (type locality, Cosamaloapam, Veracruz, Mexico; cotype in British Museum; Mr. Sallé, collector) (in part).

1873. *Cinosternon effeldtii* Peters, Monatsb. Berlin Akad. Wiss., 1873, p. 603, pl. 5, figs. 1–3 (type locality, "angeblich" Mexico, Veracruz; type in Berlin Mus.).

1885. *Cinosternum leucostomum* Günther, Biol. Centr.-Amer., Rept., p. 17 (part) pl. 16 (Cosamaloapam, Veracruz, Mexico; Guatemala) (not of Duméril).

In 1831 J. E. Gray listed a *Kinosternon* specimen in the British Museum under the varietal name *acuta*, giving as a character "Sterno postico acuto integro," without mentioning any locality. In the

catalogue of 1844 he added that the specimen is from C[entral] America, that it is a dry preparation, and the "shell wants dorsal plates" [laminae]. In the Catalogue of Shield Reptiles (1856) he listed the same specimen as No. *c* under *Kinosternon scorpioides* "Var. 1. Hinder part of sternum entire." In the Handlist (1873) he finally gave the additional information that the shell is "elongate, 3⅞ inches" [98.5 mm.]. These are all the details that have been published with regard to this specimen, which together with its name seems to have been completely overlooked by all subsequent students of the genus, even by Boulenger in his Catalogue of the Chelonians in the British Museum (1889). Not finding in the latter any indication as to whether Gray's type was still in existence, I wrote to Dr. H. W. Parker asking him if it might not be one of the unspecified specimens listed under *scorpioides* or *leucostomum*. Before the month was out I had his kind answer to the effect that he had located the specimen and that it is the one listed by Boulenger (Cat. Chelonians, p. 44) as specimen *e*. ♂, stffd. C. America, under *Cinosternum berendtianum*. The detailed measurements of it, which he communicated at the same time, agree closely with those of Cope's three cotypes proving that Boulenger's reference of it to this species was fully justified.

The critical measurements of the plastron of the type furnished by Dr. Parker are as follows: Length of plastron 91.2 mm., anterior lobe 27.5 mm., middle section 26.7 mm., posterior lobe 37.0 mm., gular 15.5 mm. The corresponding measurements of the largest male cotype of *K. berendtianum* (U.S.N.M. No. 106294) are as follows: 89, 28, 27, 34, and 17 mm.

"With regard to the locality of *acuta*," Dr. Parker writes, "there is a MS. addition in one of our copies of Gray's catalogue saying 'Honduras.' What authority there is for this I do not know." As Siebenrock lists a specimen from Lake Petén, Guatemala, the locality "Honduras" is probably correct.

Unwelcome as the change of name is, there can be no doubt as to the correctness of Boulenger's identification, and according to the International Code of Nomenclature the species will have to stand as *Kinosternon acutum*.

KINOSTERNON CRUENTATUM CONSORS, new subspecies

Diagnosis.—Three strong dorsal keels, rather close together; central laminae of carapace narrow; plastron filling opening of shell completely; posterior hinge of plastron straight; no emargination of posterior edge of plastron; similar to *K. cruentatum* Duméril, but shell averaging narrower and lower; front lobe of plastron averaging shorter and "midlobe" (the fixed part) longer.

Holotype.—U.S.N.M. No. 13912; ♂ adult; Cozumel Island, Yucatan, Mexico; collected by U.S.F.C.S. *Albatross* Expedition, 1885.

Paratypes.—U.S.N.M. Nos. 13910 ♀, 13911 ♀, 13913 ♀, same data as holotype; U.S.N.M. No. 6556 ♂, Yucatan, Progreso, A. Schott, collector; Philadelphia Acad. No. 94, Yucatan, A. Schott, collector.

Dimensions of holotype.—Length of carapace, 104 mm., width 68 mm.; length of plastron 97 mm.

Remarks.—Two species of the genus *Kinosternon* occur in Yucatan, viz, the present representative of *K. cruentatum* and the other *K. creaseri* described a few years ago by Dr. Norman Hartweg (Occas. Pap. Mus. Zool. Univ. Michigan, No. 277, Jan. 2, 1934, p. 1) from specimens collected at Chichen Itza. Unfortunately he does not describe the dorsal keels and the width of the central laminae, but as he compares his specimens with *K. berendtianum* and as I have before me two specimens also from Chichen Itza, with broad central laminae, I have no reason to doubt that they belong to *K. creaseri* and that consequently two species are represented in the state of Yucatan.

Only six specimens, three males and three females, are available for the evaluation of this form, but they display such unusual uniformity that there is little doubt as to the justification of its nomenclatorial recognition. Moreover, the two specimens from the north coast of Yucatan agree so well with the Cozumel Island specimens that the latter can have no claim to be regarded as a purely insular race. The relationship to *K. cruentatum* is unmistakable, and while the differences separating them are of significant magnitude, there is enough overlap to make the application of a trinominal advisable.

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A REVISION OF THE CHALCID-FLIES OF THE GENUS MONODONTOMERUS IN THE UNITED STATES NATIONAL MUSEUM

By A. B. Gahan

The chalid genus *Monodontomerus* Westwood is recorded from all the faunal regions except the Ethiopian and Australian. Representatives of the genus are in the United States National Museum from France, Germany, Russia, China, Japan, Mexico, Cuba, the United States, and Canada.

Only those species of which actual specimens are at hand have been included in this revision, since it is impracticable to place the others by their descriptions. The species thus omitted from the key are *nitidus* Newport, *punctatus* Thomson, *rugulosus* Thomson, *strobili* Mayr, *usticensis* Riggio and Destefani, *virens* Thomson, *laricis* Mayr, *argentinus* Brethes, *cupreus* (Spinola), *inclusus* Kieffer and Jorgenson, *phormio* Walker, *schrottkyi* Brethes, *trichiophthalmus* (Cameron), *vianai* Blanchard, and *nubecula* Rondani.

GENERIC CHARACTERS OF MONODONTOMERUS

The following combination of characters will distinguish *Monodontomerus* from all other genera placed in the subfamily Monodontomerinae: Antennae 13-jointed (scape, pedicel, one ring joint, seven funicular joints, and three club joints); flagellum cylindrical, not or only slightly thickened toward apex; occiput margined; scutellum with a distinct transverse furrow; postscutellum usually with a median carina; propodeum with a triangular or subtriangular depression

medially, the depression broadest anteriorly, bisected by a median longitudinal carina, the two sections of the depression more or less foveolated; posterior coxa large, with a more or less prominent protuberance near apex on the inner dorsal margin; posterior femur rather broad, with a single tooth on ventral margin beyond the middle; posterior tibia with two moderately long, unequal spurs located at the apex; fore wing extending beyond apex of abdomen; marginal vein usually about half as long as submarginal; postmarginal vein shorter than marginal; stigmal vein at least a little shorter than postmarginal; abdomen sessile, never strongly compressed or depressed, and approximately as long as head and thorax; posterior margins of tergites (except sometimes the third tergite) not emarginate; ovipositor always prominently exserted.

KEY TO THE SPECIES OF MONODONTOMERUS IN THE UNITED STATES NATIONAL MUSEUM

1. Scutellum, behind cross furrow, smooth and polished except for a few weak lines laterally 12
   Scutellum, behind cross furrow, distinctly sculptured, sculpture usually weaker medially than laterally and occasionally with a median area quite smooth 2
2. Malar furrow absent or impressed for only a very short distance adjacent to eye margin; face convexly swollen below antennae 11
   Malar furrow present and complete; face flat or nearly so, at least not markedly swollen 3
3. Ovipositor obviously shorter than abdomen 4
   Ovipositor at least very nearly as long as abdomen, usually as long as abdomen or longer 9
4. First tergite with very shallow but rather distinct reticulation over its dorsal surface ..... 1. **dianthidii**, new species
   First tergite dorsally without sculpture 5
5. Fore wing without a stigmal cloud; propodeum basally on each side of median carina with a broadly rounded and rather deep depression behind which is a less well defined and much smaller depression; funicle joints, except first, broader than long; ovipositor about half as long as abdomen ..... 2. **aereus** Walker
   Fore wing with a distinct cloud at stigmal vein; propodeum with median depression elongate and narrower; funicle joints rarely broader than long; ovipositor usually but not always more than half as long as abdomen 6
6. Middle and fore legs, except their coxae, entirely reddish yellow; ovipositor less than half as long as abdomen ..... **cubensis**, new species
   Middle and fore femora always metallic or black; ovipositor about two-thirds as long as abdomen 7
7. Scape metallic green; posterior tibia, except at base and apex, metallic green and middle and anterior tibiae more or less tinged with metallic ..... 4. **viridiscapus**, new species
   Scape testaceous, sometimes washed with metallic toward apex; all tibiae reddish testaceous 8

8. Dorsum of thorax uniformly coppery green ..... 5. **mexicanus**, new species
   Dorsum of thorax dark green with only a very slight brassy tint ..... 6. **indiscretus**, new species
9. Propodeum laterad of median depression very weakly sculptured, practically smooth; fore wing with a distinct stigmal cloud; eyes conspicuously pilose ..... 7. **obscurus** Westwood
   Propodeum laterad of median depression distinctly sculptured; stigmal cloud very faint or absent; eyes with very short, sparse, inconspicuous pile 10
10. Mandibles tridentate, ventral tooth not or only slightly extending beyond apex of middle tooth, and inner tooth only slightly basad of other two; all three teeth short ..... 8. **montivagus** Ashmead
    Mandibles bidentate, ventral tooth elongate and acute, inner tooth small and located far basad of apex of ventral one ..... 9. **mandibularis**, new species
11. Posterior margin of third tergite not emarginate; malar space equal to more than half height of eye; ocellocular line equal to nearly twice diameter of a lateral ocellus; pronotum and prescutum with strong purplish reflections ..... 10. **bakeri**, new species
    Posterior margin of third tergite deeply triangularly emarginate at middle; malar space less than half as long as eye; ocellocular line only slightly longer than diameter of a lateral ocellus; pronotum very slightly tinged with purplish, prescutum without purple reflections ..... 11. **emarginatus**, new species
12. Tooth on posterior femur about its own length before apex of femur; punctate groove setting off marginal frenum on scutellum continued uninterruptedly around apex of scutellum; median depression on propodeum sharply triangular 13
    Tooth on posterior femur at least twice its own length before apex of femur; punctate groove setting off marginal frenum more or less interrupted at apex of scutellum; median depression on propodeum sometimes about as broad posteriorly as anteriorly 14
13. First tergite dorsally distinctly reticulately sculptured on apical half; ovipositor half to two-thirds as long as abdomen; mesoscutum blackish, scutellum dark green; scape of female usually metallic green; scape and face of male metallic green ..... 12. **dentipes** (Dalman)
    First tergite not sculptured dorsally; ovipositor not over half as long as abdomen; mesoscutum and frequently scutellum strongly purplish or violaceous; scape of female testaceous, sometimes slightly metallic toward apex; scape and face of male brassy green ..... 13. **japonicus** Ashmead
14. Median depression on propodeum acute posteriorly or at least subacute; sculpture on propodeum laterad of the median depression consisting of obliquely transverse rugae; tooth on posterior femur slender ..... 14. **subobsoletus**, new species
    Median depression on propodeum about as broad posteriorly as anteriorly; sculpture laterad of median depression more reticulate; tooth on posterior femur broader at base and somewhat less slender ..... 15. **obsoletus** (Fabricius)

1. MONODONTOMERUS DIANTHIDII, new species

May be distinguished, from all other species having the apex of scutellum sculptured, by the distinct though very shallow sculpturing of the dorsum of the first tergite.

Female.—Length 3.25 mm.; ovipositor 1 mm. General color aenescent blackish; head dark metallic green, the face tinged with cupreous; antennal scape mostly testaceous but darker and more or less tinged with metallic toward apex; flagellum brownish black; propodeum tinged with greenish; all coxae and femora dark brownish with metallic reflections; all tibiae and tarsi testaceous; wings hyaline with only very faint indication of infuscation at stigmal vein; abdomen bronzy black; ovipositor sheaths black with a paler stripe on ventral margin extending from base to near apical one-fourth.

Head uniformly shagreened, temples nearly transverse to the longitudinal axis of body; eyes with very sparse, short pile; ocellocular line about equal to diameter of ocellus; malar space equal to approximately one-third the eye height; malar groove complete and distinct; face nearly flat; clypeus protruding very slightly beyond anterior margin of head; mandibles with the two ventral teeth short and subequal. Antennae inserted above lower extremities of eyes; scape not reaching to anterior ocellus; pedicel barely longer than broad; ring joint strongly transverse; first funicular joint about as long as broad, following joints of funicle all a little broader than long; club not thicker than funicle and about as long as two preceding joints combined.

Thorax approximately twice as long as broad, rugulosely sculptured on the dorsum, without obvious pits or punctures, the rugulae forming irregularly shaped areas; scutellum longer than broad, distinctly sculptured behind as well as before the transverse furrow and with the punctate marginal groove continuous around apex; apex of scutellum more strongly produced over postscutellum than usual; postscutellum smooth, with a delicate median carina; median depression on propodeum triangular, the surface between this depression and spiracular groove distinctly reticulately sculptured. Tooth on posterior femur not slender, located at approximately the apical one-fifth of femur. Anterior wing extending nearly to apex of ovipositor; submarginal, marginal, postmarginal, and stigmal veins in approximately the proportions of 25, 10, 9, and 4, respectively.

Abdomen about as long as thorax, slightly compressed, reticulately sculptured; first tergite dorsally about as distinctly aciculately sculptured as the other tergites and comprising a little more than one-third length of abdomen; second tergite about one-fourth as long as first; third nearly twice as long as second; fourth shorter than third but longer than second; fifth and sixth very short, the sixth with the spiracles sunk in unusually deep pits and bare except for four or five

erect hairs just dorsad of each spiracle; posterior margin of none of the tergites emarginate medially; ovipositor not so long as abdomen.

Male.—Length 2.6 mm. Scape not swollen, slightly curved, and wholly metallic; ocellocular line a little shorter than diameter of ocellus; malar space about one-fourth length of eye; eyes rather distinctly pilose; abdomen not quite so long as thorax, not compressed; first tergite comprising a little more than one-third length of abdomen; second and third subequal and together a little shorter than first; fourth and fifth subequal and each about as long as third; sixth shorter, nearly perpendicular, and with the spiracles in shallow depressions. Otherwise like the female.

Type locality.—Boulevard, Calif.

Type.—U.S.N.M. No. 54260,

Described from 3 females (1 holotype) and 10 males reared by L. H. Weld, March 2, 1922, from a cell of *Dianthidium* on oak.

2. MONODONTOMERUS AEREUS Walker

Monodontomerus aereus Walker, Ent. Mag., vol. 2, p. 158, 1834.

Monodontomerus aereus is rather easily recognized because of its unusually short ovipositor, this rarely being more than half as long as the abdomen. The antennae are a little shorter and thicker than usual, with all funicle joints, except the first, distinctly broader than long, the flagellum black, the scape usually more or less testaceous basally beneath. The eyes are inconspicuously pilose, the pile very short. The scutellum is about as broad as long, its apex behind the cross furrow uniformly strongly sculptured with longitudinal rugae, and with the marginal groove uninterrupted medially. The postscutellum is smooth, distinctly broader than long, and has a distinct median carina. The propodeum at base on each side of the median carina has a large, more or less rounded, and rather deep depression and behind this a much smaller one, the surface of propodeum between the median depression and the spiracular sulcus strongly sculptured. The fore wings extend beyond the apex of the abdomen nearly to the apex of the ovipositor and are hyaline and without a fuscous cloud at the stigmal vein. The tooth on the hind femur is prominent and rather broad. The abdomen is about as long as the thorax, the first tergite dorsally perfectly smooth and comprising approximately one-third of the length of the abdomen, the following tergites more or less distinctly sculptured. The head and thorax have the usual type of sculpture for the genus and are nearly uniformly greenish black with a brassy tint. The coxae and femora are concolorous with the thorax and the tibiae and tarsi are reddish brown to dark brown. The first tergite is bluish green and the following tergites blackish with a metallic sheen. The length of the body ranges from 2.3 to 3.5 mm.

This species has been recorded from a long list of lepidopterous, hymenopterous, and dipterous hosts and is known to develop as both a primary and a secondary parasite. It was originally described from Europe, where it is widely distributed, and has also been reported from Japan. Voluntarily introduced into America to combat the gipsy and browntail moths, it is said now to be distributed over the entire region infested by these pests. A detailed account of the life history, distribution, and hosts of *aereus* is given by Muesebeck [1] and may be consulted for more complete information.

3. MONODONTOMERUS CUBENSIS, new species

The apex of the scutellum in this species is less strongly sculptured and more shining than in any of the other species placed in the key under the group having it sculptured. In some specimens this sculpture is, in fact, so weak that it may easily be overlooked unless a fairly high magnification is used. The shorter ovipositor, together with the bright testaceous color of the anterior and middle legs, exclusive of their coxae, distinguishes the species from *mexicanus*, which it most closely resembles.

Female.—Length 3.3 mm.; ovipositor 0.8 mm. Head and dorsum of thorax nearly uniformly dull brassy green; propodeum, pleura, coxae, and all femora blackish green, less strongly tinged with brassy than the dorsum; anterior and middle legs, except their coxae, posterior trochanters, extreme apices of posterior femora, posterior tibiae and tarsi, and the antennal scape bright testaceous; all tarsi a little paler than tibiae; antennal pedicel brownish testaceous; flagellum black; wings hyaline, with a spot embracing the stigmal vein and extending approximately one-third of the way across the wing very dark fuscous; tegulae fuscotestaceous; abdomen blackish with metallic reflections.

Head uniformly shagreened and rather densely hairy; eyes with sparse, short pile; ocellocular line equal to or very slightly shorter than diameter of a lateral ocellus; temples nearly transverse to longitudinal axis of body; malar space equal to about one-third the eye height; malar furrow complete and strong; anterior margin of face nearly straight, the clypeal margin very slightly protruded. Antennal scape cylindrical, not quite attaining front ocellus; pedicel very nearly as broad as long; ring joint strongly transverse; funicle thicker than pedicel and of the same thickness throughout its length; first funicle joint a little longer than broad, all the others quadrate or nearly so; club ovate, slightly broader than funicle, and a little longer than two preceding joints combined. Mandible with three very short, subequal teeth.

[1] Journ. Agr. Res., vol. 45, No. 5, pp. 445-460, 1931.

Thorax dorsally strongly shagreened and densely clothed with rather long whitish hairs; scutellum about as broad as long, only very slightly overlapping postscutellum, weakly sculptured and shining behind the transverse furrow, the punctate marginal groove complete; postscutellum practically smooth and with only a very weak suggestion of a median carina; mesepisternum strongly sculptured; mesepimeron not entirely smooth; propodeum about half as long as scutellum, with a moderately deep triangular median depression and with the surfaces between this depression and the spiracular sulci strongly rugulose; all coxae strongly sculptured; hind femur reticulately aciculated, not especially broad, the ventral tooth acutely triangular and located approximately at apical one-sixth of femur.

Anterior wing extending a little beyond apex of abdomen; submarginal, marginal, postmarginal, and stigmal veins in approximately the proportions of 30, 13, 6, and 5, respectively; hind wing not quite attaining end of abdomen.

Abdomen moderately compressed, rather finely and evenly reticulately aciculate on sides; first tergite dorsally perfectly smooth and comprising about one-third length of abdomen; second tergite short, sometimes entirely hidden dorsally beneath the first; third and fourth tergites dorsally subequal and together a little longer than first; fifth and sixth tergites subequal on dorsal line and together about equal in length to the fourth, the sixth with numerous suberect hairs laterally and with spiracles in rather shallow pits; ovipositor about one-third as long as abdomen.

Type locality.—Santiago de las Vegas, Cuba.

Type.—U.S.N.M. No. 54261.

Seven females (one, holotype) said to have been reared from *Euproctis argentiflua* Hübner by A. R. Otero, September 27, 1930.

4. MONODONTOMERUS VIRIDISCAPUS, new species

Female.—Length 3.5 mm.; ovipositor 1.25 mm. Agreeing with the description of *mexicanus* except in the following particulars: Head green, with scarcely any brassy tinge; scape entirely green and strongly sculptured; posterior tibia dark brownish with a metallic green tinge, its extreme base narrowly and approximately the apical one-third reddish testaceous; anterior and middle tibiae more or less tinged with metallic; first tergite dorsally distinctly bluish green; ocellocular line obviously a little longer than diameter of lateral ocellus; length of eye about three times length of malar space; anterior margin of face not straight but distinctly a little concave; postscutellum perfectly smooth and polished, with a very weak median carina; second segment of abdomen dorsally very short; third tergite not longer than fourth.

Male.—Length 2.6 mm. Similar to the female but with the first tergite comprising about two-fifths of length of abdomen, the second tergite dorsally completely concealed beneath the first. Antennae mostly missing from the one specimen available.

Type locality.—Orizaba, Mexico.

Type.—U.S.N.M. No. 54262.

Described from 4 females (one holotype) and one male bearing only the label "Orizaba." The collector and date of collection not known.

5. MONODONTOMERUS MEXICANUS, new species

Similar to *montivagus* Ashmead but distinguishable at once by the conspicuous fuscous cloud embracing the stigmal vein, by the proportionally shorter ovipositor, and by the conspicuously hairy eyes.

Female.—Length exclusive of ovipositor 2.75 to 4 mm., ovipositor 0.8 to 1.38 mm. Head dull metallic green, often more or less tinged with brassy; thoracic dorsum dull coppery green; propodeum, pleura, all coxae, and all femora dark green; mesepimera brassy; tibiae and tarsi reddish testaceous; antennal scape testaceous, sometimes washed with metallic green toward apex; pedicel dark metallic; flagellum black; mandibles testaceous; wings hyaline except for a conspicuous fuscous cloud embracing the stigmal vein and extending approximately one-third of the way across the wing; tegulae metallic green; abdomen greenish black; ovipositor sheath black with the extreme apex and a narrow longitudinal stripe extending from base two-thirds of the distance to apex testaceous.

Head nearly uniformly heavily shagreened and rather densely clothed with conspicuous whitish hairs; eyes densely and conspicuously pilose; ocelli in a low triangle; ocellocular line equal to or very slightly exceeding diameter of lateral ocellus; temples nearly transverse; length of eye about three and one-half times length of malar space; malar furrow complete; anterior margin of face nearly straight, the clypeal margin very slightly protruded but straight. Antennal scape subcylindrical, not quite reaching anterior ocellus; pedicel approximately one and one-half times as long as broad; ring joint transverse; funicle thicker than pedicel and of the same thickness throughout; first funicular joint slightly longer than broad, the following joints subquadrate; club not thicker than funicle, conic ovate, and about equal in length to the two preceding funicular joints combined.

Pronotum, mesoscutum, scutellum, and axillae strongly shagreened and conspicuously hairy; scutellum about as broad as long, with a distinct but shallow transverse furrow behind the middle, and carinately margined at apex, the groove setting off the apical carina not interrupted medially; surface of scutellum behind transverse furrow

distinctly sculptured, a little more weakly so medially than laterally; postscutellum distinctly finely sculptured; pleuron, except mesepimeron, strongly punctate; mesepimeron mostly smooth. Propodeum about half as long as scutellum, densely clothed with long white hairs laterad of spiracular sulci, bare medially; spiracular sulci broad and foveated; propodeum medially with a deep, triangular depression divided in the middle by a longitudinal carina, this depression broadest anteriorly, extending from base nearly to apex of propodeum and often more or less weakly foveated; surface of propodeum between median depression and spiracular sulci distinctly reticulated. All coxae and femora strongly sculptured; posterior femur with ventral tooth a little longer and slenderer than usual.

Anterior wing a little more than two and one-half times as long as broad, reaching nearly to apex of ovipositor; submarginal, marginal, postmarginal, and stigmal veins approximately in the proportions of 70, 36, 16, and 10, respectively; basal cell completely outlined by distinct rows of hairs and with several additional hairs within the cell; cilia on disk of wing moderately dense; marginal cilia very short. Posterior wing reaching to apex of abdomen.

Abdomen about as long as thorax, distinctly shagreened on sides and beneath; first segment dorsally perfectly smooth and constituting approximately one-third total length of abdomen; second segment dorsally very faintly transversely aciculated and about one-fifth as long as first; third and fourth segments dorsally distinctly transversely aciculated, the third three or four times as long as the second, the fourth slightly shorter than third; fifth, sixth, and seventh segments short, together about equal in length to the fourth. Ovipositor exserted about two-thirds length of abdomen.

Male.—Length 2.8 mm. Differs from female only in the usual sexual characters and in its smaller size.

Type locality.—Jacala, Hidalgo, Mexico.

Type.—U.S.N.M. No. 54263.

Described from 20 females (1 holotype) and 7 males reared May 25 to 28, 1939, from cocoons of *Tryposylon mexicanum* Saussure collected at Jacala, Hidalgo, Mexico, by Phil Rau and bearing his note numbers 1477 and 1506.

6. MONODONTOMERUS INDISCRETUS, new species

Female.—Length 3.3 mm.; ovipositor 1.1 mm. This species apparently can be distinguished from *mexicanus* only by the fact that the dorsum of the thorax is blackish green with only very slight brassy reflections, the thorax appears to be slightly more slender and a little less conspicuously hairy, and the hind femur is apparently not quite so broad.

All these characters are relative, and were it not for the widely different type localities and the totally different hosts I would hesitate to consider *indiscretus* a different species from *mexicanus*, but believe it advisable to do so under the circumstances.

Type locality.—Bar Harbor, Maine.

Type.—U.S.N.M. No. 54264.

Described from four females received from A. E. Brower. Two of these (one, holotype) are labeled "Pars. of *Phyllotoma nemorata* Fallen, bred June 9, 1936." The other two were bred on the same date from birch leaves containing the same *Phyllotoma*.

7. MONODONTOMERUS OBSCURUS Westwood

Monodontomerus obscurus Westwood, Philos. Mag., ser. 3, vol. 2, p. 443, 1833.
Monodontomerus sp. Rau, Ann. Ent. Soc. Amer., vol. 30, p. 338, 1937.

This species apparently has not previously been recognized from America. In Europe it is variously recorded from hymenopterous, dipterous, and lepidopterous hosts. Among the hymenopterous hosts are at least three species of the genus *Osmia*. O. W. Richards [2] recorded it as a parasite of *Osmia emarginata* Lepiney in the Pyrenees Mountains, and Maréchal [3] reared numerous specimens from nests of *O. cornuta* (Latreille) and *O. rufa* (Linnaeus) collected at Liége, Belgium.

Three specimens of a *Monodontomerus* said to have emerged from a cocoon of *Osmia lignaria* Say taken at Nesco, Crawford County, Mo., were recently received from Phil Rau of St. Louis. The *Osmia* had utilized an empty mud cell of *Sceliphron cementarium* (Drury) as a pupation chamber. Five other specimens of the same *Monodontomerus* reared from *Osmia cordata* Robertson had previously been sent in by Mr. Rau. These formed the basis for the note on *Monodontomerus* sp. by Rau cited above in synonymy. Other specimens in the United States National Museum indistinguishable from the above are as follows: Two said to have emerged from cells of *O. lignaria* collected at Nyack, N. Y., in 1885, by J. L. Zabriskie; one taken at Mount Pleasant, Iowa, June 7, 1933, by H. E. Jacques; and four collected at Washington, D. C., without further data.

These specimens have been compared with two specimens from Europe identified by F. Ruschka as *Monodontomerus obscurus* and also with Westwood's original description of that species, and they seem to agree so completely that I am convinced they are Westwood's species.

M. obscurus differs from other known species found in America by having the surface of the propodeum lying between the median

[2] Ent. Monthly Mag., vol. 66, p. 91, 1930.
[3] Soc. Ent. France Livre Centenaire, p. 509, 1932.

depression and the spiracular sulci nearly smooth and polished except for some weak reticulation near the spiracles and occasionally some subobsolete lines on the disk. The median depression on the propodeum is unusually shallow and mostly confined to the anterior half of the propodeum, the posterior half of that sclerite having only a very narrow crease or groove on each side of the median carina.

Female.—Length 4.2 mm.; ovipositor 1.8 mm. Head dull bluish green; thorax blackish, tinted more or less strongly with bluish green on posterior margin of pronotum, posterior half of prescutum, scapulae, and scutellum in front of cross furrow; scutellum behind cross furrow black; axillae strongly tinted with coppery; propodeum bluish green; pleura black varied with green on mesepisternum; all coxae and femora blackish, tinted with green; tibiae and tarsi reddish testaceous; antennal scape testaceous, darker toward apex; pedicel brownish; flagellum black; mandibles dark reddish; wings hyaline, with a weak though obvious infuscation around the stigmal vein; tegulae dark brown; abdomen black, the base beneath often more or less testaceous and the first tergite dorsally slightly greenish; ovipositor sheaths black, with a pale stripe beneath extending from base two-thirds of distance to apex.

Head nearly uniformly heavily shagreened and moderately clothed with whitish hairs. Eyes distinctly pilose; ocelli rather large, in a low triangle; ocellocular line equal to longest diameter of a lateral ocellus; malar space equal to approximately one-third height of eye; malar groove present; anterior margin of face nearly straight. Antennal scape subcylindrical, nearly reaching to lower margin of anterior ocellus; pedicel a little less than twice as long as broad; ring joint about two-thirds as broad as long; first funicular joint subequal in length to pedicel but distinctly thicker, a little longer than broad; other joints of funicle subquadrate and no thicker than first; club the same thickness as funicle and about as long as two preceding funicular joints combined.

Thorax strongly shagreened and moderately hairy; parapsidal grooves sharply impressed; scutellum distinctly longer than broad, with a distinct transverse furrow at apical one-third and carinately margined at apex, the groove setting off the apical carina foveolated and not interrupted at middle; surface of scutellum behind cross furrow distinctly reticulated, a little more weakly so medially than laterally; mesepimeron smooth and bare, remainder of pleuron distinctly sculptured and hairy; propodeum hairy laterally, bare medially; spiracular sulci strongly foveated; all coxae and femora distinctly sculptured, the median pair less strongly so than the others; tooth on hind femur short, blunt, and located a little more than one-fifth the length of femur before its apex.

Anterior wing more than two and one-half times as long as broad; submarginal, marginal, postmarginal, and stigmal veins about in the proportions of 57, 27, 13, and 8, respectively; basal cell completely outlined by distinct rows of strong hairs and with a few hairs within the cell; ciliation on disk of wing moderately dense; marginal cilia very dense.

Abdomen about as long as thorax, distinctly sculptured on the sides, the first tergite dorsally smooth and the following tergites dorsally very weakly lineolately sculptured; first tergite constituting a little less than one-third length of abdomen, a little more than twice as long as second; third tergite one and one-half times as long as second; fourth about equal in length to second; fifth a little shorter than fourth; sixth and seventh together about equal to fourth; ovipositor sheaths about as long as abdomen.

Male.—Length 3.2 to 3.9 mm. Similar to the female, except that the scape is dark, the first funicular joint is no longer than broad, the other funicular joints are all slightly broader than long, and the second abdominal tergite is very short, sometimes almost completely covered by the first tergite.

8. MONODONTOMERUS MONTIVAGUS Ashmead

Monodontomerus montivagus Ashmead, Colorado Biol. Assoc. Bull. 1, p. 25, 1890.
Monodontomerus americanus Girault, Descriptiones stellarum novarum, p. 11, 1917. (New synonymy.)

The types of *montivagus* and *americanus* have been compared, and they do not differ in any dependable character. The holotype of *americanus* is a teneral specimen as shown by other specimens collected at the same time and place, and this fact accounts for the slight differences in color mentioned by Girault as distinguishing it from *montivagus*.

Female.—Length 3 to 5.1 mm.; ovipositor 1.6 to 2.8 mm. General color distinctly and nearly uniformly metallic green with brassy reflections of variable intensity on head and thorax; femora metallic green; all tibiae, all tarsi, antennal scape, and mandibles reddish testaceous, the scape sometimes fuscous apically; flagellum black; wings hyaline, usually with a very light infuscation at stigmal vein; abdomen shining dark green; ovipositor blackish with the lower margin more or less pale. Vestiture pale grayish.

Eyes weakly pilose, the pile short and inconspicuous; malar space equal to approximately one-third the length of eye but variable in length; malar groove distinct; anterior margin of head straight; mandibles with three short teeth, the ventral tooth not or very little longer than the middle one; ocellocular line barely longer than diameter of lateral ocellus; antennae inserted a little above lower margins of

eyes, the face distinctly more than half as long as distance from antennal fossae to anterior ocellus; funicular joints quadrate to a little longer than broad; ring joint about twice as broad as long. Thorax appearing a little narrower in proportion to its length than in some of the other species, and with sculpture of mesonotum and scutellum made up of distinct punctures intermingled with very fine reticulations or wrinkles; scutellum behind transverse groove finely aciculated, the aciculation weaker medially, the marginal groove uninterrupted; postscutellum smooth, with a weak median carina; propodeum with median depression rather shallow and triangular; surface of propodeum between median depression and spiracular sulci distinctly aciculately sculptured; mesepimeron polished; mesosternum and mesepisternum with very shallow reticulation, the mesepisternum more strongly sculptured along its posterior margin; posterior coxae strongly sculptured outwardly, anterior and middle coxae less strongly so; posterior femur not much thickened and with tooth on ventral margin not especially long or slender and located at about apical one-fourth of femur; wings extending beyond apex of abdomen; submarginal, marginal, postmarginal, and stigmal veins in approximately the proportions of 40, 16, 8, and 5, respectively; abdomen about as long as head and thorax together; first tergite comprising about one-third length of abdomen, perfectly smooth dorsally; second, third, and fourth tergites dorsally with weak transverse aciculations, smoother toward apex; fifth tergite smooth dorsally; ovipositor sheaths equal to or a little longer than abdomen.

Male.—Length 3.2 to 4.2 mm. Similar to the female except that the antennal scape is much thickened, strongly curved dorsally, and deeply and broadly excavated or notched ventrally; the funicular joints all quadrate or nearly so.

Redescribed from the following specimens: One female (type of *montivagus*), West Cliff, Colo.; one female, Boulder, Colo., collected August 1 at nest of *Anthophora occidentalis* by T. D. A. Cockerell; three females, Boulder, Colo., July 31, 1908, Cockerell collector; one male, Custis County, Colo., Cockerell collector; one male, Colorado Springs, Colo., July 14, 1895, Cockerell No. 3569; one male, on *Populus*, Boulder, Colo., May 8, 1895, Cockerell No. 2945; two females, Santa Fe, N. Mex., July 29, 1895, Cockerell No. 3918; two females, Helena, Mont., July 1892, H. G. Hubbard collector, in galleries of *Melissodes;* four females (one the type of *americanus*) and one male, Los Angeles, Calif., Coquillett collector; two females, Los Angeles, Calif., from cell of *Anthophora*, A. Davidson collector; one female, Beaver Valley, Utah; four females, Algonquin, Ill., C. F. Baker, collector; and one female, Newark, Del., June 6, 1932, L. A. Stearns collector.

The above-mentioned female taken by Cockerell at the nest of *Anthophora occidentalis* at Boulder, Colo., has the apex of the mandibles broadly rounded with only very slight indications of apical teeth. Otherwise it does not differ materially from other specimens of the species and it is believed that the mandibles are simply worn.

9. MONODONTOMERUS MANDIBULARIS, new species

Monodontomerus montivagus RAU (not Ashmead), Trans. Acad. Sci. St. Louis, vol. 24, p. 35, 1922.
Monodontomerus sp. FRISON, Trans. Amer. Ent. Soc., vol. 48, p. 154, 1922.
Monodontomerus sp. RAU, Trans. Acad. Sci. St. Louis, vol. 25, p. 222, 1926.

This species is difficult to distinguish from *montivagus* except by the mandibles, which in *mandibularis* are bidentate with the ventral tooth long and acute, the inner tooth small and located far basad of the apex of the ventral tooth so that its apex is approximately at the basal two-thirds of the mandible. The antennae are inserted only very slightly above a line connecting the lower extremities of the eyes and the distance from the base of the antennae to the anterior margin of the clypeus is only slightly more than half the distance from the lower margin of the antennal fossae to the lower margin of the anterior ocellus. The ocellocular line is distinctly a little longer than the diameter of a lateral ocellus.

The above characters hold for both sexes and are apparently the only ones by which *mandibularis* can be separated from *montivagus*. The size, color, and length of ovipositor are well within the range of variation stated in the foregoing description of *montivagus*. The scapes of the males are alike for the two species.

Type locality.—St. Louis, Mo.

Type.—U.S.N.M. No. 54265.

Described from the following specimens: 4 females (including the holotype) and 4 males (including the allotype), reared by P. Rau; from *Anthophora abrupta* Say, May 13, 1910, at St. Louis, Mo.; 1 female and 3 males, St. Louis, Mo., P. Rau, No. 4181, host and date of collection unknown; 4 females reared from *Anthophora abrupta*, Oakwood, Ill., June 9, 1919, T. H. Frison, Exp. D; 1 female and 1 male, reared from *A. abrupta*, Henry County, Ohio, 1931, W. E. Dunham; 46 females and 10 males, under Bur. Ent. No. 862P[08], reared from *Anthophora abrupta* Say in the vicinity of Washington, D. C., and bearing the respective dates November 17, 1877, May, July, and November 1878; 5 females from Bayou Sara, La., E. A. Schwarz collector, January 23, 1879, also under Bur. Ent. No. 862P[08] (specimens badly broken); 10 females and 1 male reared from *Melitoma taurea* (Say) at Washington, D. C., March 10, 1879, under Bur. Ent. No. 50X; 5 females reared from *Anthophora bomboides* Kirby at Ithaca, N. Y., April 8, 1912, and April 12, 1921, R. C. Shannon; and 1 female from

Algonquin, Ill., collected by C. F. Baker and bearing his note No. 3845.

As will be seen from the cited synonymy, the species has been confused in literature, at least in one instance, with *montivagus*. It is possible that other published records may also refer to this species.

10. MONODONTOMERUS BAKERI, new species

Most closely resembles *emarginatus* but may be distinguished at once by the nonemarginate third tergite as well as by other characters pointed out in the remarks following the description of *emarginatus*. Also resembles *montivagus* but differs by having a longer malar space, by the absence of a malar groove, by the more convex face, by the longer ocellocular line, and in the purplish color of the pronotum and prescutum.

Female.—Length 4.7 mm.; ovipositor 2.4 mm. Head bluish green, tinged with purplish on vertex; thorax bluish green, pronotum and prescutum strongly tinged with purple and with some purplish tints on pleura; coxae concolorous with thorax, with some purplish tints; posterior femora metallic bluish, slightly diluted with testaceous, median and anterior femora brownish testaceous; all tibiae and tarsi testaceous; wings hyaline with a weak infuscation at stigmal vein; antennal scape and pedicel dark brownish tinged with metallic, the extreme base of scape testaceous; flagellum brownish black; mandibles testaceous; abdomen brownish black, with weak metallic and violaceous reflections.

Head appearing rather thick anteroposteriorly, the temples less strongly receding than usual; eyes practically bare; ocellocular line nearly twice as long as diameter of a lateral ocellus; malar space equal to a little more than half height of eye; malar groove entirely absent; face below antennae distinctly swollen, especially convex medially; mandible with the two ventral teeth subequal; clypeus not protruding; antennae inserted a little below a line connecting lower extremities of eyes; scape not quite attaining level of anterior ocellus; pedicel about one and one-half times as long as broad; ring joint large, about twice as broad as long; first funicular joint subquadrate, following joints of funicle all a little broader than long; club not thicker than funicle and a little longer than two preceding joints combined. Integument of head rather strongly and nearly uniformly shagreened but with a smooth area along posterior orbit at lower extremity of eye.

Thorax inclusive of propodeum about twice as long as broad, strongly shagreened, the rugulae on mesoscutum and scutellum intermingled with numerous shallow pits or punctures; scutellum longer than broad, reticulately sculptured behind transverse groove, the punctate marginal groove continuous around apex; postscutellum faintly sculptured and with a delicate carina in middle; propodeum

with median depression triangular, area between this depression and spiracular sulcus strongly sculptured. Tooth on posterior femur short and blunt and located at approximately apical one-fifth of femur. Anterior wing extending well beyond apex of abdomen; submarginal, marginal, postmarginal, and stigmal veins approximately in the proportions of 40, 17, 9, and 6, respectively.

Abdomen a little longer than head and thorax, compressed, weakly reticulated on the sides; first tergite dorsally perfectly smooth, and comprising a little less than one-third length of abdomen, second to fifth tergites dorsally weakly transversely aciculated, the second about half as long as the first, third and fourth each a little longer than the second, fifth about as long as the second, sixth tergite finely reticulately sculptured and clothed with suberect hairs, ovipositor as long as abdomen.

Male unknown.

Type locality.—"Amile Hill," Colo.

Type.—U.S.N.M. No. 54266.

One female collected by C. F. Baker and bearing his field notebook No. 1330. The note under this number states that the specimen was collected in July at Amile Hill in northern Colorado. The locality is presumed to be in the neighborhood of Fort Collins, and the time of collection was probably July 1894.

11. MONODONTOMERUS EMARGINATUS, new species

The deep and broad emargination of the third tergite distinguishes this species at once from all other species in the collection.

Female.—Length 4.2 mm.; ovipositor 2.1 mm. Head bluish green; dorsum of the thorax greenish black; pronotum, propodeum, mesepisternum, and coxae weakly tinged with purple; mesepimeron polished greenish black; all femora metallic bluish; all tibiae and tarsi testaceous; abdomen black, tinged with metallic; antennal scape metallic, flagellum black; wings hyaline with a distinct fuscous cloud at stigmal vein.

Head moderately thick anteroposteriorly; ocellocular line very slightly longer than diameter of lateral ocellus; eyes practically bare; malar space very nearly equal to half length of eye; malar furrow effaced except for a short distance at eye margin; mandibles with the two lower teeth subequal; anterior margin of head straight, clypeal margin not protruding; face slightly swollen, especially prominent just below antennae; antennae inserted on a line connecting lower extremities of eyes; scape not quite attaining level of anterior ocellus, distinctly sculptured; pedicel a little longer than broad; ring joint large, about two-third as long as broad; first joint of funicle quadrate, second to seventh funicular joints all somewhat transverse, the seventh

about twice as broad as long; club 3-jointed, ovate, not broader than funicle and a little longer than two preceding joints combined. Surface of head nearly uniformly shagreened but with a smooth area along posterior orbit at lower extremity of eye.

Thorax about twice as long as broad, sculptured about like the head; scutellum longer than broad, its surface behind transverse furrow nearly smooth medially but distinctly though weakly aciculately sculptured laterally; punctate groove setting off marginal frenum on scutellum not interrupted; postscutellum with a weak median carina; median depression on propodeum triangular, area between median depression and spiracular sulcus distinctly though not strongly reticulated. Tooth on posterior femur short, broad at base, and located at approximately apical one-fifth of femur. Anterior wing extending beyond apex of abdomen; submarginal, marginal, postmarginal, and stigmal veins in approximately the proportions of 35, 16, 8, and 5, respectively.

Abdomen about as long as head and thorax, rather strongly compressed; distinctly reticulated on sides, more weakly sculptured dorsally; first tergite perfectly smooth dorsally, comprising approximately one-third length of abdomen; second dorsally about half as long as first and weakly aciculated; third deeply triangularly emarginate at middle, sculptured about like second; fourth sculptured like second, not emarginate medially, and about as long as second; fifth tergite shorter and practically smooth dorsally; sixth as long as fifth, distinctly sculptured and completely clothed with suberect hairs; ovipositor about as long as abdomen.

Male unknown.

Type locality.—Radium, Colo.

Type.—U.S.N.M. No. 54267.

Described from one female said to have been reared from the nest of a leaf-cutter bee (?*Megachile*) collected in an aspen log in 1922 by E. Bethel.

The type is a slightly broken but apparently normal specimen greatly resembling the new species *bakeri* described in this paper. Besides having the third tergite emarginate, it differs from *bakeri* by having the malar space somewhat shorter, the ocelli less distant from the eye margin, the cloud in the fore wing at the stigma larger and darker, and the dorsum of the thorax not purplish except to a slight extent on the pronotum.

12. MONODONTOMERUS DENTIPES (Dalman)

Torymus dentipes Dalman, Svenska Vet.-Akad. Handl., vol. 41, pp. 173, 178, pl. 7, figs. 23–25, 1820.—Boheman, Svenska Vet.-Akad. Handl., vol. 44, p. 335, 1833.

Monodontomerus dentipes (Dalman) Walker, Ann. Mag. Nat. Hist., vol. 19, p. 227, 1847.

This species differs from others having the apex of the scutellum smooth by having the dorsum of the first tergite distinctly though not strongly sculptured.

Female.—Length 3.5 mm.; ovipositor 1 mm. Head metallic green; eyes and ocelli usually reddish; mandibles testaceous; scape and pedicel usually dark metallic, scape sometimes testaceous on basal half; flagellum black; thorax mostly dark greenish with median lobe of mesoscutum black; coxae and femora dark greenish; tibiae and tarsi reddish testaceous; abdomen black with a faint greenish tint especially on dorsum of first tergite and on apices of following tergites; wings hyaline with a weakly fuscous spot embracing stigmal vein; tegulae metallic. Vestiture on dorsum of thorax brownish, elsewhere apparently paler.

Eyes conspicuously pilose; ocellocular line barely longer than diameter of lateral ocellus; temples nearly transverse to body axis; malar space equal to about one-fourth of eye height, malar furrow complete; mandibles tridentate, teeth short and subequal; face nearly flat, margin of clypeus very slightly protruding beyond anterior margin of face. Antennae inserted distinctly above lower margins of eyes; first funicular joint obviously a little longer than broad, distinctly thicker than pedicel; second to sixth joints of funicle very slightly longer than broad; seventh subquadrate; club not thicker than funicle and about as long as two preceding joints combined; scape not quite attaining anterior ocellus; scutellum about as broad as long, not overlapping postscutellum, perfectly smooth behind transverse furrow, foveolate groove setting off marginal frenum on scutellum uninterrupted medially; postscutellum with a strong median carina; propodeum distinctly sculptured, with a moderately deep and sharply triangular median depression extending from base nearly to apex and bisected by a longitudinal carina; tooth on posterior femur closer to apex of femur than usual and not so slender as in some other species; submarginal, marginal, postmarginal, and stigmal veins in approximately the proportions of 30, 17, 9, and 6, respectively; stigmal vein very little thickened and slightly longer than usual; dorsum of first tergite distinctly though not strongly sculptured on its posterior half; second to fifth tergites a little more strongly sculptured dorsally than usual; ovipositor sheaths about two-thirds as long as abdomen.

Male.—Length 2.75 mm. Similar to the female except in the usual sexual characters.

The identification of this species is based upon two specimens from Germany determined as *dentipes* by an unidentified entomologist, possibly Arnold Förster. Two other European specimens without locality labels, one of which is said to have parasitized *Diprion pini* (Linnaeus), are in the collection; also four specimens collected by

C. R. Kellogg at Foochow, China, in 1928. Besides this Old World material the collection contains several large series, comprising over 300 specimens, mostly reared from *Diprion simile* (Hartig) in Maine, Connecticut, New York, New Jersey, Pennsylvania, Michigan, Ohio, and Ontario, Canada.

Monodontomerus dentipes was originally proposed in the genus *Torymus* by Dalman accompanied by a very short description, which, so far as it goes, fits the present species. Dalman's specimens were subsequently more fully described by Boheman, and the species has most frequently been credited to that author but should be credited to Dalman.

In European literature *Monodontomerus dentipes* has been recorded as parasitizing several different species of sawflies and a number of species of Lepidoptera and in other instances as secondarily parasitic through species of Braconidae, Ichneumonidae, Chalcididae, and Tachinidae. It is probable, however, that not all these records refer to the true *dentipes*. Dalla Torre [4] has listed *dentipes* as identified by Mayr as a synonym of *virens* Thomson, and Hoffmyer [5] has indicated the same synonymy.

In the United States National Museum is one female specimen identified as *dentipes* by Mayr and another identified by Ruschka. These two specimens differ from *dentipes* as here treated by having the groove setting off the marginal carina or frenum on the scutellum distinctly interrupted at the apex of the scutellum, by having the first tergite perfectly smooth and sculptureless, by the tooth on hind femur being distinctly longer, slenderer, and farther from the apex of the femur, and by having the ovipositer very nearly as long as the abdomen. They disagree with the description of *virens* by having a strong median carina on the postscutellum and in having the marginal groove on the scutellum interrupted. A third specimen of what is evidently the same form is in the collection. This was taken in Hungary by C. Sajo and bears the name label *Monodontomerus obsoletus* (Fabricius). It is apparently not *obsoletus*, however, since the median depression on the propodeum is narrower and more acute posteriorly. The funicle joints are all a little longer than broad, the tooth on the posterior femur is longer and more slender, and the general color is slightly more greenish than in that species. It is impossible at the present time to identify this form positively and it is discussed here merely to show the probable confusion existing regarding some of the European species.

[4] Catalogus hymenopterorum, vol. 5, p. 290, 1898.
[5] Ent. Med., vol. 17, p. 258, 1930.

13. MONODONTOMERUS JAPONICUS Ashmead

Monodontomerus japonicus Ashmead, Journ. New York Ent. Soc., vol. 13, p. 83, 1904.

Very similar to *dentipes* and agreeing with the foregoing description of that species except in the following particulars:

Female.—Length 3 to 3.5 mm.; ovipositor 0.8 mm. Dorsum of first tergite perfectly smooth and polished; ovipositor a little less than half as long as abdomen; ocellocular line not longer than diameter of a lateral ocellus. Scape testaceous, sometimes washed with metallic toward apex; pronotum bluish green; mesoscutum and frequently the scutellum purplish; propodeum, pleura, all coxae, and all femora bluish green, the posterior coxae outwardly often tinted with purplish and the middle and anterior femora sometimes blackish with only a faint metallic tinge; tibiae brownish testaceous to very dark brown; tarsi testaceous; dorsum of first tergite bright bluish green, rest of abdomen blackish with a slight bluish tinge.

The male differs from the male of *dentipes* by having the first tergite smooth, the ocellocular line not longer than the diameter of an ocellus, the face brassy green, the mesoscutum purplish, and the posterior tibiae usually somewhat darker.

The type of this species is from Nikko, Japan, collected by Albert Koebele. Two other specimens in the United States National Museum collection are labeled cotypes but these were collected by Koebele in China and were not mentioned by Ashmead in his description. Besides the type material the collection also contains 3 females and 7 males reared February 4 to March 5, 1937, at Nagawa-Mura, Nagano-Ken, Japan, by R. W. Burrill from *Diprion nipponicum* Rohwer.

The species is recorded by K. Iida [6] as a parasite of *Osmia taurus* Smith.

14. MONODONTOMERUS SUBOBSOLETUS, new species

This species is extremely similar to *obsoletus* Fabricius. It differs from the few specimens of *obsoletus* in the collection, however, by having the median depression on the propodeum more distinctly triangular, more nearly acute posteriorly, by having the sculpture laterad of this depression composed of distinct oblique rugae instead of irregular reticulation resembling shallow punctation, by having the tooth on the hind femur somewhat more slender, and by having the propodeum metallic green instead of bluish black and the general color of the thorax more metallic.

Female.—Length 2.75 to 3.4 mm.; ovipositor 0.85 to 1.2 mm. Head metallic green; eyes and ocelli red; mandibles reddish testaceous;

[6] Kansai Ent. Soc. Trans. Japan, No. 3, p. 69, 1932.

scape and pedicel metallic; flagellum black; mesoscutum and scutellum blackish with brassy reflections; pronotum, pleura, all coxae, posterior femora, and propodeum dark green; anterior and median femora brownish black with a greenish metallic lustre; apices of median and anterior femora, all tibiae, and all tarsi reddish testaceous; abdomen, especially on dorsum, black with more or less metallic reflections; ovipositor black; wings hyaline with a weak infuscation at stigmal vein.

Head shagreened; temples nearly transverse to longitudinal axis of body; eyes conspicuously pilose; ocellocular line about equal to diameter of lateral ocellus; malar space a little less than one-third the eye height; malar furrow distinct and complete; face nearly flat; anterior margin of clypeus very slightly protruded beyond anterior margin of head; mandible with three short, subequal teeth. Antennae inserted distinctly above lower extremities of eyes; scape subcylindrical, not reaching anterior ocellus; pedicel a little longer than broad; ring joint about two and one-half times as broad as long; first funicular joint slightly longer than broad and distinctly thicker than pedicel; following joints of funicle subquadrate; club very slightly thicker than funicle and a little longer than two preceding joints combined.

Thorax a little less strongly sculptured than head, the sculpture of dorsum consisting of irregular reticulations without obvious pits or punctures; scutellum about as broad as long, perfectly smooth behind the transverse groove, the punctate marginal groove distinctly interrupted medially; postscutellum not or only slightly overlapped by apex of scutellum, smooth and shining and with a strong median carina; median depression on propodeum rather deep, distinctly triangular, subacute posteriorly; median carina distinctly divided or forked at base; surface of propodeum laterad of median depression with distinct obliquely transverse rugulae which form narrow elongated areae. Posterior femur moderately broad with tooth on ventral margin rather long, very little broader at base than near apex, and located at approximately the apical one-fourth of femur. Anterior wing extending beyond apex of abdomen; submarginal, marginal, postmarginal, and stigmal veins in approximately the proportions of 29, 15, 9, and 5, respectively.

Abdomen about as long as thorax, very slightly compressed, reticulately shagreened on the sides; first and second tergites perfectly smooth dorsally; third and fourth on apical halves and most of fifth also smooth dorsally, the third and fourth weakly reticulated basally; sixth weakly sculptured and with five or six erect hairs dorsad of spiracle. First tergite constituting a little more than one-third length of abdomen; second very short; third and fourth subequal and together a little longer than first; fifth a little over half length of fourth; sixth very short, with the spiracles usually concealed. Posterior margin of none

of the tergites emarginate medially. Ovipositor approximately two-thirds as long as abdomen.

Male.—Length 3.1 mm. First tergite comprising more than one-third length of abdomen; second dorsally completely concealed beneath the first; third and fourth subequal and together about equal to first; fifth and sixth subequal and each more than half as long as fourth; seventh short. Otherwise agreeing with the female except that the anterior and median femora are brownish testaceous above, metallic blackish beneath.

Type locality.—Newark, Del.

Type.—U.S.N.M. No. 54268.

The holotype female and three paratype females were reared from *Malacosoma americana* (Fabricius) at Newark, Del., June 6, 1933, by Donald MacCreary. Four males including the allotype and ten females were sent to me by O. P. Breland with the information that they had been reared by him from cocoons of *Samia cecropia* (Linnaeus) collected in Brooklyn, N. Y., by J. H. Cohen in February 1937 and March 1938. Mr. Breland stated that in each instance the *Monodontomerus* had parasitized *Spilocryptus extrematis* (Cresson) within the *cecropia* cocoons. Two females and one male were reared from *Grapholitha molesta* (Busck) material in 1935 at the Oriental Fruit Moth Laboratory, Moorestown, N. J., under Lab. No. 2335.

15. MONODONTOMERUS OBSOLETUS (Fabricius)

Ichneumon obsoletus Fabricius, Supplementum entomologiae systematicae, p. 230, 1798.

Monodontomerus obsoletus (Fabricius) Spinola, *in* Gay's Historia fisica y politica de Chile . . ., vol. 6, p. 465, 1851.

As interpreted by Mayr and other European authors this species is said to have the median depression on the propodeum broad and not acute posteriorly, the scutellum polished at apex with the marginal groove interrupted medially, the funicle joints somewhat shorter than long, the scape metallic, the tibia brown, and the fore wing with a distinct stigmal cloud.

Four European specimens without definite locality labels are in the collection identified as this species. One of these was named by Ruschka and the other three by Ashmead. All agree with the above characters as well as others given by Mayr.

This species is not known to occur in America. In Europe it is said to be widely distributed and to parasitize several species of Lepidoptera and Tenthredinoidea and also to have been reared as a secondary parasite through species of Ichneumonidae and Tachinidae.

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NOTES ON THE BIRDS OF NORTH CAROLINA

By Alexander Wetmore

During 1939 field investigations in North Carolina brought an interesting collection of birds to the United States National Museum, in continuation of a program to obtain needed material of this kind from States bordering on the Appalachian mountain system. The field work was under the direction of W. M. Perrygo, of the Museum staff, assisted by Gregor Rohwer during the spring and by Charles L. Wheeler in the fall. The party left Washington on April 11 and returned on July 22, and departed again on September 14 to continue work through the fall until November 27.

The present report presents briefly the results of a study of the specimens of birds obtained, with some additional observations on species that were not collected. It includes also a few records of other specimens in the National Museum, part of these having been obtained by the writer during recent years on occasional visits to North Carolina. The data are presented for the information of those interested in assembling records on the distribution of birds within this State and are intended to cover only the material mentioned above, without attempt to include additional records from literature except as these are pertinent to some discussion here presented.

Identification of the collection has been interesting because of the area of intergradation found for a number of species that are sepa-

rated into northern and southern subspecies. The western element that appears in a few cases in western Tennessee here is entirely lacking. But an additional factor is found in North Carolina in the ecological influence of the coastal marshes where peculiar forms appear. The extreme southeastern part of North Carolina is especially interesting, and it is suggested to observers that further studies be made on Smith Island, which is related definitely to a more southern region in its flora. As is ordinarily the case the information here assembled is indicative for many species of the necessity for further field work to determine the extent of their distribution.

The friendly cooperation of J. D. Chalk, Commissioner of Game and Inland Fisheries of the Department of Conservation and Development, and of J. D. Findlay, of the same service, provided the necessary permits under which this work was prosecuted. We are also indebted to officials of the national forests lying within the State for their aid. The universally friendly assistance accorded our field party, particularly in the privilege of entering private lands, has been most deeply appreciated. Without this courteous and interested help the work could not have been prosecuted.

The expenses of the party in the field were carried by the income of the W. L. Abbott Fund of the Smithsonian Institution.

So far as possible the itinerary was arranged to cover the different sections of the State during both spring and fall, so as to obtain representative material in both seasons. Necessarily the work in the western mountains was done in the summer, as that is the most interesting period for that region. In view of the extended observations of naturalists for many years in the general vicinity of Asheville our work in the mountains during 1939 was confined to the northern and southern sections, which have been investigated little or not at all.

Work in the field began on April 14, 1939, with Elizabeth City as a base. The principal studies were made in the Dismal Swamp area 7 miles west of South Mills, an old logging railroad and other trails giving access to the swamp. Other work concerned a cypress swamp near Gliden and higher lands of pines and old fields in the vicinity of Sunbury and Weeksville. On April 28 the party transferred to Clinton in Sampson County. The spring migration then had begun in full force, and here many birds were found, particularly in Great Cohaire Swamp and in the vicinity of Roseboro, near Bearskin Swamp and Little Cohaire Swamp. On May 8 Perrygo worked near Raleigh to secure certain birds wanted from that area.

On May 9 the work was transferred to Brunswick County in the extreme southeast, where the men were located at Southport. Here on the Coastal Plain the land was level, with extensive growths of

pine, and there were swampy lands grown with deciduous trees along the streams. Pretty Pond, 10 miles north of Southport, was typical of the woodland ponds of this area, being shallow and having a white sand bottom. Bordering the coast and the mouth of the Cape Fear River are broad reaches of salt marsh. Through the courtesy of the United States Coast Guard, work was prosecuted on Smith Island on May 13 and from May 20 to 22, with results of much interest. The island, as already stated, will repay more careful investigation. On May 24 the party transferred to Rockingham in Richmond County, a cotton- and corn-growing area drained by the Pee Dee River and its tributary streams. There were areas here, particularly in the wooded swamps, of definitely more southern affinity. Considerable collecting was done near the Pee Dee River 11 miles east of Wadesboro. Gregor Rohwer concluded his work with the party here on June 3.

On June 5 Perrygo located at Murphy in Cherokee County for studies in the low mountains of this section. He reached Pack Mountain through Pack Mountain Gap but found that cover on most of the slopes had been burned. Other collections were made from 6 to 8 miles southwest at elevations of 1,450 to 1,750 feet in abandoned fields, areas of small woodland, and stands of heavy pine. On June 17 he moved to Franklin, where permission was obtained through the forest ranger and the game warden to collect in certain regions in the Nantahala National Forest. Birds were taken here on Rocky Ridge and Rocky Bald at elevations ranging from 4,500 to 5,200 feet, mainly in deciduous forest. Other collections were made along a stream where there was a small glade at 3,500 feet, 12 miles east of Hayesville. On July 1 birds were secured in hardwood forest at 4,100 feet on Standing Indian Mountain 15 miles east of Hayesville, and on July 3 Shortoff Mountain was examined. Birds were obtained on July 5 and 6 near Highlands.

The final work of the summer centered at Boone, Watauga County, and extended from July 9 to 20, hampered somewhat by heavy rains. Elk Knob, 7 miles north, offered good collecting at altitudes ranging from 4,800 to 5,500 feet, partly in forest and partly in old farmlands. No spruce was found. Three Tops Mountain near Creston and Patty and Bluff Mountains near West Jefferson were visited also, in addition to work in the valleys near West Jefferson. Bluff Mountain had a small stand of hemlocks in which a winter wren was taken. Ravens were said to nest here formerly. Snake Mountain, 7 miles north of Boone, was visited on July 18 and 19. Perrygo returned to Washington on July 22.

For work in the autumn Perrygo left the Museum on September 14 with Charles L. Wheeler as field assistant, and on September 16

located a base in Madison, N. C. Work here until September 27 centered on the headwaters of the Dan and Haw Rivers; the valley of Hogan Creek, 7 miles northeast of Reidsville, where tracts of heavy timber still remain, was one of the best localities found. A trap line was run on Rockhouse Creek 8 miles northwest, and collections were made on Troublesome Creek 7 miles south. On September 28 the party located in Newton, Catawba County, and from here investigated the wooded bottomlands along the Catawba River, north of Catawba in Catawba County, and west of Statesville in Iredell County, the river being the boundary between these counties. On October 6 the men worked near Longisland, Catawba County.

On October 12 they located at Lakeview Camp west of Engelhard on the south shore of Lake Mattamuskeet. Here were found extensive brackish marshes and great areas of open pine timber with undergrowth of cane and bayberry tangled with smilax. Much of the low woodlands was wet from frequent rains. In eastern Dare County, near Stumpy Point, there are broad areas of savannas with springy turf almost like a heath, over which were scattered small magnolias and abundant dried stalks of sarracenia. In the drainage ditches along the road it was interesting to see stumps and logs of an ancient cypress swamp extending for a long distance, covered by a foot or two of sandy topsoil. Toward Manns Harbor there were heavy stands of gums and magnolia and large growths of pine. J. E. Graf and the writer joined the party here from October 13 to 15. On October 26 Perrygo collected in marshes along the Pungo River near Leechville and on October 28 near Fairfield. Through the courtesy of the Bureau of Biological Survey (now the Fish and Wildlife Service), Department of the Interior, a trap line for mice and shrews was run in the refuge area near the lake.

On October 29 the men located at Bethel and they remained there until November 13. Along Conetoe Creek, 3 miles west, there were fine stands of deciduous forest, while to the northwest of Greenville were great stands of pine. Birds were especially common here, including white-eyed towhees near Greenville. A few specimens were taken near Tarboro and Hassell. The last base for the season was established at Beaufort on November 14. Work here centered in the coastal area near Beaufort, Davis, Mansfield, Williston, North Harlowe, and Atlantic. On November 22 and 24 the men visited Bogue Island opposite Morehead City, on November 23 they crossed Core Sound from Marshallberg to the island facing the Atlantic Ocean, and on November 25 crossed again from the town of Atlantic farther north. The party returned to the Museum in Washington on November 27.

Family ARDEIDAE

LEUCOPHOYX THULA THULA (Molina): Snowy Egret

An adult female was taken on Smith Island on May 13.

Sharpe[1] was correct, as indicated by Peters,[2] in placing this heron in a distinct genus *Leucophoyx*, as it differs from *Egretta garzetta*, the type of the genus *Egretta*, in its large crest, in the lack of the elongate plumes on the nape, and in the different form of the feathers of the breast.

FLORIDA CAERULEA CAERULEA (Linnaeus): Little Blue Heron

An adult male was taken near Southport on May 17. One was seen on Smith Island on May 13.

While Peters[3] has not recognized a southern form of this heron, it is my opinion from examination of a large series that the adult birds in dark plumage of the Antillean area are definitely darker and duller than those of the United States. Comparisons must be made with clean skins, as specimens impregnated with fat become appreciably darker than normal.[4] Skins from the north that are discolored may thus appear as dark as those from the West Indies.

BOTAURUS LENTIGINOSUS (Montagu): American Bittern

Specimens were taken at South Mills on April 17 and 21 and 6 miles northeast of Beaufort on November 14. One was recorded in the locality last mentioned November 17.

Family ACCIPITRIDAE

ACCIPITER STRIATUS VELOX (Wilson): Sharp-shinned Hawk

A young female not quite grown and only recently from the nest was taken July 11 at 3,500 feet on Elk Knob near Meatcamp Creek, 5 miles north of Boone. This bird undoubtedly was hatched nearby, as it is too young to have flown far. Adult males were taken 4 miles south of Manns Harbor on October 25 and near Bethel on November 1. Birds were seen near Statesville on October 9 and Greenville on November 11.

BUTEO JAMAICENSIS JAMAICENSIS (Gmelin): Eastern Red-tailed Hawk

No specimens were taken but this bird has been so reduced in number that the following sight records are of interest: Southport, May 15 and 20; Suit, Cherokee County, June 7; about 8 miles southwest of Murphy, June 12; Wayah Bald, Franklin County, June 19 and 27;

[1] Bull. Brit. Orn. Club, vol. 3, 1894, p. 39.
[2] Check-list of birds of the world, vol. 1, 1931, p. 113.
[3] Check-list of birds of the world, vol. 1, 1931, p. 107.
[4] See Wetmore, A., Scientific Survey of Porto Rico and the Virgin Islands, New York Acad. Sci., vol. 9, 1927, p. 294.

Rocky Bald and Rocky Ridge 12 and 13 miles west of Franklin, June 20 and 21; Standing Indian Mountain near Hayesville, July 1. Near Engelhard single birds were seen on October 17, 20, and 23.

While shooting, trapping, and the spread of human occupation have been of major importance in the reduction in number of this and other species of hawks, the food factor may also have had far-reaching significance. The red-tail is predominantly a rodent eater, taking rabbits and other small mammals on occasion. In our operations in North Carolina it has developed that there is an astonishing dearth of small mammals through the entire Piedmont area and in the mountains except in limited sections, while in the Coastal Plain small mammals are common only in swampy regions. Our collectors placed lines of traps numbering from 50 to 125 in all areas visited in the State and kept them in constant operation, often with days passing without the capture of a single mouse or shrew. Where the ubiquitous white-footed mice may not be trapped it is obvious that small mammals must be extremely rare. Hawks in consequence here can find little food. Spring and fall burning most probably affects the mammal population seriously, but other factors may operate as well. A part of the present day scarcity of the red-tail and related hawks may be attributed to this factor of food scarcity.

BUTEO LINEATUS LINEATUS (Gmelin): Northern Red-shouldered Hawk

This common bird is represented by two specimens, a male (wing 319 mm.) taken near Roseboro May 5, and an adult female (wing 341 mm.) shot on Hogan Creek, 7 miles northeast of Reidsville, on September 19. Both specimens agree in color and size with northern specimens.

BUTEO PLATYPTERUS PLATYPTERUS (Vieillot): Broad-winged Hawk

This species was observed near Rockingham on May 30; Murphy, June 16; Hayesville, July 3; and Highlands, July 6.

Family FALCONIDAE

FALCO PEREGRINUS ANATUM Bonaparte: Duck Hawk

One was recorded 5 miles north of Engelhard on October 20.

FALCO COLUMBARIUS COLUMBARIUS Linnaeus: Eastern Pigeon Hawk

Recorded at Leakville, October 12, and Engelhard, October 20.

FALCO SPARVERIUS SPARVERIUS Linnaeus: Eastern Sparrow Hawk

A male sparrow hawk was taken on Bogue Island near Morehead City on November 22. Among other records may be mentioned birds

seen near Brunswick on May 12, and on Pack Mountain, Cherokee County, on June 6 and 7, when they must have been on their breeding grounds.

Family TETRAONIDAE

BONASA UMBELLUS TOGATA (Linnaeus): Canada Ruffed Grouse

The grouse seems now rare and restricted in range in North Carolina, as it was seen only at 4,500 to 5,000 feet on Rocky Ridge 13 miles west of Franklin on June 21 and 23 and on Wayah Bald on June 22.

Todd recently has separated the grouse from West Virginia southward as a distinct race,[5] but after comparison of considerable material I fail to find certain characters that will serve to separate birds from this area from *togata*. The color of the tail is definitely variable from rufous to gray both in the mountain birds and in *togata* from northern areas, and with the well-known gray and rufescent color phases in these grouse I see little possibility of color separation on the basis of supposed more brownish color in the southern birds. There is no question that the birds of the southern mountains are different from typical *umbellus*, but it appears to me that they cannot be distinguished successfully from *togata*.

Family PERDICIDAE

COLINUS VIRGINIANUS VIRGINIANUS (Linnaeus): Eastern Bobwhite

Quail were recorded at Sunbury on April 19, in the Dismal Swamp area 7 miles west of South Mills on April 20, at 3,400 feet on Pack Mountain, Cherokee County, on June 7, about 8 miles southwest of Murphy on June 10, at 4,000 feet near West Jefferson on July 14, and near Engelhard on October 19 and 20.

Family MELEAGRIDIDAE

MELEAGRIS GALLOPAVO SILVESTRIS Vieillot: Eastern Turkey

Records obtained for the turkey all pertain to the wilder sections of Macon County. On Wayah Bald, 12 miles west of Franklin, an adult and a dozen young the size of bantam chickens were seen on June 20, and an adult was recorded on June 22. At 4,500 to 5,100 feet on Rocky Ridge, 13 miles west of Franklin, Perrygo saw a gobbler and a hen with young three or four days old on June 21, a gobbler on June 23, and an adult with young on June 26. On the last date he collected a young bird in the down with the wing quills developing and a few contour feathers appearing in the back.

[5] *Bonasa umbellus monticola* Todd, Auk, 1940, p. 392 (Cheat Bridge, W. Va.).

Family RALLIDAE

RALLUS LONGIROSTRIS WAYNEI Brewster: Wayne's Clapper Rail

Two adult females were taken near Southport on May 17 and 18. It is currently recognized that the coast of North Carolina marks the transition point between the northern clapper rail (*Rallus l. crepitans*) and the bird of the southeastern coast (*waynei*). Oberholser [6] records specimens from as far south as Beaufort as *crepitans*, remarking that they are intermediate. The two from Southport mark the entrance into the State of the more southern race, as they are definitely darker than northern specimens.

RALLUS LIMICOLA LIMICOLA Vieillot: Virginia Rail

In fall migration this rail was seen 4 miles west of Manns Harbor on October 25, near Stumpy Point on October 26 (female taken) and 27, and near Leechville, in Hyde County, on October 26.

Family CHARADRIIDAE

CHARADRIUS WILSONIA WILSONIA Ord: Wilson's Plover

On Smith Island, where these birds were common, two males were taken on May 13.

While this species has been recognized as a distinct genus currently, I agree with Peters [7] that it is best considered as a member of *Charadrius*. The main character on which it has been separated is the larger, heavier bill, which is not sufficient for generic distinction, particularly since other related species show approach in this regard.

Family SCOLOPACIDAE

PHAEOPUS HUDSONICUS (Latham): Hudsonian Curlew

On May 10 Perrygo recorded seven near Southport and collected a male.

Peters [8] has listed the Hudsonian curlew as a geographic race of *Phaeopus phaeopus* of the Old World, but on examination I feel that it is better to consider it a distinct species. There is no question that it is representative of the Palearctic whimbrels, but it stands sufficiently apart from *P. p. phaeopus* and *P. p. variegatus* in definitely darker coloration with no white on the rump and in the heavier marks on the sides and flanks. While the birds from the

[6] Proc. U. S. Nat. Mus., vol. 84, 1937, pp. 352–354.

[7] Check-list of birds of the world, vol. 2, 1934, p. 254.

[8] Check-list of birds of the world, vol. 2, 1934, p. 261. For recognition of *Phaeopus* as a genus see Wetmore, Bull. Mus. Comp. Zoöl., vol. 63, 1919, pp. 178–179.

two regions approach each other closely, I can find no actual bridging of the gap that exists between them.

ACTITIS MACULARIA (Linnaeus): Spotted Sandpiper

A male was taken near Weeksville on April 27.

TRINGA SOLITARIA SOLITARIA Wilson: Eastern Solitary Sandpiper

A male was collected at Pretty Pond, 10 miles north of Southport, on May 12. The wing measures 128 mm.

CATOPTROPHORUS SEMIPALMATUS SEMIPALMATUS (Gmelin): Eastern Willet

Two were secured near Southport on May 11.

EREUNETES PUSILLUS (Linnaeus): Semipalmated Sandpiper

Two males and one female were obtained on Smith Island on May 13.

CROCETHIA ALBA (Pallas): Sanderling

A male was taken on November 25 6 miles northeast of Atlantic, where the birds were abundant.

Family LARIDAE

LARUS MARINUS Linnaeus: Black-backed Gull

One was seen 3 miles southeast of Marshallberg on November 23.

LARUS ATRICILLA Linnaeus: Laughing Gull

A male was taken near Marshallberg on November 23.

Family COLUMBIDAE

ZENAIDURA MACROURA CAROLINENSIS (Linnaeus): Eastern Mourning Dove

Six skins were obtained at the following localities: Near Rockingham, June 1; Southport, May 11; Smith Island, May 22; and near Engelhard, October 16 and 17.

Family CUCULIDAE

COCCYZUS AMERICANUS AMERICANUS (Linnaeus): Yellow-billed Cuckoo

Taken at Clinton on May 8, Southport on May 11, and 8 miles southwest of Murphy on June 12. Birds were seen at 4,800 feet on Elk Knob near Boone on July 11 and 12. In fall this cuckoo was collected at Reidsville, September 18, and near Catawba, September 28 and 30 and October 4.

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COCCYZUS ERYTHROPTHALMUS (Wilson): Black-billed Cuckoo

In migration this cuckoo was taken on Smith Island on May 13 and 6 miles north of Southport on May 16. A male was shot at 4,850 feet elevation on Three Tops Mountain 2 miles southeast of Creston on July 13, and a female at 5,100 feet on Elk Knob, 7 miles north of Boone, Watauga County, on July 17. The latter were on their nesting grounds.

Family STRIGIDAE

OTUS ASIO ASIO (Linnaeus): Southern Screech Owl

A male taken 6 miles north of Southport, May 15, is typical of the southern form. It measures as follows: Wing 146.5, tail 70.5, culmen from cere 14.2, tarsus 29.3 mm. On December 31, 1933, I found a female dead in the road near the bridge north of Kitty Hawk. This bird has a wing measurement of 162.0 mm., and while a little large it is assigned under the present subspecies as an intermediate, though Leon Kelso has considered it representative of *O. a. naevius*. It is to be expected that the latter race ranges through the highland area of North Carolina, but the actual extent that it may cover will need to be established by specimens.

STRIX VARIA GEORGICA Latham: Florida Barred Owl

Two specimens available include one that I obtained near Bath on January 16, 1930, and one forwarded from Bethel by Velva Howard on January 22, 1940. Both of these have the bare area on the toes extensive as is characteristic of this southern race. The distribution of this and the northern form in North Carolina remains to be ascertained. It is possible that the southern race extends throughout the Coastal Plain.

Family CAPRIMULGIDAE

CAPRIMULGUS CAROLINENSIS Gmelin: Chuck-will's-widow

A male was secured at Southport on May 19 and a female on Smith Island on May 22.

Goatsuckers as a group exhibit a remarkable similarity in color and form, and from external characters it must be conceded that there is reason for including the whippoorwills and chuck-will's-widows and their near relatives of the New World in the genus *Caprimulgus*. Ridgway's endeavors to segregate a number of genera have not proved acceptable, as the characters he found are not certain. I believe, however, that the broad genus *Caprimulgus* as at present constituted will be divided eventually on the basis of osteological characters. At present skeletons of only a few species are available,

but these indicate among other points that the skull of the chuck-will's-widow differs from any others seen in the considerable backward extension of the transpalatine processes. Dr. H. C. Oberholser, in his consideration of some of these matters,[9] through an error in identification has figured a skull of *Nyctidromus* as that of the chuck-will's-widow.

Family TROCHILIDAE

ARCHILOCHUS COLUBRIS (Linnaeus): Ruby-throated Hummingbird

Two taken, both males, come from South Mills, April 19, and 9 miles southwest of Murphy, June 14.

Family PICIDAE

COLAPTES AURATUS AURATUS (Linnaeus): Southern Flicker

This race is represented by four specimens, as follows: Gliden, April 26, female (wing 148.6 mm.); Clinton, May 4, female (wing 142.5 mm.); Southport, May 18, male (wing 145.6 mm.); and finally a male collected near Bethel, November 1 (wing 147.4 mm.). These bear out the current supposition that *auratus* is the breeding form of the eastern part of North Carolina. It will be noted from the bird from Gliden, Chowan County, that this race ranges north into the extreme northeastern section of the State.

COLAPTES AURATUS LUTEUS Bangs: Northern Flicker

The flicker population breeding in the extreme western area of North Carolina is to be referred to the northern form, though there is indication of some mixture of southern blood in the extreme southwest. A male taken on June 12 at 1,450 feet elevation 8 miles southwest of Murphy has the wing 151 mm., being thus on the actual borderline between the two geographic races under consideration. I have called it *luteus*. A female shot on June 7 at 3,100 feet on Pack Mountain 14 miles southwest of Murphy measures 153.5 mm., being thus a little larger. Two from Clay County show the same mixture, as a female taken June 29 at 3,700 feet 12 miles east of Hayesville measures 158 mm., while a male from 3,500 feet secured on June 27 is only 149.5 mm. In this latter bird, however, the wing is considerably worn, with the tips of the primaries much broken, so that it is considered *luteus*. An immature male not quite grown was taken here on June 28. Four from 4,800 feet elevation on Elk Knob, 7 miles north of Boone, are *luteus*, the wing in two males being 151.9 and 154.7 mm. and in two females 152.5 mm.

[9] U. S. Nat. Mus. Bull. 80, 1914, p. 6, pl. 2, fig. 1.

In fall and spring the northern flicker is widespread throughout the State, records of specimens being as follows: South Mills, April 19 and 20; Catawba, October 5; Statesville, October 7 and 19; Reidsville, September 18 and 19; Bethel, October 30 and November 1 and 2; Manns Harbor, October 25; Englehard, October 20; and Williston, November 21.

The eastern extension of the breeding range of *luteus* in the northern section of North Carolina remains to be ascertained.

CEOPHLOEUS PILEATUS PILEATUS (Linnaeus): Southern Pileated Woodpecker

Five specimens typical of this form were taken, two at South Mills, April 15 and 17, and three near Engelhard, October 13 and 14. Three males have the wing 217, 219, and 227 mm. and the culmen from base 42.2, 48.8, and 49.7 mm. In two females the wing is 218 mm. and the culmen from base 41.3 and 44.1 mm. It is probable that *C. p. pileatus* may be the form found throughout the State, since specimens from the mountain area in extreme eastern Tennessee all pertain to the southern race.

Birds were seen near Rockingham on May 30, near Statesville on October 4 and 9, near Bethel on November 1 and 2, and at Williston on November 16.

CENTURUS CAROLINUS (Linnaeus): Red-bellied Woodpecker

Outside of the higher mountain area this species seems to be of state-wide distribution. Specimens were taken as follows: Statesville, October 6; Reidsville, September 18 (in immature plumage); Wadesboro, May 27; Rockingham, May 31; Roseboro, May 4; Clinton, May 3; Southport, May 16; Bethel, November 1 and 2; and South Mills, April 15 and 24. The distribution through the mountains of the western part of North Carolina remains to be ascertained.

MELANERPES ERYTHROCEPHALUS ERYTHROCEPHALUS (Linnaeus): Eastern Red-headed Woodpecker

Specimens were obtained at South Mills on April 17 and Southport on May 16.

Measurements are as follows: Two males, wing 132.5–135.9, tail 71.6–77.4, culmen from base 28.3–31.0, tarsus 22.3–22.5 mm.; one female, wing 128.2, tail 75.0, culmen from base 27.1, tarsus 20.1 mm.

A female from Southport shot on May 16 still retains part of the juvenal plumage of the previous year on the head and dorsum. From the indication of wear on the wings and tail it is obviously a bird of the previous season.

SPHYRAPICUS VARIUS VARIUS (Linnaeus): Yellow-bellied Sapsucker

Birds on their breeding grounds were obtained at 5,100 feet elevation on Rocky Bald, 12 miles west of Franklin, on June 20 (two females) and at 4,500 feet on Rocky Ridge, 13 miles west of Franklin, on June 21 (one female). A male was collected July 1 at 4,100 feet on Standing Indian Mountain, 15 miles east of Hayesville. Elsewhere I have explained my reasons for not recognizing a southern race of this sapsucker.[10]

In fall migration this bird was found on the Catawba River 7 miles west of Statesville, September 30. Specimens were taken here on October 5 and 7. Others were obtained at Bethel, October 30, and near Greenville, November 8.

DRYOBATES VILLOSUS VILLOSUS (Linnaeus): Eastern Hairy Woodpecker

A small series of hairy woodpeckers is of some assistance in delimiting the ranges of the two races in the State, though the detailed distribution remains to be established. Perrygo recorded this bird in June on Pack Mountain, Cherokee County, and on Rocky Bald and Rocky Ridge, Macon County, but did not secure specimens, so that doubt attaches to the identity of the birds from this area. This is true in particular of the record from Pack Mountain, since skins from Big Frog Mountain in Polk County, Tenn., a short distance to the west are recorded as *D. v. audubonì*. A female from 3,200 feet elevation 3 miles west of West Jefferson in Ashe County, N. C., has the tips of the primaries badly broken from wear, so that though in existing condition the wing measures only 113.9 mm. it is obvious that the true dimension was appreciably greater. This bird therefore is considered to be *villosus*, particularly since an immature male, fully grown, from 4,300 feet on Bluff Mountain, a mile or more farther west, has the wing 120 mm. and is obviously the larger bird. Two males from the Catawba River 7 and 10 miles southwest of Statesville, shot on October 7 and 9, are on the borderline, but with wing measurements of 118.2 and 118.9 mm. they seem properly allocated with *villosus*. A female from Hogan Creek 7 miles northeast of Reidsville also belongs here, as the wing is not fully grown after molt but still measures 115.6 mm.

DRYOBATES VILLOSUS AUDUBONI (Swainson): Southern Hairy Woodpecker

An immature female from 7 miles southeast of Rockingham with the wing fully grown measures 114.3 mm., seeming to be *audubonì*, but the identity of birds from this section should be checked definitely with adult specimens. Other specimens at hand to the eastward are all clearly the southern subspecies, which in the eastern lowlands

[10] Proc. U. S. Nat. Mus., vol. 86, 1939, pp. 193–195.

ranges north throughout the State. A male taken in the Dismal Swamp area near Sunbury, Gates County, on April 21 has the wing 115.3 mm., being obviously small. From near Engelhard a male taken on October 13 measures 113.5 mm., and three females secured on October 13 and 14 register 110.5, 111.7, and 112.0 mm., respectively. In a pair from 6 miles west of Clinton, Sampson County, the male has the wing 115.3 and the female 110.4 mm. A female from Williston, Carteret County, measures 111.6 mm.

DRYOBATES PUBESCENS MEDIANUS (Swainson): Northern Downy Woodpecker

On examination of a very good series of birds this form of the downy woodpecker is found to have a much more extensive range in North Carolina than had been supposed. Birds from the mountain area in the west belong here without question. A male taken about June 1890 at Waynesville by P. L. Jouy has the wing 93.7 mm., exceptionally large for this far south. A male from an elevation of 1,450 feet 8 miles southwest of Murphy, June 9, measures 92.0 mm., and a fully grown immature female from nearby, shot on June 14, records 91.5 mm. Another fully grown immature bird, a male, from 5,000 feet elevation on Rocky Ridge, 13 miles west of Franklin, has the wing 92.2 mm. A pair from 4,800 feet on Elk Knob, 7 miles north of Boone, measure 93.5 in the male and 91.4 in the female. Skins from the Catawba River west of Statesville, October 3, 4, and 7, a male with the wing 92.5 and two females, wing 91.6 and 90.5, are also to be placed here. The second of these females verges toward the southern bird, which must range lower down in the valley of this stream. Skins from Hogan Creek 7 miles northeast of Reidsville belong here without question, males taken September 18 and 19, measuring 92.3 and 92.8, and a female, September 18, measuring 91.9 mm. A male from Madison taken on September 21 in the same region measures 92.5 mm. A male that I shot 4 miles west of Winton on December 2, 1934, with the wing 91.4 mm., may indicate that *medianus* goes clear across the northern part of North Carolina to the uplands above the Dismal Swamp area, though this specimen may possibly be a migrant.

There are two others that are assumed to be migrants, as they come from within the range ascribed to *pubescens* but have the size and purer white color of *medianus*, viz, a female (wing 92.8 mm.) from the Dismal Swamp area 7 miles west of South Mills taken on April 14, and a male (wing 91.9 mm.) from North Harlowe, Craven County, secured November 20.

DRYOBATES PUBESCENS PUBESCENS (Linnaeus): Southern Downy Woodpecker

The specimens at hand indicate a distribution for this form extending eastward from the valley of the Pee Dee River near the

South Carolina state line through Wilson to the northeastern part of the State. Thus, as a breeding bird, it covers the entire Coastal Plain and the eastern section of the Piedmont.

In the following account wing measurements are given in parentheses for each record. A male (wing 87.2 mm.) was taken 11 miles east of Wadesboro, May 29, and a female (88.8 mm.) 7 miles southeast of Rockingham, May 31. A female (89.9 mm.) comes from 3 miles west of Roseboro, May 6. A male (90.6 mm.) was taken 3 miles west of Clinton May 1, and another male (88.9) 6 miles west in the Great Cohaire Swamp, May 6. The first is a little large, showing an approach toward *medianus*. There is also before me a female (89.8 mm.) from Wilson secured on November 24, 1923. A male (90.2 mm.) from 6 miles northwest of Greenville, November 8, is a little large. A male (88.9 mm.) and a female (89.8 mm.) were shot 7 miles west of Bethel on October 30, and a female (89.6 mm.) 3 miles west, November 1. A male (88.0 mm.), shot April 17, and a female (88.8 mm), taken April 21, come from the Dismal Swamp area 7 miles west of South Mills. It will be recalled that one larger bird, possibly a migrant, from here is listed as *medianus*. Near Engelhard a male (86.5 mm.) and two females (90.6 and 87.9 mm.) were taken on October 13 and 16. One of the females shows approach in size to *medianus*. Near Bath on January 16, 1929, I collected a male (85.1 mm.) and a female (86.5 mm.) at the mouth of Mixon Creek, and on January 13, 1930, a male (87.3 mm.) at the mouth of Duck Creek. Perrygo secured two females (both with the wing 87.2 mm.) near Williston on November 17 and 21, and a female (86.5 mm.) 6 miles north of Southport on May 15.

It may be expected that migrants of *medianus* will invade this area outside the breeding season.

DRYOBATES BOREALIS BOREALIS (Vieillot): Northern Red-Cockaded Woodpecker

In the eastern section of North Carolina this woodpecker is locally common, though it is absent from many localities. It is a quiet bird that may be overlooked by one not familiar with it.

There is one old specimen at hand without date marked as taken by Rev. M. A. Curtis at Raleigh. Perrygo secured two 7 miles southeast of Rockingham, May 30 and June 1, and three 6 and 7 miles northeast of Greenville, November 7 and 8. On January 15, 1930, I collected a pair at the mouth of Duck Creek on the Pamlico River near Bath. On October 13, Perrygo shot two near Engelhard, a locality where the birds were fairly common, and secured three at North Harlowe on November 20. There is an old specimen in the National Museum taken by Elliott Coues at Fort Macon on November 1, 1870. Specimens were secured by Perrygo near Southport on May 15 and 16.

In working over this species two years ago it became apparent to me that birds from central and southern Florida have shorter wings than those from elsewhere in the range, but it seemed desirable to check this with additional material from North Carolina and South Carolina, which is now at hand. The two races will stand as follows:

Dryobates borealis borealis (Vieillot):

Picus borealis VIEILLOT, Histoire naturelle des oiseaux de l'Amérique septentrionale, vol. 2, 1807, pl. 66, pl. 122 ("dans le nord des États-Unis"; type locality hereby designated as Mount Pleasant, S. C.).

Wing longer.

Measurements.—Thirty-one males, wing 116.1–123.7 (119.2 [11]), tail 68.2–80.5 (74.7), culmen from base 20.7–22.9 (21.7), tarsus 18.9–22 (19.8 [11]) mm.

Thirty-two females, wing 116.0–123.3 (118.9), tail 69.2–81.3 (76.2 [12]), culmen from base 19.7–22.6 (21.0 [13]), tarsus 18.4–22 (20.6 [12]) mm.

The locality indicated by Vieillot for this bird is obviously uncertain, but so far as I have ascertained it has never been corrected. The type locality therefore is designated as Mount Pleasant, opposite Charleston, S. C.

Three names other than *borealis* applied to this woodpecker refer to the northern form. *Picus querulus* Wilson [14] is described as from North Carolina, South Carolina, or Georgia, these States being within the range of typical *borealis*. *Picus vieilloti* Wagler [15] is merely a new name for the adult male of Vieillot's *Picus borealis*. *Picus leucotis* Lichtenstein [16] is a new name for *Picus querulus* Wilson.

The typical form ranges from northern Florida (Overstreet, Milton, Farmdale, Apalachicola, and Welaka) to Texas, Oklahoma, Arkansas, Tennessee, and North Carolina. Specimens reported from Kentucky and Virginia are presumed to belong here on geographical grounds.

As the bird from the peninsula of Florida is without a name it may be known as

Dryobates borealis hylonomus, new subspecies:

Similar to *Dryobates borealis borealis* (Vieillot) but wing appreciably shorter.

Type.—U.S.N.M. No. 152081, male, from 7 miles southwest of Kissimmee, Fla., collected March 19, 1896, by Robert Ridgway.

Description.—Upper parts black, the crown glossy black, with the hindneck, back, and wings faded to fuscous; a red spot on each side

[11] Thirty specimens.
[12] Thirty-one specimens.
[13] Thirty specimens.
[14] American ornithology, vol. 2, 1810, p. 103, pl. 15, fig. 1.
[15] Systema avium, 1827, *Picus*, sp. 20.
[16] Verzeichniss der Doubletten des zoologischen Museums . . ., 1823, p. 12.

of the crown at the back of the head; nasal plumes, a spot on the side of the mandibular ramus, a spot above the eye, and the side of the head beginning as a narrow line behind the lores and spreading widely over the auricular region, white; back and wings barred with strong white bars, which tend to become spots on the wing coverts; rump plain black; under surface white; a broad black stripe extending from the base of the mandible along the side of the neck, diffusing on the sides of the breast into elongated spots of black, which become smaller on the sides; feathers of flanks with partly concealed bars of fuscous; under wing coverts spotted with black; inner webs of primaries and secondaries with large spots of white; under tail coverts with partly concealed, pointed spots of fuscous; two outer rectrices white, with cross bars at the tip and other partial bars across the inner webs of dull black; third rectrix with about half of the distal part of the outer web white; two central rectrices black. Bill black; tarsus and toes deep neutral gray (from dried skin).

Measurements.—Twenty-nine males, wing 110.2–117 (113.8), tail 65–78.3 (74.4[17]), culmen from base 20.7–24.0 (22.0), tarsus 18.5–21.5 (20.4) mm.

Eighteen females, wing 111.3–116.7 (113.7), tail 71.5–79.7 (75.4[18]), culmen from base 19.0–23.0 (21.2), tarsus 20.0–21.0 (20.4[19]) mm.

Type, male, wing 112.6, tail 75.0, culmen from base 21.2, tarsus 20.5 mm.

Range.—This form is found in central and southern Florida, specimens having been examined from Enterprise, Gainesville, Clearwater, Davista, Tarpon Springs, Seven Oaks, Auburndale, Lake Trafford, Lake Arbuckle, near Fort Bassinger, Driggs Landing, Kissimmee, Lake Hatch-Ne-Haw, Miami, Long Key, and Florida City.

Remarks.—Through the range indicated I have seen only one specimen that falls without the dimensions given. This is a male taken at Arnolds, Fla., February 27, 1895, with the wing 119.2 mm. This bird I have considered a straggler of *Dryobates b. borealis*, a wanderer from farther north. I have noted no color differences between the two forms.

Family TYRANNIDAE

TYRANNUS TYRANNUS TYRANNUS (Linnaeus): Eastern Kingbird

Three specimens were taken at Southport, May 12 and 15, and on Smith Island, May 22. The bird was recorded near Franklin, June 22, and at Meat Camp, Watauga County, July 12.

[17] Twenty-eight specimens.
[18] Sixteen specimens.
[19] Seventeen specimens.

MYIARCHUS CRINITUS BOREUS Bangs: Northern Crested Flycatcher

Of this common species skins were preserved as follows: Rockingham, June 1; Roseboro, May 2 and 4; Clinton, May 4; South Mills, April 14 and 17; and Southport, May 12 and 19.

On Smith Island several of these birds were noted, and an adult male was taken on May 22. This bird shows a very definite approach to the southern form *Myiarchus crinitus crinitus* in its slightly larger bill and somewhat darker dorsal color. This one individual for the time being I have marked as an intermediate and have placed it with *boreus*, as I hesitate to establish a State record on this one skin, especially in this case where the differences between the two races concerned are not sharply defined. Further breeding specimens from Smith Island should be obtained to see if they may not properly be classified as true *crinitus*.

SAYORNIS PHOEBE (Latham): Eastern Phoebe

Breeding birds of this common species were collected as follows: 8 miles southwest of Murphy, June 8 (adult and fully grown juvenile); 3,500 feet elevation, 12 miles east of Hayesville; and 4,800 feet elevation on Elk Knob, 7 miles north of Boone. In fall it was obtained on the Catawba River near Catawba, October 4; on the same stream 7 and 10 miles west of Statesville, October 2 and 4; on Hogan Creek 7 miles northeast of Reidsville, September 19; and near Greenville, November 6.

EMPIDONAX VIRESCENS (Vieillot): Acadian Flycatcher

This widely distributed species was encountered as follows: At 1,450 feet elevation 8 miles southwest of Murphy, June 9; at 3,500 feet elevation 12 miles east of Hayesville, June 26 and 27; 11 miles east of Wadesboro, May 26; near Roseboro, May 2, 5, and 6; Clinton, May 1; Southport, May 19; and Gliden, April 25. The progressive graying from wear in this species with advance through spring into summer is noticeable.

EMPIDONAX MINIMUS (Baird and Baird): Least Flycatcher

In the high country 12 miles east of Hayesville this small flycatcher was fairly common, as birds were taken here at 3,500 feet elevation on June 26, 27, and 28 and others were seen on June 30. One was seen at 3,800 feet 2 miles north of Highlands on July 6. An immature female fully grown was obtained at 4,800 feet on Elk Knob, 7 miles north of Boone, on July 18. On July 5, 1936, J. J. Murray and I found this species common between Sturgills and Warrensville, where the birds ranged along streams and in the adjacent groves at elevations as low as 2,800 feet.

MYIOCHANES VIRENS (Linnaeus): Eastern Wood Pewee

This common species was recorded as follows: Near Murphy, June 12 and 13; 4,100 feet elevation on Standing Indian Mountain, 15 miles east of Hayesville, July 1; near Franklin, July 1; Wadesboro, May 29; Rockingham, May 30; Reidsville, September 19; Roseboro, May 2; and Southport, May 10 and 11.

Family ALAUDIDAE

OTOCORIS ALPESTRIS PRATICOLA Henshaw: Prairie Horned Lark

Apparently this bird has come to breed in North Carolina, since Perrygo observed one near Meat Camp Creek, Watauga County, on July 11. Though he did not collect it, he was certain of the identity.

Family HIRUNDINIDAE

IRIDOPROCNE BICOLOR (Vieillot): Tree Swallow

Perrygo secured a male in the edge of the Dismal Swamp, 7 miles west of South Mills, on April 19. On October 14 and 15 I recorded scores circling over Lake Mattamuskeet near Lake Landing. On the latter date on Roanoke Island, a mile north of Manteo, a flock of about 3,000 tree swallows rested in close order on the low plants of a bean field, where they were sheltered somewhat by the nearby pines from a strong, cold wind. Others perched on telephone wires above. Apparently a few minutes earlier the flock had alighted to get the sun on the paved highway where a car or cars passing at high speed had killed about 150, the pavement and the roadside being strewn with their bodies. I picked up 30 or so in good condition, and later most of these were prepared either as skins or skeletons.

STELGIDOPTERYX RUFICOLLIS SERRIPENNIS (Audubon): Rough-winged Swallow

The only specimen taken was secured 5 miles east of Weeksville, April 27. Two were recorded 5 miles west of Franklin, June 22.

HIRUNDO RUSTICA ERYTHROGASTER Boddaert: Barn Swallow

An adult female was shot near Southport, May 17.

PROGNE SUBIS SUBIS (Linnaeus): Purple Martin

A male in immature plumage was taken 5 miles northeast of Southport on May 12.

On July 30, 1941, at the southern end of the long bridge across Albemarle Sound, south of St. Johns, I found about 150 purple martins lying dead on the pavement, where they had been killed that

morning by passing cars. Apparently the birds had gathered in the sun on the bridge and on the approach to meet disaster in the same manner as described above for the tree swallows.

Family CORVIDAE

CYANOCITTA CRISTATA CRISTATA (Linnaeus): Florida Blue Jay

Specimens of the blue jay were taken at the following localities: 4,500 feet elevation on Rocky Ridge, 13 miles west of Franklin, June 22; Catawba River, 7 miles west of Statesville, September 29 and 30; 7 miles southeast of Rockingham, May 31; near Reidsville, September 20 and 25; Roseboro, May 8; Bethel, November 1; and Southport, May 11.

This entire series of 15 skins is identified as the southern form, both on size and color, so that apparently this is the breeding bird throughout most of if not all the State. The wing in males taken ranges from 123.6 to 130.7 mm. and in females from 126.9 to 129.1. The birds seen are definitely dark in color above with restricted white markings in the wings. One bird from Bethel and two from Reidsville have the white more extensive and appear somewhat less purplish but are small in size. They are considered to be intermediate.

Examination of this and other material makes it apparent that Oberholser [20] is correct in extending the range of the southern form of the blue jay to the north so far that it covers the type locality of *cristata*. The bird currently called *florincola* then becomes *Cyanocitta c. cristata*, while the northern race will be known as *Cyanocitta c. bromia* Oberholser.

The northern blue jay should come as a migrant to North Carolina, though no specimens are at hand to substantiate this, but whether the northern form nests in the State apparently is a matter still to be established. It may occur in the higher mountains of the northwest. In fact, Oberholser,[21] in a review of the races of the blue jay cited above, has listed as the northern form a specimen taken on July 11, 1895, on Roan Mountain. This specimen, in the National Museum, is a young female only recently from the nest, with the juvenile plumage only partly replaced by first fall dress. I am inclined to believe that it might be more properly considered an intermediate, a question, however, to be settled only by additional specimens. A jay secured by Perrygo on September 23, 1937, on that part of Roan Mountain found in Tennessee is definitely intermediate but seems nearer to the southern form. Three collected by J. J. Murray at Blowing Rock on August 7 and 18, 1937, which I have examined, are also young birds in process of attaining fall plumage, and like Dr. Oberholser's

[20] Auk, 1921, pp. 83–89.
[21] *Loc. cit.*, p. 88.

skin from Roan Mountain they are in too poor condition to warrant establishing a State record without supporting evidence. They appear intermediate. The wing measurements in two females are 126.6 and 127.3 mm. and in one male 128.7 mm., and in the Roan Mountain, N. C., skin, a female, 128.4 mm. I am not certain, however, that the wing is fully grown in any of these.

CORVUS CORAX PRINCIPALIS Ridgway: Northern Raven

Perrygo recorded this species in small numbers on Roan Mountain, N. C., September 11 and 12, 1937, and observed one on Snake Mountain, Watauga County, July 18, 1939. He was told that up to fifteen years or so previous ravens had nested regularly on Bluff Mountain north of Boone but had left this locality.

CORVUS BRACHYRHYNCHOS BRACHYRHYNCHOS Brehm: Eastern Crow

As a migrant this northern race, marked by larger size, comes into North Carolina, though its comparative abundance in relation to the southern form remains to be ascertained. In a considerable series in the National Museum there are two male *brachyrhynchos* (wing 325, 312, culmen from base 55, 52 mm.), and one female (wing 310, culmen from base 50 mm.) taken January 7, 1914, near Currituck Sound.

CORVUS BRACHYRHYNCHOS PAULUS Howell: Southern Crow

North Carolina is in the northern section of the range of this rather poorly marked form, and from a small number of breeding specimens the nesting birds that I have seen all appear best referred to *paulus*. In a pair from the edge of the Dismal Swamp 7 miles west of South Mills the male has the wing 308 and the culmen from base 51.6 mm., while in the female these measurements are 292 and 48.3 mm., respectively. A female from Wadesboro, May 26, measures 285 and 44.8 mm., and one from Statesville, October 4, has the wing 280 and the culmen from base 49.1 mm. A female from Engelhard, October 23, measures 299.5 and 51.8, and a male from Greenville 297 and 50.3 mm. A male taken at Asheville on May 3, 1932, is definitely *paulus*, with the wing 280 and the culmen from base 47 mm.

The only anomalous specimen in the breeding series is a male, taken 8 miles southwest of Murphy, in which the wing is 316 and the culmen from base 50.5 mm. This specimen is of uncertain status but it is probably an intermediate specimen, as birds from the mountains of northeastern Tennessee and southwestern Virginia belong with *paulus*. Further breeding specimens should be obtained in the mountain area of western North Carolina.

In addition to the skins listed we have a male from Asheville shot November 1, 1930 (wing 297), and a series from Currituck Sound taken January 7, 1914, that includes 5 males and 9 females.

CORVUS OSSIFRAGUS Wilson: Fish Crow

This common species in the coastal area is represented by skins from Southport, May 11, 19, and 20, and Engelhard, October 24. In addition Perrygo observed it at Sunbury, April 19; in the Dismal Swamp area 7 miles west of South Mills, April 21 and 24; in the Bear Skin and Little Cohaire Swamps near Roseboro, April 24 and May 2; and on Smith Island, May 13. I found a number near Bath on the Pamlico River on January 15 and 17, 1929, and recorded them as fairly common at Manteo on March 31, Nags Head on April 1, and Atlantic on April 2, 1934. On October 15, 1939, I observed a number at Stumpy Point.

Family PARIDAE

PENTHESTES CAROLINENSIS CAROLINENSIS (Audubon): Carolina Chickadee

The typical form of the Carolina chickadee, marked by darker gray on the back and duller buffy brown on sides and flanks, extends across the southern part of the State from the mountains to the coast. Records based on specimens are as follows: Murphy, June 8 (juvenile) and 12; 5,100 feet elevation on Rocky Bald, 12 miles west of Franklin, June 20; 3,500 feet elevation 12 miles east of Hayesville, June 28; Catawba, September 29; Catawba River, 7 miles west of Statesville, September 30; Rockingham, May 30; 11 miles east of Wadesboro, May 26; Engelhard, October 13 and 23; Southport, May 15 and 16 (including one juvenile).

Specimens from Engelhard are somewhat intermediate but appear nearer the southern race.

PENTHESTES CAROLINENSIS EXTIMUS Todd and Sutton: Northern Carolina Chickadee

This recently described northern race extends into the northern part of the State, its range in the northwest remaining to be ascertained.

Specimens have been examined from the following points: Hogan Creek, 7 miles northeast of Reidsville, September 18; Troublesome Creek, 7 miles south of Reidsville, September 25; Conetoe Creek, 3 miles west of Bethel, November 2; Clinton, May 1; and the Dismal Swamp area, 7 miles west of South Mills, April 14, 15 and 17.

BAEOLOPHUS BICOLOR (Linnaeus): Tufted Titmouse

From the mountains to the lowland swamps of the coast this is one of the common birds of North Carolina wherever there are wood-

lands. Specimens were obtained as follows: Murphy, June 14; at 5,000 and 5,100 feet on Rocky Bald; 12 miles west of Franklin, June 23 and 26; Statesville, September 29 and October 5; Wadesboro, May 29; Roseboro, May 2; Clinton, May 1; Bethel, October 30 and November 1; South Mills, April 14 and 24; and Southport, May 10 and 12. It was observed at 4,800 feet on Elk Knob, 7 miles north of Boone on July 12 and at 4,600 feet on Three Top Mountain, 2 miles south of Creston on July 13.

Family SITTIDAE

SITTA CAROLINENSIS CAROLINENSIS Latham: White-breasted Nuthatch

Through North Carolina there is a definite area of intergradation between the northern and southern races of this widely distributed bird, of which the northern form is paler dorsally and slightly larger and the southern one darker and a little smaller. In addition the female of typical *carolinensis* has the black of the crown partly concealed by an edging of gray, a marking most evident in fall and winter as in occasional individuals in spring and summer this disappears. In the southern bird the crown is definitely black in both sexes.

Birds from the northern section of the State belong definitely with the northern form, though in some there is more or less indication of intergradation. Birds ascribed to the northern subspecies were taken as follows: Hogan Creek, 7 miles northeast of Reidsville, September 18 (male somewhat darker, female with crown distinctly gray); 6 miles northwest of Greenville, November 8; Conetoe Creek, 7 miles northwest of Bethel, October 30 (somewhat intermediate); Gliden, April 25; Dismal Swamp area, 7 miles west of South Mills, April 14 and 17 (male and female, both intermediate).

SITTA CAROLINENSIS ATKINSI Scott: Florida Nuthatch

The southern form is represented by skins from the southern section of the State, some of which, again, are more or less intermediate. In a pair taken 8 miles southwest of Murphy, June 13, at an elevation of 1,450 feet the male is definitely intermediate in color and a little large (wing 89.2 mm.), while the female is duller gray and has the crown black. A male and a female taken at 4,100 feet on Standing Indian Mountain, 15 miles east of Hayesville are also intermediate in depth of gray color, but here again the female has a black head. A pair from 7 miles southeast of Rockingham, May 31, seem to belong more definitely with the southern bird, as do an adult male and a juvenile female from near Roseboro, taken on May 5.

The range of the two subspecies remains to be worked out in detail. Undoubtedly many specimens will be found that can be allocated only arbitrarily.

SITTA PUSILLA PUSILLA Latham: Brown-headed Nuthatch

This interesting nuthatch is locally common through wide areas in the eastern and southern part of the State, seemingly more abundant on the Coastal Plain than farther inland. Specimens at hand come from the following localities: 7 miles southeast of Rockingham, May 30 and June 1; Wake Forest, April 11, 1885 (from Frank Blake Webster); 6 miles northwest of Greenville, November 9; near Bath (mouth of Mixon Creek, January 16, 1929, and mouth of Duck Creek, January 13, 1930, taken by A. Wetmore); Engelhard, October 13 and 19; North Harlowe, November 20; and Southport, May 10, 12, and 15.

The northern race of this bird, which extends in its range from Georgia northward to Maryland and west into eastern Texas, when compared with *Sitta pusilla caniceps* Bangs of Florida averages slightly larger, there being, however, some overlap in size. The northern bird in addition has the gray of the back slightly darker, and the brown of the head darker with the paler edgings on the crown feathers, where present, distinctly darker.

The southern race, from material in the U. S. National Museum, is found throughout Florida, including the northwestern extension of the State. Birds from St. Marys in extreme southeastern Georgia belong also to this form.

Family CERTHIIDAE

CERTHIA FAMILIARIS AMERICANA Bonaparte: Brown Creeper

Specimens were taken at Statesville on October 7 and Engelhard on October 18.

Family TROGLODYTIDAE

TROGLODYTES AËDON AËDON Vieillot: Eastern House Wren

The four specimens of the house wren taken were obtained near Engelhard, in Hyde County, on October 16, 20, 21, and 24. All belong to the typical form. The darker, grayer, and less refuscent Ohio house wren *Troglodytes aëdon baldwini* has been recorded from a number of localities in North Carolina.[22]

NANNUS HIEMALIS HIEMALIS (Vieillot): Eastern Winter Wren

Specimens of this migrant race were secured at Engelhard, October 23, and near Bethel, October 30. I collected one at the mouth of Mixon Creek near Bath on January 16, 1929.

[22] Ohio Journ. Sci., vol. 34, Mar. 1934, p. 92.

NANNUS HIEMALIS PULLUS Burleigh: Southern Winter Wren

It is interesting to find two of these birds collected on Conetoe Creek 3 miles west of Bethel on November 1, indicating a migration away from their mountain breeding range.

An adult male taken at 4,300 feet on Bluff Mountain 4 miles west of West Jefferson is an abnormal individual, as it is much paler than the average for the southern bird, being very similar to typical *hiemalis*. It is considered an aberrant specimen.

One was recorded singing at 4,500 feet on Rocky Ridge 13 miles west of Franklin on June 21.

THRYOMANES BEWICKI BEWICKI (Audubon): Bewick's Wren

Three juvenile individuals only recently from the nest were obtained at 4,500 and 4,800 feet on Elk Knob, 7 miles north of Boone, July 11 and 12, and at 4,600 feet on Three Tops Mountain, 2 miles southeast of Creston, July 13. The species was recorded near West Jefferson on July 14. It was fairly common in the localities noted.

THRYOTHORUS LUDOVICIANUS LUDOVICIANUS (Latham): Carolina Wren

Specimens of this species were secured at 1,450 feet elevation 8 miles southwest of Murphy, June 10 and 13 (the latter recently from the nest); at 3,500 feet 12 miles east of Hayesville, July 4; at 4,000 feet near Highlands, July 5; and 4,300 feet elevation on Three Tops Mountain, near Creston, July 13, the last three being records of some interest as indicating altitudinal distribution. Elsewhere the bird was obtained as follows: On the Catawba River 3 miles north of Catawba, September 29, and 10 miles southwest of Statesville, October 6; Reidsville, September 22; Bethel, October 31; Roseboro, May 2; Clinton, May 3; South Mills, April 15, 18, and 21; and on Smith Island, May 13 and 22 (young recently from the nest).

TELMATODYTES PALUSTRIS PALUSTRIS (Wilson): Long-billed Marsh Wren

A series of 14 skins of the long-billed marsh wren presents a truly remarkable picture, since in it there are represented four distinct subspecies, two of them certainly breeding and the other two migrant, though possibly one of these last may nest in the northeastern coastal area.

In the specimens collected there is one example of the typical race taken 8 miles southwest of Stumpy Point in Dare County, October 20. This bird comes from the breeding area of *T. p. waynei* and is evidently a migrant.

Hellmayr [23] has united *Cistothorus* and *Telmatodytes* in one genus on the grounds that *Cistothorus apolinari* Chapman from the Suba Marshes near Bogotá is a connecting link between the two. In this he has been deceived by the gross appearance of the South American bird, a most remarkable species, which is, relatively speaking, a giant in its group. The much larger size of *apolinari* is deceptive, as in the relative proportions of its large, heavy bill, in the graduation of the tail, in the distal tapering of the rectrices, and in the relative length of the exposed culmen compared with the middle toe it agrees with *Cistothorus stellaris* and differs as does that species from *Telmatodytes palustris*. Under the circumstances it seems to me necessary to recognize two genera, unless we proceed to recast our ideas of generic alliance, in which case these and many others would attain the value of subgenera. *Cistothorus apolinari* in its very large, strong feet and tarsi differs decidedly from all the other marsh wrens, and on this basis it possibly may be separated as a third generic or at least subgeneric group when more is known about it.

TELMATODYTES PALUSTRIS WAYNEI Dingle and Sprunt [24]: Wayne's Marsh Wren

This is a strongly marked form, characterized by very dark color above, with the black extensive and the browns dark and with more or less barring on sides and under tail coverts. It was described from a migrant bird at Charleston with the indication that it was the breeding bird of the coastal area of North Carolina, a supposition that has proved true.

A mile north of Engelhard these birds were common in October, so that Perrygo and I secured four on October 14 in marshes near the highway leading north. Perrygo collected another 7 miles southwest of Stumpy Point, October 17, and one 6 miles northeast of Beaufort, November 18. More interesting is an adult female obtained 2 miles northeast of Southport May 17. This bird is entirely typical of its race though taken a mile distant from *T. p. griseus*, which breeds here in the coastal region. It is probable that it is a migrant in passage from the south, but possibly here is a point where the ranges of the two forms in question join.

Burleigh,[25] late in May 1932, found *waynei* in the coastal area from Swanquarter northward and reports that no marsh wrens were encountered at Beaufort. The matter is one that should be carefully investigated.

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[23] Field Mus. Nat. Hist., Zool. Ser., vol. 13, Nov. 15, 1934, p. 114.

[24] *Telmatodytes palustris waynei* Dingle and Sprunt, Auk, Oct. 1932, p. 454 (Mount Pleasant, S. C.).

[25] Auk, 1937, p. 457.

TELMATODYTES PALUSTRIS GRISEUS (Brewster): Worthington's Marsh Wren

This race, in very gray color with entire absence of bright brown, is so different from the other marsh wrens with which we are concerned here as to be distinguished at a glance. An adult female obtained a mile northeast of Southport on May 19 and four taken on Smith Island opposite on May 21 all belong to this race. Evidently here is the northern limit of this interesting bird. Attention is called again to the fact that the one from Southport was taken a mile south of the point where a skin of *T. p. waynei* was secured.

The details of the occurrence of the four marsh wrens here listed furnish a fascinating problem for investigation by local ornithologists.

TELMATODYTES PALUSTRIS ILIACUS Ridgway: Prairie Marsh Wren

I collected an adult male in a marsh a mile north of Engelhard on October 14 in an area where *T. p. waynei* was abundant. This migrant from the northern interior regions is brighter, lighter brown on the back and flanks but is otherwise like typical *palustris*. There is another specimen in the National Museum taken at Fort Macon, N. C., in September 1869.

CISTOTHORUS PLATENSIS STELLARIS (Naumann): Short-billed Marsh Wren

In fall this interesting wren was common locally in fresh-water marshes in the coastal area, being found in company with the other marsh wrens. At Engelhard on October 14 I noted that they were as common as the long-billed marsh wrens. Specimens were taken here on October 14, 16, and 24. Perrygo took four more 6 miles northeast of Beaufort on November 15 and 18. Howell and Burleigh [26] found half a dozen pairs of the short-billed marsh wren near Pungo, Va., a short distance north of the North Carolina line from May 17 to 20, 1932, and believed that they may have nested there. Search for them should be made in the Currituck Sound area in North Carolina in the nesting season.

The smaller forms of *Cistothorus* of Central and South America seem so closely allied to our familiar bird of the north that it appears that Hellmayr [27] is justified in considering all as geographic races of one species. The oldest name for the group as a whole is *platensis* of Latham so that the bird of the A. O. U. Check-list will become *Cistothorus platensis stellaris*.

[26] Auk, 1934, p. 250.
[27] Field Mus. Nat. Hist., Zool. Ser., vol. 13, pt. 7, Nov. 15, 1934, pp. 114–123.

Family MIMIDAE

MIMUS POLYGLOTTOS POLYGLOTTOS (Linnaeus): Eastern Mockingbird

The mocker was obtained as follows: Weeksville, April 27; Engelhard, October 16; Morehead City, November 24; Marshallberg, November 23; and Southport, May 18. It was seen on Smith Island, May 13; near Reidsville, September 19 and 23; near Bethel, November 1; and at Franklin, June 29.

DUMETELLA CAROLINENSIS (Linnaeus): Catbird

Of this abundant species specimens were obtained as follows: Murphy, June 8 and 9; Hayesville, June 26; Catawba, September 30; 4,600 feet elevation on Elk Knob, 7 miles north of Boone, July 19; Reidsville, September 23 and 25; Roseboro, May 4; Clinton, May 3 and 4; Bethel, November 1; Stumpy Point, October 17; Bogue Island near Morehead City, November 24; and South Mills, April 19.

TOXOSTOMA RUFUM RUFUM (Linnaeus): Eastern Brown Thrasher

Of state-wide distribution, this interesting bird was obtained at the following localities: Murphy, June 9 and 10; Hayesville, June 26 and 27; 4,000 feet elevation on Patty Mountain, near West Jefferson, July 14; Statesville, October 4 and 5; Reidsville, September 23 and 26; Clinton, May 6; and Southport, May 11. All these check in size with the dimensions of the eastern race.

Family TURDIDAE

TURDUS MIGRATORIUS MIGRATORIUS Linnaeus: Eastern Robin

The larger, darker eastern robin breeds in the higher mountains of western North Carolina in a more or less intermediate form whose distribution at present is not fully understood. In part of the area at least it intergrades or mingles with the southern race. In the present collection there is one male, taken on June 22 at 5,000 feet on Rocky Ridge, 13 miles west of Franklin, that represents the eastern bird, as it is dark in color. Though the wing measures only 126 mm. the tips of the primaries are broken and worn, so that the proper length is perhaps 2 mm. more. A male taken at Statesville on October 9 has the wing 129.3 mm., and one from Reidsville measures 130.1 mm. Two other winter birds were shot at Greenville on November 3 and 9, and a very large female was collected in the edge of the Dismal Swamp near South Mills April 14 (wing 133.4 mm.).

In January 1929 I recorded great flocks of robins roosting and feeding in the wooded swamps along the Pamlico River near Bath, and on January 16 I shot two, one of which was the typical form.

During winter the northern form should be common in North Carolina.

TURDUS MIGRATORIUS ACHRUSTERUS (Batchelder): Southern Robin

This is the breeding robin of North Carolina outside the mountain area and seemingly has increased in numbers in recent years. As already indicated there is mixing between this race and the typical one in the mountain areas of the southeastern Appalachian region in a manner not yet fully understood. Two females from Highlands, taken July 5 at 4,000 feet, are typical of the southern bird in size and color, as are also three secured at from 4,550 to 4,800 feet on Elk Knob, 7 miles north of Boone, July 11 and 18, and one from 4,300 feet on Bluff Mountain, 4 miles west of West Jefferson, collected July 15. Dr. J. J. Murray has sent me a female taken at Blowing Rock on August 7, 1940. Further study is desirable to ascertain the ranges of the two subspecies of robin throughout the mountain area.

Considerable variation in color is evident in four other breeding birds. A female from near Raleigh (the type locality of the race), taken on May 8, is quite dark on the breast but paler above and has the wing 119 mm. In a pair taken in Harnett County 20 miles southwest of Raleigh on May 8 the male is dark (wing 124.4) and the female pale (wing 114.2). A male shot on May 6 at Clinton is very dark above and below (wing 117.4).

Other skins come from Reidsville, September 22; near South Mills, April 15 and 21; and Marshallberg, November 23. I secured one at the mouth of Mixon Creek near Bath on January 16, 1929.

HYLOCICHLA MUSTELINA (Gmelin): Wood Thrush

Specimens were secured as follows: 9 miles southwest of Murphy, June 16; 12 miles east of Hayesville, June 28; Catawba, October 3; Statesville, October 9; Reidsville, September 20 and 23; Rockingham, May 30; Clinton, May 6; and Gliden, April 26.

HYLOCICHLA GUTTATA FAXONI Bangs and Penard: Eastern Hermit Thrush

Specimens were obtained at South Mills, April 17, 19, and 21; Bethel, November 4; and Greenville, November 7.

HYLOCICHLA USTULATA SWAINSONI (Tschudi): Eastern Olive-backed Thrush

The three collected were obtained at Clinton, May 1, Statesville, October 3, and Bethel, October 30.

HYLOCICHLA MINIMA MINIMA (Lafresnaye): Gray-cheeked Thrush

In spring, male and female were taken near Clinton, May 6. During the fall migration specimens were obtained at Reidsville, September

20 and 24; the Catawba River near Statesville, October 3; and Catawba, October 4. These all represent the larger form, now known as *minima*.[28]

HYLOCICHLA MINIMA BICKNELLI Ridgway: Bicknell's Thrush

A male was collected near Southport, May 12. In this specimen the wing measures 95.1 mm., so that it is clearly representative of the smaller form.

HYLOCICHLA FUSCESCENS FUSCESCENS (Stephens): Veery

Migrants were collected at Clinton on May 1 and at Roseboro on May 2. On the breeding grounds two males were taken at 5,000 and 5,100 feet on Rocky Bald, 13 miles west of Franklin, on June 20 and 23. On the latter date a juvenile bird recently from the nest was obtained. Birds were seen at 5,200 feet on Rocky Ridge, 13 miles west of Franklin, on June 22; at 3,700 feet, 12 miles east of Hayesville, June 27, 28, and 29; and near Highlands, July 5 and 6. A female was collected at 3,200 feet 3 miles west of West Jefferson on July 14, and another at 5,500 feet on Elk Knob, 7 miles north of Boone, July 10.

SIALIA SIALIS SIALIS (Linnaeus): Eastern Bluebird

Records for this pleasing bird are as follows: Murphy, June 10; Rockingham, June 2; Roseboro, May 2; Greenville, November 8 and 9; Gliden, April 26; Engelhard, October 16; Beaufort, November 20; Davis, November 18; and Southport, May 10 and 16.

Family SYLVIIDAE

POLIOPTILA CAERULEA CAERULEA (Linnaeus): Blue-gray Gnatcatcher

The gnatcatcher is an elusive species that is easily overlooked after leaves cover the trees in spring. Perrygo and his companions obtained specimens as follows: At 1,450 feet, 9 miles southwest of Murphy, June 16; Rockingham, May 30 and June 1; Roseboro, May 2; Clinton, May 3; Gliden, April 25; South Mills, April 21; and Smith Island, May 22.

REGULUS SATRAPA SATRAPA Lichtenstein: Eastern Golden-crowned Kinglet

Near Engelhard, on October 23, when two were collected, these birds were common. Another was secured at Greenville on November 7. There is an adult male in the Museum collection obtained on the summit of Roan Mountain, N. C., on July 26, 1890, by P. L. Jouy.

CORTHYLIO CALENDULA CALENDULA (Linnaeus): Eastern Ruby-crowned Kinglet

Taken at Statesville on October 7 and near Bethel on November 2.

[28] See Wetmore, A., Proc. U. S. Nat. Mus., vol. 88, 1940, p. 552.

Family BOMBYCILLIDAE

BOMBYCILLA CEDRORUM Vieillot: Cedar Waxwing

On Smith Island Perrygo found a flock of seven on May 20 and secured two females. One has a very tiny tip of wax on one of the rectrices, in addition to well-developed red points on the secondaries. The other has no trace of these markings. A male was collected 12 miles east of Hayesville at 3,500 feet elevation on July 1.

Family LANIIDAE

LANIUS LUDOVICIANUS LUDOVICIANUS Linnaeus: Loggerhead Shrike

The five shrikes taken all belong to the darker southern form. Breeding birds were obtained at Autryville and Roseboro on May 2 and Rockingham on May 30. In fall, one was shot at Tarboro on November 3 and one at Williston on November 17.

Family VIREONIDAE

VIREO GRISEUS GRISEUS (Boddaert): White-eyed Vireo

Skins were obtained as follows: Rockingham, May 30 and June 1; Roseboro, May 3; Clinton, May 3; South Mills, April 14 and 15; Southport, May 12; and Smith Island, May 13. These belong to the typical form.

VIREO FLAVIFRONS Vieillot: Yellow-throated Vireo

Taken 8 miles southwest of Murphy on June 12.

VIREO SOLITARIUS ALTICOLA Brewster: Mountain Vireo

In the mountains of western North Carolina this race is common, and at times it ranges to low elevations, as male and female were taken at 1,750 feet elevation 6 miles southwest of Murphy on June 9. At 4,100 feet on Standing Indian Mountain, 15 miles east of Hayesville, a male and a juvenile bird fully grown were collected on July 1. A male comes from 5,000 feet on Rocky Bald, 13 miles west of Franklin, June 23. Near Highlands, the type locality, Perrygo collected four males and a female on July 5 and 6 between 3,800 and 4,000 feet elevation. In the northwest two were taken at 4,800 feet on Elk Knob on July 11 and 12, and two at 5,000 feet on Snake Mountain on July 18, both localities lying about 7 miles north of Boone. One was shot at 4,300 feet on Bluff Mountain, 4 miles west of West Jefferson, on July 15.

Measurements from this series are as follows: Males (11 specimens), wing 75.7–83.2, tail 52.0–55.0, culmen from base 13.1–14.8, tarsus 18.2–19.6 mm.

Females (2 specimens), wing 77.8–79.1, tail 52.3–53.3, culmen from base 13.9–14.2, tarsus 18.9 mm.

VIREO OLIVACEUS (Linnaeus): Red-eyed Vireo

This, one of the common woodland species of the eastern United States, was secured at the following localities: 3,500 feet elevation, 12 miles east of Hayesville, June 27 and 28; 4,300 feet elevation on Three Tops Mountain, 2 miles southeast of Creston, July 13; Statesville, October 7; Wadesboro, May 26; Rockingham, May 31; Reidsville, September 18 and 26; Roseboro, May 2; Clinton, May 3; South Mills, April 20 and 24; and Southport, May 12 and 17.

After examination of further material I am still of the opinion that it is better at present to treat the red-eyed vireo as a species distinct from its near relatives.

Family COMPSOTHLYPIDAE

MNIOTILTA VARIA (Linnaeus): Black and White Warbler

This interesting bird, of common occurrence, was recorded as follows: 8 miles southwest of Murphy, June 10; near Hayesville, June 28 (young bird, fully grown) and July 1 (adult male); 4,300 feet elevation on Three Tops Mountain, 2 miles southeast of Creston, July 13; Statesville, September 30; Clinton, April 29; Gliden, April 25; and South Mills, April 22.

PROTONOTARIA CITREA (Boddaert): Prothonotary Warbler

This beautiful swamp warbler is one of the most interesting birds of the lowland swamps. Specimens were taken at the following localities: Near the Pee Dee River, 11 miles east of Wadesboro, May 26 and 29; 7 miles southeast of Rockingham, May 30; near Roseboro, May 4 and 6; Gliden, April 26; the Dismal Swamp area 7 miles west of South Mills, April 18, 20 and 24; and Southport, May 12.

VERMIVORA CHRYSOPTERA (Linnaeus): Golden-winged Warbler

A male was taken at Roseboro, May 5, and another at 4,300 feet on Three Tops Mountain, 2 miles southeast of Creston, July 13. The species was recorded near Hayesville, June 28 and 29.

VERMIVORA PINUS (Linnaeus): Blue-winged Warbler

An adult male was collected on Hogan Creek, 7 miles northeast of Reidsville, September 26.

VERMIVORA PEREGRINA (Wilson): Tennessee Warbler

Taken at Reidsville on September 18 and on the Catawba River 10 miles southwest of Statesville on October 4, 6, and 7.

COMPSOTHLYPIS AMERICANA PUSILLA (Wilson): Northern Parula Warbler

An immature female taken on Hogan Creek, 7 miles northeast of Reidsville, on September 18, with a wing measurement of 58 mm., and a male taken at Engelhard on October 16, with the wing 62.6 mm., belong to the northern form.

COMPSOTHLYPIS AMERICANA AMERICANA (Linnaeus): Southern Parula Warbler

Aside from slight difference in size (the northern bird has a slightly longer wing and a smaller bill) the characters that have been used to separate the northern and southern forms of the parula warbler appear variable. In the series at hand from North Carolina all are considered *americana* on the basis of size except the two *pusilla* listed above. In the series of *americana* two males from South Mills, taken on April 19 and 20, and one from Gliden, collected on April 25, agree in indefinite chest band, and so carry what has often been considered the chief character of the southern form. However, males shot at Southport on May 12 and on Smith Island on May 21, evidently breeding birds, have heavily marked breast bands, the band in the latter bird especially being broad and heavy. Two males from Murphy taken on June 13 and 16 and one from 3,500 feet elevation 12 miles east of Hayesville likewise have well-marked chest bands though small in size. Females were taken at Clinton on April 29. In fall, a female was taken on Hogan Creek 7 miles northeast of Reidsville on September 26.

Measurements of the North Carolina birds are as follows: Males (8 specimens), wing 56.2–57.9, tail 38.3–41.6, culmen from base 11.7–12.8, tarsus 15.3–17.6 mm.

Females (5 specimens), wing 52.1–55.9, tail 37.7–43.3, culmen from base 11.6–12.3, tarsus 15.4–16.3 mm.

DENDROICA AESTIVA AESTIVA (Gmelin): Eastern Yellow Warbler

Near Murphy these birds were fairly common in June, two males being taken on June 9.

DENDROICA MAGNOLIA (Wilson): Magnolia Warbler

Specimens were taken at Reidsville, September 29; on the Catawba River near Catawba, September 28 and 30; and 7 miles west of Statesville, September 30.

DENDROICA TIGRINA (Gmelin): Cape May Warbler

Four were seen and one taken at the Catawba River near Catawba, October 5.

DENDROICA CAERULESCENS CAERULESCENS (Gmelin): Black-throated Blue Warbler

Migrant examples of the northern subspecies were collected as follows: Roseboro and Clinton, May 4; Madison, September 21; and Statesville, October 4.

DENDROICA CAERULESCENS CAIRNSI Coues: Cairns's Warbler

It is of especial interest to record a male of this race taken in migration 3 miles southwest of Clinton, on May 1. In the mountain breeding grounds specimens were collected as follows: 3,500 to 3,700 feet elevation 12 miles east of Hayesville, June 27 and 29; 4,500 to 5,200 feet on Rocky Ridge, 12 miles west of Franklin, June 21 and 22, and 5,000 feet on Rocky Bald, 13 miles west of the same town, June 23; 5,500 feet on Elk Knob, 7 miles north of Boone, July 10; and 3,800 to 4,300 on Bluff Mountain 4 miles west of West Jefferson, July 15.

DENDROICA CORONATA CORONATA (Linnaeus): Myrtle Warbler

In spring migrants were collected at South Mills, April 14 and 15; Roseboro, May 2; and Clinton, May 3. In the fall migration three were recorded and one was taken on the Catawba River, 10 miles southwest of Statesville, on October 5. Others were secured at Stumpy Point, October 23; Bethel, November 2; and Davis, November 18.

DENDROICA VIRENS VIRENS (Gmelin): Black-throated Green Warbler

An adult male was taken 9 miles north of Southport on May 18. This bird in larger bill resembles those of the north and must be considered a belated migrant.

DENDROICA VIRENS WAYNEI Bangs: Wayne's Warbler

On May 4 the first of these birds was taken 3 miles west of Roseboro, a male marked by small bill and slightly darker dorsal coloration. Male and female were taken 6 and 9 miles north of Southport on May 17 and 19. Apparently this race extends across to the mountains in North Carolina, as a male taken at 4,300 feet on Bluff Mountain, 4 miles west of West Jefferson, on July 15, 1939, agrees with the birds from the coastal area in the characters indicated.

DENDROICA FUSCA (Müller): Blackburnian Warbler

This interesting bird was taken in the breeding season at 5,000 feet on Rocky Bald, 13 miles west of Franklin, on June 23, at 4,100 feet on Standing Indian Mountain, 15 miles east of Hayesville, on

July 1, and at 4,000 feet near Highlands on July 5. A migrant was shot at Catawba on October 5.

DENDROICA DOMINICA DOMINICA (Linnaeus): Yellow-throated Warbler

Localities for this handsome warbler are as follows: Pee Dee River, 11 miles east of Wadesboro, May 27 and 29; Roseboro, May 6; South Mills, April 18; Gliden, April 25 and 26; and Southport, May 10, 11, and 16. All these show more or less yellow in the anterior part of the superciliary, though in birds in worn plumage this may become very faint.

DENDROICA PENSYLVANICA (Linnaeus): Chestnut-sided Warbler

This warbler was found during the summer in the mountains at the following localities: 3,500 to 3,700 feet elevation in Clay County, 12 miles east of Hayesville, June 27 to 29; 5,100 feet on Rocky Bald, 12 miles west of Franklin, June 20; and 5,200 to 5,500 feet on Elk Knob, 7 miles north of Boone, July 10 and 17. Fully grown immature specimens were collected on Three Tops Mountain, 2 miles southeast of Creston, on July 13, and one was taken in fall migration near Madison, Rockingham County, on September 21.

DENDROICA CASTANEA (Wilson): Bay-breasted Warbler

One was taken and others were seen along the Catawba River, 10 miles southwest of Statesville, on October 4.

DENDROICA PINUS PINUS (Wilson): Northern Pine Warbler

Records for this widely distributed resident warbler are as follows: Statesville, October 9; Wadesboro, May 27; Rockingham, May 30; Reidsville, September 22; Clinton, May 3 (including a bird recently from the nest); Roseboro, May 4; Greenville, November 8; Engelhard, October 16; Beaufort, November 20; Southport, May 10; and Smith Island, May 22.

DENDROICA DISCOLOR DISCOLOR (Vieillot): Northern Prairie Warbler

The small series obtained comes from the following localities: At 1,450 feet elevation, 8 miles southwest of Murphy, June 12; Anson County, 11 miles east of Wadesboro, May 26; near Clinton, May 4; Sunbury, April 19 and 21; Southport, May 12 and 15; and Smith Island, May 22.

DENDROICA PALMARUM PALMARUM (Gmelin): Western Palm Warbler

Three were taken at Reidsville, September 25, Statesville, October 9, and Stumpy Point, October 27. Curiously enough all are the

western form which is supposed to be of casual occurrence in the State.

SEIURUS AUROCAPILLUS (Linnaeus): Ovenbird

Spring and summer specimens were taken at Gliden, April 25; Clinton, May 3; Murphy, June 7 and 12; and Hayesville, June 29. In fall this species was collected at Reidsville on September 25 and on the Catawba River west of Statesville on October 4 and 9.

SEIURUS NOVEBORACENSIS NOVEBORACENSIS (Gmelin): Northern Water-thrush

Taken in spring near Clinton on May 8, and in fall on Hogan Creek, 7 miles northeast of Reidsville, on September 26.

SEIURUS NOVEBORACENSIS NOTABILIS (Ridgway): Grinnell's Water-thrush

An immature male was taken on Hogan Creek, 7 miles northeast of Reidsville, on September 18. This bird is distinctly more sooty gray, less brownish above, and lighter below. The wing measures 75.3 mm.

SEIURUS MOTACILLA (Vieillot): Louisiana Water-thrush

Two were collected at Gliden on April 25. At Clinton one was taken on May 1 and at Rockingham one on June 1. An interesting record is of one shot at 5,000 feet on Rocky Ridge, 13 miles west of Franklin, on June 22. These birds were recorded also near Hayesville, June 29 and 30 and July 4; near Baldwin, July 13; and near West Jefferson, July 14.

OPORORNIS FORMOSUS (Wilson): Kentucky Warbler

This handsome species was taken at Clinton and Roseboro on May 4 and 6 miles southwest of Murphy on June 15.

OPORORNIS AGILIS (Wilson): Connecticut Warbler

To the small number of records of this species for North Carolina there is added an immature male secured on the Catawba River, 10 miles southwest of Statesville, on October 4.

GEOTHLYPIS TRICHAS BRACHIDACTYLA (Swainson): Northern Yellowthroat

Breeding birds referred to this form come from the high area in the west. Two males and a female from 8 miles southwest of Murphy, at 1,450 feet, taken on June 8, 9, and 10, agree with this form, as does a male from 2,200 feet 7 miles west of Franklin, collected on July 4, and a male from 4,600 feet on Three Tops Mountain, 2 miles southeast of Creston, July 13. I have also a male sent to me by Dr. J. J. Murray

from 3,700 feet at Blowing Rock, shot on August 8, 1940. In spring, migrants were obtained at South Mills on April 14 and at Roseboro on May 4. Fall specimens were taken on the Catawba River near Catawba, September 29, and west of Statesville, October 2, 3, and 5. A male from Williston, taken on November 16, is apparently nearest this race in color though small, as the wing measures 51.2 mm. only.

It appears that this form nests throughout western North Carolina and that it is state-wide in occurrence in migration.

GEOTHLYPIS TRICHAS TRICHAS (Linnaeus): Maryland Yellowthroat

This race apparently occurs in North Carolina only as a migrant though it may breed near the coast in the extreme northeast, since Duvall [29] records one from near Pungo in southeastern Virginia.

It is the smallest of those found here in wing measurement, and it has the flanks more grayish, less brownish like the northern yellowthroat (*Geothlypis t. brachidactyla*).

In the series at hand there are two females ascribed to this race taken in the Dismal Swamp area 7 miles west of South Mills, April 17 (wing 48.8 mm.); and near Sunbury, April 22 (wing 49.5 mm.). It is probable that this subspecies may be found to be the breeding form somewhere along the northern boundary of the State.

GEOTHLYPIS TRICHAS TYPHICOLA Burleigh [30]: Athens Yellowthroat

This race, an intermediate between *Geothlypis t. ignota* of farther south and *trichas*, is marked by darker, browner coloration of back and flanks, though not so dark as *ignota*. Though definitely an intermediate it seems to occupy a wide enough range from Georgia to southeastern Virginia to warrant recognition. In North Carolina it is found as the breeding bird of the Coastal Plain, extending back over the eastern section of the Piedmont. Birds from much of this area are not so dark as those from farther south and tend to range a little small, but they are too dark to be considered *trichas*.

Two males and a female from near Southport, May 15 and 17, are fairly typical in size and color. Of two taken near Roseboro on May 2 and 6, one is fairly typical and the other somewhat light in color. A pair secured 11 miles east of Wadesboro on May 26 are definitely intermediate both in size and color.

Two males and two females, all immature, taken on Hogan Creek, 7 miles northeast of Reidsville, September 18, 19, and 22, have the size of *trichas* but appear very dark, so that they are allocated as inter-

[29] Auk, 1937, p. 461.

[30] *Geothlypis trichas typhicola* Burleigh, Proc. Biol. Soc. Washington, vol. 47, Feb. 9, 1934, p. 21 (Athens, Ga.).

mediates under this name. More of these birds should be collected in this area in the breeding season to check their identity.

Other fall specimens were obtained at Engelhard, October 14 and 20, and Morehead City, November 22.

ICTERIA VIRENS VIRENS (Linnaeus): Yellow-breasted Chat

Of this elusive species skins come from Southport, May 11; Wadesboro, May 27; Murphy (9 miles southwest), June 14; and 3,200 feet elevation, 3 miles west of West Jefferson, July 14.

WILSONIA CITRINA (Boddaert): Hooded Warbler

Recorded from Murphy, June 7 and 12; 3,700 feet elevation, 12 miles east of Hayesville, June 29; Wadesboro, May 27; Rockingham, June 1; Reidsville, September 18; Clinton, April 29; South Mills, April 17; and Southport, May 16. Females in this series show interesting variation in the amount of black present on the forepart of the body, ranging from one with the faintest of darkened yellow on the foreneck, with a slight edging of dusky on the auricular region, to birds with the center and posterior part of the crown extensively black and the breast plain, or with the black much reduced on the crown but extended as a smudged band or necklace across the foreneck and upper breast.

WILSONIA CANADENSIS (Linnaeus): Canada Warbler

This mountain breeding bird was taken at 4,500 feet elevation on Rocky Ridge, June 21, and at 5,100 feet on Rocky Bald, June 20, both localities being in Macon County, 12 to 13 miles west of Franklin. Others were secured at 5,500 feet on Elk Knob, 7 miles north of Boone July 10, and at 4,600 feet on Three Tops Mountain, 2 miles southeast of Creston, on July 13, the latter being a fully grown immature individual.

SETOPHAGA RUTICILLA (Linnaeus): Redstart

In spring this alert warbler was taken at South Mills on April 19 and 24, near Clinton on May 3, and at Roseboro on May 5. A summer male shot 11 miles east of Wadesboro in Anson County, May 26, has an exceptionally large orange wing spot. Individuals were seen but not taken 12 miles east of Hayesville on July 4 and near West Jefferson on July 14. Fall specimens were obtained at Reidsville on September 22 and 25 and on the Catawba River west of Statesville on September 30 and October 3.

Family ICTERIDAE

DOLICHONYX ORYZIVORUS (Linnaeus): Bobolink

The only specimen taken was shot 8 miles southwest of Stumpy Point, Dare County, on October 24, an unusually late date.

STURNELLA MAGNA ARGUTULA Bangs: Southern Meadowlark

The series obtained during the present work was collected either along the southern border of North Carolina or on the Coastal Plain. All are the southern form.

During the breeding season birds were obtained 7 miles southeast of Rockingham, May 31; near Southport, May 12, 15, and 16; and near the Dismal Swamp 7 miles west of South Mills, April 19. The latter, a male, has the wing 115.2 mm. and is especially dark and richly colored. The fall series also represents the southern form, including specimens from the Catawba River near Catawba, October 6; Stumpy Point, October 27; Beaufort, November 15 and 17; and Marshallberg, November 23. Two from Beaufort listed above are somewhat intermediate but are nearer the southern form, which apparently may winter in the coastal area.

AGELAIUS PHOENICEUS PHOENICEUS (Linnaeus): Eastern Red-wing

In the small series obtained breeding individuals come from Southport, May 10, 17, and 18, and Smith Island, May 20. Fall specimens were collected at Engelhard, October 16, 18, and 24, and Williston, November 17.

ICTERUS SPURIUS (Linnaeus): Orchard Oriole

A second-year male comes from Southport, taken on May 18. It has a small spot of chestnut in the center of the breast.

CASSIDIX MEXICANUS MAJOR (Vieillot): Boat-tailed Grackle

Skins of the "jackdaw" come from Southport, May 10 and 18; Smith Island, May 13 and 20; and 6 miles northeast of Beaufort, November 14. Individuals were seen at Marshallberg on November 23 and Atlantic on November 25. I have recorded them on various occasions on Roanoke Island and near Nags Head and Kitty Hawk. The tips of the bills in two summer males show an interesting condition in which the ramphotheca on the premaxilla (upper mandible) has been worn away for a distance of about 7 mm., so that this part of the bill tip has been much narrowed, back of this it being normal. Two females taken at the same season exhibit this condition to a lesser degree. Obviously this is due to some feeding habit at the area where these birds were obtained, perhaps to eating clams or other shellfish. Three females taken in fall near Beaufort do not show this wear.

The subspecific status and nomenclature of the eastern grackles of this group seem at present so uncertain that after some consideration I have listed these birds as *major*. Without going into unnecessary detail here I may add that the bird of Florida has been described by Alexander Sprunt, Jr., as a separate race *westoni*,[31] while almost simultaneously the bird from Delaware to Florida was named by Francis Harper as *torreyi*.[32] Lowery [33] tentatively recognizes both forms, though acknowledging that this is debatable. After examination of the highly unsatisfactory series of these birds in the National Museum I cannot make out the characters alleged for either and feel that further study is required to determine whether the eastern group differs from that of Louisiana. The question of difference in eye color must be decided by further field investigations.

QUISCALUS QUISCALUS STONEI Chapman [34]: Purple Grackle

A male taken in the Dismal Swamp, 7 miles west of South Mills, on April 18 is referred to this form in accordance with Dr. Frank M. Chapman's modern studies of this interesting group of birds. Two other forms should occur in North Carolina.

Family THRAUPIDAE

PIRANGA ERYTHROMELAS Vieillot: Scarlet Tanager

Birds were secured in summer in the mountain area of western North Carolina as follows: 1,450 feet altitude 8 miles southwest of Murphy, June 12 and 13; 3,700 feet 12 miles east of Hayesville, June 30; 4,100 feet on Standing Indian Mountain, 15 miles east of Hayesville, July 1; and 4,700 feet on Three Tops Mountain, 2 miles southeast of Creston, July 13. The species was seen on Pack Mountain in Cherokee County, June 7; on Rocky Ridge, Franklin County, June 22; near Highlands, July 6; and on Elk Knob, Watauga County, July 17 and 18. Migrants were taken in Reidsville on September 23 and on the Catawba River west of Statesville on October 4.

PIRANGA RUBRA RUBRA (Linnaeus): Summer Tanager

Records for this bird are as follows: Wadesboro, May 26; Rockingham, May 30; Gliden, April 25; Clinton, May 1 and 3; and Southport, May 10. On June 6 Perrygo recorded three on Pack Mountain above Pack Mountain Gap, Cherokee County.

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[31] *Cassidix mexicanus westoni* Sprunt, Charleston Mus. Leaflet No. 6, Feb. 24, 1934 (St. Johns River Marshes, Indian River County, Fla.).

[32] *Cassidix major torreyi* Harper, Proc. Acad. Nat. Sci. Philadelphia, vol. 85, Mar. 8, 1934, p. 1 (Chincoteague, Va.).

[33] Occ. Papers Mus. Zool. Louisiana State Univ., No. 1, May 4, 1938, p. 6.

[34] *Quiscalus quiscula stonei* Chapman, Auk, 1935, p. 25 (Lakehurst, N. J.).

Family FRINGILLIDAE

RICHMONDENA CARDINALIS CARDINALIS (Linnaeus): Eastern Cardinal

The attractive cardinal ranges widely in North Carolina, as the following records will indicate: 8 miles southwest of Murphy, June 12; 3,200 feet elevation, 9 miles west of Franklin, July 4; 3,200 feet near West Jefferson, July 14; near Wadesboro, May 27; Catawba River north of Catawba, September 29, and west of Statesville, October 2 and 4; Reidsville, September 18 and 22; Madison, September 21; Clinton, May 4; South Mills, April 15 and 21; Southport, May 12; and Smith Island, May 22.

HEDYMELES LUDOVICIANUS (Linnaeus): Rose-breasted Grosbeak

On Rocky Bald and Rocky Ridge, 12 and 13 miles west of Franklin, rose-breasted grosbeaks were common, specimens being taken on June 20, 21, and 22. East of Hayesville several were recorded at 3,500 feet and above on June 27 to 30, and four were seen on July 1, at 4,100 feet on Standing Indian Mountain. Three were recorded near Highlands on July 5. Three were collected 7 miles north of Boone on Elk Knob at 4,800 to 5,100 feet on July 11, 17, and 18. In fall, one was secured near Reidsville on September 19, and one was recorded near Statesville on October 9.

On careful comparison of the breeding birds from this southern area with excellent series from the north there is indication that the species is uniform throughout its extensive breeding range.

PASSERINA CYANEA (Linnaeus): Indigo Bunting

Specimens come from Murphy, June 10; 2,200 feet elevation 7 miles west of Franklin, July 4; 4,800 feet on Elk Knob, 7 miles north of Boone, July 11 and 12; near Longisland, October 6; Wadesboro, May 26 and 27; and Reidsville, September 22 and 25.

PASSERINA CIRIS CIRIS (Linnaeus): Eastern Painted Bunting

Near Southport three were seen and a male taken on May 11. Others were obtained on Smith Island, where the species was abundant, on May 13, 20, and 22.

Comparison of a good series indicates clearly that there are two geographic races of this handsome species instead of the one included in the fourth edition of the A. O. U. Check-list. The western form, *C. s. pallidior*, is lighter colored in the male and lighter and somewhat grayer in the female.

Measurements of birds obtained in North Carolina are as follows: Males, wing 67.1, 67.9, 69.6, tail 50.9, 51.0, 51.1, culmen from base

11.4, 11.6, 12.1, tarsus 18.0, 18.5, 19.6 mm. Females, wing 63.7, 64.7, 65.5, tail, 50.4, 50.8, 51.4, culmen from base 11.0, 11.5, 12.0, tarsus 18.4, 18.5, 19.1 mm.

SPINUS TRISTIS TRISTIS (Linnaeus): Eastern Goldfinch

In the mountain region the goldfinch was obtained near Murphy on June 9 and 15, in the vicinity of Hayesville on June 30, on Elk Knob north of Boone on July 18, and near West Jefferson on July 14. A winter bird was collected at Williston on November 16. The species was recorded near Reidsville on September 19, 22, and 23.

PIPILO ERYTHROPHTHALMUS ERYTHROPHTHALMUS (Linnaeus): Red-eyed Towhee

With three forms of the towhee represented in the series of skins secured in 1939, it is obvious that there is much to be done in determining ranges and occurrence of this species in North Carolina. The typical form is marked by larger size, reddish-brown eye, deeper brown on the sides and flanks, and large size of the white spot on the end of the outer tail feather. The wing in five males in the present series ranges from 82.0 to 86.4 mm. and in five females from 75.7 to 81.8 mm.

Specimens allotted to this race include birds taken in the Dismal Swamp area 7 miles west of South Mills, April 17 and 18; about 3 miles southwest of Clinton, May 1; about 3 miles northeast of Roseboro, May 2; and 4,800 feet elevation on Elk Knob, 7 miles north of Boone, June 10 and 11. Fall specimens include one from Hogan Creek, 7 miles northeast of Reidsville, September 22; one from the Catawba River 7 miles west of Statesville, October 3; and two secured at Stumpy Point, October 17 and 21. The bird from Statesville may be a migrant, while the two from Stumpy Point certainly are in that category.

PIPILO ERYTHROPHTHALMUS CANASTER Howell: Alabama Towhee

This race has a reddish-brown eye, and is about equivalent in size to *P. e. erythrophthalmus*, but has the tail spot smaller and the brown of the sides and flanks paler. Males taken 8 miles southwest of Murphy, June 12, and at 5,100 feet on Rocky Bald, 12 miles west of Franklin, agree with this form, though the tail spots, measuring 34 and 35 mm., are a little large. It is expected that this bird will be found elsewhere along the western border of the State, as it occurs in adjacent sections of Tennessee.

PIPILO ERYTHROPHTHALMUS ALLENI Coues: White-eyed Towhee

That towhees with light-colored eyes are found in the southeastern coastal region of North Carolina is well known, the present mate-

rial indicating that they range more widely than anticipated. The birds here come in contact with the true red-eyed towhee, *P. e. erythrophthalmus*, and show intergradation in some individuals through variation in the light color of the eyes and in larger size, as well as in the extent of the white tip on the outer rectrix, which is much restricted in typical *alleni*.

The name to be applied to these light-eyed birds may be subject to some question, but to me it appears better, for the present at least, to call them *alleni*, on the basis principally of the light-colored eye. Burleigh [35] has identified these coastal birds of North Carolina as *canaster* and has written me that he considers this to be the proper name to be applied to them. *P. e. canaster* at best is an intergrade toward *alleni* as indicated by the reduced white on the outer rectrices. Its principal definite peculiarity is in the paler brown of the sides and flanks. The iris is red like that of *erythrophthalmus*, though where *canaster* reaches *alleni* in the south we may expect paler-eyed birds. It hardly seems to me desirable to place the coastal birds with light eyes and dark brown flanks and sides with *canaster*, as in so doing we use this name for birds with two definite characters of another race.

It may be added that apparently it is this intermediate white-eyed group here allocated under *alleni* that Koelz recently has named *rileyi* from the coast of Georgia.[36] I do not feel, however, that this group of intermediates can be properly segregated under a distinct name without more evidence.

At Southport this is the breeding form, specimens being taken on May 11 and 18. Three males, with wing measurements of 80.3, 82.3, and 85.8 mm., average a little large but have the white tips on the tail small. A female is nearly typical, as the wing measures 72.4 mm., and the forepart of the body has a definitely grayish cast. It was somewhat of a surprise to get light-eyed towhees 7 miles southeast of Rockingham in Richmond County, indicating the influence of the southern bird coming in from the south along the valley of the Pee Dee River. These birds are a little large, a male having the wing 85.0 and a female 83.0 mm., but the white on the tail is not extensive and the female is distinctly dark and grayish. Though not typical they are definitely to be placed with *alleni*. It was also unexpected to find this same intermediate type of bird near Greenville on November 4 and 9, four males having definitely light eyes though averaging a little large, with the white on the tail more extensive. Wing measurements range from 80.1 to 89.3 mm. Other

[35] Auk, 1937, p. 459.

[36] *Pipilo alleni rileyi* Koelz, Proc. Biol. Soc. Washington, vol. 52, July 22, 1939, p. 121 (Brunswick, Ga.).

fall birds were taken at Engelhard on October 20, Mansfield on November 16, and Morehead City on November 24.

PASSERCULUS SANDWICHENSIS SAVANNA (Wilson): Eastern Savannah Sparrow

This common wintering bird from the north was taken in spring near Weeksville on April 27. There are also two in the National Museum that I collected near Manteo on Roanoke Island on April 21, 1935.

In fall Perrygo found this race common, mainly in the coastal area, specimens being taken as follows: Engelhard, October 23; Stumpy Point, October 20, 21, 23 and 27; Lake Landing, near Lake Mattamuskeet, October 28; Fairfield, October 28; Greenville, November 6; near Beaufort, November 14 and 15; Williston, November 16 and 17; Morehead City, November 22; Marshallberg, November 23; and Atlantic, November 25. There is some variation toward *labradorius* in occasional specimens in this series.

PASSERCULUS SANDWICHENSIS LABRADORIUS Howe: Labrador Savannah Sparrow

This very darkly colored northern subspecies does not seem to have been reported previously from North Carolina, but its occurrence as a migrant is to be expected. The present collection contains seven specimens taken as follows: Engelhard, October 13; Stumpy Point, October 27; Greenville, November 6; about 6 miles northeast of Beaufort, November 14 and 15; and near Atlantic, November 25. Some of these are somewhat intermediate toward *P. s. savanna.* It will be interesting to learn more of the occurrence of this race whose characters have not until recently been fully understood.

There is still another form, *Passerculus sandwichensis oblitus*, that has been recorded from the State, a race marked by gray color with a reduction of brown, of which Perrygo did not obtain samples.

AMMOSPIZA CAUDACUTA CAUDACUTA (Gmelin): Sharp-tailed Sparrow

Specimens were obtained at Beaufort on November 14 and 15.

AMMOSPIZA CAUDACUTA DIVERSA (Bishop): Southern Sharp-tailed Sparrow

One was collected near Beaufort on November 17. This race, described by Bishop [37] from Roanoke Island though not recognized in the fourth edition of the A. O. U. Check-list, is easily told from other races by its definitely darker coloration above. Below the sides and breast are heavily streaked. It breeds from North Carolina north to Maryland.

[37] *Ammodramus caudacutus diversus* Bishop, Auk, 1901, p. 269 (Wanchese, Roanoke Island, N. C.).

AMMOSPIZA CAUDACUTA NELSONI (Allen): Nelson's Sparrow

Near Southport specimens were secured on May 10 and 17, the late dates being interesting in view of the long migration that this race makes to its interior nesting grounds. One of the skins taken on May 10 is very slightly paler than the others and shows some approach to the intermediate type that Todd has recently described under the name *altera*. In fall, one was shot 6 miles northeast of Beaufort on November 14, an indication that Nelson's sparrow may possibly winter in the coastal area.

POOECETES GRAMINEUS GRAMINEUS (Gmelin): Eastern Vesper Sparrow

At 4,500 feet elevation on Elk Knob, 7 miles north of Boone, these sparrows were taken on July 17, 18, and 19. One was collected near Engelhard on October 24. On June 9, 1917, I observed two between Grove Hill and Warrenton, near the highway.

CHONDESTES GRAMMACUS STRIGATUS Swainson: Western Lark Sparrow

On October 23 an immature female was taken 8 miles southwest of Stumpy Point in Dare County. This stray from the west may be identified at a glance by its pale dorsal color with restricted black streaks and the light shade of brown on cheeks and forecrown.

AIMOPHILA AESTIVALIS BACHMANI (Audubon): Bachman's Sparrow

Near Southport three specimens were taken on May 12 and 15.

JUNCO HYEMALIS HYEMALIS (Linnaeus): Slate-colored Junco

An abundant winter resident. In fall the first one was taken at Stumpy Point on October 17. Others were secured at Greenville on November 6 and at Morehead City on November 24.

JUNCO HYEMALIS CAROLINENSIS Brewster: Carolina Junco

Near Franklin these juncos were taken on Rocky Bald at 5,000 and 5,100 feet on June 20 and 23, the specimen on the latter date being a fully grown juvenile. They were seen at 4,500 and 5,000 feet on Rocky Ridge in this same region on June 21 and 23. Others were recorded near Hayesville at 3,500 and 3,700 feet on June 27 and 30 and at 4,100 feet on Standing Indian Mountain on July 1. An adult female was collected at 4,000 feet near Highlands on July 5, and other specimens were secured at 4,800 to 5,500 feet on Elk Knob near Boone on July 10 and 11.

SPIZELLA PASSERINA PASSERINA (Bechstein): Eastern Chipping Sparrow

The quiet but attractive chipping sparrow is represented by specimens as follows: Murphy, June 9 and 10; Wadesboro, May 26 and 27; Reidsville, September 22; Raleigh, May 8; Roseboro, May 2; Clinton, May 3; and Southport, May 18.

SPIZELLA PUSILLA PUSILLA (Wilson): Eastern Field Sparrow

The specimens of this widely distributed bird as expected all pertain to the typical form. Records are as follows: Murphy, June 10; near Hayesville (juvenile), June 27; Bluff Mountain, 4 miles west of West Jefferson, July 15; Statesville, October 3 and 4; Wadesboro, May 27; Rockingham, May 31; Reidsville, September 25; Greenville, November 9; Engelhard, October 23; and South Mills, April 17 and 18.

ZONOTRICHIA ALBICOLLIS (Gmelin): White-throated Sparrow

In spring the white-throat was taken at South Mills on April 18, near Weeksville on April 27, at Clinton on May 3, and in the vicinity of Roseboro on May 6. The fall migration began with one secured on October 7 on the Catawba River 10 miles southwest of Statesville. Others were obtained at Greenville, November 6 and 8, and Morehead City, November 24.

PASSERELLA ILIACA ILIACA (Merrem): Eastern Fox Sparrow

This fox sparrow, migrant from the north, was taken near Greenville on November 6 and was seen in the same locality on November 10.

MELOSPIZA LINCOLNI LINCOLNI (Audubon): Lincoln's Sparrow

In the edge of the Dismal Swamp, 7 miles west of South Mills, an adult female was collected on April 14. One was observed near Sunbury in Gates County on April 19. An immature female was shot on Troublesome Creek, 7 miles south of Reidsville, on September 23.

MELOSPIZA GEORGIANA GEORGIANA (Latham): Eastern Swamp Sparrow

Swamp sparrows were taken in spring near South Mills on April 17 and 18 and were seen near Sunbury on April 19. In fall they were common at Engelhard by October 17, specimens being taken on that date and on October 18 and 20. Others were obtained at Stumpy Point, October 21; Lake Landing, October 28; Greenville, November

6; Beaufort, November 15; Williston, November 16 and 21; and Atlantic, November 25.

All specimens examined are of the darker eastern race. Recently,[38] in another connection, I discussed the eastern and western forms of this bird and indicated that in my opinion both should be recognized.

MELOSPIZA MELODIA MELODIA (Wilson): Eastern Song Sparrow

The typical eastern song sparrow is a common migrant to North Carolina but is not known to nest within the State. Specimens taken by Perrygo and his assistants that are assigned to this race were obtained as follows: Catawba River, 7 miles west of Statesville, October 9; Fairfield, Hyde County, October 28; Engelhard, October 24; Greenville, November 6; Conetoe Creek, near Hassell, Martin County, November 4; near Beaufort, November 14 and 15; Bogue Island, near Morehead City, November 22; and Williston, November 16.

MELOSPIZA MELODIA ATLANTICA Todd: Atlantic Song Sparrow

An adult female was secured in Carteret County at the edge of the salt marshes 6 miles northeast of Beaufort on November 15. This race is easily distinguished by its more grayish dorsal coloration and by its heavier bill. It is the form that nests adjacent to the Atlantic beaches along the coast, and it does not range inland, being confined to those areas that feel the influence of salt water. The details of its coastal distribution and the extent (if any) to which it follows back along the shores of inlets and sounds away from the actual coast will be of interest.

MELOSPIZA MELODIA EUPHONIA Wetmore: Mississippi Song Sparrow

This is the breeding race of the elevated section of western North Carolina, a subspecies marked by darker dorsal color, and heavier, broader black and blackish markings above.

Perrygo recorded these birds at an elevation of only 1,450 feet along Persimmon Creek, 8 miles southwest of Murphy, June 8, 10, and 13, but did not collect specimens. At 3,500 feet, 12 miles east of Hayesville, three adults were taken on June 26 and a fully grown young bird on July 2. Farther north two were shot at 4,550 feet on Elk Knob, 7 miles north of Boone, on July 18, both being in juvenal plumage, and two more were taken at 3,200 feet near West Jefferson on July 14. On June 5, 1936, in company with J. J. Murray, I secured one at 2,800 feet on Big Helton Creek 1 mile east of Sturgills and another at 2,700 feet on Little Helton Creek 3 miles

[38] Proc. U. S. Nat. Mus., vol. 88, 1940, pp. 572–573.

east of the same place. Dr. Murray has sent me two from near Blowing Rock, one taken at 3,600 feet on August 5, 1937, on a tributary of the New River, and another shot at 3,400 feet 5 miles south of town near Bailey Camp on the head of the Yadkin River.

It is of particular interest to record specimens secured by Perrygo near Stumpy Point on October 17, near Engelhard on October 24, and near Greenville on November 6, since here they were migrants, away from the mountains.

PLECTROPHENAX NIVALIS NIVALIS (Linnaeus): Eastern Snow Bunting

On the beach 3 miles southeast of Marshallberg Perrygo shot two snow buntings and saw another on November 23. Two more were seen and one taken 6 miles northeast of Atlantic on November 25.

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NOTES ON SOME NORTH AND MIDDLE AMERICAN DANAID BUTTERFLIES

By Austin H. Clark

Among the most interesting problems connected with the study of the Lepidoptera are those having to do more or less directly with the migrations of many species, and of all the migratory species the one that has attracted the most attention is our common milkweed butterfly, or monarch (*Danaus plexippus*).

This butterfly ranges from far north in Canada southward throughout North and South America to Patagonia. It occurs in a number of different forms, of which only the most northern (*plexippus*) and the most southern (*erippus*) are known to be migratory, the several tropical forms being apparently sedentary and in some cases of very restricted range.

All the forms of this butterfly are much alike. But if we are to obtain a clear picture of the migrations of our common North American form (*plexippus*) and its distribution, regular or casual, in Central America and in the West Indies we must distinguish it from the local and apparently sedentary forms, the ranges of which it frequently overlaps and with some of which it intergrades.

Dr. William Schaus and John F. G. Clarke have been so kind as to permit me to study the excellent series of specimens of this species in the collection of the National Museum, including the Barnes collection. In addition to these I have studied several hundred individuals mainly from New England and from the vicinity of Washington, D. C., in my own collection; about 70 specimens from the vicinity of New Orleans, La., generously sent me by Percy Viosca, Jr.; a fine specimen

of the subspecies *megalippe* from Key West, Fla., which I owe to the courtesy of Lucien Harris, Jr., of Atlanta, Ga.; a number of specimens from eastern Virginia in the collection of the University of Richmond captured by Dr. Carroll M. Williams; and about 50 from Tahiti, which were sent me by J. Morgan Clements. Dr. Hugo Kahl, of the Carnegie Museum at Pittsburgh, Pa., and Ralph Chermock were so good as to look up for me the specimen figured by Dr. W. J. Holland in "The Butterfly Book" as *plexippus* which I had long recognized as representing the South and Central American form *megalippe*.

My interest in the milkweed butterfly was first aroused a few years ago by the capture of two very worn examples of *Danaus plexippus megalippe* in eastern Virginia. These, at the time, were regarded merely as aberrations of the common *D. p. plexippus*. Later Mr. Harris sent me a fine specimen from Key West, Fla., and Mr. Viosca sent me four others that had been taken with numerous very worn migrants of *D. p. plexippus* near New Orleans, La. I then found that *megalippe* occurs sparingly in the coastal marshes of eastern Virginia in company with the much more numerous *plexippus*.

Whether this southern form is endemic on our southeastern coast or whether it is simply a casual, swept up, so to speak, in the wave of north-bound *plexippus* in spring, remains to be determined.

Unfortunately the material available has been far too limited to permit the drawing of any but tentative conclusions regarding the number and distribution of the forms of *Danaus plexippus* occurring in northern South America and in the West Indies. No specimens are at hand from Venezuela, except from Aroa in the west, or from most of the West Indian islands. The few West Indian specimens certainly do not give, in some cases, a true picture of the status of the species in those islands that are represented. For instance, only the northern *D. p. plexippus* is represented from Cuba and from Trinidad where the prevailing local form would presumably be *D. p. megalippe* or some variant of it.

It is hoped that this paper will serve to call attention to the interest attaching to the careful working out, on the basis of adequate material, of the tropical forms of this polymorphic species.

The National Museum has recently received from C. O. Neumann, of San Antonio, Tex., a fine specimen of *Danaus cleothera*, a species not heretofore recorded from the United States, and there is another specimen of the same species, also from Texas, in the Barnes collection. This collection includes, in addition, a specimen of *Danaus jamaicensis* from Florida. J. F. G. Clarke has suggested that notices of these specimens be included in the present paper.

With these additions the number of forms in the genus *Danaus* recorded from the United States reaches a total of seven—*Danaus*

plexippus plexippus, *D. p. megalippe*, *D. berenice berenice*, *D. b. strigosa*, *D. eresimus*, *D. cleothera*, and *D. jamaicensis*. In order to facilitate the identification of these forms in localities where information on the tropical American danaids is not easily accessible, it has seemed advisable to include a key to them.

At the suggestion of Mr. Clarke the description of an interesting new species from Peru allied to *D. nivosus* is appended.

KEY TO THE NORTH AND MIDDLE AMERICAN SUBSPECIES OF DANAUS PLEXIPPUS

a^1. Larger, fore wing more than 45 mm. long; fore wing with two light spots beyond end of cell; black border of hind wing with more or fewer small white spots.

b^1. Two spots beyond end of cell on fore wing and two larger spots between these and apex light dull orange contrasting with small white spots on costal border; apical portion of fore wing with more or less dull orange; two rows of small white spots in black border of hind wing.
plexippus (pl. 71, fig. 1)

b^2. Two spots beyond end of cell on fore wing and two larger spots between these and apex white; apical portion of fore wing with little or no dull orange; small white spots in black border of hind wing obsolete or lacking except at the outer and anal angles.

c^1. Ground color of wings dull orange———— megalippe (pl. 71, fig. 2)

c^2. Ground color of wings pale lavender-brown——— tobagi (pl. 71, fig. 3)

a^2. Smaller, fore wing less than 45 mm. long; fore wing lacking the two light spots beyond end of cell; no small white spots in black border of hind wing.
portoricensis (pl. 72, figs. 3, 4)

DANAUS PLEXIPPUS PLEXIPPUS Linnaeus

PLATE 71, FIGURE 1

Range.—Trinidad, British West Indies; Cuba; Peru; from Costa Rica (San José and Juan Vinas), the Gulf coast, and southern Florida northward throughout North America to Vancouver Island, the Northwest Territories, the Red River Valley, Fort Providence (west of Great Slave Lake), Lake Athabasca, the western shore of Hudson Bay, Moose Factory (on southwestern James Bay), southern Quebec, and Nova Scotia; Bermuda; the Canary and Cape Verde Islands; casual in the British Isles and western Europe; also, as a relatively recent immigrant, from the Hawaiian Islands and eastern Polynesia westward to the Andaman Islands, southward to northern New Zealand and eastern and southern Australia, and northward to Formosa.

Specimens from tropical America examined.—MEXICO: Coatepec, 1 ♀ (William Schaus); San Juan, Veracruz, 1 ♀ (W. Schaus). COSTA RICA: San José, 1 ♂; Juan Vinas, 2,500–3,500 feet, October 1906, 1 ♂ (W. Schaus and John Barnes). PERU: No further data,

1 ♂. TRINIDAD, British West Indies. MONTSERRAT, 1 ♂ (W. Schaus). CUBA: No. further data, 1 ♂ (W. Schaus).

Notes.—This insect is extraordinarily constant throughout its enormous range, and aberrations are rare. Most of the numerous specimens from Polynesia that I have examined, all more or less worn, are unusually dull in color, but this appears to be due simply to fading in intense sunlight. Old individuals from the eastern United States and from the Gulf coast are often equally dull.

In the Old World Tropics this northern subspecies shows no tendency to assume the characters of its tropical representative (*megalippe*) in America.

Regarding *Danaus plexippus* as it appears in Central America Godman and Salvin wrote:

> Central-American specimens, as a rule, agree closely with North-American ones in having the spots toward the apex of the anterior wings tawny instead of pure white. In Nicaragua, however, and further to the southward specimens approach more nearly to the race prevalent in the north-western portions of the southern continent [*megalippe*], and have these spots white and the veins of both wings more strongly margined with black. These characters are very slight, and show a tendency to a certain type rather than a present existing definable feature; and therefore we are unwilling to separate them. Still the divergence seems to commence in Nicaragua, all specimens found to the northward belonging to the northern form [*plexippus*], whilst those to the southward generally, but not universally, belong to the southern [*megalippe*].

Dr. Marston Bates wrote that "Cuban specimens of this species * * * fall within the range of variation shown by the North American population. Specimens from other West Indian islands and from the tropical mainland have been separated as distinct choromorphs." He also said that "The apex of the forewing above is almost entirely black in some specimens, and includes several white spots; the black border of the outer margin of both wings also includes two rows of white spots, sometimes only partly developed."

From this it would appear that both *plexippus* and *megalippe*, with intergrades, occur in Cuba as well as in parts of Mexico, southern Central America, and along the southern and southeastern coasts of the United States.

Migration notes.—Our knowledge of the migrations of this butterfly is as yet very imperfect. We need many more detailed records than are available at present, especially in the southeastern portion of the country, and we need far more information regarding the assumed northward migration in the spring.

The occurrence of a definite northward migration has always seemed to me debatable. It appeared to me more likely that a few individuals succeeded in overwintering in the north and that the northern population was maintained year after year by these rather

than by the annual mass incursion of immigrants from the south. While it is possible that a few individuals may succeed in overwintering in the north, as occasionally happens in the case of *Phoebis eubule*, it seems most probable that most of the northern population each season is derived from individuals of southern origin, as is usually assumed.

Dr. Frank Morton Jones, of Wilmington, Del., and Miss Dorothy K. Cleaveland, of California, Pa., have both been so kind as to send me records of unusual interest in connection with the northward migration.

Dr. Jones writes that at Virginia Beach, Va., from April 18 to 30, 1906, throughout most days, one to three or four of these butterflies were usually in sight, flying north or northwest, some obviously seeking the larval food plant. There were many dead ones along the shore, washed up by the waves.

This note is particularly interesting and significant in view of the fact that later in the season, in summer and autumn, this is not a common insect about Virginia Beach. It also suggests an explanation for the occurrence of the form with white preapical spots on the fore wings (*megalippe*) in southeastern Virginia. Individuals of this form, which so far as known is normally nonmigratory, may join the flocks of *plexippus* in the far south where both occur.

Miss Cleaveland thus describes a flight presumably of this species seen at Tahlequah, Oklahoma, on March 9, 1928:

> Tonight about 5:30 I saw a flock of hundreds of butterflies (?monarchs) flying low over my head, due north, characteristic butterfly flutter-flying and near enough to see the lack of bodies like birds, but too far to see markings. I was on upper Delaware Street, just starting to supper from the Rosses'.
>
> This is the note, made at the time, in my bird (and other nature subjects) journal. From all appearances I felt confident at the time, and have ever since, that I saw a northward spring migratory flight of monarch butterflies. It was much smaller than fall flights I have seen, but otherwise similar. The creatures were too close to me and I am too familiar in observing nature to be mistaken in their identity as butterflies. I judged they were monarchs because of their relative size and because I have seen the monarch southward flights and know something of their habits.

Dr. Carroll M. Williams writes that in the fall of 1936 he noticed a southerly movement of this species at Richmond, Va. "The steady, yet completely scattered migration in a general southern direction was quite apparent. No hint of mass migration was visible, however."

Dr. Williams quotes from a letter from Mrs. Walton, of Clifton Forge, Va., describing a mass migration in that locality. Mrs. Walton wrote:

> During the first of October 1935 a great mass of monarch butterflies passed through the valley coming from the northeast and following the valley river [the James] and railroad. They were about 30 yards in width and 6 feet in

depth. They were flying just high enough to miss the housetops and so on down until you could even touch them. They were flying at a moderate speed and some of them would pause a second to rest; and when night came they would all rest just where darkness caught them. They were so thick in places that they seemed like a cloud passing. Some of them would dart in and out between the houses. In their flight they followed the mountain valley.

This unusual flight was the subject of much discussion locally at the time.

Driving from Washington to Alexandria, Va., along the main boulevard on September 22, 1934, I saw between 200 and 300 of these butterflies in the adjacent fields or crossing the road, flying singly or more rarely in twos or threes, occasionally in larger groups, 6 to 15 or 20 feet above ground. All were flying directly west. The light wind, as determined from weather vanes in Alexandria, was east or slightly north of east. Continuing from Alexandria to Accotink, I noticed the same phenomenon; between 200 and 300 butterflies were seen, all flying west. On September 25, 1934, between 5 and 5:30 in the afternoon on the road from Accotink to Alexandria a few butterflies were noticed, flying west as before.

Dr. Remington Kellogg has given me a note on a migratory flight that he witnessed at Fishers Island, N. Y. Under date of September 19, 1921, he wrote that for the past two days large numbers, and at times a steady procession, of large dragonflies were observed flying across the island toward the southwest. Monarch butterflies (*Danaus plexippus*) were frequently seen, though never in such large numbers as the dragonflies. He noted that winds—that is, the prevailing northwest wind—apparently have little to do with the migration of the dragonflies and added that it is easy now to understand how it is that dragonflies form such a large item in the stomach contents of the pigeon hawks, which were migrating along the same route.

DANAUS PLEXIPPUS MEGALIPPE (Hübner)

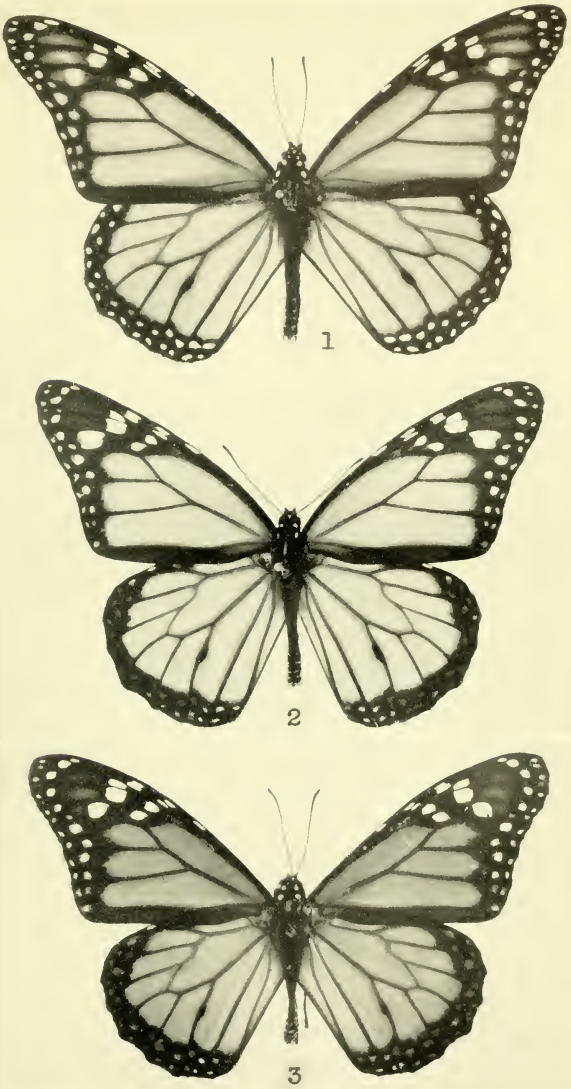
PLATE 71, FIGURE 2

Euploea Megalippe HÜBNER, Index systematicus, No. 220, 1826.

Anosia Megalippe HÜBNER, Sammlung exotischer Schmetterlinge, vol. 2, pl. 220 (7), figs. 1, 2, 1826.

Danais archippus form *nigrippus* HAENSCH, *in* Seitz, Die Gross-Schmetterlinge der Erde, vol. 5, p. 113, May 13, 1909.

Range.—From Peru (Chanchamayo) northward to Mexico (Colima) and eastward in northern South America to Venezuela (Aroa) and British and French Guiana; islands of St. Lucia and Dominica, Lesser Antilles; Puerto Rico; Dominican Republic (Samaná); coast of Texas; near New Orleans, La.; Key West, Fla.; about Currituck Sound, N. C.; coast of Virginia south of Chesapeake Bay; casual in Long Island, N. Y., and Decatur, Ill.



1. *Danaus plexippus plexippus*, male, Kendall, N. Y.; H. S. Burnett.
2. *Danaus plexippus megalippe*, male, British Guiana.
3. *Danaus plexippus tobagi*, new subspecies, male, Tobago, August 12, 1913; N. A. Wood; type specimen (U. S. N. M. No. 53526).

1, 2. *Danaus candidus*, new species, male, near Cuzco, Peru; H. A. Jaynes; upper (1) and under (2) sides; type specimen (U. S. N. M. No. 53528).
3, 4. *Danaus plexippus portoricensis*, new subspecies, male, Ciales, Puerto Rico, December 5, 1933; C. G. Anderson and A. S. Mills; upper (3) and under (4) sides; type specimen (U. S. N. M. No. 53527).

1, 2. *Danaus jamaicensis*, male, Florida: Roland Thaxter; upper (1) and under (2) sides
3. *Danaus berenice berenice*, male, Miami, Fla.; under side.
4. *Danaus berenice strigosa*, male, Brownsville, Tex.: George Dorner: under side.

1, 2. *Danaus eresimus*, female, Paso Prieto, Santiago, Cuba, October 27, 1934; upper (1) and under (2) sides.
3, 4. *Danaus cleothera*, male, Castroville, Tex., October 30, 1938; C. O. Neumann; upper (3) and under (4) sides.

Specimens examined.—Mexico: Esperanza, Colima, August 2, 1916, 1 ♂ (Leopold Conradt). El Salvador: San Salvador, October 1920, 1 ♂. Costa Rica: Juan Vinas, 2,500–3,500 feet, 2 ♀ ♀ (Schaus and Barnes). Panamá: Chiriquicito, July, 2 ♂ ♂ (Schaus and Barnes). Colombia: No further data, 1 ♂. Ecuador: Sarayaco, 3 ♀ ♀ (W. Schaus); Macas, 3,500 feet, July 1 ♂ (Mrs. James B. Rorer); Baños, 1 ♂; no further data, 2 ♀ ♀ (Prof. F. Campos R.). Peru: Chanchamayo, 1 ♂. Venezuela: Aroa, 1 ♀ (W. Schaus). British Guiana: Rockstone, Essequibo, 1 ♂ (Schaus and Barnes); no further data, 3 ♂ ♂, 1 ♀. French Guiana: St. Jean, Maroni, 1 ♂ (W. Schaus). St. Lucia: No further data, 1 ♂ (W. Schaus). Dominica: No further data, 1 ♂ (Prof. Harry Ward Foote, Yale explorations June–July 1913); July 29, 1903 1 ♀ (August Busck). Puerto Rico: Mayagüez, January 1899, 1 ♀ (August Busck). Dominican Republic: Samaná, 1 ♀. South America: No further data, 2 ♂ ♂, 1 ♀. No locality: 2 ♀ ♀. Louisiana: Rigolets Pass, St. Tammany Parish, 3 ♂ ♂, 1 ♀ (Percy Viosca, Jr.). Florida: Key West, December 18, 1936, 1 ♀ (Lucien Harris, Jr.). North Carolina: Northern end of Currituck Sound, July 4, 1938. Virginia: Back Bay, Princess Anne County, July 4, 1938; 2 miles west of Spring Grove, Surry County, June 15, 1938. New York: Long Island, September. 1 ♀. Illinois, Decatur, July 24–30, 1 ♀.

Notes.—Long ago W. F. Kirby correctly identified Hübner's figures of *Anosia megalippe* as representing the southern form of the common North American *plexippus*. He recorded the fact that whereas Hübner showed the apical spots on the fore wings as white, in *plexippus* "most of the apical spots on the fore wings are not white, but tawny." He gave the habitat of *megalippe* as the Antilles, Venezuela, Bogotá, and Ecuador. But his determination seems generally to have been overlooked, and in 1909 Dr. R. Haensch renamed this form *nigrippus*.

This is the subspecies represented by Dr. W. J. Holland in "The Butterfly Book," plate 7, figure 1. The figured specimen in the Carnegie Museum, as I have been kindly informed by Dr. Hugo Kahl and Ralph Chermock, bears the label "*Danais erippus*, South America" and was obtained from Dr. Staudinger. It agrees well with others at hand from the Guianas.

The specimens from western South America, including Venezuela, and Central America, are somewhat darker and more reddish than those from the Guianas, the West Indies, and the eastern United States, but the difference is very slight and inconsistent.

Godman and Salvin noted that three examples from St. Vincent (both windward and leeward sides) had white subapical spots, agreeing with South American specimens. They had many specimens from Dominica, all belonging "to the form prevalent in the northern parts

of South America, in which the spots in the apical portion of the primaries are purer white than in North American examples." W. J. Kaye wrote that in Jamaican and Haitian specimens the usual white spots in the apex of the fore wing are oftener than not yellowish.

As examples of intermediates between this form and typical *plexippus* the following specimens may be mentioned: A rather dark female from Jalapa, Mexico, collected by Dr. William Schaus, has the preapical spots on the fore wings pale yellowish, though the apical area is very dark; there are two complete rows of small spots in the black border of the hind wings. In a female from San José, Costa Rica, the upper preapical spots on the fore wing are white, the lower ones yellowish; the apical area is black; the spots in the border of the hind wing are obsolete, except at the anal angle. One of the specimens from Juan Vinas, Costa Rica, has both rows of white spots developed in the black border of the hind wings.

The specimen from Mayagüez, Puerto Rico, lacks the two white spots beyond the end of the cell in the fore wing; the fore wing is 52 mm. long. One of the females from "South America" is very dark.

The boundary between plexippus *and* megalippe.—In Nicaragua (Godman and Salvin), Jamaica (Kaye), Haiti (Kaye), and Cuba (Bates) and along the southern and southeastern coast of the United States *Danaus plexippus* appears to be represented by a population including individuals typical of both *plexippus* and *megalippe*, with a complete series of intergrades. In some of these areas, as in southern Central America, the *megalippe* form appears to predominate; in others, as in Cuba and the southern and southeastern United States, the *plexippus* form. The exact relation between the two forms in this intermediate region remains to be worked out.

DANAUS PLEXIPPUS TOBAGI, new subspecies

PLATE 71, FIGURE 3

Diagnosis.—Similar in all respects to *D. p. megalippe* but with the ground color of the wings pale lavender-brown.

Range.—Confined to the island of Tobago, British West Indies.

Type—Scarborough, Tobago, collected by N. A. Wood on August 12, 1913, ♂ (U.S.N.M. No. 53526).

Additional specimens examined.—TOBAGO: Scarborough, August 5, ♂, August 8, ♀; Botanic Station, August 1, ♂, July 24, ♀; The Bay, August 2, ♀; all collected by N. A. Wood in 1913.

Remarks.—This form is strikingly different from *D. p. megalippe* in the ground color of the wings, though it resembles it in all other features. In a rather rare aberration of *D. p. plexippus* (*fumosus*) the wings have the same ground color.

DANAUS PLEXIPPUS, ?subspecies

Speaking of *Danaus plexippus* as it occurs on the island of Trinidad, British West Indies, William James Kaye said "The specimens from Trinidad are very richly dark coloured and have the marginal band to the hind wing very dark and very little spotted." From this it would appear that Trinidad is inhabited by a local race allied to that on the neighboring island of Tobago. Mr. Kaye's description certainly does not apply to specimens from the mainland in Guiana, which are unusually bright.

The only specimen at hand from Trinidad represents *D. p. plexippus* and not the form mentioned by Mr. Kaye.

DANAUS PLEXIPPUS PORTORICENSIS, new subspecies

PLATE 72, FIGURES 3, 4

Diagnosis.—Resembling *D. p. megalippe* from the Guianas but smaller, the fore wing less than 45 mm. long; pair of white spots just beyond the end of the cell in the fore wing absent; two preapical spots small and pale yellowish; no white spots in the black border of the hind wing.

Range.—Known only from the island of Puerto Rico.

Type.—Ciales, north-central Puerto Rico, collected by C. G. Anderson and A. S. Mills, of the United States Bureau of Entomology and Plant Quarantine, December 5, 1933, ♂ (U.S.N.M. No. 53527).

Additional specimen examined.—No data, ♂; received from the Brooklyn Museum.

Remarks.—The small size, absence of the two light spots beyond the end of the cell, and absence of white spots in the border of the hind wing give this form a very distinctive appearance. It is, of course, possible that it may prove to be merely an abnormally marked dwarf of *D. p. megalippe*, but the fact that the two specimens at hand are quite alike would seem to indicate that it is a valid race.

A specimen of *D. p. megalippe* from Puerto Rico also lacks the two white spots beyond the end of the cell of the fore wing, and these are occasionally absent from specimens of *D. p. plexippus* taken in the southeastern United States.

DANAUS CLEOTHERA Godart

PLATE 74, FIGURES 3, 4

Localities.—TEXAS: Medina River near Castroville, Medina County, collected by C. O. Neumann on October 30, 1938, ♂; Brownsville, Cameron County, collected by Armstrong on November 17, 1933, ♂.

Notes.—The specimen from near Castroville is a rather small male with the fore wing 39 mm. long. It is rather dark and unusually well

and clearly marked on the under side of the hind wings. It resembles most closely specimens from Guatemala and from San Mateo, Costa Rica, in the National Museum collection.

The specimen from Brownsville is a slightly larger male with the fore wing 42 mm. long. It is not so contrastingly marked on the under side of the hind wings as is the specimen from near Castroville. It agrees very closely with a specimen from Honduras in the National Museum collection.

Danaus cleothera is easily distinguished from *D. eresimus*, which, according to Dr. Marston Bates, occurs in southern Florida, by the absence of the two large white spots between veins 2 and 3 and 3 and 4 on the fore wings above and by the conspicuous white borders of the veins on the hind wings beneath.

DANAUS JAMAICENSIS Bates

PLATE 73, FIGURES 1, 2

Locality.—Florida, collected by Prof. Roland Thaxter.

Notes.—The Barnes collection, now in the United States National Museum, contains a typical example of this species from Florida. The label has printed upon it the word "*Florida*," below which is written in a German hand the name "Thaxter." Presumably the specimen was collected in Florida by Dr. Roland Thaxter, professor of cryptogamic botany at Harvard University, who in his early years was an enthusiastic entomologist, and the name "Thaxter" written on the label by Dr. Herman August Hagen, who until his death in 1893 had charge of the insects in the Museum of Comparative Zoology. The label has been compared with a specimen of Dr. Hagen's handwriting, and there appears to be little doubt that the name "Thaxter" was written on the label by him.

Remarks.—Certain small pale specimens of *Danaus berenice strigosa* from Mexico approach *D. jamaicensis* so very closely as to suggest that *jamaicensis* should be considered as a subspecies of *berenice* rather than as a distinct species.

KEY TO THE DANAIDS RECORDED FROM THE UNITED STATES

a^1. Ground color of wings dull orange, veins black_____ plexippus

b^1. Preapical spots on fore wings light dull orange; apical portion of fore wing with more or less dull orange; two rows of small white spots in the black border of hind wing_____ plexippus plexippus (pl. 71, fig. 1)

b^2. Preapical spots on fore wings white or whitish; apical portion of fore wing almost wholly, or quite, black; spots in black border of the hind wing obsolete or wholly absent in central portion.

plexippus megalippe (pl. 71, fig. 2)

a^2. Wings except for black border uniform brown, dark or light.

b^1. Underside of hind wing with ground color uniform, veins black with white edgings.

c^1. Larger, fore wing more than 40 mm. long; color dark chocolate-brown. berenice

d^1. Veins on hind wing above concolorous with ground color. berenice berenice (pl. 73, fig. 3)

d^2. Veins on hind wing above edged with light gray. berenice strigosa (pl. 73, fig. 4)

c^2. Smaller, fore wing less than 40 mm. long; color light yellowish brown. jamaicensis (pl. 73, figs. 1, 2)

b^2. Underside of hind wing with ground color not uniform, having lighter and darker markings.

c^1. Fore wing above with two large submarginal white spots between veins 2 and 3 and 3 and 4; hind wing below with an arc of large, pale, inconspicuous, more or less confluent spots parallel with margin midway between cell and dark border, and with veins narrowly blackish. eresimus (pl. 74, figs. 1, 2)

c^2. Fore wing above without white spots between veins 2 and 3 and 3 and 4; hind wing below with a dark line from anterior border along end of cell and another parallel to and some distance from it, these two lines fusing at lower end of cell and running as a broad band to inner border of wing; veins in central portion of wing, except where crossing dark bands, broadly edged with white_____ cleothera (pl. 74, figs. 3, 4)

DANAUS CANDIDUS, new species

PLATE 72, FIGURES 1, 2

Description.—Upper surface: White, faintly clouded with pale buff, with a broad black border including two rows of rather large white spots, the veins on the hind wings very dark brown narrowly edged with gray, those on the fore wings edged with lighter brown; cell of fore wing brown with a broad light streak near the lower border; between veins 1 and 2, 2 and 3, and 3 and 4 are three large subcircular white spots occupying the entire width of the interspace, delimited interiorly by a faint clouding of the background; there is a similar spot, situated nearer the margin of the wing, between veins 4 and 5; above this last and in line with the three preceding spots are two somewhat smaller elongated spots; between these and the end of the cell are two approximately similar spots, and just within the end of the cell a triangular or broadly chevron-shaped spot; above the cell spot and each of the two pairs of spots beyond is a white dash on the costal border. *Lower surface*: Fore wing with the cell brown, and the interspaces between the veins brown as far as the submarginal spots, with a large broadly chevron-shaped white spot between the bases of veins 2 and 3, a small spot just above this, a long dash along the inner portion of vein 2 which is continued inward along the lower border

of the cell half way to the wing base, and a similar dash just above vein 1; hind wings faintly tinged with dull yellowish, the veins blackish brown.

The sexes are similar.

Type.—Near Cuzco, Peru, collected by H. A. Jaynes, of the U. S. Bureau of Entomology and Plant Quarantine, now stationed at Jeanerette, La., ♂ (U.S.N.M. No. 53528).

Additional specimen examined.—A female, from the same locality, also collected by Mr. Jaynes.

Remarks.—This species is allied to *D. nivosus*, of which it may eventually prove to be merely an extreme form. It is easily distinguished from *nivosus* by the almost pure white hind wings and the much whiter fore wings on which the submarginal white spots between vens 1 and 2, 2 and 3, and 3 and 4 are larger, the first two reaching the dark border; the spots in the dark border of the wings are also larger, and the inner row is complete, the spots in this row being as large as those in the outer row.

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A NEW GENUS OF PSAMMOCHARID WASP FROM CHINA

By P. P. Babiy

When looking through the undetermined Psammocharidae in the United States National Museum I found several specimens of an apparently undescribed form that drew my interest. I had already had a specimen of this species under scrutiny in the American Museum of Natural History in New York, but had hesitated to describe it from only one sex. In Washington I found both sexes represented. This is the first record of the subfamily Notocyphinae from the Asiatic continent. The general appearance is that of *Notocyphus*, but the labrum is not fully extended, a character that made me hesitate at first to attribute it to the subfamily.

Subfamily Notocyphinae

SINOTOCYPHUS, new genus

The labrum is broader than long and rounded below as in *Minotocyphus* Banks, the other genus of the subfamily, described from the Philippines. The malar space is exceedingly narrow; the eyes are not hairy. The antennae are slender. The head basis is more flattened than in *Notocyphus*. The tips of the mid and hind tibiae show the row of small subequal parallel spines—a character of the subfamily—but a dense pubescence makes them less conspicuous. In the male the abdomen is rather flattened. The male genitalia show a quite different construction from those of *Notocyphus*. Unfortunately no description of the male genitalia of *Minotocyphus* is available. The small spines in pits so prominently mentioned for *Minotocyphus* are present on the front coxae as well as the mid and hind legs. The

claws of the female are bifid; in the male there is a hairy plate where otherwise the inner tooth is situated.

Genotype.—Sinotocyphus chinensis, new species.

SINOTOCYPHUS CHINENSIS, new species

FIGURE 23

Black with extensive yellow markings on head and thorax; wings of female yellow with fuscous apical half, of male fuscous with hyaline base. The entire insect shows a brownish-golden appressed pubescence, with a few short hairs, which are pale on the head and lower pronotum and dark at the apex of the abdomen.

Female.—Head black, with yellow vertex, front, face above the antennae, and narrow outer orbits; a yellow line between the antennae as well as one on each side of base of antenna leading down to base of clypeus. Two small yellow spots on the base of the clypeus in two of the specimens show that a certain amount of variation in coloration is to be expected, indicated also by the more or less brownish tinge on clypeus and labrum. Mandibles brown; antennae chestnut-brown below, fuscous above. Pronotum on its upper surface yellow with exception of shoulders, one specimen showing considerable shrinkage of yellow area; on one specimen a prolonged rectangular yellow spot on mesonotum reaching from the hind border two-thirds of its length in front; scutellum and postscutellum in this case also partly yellow. In other specimens all those yellow spots gradually disappear, and one specimen shows no trace of them. Abdomen and legs black with traces of brown on the legs, the front legs especially on the inner side showing a light-brown coloring. Wings fuscous-yellow with brown veins, the darker part of the front wing fading into the yellow of the base gradually, reaching into the first cubital cell and the apical tip of the first discoidal cell and covering all the third discoidal cell. In the hind wing the darkening is less pronounced; it fills the apical half, merging very gradually with the yellowish base of the wing.

Face rather long and narrow; eyes slightly emarginate; vertex elevated behind ocelli, which are placed high up on front; hind ocelli nearer to eyes than to each other; front ocellus somewhat larger than the two others and separated from them by its diameter. Middle part of front above base of antennae elevated and cut by a deep narrow line, which reaches upward from between the antennae half the distance to lower ocellus. Clypeus twice as broad as high, truncate at apex; labrum more than twice as broad as long, rounded; mandibles with a very inconspicuous small tooth on their inner side far back. Pronotum moderately prolonged, curved forward with mesonotum; scutellum and postscutellum elevated; propodeum as long as pronotum,

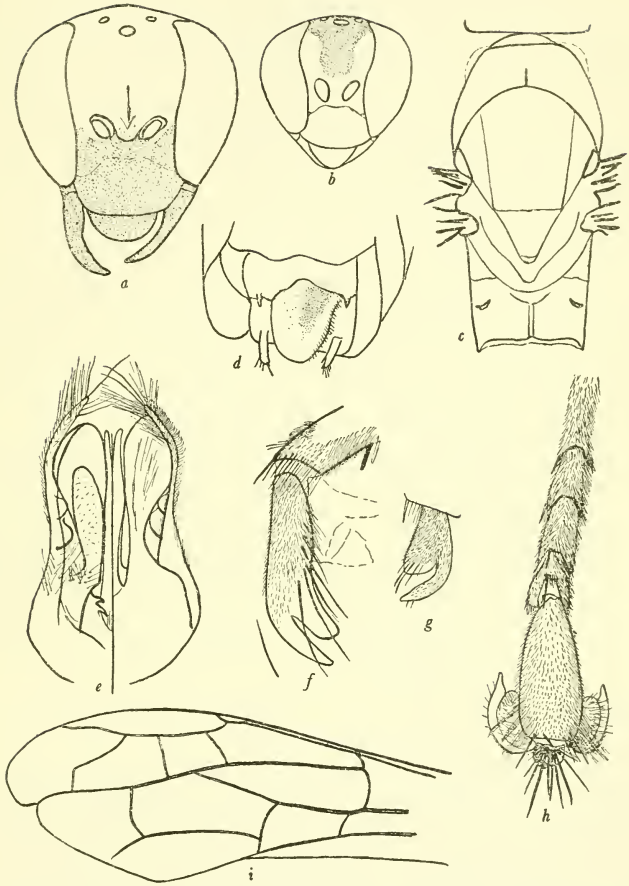

FIGURE 23.—*Sinotocyphus chinensis*, new species: *a*, Head of female; *b*, head of male; *c*, thorax of female from above; *d*, apical sternites of male; *e*, male genitalia (half each of dorsal and ventral views); *f*, claw from hind leg of female; *g*, claw from hind leg of male; *h*, tarsi of front leg of male; *i*, front wing of female.

horizontal, with a distinct median line, deeply cut out behind, the sides forming rounded vertical lobes; stigma situated at about half the length of propodeum. Abdomen rather long, longer than head and thorax together, distinctly compressed, strongly so on the apex; a slight trace of a depressed line on second sternite near its base. Front coxae as well as middle and hind tibiae and femora show small spines in pits; there are no other spines on the long and slender legs; long spur of hind tibia somewhat longer than half of the basitarsus. In the fore wing the radial cell conspicuously long and slender; other venation as the figure indicates. Anal vein in hind wing interstitial with cubital.

Length, 14–24 mm.; wing spread, 29–40 mm.; length of fore wing, 13–19 mm.

Male.—Head black; yellow areas: Face below and between antennae, clypeus, labrum, a triangular spot at base of mandible, broad inner orbits not reaching the vertex and narrow outer orbits, posterior border of pronotum and two large spots on its sides, seventh sternite, front coxae on their outer side, and front legs with exception of a black stripe on upper side. Fore wings fuscous with hyaline base; hind wings hyaline with fuscous apical half.

Head shorter and broader than in female; eyes more sinuous in the middle; labrum more tipped and vertex not elevated behind ocelli; distance between hind ocelli much greater than their distance from the eyes. Pronotum and propodeum less prolonged, propodeum showing a considerable amount of silvery pubescence. Abdomen flattened, especially at apex, where fourth and fifth sternite show some longer dark hairs. Fifth and sixth sternite emarginate in the middle. Subgenital plate prolonged and rounded with an elevation in the middle at the base, which gradually disappears against the apex. Genitalia as shown in figure.

Length, 12–12.5 mm.; wing spread, 23–24 mm.; length of fore wing, 11–12 mm.

Type locality.—Suifu, Szechwan, China.

Holotype, allotype, and paratypes.—U.S.N.M. No. 54066. Holotype: Female, Suifu, Szechwan, China, D. C. Graham, collector. Allotype: Male, Szechwan, China, September 12–22, 1934. Paratypes: Female, Maan Chi Shaon, China, October–December 1921, C. W. Howard, collector; female, Soochow, China, N. Gist Gee, collector; female, Kuanshien, Szechwan, China, August 6–7, 1934, 3,000 feet, D. C. Graham, collector; male, Kuanshien, Szechwan, China, September 12–22, 1934, 3,000 feet, D. C. Graham, collector; female, Yen-ping, China, July 26, 1917. The last paratype listed, from Yen-ping, is deposited in the American Museum of Natural History.

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TWO NEW SPECIES OF CECIDOMYIID FLIES FROM PHLOX

By Charles T. Greene

The two new species of Diptera described below were reared by Dr. C. R. Neiswander, of the Ohio Agricultural Experiment Station, in Ohio from phlox that had been severely damaged. As a result of experiments conducted by Dr. Neiswander it was discovered that the new species of *Hyperdiplosis* was responsible for the injury. The other new species, which belongs in the genus *Lestodiplosis*, is undoubtedly a predator on the former.

Genus HYPERDIPLOSIS Felt

HYPERDIPLOSIS PHLOX, new species

Male.—Length 1 to 1.25 mm. Antenna nearly twice the length of the body, binodose, brown, yellowish basally; with 14 segments, the fifth segment with three circumfili (fig. 24, *B*), the middle circumfilus slightly shorter than the other two; the basal node rounded, the other nearly one and one-half times as long as its diameter, slightly constricted in the middle; the stems varying in length from three to three and one-half times as long as their diameter. Palpus pale yellow, slender, quadriarticulate; segments of nearly equal length. Face pale, almost white. Mesonotum light amber, shining, in certain lights with a very delicate whitish pruinosity on the sides, forming two narrow longitudinal stripes; scutellum pale yellow;

metathorax darker, infuscated with brown. Abdomen pale, dull yellow, the dorsum with a brownish infuscation on the second segment and also a little before the apex. Genitalia (fig. 24, *A*) : Basal segment of clasper large, brown, its length slightly more than twice its greatest width; inner edge uneven, with a large concavity in the apical third; two large bristles of unequal length inside, just below the apical joint; dorsal plate broad, with a broad V-shaped emargination forming two broad lobes each having a deep rounded emargination that forms two small lobes, the outer one more pointed and slightly lower; the ventral plate somewhat elliptical, the apical end with a deep rounded emargination forming two small, slightly oblique lobes; the style very narrow, rounded at the tip and considerably longer than the basal segment of the clasper. Wing (fig. 24, *D*) hyaline, costa brown: three long veins; petiole at base of wing long and narrow. Halteres dark brown, base of the stem pale yellow. Legs nearly uniformly dark brown, femora paler ventrally.

Female.—Length 1 to 1.25 mm. Very similar to the male. In some specimens the yellow of the abdomen is a little deeper in color and sometimes faintly reddish. Antenna with 13 segments, the fifth (fig. 24, *C*) with the stem about three times as long as its diameter; basal enlargement twice as long as its diameter; the circumfili pale, more distinctly marked in some specimens than in others. Ovipositor a little longer than broad, the terminal lobes pale.

Last-instar larva (fig. 24, *E*, ventral view; *F*, dorsal view).—Length 1.75 to 2.5 mm. Body composed of 12 segments in addition to a small, slightly rounded, retractile head; anterior three segments, especially the first and second, tapering sharply anteriorly; anterior two segments much shorter than the following; posterior two segments tapering slightly toward the caudal end. Color white. Breast plate Y-shaped, flat, pale amber-yellow; each side of the fork broad, with a slight narrowing near the base; main stem slightly constricted below the fork. Antenna cylindrical, about twice as long as its diameter; located on a broad, flattened tubercle. Posterior segment with a large pointed tubercle at each posterior angle; below these a pair of smaller tubercles that are less widely separated than the others; on each side of the last segment, anterior to the large tubercle, a pair of pale bristles. The ventral side of segments 2 to 10 each with an ambulatory area having minute spines, arranged in about four transverse rows.

Type locality.—Chagrin Falls, Ohio, June 20, 1938. Other specimens are from Chagrin Falls, Ohio, June 20 to August 29, 1938, August 8 to September 19, 1939; Wooster, Ohio, June 29, 1936, August 9 to 29, 1937, June 25 to July 4, 1938; Canton, Ohio, July 1

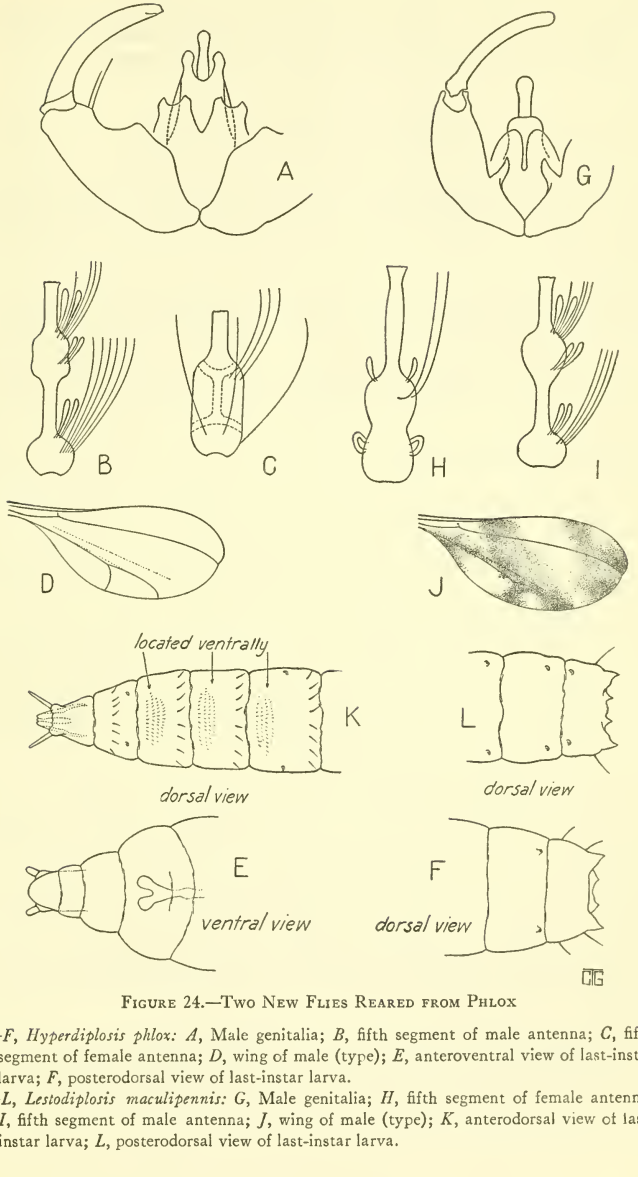

FIGURE 24.—TWO NEW FLIES REARED FROM PHLOX

A–F, Hyperdiplosis phlox: A, Male genitalia; *B,* fifth segment of male antenna; *C,* fifth segment of female antenna; *D,* wing of male (type); *E,* anteroventral view of last-instar larva; *F,* posterodorsal view of last-instar larva.

G–L, Lestodiplosis maculipennis: G, Male genitalia; *H,* fifth segment of female antenna; *I,* fifth segment of male antenna; *J,* wing of male (type); *K,* anterodorsal view of last-instar larva; *L,* posterodorsal view of last-instar larva.

to October 2, 1939. All the material was reared from phlox by Dr. C. R. Neiswander. Described from numerous specimens.

Type male and 74 paratypes.—U. S. N. M. No. 54187.

Genus LESTODIPLOSIS Kieffer

LESTODIPLOSIS MACULIPENNIS, new species

This species is superficially very similar to *Hyperdiplosis phloxæ* and was reared from the same plant material. The principal differences are found in the wing, the female antenna, and the male genitalia.

Male.—Length 1.25 mm. Differs from *Hyperdiplosis phloxæ* in the following characters: Antenna about twice the length of the body, binodose, mostly pale yellow, with 14 segments, the fifth segment (fig. 24, *I*) with three circumfili; the middle circumfilus shorter than the other two; the basal node rounded, the upper and lower stems about three times as long as their diameter. Abdomen pale, dull yellow, darker on the basal third. Genitalia (fig. 24 *G*): Basal segment of clasper large, three times as long as its greatest width; the apical half much thicker than the basal portion; a pointed projection on the inner side just below the middle; dorsal plate broad, very deeply and very narrowly emarginated; each lobe simple and elliptical in form; ventral plate broad and rounded, with the apical edge nearly straight; style narrow, broadly round at the apex, slightly longer than the basal segment of the clasper. Wing (fig. 24, *J*) with the basal petiole shorter than in *phloxæ;* color pale luteous; black hairs forming two diagonal crossbands, one in the middle and the other at the apical portion of the wing; much darker areas at the apices of all the veins and indefinite spots before and beyond the apex of the third vein. Halteres pale yellow. Legs nearly uniformly dark brown, femora paler ventrally.

Female.—Length 1 to 1.25 mm. Like the male except for the following differences: Antenna with 13 segments, the fifth segment (fig. 24, *H*) with the stem as long as the basal enlargement about six times as long as its greatest diameter and slightly narrower at the base and near the outer end; basal enlargement twice as long as its greatest diameter, somewhat constricted in the middle; two circumfili, the upper one in narrow loops; the lower loops much broader and somewhat triangular in shape. Palpus quadriarticulate; basal segment one-half as long as the second; segments 2 to 4 of equal length.

Last-instar larva (fig. 24, *K*, *L*).—Length 1.75 to 2.5 mm. Body composed of 12 segments in addition to the small head, which tapers sharply anteriorly; first thoracic segment tapering slightly toward

the head; posterior two segments tapering slightly toward the caudal end; color in life orange to reddish; breast plate absent. Antenna slender, cylindrical, tapering anteriorly, about six times as long as its basal diameter, located on a small, rounded tubercle. Posterior segment with a large pointed tubercle on each posterior angle; below these a pair of smaller tubercles that are less widely separated than the others; a large bristle on each side of the last segment, anterior to the large tubercle. Segments 1 to 11 each with a dorsal, transverse row of eight bristles. The ventral side of segments 2 to 10 each with an ambulatory area having minute spines, arranged in about four transverse rows.

Type locality.—Chagrin Falls, Ohio, August 10, 1939. Other specimens from Wooster, Ohio, August 9 to 12, 1937; Chagrin Falls, Ohio, August 24, 1938. All reared from phlox by Dr. C. R. Neiswander.

Type male and 5 paratypes.—U.S.N.M. No. 54188.

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