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THE ACADEMY OF NATURAL SCIENCES
LOGAN SQUARE
1920

The Academy of Natural Sciences of Philadelphia,
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I hereby certify that printed copies of the Proceedings for 1919 were mailed as follows:

Pages	1–16	May 20, 1919.
"	17–120	June 13, 1919.
"	121–152	September 11, 1919.
"	153–168	October 15, 1919.
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"	207–318	March 13, 1920.

EDWARD J. NOLAN, *Recording Secretary*,
Per WILLIAM J. FOX, *Acting Editor*.

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PROCEEDINGS

OF THE

ACADEMY OF NATURAL SCIENCES

OF

PHILADELPHIA.

1919

January 21.

The President, JOHN CADWALADER, A.M., LL.D., in the Chair.

Twenty-seven persons present.

DR. WITMER STONE made a communication on the plants of Cape May. (No abstract.)

DR. HENRY A. PILSBRY spoke of the results of his collecting, with Mr. J. H. Ferris, mollusks of southern Arizona. (No abstract.)

The following was ordered to be printed:

NOTES ON SYNENTOGNATHOUS FISHES

BY HENRY W. FOWLER.

The fishes embraced in this order are commonly known as bill-fishes or green-gars, sauries, half-beaks and flying-fishes. With one exception, as noted below, all are contained in the collection of the Academy.

BELONIDÆ.

At least two distinct sub-genera occur in the limits of *Belone*, Cuvier. *Raphistoma* Rafinesque, as pointed out by Regan, may be accepted as a nomen nudum.

Sub-genus BELONE Cuvier.

Body compressed behind vent, without lateral keels. Gill-opening extends well forward. Gill-rakers moderate, lanceolate.

Belone belone (Linnæus).

Eight from the Mediterranean.

PLATYBELONE new sub-genus.
Type *Belone platyura* Bennett.

Body broadly depressed behind, with strong lateral keels. Gill-opening rather restricted. Gill-rakers short points. (πλατύς, broad, with reference to the caudal peduncle; *Belone*.)

Belone platyura Bennett.

Two Hawaiian examples from J. K. Townsend. These examples are of interest historically, as among the first of the species obtained in the Hawaiian Islands, several years before Valenciennes described it as *Belone carinata*.

B. trachura Valenciennes also belongs in the present sub-genus.

STRONGYLURA Van Hasselt.

Bull. Sci. Nat. Férussac (2 sect.) II, 1824, p. 374. Type *Strongylura caudimaculata* Van Hasselt.

Strongylura Van Hasselt thus antedates *Tylosurus* Cocco,[1] and though without diagnosis is clearly based on the easily recognized

[1] Giorn. Sci. Lett. Sicilia, XLII, 1833, No. 124, 18.

figure and account by Russell. *S. caudimaculata* Van Hasselt was deliberately proposed to avoid tautonomy and replace *Belone strongylura* Van Hasselt of the preceding year, while both specific names gained usage through the works of Bleeker. The species with large scales and blunt caudal fin may then remain in the subgenus *Strongylura* Van Hasselt, while the larger and more finely-scaled species with forked caudals may contain *Tylosurus* Cocco.

Strongylura strongylura (Van Hasselt).

Philippines.

Strongylura notata (Poey).

A large series from Florida (Stuart, Boca Grande, Marquesas Keys, Big Pine Key, Hailer's Rock, Boca Chica Key, Bayport, West Palm Beach and Key West).

Strongylura scapulare (Jordan and Culver).

Panama.

Strongylura timucu (Walbaum).

Colon, and Santo Domingo, W. I.

Strongylura exile (Girard).

San Diego, Cal.

Strongylura peruana new species. Fig. 1.

Head, from tip of frontal process, $5\frac{1}{4}$; depth $1\frac{1}{3}$ in postocular; D. II, 12; A. II, 14; P. I, 10; V. I, 5; scales about 350 from opposite upper hind edge of gill-opening to caudal base medially; about 235 scales between occiput and dorsal origin; eye $2\frac{3}{4}$ in postocular; interorbital $2\frac{2}{5}$; first branched dorsal ray about $1\frac{1}{2}$; first branched anal ray about $1\frac{1}{4}$; pectoral 1; ventral $1\frac{3}{4}$.

Body elongate, moderately slender, cylindrical. Caudal peduncle cylindrical, or about broad as deep, least depth $1\frac{1}{2}$ in eye, and with slight keel each side behind for lateral line.

Head level above, flattened sides narrowly constricted below, width $1\frac{3}{5}$ in postocular. Jaws not completely closing basally, snout width at eyes long as frontal process. Eye little ellipsoid, close to upper profile though not impinging. Maxillary well exposed, reaches beyond front of eye or half way in front part of iris to pupil. Band of outer teeth in jaws very fine and narrow, and larger inner well spaced. No teeth on mouth roof. Tongue

elongate, pointed, free. Triangular nasal cavity about long as pupil. Interorbital and top of head with rather shallow concave median depression, not extending back to occiput. Few ridges or striæ on bones of head above. Opercle width about wide as cheek.

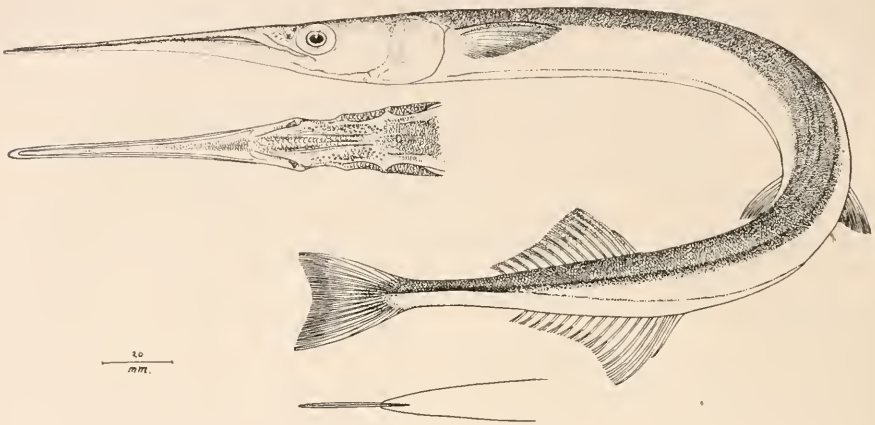

Fig. 1.—*Strongylura peruana.*

Gill-opening extends forward to front pupil edge. No rakers. Gill-filaments $1\frac{1}{2}$ in eye. Isthmus long narrow frenum.

Scales small, uniform, each with about 18 to 20, coarse complete circuli. Maxillary, sides of mandible basally, opercles, and most of head covered with fine scales. Cheek with about 30 rows of scales behind eye to preopercle ridge. Front of dorsal and anal basally with small scales. Lateral line with short branch to pectoral base, and behind extends up midway along caudal peduncle side on keel to caudal base.

Dorsal inserted about last fourth between hind eye edge and caudal base, front rays elevated as lobe. Anal similar, inserted little before dorsal. Caudal broad, hind edge (damaged) emarginate or with lower lobe slightly longer. Pectoral inserted little high, pointed, and uppermost or simple ray enlarged. Ventral rather obtuse, inserted about midway between hind preopercle edge and caudal base. Vent about half an eye-diameter before anal.

Color in alcohol dull, brownish generally, sides and below paler or with brassy to silvery reflections. Narrow brassy-leaden streak

along side, most distinct at front of dorsal and anal. Iris pale. Fins all dull brownish.

Length (beak broken) 310 mm.

Type, No. 21,924, A. N. S. P. Callao Bay, Peru. Prof. James Orton. Collection of 1876–1877. Prof. E. D. Cope.

Only the type known. Allied with *Strongylura exile*, but differs in the shorter preorbital, less notched maxillary, slightly fewer branched dorsal and anal rays and larger scales. (Named for Peru.)

Strongylura marina (Walbaum).

A large series from Massachusetts (Wood's Hole); New Jersey (Barnegat, Great Bay, Atlantic City, Ocean City, Sea Isle City, Corson's Inlet, Newbold's Island, Florence and Duck Island); Pennsylvania (Delaware River, Philadelphia, Torresdale, Susquehanna River, Peach Bottom); Maryland (Chesapeake Bay, Elk Neck, Pool Creek, Charlestown, Ocean City); and Florida (Bayport and Boca Grande).

Strongylura leiuroides (Bleeker).

Philippines.

Strongylura anostomella (Valenciennes).

Hakodate, Japan.

Strongylura leiura (Bleeker).

Padang, Sumatra.

Strongylura raphidoma (Ranzani).

Kingston, Jamaica, and Culebra, Porto Rico.

Strongylura acus (Lacépède).

A series of all ages: Massachusetts (Nantucket); New Jersey (Sea Isle City and Ocean City); Pennsylvania (Susquehanna River); Mediterranean.

Strongylura coromandelica (Van Hasselt).

Padang, Sumatra.

Strongylura crocodila (Le Sueur).

Padang, Sumatra. Although I have only the present example from the East Indies, it differs slightly from one I identified as *Tylosurus choram* (Rüppell) obtained in the Camaroons. The

Padang fish differs in the maxillary reaching the pupil, gill-opening extending forward about to front pupil edge, longer hind dorsal rays and much finer scales, though the last structurally identical.

Xenentodon cancila (B. Hamilton).

Ganges River, India.

Potamorrhaphis guianensis (Schomburgk).

Peruvian Amazon and Rupununi River. *Potamorrhaphis eigenmanni* Ribeiro[2], from Paraguay, has D. 28, A. 25 and scales 136 to 150. My examples reveal an extent of variation not quite so low as these formulas, other characters well within the limits, and still others exceeding even some Dr. Ribeiro gives for *P. guianensis*.

Ablennes hians (Valenciennes).

St. Christopher's Island, British West Indies.

SCOMBERESOCIDÆ.

Scomberesox saurus (Walbaum).

Newport, R. I.; Cape Cod, Mass. Three from the Atlantic in the Bonaparte Collection.

HEMIRAMPHIDÆ.

Chriodorus atherinoides Goode and Bean.

Marquesas Keys and Hailer's Rock, Florida.

Hyporhamphus pacificus (Steindachner).

Hawaiian Islands.

Hyporhamphus neglectus (Bleeker).

Padang, Sumatra.

Hyporhamphus unifasciatus (Ranzani).

Colon, Canal Zone; St. Martin's, W. I.; Trinidad; Boqueron, Porto Rico; West coast of Mexico; Los Animas Bay, Lower California. Provisionally this species may be retained as the short-billed form, though I have but one example from the Boqueron lot and another from the west coast of Mexico as exceptions. None of the young appear to have longer beaks than the adults.

[2] Arch. Mus. Nac. Rio Janeiro, XVII, 1915, p. 13.

Hyporhamphus roberti (Valenciennes).

Newport, Rhode Island; Corson's Inlet, New Jersey; Volusia, St. Augustine, Key West and Point Puellas, West Florida. In most examples, or excepting the largest, which from Rhode Island, and another from Key West, the ventral origin is about midway between preopercle edge and caudal base. In the exceptions it is about midway between hind eye edge and caudal base. All, however, have the beak over twice the head length as measured after front eye edge.

Hyporhamphus kurumeus Jordan and Starks.

Chikugo River at Kurume, Japan.

EULEPIDORHAMPHUS new sub-genus.

Type *Hemiramphus sajori* Schlegel.

Distinguished from the sub-genus *Hyporhamphus* Gill by its very small scales, 90 to 100 in lateral series. (Εὖ, well; λεπίς, scale; ῥάμφος, beak.)

Hyporhamphus sajori (Schlegel).

Hakodate and Kushiro, Japan.

Hemiramphus intermedius Cantor.

Victoria, Australia. Though Günther says[3] dorsal and anal scaleless, and Macleay[4] apparently copies, McCoy[5] shows the dorsal and anal scaleless. The last, however, indicated the dorsal entirely with broken or somewhat dotted horizontal dark lines, which are not clearly intended as scales. In my examples the membranes of the soft dorsal and anal are covered with fine narrow scales for at least $\frac{3}{5}$ basally.

Hemiramphus far (Forskål).

Philippines; Padang, Sumatra; Zanzibar.

Hemiramphus brasiliensis (Linnæus).

Sea Isle City, New Jersey; Chesapeake Bay; Aguadilla, Porto Rico; St. Kitts and St. Croix, West Indies; Port Antonio, Jamaica; Christian Island, west coast of Mexico; Honolulu, Hawaiian Islands.

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[3] Cat. F. Brit. Mus., VI, 1866, p. 260.
[4] Proc. Linn. Soc. N. S. Wales, V, 1881, p. 181.
[5] Nat. Hist. Victoria, II, 1890, p. 133, Pl. 135, fig. 1.

Hemiramphus limbatus Valenciennes.

Philippines.

Hemiramphus quoyi Valenciennes.

Philippines.

Hemiramphus affinis Günther.

Apia, Samoa.

Zenarchopterus hendersoni new species. Fig. 2.

Head (from upper jaw tip) 4; depth $9\frac{1}{4}$; D. I, 12; A. II, 9; P. I, 7; V. I, 5; scales 45 in lateral series from shoulder to caudal base medially; 34 scales before dorsal to head; 5 scales above lateral line at dorsal origin, and 1 below at anal origin; snout $2\frac{1}{2}$ in head from upper jaw tip; eye 5; maxillary $2\frac{3}{5}$; interorbital $3\frac{4}{5}$; first branched dorsal ray about 4; first branched anal ray about $3\frac{2}{5}$; least depth of caudal peduncle $3\frac{3}{4}$; caudal $1\frac{2}{3}$; pectoral $2\frac{1}{4}$; ventral about 4.

Body moderately elongate and compressed, more especially behind dorsal and anal origins, and back at present much broader than belly. Caudal peduncle short, its length little less than eye.

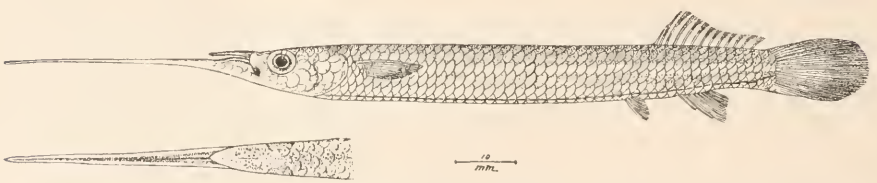

Fig. 2.—*Zenarchopterus hendersoni*.

Head well compressed, flattened sides narrowly convergent below, width $3\frac{1}{3}$ in its length from upper jaw tip. Upper jaw depressed, elongate, triangular, width at front of eyes $1\frac{1}{5}$ its length. Eye moderate, about half of snout, touches upper profile, and midway in head length. Mouth with rather long, horizontal gape, at least $\frac{2}{3}$ to eye. Maxillary concealed, reaches opposite nasal cavity. Teeth minute, conic, in narrow bands in jaws, though bands of lower only extend forward about $\frac{2}{3}$ as far as upper. Front maxillary edge with narrow band of fine teeth. No teeth on roof of mouth. Lower jaw produced as long, flattened beak,

edges entire, and head behind front eye edge about 3 in its length. Nasal cavity about $\frac{3}{5}$ of pupil, superior. Interorbital flattened.

Gill-opening extends forward about opposite front pupil edge. Gill-rakers 5+11, lanceolate, longest about $\frac{2}{3}$ of filaments and latter $2\frac{1}{3}$ in eye. Isthmus narrow slender frenum.

Scales moderately large, cycloid, rather narrowly imbricated, basal striæ 4 to 6, basal circuli 35 to 40 and terminal faces entire. Head scaly, a single row of large scales on cheek, and scales on opercles large. Several rows of small scales on caudal base, and dorsal and anal apparently without scales. Lateral line complete, low along side, and extends up behind just below median scale at caudal base, all tubes simple.

Dorsal inserted at last fourth between hind edge of gill-opening and caudal base, last ray reaching back little beyond latter. Anal inserted trifle behind dorsal origin, much shorter than dorsal. Caudal rounded behind. Pectoral placed high, small. Ventral inserted scarcely before last third in space between hind edge of gill-opening and caudal base, fins not quite half way to anal. Vent close before anal.

Color in alcohol pale, dull brownish generally, more or less uniform. Sides of head and below with traces of silvery reflections. A narrow silvery-gray lateral band, about wide as pupil, most conspicuous between dorsal and anal.

Length 142 mm.

Type, No. 7,584, A N. S. P. Japan. Dr. A. A. Henderson.

This species, known only from the type described above, is closely related to *Zenarchopterus amblyurus* (Bleeker). According to Bleeker's figure[6], it differs in the more posterior insertion of the ventral, shorter row of lower teeth, apparently more rounded caudal and scaleless dorsal fin. This specimen has long been in the Academy, probably sixty years or more, and still has the original labels intact.

(Named for Dr. A. A. Henderson.)

Zenarchopterus philippinus (Peters).

Philippines.

Zenarchopterus dispar (Valenciennes).

Philippines.

[6] Atlas Ichth., VI, 1866–72, p. 61, Pl. 4, fig. 1.

Dermatogenys viviparus (Peters).

Philippines.

Euleptorhamphus velox (Poey).

Atlantic City, N. J.

Hemiexocœtus caudimaculatus Fowler,

Proc. Acad. Nat. Sci. Phila., 1901, p. 293, fig. N. Lat. 23° W. Long. 106° (Mazatlan, Mexico).

No. 7,508, A. N. S. P., type.

EXOCOETIDÆ.

Fodiator acutus (Valenciennes).

Panama.

Evolantia microptera (Valenciennes).

An example from south of the Revillagigedo Islands (Dr. Wm. H. Jones). The label says "from the stomach of a gannet captured June, 1875, 150 miles south of the Revillagigedo Islands, and stomach had 11 fish of same kind."

Parexocœtus brachypterus (Richardson).

Hawaiian Islands.

Parexocœtus mesogaster (Bloch).

Newport, Rhode Island; St. Martin's, West Indies.

Exocœtus volitans Linnæus.

Exocœtus chilensis Abbott, Proc. Acad. Nat. Sci. Phila., 1860, p. 472. Chili.

Nos. 7498 and 7499, A. N. S. P., co-types of *E. chilensis* Abbott. Others from the Atlantic Ocean, "in the tropics," Indian Ocean, Hawaii and Victoria, Australia.

Cypselurus exsiliens (P. L. S. Müller).

N. Lat. 31° 30′ W. Long. 36° 36′.

Cypselurus rondeleti (Valenciennes).

Two adults, Gulf of Mexico and the Bonaparte Collection, respectively.

Cypselurus polyethmus new species. Fig. 3.

Head $4\frac{3}{4}$; depth 6; D. II, 9; A. II, 10; P. II, 15; V. I, 5; scales (pockets) about 40 counted from shoulder to caudal base medially; 27 scales before dorsal to occiput; about 8 scales (pockets) above

l. l. to dorsal origin; snout $3\frac{3}{4}$ in head, measured from upper jaw tip; eye $3\frac{1}{8}$; maxillary $3\frac{3}{4}$; interorbital $2\frac{1}{5}$; least depth of caudal peduncle $3\frac{3}{4}$.

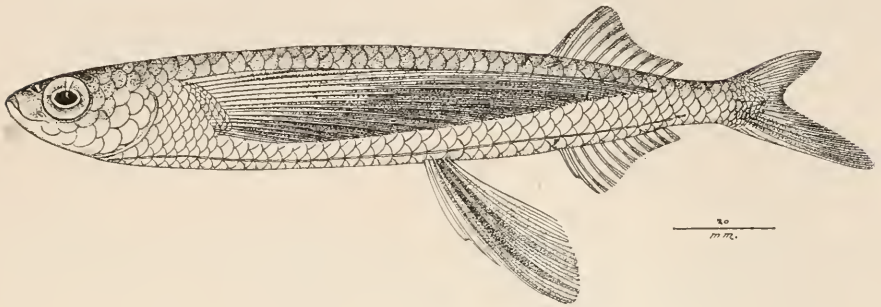

Fig. 3.—*Cypselurus polyethmus.*

Body elongately fusiform in contour, deepest medially, broad and depressed above forward, and becoming well compressed behind. Caudal peduncle compressed, least depth $1\frac{3}{5}$ its length.

Head broadly depressed above, flattened sides narrowly constricted below, width $1\frac{2}{3}$ its length, and lower profile much more inclined. Snout broadly depressed, length $\frac{2}{3}$ its width. Eye high, large, impinging slightly on upper profile, hind pupil edge slightly in advance of head center. Mouth small, with short gape, and mandible slightly protruding beyond snout tip. Teeth minute, feeble, only a few scattered along front edges of trenchant jaws, which otherwise smooth. Mouth roof toothless. Maxillary largely concealed, only narrow lower edges exposed, reaches eye. Tongue smooth, depressed, moderately long, front end rounded and free. Nasal cavity triangular, about half of pupil. Preorbital $1\frac{2}{5}$ in eye. Interorbital broad, level.

Gill-opening extends forward to nasal cavity. Gill-rakers 9+21, lanceolate, very slightly less than filaments which $1\frac{4}{5}$ in eye. Isthmus slender frenum in front.

Scales large, very caducous, cycloid, rather narrowly exposed, largest anteriorly on back and head above, basal radii 4 to 6, circuli complete, about 36 to 40. Dorsal and anal apparently scaleless, though caudal base scaly. Head covered with scales, though apparently edge of snout rather broadly naked. Breast covered with moderately small scales.

Dorsal origin about last third in space between hind gill-opening edge and caudal base, front rays a little elevated. Anal inserted

about opposite dorsal origin, similar to dorsal. Caudal well forked, lobes pointed and lower apparently much longer (damaged) and about long as head. Pectoral long, reaches back to last dorsal ray base, its first and second uppermost rays simple. Ventral inserted slightly nearer head than caudal base, reaches back not quite so far as pectoral or about $\frac{2}{3}$ to caudal base, with median branched ray longest. Vent close before anal.

Color in alcohol pale brown on back, sides and below silvery-whitish. Dorsal and caudal pale, medially tinged with brown. Pectoral deep brownish over greater median portion, blackish inside, though extreme inner edge and whole outer edge whitish. Anal whitish, also ventral, though latter with quite large median lengthwise brownish area. Iris whitish and muzzle pale.

Length 175 mm.

Type, No. 7,493, A. N. S. P. Atlantic Ocean. C. L. Bonaparte (No. 346).

Only the above described example known, which differs from *Cypselurus rondeleti* in the shorter pectoral and more numerous gill-rakers. My examples of *C. rondeleti* show the pectoral reaching the caudal base and the gill-rakers 7+15, though the larger 248 mm. long.

(πολύς, many; ἠθμός, strainer, or gill-raker, as here understood.)

Cypselurus vinciguerræ (Jordan and Meek).

Adult from Gulf of Mexico.

Cypselurus hyperistius new species. Fig. 4.

Head $4\frac{1}{8}$; depth 6; D. II, 9; A. II, 9; P. I, 17; V. I, 5; scales 50 counted from shoulder to caudal base medially and 4 more on latter; 31 predorsal scales to head; 7 scales above l. l. to dorsal origin; snout 4 in head, measured from upper jaw tip; eye 3; maxillary $3\frac{3}{5}$; interorbital $2\frac{1}{4}$; least depth of caudal peduncle $3\frac{1}{2}$.

Body elongate, robust forward where also constricted below and upper surface broadened, though posterior regions well compressed. Caudal peduncle well compressed, least depth about $1\frac{2}{3}$ its length.

Head broadly depressed above, flattened sides narrowly constricted below, width $1\frac{1}{2}$ its length, and front profiles about evenly inclined. Snout moderately broad, conic, length about $\frac{2}{3}$ its width. Eye very large, high, greatly impinging on upper profile, and hind pupil edge slightly advanced from center in head length.

Mouth small, with short inclined gape, and mandible slightly protruded beyond snout tip. Teeth small, simple, conic, and as very narrow band or row along front edges of trenchant jaws. Mouth roof toothless. Maxillary well exposed, or at least lower half its whole length, extends slightly beyond front of eye or not quite half way in iris to pupil. Tongue smooth, depressed, moderately long, front end rounded and free. Nasal cavity close before eye, about half of pupil. Preorbital rather slender, $1\frac{1}{2}$ in eye. Interorbital broad, slightly concave.

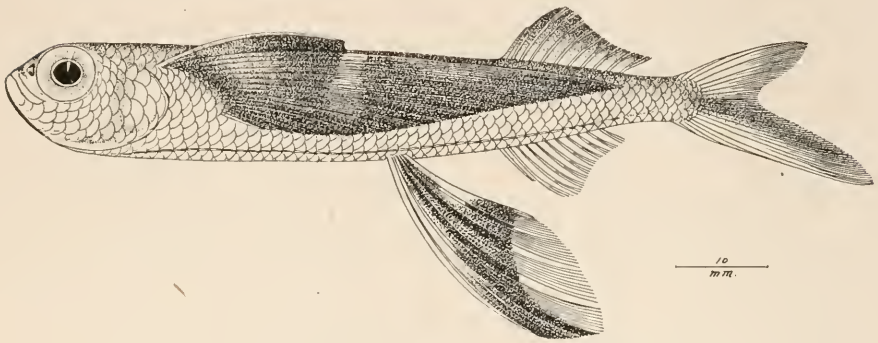

Fig. 4.—*Cypselurus hyperistius.*

Gill-opening extends forward to front eye edge. Gill-rakers 7+17, lanceolate, about long as filaments, which slightly less than 2 in eye. Isthmus long slender frenum in front.

Scales large, mostly adherent, cycloid, moderately exposed, largest anteriorly on back and head above, basal radii 3 to 5, circuli complete, about 26 to 30. Dorsal and anal apparently scaleless, though caudal base scaly. Head covered with scales, 2 or 3 rows on cheek and edge of snout rather broadly naked. Breast scales of moderate size. Lateral line apparently not beyond anal as squamation damaged.

Dorsal origin at last third between hind pupil edge and caudal base, front rays a little elevated. Anal origin slightly before that of dorsal, fin similar. Caudal well forked, lobes pointed and lower much longer or about equals head and eye length. Pectoral long, reaches back not quite far as last depressed dorsal and anal rays, thus not quite to caudal base, and first or uppermost simple ray connected with next or first branched ray by broad membrane. Ventral inserted midway between hind eye

edge and caudal base, simple ray about $\frac{3}{4}$ length of first branched ray which longest, fin thus reaching slightly nearer caudal base than last depressed dorsal or anal rays. Vent close before anal.

Color in alcohol with back and upper surfaces dull brownish, sides and below silvery-whitish, also iris. Muzzle pale, and broad, dull blackish streak on chin to front of branchiostegals. Dorsal and caudal pale brownish, ends of long front rays of former blackish. Anal whitish. Pectoral with membranes largely blackish, lower face of fin with silvery tinge, inner edge whitish and at point near basal $\frac{2}{3}$ pale cross-bar half way from upper edge. Ventral largely blackish medially, edges and end broadly whitish.

Length about 92 mm. (Caudal tip damaged.)

Type, No. 7,485, A. N. S. P. St. Martins, West Indies. Dr. R. E. Van Rijgersma.

Only the type known. This species is allied with *Cypselurus vinciguerræ*, but differs in the uppermost or elongate simple ray of the pectoral being provided with a broad membrane.

(Ὑπὲρ, over; ἱστίον, sail; with reference to the structure of the pectoral fin.)

Cypselurus speculiger (Valenciennes).

Atlantic Ocean.

Cypselurus rufipinnis (Valenciennes).

Exocœtus scylla Cope, Trans. Amer. Philos. Soc. Phila., (n. s.) XIV, 1871, p. 481. Tobasco, Mexico.

No. 7,500, A. N. S. P., type of *E. scylla* Cope.

Cypselurus heterurus (Rafinesque).

St. Martins, West Indies.

Cypselurus lutkeni (Jordan and Evermann).

Exocœtus lutkeni Jordan and Evermann, Bull. U. S. Nat. Mus., No. 47, I, 1896, p. 736. "Cape San Antonio, Cuba." (Evidently erroneous.)

No. 7,502, A. N. S. P., type of *E. lutkeni* Jordan and Evermann.

Cypselurus furcatus (Mitchill).

Atlantic Ocean and Newport, R. I.

Cypselurus bicolor (Valenciennes).

S. Lat. 18° 20′ 5″ W. Long. 34° 5′.

Cypselurus nigricans (Bennett).

Sea Isle City, N. J.

Cypselurus lineatus (Valenciennes).

One mile north of Funchal, Madeira (September 17, 1912). Joseph Redl.

Cypselurus bahiensis (Ranzani).

An example about a foot long, was kindly loaned to me by Dr. P. P. Calvert, now in his possession. It "flew" on board a vessel off the coast of Brazil.

Cypselurus californicus (Cooper).

San Pedro, California. Also others from Santa Catalina, received from Messrs. Morgan Hebard and J. A. G. Rehn.

Cypselurus agoo (Schlegel).

Tsuruga, Yokahama and Miyako, Japan.

Cypselurus quindecimradiatus Fowler.

Cypselurus quindecimradiatus Fowler, Proc. Acad. Nat. Sci. Phila., 1899, p. 482, Pl. 17. Thornton Island, South Pacific.

No. 23,275, A. N. S. P., type of *C. quindecimradiatus* Fowler.

Cypselurus simus (Valenciennes).

Honolulu, Hawaiian Islands.

Cypselurus gibbifrons (Valenciennes).

Newport, Rhode Island.

February 18.

The President, JOHN CADWALADER, A.M., LL.D., in the Chair.

Forty-nine persons present.

DR. EDGAR FAHS SMITH spoke of the mineralogists and chemists associated with the early history of the Academy. (No abstract.)

George L. Harrison, Jr., was elected a member of the Council to serve one year, and Roswell C. Williams, Jr., to serve two years.

W. Judson Coxey was elected a member.

The following was ordered to be printed:

MOLLUSCA FROM THE UPPER MIOCENE OF SOUTH CAROLINA WITH DESCRIPTIONS OF NEW SPECIES

BY JULIA A. GARDNER AND T. H. ALDRICH

The exact locality from which the mollusca listed in this paper were collected is known as the Muldrow Place, Sumter County, South Carolina, and is located five miles southeast of Mayesville. The material is a blue clay marl twelve feet thick, exposed on some small streams. Normally it is overlaid by about twelve feet of sand and loam. Earle Sloan listed it on p. 308 of his "*Catalogue of the Mineral Localities of South Carolina*," and named it "Upper Pee Dee Phase" of the Miocene. It seems to be very nearly of the same age as the Duplin beds farther north, and contains a great number of the same species. The fauna is more tropical in character than the Miocene of Maryland and Virginia.

List of species

Malampus lineatus Say.
Acteon cf. *shilohensis* Whitfield.
Acteocina canaliculata (Say).
Acteocina myrmecöon Dall.
Volvula oxytata Bush.
Terebra carolinensis (Conrad).
Terebra neglecta Emmons.
Terebra dislocata Say.
Terebra indenta Conrad.
Terebra concava Say.
Conus marylandicus Green.
Conus adversarius Conrad.
Drillia tricatenaria Conrad.
Drillia myrmecöon Dall.
Drillia elegans Emmons.
Drillia tuberculata Emmons.
Drillia aphanitoma subsp. *oxia* Dall.
Drillia precursor n. sp.
Drillia sumterensis n. sp.
Drillia limatula Lea.
Drillia perpolita Dall.
Drillia polygonatis Dall.
Drillia pagodula Dall.
Drillia simpsoni Dall.
Mangilia eritima Bush.
Mangilia aff. rubella Kurtz & Stimpson.
Glyphostoma johnsoni Dall.
Cancellaria tabulata n. sp.
Cancellaria venusta Tuomey & Holmes.
Cancellaria (*Trigonostoma*) *tenera* Philippi.
Oliva litterata Lamarck.
Olivella mutica (Say).
Marginella borealis Verrill.
Marginella contracta Conrad.
Marginella bella (Conrad).
Marginella denticulata Conrad.
Marginella aureocincta Stearns.
Marginella aff. avena subsp. *avenacea* Deshayes.
Marginella gravida Dall.
Marginella antiqua Redfield.
Marginella oliviformis Tuomey & Holmes.
Marginella minuta Pfeiffer.
Marginella (*Volutella*) *dacria* Dall.
Aurinia mutabilis (Conrad).
Mitra carolinensis Conrad.
Mitra wandoensis (Holmes).
Mitra dalli n. sp.
Mitromorpha mitrolita n. sp.
Fasciolaria rhomboidea Rogers.
Busycon pyrum subsp. *excavatum* Conrad.
Busycon concinum Conrad.
Busycon maximum Conrad.
Busycon perversum Linné.
Ecphora quadricostata (Say).
Fusinus ? exilis (Conrad).

Fusinus caloosaensis subsp. *carolinensis* Dall.
Pisania (*Calatoconus*) *nux* Dall.
Nassaria (*Nassarina*) *glypta* Bush.
Ptychosalpinx laqueatum Conrad.
Phos sloani n. sp.
Ilyanassa granifera Conrad.
Alectrion scalaspira (Conrad).
Alectrion johnsoni (Dall).
Alectrion vibex (Say).
Alectrion ? consensa Ravenel.
Alectrion neogenensis n. sp.
Anachis ? camax Dall.
Anachis sumterensis n. sp.
Anachis styliola n. subsp. *obsoleta.*
Anachis anomala n. sp.
Astyris communis n. subsp. *carolinensis.*
Astyris lunata (Say).
Murex (*Chicoreus*) *aff. burnsii* Whitfield.
Murex (*Pterorytis*) *conradi* Dall.
Ocinebra cellulosa (Conrad).
Urosalpinx trossulus (Conrad).
Urosalpinx phriknos n. sp.
Muricidea aff. floridana (Conrad).
Peristernia filicata Conrad.
Coralliophila lepidota Dall.
Epitonium muldrowi n. sp.
Epitonium aff. lineatum Say.
Niso ? willcoxiana Dall.
Melanella bartschi n. sp.
Melanella magnoliana n. sp.
Strombiformis dalli n. sp.
Cassis hodgei Conrad.
Cypraea carolinensis Conrad.
Erato ? maugeriae Gray.
Triforis ? nodesta C. B. Adams.
Seila clavulus (H. C. Lea).
Cerithiopsis aff. subulata Montagu.
Cerithiopsis aff. greenei (C. B. Adams).
Caecum cooperi Sanderson Smith.
Caecum flemingi n. sp.
Caecum ibex Dall.
Vermetus (*Petaloconchus*) *sculpturatus* H. C. Lea.
Turritella etiwanensis Tuomey & Holmes.
Turritella duplinensis n. sp.
Turritella carolinensis Conrad.
Turritella burdeni (Tuomey & Holmes).
Fossarus lura Conrad.
Architectonica granulata Lamarck.
Rissoina johnsoni Dall.
Crucibulum auriculum subsp. *imbricatum* (Sowerby).
Crucibulum auriculum subsp. *spinosum* (Sowerby).
Crucibulum constrictum Conrad.
Crucibulum multilineatum Conrad.
Calyptræa centralis Conrad.
Crepidula fornicata (Linné).
Crepidula aculeata subsp. *costata* Morton.
Crepidula plana Say.
Natica canrena Linné.
Natica pusilla Say.
Polynices (*Neverita*) *duplicatus* Say.
Polynices (*Lunatia*) *internus* (Say).
Polynices (*Lunatia*) *aff. perspectivus* Rogers.
Sinum ? perspectivum (Say).
Eunaticina carolinensis Dall.
Collonia aff. elegantula Dall.
Chlorostoma (*Omphalium*) *exoleta* Conrad.
Calliostoma aff. willcoxianum Dall.
Calliostoma aff. aluminum Dall.
Calliostoma aff. bellum (Conrad).
Calliostoma (*Eutrochus*) *arnillatum* Tuomey & Holmes.
Liotia (*Arene*) *gemma* Tuomey & Holmes.
Liotia (*Arene*) *major* n. sp.
Teinostoma carinatum (H. C. Lea).
Cochliolepis aff. striata Dall.
Episcynia multicarinata Dall.
Fissuridea catelliformis Rogers.
Fissuridea chipolana Dall.
Fissuridea nuclea Dall.
Dentalium ? danai Meyer.
Dentalium attenuatum Say.
Dentalium carolinense Conrad.
Cadulus thallus Conrad.
Nucula proxima Say.
Nucula lapteria Dall.
Leda acuta Conrad.
Leda trochilia Dall.
Yoldia lævis Say.
Glycymeris subovata Say.
Glycymeris americana de France.
Glycymeris duplinensis Dall.
Arca (*Barbatia*) *adamsi* (Shuttleworth).
Arca (*Nætia*) *incile* Say.
Arca (*Scapharca*) *scalaris* Conrad.
Arca (*Scapharca*) *lienosa* Say.
Arca (*Scapharca*) *carolinensis* Wagner.
Arca (*Scapharca*) *improcera* Conrad.
Arca (*Scapharca*) *improcera* subsp. *bucula* Conrad.
Ostrea compressirostra Say.
Ostrea sculpturata Conrad.
Pecten eboreus Conrad.
Plicatula marginata Say.
Mytilus conradinus d'Orbigny.
Thracia transversa H. C. Lea.
Pandora (*Kennerleyia*) *arenosa* Conrad.
Pandora (*Clidiophora*) *prodromos* n. sp.
Pandora (*Clidiophora*) *tuomeyi* n. sp.

Cuspidaria (*Cardiomya*) *aff. ornatissima* d'Orbigny.
Verticordia emmonsi Conrad.
Astarte glenni Dall.
Astarte undulata Say.
Astarte concentrica Conrad.
Crassitellites (*Scambula*) *undulatus* Say.
Crassitellites (*Crassinella*) *lunulatus* Conrad.
Crassitellites (*Crassinella*) *duplinianus* Dall.
Cyrena (*Pseudocyrena*) *dupliniana* Dall
Cardita (*Carditamera*) *arata* Conrad.
Venericardia (*Cyclocardia*) *granulata* Say.
Venericardia (*Pleuromeris*) *tridentata* Say.
Venericardia (*Pteromeris*) *perplana* Conrad.
Venericardia (*Pteromeris*) *perplana* subsp. *abbreviata* Conrad.
Chama corticosa Conrad.
Chama striata Emmons.
Phacoides (*Cavilucina*) *trisulcatus* (Conrad).
Phacoides (*Cavilucina*) *trisulcatus* subsp *multistriatus* (Conrad).
Phacoides (*Lucinisca*) *cribarius* Say.
Phacoides (*Pseudomiltha*) *anodonta* Say.
Phacoides (*Callucina*) *radians* (Conrad).
Phacoides (*Parvilucina*) *multineatus* Tuomey & Holmes.
Phacoides (*Bellucina*) *tuomeyi* Dall.
Codakia (*Jagonia*) *speciosa* (Rogers).
Divaricella quadrisulcata d'Orbigny.
Diplodonta nucleiformis (Wagner).
Diplodonta aclinis Conrad.
Diplodonta aff. leana Dall.
Erycina carolinensis Dall.
Bornia triangula Dall.
Bornia rota Dall.
Rochefortia stantoni Dall.
Rochefortia stimpsoni Dall.
Sportella constricta Conrad.
Sportella protexta (Conrad).
Anisodonta (*Fulcrella*) *carolina* Dall.
Hindsiella acuta Dall.
Hindsiella aff. carolinensis Dall.
Aligena æquata (Conrad).
Aligena minor Dall.
Cardium (*Trachycardium*) *ædalium* Dall.
Cardium (*Cerastoderma*) *acutilaqueatum* Conrad.
Cardium (*Fragum*) *medium* Linné.
Cardium (*Lævicardium*) *sublineatum* Conrad.
Dosinia elegans Conrad.
Transenella carolinensis Dall.
Gafrarium (*Gouldia*) *metastriatum* Conrad.
Macrocallista reposta Conrad.
Callocardia (*Agripoma*) *sayana* (Conrad).
Pitaria filosina Dall.
Chione cribaria (Conrad).
Chione (*Lirophora*) *latilirata* (Conrad).
Chione (*Timoclea*) *grus* Holmes.
Venus campechiensis subsp. *rileyi* Conrad.
Gemma magna Dall.
Gemma trigona Dall.
Tellina (*Merisca*) *æquistriata* Say.
Tellina (*Angulus*) *macilenta* Dall.
Tellina (*Angulus*) *umbra* Dall.
Tellina (*Angulus*) *dupliniana* Dall.
Strigilla eutykta n. sp.
Metis magnoliana Dall.
Macoma carolinensis n. sp.
Macoma (*Psammacoma*) *holmesii* Dall.
Semele carinata Conrad.
Semele subovata subsp. *duplinensis* Dall.
Semele subovata subsp. *appressa* Dall.
Semele nuculoides (Conrad).
Abra æqualis Say.
Tagelus gibbus Spengler.
Donax emmonsi Dall.
Donax cuneola n. sp.
Ensis directus Conrad.
Spisula confragosa (Conrad).
Spisula subparilis (Conrad).
Mulinia congesta (Conrad).
Mulinia congesta subsp. *magnoliana* Dall.
Labiosa lineata Say.
Mya ? arenaria Linné.
Sphenia dubia (H. C. Lea).
Corbula (*Aloidis*) *caloosæ* Dall.
Corbula (*Cuneocorbula*) *inæqualis* Say.
Corbula (*Cuneocorbula*) *cuneata* Say.
Panope reflexa (Say).
Saxicava arctica Linné.
Gastrochæna cuneiformis Spengler.
Chætopleura apiculata Say.
Discinisca lugubris (Conrad).

Drillia tricatenaria (Conrad). Plate I, fig. 2.

Pleurotoma tricatenaria Conrad, 1834, Jour. Acad. Nat. Sci. Philadelphia, 1st ser. vol. vii, p. 139.
Surcula (*Pleurotoma*) *tricatenaria* Conrad, 1863, Proc. Acad. Nat. Sci. Philadelphia for 1862, vol. xiv, p. 561 (name only).
Surcula tricatenaria Conrad, 1864, Meek, Miocene Check List, Smith. Misc. Coll., No. 183, p. 21 (name only).

Description.—"Shell subulate, turrited, with longitudinal undulations, which on each whorl of the spire are crossed by three equidistant prominent spiral lines; whorls indented above; indentations finely striated; suture margined by a carinated line; body whorl with about thirteen spiral lines; aperture more than one-third the length of the shell. Length, three-fourths of an inch." Conrad, 1834.

General Characters.—Shell rather large, robust. Aperture approximately one-third the total altitude. Whorls probably 8 to 10 in number, concave posteriorly, straight sided or gently convex in front of the fasciole. Body smoothly contracted at the base. Appression of the whorls rather marked. Suture line inconspicuous.

Protoconch.—Apex broken away in all available material. Nucleus apparently small.

Sculpture.—External sculpture vigorous, both axial and spiral. Axial costae rather strongly elevated, rounded, somewhat undulatory and slightly protractive, 12 to 14 in number on the later whorls, persisting with undiminished strength to the anterior suture but quite abruptly evanescent posteriorly at the margin of the fasciole; on the body whorl, weakening a little in front of the periphery and becoming obsolete before reaching the pillar and, in the older forms, irregular or altogether obsolete toward the aperture; intercostal areas concave, narrower than the costals. Spiral sculpture of broadly arched, rather prominent, primary fillets, uniform in strength on both the costal and the intercostal areas, 9 to 11 in number on the ultima, 3 or 4 upon the penultima, usually, though not always, equal or sub-equal in size and spacing; intercalaries absent in the type but present, as a rule, to the number of 1, 2, or 3 between the primaries of the later whorls; posterior fasciole obscurely undulated anteriorly by the axial sculpture, spirally threaded with 4 to 6 fine, close-set lirae with 1 or 2 stronger cords at the posterior margin, directly in front of the suture line. Anterior canal sculptured with 4 to 6 crowded lirae.

Aperture.—Aperture narrow, obliquely lobate, obtusely angulated at the posterior commissure. Labrum somewhat flaring; posterior siphonal notch very narrow, but rather deep. Labium gently excavated at the base of the body whorl. Pillar straight, moderately long, simple. Parietal wall and pillar heavily reinforced. Anterior canal rather long and broad, obtusely truncate at the extremity.

Dimensions.—Altitude, 17.5 mm. Maximum diameter, 6.0 mm.

Type Locality.—Smithfield, James River, Isle of Wight County, Virginia. *Yorktown Formation.*

Observations.—*Drillia tricatenaria* Conrad is more vigorously sculptured than any of its congeners, even the closely related *Drillia pyrenoides* Conrad. *D. pyrenoides* is, furthermore, a relatively shorter, somewhat stouter shell than *D. tricatenaria*, with a more rapidly tapering spire and a slightly shorter canal. The axial costae of the former are much more nodose in character than in the latter, while the spirals, both primary and secondary, are fewer in number, more irregular and less prominent. Upon the posterior fasciole, the spiral sculpture is often altogether obsolete, excepting for the sutural cord, which is always less prominent than in *D. tricatenaria*. Members of this species appear under such various names in the different collections that it has seemed worth while to redescribe and figure the type kindly loaned for the purpose by the Academy of Natural Sciences of Philadelphia.

Distribution.—*St. Mary's Formation.* Sycamore, Southampton County, Virginia; 8 to 9 miles and 9 to 10 miles south of Greenville, Pitt County, North Carolina. *Yorktown Formation.* Yorktown, York County; Smithfield, Isle of Wight County; Suffolk and 1 mile northeast of Suffolk, Nansemond County, Virginia. *Duplin Formation.* Natural Well, $1\frac{1}{2}$ miles north of Magnolia, Duplin County; Lake Waccamaw, Columbus County, North Carolina. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Drillia precursor new species. Plate I, fig. 1.

General Characters.—Shell small, polished, rather slender, obtusely tapering. Aperture less than half the entire altitude. Whorls $7\frac{1}{2}$ in all, flattened laterally, the profile of the spire feebly crenulated, however, by the axial ribbing. Body whorl broadly rounded, rather strongly constricted at the base. Volutions very closely appressed, delimited by very fine and inconspicuous sutures.

Protoconch.—Protoconch small, obtuse. Initial turn smooth and almost entirely immersed in the succeeding volution. Sculpture foreshadowed by the gradual introduction of a keel on the early part of the second nuclear turn,—the spirals increasing in number and prominence so that the close of the whorl is sculptured with

4 strong lirae, the third from the posterior suture being the strongest. Dividing line between conch and protoconch very sharp, marked by the abrupt reduction of the spiral sculpture and the even more abrupt appearance of the axial sculpture.

Sculpture.—Axials low and rounded, 13 or 14 to a turn, least prominent upon the body, obsolete upon the pillar; interaxial areas broadly concave, usually wider than the axials. Spirals somewhat irregular, wide, flattened, little elevated bands, separated by narrower interspaces, 4 or 5 in number on the earlier whorls, 10 or 12 on the ultima and pillar. Posterior fasciole distinct, sculptured with 3 low, flat spirals separated by linear interspaces, and with a prominent rounded thread revolving anterior to the suture; a much less prominent liration also developed just posterior to the suture.

Aperture.—Aperture narrow, obliquely lenticular, acutely angulated at the posterior commissure. Labrum broadly and feebly arcuate. Siphonal notch narrow and not very deep. Labium feebly convex. Pillar straight, simple. Parietal wall and pillar heavily reinforced. Anterior canal short, rather broad, feebly emarginate.

Dimensions.—Altitude, 7.2 mm. Maximum diameter, 3.0 mm.

Type Locality.—Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. *Duplin Formation.*

Observations.—It seems quite probable that this late Miocene *Drillia* is the ancestor of the Caloosahatchie Pliocene form, *Drillia piscator* Dall. In general aspect, it is a more highly polished shell with a less strongly defined sculpture. In detail, it differs from *D. piscator* in the nuclear characters, the more numerous axial ribs, which are more prominent especially on the ultima, the narrower and more elevated spicals and the stronger and more angular liration revolving anterior to the suture.

Distribution.—Duplin Formation. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Drillia sumterensis new species. Plate I, fig, 3.

General Characters.—Shell rather small for the genus, slender, tapering. Component volutions 10 in number. Whorls of spire gently convex, regularly increasing in diameter. Body less than half as high as the entire shell, rounded like the later whorls of

the spire, smoothly constricted at the base. Volutions so closely appressed against each other that the suture line is undulated by the costæ of the preceding turn.

Protoconch.—Protoconch very small and smooth, twice-coiled. Initial turn for the most part submerged in the succeeding volution. Second turn feebly inflated. Opening of conch marked by the abrupt appearance of the axial sculpture.

Sculpture.—Axial ribs 8 or 9 to the whorl, broad and undulatory, extending from the anterior margin of the fasciole to the suture and, on the final volution, well down on to the pillar; incrementals perceptible with a hand lens. Spirals low, broad, inconspicuous lirations, numbering 7 to 9 to the whorl, separated by interspaces of about half their own width; fortuitous secondaries occasionally intercalated; pillar threads more rounded and more prominent than those behind them; fasciole well defined, feebly concave, slightly corrugated by the costae, sculptured with 5 to 7 very faintly impressed revolving lines and oblique incrementals.

Aperture.—Aperture narrow, lobate, acutely angulated at the posterior commissure. Outer lip gently arcuate, not sharply constricted at the base of the body. Siphonal notch rather shallow, symmetrically disposed upon the fasciole. Labium excavated. Pillar straight, simple. Parietal wall and pillar wash heavy. Anterior canal very short, moderately broad, obtusely truncate.

Dimensions.—Altitude, 14.0 mm. Maximum diameter, 5.0 mm.

Type Locality.—Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. *Duplin Formation.*

Observations.—*Drillia sumterensis* closely approaches *Mangilia* in delicacy of outline and ornamentation. The character of the anterior canal is, however, more suggestive of *Drillia.*

Distribution.—*Duplin Formation.* Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Cancellaria tabulata new species. Plate I, fig. 9.

General Characters.—Shell rather large and heavy, conspicuously scalariform. Aperture a little more than half as high as the entire shell. Conchal volutions 5 in number, widely tabulated, the whorls of the spire flattened laterally, the body broadly rounded and abruptly constricted at the base. Suture distinct, feebly impressed, undulated by the costal of the preceding volution.

Protoconch.—Protoconch rather small, smooth, thrice-coiled, the component whorls increasingly rapidly in diameter, altitude, and degree of inflation. Dividing line between conch and protoconch indicated by the abrupt initiation of the axial sculpture.

Sculpture.—Whorls of conch latticed. Axial sculpture of narrow, rounded, elevated ribs, irregularly spaced and, on the ultimar and penultimar whorls, varying from 16 to 26 in number; costals of spire continuous from suture to suture, strongly retractive on the shoulder, weakening perceptibly posteriorly; on the ultima, persisting with diminishing strength well down on to the pillar; incrementals well developed. Spiral sculpture often more prominent than the axial; lirations flat topped, well elevated threads, separated by interspaces a little wider than the lirae and just about equal to the intercostal areas; the spirals overiding the costæ at their intersection, producing a series of elevations which would appear granular in a more closely sculptured shell; normal number of primaries on the sides of the whorls of the spire, 3; on the body and pillar, 8 to 10; anterior primary of each volution following the peripheral angle; angle rounded off on the final half turn and, at the aperture, almost or altogether obsolete; a single secondary occurring midway between the periphery and the suture; other secondaries intercalated upon the body whorl; anterior fasciole threaded with 3 or 4 subequal, closely spaced lirae.

Aperture.—Aperture rather narrow for the group, oblique. Outer lip arcuate, lirate within; lirae approximately 9 in number, corresponding in position to the secondaries on the body whorl. Columella quite strongly excavated at the base of the body. Parietal wash not sufficiently heavy to conceal the basal sculpture. Pillar quite long and straight. Columellar plications narrow, oblique, sub-parallel and almost equally spaced, increasing rapidly in prominence from the anterior to the posterior; anterior fold marginal.

Umbilicus.—An umbilical chink usually open, though occasionally concealed by callous.

Dimensions.—Altitude, 29.62 mm. Maximum diameter, 17.0 mm.

Type Locality.—5 miles northeast of Smithfield, James River, Isle of Wight County, Virginia. *Yorktown Formation.*

Observations.—*Cancellaria tabulata* is separated from the later but closely allied *Cancellaria conradiana* Dall by the lower spire, the stouter body whorl, the much wider, much more sharply defined shoulder, and the more loosely reticulated sculpture.

Distribution.—*Yorktown Formation.* 5 miles northeast of Smithfield, James River, Isle of Wight County, Virginia. *Duplin Formation.* Natural Well, 1½ miles north of Magnolia, Duplin County, North Carolina. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Mitra dalli new species. Plate I, figs. 4, 8,

Mitra sp. indet., Dall, 1890, Trans. Wagner Free Inst. Sci., Philadelphia, vol. iii, pt. ii, p. 93.

Original Description.—"A single specimen too worn to name was found in the Caloosahatchie marl. It has about sixteen ribs and in general resembles a slender *M. Wandoensis*, but just below the periphery of the whorl is a marked groove, channelled and cutting the ribs as well as the interspaces. On the earlier whorls this channel revolves a short distance behind the suture, which thus appears double. This character will enable the species to be recognized when perfect specimens are found. There are three folds on the columella and the shell is about the size of the next species. (*Mitra wilcoxii.*)" Dall, 1890.

General Characters.—Shell small, slender, terminating obtusely. Aperture about one-third the total altitude. Whorls of conch 6½ in number, flat-sided, tabulated behind, wound about one another like a bandage with the posterior edge folded under. Body rather abruptly constricted at the base. Sutures deeply impressed.

Protoconch.—Nucleus smooth, papillate, coiled 1½ times.

Sculpture.—Axial sculpture of about 18 sharp, narrow, elevated, slightly arcuate costæ which persist with undiminished strength from suture to suture and, on the ultima, as far as the canal. Spiral lirations, for the most part, discernible only under magnification; the spiral sculpture, of the apical whorls, with the exception of the pre-sutural groove, confined to the intercostal areas; lirations low, broad, and flattened, 5 to 8 to the whorl as a rule, separated by narrower interspaces; number and character of the lirations on the portion of the body whorl posterior to the impressed groove similar to that of the earlier whorls; spirals much more prominent anterior to the groove and visible without magnification, 4 to 6 in number, exclusive of those upon the canal, unequal in size and strength, and for the most part, separated by linear interspaces;

anterior fasciole adorned with about 4 rounded, elevated, close-set cords.

Aperture.—Aperture very narrow, somewhat crescentic. Posterior commissure well rounded. Outer lip arcuate, smooth within. Columella concave, bearing 3 folds, of which the two posterior are the strongest. Anterior canal short, recurved, slightly emarginate.

Dimensions.—Altitude, 8.0 mm. Maximum diameter, 2.5 mm.

Type Locality.—Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. *Duplin Formation.*

Observations.—The species is characterized not only by the spiral furrow but also by the slender, tabulated outline of the whorls. The type has been compared with the form from which Dall's description was made and there is no doubt of their identity. The young of the species are stout little cones with well developed sculpture and an angular whorl.

Distribution.—*Yorktown Formation.* Drainage ditch 1 mile northeast of Suffolk, Nansemong County, Virginia. The young individual collected at this locality is referred rather doubtfully to this species.

Duplin Formation.—Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. *Caloosahatchie Formation.* Caloosahatchie River, Florida.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Mitromorpha mitrodita new species. Plate I, fig. 7.

General Characters.—Shell very small, fusiform, the greatest diameter falling at or just anterior to the median line of the shell. Aperture nearly half the total altitude. Whorls of conch $4\frac{1}{2}$ in number, regularly increasing in diameter, those of the spire somewhat trapezoidal in outline, the body broadly arcuate. Sutures inconspicuous, undulated by the costæ of the preceding whorl.

Protoconch.—Protoconch twice coiled. Initial turn minute, inflated, immersed only at the tip. Succeeding volution relatively high, broadly convex. Opening of conch indicated by the abrupt appearance of the axial and spiral ornamentation.

Sculpture.—Axial sculpture less conspicuous than the spiral; costæ confined largely to the earlier whorls and tending to become obsolete on the ultima and penulta, 9 to 10 in number, low, rounded, and undulating, continuous from suture to suture but most promi-

nent directly behind the anterior suture. Spirals equisized and equispaced, narrow, sharp, much elevated liræ, prominent alike on the costal and intercostal areas; lirations 4 in number on each of the apical whorls, 12 or 13 upon the body and pillar which are not well differentiated; the wider interspaces striated with fine, even, close-set incrementals; fasciole indicated by the slightly wider interspace between the posterior and the next succeeding spiral.

Aperture.—Aperture narrow, sinuous, acutely angulated posteriorly. Outer lip broadly arcuate, feebly lirate within. Columella excavated at the base of the body whorl. Parietal and pillar wash rather thin. Pillar moderately long, slightly twisted, bearing 2 equal, oblique, and rather feeble plications, midway between the anterior and posterior canals. Anterior canal broad and open, obtusely truncated at the extremity.

Dimensions.—Altitude of type, 5.5 mm. Maximum diameter, 2.0 mm. Altitude of average individual, 3.7 mm. Maximum diameter, 1.5 mm.

Type Locality.—Natural Well, Duplin County, North Carolina. *Duplin Formation.*

Observations.—*Mitromorpha mitrodita* is separated from *M. pygmaea*, its nearest southern relative, by the more slender outline, and the broader and less numerous costals, which, in *mitrodita*, are not confined exclusively to the early whorls but undulate the penult and even the ultima. *M. smithfieldensis* Olsson, the Yorktown analogue, differs in the less numerous conchal turns, the more distant axial sculpture, and the lower number of body spirals.

Distribution.—*Duplin Formation.* Natural Well, 1½ miles north of Magnolia, Duplin County, North Carolina. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina.

The species is rare and, even when present, is so small that it is easily overlooked.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Phos sloani new species. Plate I, fig. 10.

General Characters.—Shell slender; spire greatly elevated for the genus. Aperture less than two-thirds the total altitude. Whorls closely appressed, almost flat, though apparently somewhat convex because of the greater prominence of the axial ribs near the median line of the whorl. Body whorl gently rounded,

rather sharply constricted at the base. Suture distinct, not conspicuous, gently undulated by the axial ribs of the preceding whorl.

Protoconch.—Protoconch small, smooth, acutely tapering, paucispiral, although the exact number of turns can not be determined because of the decortication of the apex.

Sculpture.—Axial sculpture of prominent, rounded ribs and of incrementals visible only under magnification; costæ 7 or 8 to the whorl, rounded, though sharply defined, conspicuous elevations, which, on the spire, persist from suture to suture, although strongest on the periphery; body costæ rounded on the summits, the sides almost vertical, gradually flattening as they approach the canal; prominence of the costæ greatly increased by the peculiar spiral lirations which cross them. Primary spirals 3 or 4 in number upon the whorls of the spire, broad and low and very flat in the intercostal areas and on the sides of the costæ; liræ abruptly thickening, however, upon the summits of the costals thereby throwing the intercostal areas into relief and apparently increasing the elevation of the costæ; secondary spiral lirations narrow, flat bands less than one-half as wide as the primaries and separated from them by interspaces the width of the former; secondaries not increasing in prominence as they cross the axials; posterior fasciole rather wide, sculptured with an anterior secondary, 2 or 3 primaries of uniform elevation and without intercalated secondaries, together with a broad, pre-sutural ribbon equal to the primaries in altitude and exceeding them in breadth; body whorl ornamented with 12 primaries; secondaries intercalated on the posterior portion but absent anteriorly; anterior fasciole differentiated but not prominently keeled, sculptured with 5 to 8 crowded liræ.

Aperture.—Aperture ovate-elongate. Labrum arcuate, furnished with 8 or 9 sharp plications upon the surface. Columella concave, smooth, calloused. Canal short, slightly recurved, emarginate.

Dimensions.—Altitude, 20.7 mm. Maximum diameter, 7.2 mm.

Type Locality.—Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. *Duplin Formation.*

Observations.—*Phos sloani* is known only from Sumter County, South Carolina, and is quite unlike any described form. It is characterized by the peculiar, abrupt increase in the prominence of the spirals as they mount the summit of the costals, so that the intercostals have the appearance of being smoothly scooped.

We have the pleasure of naming this interesting species in honor of Dr. Earle Sloan, of Charleston, South Carolina, whose name will always be so pleasantly associated with the development of the Geological Survey of South Carolina.

Distribution.—Duplin Formation. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Alectrion neogenensis new species. Plate I, figs. 5, 6.

General Characters.—Shell elevated, slender, turrited. Body whorl slightly more than half the altitude. Conchal whorls 6 in number, feebly convex, the ultima abruptly constricted at the base. Suture line distinct, slightly impressed, undulated by the costals of the preceding volution.

Protoconch.—Protoconch of 2 small, smooth, button-like whorls, the earlier turn submerged in the later.

Sculpture.—Axial and spiral sculpture normally initiated simultaneously; in some individuals, however, the costals apparently preceding the spirals. Costals, when well established, narrow, rounded, and moderately elevated, 10 to 14 in number on the later volutions; for the most part, equi-size, persistent with uniform strength from suture to suture and separated by intercostals of approximately equal width. Spirals regular as a rule, in size and spacing, from the nucleus to the anterior canal, very low, rather broad, overriding the costal and the intercostal areas with uniform strength, 6 in number on the later whorls of the spire, and 10 or 12 on the body,—the two anterior narrow, and more elevated than those behind; interspirals equal to or a little narrower than the spirals. Base of body margined by profound sulcus on which the incremental sculpture is well marked. Anterior fasciole bearing some half dozen crowded spirals.

Aperture.—Aperture not quite one-third the total altitude, obliquely ovate. Outer lip sub-varicose, flaring anteriorly, though abruptly contracted at the canal; inner denticles sharp little ridges at right angles to the margin, uniformly spaced and about 6 in number. Columellar lip sigmoidal, heavily calloused, the outer margin of the callous sharply defined. A rather prominent transverse ridge developed near the posterior commissure, and shorter irregular denticles toward the anterior canal. Anterior canal short, recurved, and deeply emarginate.

Dimensions.—Altitude, 12.1 mm. Maximum diameter, 6.0 mm. Diameter at right angles to the maximum diameter, 5.0 mm.

Type Locality.—Neill's Eddy Landing, 3 miles north of Cronley, Columbus County, North Carolina. *Waccamaw Formation.*

Observations.—The *Alectrion lapontierei* of Dall is quite similar in outline but runs smaller, and has fewer, much narrower, and more distant spirals.

Distribution.—*St. Mary's Formation.* 4 miles northwest of Williamston, Martin County; 1 mile west of Wilson in Hominy Swamp, Wilson County, North Carolina. *Yorktown Formation.* Yorktown, York County; $1\frac{1}{2}$ miles north of Suffolk, 1 mile northeast of Suffolk, and at Suffolk, $\frac{1}{2}$ mile below the Suffolk water works dam, Nansemond County, Virginia. Colerain Landing on the Chowan River, Bertie County, North Carolina. *Duplin Formation.* 2 miles below Lumberton, and 4 or 5 miles below Lumberton, Robeson County, North Carolina. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. *Waccamaw Formation.* Neill's Eddy Landing, 3 miles north of Cronley, Columbus County, North Carolina.

Although the type of this widely distributed little species comes from the *Waccamaw*, it occurs most commonly in the *Yorktown* and *Duplin* Formations.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Anachis styliola new subspecies **obsoleta**. Plate II, figs. 7, 9, 12.

General Characters.—Shell moderately tall, varying quite widely in degree of slenderness. Spire acute, attenuated. Aperture sometimes less than one-third the total altitude. Whorls 8 to 10 in number, regularly increasing in size, minutely tabulated posteriorly, the preceding volution, correspondingly undercut anteriorly. Early whorls of conch strongly carinated, the keel moving forward from its initial position at approximately the median horizontal, till, by the end of the first whorl, it directly overhangs the suture and conspicuously coronates the succeeding turn, gradually, however, becoming lower and less prominent, and usually reduced to the normal plane of the spire by the end of the third whorl. Suture distinct, inconspicuous; sulcus outlining the periphery of the preceding whorl often visible behind it.

Protoconch.—Protoconch smooth, including $1\frac{1}{2}$ to 2 whorls, the first half turn largely immersed, the second quite strongly globose posteriorly, becoming decreasingly convex anteriorly.

Sculpture.—Axial sculpture appearing, as a rule, on the first coil of the conch in the shape of faint incremental striæ, which rapidly strengthen and recur at more and more regular intervals until, by the beginning of the second conchal whorl, there is, in the majority of individuals, a well established axial sculpture of 16 to 18 narrow, obtuse, slightly arcuate riblets which are uniform in strength on the early whorls, from the posterior shoulder to the anterior keel which they delicately crenulate; axial sculpture varying in degree of development and persistence from that of the *A. styliola sensu stricto* to an almost smooth type in which the costals are reduced to feeble undulations faintly visible just posterior to the suture line and even feebler wavelets anterior to the suture. Spiral sculpture confined, as a rule, to the base of the body whorl, the pillar, and the anterior canal; periphery of ultima usually outlined by a shallow linear sulcus; base of ultima usually sculptured with 6 to 8 low, half obsolete threads separated by linear interspaces, and, in front of them, 2 less feeble, more widely separated spirals; lirations upon the pillar and anterior siphonal canal normally 9 or 10 in number, well rounded, rather prominent, and close-set; faint traces of spiral liræ visible under high magnification upon other portions of the surface but nowhere sufficiently strong to affect the general aspect of the shell.

Aperture.—Aperture narrow, lenticular, angulated posteriorly. Outer lip feebly arcuate, obscurely varicose in the adult forms and transversely lirate within. Inner lip contracted at the base of the body whorl. Parietal wall glazed, more or less corrugated in harmony with the spiral sculpture; margin of reflected callous sharp, and standing apart from the pillar wall. Anterior canal moderately long for the genus, recurved, obliquely emarginate.

Dimensions.—Altitude, 16.5 mm. Maximum diameter, 4.6 mm.

Type Locality.—Natural Well, $1\frac{1}{2}$ miles north of Magnolia, Duplin County, North Carolina. *Duplin Formation.*

Observations.—The diagnostic characters of the subspecies are the relatively shallow sutural channel and the more or less obsolete sculpture, both axial and spiral. It is a rather common little form in the *Duplin* of the Carolinas.

Distribution.—Duplin Formation. Natural Well, $1\frac{1}{2}$ miles north of Magnolia, Duplin County, North Carolina. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Anachis sumterensis new species. Plate II, figs. 2, 6.

General Characters.—Shell small, slender, fusiform, including from 6 to 7 volutions. Whorls of spire keeled and slightly overhanging. Body whorl gently and evenly rounded, approximately half as high as the entire shell. Posterior margins closely appressed. Suture distinct.

Protoconch.—Nucleus small, erect, sub-globular, including $1\frac{1}{2}$ volutions. First turn and part of second smooth. Last quarter turn sculptured with very fine, microscopic, axial striations.

Sculpture.—Axial sculpture of about 10 longitudinal undulations which are most conspicuous upon the keel, evanescing above and below and becoming almost or altogether obsolete upon the ultima; growth lines confined to the interspaces between the spirals. Spiral sculpture abruptly initiated at the origin of the conch; lirations flattened, rather broad, conspicuous alike on the costal and the intercostal areas, 4 in number on the early whorls of the spire, the anterior the most prominent, so strong indeed, that it forms a keel which overhangs the succeeding turn; one or 2 additional spirals introduced on the later volutions between the keel and the anterior suture; lirations on the body 6 or 7 in number, similar in character to those upon the spire; interspaces approximately the width of the spirals, straight-sided and misroscopically striated with fine, close-set incrementals; pillar and canal adorned with about double the number of liræ present upon the body whorl, these liræ differing, however, from the body spirals in being narrower, slightly rounded and much more crowded.

Aperture.—Aperture a rounded, irregular oval, angulated posteriorly. Outer lip strongly arcuate, faintly lirate within. Inner lip excavated, thinly calloused. Canal rather short for the genus, wide and open, truncate anteriorly.

Dimensions.—Altitude, 5.5 mm. Maximum diameter, 2.0 mm.

Type Locality.—Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. *Duplin Formation.*

Observations.—The overhanging whorls suggest the young of *Anachis styliola* Dall, but the former is much more angular in outline and is sculptured with numerous narrow riblets and ill-defined spirals while in the latter, the axial costals are relatively few in number and broad and undulatory in character, while the spirals are strong and regular.

Distribution.—Duplin Formation. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Anachis anomala new species. Plate II, fig. 3.

General Characters.—Shell small, heavy, rather stout, fusiform. Volutions $5\frac{1}{2}$ to 6, slightly convex, narrowly tabulated, rapidly increasing in size. Body smoothly constricted at the base. Aperture a little less than one-half the total altitude. Suture line inconspicuous, impressed.

Protoconch.—Apex somewhat decorticated so that is is impossible to determine all of the characters of the earlier whorls. Protoconch probably small, smooth, papillate, and pauci-spiral.

Sculpture.—First whorl of conch apparently smooth; second whorl sculptured with about 16 narrow, rounded, axial riblets which disappear quite abruptly on the penultima. Spiral sculpture, for the most part, wanting though faintly impressed lines may occasionally be caught on the second whorl under magnification and a faint but distinct linear sulcus follows directly behind the suture from the second turn to the last; two stronger impressed spirals directly in front of the periphery of the ultima; pillar and canal sculptured with 9 straight sided, proximate grooves sufficiently deep to be visible with the unaided eye.

Aperture.—Aperture irregularly elongate. Outer lip straight, somewhat flaring anteriorly, subvaricose, thickened and quinquedenticulate within,—the denticles decreasing in prominence anteriorly; posterior commissure filled with callous. Labium broadly constricted at the base of the body. Pillar straight, simple, heavily calloused, slightly rugose near the outer margin of the wash,—the rugæ corresponding in position to the external sculpture. Canal short, open, slightly recurved, abruptly truncate and broadly emarginate anteriorly.

Dimensions.—Altitude, 5.0 mm. Maximum diameter, 2.5 mm.

Type Locality.—Natural Well, Duplin County, North Carolina. *Duplin Formation.*

Observations.—*Anachis anomala* is doubtless a near relative of the protean *A. avara* of Say. Though very similar in general aspect and outline, the absence of an axial sculpture upon the first and the last whorl is sufficient to readily differentiate it specifically.

Distribution.—*Duplin Formation.* Natural Well, $1\frac{1}{2}$ miles north of Magnolia, Duplin County, North Carolina. Muldrow's Place,

5 miles southeast of Mayesville, Sumter County, South Carolina. The species is rare even within the apparently restricted area within which it occurs.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Astyris communis new subspecies **carolinensis**. Plate II, fig. 11.

General Characters.—Shell rather large for the genus, stout, rudely biconic. Whorls approximately 8 in number, tapering rapidly to an acute apex which is somewhat decorticated so that the characters of the protoconch are obscured. Body whorl between one-half and two-thirds of the total altitude, obtusely angulated at the periphery excepting near the aperture where it is broadly rounded and scarcely constricted. Whorls of spire trapezoidal in outline. Suture impressed; edge of whorl in front of it sharp, but closely appressed.

Protoconch.—Protoconch very imperfectly preserved.

Sculpture.—External surface unsculptured excepting for some 15 linear sulci upon the pillar and anterior canal.

Aperture.—Aperture a little less than one-half the total altitude, rather narrow, angulated behind. Outer lip a sinistral hook, feebly emarginate posteriorly, thickened and dentate within; denticles 8 in number in the type, the posterior rather smaller and somewhat removed from the 7 in front of it which are equisize and equispaced and extend well around the anterior curvature. Columella rather sharply excavated at the base of the body, simple, excepting for an obscure marginal fold. Parietal wall glazed, a drop of callous deposited just in front of the posterior angle, feebly rugose at the initiation of the pillar. Anterior canal straight or very slightly recurved, deeply emarginate.

Dimensions.—Altitude, 13.3 mm. Maximum diameter, 6.1 mm.

Type Locality.—Tilly's Lake, South Carolina. *Waccamaw Formation.*

Observations.—The subspecies *carolinensis* is isolated from the *communis s. s.* by the absence of the minute tabulation in front of the suture, and the longer and straighter anterior canal. In many of the collections and check-lists, forms similar to those which have been included under this subspecies are listed under *Astyris profundi* or its subspecies *minor* and *permagna*. The type of *profundi* was dredged in eight hundred and five fathoms. The body whorl is more rounded than in any of the Tertiary indi-

viduals with which it is confusable, the nucleus has more turns, and furthermore, there is a microscopically fine but very distinct and regular spiral sculpture developed on the earlier whorls of the conch, which has never been perceptible on any of the fossil individuals. It would be indeed remarkable to find in the Tertiary sands the representatives of a recent deep water species associated with limpets, littorinas, clams and other characteristic denizens of the littoral zone. There is, however, no reliable evidence that we are in the face of any such phenomenon. The type is in the Collections of the United States National Museum and has been listed as *Astyris profundi* var. *permagna*. As *permagna* has never been described nor figured, the label name has been abandoned in order to avoid the confusion of applying so suggestive an adjective to a subspecies of approximately the same dimensions as the species *sensu stricto*.

Distribution.—*Duplin Formation.* Natural Well, 1½ miles north of Magnolia, Duplin County; Lake Waccamaw, Columbus County, North Carolina. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. *Waccamaw Formation.* Walker's Bluff, Bladen County. Neill's Eddy Landing, 3 miles north of Cronley, Columbus County, North Carolina. Tilly's Lake, Horry County, South Carolina.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Urosalpinx phriknos new species. Plate IV, figs. 2, 4, 6, 7.

General Characters.—Shell of medium size, fusiform, the greatest diameter falling very close to the median line. Aperture approximately half the total altitude. Component volutions normally 7 in number in the adult conch. Whorls of spire convex, obscurely shouldered, decreasing rapidly in size toward the acute apex. Body whorl rather abruptly constricted at the base. Posterior fasciole closely appressed against the preceding volution. Suture line slightly impressed, undulated.

Protoconch.—Protoconch including 1½ small, smooth, somewhat flattened whorls. First half turn partially submerged in the succeeding volution. Differentiation between conch and protoconch very sharp.

Sculpture.—Both axial and spiral sculpture initiated at the beginning of the first whorl of the conch. Axial sculpture of 9 or 10 broad, rounded, prominent ribs which tend to evanesce

upon the posterior fasciole and canal; intercostal areas broadly convex and approximately equal in width to the costals; incremental sculpture consisting of minute, over-lapping lamellæ most conspicuous upon the fasciole, and at the intersection with the spirals. Primary spirals rather low, uniform, broadly arched lirations, 3 or 4 in number on the penult and 14 to 16 upon the ultima and canal; secondaries regularly intercalated; tertiaries rarely.

Aperture.—Aperture rather narrow, pyriform. Labrum arcuate, sub-varicose during the development of the costals; outer edge often minutely crenulated; inner transverse lirations analagous to external secondaries. Labium gently excavated at the base of the body, somewhat thickened but not plicate at the entrance to the canal. Anterior canal rather long, slightly twisted, with proximate margins and a shallow terminal notch.

Umbilicus.—Umbilical chink almost or entirely concealed by the parietal callous.

Dimensions.—Altitude, 19.7 mm. Maximum diameter, 10.4 mm. Diameter at right angles to the maximum diameter, 9.5 mm. Dimensions of a less perfect individual: altitude, 23.3 mm. Maximum diameter, 13.1 mm. Diameter at right angles to the maximum diameter, 12.1 mm.

Type Locality.—Natural Well, Duplin County, North Carolina. *Duplin Formation.*

Observations.—*Urosalpinx phriknos* is remarkable among its congeners for its relatively few but uniform and vigorous axial costæ.

Distribution.—*St. Mary's Formation.* 3 miles southwest of Frog Level, Pitt County. Wilson, Wilson County, North Carolina. *Duplin Formation.* Natural Well, $1\frac{1}{2}$ miles north of Magnolia, Duplin County; 4 to 5 miles below Lumberton and $1\frac{1}{2}$ miles northeast of Fairmont, Robeson County, North Carolina. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Epitonium muldrowi new species. Plate II, fig. 10.

General Characters.—Outline slender, whorls enlarging but slowly. Apex of spire broken away; remaining volutions $4\frac{1}{2}$ in number, convex, barely contiguous, very strongly constricted at the deeply impressed sutures.

Protoconch.—Protoconch not preserved.

Sculpture.—Axial varices equisize, 8 to the whorl; on the later turns, made up of four heavy lamellæ which open up slightly on the medial portion of the whorl, abruptly contracting both vertically and horizontally about midway between the periphery of the whorl and the posterior suture, thus giving to the whorl a somewhat shouldered appearance; varices continuous, fused at the suture line, set somewhat obliquely so that each longitudinal series describes about half a turn around the axis of the shell; intervarical spaces smooth with not even a suggestion of spiral sculpture.

Aperture.—Aperture entire, sub-circular. Outer lip well rounded, margined by the terminal varix, which, in the type, is equal in size to the other varices of the whorl. Inner lip less strongly rounded than the outer and less heavily enameled.

Dimensions.—Altitude, 6.0 mm. Maximum diameter, 3.0 mm.

Type Locality.—Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. *Duplin Formation.*

Observations.—Though only a single specimen has been preserved and that a mutilated one, yet the form seems sufficiently distinct to warrant description. The nearest of kin among the *Epinonia* of the area is, apparently, *Epitonium sayana* Dall. *E. muldrowi* may, however, be separated at a glance by the much heavier varices.

Distribution.—*Duplin Formation.* Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina.

Collections.—Johns Hopkins University.

Melanella bartschi new species. Plate II, fig. 1.

General Characters.—Shell imperforate, straight, quite large for the genus, elongate-conic in outline. Spire subulate, the body a little more than one-third the altitude of the entire shell. Whorls closely appressed, flattened, regularly increasing in size, approximately 15 in number. Body evenly rounded in the adults, more or less obtusely angulated in the young and adolescents. Suture distinct but inconspicuous.

Protoconch.—Apex broken in all available material.

Sculpture.—External surface smooth, polished.

Aperture.—Aperture holostomous, obliquely sub-ovate, moderately wide, acutely angulated posteriorly. Peristome not continuous. Outer lip arcuate, feebly contracted directly in front

of the posterior suture, expanding again away from the suture, slightly patulous anteriorly. Columella quite strongly concave at the base of the body. Inner lip reflexed and fused with the heavy parietal wash.

Dimensions.—Altitude, 16.0+mm. Maximum diameter, 4.2mm.

Type Locality.—Magnolia, Duplin County, North Carolina. *Duplin Formation.*

Observations.—*Melanella bartschi* has been confused in the reference collections with *Melanella conoidea* Kurtz and Stimpson. It is, however, double the size of *M. conoidea,* and has a relatively higher and more compressed body and fewer volutions in proportion to the altitude. The variation in relative dimensions is quite wide. The young are perfect little cones,—the sides of the spire sloping uniformly to the sharply angulated periphery of the body.

We have the pleasure of naming the species in honor of Dr. Paul Bartsch, of the U. S. National Museum, who has so critically monographed the *Melanellidæ* of the West Coast.

Distribution.—Duplin Formation. Magnolia and the Natural Well, $1\frac{1}{2}$ miles north of Magnolia, Duplin County, North Carolina. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina.

Melanella bartschi is quite common in the *Duplin* of the Carolinas.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Melanella magnoliana new species. Plate II, fig. 8.

General Characters.—Shell imperforate, straight, of moderate size and moderately stout for the genus. Elongate conic in outline. Spire subulate, the body a little more than one-third the total altitude. Whorls closely appressed, flattened, regularly increasing in size, 12 in number, including the protoconchal turns. Body whorl broadly rounded. Sutures distinct, even faintly impressed toward the apex.

Protoconch.—Nuclear turns minute, not more than 2 in number, differentiated only by their very slight convexity.

Sculpture.—External surface highly polished, entirely devoid of sculpture.

Aperture.—Aperture holostomous, rather narrow, obliquely subovate in outline, acutely angulated posteriorly. Outer lip feebly

contracted directly in front of the posterior suture, expanding again away from the suture, quite strongly reflexed and patulous anteriorly. Columella obliquely contracted at the base of the body. Inner lip widely reflexed, fused with the parietal callous.

Dimensions.—Altitude, 7.5 mm. Maximum diameter, 2.5 mm.

Type Locality.—Magnolia, Duplin County, North Carolina. *Duplin Formation.*

Observations.—*Melanella magnoliana* is most closely allied, apparently, to *Melanella eborea* Conrad. It differs from the latter, however, in its rather more slender outline, more numerous whorls in proportion to the altitude, and the more widely reflexed, and patulous anterior portion of the aperture.

Distribution.—*Duplin Formation.* Magnolia and the Natural Well, $1\frac{1}{2}$ miles north of Magnolia, Duplin County, North Carolina. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. *Waccamaw Formation.* Walker's Bluff, Bladen County, North Carolina.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Strombiformis dalli new species. Plate II, fig. 5.

Eulima (*Leiostraca*) *rectiuscula* Dall, 1890, Trans. Wagner Free Inst. Sci. Philadelphia, vol. iii, pt. i, p. 160 (ex parte).

General Characters.—Shell imperforate, moderately tall and exceedingly slender. Altitude of body approximately one-half that of the entire shell. Whorls closely appressed, slightly flattened dorso-ventrally, feebly constricted at the suture lines, 10 to 11 in number. Spire subulate, faintly undulated by the barely perceptible medial convexity of the whorls. Body evenly and very gently curved. Base and aperture very long drawn out. Sutures obscure.

Protoconch.—Nuclear turns minute, probably 2 in number, differentiated only by their relative inflation.

Sculpture.—External surface smooth, lustrous.

Aperture.—Aperture holostomous, sub-ovate, acutely angulated posteriorly. Outer lip approximately vertical, patulous and feebly reflexed anteriorly. Inner lip oblique, reflexed, fused with the parietal callous.

Dimensions.—Altitude, 9.8 mm. Maximum diameter, 1.95 mm.

Type Locality.—Caloosahatchie River, Florida. *Caloosahatchie Formation.*

Observations.—In 1889,* Dall referred to *Eulima* (*Leiostraca*) *stenostoma* Sars, a form collected off Fernandina, Florida. In 1890 (see synonomy), he separated it under the name of *Eulima* (*Leiostraca*) *rectiuscula* and united with it some forms collected from the Caloosahatchie. The Tertiary shells are, however, quite distinct from the recent individuals in question: the whorls of the latter are much more numerous,—probably 15 in a perfect specimen of the Recent shell instead of only 11 or 10 as in the fossil,—and the spire includes fully two-thirds of the total altitude of the shell instead of not more than half of it.

Distribution.—*Yorktown Formation.* ½ mile below Suffolk water works dam, Nansemond County, Virginia. *Duplin Formation.* Natural Well, 1½ miles north of Magnolia, Duplin County, North Carolina. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. *Caloosahatchie Formation.* Caloosahatchie River, Florida.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Cæcum flemingi new species. Plate IV, fig. 5.

General Characters.—Shell a gently arcuate tube, slightly smaller at the anterior end than at the posterior.

Protoconch.—Protoconch not preserved. Plug ungulate—a minute, dextrally truncated cone set well to the right of the median vertical.

Sculpture.—External surface smooth excepting for microscopically fine, irregular, incremental striæ.

Aperture.—Aperture oblique to the horizontal axis,—the margin faintly, but perceptibly, contracted.

Dimensions.—Altitude, 3.8 mm. Diameter of aperture, 1.2 mm. Diameter of posterior extremity, 1.0 mm.

Type Locality.—Neill's Eddy Landing, 3 miles north of Cronley, Columbus County, North Carolina. *Waccamaw Formation.*

Observations.—The only constant difference which separated *Cæcum flemingi* from *Cæcum virginianum* Meyer, of the Yorktown Formation, is the contraction of the anterior aperture. No trace of this is discernible in any one of the many Yorktown individuals examined, while, on the other hand, it is a diagnostic of every perfect adult from the Duplin and Waccamaw. The Yorktown forms, furthermore, run a little larger, and perhaps

* Dall, 1889, Bull. U. S. National Museum, No. 37, p. 126.

a little less arcuate. The greater dimensions will serve to separate *C. flemingi* from the only other unsculptured species of the Neocene of Virginia and North Carolina, the *Cœcum glabrum* of Montagu.

The species is named in honor of the author of the genus.

Distribution.—Duplin Formation. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. *Waccamaw Formation.* Neill's Eddy Landing, 3 miles north of Cronley, Columbus County, North Carolina.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Turritella duplinensis new species. Plate II, fig. 4.

General Characters.—Shell a uniformly tapering pyramid, relatively more slender in the immature stages than in the adult. Volutions approximately 15 in number. Earlier coils prominently keeled at the periphery, the later trapezoidal, or slightly overhanging. Peripheral angle approaching a right angle. Base flattened to slightly convex in the adult. Suture lines distinct, the later whorls somewhat constricted.

Protoconch.—Protoconch small, smooth, twice-coiled, with slightly tilted tip.

Sculpture.—Axial sculpture absent or restricted to faint, irregular, incremental wrinkles on the later whorls of the adult. Spiral sculpture fairly constant for the genus; in a typical, half-grown individual, a single, well rounded primary, situated posterior to the suture line and strong enough to subcarinate the later whorls; secondaries 2 in number, as a rule, the one outlining the equatorial region of the whorl, the other a little behind it, the latter increasing in prominence away from the apex, the former crowning the periphery of the earlier whorls, decreasing in relative elevation anteriorly; a tertiary intercalated about midway between the suture and the posterior secondary, and another directly in front of the primary and constituting the circumbasal lira of the ultima; quaternaries sub-equal, and separated by equal interspaces, 12 to 15 in number, 3 between the posterior tertiary and the suture, 1 to 3 between the posterior tertiary and the posterior secondary, 3 or 4 between the two secondaries, 5 between the anterior secondary and the primary, 1 to 3 between the primary and the anterior tertiary and occasionally 1 or 2 between the anterior tertiary and the suture; basal liræ 15 to 20, the majority of them fine, but with coarser threads irregularly interspersed.

Aperture.—Aperture holostomous, sub-quadrate. Outer lip straight. Inner lip strongly arcuate.

Dimensions.—Altitude, 24.0 mm. Maximum diameter, 6.5 mm.

Type Locality.—Natural Well, Duplin County, North Carolina. *Duplin Formation.*

Observations.—*Turritella duplinensis* bears a strong resemblance to the laterally compressed race of *Turritella subannulata* Heilprin. It is doubtless closely related and may be a precursor. It also suggests *Turritella æquistriata* Conrad in general outline and type of sculpture, although the latter is keeled at the median line of the volution, the lirations are broader, more nearly equal in size, and separated by linear interspaces.

In the single adult form in the U. S. National Museum Collection from the Cape Fear River, the systems have broken down and the liræ are numerous, equisized, irregularly alternating, and tending to concentrate on the anterior portion of the whorl. This suggests the possible identity with *Turritella carolinensis*, vaguely described and badly figured by Conrad in 1875.* It is probable, however, that the latter is characterized by a relatively broader base, and a consistently more uniform spiral sculpture. Conrad's type is not available, unfortunately, and it seems unwise to attempt to establish definite relationships between two species, one of which is so ill defined.

Distribution.—*Duplin Formation.* Natural Well, 1½ miles north of Magnolia, Duplin County, North Carolina. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. Porter's Landing, Savannah River, Georgia. *Waccamaw Formation.* Neill's Eddy Landing, 3 miles north of Cronley, Columbus County, North Carolina.

Turritella duplinensis is the most abundant and characteristic species of the Formation from which it has received its name.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Liotia (Arene) major new species. Plate IV, figs. 1, 3.

General Characters.—Shell nacreous within. Large for the genus. Scalar-turbinate in outline. Spire moderately elevated, scalariform. Body whorl well rounded, though pseudo-angulated by the prominence and position of the spirals. Whorls 6 in number,

*Conrad in Kerr, 1875, Rept. Geol. Survey, North Carolina, Appendix A, p. 22, pl. iv, fig. 8.

including those of the protoconch. Suture lines distinct but not impressed.

Protoconch.—Protoconch small and smooth, not sharply differentiated from the conch, twice-coiled. Initial turn quite highly inflated, immersed only at the tip. Succeeding volution increasing rapidly in diameter and gradually assuming the angular outline of the whorls of the conch. Opening of conch indicated by the appearance of a faint sculpture and by the sharpening of the shoulder angle.

Sculpture.—Axial sculpture absent excepting for incrementals; incrementals vigorous, oblique to the sutures, most conspicuous upon the shoulder at their intersection with the moniliform spirals and within the umbilicus. Spiral sculpture of coarse, heavily beaded liræ, 2 in number upon the earliest sculptured whorl, the one outlining the shoulder, the other midway between the shoulder and the anterior suture; a third lira which increases rapidly in prominence until near the aperture it almost, but not quite, equals those on either side, intercalated midway between them; a fourth non-annulate liration emergent from behind the posterior suture of the body whorl and outlining the anterior margin of the periphery. Base ornamented with 4 broad, flattened fillets, somewhat irregular in size and spacing, occasionally sulcated medially, and with a fortuitous secondary introduced behind the periphery. Umbilical carina very prominent, heavily annulated.

Aperture.—Aperture entire, sub-circular in outline. Outer lip heavier and more broadly arcuate than the inner margin, crenulated in harmony with the external sculpture. Pillar not reinforced. Parietal wall heavily glazed.

Umbilicus.—Umbilicus scalariform, profound, persistent to the apex of the spire, sculptured with indistinct spiral liræ and heavy incrementals.

Dimensions.—Altitude, 5.7 mm. Maximum diameter, 8.7 mm. Diameter at right angles to the maximum diameter, 7.5 mm.

Type Locality.—Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. *Duplin Formation.*

Observations.—*Liotia major* is much the largest of any of the Liotias recorded from the area under discussion, though not so large as *Liotia shacklefordensis* Olsson, the closely related Yorktown analogue. *L. major* differs from the common co-existent *L. gemma* in the development of strong basal spirals and in the

absence of a sutural channel and of any radial sculpture other than the incrementals. *L. shacklefordensis* is higher relatively and differs in the details of the body sculpture.

The shell is well protected by an outer percellanous covering, which, in the best preserved individuals, completely conceals the nacre within. The weathered shells are so highly iridescent, however, that they are much more suggestive of *Solariella* than of *Liotia*.

Distribution.—Duplin Formation. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. Not uncommon.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Pandora (Clidiophora) prodromos new species. Plate IV, figs. 9, 11, 12, 14.

General Characters.—Shell of moderate dimensions, rather heavy, compressed. Inequivalve. Strongly inequilateral. Sub-quadrate in outline. Umbones very low and inconspicuous, often perforate, strongly anterior. Lunula not developed. Escutcheon persisting to the extremity of the posterior dorsal margin, sub-linear, sharply delimited. Anterior extremity broadly rounded. Posterior extremity quite squarely truncate. Dorsal margin feebly convex. Ventral margin broadly arcuate. Submarginal carina outlined in the right valve by a linear sulcus, in the left by a sub-acute ridge. Anterior area very obscurely differentiated, occupying approximately one-third of the entire valve.

Sculpture.—Radial sculpture not developed. Incremental sculpture somewhat undulatory on the early portion of the valve, laminar and crowded toward the ventral margin.

Ligament.—Ligament internal, lodged, in the right valve between the middle and posterior cardinals and, in the left valve, in a bilobed pit posteriorly produced along the dorsal margin.

Dentition.—Hinge dentition robust. Anterior cardinal of right valve almost entirely obsolete. Middle cardinal elongate, rhombic, strongly and abruptly elevated. Posterior cardinal compressed, elongate-cuneate, wedging out dorsally. Anterior cardinal of left valve extending from the apex of the umbones to the anterior adductor scar, uniformly elevated, widening slightly toward the umbones. Posterior cardinal linear, inconspicuous, outlining the anterior margin of the resilial pit.

Muscle Impressions and Pallial Line.—Adductor impressions small, slightly sunken, irregularly rotund, placed well up toward

the dorsal margin. Pallial line punctate, broadly arcuate, remote from the ventral margin.

Dimensions.—Altitude, 33.0 mm. Latitude, 21.0 mm. Diameter, 6.0 mm.

Type Locality.—Yorktown, York County, Virginia. *Yorktown Formation.*

Observations.—Though *Pandora prodromos* does not occur at Mayesville, the species has been described in this paper in order to bring out the close relationship which apparently exists between the Tertiary Pandoras of the East Coast and the Recent. In the Recent, the sub-genus *Clidiophora* is represented south of the Hatteras axis by the delicate, alate little form, *Pandora trilineata* Say. The northern analogue, *P. gouldiana* Dall, is larger, heavier, and rudely rectangular in outline. The differences between the northern and the southern analogues have apparently been inherited from their Tertiary precursors, *Pandora tuomeyi* new species of the Duplin and Waccamaw faunas and *Pandora prodromos* of the Yorktown. *P. prodromos* is a little higher, relatively than *P. gouldiana* Dall, and the posterior margin is not so sharply constricted below the sub-marginal keel. The dentition of the Tertiary species is very much heavier than that of the Recent. The middle and posterior cardinals of the right valve and the anterior cardinal of the left are, in *P. gouldiana* Dall, compressed into little more than linear ridges, while in *P. prodromos* they are decidedly heavy and robust. *P. prodromos* is neither so large nor so heavy, however, as the co-existent *P. crassidens* Conrad; there is no trace retained of the linear radial sculpture which characterizes *crassidens*, and the dorsal portion of the anterior cardinal of the left valve is not expanded into a well defined flange as in Conrad's species.

Distribution.—*Yorktown Formation.* Yorktown, York County; $1\frac{1}{2}$ miles north of Suffolk, $1\frac{1}{2}$ miles east of Suffolk, 1 mile northeast of Suffolk, 1 mile west of Suffolk, and $\frac{1}{2}$ mile below the water works dam at Suffolk, Nansemond County, Virginia. Tar Ferry, on Wiccacon Creek opposite Harrelsville, Hertford County, North Carolina.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Pandora (Clidiophora) tuomeyi new species. Plate IV, figs. 8, 10, 13.

Pandora trilineata Say, 1856, Tuomey and Holmes, Pleiocene Fossils South Carolina, p. 76, pl. xx, fig. 13.

Not *Pandora trilineata* Say, 1822, Jour. Acad. Nat. Sci. Philadelphia, 1st ser., vol. ii, p. 261.
Pandora (Clidiophora) trilineata Say, 1903, Dall, Trans. Wagner Free Inst. Sci. Philadelphia., vol. iii, pt. vi, p. 1519 (ex parte).

General Characters.—Shell rather small, rather thin. Transversely alate in outline, slightly flexuous, compressed. Inequivalve, but only to slight degree. Strongly inequilateral. Umbones very low, the apices usually perforate, strongly anterior but not terminal. Lunule absent. Escutcheon sub-linear, almost as long as the posterior dorsal margin, strongly angulated upon its outer border. Anterior end of valve sharply rounded or obtusely pointed. Posterior dorsal margin gently convex. Submarginal carinæ very sharp, wider and more depressed posteriorly in the left valve than in the right. Ventral margin curving winglike from the anterior expansion to the posterior rostrum. Margin in front of the rostrum contracted in the left valve by the anterostral depression. Right carina outlined by a linear sulcus. Anterior area between one-third and one-half the entire valve, differentiated only in the left valve, and then merely by a more or less obsolete, linear sulcus and the abrupt upcurving of the growth lines toward the front.

Sculpture.—Radial sculpture usually absent even in the right valve. Incremental sculpture fine, irregular, often discontinuous, with no very pronounced resting stages.

Ligament.—Ligament entirely enternal; lodged in the right valve, between the middle and posterior cardinals and, in the left valve, in a bilobed pit, posteriorly produced beneath the dorsal margin.

Dentition.—Hinge dentition moderately robust. Anterior cardinal of right valve obsolete. Middle cardinal compressed, rhomboidal or hatchet-shaped. Posterior cardinal compressed, obliquely produced, often acutely pointed medially or ventrally. Anterior cardinal of left valve a moderately prominent ridge of uniform elevation extending from the umbones to a point just dorsal to the medial line of the anterior adductor. Posterior cardinal linear, inconspicuous, seated upon the anterior edge of the resilial pit.

Muscle Impressions and Pallial Line.—Adductor muscle impressions slightly sunken, irregularly rotund. Pallial line punctate, non-sinuous, nearer the base anteriorly than posteriorly.

Dimensions.—Altitude, 9.5 mm. Latitude, 21.0 mm. Semidiameter (left valve), 2.0 mm.

Type Locality.—Walker's Bluff, Bladen County, North Carolina. *Waccamaw Formation.*

Observations.—*Pandora tuomeyi* has apparently been confused with the recent *Pandora trilineata* Say, a rather smaller, and relatively lower species, more tapering in outline posteriorly. The most fundamental difference lies, however, in the dentition. In general, the cardinals of the recent species are the more compressed, the more produced, and the more sharply cut. In particular, the inner surface of the right valve of the Tertiary form, in front of the middle cardinal, is not thickened, but often feebly channelled; the middle cardinal is hatchet-shaped or rhomboidal and shorter than the elevated laminar tooth of *P. trilineata;* the posterior cardinal is shorter, heavier, and less uniform in elevation, and the inequality between the two right cardinals is much more marked in the fossil than in the recent species. In the left valve, the resilial pit in *tuomeyi* is broader and less produced, and the cardinal upon its anterior margin, shorter and less sharp; the left cardinal in *P. trilineata* has strongly defined margins, bears a flange upon the dorsal half of its inner surface, and terminates ventrally near the dorsal end of the anterior adductor impression; the anterior cardinal of *tuomeyi,* on the other hand, suggests much more strongly a kinship to the sub-genus *Kennerleyia;* its anterior limit is often ill-defined, and the hiatus between such a tooth and the incurved and calloused surface of the anterior margins of *Kennerleyia* is not great; the cardinal in *tuomeyi,* furthermore, is not expanded dorsally into a flange, and is placed forward so that its ventral termination is at the medial line of the adductor impression.

The young of *Pandora carassidens* Conrad, while similar in dentition, are relatively higher, less alate, heavier, and less compact in shell texture, and show a very much stronger tendency toward radial sculpture in the right valve.

Distribution.—*Duplin Formation.* Darlington, Darlington County; Muldrow's Mills, 5 miles southeast of Mayesville, Sumter County, South Carolina. *Waccamaw Formation.* Walker's Bluff, Cape Fear River, Bladen County, North Carolina.

Collections.—U. S. National Museum. Johns Hopkins University. Academy of Natural Sciences of Philadelphia.

Strigilla eutykta new species. Plate III, figs. 4, 8, 10.

General Characters.—Shell sub-orbicular, slightly oblique, inequilateral, moderately inflated in the umbonal region. Anterior

end evenly rounded from umbone to base. Posterior end somewhat obliquely produced and obscurely truncate dorsally, rounded laterally. Base very gently curved. Umbones inconspicuous, opisthogyrate, placed a little in front of the median line. Lunule rather narrow, clearly delimited, Escutcheon narrow, somewhat elongated.

Sculpture.—External sculpture typical of the genus in general character. Posterior portion of the valve slightly depressed but not angulated, sharply differentiated, however, by the discrepant ornamentation. Medial and anterior positions covered with fine, chiselled grooves which extend from the boundary line of the posterior area and from the ventral margin obliquely upward and forward to the umbones and anterior margin. Grooves of posterior area arranged in crowded concentric chevrons with a high apical angle directed toward the umbones.

Ligament.—Enternal characters as in *Strigilla flexuosa* Say. Ligament external, opisthodetic.

Dentition.—Right valve armed with a very small, simple, anterior cardinal, a much more prominent bifid posterior cardinal, and a strong, posterior and anterior lateral. Dentition of left valve reduced to a moderately stout anterior, and a very slender, laminar, posterior cardinal. Dorsal margins slightly modified to function as laterals.

Muscle Impressions and Pallial Line.—Muscle impressions indistinct. Anterior somewhat more elongated than the posterior. Pallial line rarely discernible, its dorsal margin a low arch extending from the ventral boundary of one adductor to the ventral boundary of the other, rising a little higher in the left valve than in the right, but not even in its maximum elevation overreaching the medial line of the adductors.

Dimensions.—Altitude of type, 10.7 mm. Latitude, 11.0 mm. Semi-diameter, 3.3 mm. Altitude of other figured individuals, 10.1 mm.; 8.7 mm. Latitude, 10.5 mm.; 9.3 mm. Semi-diameter, 2.8 mm.; 2.2 mm.

Type Locality.—Walker's Bluff, Cape Fear River, Bladen County, North Carolina. *Waccamaw Formation.*

Observations.—Representatives of this species have formerly been included under *Strigilla flexuosa* Say. Say's type is not available at present nor does he give a specific locality. From a comparison of his description and the recent material in the reference collections in the National Museum, it seems probable that the

type comes from off the eastern coast of Florida or from the Bahamas. These forms are more convex than *Strigilla eutykta*, more inequilateral, less rounded, and shorter anteriorly, and are sculptured posteriorly with a fine zigzag grooving instead of the elongated cone-in-cone of the new species. There is a considerable degree of variation among the recent forms, but the characters hold constant for any one general locality. In the shells from off the west coast of Florida the sculpture is approximately uniform over the entire valve. It is possible that even among the recent faunas, the species has not been sufficiently restricted. The species figured on Plate iv, fig. 9, is from Cape Florida, Catalogue Number 93380 of the U. S. National Museum Collection.

Distribution.—*St. Mary's Formation.* 2½ miles northwest of Williamston, Martin County, North Carolina. *Duplin Formation.* Natural Well, 1½ miles north of Magnolia, Duplin County; 4 miles north of Lumberton, 2 miles below Lumberton, 4 to 5 miles below Lumberton, Fairmont (Ashpole), 1½ miles northeast of Fairmont, Robeson County; Lake Waccamaw, Columbus County, North Carolina. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. *Marks Head Marl.* Porter's Landing, Screven County, Georgia. *Waccamaw Formation.* 4 miles south of Elizabethtown on Hammond Creek, and at Walker's Bluff on the Cape Fear River, Bladen County; Neill's Eddy Landing, 3 miles north of Cronley, Columbus County, North Carolina. *Caloosahatchie Formation.* Caloosahatchie River and Shell Creek, Florida.

Collections.—U. S. National Museum. Johns Hopkins University. The Academy of Natural Sciences of Philadelphia.

Donax cuneola new species. Plate III, figs. 1, 3.

General Characters.—Shell small, ventricose, inequilateral, cuneate. Umbones posterior, opisthogyrate, inflated and fairly conspicuous for the genus. Anterior margin obliquely truncated. Posterior margin rounded. Base line straight or very slightly contracted in front of the posterior keel which is clearly defined, as a rule, by an elevated ray. Anterior area often feebly differentiated by an ill-defined rostrum.

Sculpture.—Radial sculpture fine and faint, much more conspicuous in forms from which the periostracum has been eroded. Basal serration sharp.

Ligament.—Ligament short, external, opisthodetic.

Dentition.—Hinge heavy for the genus and astonishingly variable within the limits of the species. Anterior cardinal of the right valve laminar, almost or entirely obsolete, the posterior trigonal and very strong. Cardinals of the left valve equal size and fairly strong. Laterals heavy, two in number in each valve.

Muscle Impressions and Pallial Line.—Anterior muscle impression rather small, cuneate, rounded ventrally. Posterior muscle impression rotund. Pallial line and sinus often obscure, the sinus very broad and deep, partially confluent ventrally with the pallial line.

Dimensions.—Altitude, 6.4 mm. Latitude, 10.0 mm.

Type Locality —Neill's Eddy Landing, Columbus County, North Carolina. *Waccamaw Formation.*

Observations —The most closely allied species is *Donax emmonsi* Dall. From this form, *Donax cuneola* is separated by the higher, more tumid umbones, the more oblique anterior, the more rounded posterior and the straighter ventral margin, the faintly indicated anterior angulation, the more strongly differentiated posterior area, and the heavier, more compact hinge teeth From *Donax fossor* Say, it is distinguished by the relatively greater altitude, the more nearly central umbones, and the less produced anterior margin.

Distribution.—Yorktown Formation. Yorktown, York County; 1½ miles northeast of Suffolk, Nansemond County, Virginia. *Duplin Formation.* 4 miles northeast of Fairmont, Robeson County, North Carolina. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. *Waccamaw Formation.* Walker's Bluff, Cape Fear River, Bladen County; Neill's Eddy Landing, 3 miles north of Cronley, Cape Fear River, Columbus County, North Carolina.

Collections.—U. S. National Museum. Johns Hopkins University. The Academy of Natural Sciences of Philadelphia.

Macoma carolinensis new species.. Plate III, figs. 5, 6, 7.

General Characters.—Shell thin. Inflated. Irregularly ovate, with a very feeble posterior flexure. Slightly inequivalve, the right valve a little higher than the left. Inequilateral. Anterior dorsal slope gentle, merging gradually into the broadly rounded anterior end. Posterior end blunt. Anterior dorsal and ventral margins usually converging at a very low angle in the right valve, parallel in the left. Posterior dorsal margin declining much more

rapidly than the anterior. Ventral margin approximately straight medially, slightly upcurved distally. Umbones low, opisthogyrate, situated a little behind the median line.

Sculpture.—External surface smooth except for feeble incrementals. Faint traces of radial color markings also visible.

Ligament.—Ligament external, opisthodetic, seated on a narrow and elongated nymph.

Dentition.—Dentition as in *Macoma virginiana* Conrad. Anterior cardinal of the right valve simple and stout. Posterior bifid and relatively slender. In the left valve a bifid, relatively heavy anterior, and a simple, sub-laminar posterior cardinal.

Muscle Impressions and Pallial Line.—Interior faintly striated radially. Anterior muscle impression elongated. Posterior semi-elliptical. Pallial sinus deep, projected more than two-thirds of the distance forward toward the anterior margin, confluent ventrally with the pallial line for about one-half its length, its dorsal margin, in the right valve, bowed upward perceptibly beneath the umbones; in the left valve, apparently much more nearly parallel to the base.

Dimensions.—Right valve. Altitude, 12.3 mm. Latitude, 18.2 mm. Semi-diameter, 4.3 mm. *Left valve,* of another individual. Altitude, 12.5 mm. Latitude, 19.5 mm. Semi-diameter, 3.3 mm.

Type Locality.—Darlington, South Carolina. *Duplin Formation.*

Observations.—Macoma carolinensis is the analogue in the Neogene south of the Hatteras axis of *Macoma virginiana* and its subspecies *conradi* north of the axis. It is rather higher, less flexuous, and more nearly equilateral than either of the former, both by reason of the more nearly central umbones and the greater similarity of the anterior and posterior extremities. The posterior dorsal margin of *M. carolinensis* has a uniform, fairly steep slope, while that of *M. virginiana* is slightly contracted directly behind the umbones, then obliquely produced at a very low angle. The posterior lateral margin of the former is rounded into the slightly upturned base, that of the latter, obscurely truncated and its ventral margin more strongly recurved. The pallial sinus in both species varies quite widely but that of *carolinensis* is, on the average, more profound, and more strongly arched beneath the umbones.

The species is rare in the *Duplin* and *Waccamaw* Formations of North and South Carolina.

Distribution.—*Duplin Formation.* 2 miles below Lumberton, Robeson County, North Carolina. Darlington, Darlington County; Muldrow's Place, 5 miles south east of Mayesville, Sumter County, South Carolina. *Waccamaw Formation.* Mrs. Guion's marl pit, Cape Fear River, Columbus County, North Carolina.

Collections.—U. S. National Museum. Johns Hopkins University. The Academy of Natural Sciences of Philadelphia.

Mulinia magnoliana Dall. Plate III, fig. 2.

Spisula (Hemimactra ?) magnoliana Dall, 1898, Trans. Wagner Free Inst. Sci. Philadelphia, vol. iii, pt. iv, p. 899, pl. xxvii, fig. 29.

Original Description.—"Shell small, equilateral, somewhat compressed, with small, little-elevated, pointed, adjacent beaks; surface smooth except for lines of growth and a feeble angulation extending backward from the umbo to the lower posterior margin; ends nearly equally rounded, the posterior slightly more pointed, the base moderately and evenly curved; pallial sinus small, angular, very short; hinge normal, feeble, with short, granulose laterals. Lon. 17, alt. 11, diam. 7 mm." Dall, 1898.

Type Locality.—Magnolia, Duplin County, North Carolina. *Duplin Formation.*

Observations.—In the unique valve, which was selected as the type of *Spisula magnoliana* Dall, the cardinal margin has been broken away, and the edges so perfectly rounded by erosion, that all traces of the characteristic ligamentary attachment of the *Mulinia* have been obliterated and replaced by a pseude-Spisuloid attachment. This fact was established by the examination of fresh individuals in which the septum had been recently chipped away.

The subspecies is separated from the closely related protean *congesta* by the lower, more regularly oval and elongate valves, the less prominent umbones and the short, rather heavy laterals.

Distribution.—*St. Mary's Formation.* South Quay, Nansemond County, Virginia. 3½ miles below Palmyra Bluff, Halifax County; 8 to 9 miles south of Greenville, Pitt County; 1 mile north of Castoria, Greene County, North Carolina. *Yorktown Formation.* Rock Landing, Craven County, North Carolina. *Duplin Formation.* 10 miles south of Clinton, Sampson County, Natural Well, ½ mile north of Magnolia, Duplin County; 2 miles below Lumberton, Robeson County, North Carolina. Muldrow's Place, 5 miles southeast of Mayesville, Sumter County, South Carolina. Bruns-

wick River bed, Brunswick, Glynn County, Georgia. *Waccamaw Formation.* Walker's Bluff, Bladen County, Neill's Eddy Landing, 3 miles north of Cronley, Columbus County, North Carolina.

Collections.—U. S. National Museum (type, Catalogue Number 115080). Johns Hopkins University.

Explanation of Plates I, II, III and IV.

Plate I.—Fig. 1.—*Drillia precursor* n. sp. (×8)
Fig. 2.—*Drillia tricatenaria* Conrad. (×4)
Fig. 3.—*Drillia sumterensis* n. sp. (×4)
Fig. 4.—*Mitra dalli* n. sp. (×8)
Fig. 5.—*Alectrion neogenensis* n. sp. (×5)
Fig. 6.—*Alectrion neogenensis* (×5)
Fig. 7.—*Mitromorpha mitrodita* n. sp. (×7)
Fig. 8.—*Mitra dalli* n. sp. (×7)
Fig. 9.—*Cancellaria tabulata* n. sp. (×2)
Fig. 10.—*Phos sloani* n. sp. (×3)

Plate II.—Fig. 1.—*Melanella bartschi* n. sp. (×3)
Fig. 2.—*Anachis sumterensis* n. sp. Apical view. (×10)
Fig. 3.—*Anachis anomala* n. sp. (×6)
Fig. 4.—*Turritella duplinensis* n. sp. (×2)
Fig. 5.—*Strombiformis dalli* n. sp. (×6)
Fig. 6.—*Anachis sumterensis* n. sp. (×8)
Fig. 7.—*Anachis styliola* n. subsp. *obsoleta.* Type. (×4)
Fig. 8.—*Melanella magnoliana* n. sp. (×8)
Fig. 9.—*Anachis styliola* n. subsp. *obsoleta.* Stout form. (×4)
Fig. 10.—*Epitonium muldrowi* n. sp. (×8)
Fig. 11.—*Astyris communis* n. subsp. *carolinensis.* (×3)
Fig. 12.—*Anachis styliola* n subsp. *obsoleta.* Stout form. (×4)

Plate III.—Fig. 1.—*Donax cuneola* n. sp. Exterior of right valve. (×3)
Fig. 2.—*Mulinia magnoliana* Dall. Interior of left valve. After Dall. (×2.5)
Fig. 3.—*Donax cuneola* n. sp. Interior of right valve. (×3)
Fig. 4.—*Strigilla eutykta* n. sp. Exterior of right valve of type. (×4)
Fig. 5.—*Macoma carolinensis* n. sp. Exterior of right valve of type. (×3)
Fig. 6.—*Macoma carolinensis* n. sp. Interior of right valve of type. (×3)
Fig. 7.—*Macoma carolinensis* n. sp. Interior of left valve. (×3)
Fig. 8.—*Strigilla eutykta* n. sp. Interior of left valve. (×4)
Fig. 9.—*Strigilla flexuosa* Say. Exterior of left valve. (×4)
Fig. 10.—*Strigilla eutykta* n. sp. Interior of right valve. (×4)

Plate IV.—Fig. 1.—*Liotia* (*Arene*) *major* n. sp. Profile. (×4)
Fig. 2.—*Urosalpinx phriknos* n. sp. Apical view. (×6)
Fig. 3.—*Liotia* (*Arene*) *major* n. sp. Basal view. (×4)
Fig. 4.—*Urosalpinx phriknos* n. sp. (×2)
Fig. 5.—*Caecum flemingi* n. sp. (×6)
Fig. 6.—*Urosalpinx phriknos* n. sp. Profile of apex. (×6)
Fig. 7.—*Urosalpinx phriknos.* Apertural view. (×2)
Fig. 8.—*Pandora* (*Clidiophora*) *tuomeyi* n. sp. Interior of right valve. (×2)
Fig. 9.—*Pandora* (*Clidiophora*) *prodromos* n. sp. Exterior of right valve. (×1)
Fig. 10.—*Pandora* (*Clidiophora*) *tuomeyi* n. sp. Exterior of left valve. (×2)
Fig. 11.—*Pandora* (*Clidiophora*) *prodromos* n. sp. Exterior of left valve. (×1)
Fig. 12.—*Pandora* (*Clidiophora*) *prodromos* n. sp. Interior of right valve. (×1)
Fig. 13.—*Pandora* (*Clidiophora*) *tuomeyi* n. sp. Interior of left valve. (×2)
Fig. 14.—*Pandora* (*Clidiophora*) *prodromos* n. sp. Interior of left valve. (×1)

March 18.

The President, JOHN CADWALADER, A.M., LL.D., in the Chair.

Thirty-six persons present.

A paper entitled "A Study of the Orthopterous Genus Mermiria Stål", by JAMES A. G. REHN, was presented for publication.

The deaths of the following members were announced:

Charles J. Bender.
Francis A. Cunningham.

The death of Raphael Blanchard, a correspondent, was also reported.

Oyster Farms of Delaware Bay.—DR. PILSBRY spoke of the oyster industry of Delaware Bay, illustrating his remarks with photographs taken mainly on Maurice River, New Jersey. The processes of oyster cultivation were described. In Maurice River Cove the beds are seeded from oysters dredged in deeper parts of the Bay, but probably reproduction on the spot is the chief source of the supply. On mud bottom a cultch of oyster shells is first scattered. This is not necessary on sand or gravel bottom. The situation of these beds, remote from any source of sewage, insures a wholesome food supply, free of pathologic bacteria. The processes and apparatus of dredging, freshening ("drinking"), and culling were shown by lantern illustrations. In the autumn months the oysters cannot remain in the floats, in which they absorb fresh water, more than 24 hours. At the time of the speaker's visit (January), about 400 schooners were in commission.

The subject was further discussed by the President, who had long been interested in the development of this industry, and by Dr. Henry Skinner.

The following was ordered to be printed.

A STUDY OF THE ORTHOPTEROUS GENUS MERMIRIA STÅL

BY JAMES A. G. REHN

For a number of years we have found that any attempt to make determinations in this genus from the basis of the last revisionary treatise published upon it, that by Scudder in 1899, led us into difficulties, some clearly evident, others more subtle and then not possible of correction. In order to clear up the situation, Mr. Morgan Hebard and the author, in the course of extensive field work on the North American Orthoptera, have paid particular attention to this genus, as a result of which a most extensive series has been made accessible for study.

Within the last five years or so we have received an added incentive for making a comprehensive taxonomic, variational and distributional study of the genus *Mermiria*, in that we have had the pleasure and profit of association with Dr. C. E. McClung, who has made extensive studies on the chromosomes in this genus. From his work he was able to point out certain evident differentiations, which our studies show to be reflected in the external morphological features, and it was his earnest desire that a good taxonomic groundwork be laid for future work, cytological as well as morphological.

The author owes much to the encouragement and assistance of Dr. McClung in the preparation of this paper, the assistance being of a practical character, as the basic sorting of the whole series studied was made by him in intervals between his official duties, and the first draft of a key to the species was also drawn by him. The cordial coöperation and valued suggestions given by him have made easier some of the irksome portions of the examination and analysis of the really large series on which this paper is based. We are also indebted to our colleague, Mr. Hebard, for numerous suggestions and kindly criticisms, as well as unrestricted use of his collection.

MERMIRIA Stål

1839. *Opsomala* Serville, Hist. Nat. Ins., Orth., p. 586. (Part.)
1870. *Opomala* Thomas, Proc. Acad. Nat. Sci. Phila., 1870, p. 77. (Error for *Opsomala*.)

1873. *Mermiria* Stål, Recensio Orthopt., i, p. 102. [*M. belfragii* Stål.]
1877. *Mermiria* Scudder, Proc. Boston Soc. Nat. Hist., xix, p. 30.
1890. *Mermiria* Bruner, Proc. U. S. Nat. Mus., xii, p. 53.
1897. *Mermiria* McNeill, Proc. Davenp. Acad. Nat. Sci., vi, pp. 195, 203.
1899. *Mermiria* Scudder, Proc. Amer. Acad. Arts and Sci., xxxv, p. 41.
1904. *Mermiria* Bruner, Biol. Cent.-Amer., Orth., ii, pp. 26, 37.
1904. *Papagoa* Bruner, Ibid., ii, pp. 27, 42. [*P. arizonensis* Bruner.]

Genotype: *M. belfragii* Stål (=*Opomala neo-mexicana* Thomas). Type by monotypy.

Position of Genus.—The genus *Mermiria* is the sole member of the group Mermiriæ. The other genus placed in that group by Brunner, 1893, was *Syrbula*, and this has no close affinity with *Mermiria*, being instead a member of the group Amblytropidiæ.[1] No affinity exists with any of the typical Hyalopterygine genera, such as *Hyalopteryx, Achurum, Eutruxalis, Truxalis* and *Radinotatum*, but considerable resemblance and some real relationship is evident with *Pseudopomala*, which is an aberrant Hyalopterygid, probably connecting the latter group with the Mermiriæ. The genus *Acantherus* is not allied and its affinities are clearly with the Orphulellæ or the Amblytropidiæ, or perhaps both.

The exact position of the Mermiriæ in the sub-family Acridinae remains to be determined, and then only after a comprehensive study of the known genera, but it is evident that its development was probably from a Hyalopterygine stock, possibly through *Pseudopomala*, and the Mermiriæ should, at least, be kept in the general neighborhood of the Hyalopteryges.

Generic Description.—Form typically Truxaloid, elongate, alate. Head with facial line decidedly retreating: fastigio-facial angle evident: fastigium produced, angulate to rounded, weakly or not at all carinate, weakly or moderately impressed: lateral foveolæ obsoletely to appreciably indicated, sub-ventral in position, not visible from the dorsum: frontal costa sharply indicated, continuous, in part at least sulcate: lateral facial carinæ prominent, diverging ventrad: eyes ovoid to ovoid-elliptical, axis dorso-cephalad to ventro-caudad, moderately prominent from dorsum: antennæ ensiform, deplanate. Pronotum longitudinal, median carina indicated, with or without lateral carinæ: lateral lobes normal, with or without supplementary longitudinal carinæ at middle, ventral margin of lateral lobes distinctly or scarcely thickened: caudal margin of disk arcuate or angulate; prozona of dorsum

[1] This is very evident after making comparisons of *Syrbula* with a number of genera of the Amblytropidiæ. It is clearly not far removed from *Leurocerus* and *Amblytropidia*.

always longer than metazona. Tegmina and wings fully developed. Prosternum with low median protuberance or slight transverse ridge: mesosternal lobes separated by a distinct interspace or subattingent: metasternal lobes separated by a narrow interspace to attingent. Subgenital plate of ♂ very bluntly, moderately or strongly conoid produced, hardly compressed. Cephalic and median limbs short, slender. Caudal femora moderately robust to slender, genicular lobes and angles not produced; caudal tibiæ with spines of external margin more numerous than those of internal margin.[2]

Classification.—The features of greatest value in differentiating the species of the genus are almost entirely structural, although several color features are of relative, or even, in one case in one sex, of primary importance. The most important feature, and one which shows no intra-specific variation in this genus, is the presence or absence, and strength when present, of lateral pronotal carinæ. In all but *intertexta* there can be no question of the presence or absence of these structures, while in *intertexta* they are weakly indicated. In certain species there is found, bordering ventrad the paired dark lateral bars on the postocular region of the head and the lateral lobes of the pronotum, a strumose line or carina. This is distinctly indicated in *texana* and *alacris*, and incompletely and weakly so in *neo-mexicana* and *intertexta*. The lateral foveolæ of the vertex are of taxonomic importance in the depth of their indication, but there is some variation in this feature. The general form of the fastigium, of the fastigio-facial angle and the angle of the facial line are of value, but there is much variation in the exact degree of these features, particularly in that of the form of the fastigium. The proportion of length to depth of the lateral lobes of the pronotum is a feature which has considerable importance. The very slender or the average form of the caudal femora are also features of value, but there is much individual variation in that considered average, although the very slender type is more constant. The antennæ show certain specific types which, however, are very difficult to compare satisfactorily. The general form, whether average or very slender, is also an important feature in this genus. We find so little wing length variation that the relative form remains approximately uniform within each species.

[2] These are so variable in number (at least 15 to 24 on external, and 14 to 20 on internal margin) that they cannot be used as diagnostic features for the genus.

The diagnostic features given by Scudder in the key of his study of the genus are largely valueless, extensive series exhibiting clearly their variability. In a few cases their importance is relative, but not primary.

Morphological Variational Notes.—Probably the most striking feature of variation in the external morphology of the species of this genus is in the form of the fastigium, when viewed from the dorsum. Practically the only satisfactory method of comparison in the variation of this feature is to measure the angle, and the extremes have been figured and discussed under each species. The folly of using a feature of this sort in a strictly diagnostic sense is evident when it is known that certain species show variations of from 33° to 65° (*alacris*), 52° to 84° (*intertexta*), and 62° to 87° (*maculipennis maculipennis* and *mac. macclungi*) in the male sex, and 42° to 70°, 80° to 95°, and 65° to 95° respectively in the female sex. In addition to the exact angle there is much variation in the curvature or relative straightness of the margins themselves. The facial line shows occasional variation from the specific type, but these are generally geographic. The frontal costa varies much in its degree of sulcation and also in exact form, so much so that we prefer to dispense with it as a diagnostic feature. The form of the frontal costa, its exact width and relative depth are so variable that no great weight can be attached to these features. As we have already mentioned under "Classification," there is a very considerable amount of variation in the form of the caudal femora. Those species having the more slender type of caudal femora show less of such variation than the species having normally more robust and less attenuate femora.

There is a considerable amount of geographic variation in proportions and form, this being particularly apparent in southern Arizona material of *maculipennis* and *neo-mexicana*. In size, in addition, there is a very decided amount of geographic variation, the details of which are given under the individual species.

Color Pattern.—The basic color pattern of the genus is found in all the species, i. e. a pale base color, of a green, greenish-yellow, brownish or ochraceous tone, with a pair of dark postocular bars extending across the postocular portion of the head, the dorsal section of the lateral lobes of the pronotum, thence spreading out and to a greater or lesser degree continued as a narrow line on the pleura, and intensively coloring the marginal and discoidal fields of the tegmina. In addition there is frequently a medio-

longitudinal dorsal dark bar of variable strength and completeness, this always indicated in *texana* and carried over the anal field of the tegmina, leaving the anal angle pale. This mediolongitudinal line may be merely a lining of the median carina of the pronotum, or a pair of arcuate lines on the head. The tegmina in certain species (i. e., *bivittata* and both races of *maculipennis*) may show a maculate pattern of variable intensity. In all the species except *M. bivittata* the tegmina show a decided pale subcostal line on the proximal half in both sexes, while in *bivittata* the male sex is without such a line, although the female is marked as in the other species. In *M. neo-mexicana* and *alacris* the pale subcostal line broadens out into a wash which colors a very considerable portion of the tegmina, but its correlation with the subcostal line is evident. Occasionally the pale subcostal line is weak, but we have never seen it absent in any individuals but males of *bivittata*. The dark postocular lateral bars on the pronotum encroach upon the dorsal surface of the pronotum in numerous individuals of *maculipennis*, and in *texana*, *neo-mexicana* and *alacris* the dark postocular bars are bordered with yellowish. The lateral facial carinæ are similarly marked in the same species, and the face is variably infuscate in *texana*, *neo-mexicana*, *alacris* and *intertexta*.

Groups.—The genus comprises three groups, which at first glance appear more different than a detailed analysis indicates. One of these contains *texana* alone, another is made up of *neo-mexicana* and *alacris*, with *intertexta* an aberrant member approaching the third group, which is composed of *bivittata* and *maculipennis*. If the features separating these groups were more decided, or their differentiation more clearly indicated, it would be advisable to use subgeneric names for them, but this is not desirable, owing to the relatively slight divergence of the species, judging from external morphological features.

The groups and their chief features are:

Group A (*texana*)	Form relatively robust. Lateral foveolæ obsolete. Antennæ moderately heavy. Pronotum short. Lateral carinæ of pronotum distinct, diverging caudad. Supplementary carinæ on lateral lobes of pronotum distinct. Caudal limbs relatively robust. (Coloration distinctive.)

Group B { *neo-mexicana*, *alacris*, *intertexta* } Form slender, elongate. Lateral foveolæ weakly indicated. Antennæ very heavy. Pronotum elongate. Lateral carinæ of pronotum distinct or incompletely indicated (*intertexta*), faintly if at all divergent caudad. Supplementary carinæ on lateral lobes of pronotum distinctly (*alacris*) or weakly (*neo-mexicana* and *intertexta*) indicated. Caudal limbs elongate, slender.

Group C { *bivittata*, *maculipennis* } Form less slender than in Group B, more attenuate than in Group A. Lateral foveolæ indicated to a greater (*maculipennis*) or lesser (*bivittata*) degree of completeness. Antennæ heavy. Pronotum short. No lateral carinæ on pronotum. No supplementary carinæ on lateral lobes of pronotum. Caudal limbs relatively robust.

We feel quite confident that Groups A and B are the more primitive ones, but which of these two is closer to the ancestral type is difficult to say. In some ways *texana* appears the more generalized, in others *alacris* and *neo-mexicana*, with *intertexta* clearly a more advanced type. We feel, however, that, as *texana* represents a divergence from the type species (*neo-mexicana*) in antithetical characters from Group C, a clearer presentation of the interspecific relationship is shown by arranging the species as done herein.

Distribution of the Genus.—From southern New Jersey (*intertexta*), central Illinois (*neo-mexicana* and *maculipennis macclungi*), Iowa (*neo-mexicana*, *bivittata* and *maculipennis macclungi*), Missouri River region of North Dakota (*neo-mexicana*), and eastern Montana (Forsyth—*maculipennis macclungi*); south to the Florida Keys (*intertexta*), the Gulf Coast (*bivittata*, *alacris* and *maculipennis maculipennis*), southern Texas (Mission and Lyford—*maculipennis maculipennis*), central Coahuila [Monclova] and northern Durango [Lerdo], Mexico (*texana*), and southern Arizona (Huachuca and Baboquivari Mountains—*texana*, *neo-mexicana* and *maculipennis maculipennis*); from the eastern coast of the United States west to northern Utah (Salt Lake City—*maculipennis macclungi*), southern Nevada (Rioville—*maculipennis maculipennis*), and central

southern Arizona (Baboquivari Mountains—*neo-mexicana* and *maculipennis maculipennis*). The genus is apparently absent, within this area, from the east central states, excepting certain portions of Illinois, and in the eastern states it has a very limited range, being absent from almost the entire Piedmont and more elevated regions, only a few records from above the fall-line in North Carolina, Georgia and Alabama being known. As one passes northward along the eastern coast the area of distribution narrows, until, in Virginia, it is merely the narrow coastal and estuarine marginal region. Beyond question a number of the species of the genus range over much of northern Mexico, but the lack of data from that region is so great that we can do no more than mention the probability of their occurrence.

All of the species are partial to grassland, tall salt marsh grass, grassy fresh marsh, prairie grassland, grass patches in park-like woodland, the clump type of bunch grass in arid steppe and sandhill regions and even grassy pockets on steep rocky slopes. While frequently taken on other vegetation, the presence of grass will be found to be the influencing factor, and the campestrian environment is the favorite situation.

Zonally the genus *Mermiria* is an inhabitant of the Lower Austral, Sabalian and Tropical Florida Zones in the eastern states, narrowly encroaching on the Upper Austral in the northeast, while in the western and central United States it occurs in the Upper and Lower Austral Zones, entering areas of the lower part of the Transition Zone in western Texas (Davis Mountains) and southern Arizona (Santa Catalina Mountains) and possibly in the northwestern United States (Montana and North Dakota).

When tested out for a probable center of distribution we find that far the greater proportion of the factors, to be considered in locating such a center, give central Texas as the center of the generic dissemination and differentiation. This is the region of greatest differentiation, dominance in individuals, location of synthetic forms (i. e., *bivittata* and *maculipennis, neo-mexicana* and *alacris*), maximum size of individuals, convergence of lines of dispersal and of least dependence on a restricted habitat.[3]

[3] Our quotation of these criteria should not be taken as an indication that we are convinced of the propriety of using all of them for such work. We are following the general practice in so using them, but at least one, i. e. area of maximum size of individuals, can hardly be given equal importance with the others. The advent of species of insects into a favorable habitat, removed from their normal natural enemy control, often produces colonies of maximum sized individuals.

History.—The first species known belonging to the present genus was described by Serville, in 1839, as *Opsomala bivittata*.[4] The locality given was "North America," and the specimen described was from the Latreille Collection. The identity of this insect has been the disturbing factor in all subsequent work in the genus, but we have sufficient knowledge now to show that Latreille received material from Palisot de Beauvois and Bosc, and that the exact locality was probably in the Carolinas. In consequence we feel fully satisfied with our placing of Serville's name. In 1870, Thomas described another species as *Opomala* [sic] *neo-mexicana*, from northeastern New Mexico,[5] while in 1873 Stål erected the genus *Mermiria* for his new species *M. belfragii*, described from Texas,[6] which is identical with *neo-mexicana*. In 1877, Scudder described a third species from Georgia, under the name *Mermiria alacris*;[7] while, in 1890, Bruner described the striking *M. texana* from El Paso, Texas, and Lerdo, Durango, Mexico,[8] and also *M. maculipennis* from San Antonio and Carrizo Springs, Texas.[9] McNeill, in 1897, in his Revision of the Truxalinae, published the first study of the genus, and there described *M. rostrata*, from Mackay, Indian Territory.[10] The latter, we are now able to say, is but an extreme condition of *alacris*. McNeill made the error of referring material representing three different species to *bivittata*, and his study left us with no better conception of the group than we had before its publication. In 1899, Scudder published a short review of the species of the genus,[11] separating the eastern hygrophilous species as *M. intertexta*, and also describing *M. vigilans*, which latter has given authors considerable trouble since then, but which we now know to be an individual condition of *M. alacris*. Scudder united *maculipennis* with *bivittata*, "as at most only a variety." In 1904, in the Biologia Centrali-Americana, Bruner retained for the species of the genus the nomenclature used by Scudder in 1899.[12] In the same work he also erected[13] a new genus and species, *Papagoa arizonensis*,

[4] Hist. Nat. Ins., Orth., p. 589, (1839).
[5] Proc. Acad. Nat. Sci. Phila., 1870, p. 77, (1870).
[6] Recens. Orthopt., i, p. 102, (1873).
[7] Proc. Boston Soc. Nat. Hist., xix, p. 30, (1877).
[8] Proc. U. S. Nat. Mus., xii, p. 53, pl. I, fig. 11, (1890).
[9] Ibid., p. 54, (1890).
[10] Proc. Davenp. Acad. Nat. Sci., vi, pp. 205, 207, pl. I, fig. 3c, (1897).
[11] Proc. Amer. Acad. Arts and Sci., xxxv, pp. 41 to 44, (1899).
[12] Biol. Cent.-Amer., Orth., ii, pp. 38 to 39, (1904).
[13] Ibid., pp. 27, 42, (1904).

for a specimen from "Arizona or Northern Mexico," which we now know to be a shrivelled alcoholic individual of *Mermiria texana*.

Material.—In the preparation of the present paper the types of the following species have been examined by us:

Mermiria texana Bruner.
Papagoa arizonensis Bruner (synonym of *M. texana*).
Opomala neo-mexicana Thomas.
Mermiria alacris Scudder.
Mermiria vigilans Scudder (synonym of *M. alacris*).
Mermiria intertexta Scudder.
Mermiria maculipennis Bruner.
Mermiria maculipennis macclungi new subspecies.

The entire series of the genus examined by us and here recorded numbers 1514 specimens. The majority (938) of these were taken by Rehn and Hebard on recent trips and are located in the Hebard Collection and that of the Academy of Natural Sciences of Philadelphia. Of the remainder of the representation we have had before us, 50 specimens were from the Hebard Collection ex Bruner, 33 specimens from the Scudder Collection at the Museum of Comparative Zoology at Cambridge, Massachusetts, 73 specimens from the United States National Museum, 39 specimens from the collection of Prof. A. P. Morse, 12 from that of Prof. M. P. Somes, 3 from the Illinois State Laboratory of Natural History, 103 from the Academy of Natural Sciences of Philadelphia (other than Rehn and Hebard collecting), and 263 specimens from other collections and institutions, including the Hebard Collection other than Rehn and Hebard collecting and ex Bruner. In addition to this material we have re-examined considerable material already recorded by Rehn and Hebard, and not included in these totals. All the institutions and collections represented in the studied series are indicated by their initials in the summaries of material under the species, with the exception of the series collected by Rehn and Hebard, which it should be understood, are in the Hebard Collection and that of the Academy of Natural Sciences of Philadelphia.

We wish to express our hearty thanks to the above mentioned gentlemen, and the authorities of these museums for their assistance in the present study. We have been able, with their assistance, to gather together a sufficiently extensive and representative series of the genus to give authority and permanency to the conclusions here reached.

Key to Species.

We would suggest that, in using this key, frequent reference be made to the figures accompanying the paper. Occasionally insistence is made upon a single differential character, and in such cases it should be borne in mind that these characters are the crucial ones, not subject to fluctuation by variation. Other features may aid in distinguishing the forms, and these are detailed under the specific treatments, but variation will occasionally rob these features of their critical value.

A. Lateral carinæ of pronotum strongly or weakly (*intertexta*), but always appreciably indicated. Form slender or relatively robust; when of the latter type the tegmina bear a longitudinal pale line in distal half of discoidal field, in addition to the strongly marked proximal subcostal line and pale anal angles of tegmina.

B. Supplementary carinæ on lateral lobes of pronotum evident (rather weakly in *neo-mexicana*). Species decidedly or typically xerophilous.

C. Form relatively robust. Lateral carinæ of pronotum decidedly diverging caudad, rarely by variation subparallel. Lateral lobes of pronotum with ventral margin shorter than depth of lobes. Tegmina relatively broad. Color pattern bold, distinctive; subcostal pale line of tegmina strongly marked, narrow; medio-longitudinal dorsal line invariably present. Antennæ moderately ensiform. Caudal femora relatively robust, almost invariably falling distinctly short of the tegminal apices. Subgenital plate of male short, weakly produced, blunted. *texana* Bruner

CC. Form slender. Lateral carinæ of pronotum not at all, or, by variation, faintly diverging caudad. Lateral lobes of pronotum with ventral margin longer than depth of lobes. Tegmina relatively narrow. Color pattern with broad medio-longitudinal dorsal line rarely present. Antennæ strongly ensiform. Caudal femora slender (surpassing, equalling, or falling faintly short of tegminal apices). Subgenital plate of male produced, elongate pyramidical.

D. Fastigium more semi-elliptical, the sides converging in a well-rounded curve, the tip very broadly or at least bluntly rounded. Subgenital plate of male moderately produced. Species campestrian, central and western in habitat ..... *neo-mexicana* (Thomas)

DD. Fastigium triangular, the sides converging in straight or only slightly curved lines, the tip narrowly rounded. Subgenital plate of male greatly produced. Species

inhabiting grassy woodland, central and southeastern in habitat ..... *alacris* Scudder

BB. No supplementary carinæ on lateral lobes of pronotum. Species invariably hygrophilous. (Form very elongate. Ventral margin of lateral lobes of pronotum longer than depth of lobes. Subgenital plate of male greatly produced. Eastern and southeastern coast.) *intertexta* Scudder

AA. No lateral carinæ indicated on pronotum. Form relatively robust; tegmina but faintly or not at all surpassing the apices of the caudal femora.

B. Male with no subcostal pale bar on the proximal half of the tegmina. Fastigio-facial angle, when seen from the side, more broadly rounded in both sexes.[14] Coloration more frequently greenish. Species central and southeastern in habitat ..... *bivittata* (Serville)

BB. Male with subcostal pale bar on the proximal half of tegmina. Fastigio-facial angle, when seen from the side, more narrowly rounded and more angulate in both sexes.[14] Coloration more frequently buffy. Species central and western in habitat.

C. Form more attenuate and elongate. Pronotum distinctly more elongate and appreciably constricted mesad; caudal angle of disk of pronotum very broadly and weakly angulate. Eyes of female moderately prominent, when viewed from the dorsum. Size in general larger. South-central and southwestern in habitat.

maculipennis maculipennis Bruner

CC. Form less attenuate and elongate. Pronotum shorter and relatively broader, not appreciably constricted mesad; caudal angle of disk of pronotum more distinctly produced and angulate. Eyes of female less prominent, when viewed from the dorsum. Size in general smaller. North-central in habitat.

maculipennis macclungi new subspecies

Treatment of Species

Mermiria texana Bruner. Plate V, figs. 1-14.

1890. *Mermiria texana* Bruner, Proc. U. S. Nat. Mus., xii, p. 53, pl. I, fig. 11. [♂ ♀: El Paso, Texas; Lerdo, Durango, Mexico.]

1897. *Mermiria texana* McNeill, Proc. Davenp. Acad. Nat. Sci., vi, pp. 204, 206. [Lerodo (error for Lerdo), Durango, Mexico; El Paso, Texas; Colorado Springs, Colorado; Fort Grant, Arizona.]

1899. *Mermiria texana* Scudder, Proc. Amer. Acad. Arts and Sci., xxxv, pp. 41. 42. [Colorado; Coahuila, Mexico; also summary of previously reported localities.]

1902. *Mermiria texana* mut. *viridis* Cockerell, in Scudder and Cockerell, Proc. Davenp. Acad. Sci., ix, p. 24. [Las Vegas Hot Springs, New Mexico.]

1904. *Mermiria texana* Bruner, Biol. Cent.-Amer., Orth., ii, p. 38, pl. I, figs. 19. 19a. [Summary of previous records.]

1904. *Papagoa arizonensis* Bruner, Ibid., p. 42. [♂: Arizona or northern Mexico.]

[14] These features are relative and average, and by variation overlapping.

The present species stands in a relatively isolated position in the genus, and it has been suggested to the author that it should be subgenerically differentiated from the genotype. We do not feel warranted in taking such action at this time, as we lack sufficient evidence to justify it. However, *texana* can be readily distinguished from all the other forms of the genus by combining with lateral pronotal carinæ and supplementary carinæ on the lateral lobes of the pronotum, a relatively robust form, short male subgenital plate, relatively short and robust caudal femora and a strikingly contrasted and longitudinally barred color pattern. The latter is mainly featured by a pronounced, broad, medio-longitudinal dark bar, pale anal angles on the tegmina, a second pale line in the distal half of the discoidal field of the tegmina and incomplete barring on the dorsal surface of the caudal femora.

Type.—♂; El Paso, Texas; [November, 1887]; (L. Bruner); [Hebard Collection ex Bruner, Type no. 21]. Designated by Rehn and Hebard, 1912.[15]

Allotype.—♀; same data as type.

Of the original series the type and the allotypic female are now before us, a paratypic El Paso male, in the collection of the United States National Museum, has been examined, and a paratypic female from Lerdo, Durango, Mexico, in the Hebard Collection ex Bruner, is also in hand.

The species is sharply defined and so easily recognized by the features given in the key, and by the figures, that no description is necessary. The following comments cover the more noteworthy features of variation.

Morphological Notes.—The variation in fastigial form found in most of the species of this genus is well examplified in *texana*. In each of the series from Sanderson, Persimmon Gap, Pine Mountain and Prescott we find males (figured) which show a range from a moderately acute-angulate to a strongly acuminate outline. In the females this variation is rarely decided, yet occasionally we find it distinctly marked, the three females from Canyon behind Pulliam Bluff, Chisos Mountains, showing different types with well-marked extremes, the two females from Lost Mine Peak, Chisos Mountains, are very different in this respect, while the extremes of the twenty-eight Marathon females are decidedly

[15] Proc. Acad. Nat. Sci. Phila., 1912, p. 62, (1912).

different. There is very considerable variation in the relative width of the pronotum, particularly in the female, the greatest width varying very decidedly in proportion to the length. This variation, in its most decided phase, has no geographic correlation, the Marathon series alone showing both the markedly different forms figured. In both sexes there is a weak but apparent tumidity of the pronotum caudad in the majority of the specimens, but more pronounced in the male. This is occasionally almost absent and there is no geographic correlation in this variation in width, nor is there any apparent correlation with the proportion of width to length.

Synonymy.—We have before us the unique male type of *Papagoa arizonensis* Bruner. As mentioned by Bruner, the specimen has been dried from alcohol and is greatly shrivelled. The form of the fastigium has been greatly altered, being unnaturally acute and the dorsal surface of the same part is greatly distorted. The specimen is unquestionably a male individual of *Mermiria texana*, of the general size of material of that sex from southern Arizona. The genus *Papagoa* and the species *arizonensis* must be sunk in synonymy under *texana*. Cockerell's mutation *viridis* we have not seen, but we must decry the use of technical names for such phases, as the logical outcome would be the enforced establishment of thousands of similar names in the Orthoptera, for well known and easily recognized manifestations of elementary, probably physiological and clearly non-genetic, influences.

Measurements (in millimeters).

♂	Length of body.	Length of pronotum.	Length of tegmen.	Length of caudal femur.
Sanderson, Texas	25.5	3.9	20.4	14.8
Sanderson, Texas	26.5	4.2	22.5	16.6
Marathon, Texas	29.2	4.5	22.7	16.5
Marathon, Texas	31.5	5.1	25.6	17.5
Persimmon Gap, Texas	24.9	4.1	19.4	13.5
Persimmon Gap, Texas	29.5	4.6	24.2	17
Lost Mine Peak, Texas	29	4.7	24.6	17
Lost Mine Peak, Texas	30	5	25	18
Pine Mountain, Texas	25	4	20.3	14.6
Pine Mountain, Texas	28.3	4.8	24.4	17.9
El Paso, Texas, *type*	30.2	5	27	18.2
Franklin Mountains, Texas	29.2	5	25.2	17
Franklin Mountains, Texas	32.3	5.3	27.6	18.2
Rock House Canyon, Arizona	26.8	4.4	24.4	16.5
Mud Springs, Arizona	25.2	4.2	21	14.5
Mud Springs, Arizona	25.2	4	21.7	14.7
Prescott, Arizona	23	3.6	18.5	12.8
Prescott, Arizona	25.2	4	22	15.5
Mount Tritle, Arizona	23.8	4.1	19.4[16]	13.8

[16] Apex incomplete.

♀	Length of body.	Length of pronotum.	Length of tegmen.	Length of caudal femur.
Sanderson, Texas	35	5.7	27.8	20.2
Marathon, Texas	40.5	6	29.8	21
Marathon, Texas	51	7.3	35.8	25.4
Persimmon Gap, Texas	37	5.7	29	20.4
Persimmon Gap, Texas	41.2	5.9	31.6	21.9
Lost Mine Peak, Texas	40	6.3	31.5	21.8
Lost Mine Peak, Texas	43.5	6.6	32.5	24
Pine Mountain, Texas	40.5	6.1	29.5	21.5
Pine Mountain, Texas	45	6.7	31.5	23
El Paso, Texas, *allotype*	45	6.5	34.4	—
Franklin Mountains, Texas	48.5	7.2	35	23.7
Jemez Hot Springs, New Mexico	36.8	6.4	30.6	22
Jemez Hot Springs, New Mexico	43.6	6.5	32.2	23
Rock House Canyon, Arizona	42	6.5	32.5	23.5
Rock House Canyon, Arizona	44.5	6.5	32.5	22.8
Carr Canyon, Arizona	40	6.5	32	23.5
Carr Canyon, Arizona	46.5	7.5	34	24.5
Mud Springs, Arizona	40.5	6.2	29.5	21.5
Mud Springs, Arizona	41	6.2	32	22.8
Prescott, Arizona	32.2	5.5	26.2	19
Prescott, Arizona	36	6	30	21.2
Lerdo, Durango, Mexico, *paratype*	45.3	7.4	35.4	24.7

From these figures, which have been taken from extremes in the representations where more than two of each sex are present, it is evident that individuals are of minimum size at the higher elevations and at the periphery of the range. The Sanderson material, which, while taken at a low elevation, is from the eastern known limit of the range, and that from Mud Springs, Prescott and Mount Tritle at the western limit and quite elevated, present the minima, while specimens from Persimmon Gap, another quite eastern locality, are quite close in size; Pine Mountain, another quite elevated station, also presents uniformly small individuals. The optimum of size is developed in the Eastern Desert region (Franklin Mountains, Aden and Lerdo).

Color Notes.—The greenish phase of this species, which we have never seen adult, was named by Cockerell.[17] The description of immature individuals of both color phases has been given elsewhere by the same author.[18] From the present material the principal individual color variations appear to be: a fluctuation in depth of the dorso-median dark bar of the head, pronotum and proximo-sutural section of the tegmina; an occasional dark livid suffusion of the ventral half of the lateral lobes of the pronotum; a weak maculation of the tegminal intercalary area and some instability in the strength of the femoral markings. The dorsal bar ranges from nearly solid, through a type with paler center to

[17] Proc. Davenp. Acad. Sci., ix, p. 24, (1902).
[18] Psyche, ix, p. 430, (1902).

an extreme with the bar itself virtually eliminated, leaving only a pair of arcuate lines on the head (lateral margins of the bar) and a median dark line on the median carina of the pronotum. The geographic color variation is largely tonal. The Sanderson and Persimmon Gap series have the pale areas quite whitish, the brown Vandyke brown; the Marathon series and those from the El Pasan region run to yellow in the pale areas, while the Arizonan series largely (but not entirely) to light pinkish buff in the same sections. The pale markings in the vicinity of the humeral trunk of the tegmina, however, are always more whitish than the other pale areas. The Pine Mountain series has a strongly intensive type of coloration, the brown being very dark (blackish brown) and the pale areas dull soiled buffy.

Distribution.—The range of this species extends from an undetermined point in Colorado, at least as far north as Salida and Colorado Springs,[19] south to northern Durango (Lerdo) and east-central Coahuila (Monclova),[20] Mexico; east almost to the Pecos River (Sanderson), Texas, west to central (Oak Creek Canyon), and southern (Santa Catalina, Santa Rita and Huachuca Mountains) Arizona. It doubtless extends south for a considerable distance in the central mountainous regions of northern Mexico. Its zonal range is Upper and Lower Sonoran, occurring in Upper Sonoran islands in Transition surroundings.

Its vertical distribution is, on the basis of present records and information, from 2750 feet (Sanderson, Texas) to 7000 (Pine Mountain and Lost Mine Peak, Texas) and even 7300 feet (Mount Tritle, Arizona). In Texas alone the records range from the minimum to near (7000 feet) the maximum elevations known for the species, while in Arizona the records cover localities from 3800 feet (Sabino Basin) to 7300 feet (Mount Tritle).

Biological Notes.—This insect is a very active one and flies quickly upon being approached. The dried specimen would hardly be called protectively colored, with its boldly striped

[19] The specimen given by Scudder as "Colorado, 7000 (Morrison)" is also clearly this species. We feel quite certain it came from the more southern part of the state.

Caudell (Proc. U. S. Nat. Mus., xxvi, p. 780, (1903)) reported a pair of this species from Fort Collins, Colorado, and, with some doubt, immature material from Salida, Colorado. These specimens are now before us. The Fort Collins pair are typical of *M. maculipennis macclungi*, while a pair of immature specimens from Salida clearly represent *texana*.

[20] Reported as Montelovez; see comments by Hebard, Proc. Acad. Nat. Sci. Phila., 1917, p. 252, (1917).

pattern, yet in short yellow grass, or tufted bunch grass, the species is not easy to locate, often never being seen unless marked down after a flight. It is distinctly a hillside species, rarely found on dirt hills, but with a strong preference for stony or rocky slopes, with scattered cover of short grass or bunch grass, and dotted with lecheguilla (*Agave lechuguilla*), agaves (*Agave schotti* and *palmeri*), bear grass (*Nolina microcarpa*), ocotillo (*Fouquieria splendens*), sotol (*Dasylirion leiophyllum* and *wheeleri*) and cacti. Near the upper limits of its vertical distribution it occurs in the open spots of scrub oak areas. In southern Arizona it is a species of the Desert and Encinal regions, as they have been delimited by Shreve.[21] In but a single case have we noted the species in flat land, then at Marathon, Texas, where two were seen on the plain some distance from the hills where individuals of the species were numerous.

The species has been taken adult as early as June 10 to 12 (Chisos Mountains, Texas) and as late as November (El Paso, Texas, and Lerdo, Durango, Mexico). The latest exact date we have is October 14 (Rock House Canyon, Arizona), immature individuals in the stage preceding maturity being taken as well as adults. It is possible the species matures earlier and persists later in the season southward at lower elevations than toward the northern limit of its range, or at higher elevations southward, but the evidence is not fully conclusive. The earliest records we have for northern New Mexico are August 10 (Las Vegas Hot Springs) and August 12 to 20 (Jemez Hot Springs), while we have adults from the border region taken from July 9 (Franklin Mountains, Texas) and 18 (Mud Springs, Arizona[22]) on. However, we have a single adult male from Prescott, Arizona, taken July 7, and a good series of both sexes from the same locality, taken from July 9 on. The latest date for immature specimens in the Prescott series is August 5, while we have adults taken as late as August 25. At Pine Mountain, Davis Mountains, Texas, elevation 5800 to 7000 feet, we found both adults and immature specimens common on August 31, which shows a late maturing season at an elevated locality in a relatively southern region, while, as stated above,

[21] Publ. 217, Carneg. Inst. Wash., pp. 15–29, (1915).

[22] The occurrence of adults so early, at a locality relatively so high (6800 feet), can be explained, we are certain, by slope exposure. The locality is on a warm south-facing slope, at the upper edge of the Encinal region. Shreve (Publ. 217, Carneg. Inst. Wash., p. 97 et seq., (1915)) has carefully analyzed the role of slope exposure in the Santa Catalina Mountains.

immature specimens were also present at Rock House Canyon, Arizona, on October 14. Identifiable immature specimens are before us, taken July 7 (Prescott, Arizona) and July 8 to 11 (Sabino Basin, Arizona).

Specimens examined: 349; 187 males, 127 females, 13 immature males, 22 immature females.

Texas: Sanderson, Terrell County, 2750 to 3180 feet; VIII, 25, 1912; (R. & H.; scarce in sotol (*Dasylirion*) and grasses in bed of canyon water course and in similar situations on adjacent steep slopes); 7 ♂, 1 ♀. Marathon, Brewster County, 3940 to 4160 feet; VIII, 26 to 27, IX, 12 to 13, 1912; (R. & H.; very common on rocky hillsides, especially toward top, two seen on plain far from hills); 22 ♂, 17 ♀; VIII, 20, 1916, (R.; relatively common on hill slopes); 4 ♂, 6 ♀; [Hebard Cln.]. Persimmon Gap, Santiago Mts., Brewster County, IX, 3 and 10, 1912; (R. & H.; near grass tufts on rocky hillside with much lecheguilla, *Agave lechuguilla*); 11 ♂, 2 ♀. Between Neville Spring and Government Spring, Chisos Mts. slope, Brewster County, 3600 to 3800 feet; IX, 5, 1912; (R. & H.; on slope with little grass and much lecheguilla, yucca and creosote bush, *Covillea*); 1 ♀. Chisos Mts., Brewster County, VI, 10 to 12, 1908, (Mitchell and Cushman; at light), 1 ♂; [U. S. N. M.]: VII, 1911, (H. A. Wenzel); 3 ♂, 7 ♀; [A. N. S. P.]. Moss Well, Chisos Mts., Brewster County, 4500 to 5000 feet; IX, 5 to 8, 1912; (R. & H.; scarce in grasses on hillside, immatures common); 2 ♂, 1 ♀, 1 juv. ♂, 2 juv. ♀. Canyon behind Pulliam Bluff, Chisos Mts., Brewster County, 4600 to 5000 feet; IX, 7, 1912; (R. & H.; in high grass and sotol); 2 ♂, 3 ♀. Lost Mine Peak, Chisos Mts., Brewster County, 5500 to 7000 feet; IX, 7, 1912; (R. & H.; in open places of oak scrub on steep slope, few above 6000 feet); 7 ♂, 2 ♀. Alpine, Brewster County, IX, 8, 1911; (F. C. Bishopp); 1 ♀; [U. S. N. M.]. Puertacitas Mts., Presidio County, 5100 to 5200 feet; VIII, 31, 1912; (R. & H.); 1 ♂. Pine Mountain (slope), Davis Mts., Jeff Davis County, 5800 to 7000 feet; VIII, 29, 1912; (R. & H.; common in high bunch grass); 22 ♂, 4 ♀, 7 juv. ♀. Sierra Blanca, El Paso County, 4750 feet; IX, 14, 1912; (R. & H.; on slopes of low desert hill); 1 ♂. Quitman Mts., El Paso County, 4800 to 5400 feet; IX, 14, 1912; (R. & H.; occasional on hillside in grasses); 2 ♂, 1 ♀. Franklin Mts., El Paso County, 4500 to 5500 feet; IX, 15 to 16, 1912; (R. & H.; on barer slopes with lecheguilla, creosote bush, a few grasses and other desert plants); 10 ♂, 4 ♀.

New Mexico: Jemez Hot Springs, Sandoval County; VIII, 12 to 20, 1913, IX, 17, 1914; (John Woodgate); 4 ♀; [Hebard Cln.].

Arizona: Prescott, Yavapai County, 5400 to 5600 feet; VIII, 14 to 24, 1917; (J. A. Kusche); 3 ♂, 2 ♀: VII, 7 to VIII, 25, 1917; (O. C. Poling); 68 ♂, 54 ♀, 5 immature ♂, 7 immature ♀; [Hebard

Cln.]. Near Battle Mountain, near Prescott, Yavapai County; VIII, 18, 1917; (J. A. Kusche); 4 ♂, 4 ♂; [Hebard Cln.]. Near Granite Peak, Sierra Prieta, Yavapai County; VIII, 17, 1917; (J. A. Kusche); 3 ♂, 1 ♀; [Hebard Cln.]. Mount Tritle, Yavapai County, 7300 feet; VIII, 27 to 28, 1917; (J. A. Kusche); 1 ♂; [Hebard Cln.]. Rock House Canyon, Chiricahua Mts., Cochise County, 4600 feet; X, 14, 1910; (R. & H.; in high grasses among great rocks); 1 ♂, 3 ♀, 2 immature ♂, 1 immature ♀. Santa Rita Mts., 5000 to 8000 feet; (Snow); 7 ♂, 3 ♀; [Univ. of Kansas]. Mud Springs, Santa Catalina Mts., Pima County, 6800 feet; VII, 18 and 19, 1916; (Lutz and Rehn; immature and adults moderately common on slopes under oaks and on crumbling rocks); 5 ♂, 6 ♀, 1 immature ♂, 3 immature ♀; [A. M. N. H. and A. N. S. P.]. Sabino Basin, Santa Catalina Mts., Pima County, 3800 feet; VII, 8 to 11, 1916; (Lutz and Rehn; on slopes with bunch grass, lechequilla, agave and bear grass (*Nolina*); 1 immature ♂, 1 immature ♀, [A. M. N. H. and A. N. S. P.].

Colorado: Salida, Chaffee County; VIII, 2, 1901; (Dyar and Caudell); 2 immature ♂, 1 immature ♀; [U. S. N. M.]. Colorado Springs, El Paso County; VII, 1877; 1 immature ♂; [U. S. N. M.].

In addition, previously recorded material from El Paso and Franklin Mountains, Texas; Aden, New Mexico; Carr Canyon, Huachuca Mountains, Arizona, and Lerdo, Durango, Mexico, has been before us.

Mermiria neo-mexicana (Thomas). Plate V, figs. 15-27; Plate VII, fig. 7.

1870. *O*[*pomala*] *neo-mexicana* Thomas, Proc. Acad. Nat. Sci. Phila., 1870, p. 77. [♀: Northeastern New Mexico.]
1873. *M*[*ermiria*] *belfragii* Stål, Recensio Orthopt., i, p. 102. [♀: Texas.]
1874. *Opomala neomexicana* Glover, Ill. N. Amer. Ent., Orth., pl. 16, fig. 10.[23]
1876. *Mermiria neomexicana* Scudder, Bull. U. S. Geol. Surv. Terr., ii, p. 262. [Juv.; Clear Creek Canyon and Manitou, Colorado.]
1897. *Mermiria neomexicana* McNeill, Proc. Davenp. Acad. Nat. Sci., vi, pp. 205, 206. ["Eastern slopes of the Rocky Mountains from Wyoming to New Mexico and eastward to Georgia."]
1899. *Mermiria neomexicana* Scudder, Proc. Amer. Acad. Arts and Sci., xxxv, pp. 42, 43. [Pueblo, Colorado; Dallas and Bosque County, Texas.]
1904. *Mermiria neo-mexicana* Bruner, Biol. Cent.-Amer., Orth., ii, p. 39. [New Mexico; Texas; Villa Lerdo, Durango, Mexico.]

As we have indicated in the generic discussion of classification and in the key to the species, this species is closely related solely to *alacris*, with which it comprises Group B of the genus, and which has, however, a different, though contiguous and slightly

[23] This figure is extremely poor and may possibly have been taken from a discolored specimen of *texana*, instead of *neo-mexicana*. However, we have no means of checking the source of the drawing and can only let it stand in the references of *neo-mexicana*.

overlapping, area of distribution. From *alacris*, *neo-mexicana* can be chiefly distinguished by the more semi-elliptical fastigium, the sides of which converge in well-rounded curves, with the apex very broadly, or at least obtusely, rounded, and in the subgenital plate of the male being but moderately produced. The coloration of the two species is usually distinctive, but not invariably so. Very rarely, in the male sex, the fastigium will be unusually angulate in *neo-mexicana*, so much so that the separation of such specimens from *alacris* is difficult. The male subgenital plate will be found, however, to furnish a good index of the specific position of the specimen, almost invariably supported by coloration features. In their habitats the two species frequent radically different environments, *neo-mexicana* being invariably campestrian and *alacris* a species of woodland cover or recently cleared timber land, which still retains its low growth or has grown up in woodland scrub.

Type.— ♀ ; Northeastern New Mexico. [United States National Museum, Type No. 1030.]

This specimen has been dried from alcohol, but the species has been correctly determined by all subsequent authors excepting Stål, who probably was unacquainted with the description of *neo-mexicana*. Measurements of the type are given below.

Morphological Notes.—The principal points of morphological variation are: general form; horizontal angle of fastigium and angle of face. The general form is slender, but the series from the Baboquivari Mountains, Arizona, shows an average more robust form in both sexes. This is not an absolute condition, however, but an average, as several specimens, representing both sexes, from that locality are but little different from numerous individuals taken from the entire series of the species. This greater bulk applies to depth as well as breadth, and is correlated with a generally less strongly declivent face and a broader fastigial angle. The form of the fastigium varies in both sexes to at least as decided a degree as in the other species of the genus, yet being, as a whole, shorter, broader and blunter in the Baboquivari Mountains specimens than in the others. There is, however, appreciable variation in these features in even the limited series from that locality, and in series such as those from Cisco, Marathon and Dallas, Texas, and Syracuse, Kansas, the range of variation is very pronounced in each, the extremely narrow, most acute type

looking quite different from the short, rounded sub-rectangulate extreme found in the Baboquivari Mountains individuals, and relatively closely approximated in a number of the specimens from other localities.

The angle of declivence of the facial line shows considerable variation, being, as a rule, more strongly retreating in the more slender individuals. Thus the least retreating faces are found in the more robust Baboquivari specimens, but there is very considerable variation in that series in this respect, so much so that extremes from that locality have their heads, when viewed from the side, quite different in general inclination of the face. The frontal costa varies, of course, in its width and also in its relative depth, with the greater or lesser narrowing of the general form, the quite slender specimens having the costa narrow and with the sulcus more regularly defined, deeper and, as would be expected, narrower and more sharply defined dorsad than in the more robust specimens.

The tegmina show a slight amount of variation in their relative width, but this is not at all decided. See Remarks for discussion of the value of the morphological differences.

Synonymy.—Stål's *belfragii* is clearly the same as Thomas' older species. The description is matched by numerous individuals in the series before us. The name was first properly synonymized by McNeill in 1897.

Measurements (in millimeters).

♂	Length of body.	Length of pronotum.	Length of tegmen.	Length of caudal femur.
Hot Springs, South Dakota	29	4.4	16.9	15.6
Little Big Horn River, Montana	28.5	4.6	19.7	15.8
Havana, Illinois	32.2	4.6	20.6	18.3
Sidney, Nebraska	26.4	4.1	19	15.1
Sidney, Nebraska	27	4.4	18.6	14.4
Dodge City, Kansas	28.5	4.6	20.4	17.5
Dodge City, Kansas	31.2	4.8	20	17.1
Syracuse, Kansas	33.8	5.2	22	19
Syracuse, Kansas	34	5.1	23.3	20
Julesburg, Colorado	29.5	4.8	21.3	17.1
Holly, Colorado	37.1	5.5	24.9	19.2
La Junta, Colorado	29.7	5	21.8	17.6
La Junta, Colorado	31	5	21.3	18.6
Cache, Oklahoma	35.3	5	25	19.5
Mountain Park, Oklahoma	36.6	5.1	25.2	21.8
Summit of Mt. Sheridan, Oklahoma	35	5.3	24.4	21
Dallas, Texas	32	4.7	22.8	18.9
Dallas, Texas	36.5	5.6	26.4	22.3

	Length of body.	Length of pronotum.	Length of tegmen.	Length of caudal femur.
Kerrville, Texas	33	4.9	23.5	19.5
Kerrville, Texas	35.5	5.3	24.3	20
Cisco, Texas	33.1	4.8	23.3	18.9
Cisco, Texas	37.7	5.8	26.5	22
Amarillo, Texas	32	4.9	22.5	18.1
Amarillo, Texas	32.5	4.9	22.4	19
Marathon, Texas	30.6	4.6	21	17
Marathon, Texas	35.6	5.5	24.8	21
Sycamore Canyon, Baboquivari Mountains, Arizona	31.3	5	22	18.2
Sycamore Canyon, Baboquivari Mountains, Arizona	37	5.7	27.4	21
♀				
Hot Springs, South Dakota	36.5	6	23	20
Havana, Illinois	38.6	5.5	24.8	21
Hamburg, Iowa	43.7	7	28.3	24.2
Hamburg, Iowa	44	7	30.5	—
Southwestern Nebraska	41.2	6.3	26	26.8
Southwestern Nebraska	41.2	6.2	29	22.4
Dodge City, Kansas	40.2	6.1	28	23.4
Dodge City, Kansas	39.7	6	27	23
Syracuse, Kansas	39.8	6.9	29.2	23.4
Syracuse, Kansas	50	7.5	31.6	27.4
Dallas, Texas	45	7.2	31	26.2
Dallas, Texas	52	7.8	33.4	28.8
Kerrville, Texas	47.2	7	30.6	24
Cisco, Texas	46.6	6.5	30	25.3
Cisco, Texas	52.2	7.5	34	26.9
Amarillo, Texas	45	6.8	30	25.2
Marathon, Texas	44.2	6.5	38.3	25.3
Marathon, Texas	51.2	7.6	32.2	26.4
Northeastern New Mexico (*type*)	37.3	7	25.5	22.4
Sycamore Canyon, Baboquivari Mountains, Arizona	50.5	8	33	26.2
Sycamore Canyon, Baboquivari Mountains, Arizona	51	7.8	33.2	26.9

From these measurements it is quite apparent that the species shows minimum size at the more northern and more eastern localities and the maximum size southward, at least as far as its distribution within the United States is concerned. Immediate environment appears to us to be an extremely potent factor in influencing the size of individuals, those from the relatively poorly grassed Great Plains regions being of small size, excepting when from the more heavily carpeted swales and valleys. The material from the Illinois sand areas, the most eastern locality known for the species, is of very small size, well illustrating the response of the species to a rather unfavorable environment. The optimum size development of the species is reached in northeastern Texas and south-central Oklahoma, with grassland areas of western Texas (Marathon) and southern Arizona (Sycamore Canyon), following in the large size of their representatives.

Color Notes.—The species shows a decided amount of variation in both general tonal color and pattern. It has well marked green and brown phases, which are generally clearly distinct, but occasionally brownish specimens will show some element of the green phase, such as the green humeral stripe. The male sex is predominatingly brown phase, the green phase being relatively scarce in that sex, hardly one-tenth of the series of males being in the greenish phase. The female sex is predominatingly green phase, about two-thirds of the female specimens examined representing that type. Our environmental data is not sufficient to warrant any statement as to the correlation of the color tones and the environment, as the information in part contradicts what would be the general assumption regarding such correlation.

The tone of the green base color varies from light chalcedony yellow (in an apparently teneral individual) through light grape yellow and yellowish citrine to courge green on the head, pronotum, pleura and caudal femora, while the humeral bar on the tegmina is always more nearly approaching one of the shades of malachite green. The Baboquivari individuals have a base color ranging from dull mustard yellow to wax yellow, with more or less distinctly marked malachite green humeral bars on the tegmina.

The tone of the brown base color varies from light ochraceous-buff through ochraceous-tawny and tawny to cinnamon-brown, in the latter condition often largely overcast with hoary white except at the normal dark bars.

The lateral postocular bars range in depth from snuff brown (teneral specimen) through kaiser brown and chestnut brown to mummy brown. The postocular bars are almost invariably well marked. A medio-longitudinal bar on the head and pronotum is occasionally (♀) or generally (♂) present, again just intimated, very rarely strongly pronounced in the female sex (one only, from Baboquivari Mountains, Arizona) and infrequently indicated only by arcuate lines of color. In numerous specimens the median carina of the pronotum is finely lined with the color of the postocular bars, but no median bar will be marked on the head or otherwise on the pronotum. This condition is connected up by numerous specimens with the uniform medio-longitudinal bar pattern.

The tegmina vary in the degree of contrast between their base color and the humeral bar. This variation, and also the degree

of contrast of the paler lining of the immediate anal angle, is much as in the other species of the genus. The depth of the coloration of the caudal tibiæ is gauged by the general tone and pattern. It may be as dull as cameo brown (very dark and recessively colored female from the Illinois sand region), as light as coral red or as rich as scarlet. The latter condition is indicated only in Baboquivari Mountains, Arizona, specimens.

The small Baboquivari Mountains series is much more brilliant in coloration and averages more lineate (i. e., high percentage with medio-longitudinal bar) than any others. What Mearns has said of the mammals of an adjacent portion of the United States and northern Mexico can be noted in relation to the intensity of coloration in these individuals. "Increased intensity of coloration characterizes the mammals from the valleys containing the terminal streams of the great Yaqui River of Mexico, some of which rise on the United States side of the Boundary."[24] We hope to have more to say in the near future regarding the intensification of color tones and increase in contrast of patterns in Orthoptera from certain sections of the Mexican Boundary region.

Distribution.—The range of this species extends from the Yellowstone and Missouri Rivers region of eastern Montana and western North Dakota, south to central (Kerrville) and western (Chisos Mountains) Texas and northern Durango (Villa Lerdo), Mexico; east to north-central Illinois (vicinity of Havana and Bishop), southwestern Iowa (Hamburg), eastern Oklahoma (Cherokee Nation) and central northern Texas (Dallas region); west to southern Montana (Little Big Horn River), west-central Colorado (Clear Creek Canyon) and southern Arizona (Baboquivari Mountains). The latter region is separated from the other localities from which the species is known by an interval of about five hundred miles. This striking isolation of the Baboquivari material would be extraordinary, if it were not shared by a number of other steppe species having a similar range. The explanation of this type of distribution is yet to be found. The occurrence of areas of tall grass is, however, a controlling factor within the range of the species.

The vertical range of this species extends from at least as low as 430 feet (Dallas, Texas) to as high as 9000 feet (mouth of Clear Creek Canyon, Colorado). In Texas alone, the vertical range is definitely known to be from the minimum given above to at least

[24] Bull. 56, U. S. N. M., p. 74, (1907).

4485 (Alpine) and 4500 to 5000 (Moss Well) feet. In Oklahoma it has been reported from as low as 1275 feet (Cache), while in Colorado (within its range) it occurs as low as 3460 feet (Julesburg).

Biological Notes.—Morse has very truthfully and concisely given this species as "characteristic of the coarse grasses of the drier parts of the prairie plains and * * often locally abundant." It is, however, quite at home on hills and slopes, even being considered by Bruner to be partial to hill-tops, while Gillette states it is found both within and without the foothills at Fort Collins. Hart reports it on bunch grass (*Panicum virgatum*) in blowouts between sand dunes in the Illinois sand areas, while in our experience it occurred in a variety of situations, even within the zone of oaks in the Baboquivari Mountains, Arizona, at 6000 feet elevation. The necessary requirement for its presence is a sufficient area of coarse grass, which is as attractive when sun-cured as it is when fresh. It is often taken in company with *M. maculipennis macclungi*, but is more local and generally less abundant.

The earliest exact date we have for adults is July 29 (Julesburg), although material taken that month, without exact date, from Little Big Horn River, Montana, and Chisos Mountains, Texas, is now before us. The latest date we have record of is October 6 to 9 (Sycamore Canyon, Baboquivari Mountains, Arizona). That the species persists late at relatively northern localities is evident, as we have October material, without exact date, from Hot Springs, South Dakota. Adult material taken at Dallas, Texas, on August 14 to 16 was accompanied by immature individuals, also adult males and immature females were secured at Marathon, Texas, on August 20, so it is evident that the species does not mature very much earlier southward than it does northward. Morse, in his work in Texas and Oklahoma, secured no adults before August 15 (Wichita Falls, Texas), although he had taken immature material on August 8 (Caddo, Oklahoma) and again on August 18 (Clarendon, Texas). Hart has reported immature specimens taken in Illinois on August 17 and adults on August 18 to 20. Identifiable immature material has been recorded by other authors, or is now before us, taken as early as July 3 (Clear Creek Canyon, Colorado) and as late as September 5 to 8 (Moss Well, Chisos Mountains, Texas). No adults were taken with the latter.

Remarks.—This species is, when due allowance is made for the variation found in all of the forms of the genus, a very plastic

one, apparently responding readily to environmental influences, in modifications of both structure and coloration. None of these tendencies, however, seem well enough established or as constant as would be required of such differential features to form adequate bases for naming geographic races. The southern Arizonan (Baboquivari Mountains) material is the more strikingly isolated of these, in its generally blunter fastigium, somewhat more robust form and prominent coloration features. However, as we have shown above, this material itself varies appreciably, and is virtually connected with the more normal condition by a number of individuals from component series of the representation before us. Until we know more concerning the species in the southwestern portion of its range, its variation there and the geographic extent of the tendencies shown by our small Baboquivari series, it is inadvisable to propose a racial name for this material. The future may show the desirability of such action, but at this writing the evidence does not warrant it.

Specimens examined: 248; 152 males, 87 females, 2 immature males, 7 immature females.

Illinois: Havana, Mason County; (J. D. Hood); 1 ♂, 1 ♀; [U. S. N. M.]. Bishop, Mason County; VIII, 13, 1907; 1 ♂; [Ill. State Lab. Nat. Hist.].

Iowa: Hamburg, Fremont County; IX, 2, 1914; (M. P. Somes); 2 ♀; [Somes Cln.].

South Dakota: Hot Springs, Fall River County; X, 1888 (one specimen); 1 ♂, 1 ♀; [Hebard Cln.].

Nebraska: Sidney, Cheyenne County, elevation 4100 to 4300 feet; VII, 30, 1910; (R. & H.; on top and slopes of bluffs of Lodge Pole Creek); 2 ♂. Southwest Nebraska; 2 ♀; [Hebard Cln.].

Kansas: Hill City, Graham County; 1910; (C. E. McClung); 1 immature ♂; [McClung Cln.]. Graham County; (C. E. McClung); 1 ♂, 1 ♀; [McClung Cln.]. Russell, Russell County; (C. E. McClung); 2 ♂, 1 ♀; [McClung Cln.]. Dorrance, Russell County; 1908; (C. E. McClung); 2 ♂; [McClung Cln.]. Wilson, Ellsworth County; 1910; (Pinney); 1 ♂; [McClung Cln.]. Wellington, Sumner County; (E. G. Kelly); 1 ♂; [Somes Cln.]. Dickinson County; 1908; (Robertson); 3 ♂; [McClung Cln.]. Richmond, Franklin County; 1910; (Taylor); 1 ♂; [McClung Cln.]. Kingman, Kingman County; 1911; (E. Carothers); 1 ♂; [McClung Cln.]. Barber County; (F. W. Cragin); 1 ♂, 3 ♀; [Hebard Cln.].[25] Dodge City, Ford County, elevation 2500 feet; IX, 13, 1909; (H.; very plentiful in areas of short grass); 10 ♂, 2 ♀. Syracuse, Hamilton County, elevation 3230 feet; IX, 12, 1909; (R. & H.; in short prairie grass); 3 ♂, 12 ♀.

[25] Previously recorded by Bruner.

Oklahoma: Mountain Park, Tillman County, elevation 1360 to 1390 feet; VIII, 22, 1905; (A. P. Morse); 1 ♂; [Morse Cln.].[26] Summit of Mount Sheridan, Wichita Mountains, Comanche County, elevation 2500 feet; VIII, 24, 1905; (A. P. Morse); 1 ♂; [Morse Cln.].[26] Cache, Comanche County, elevation 1275 feet; VIII, 25, 1905; (A. P. Morse); 1 ♂; [Morse Cln.].[26] Cherokee Nation; VIII, 1896; 1 ♀; [U. S. N. M.].[27]

Texas: No exact locality; (Belfrage); 2 ♂; [U. S. N. M.]. Amarillo, Potter County, elevation 3600 feet; VIII, 20, 1905; (A. P. Morse); 2 ♂, 1 ♀; [Morse Cln.].[26] Wichita Falls, Wichita County, elevation 950 feet; VIII, 15, 1905; (A. P. Morse); 1 ♂; [Morse Cln.].[26] Dallas, Dallas County, elevation 430 feet; VIII, 14 to 16, 1915; (R.; common in grasses in prairie region, immature individuals very common, female adults not numerous); 35 ♂, 7 ♀; 1 immature ♂, 4 immature ♀: IX, 25 to 26, 1912; (R. & H.; scarce in areas of tall grass); 8 ♂, 4 ♀: IX, 3 (one specimen); (Boll); 2 ♂, 3 ♀; [U. S. N. M. and M. C. Z.]. Sagamore Hill, Tarrant County, elevation 650 feet; IX, 27, 1912; (R. & H.); 2 ♀. Weatherford, Parker County, elevation 1000 to 1100 feet; IX, 23, 1912; (R. & H.); 1 ♀. Cisco, Eastland County, elevation 1450 to 1550 feet; IX, 21 to 22, 1912; (R. & H.; in grasses along stream and in meadows, locally more common than *M. maculipennis maculipennis*, with which it was associated); 12 ♂, 18 ♀. Kerrville, Kerr County, elevation 1525 to 1800 feet; VIII, 17 to 18, 1912; (R. & H.; scarce in low scant grass about low oak thickets); 2 ♂, 1 ♀. Marathon, Brewster County, elevation 3940 to 4160 feet; VIII, 20, 1916; (R.; uncommon in moister areas); 2 ♂, 2 immature ♀: VIII, 25 to 27 and IX, 12 to 13, 1912; (R. & H.; in high grasses); 35 ♂, 13 ♀. Chisos Mountains, Brewster County; VI, 1911; (H. A. Wenzel); 1 ♂; [A. N. S. P.]. Moss Well, Chisos Mountains, Brewster County, elevation 4500 to 5000 feet; IX, 5 to 8, 1912; (R. & H.); 1 immature ♀. Alpine, Brewster County; IX, 8, 1911; (F. C. Bishopp); 1 ♂; [U. S. N. M.].

Montana: Little Big Horn River; VII, 1883; 1 ♂; [U. S. N. M.].[28]

Colorado: Julesburg, Sedgwick County, elevation 3460 to 3550 feet; VII, 29, 1910; (R. & H.; on scantily grassed hills); 1 ♂, 1 ♀. Holly, Prowers County; IX, 8, 1898; (C. P. Gillette); 1 ♂, 1 ♀; [Hebard Cln.]. La Junta, Otero County, elevation 4150 feet; IX, 11, 1909; (R. & H.; not common on poorly grassed broken limestone surface at edge of Great Plains plateau); 4 ♂, 5 ♀.

Arizona: Baboquivari Mountains, Pima County; (F. H. Snow); 2 ♂; [A. N. S. P.].[29] Sycamore Canyon, Baboquivari Mountains, Pima County, elevation 3700 to 6000 feet; IX, 6 to 9, 1910; (R. &

[26] Previously recorded by Morse.
[27] Previously recorded by Caudell.
[28] This specimen is labelled "Little Horn River," which is doubtless meant to be Little Big Horn River
[29] Previously recorded by Rehn.

H.; on grassy benches of canyon slopes to tops of ridges and, very rarely, in tall yellow grass in the zone of oaks); 6 ♂, 4 ♀.

Mermiria alacris Scudder.[30] Plate V, figs. 28 35; Plate II, figs. 1-4.

1877. *Mermiria alacris* Scudder, Proc. Boston Soc. Nat. Hist., xix, p. 30. [♂, ♀: Georgia.]

1897. *Mermiria rostrata* McNeill, Proc. Davenp. Acad. Nat. Sci., vi, pp. 205, 207, pl. I, fig. 3c. [♂, ♀: Mackay, Oklahoma (Indian Territory).]

1899. *Mermiria vigilans* Scudder, Proc. Amer. Acad. Arts and Sci., xxxv, pp. 42, 43. [♂, ♀: Smithville, North Carolina.]

Comparison with *M. neo-mexicana*, the only close ally of the present species, has already been made under that form.

This species was based on a series of thirty-two males and two females, collected in "Georgia" by H. K. Morrison. Of these we have examined nineteen males and one female, all in the Scudder Collection at the Museum of Comparative Zoology with the exception of one male in the United States National Museum. We here select a single male as the lectotype.

Single Type (by present selection).—♂; Georgia. "Type specimen." "Mermiria alacris Scudd." [Scudder Collection in Museum of Comparative Zoology.]

Morphological Notes.—The striking morphological variational feature seen in this species is that most noticeable in the other species of the genus, *i. e.* the form of the fastigium. This variation is spread over the whole distribution of the species and not confined to any one region or sex. In the more rounded type the fastigium forms a rounded, approximately 70° (♀) or 65° (♂) angle, from which the variations range through all degrees of production and rounding to 42° (♀) or 33° (♂). The character of the lateral margins of the fastigium varies independently of the exact angle, being weakly arcuate to straight. The exact outline of the dorsum of the head, when seen from the side, the degree of decurving of the fastigial line, the exact form of the outline of the eye and the exact location of the fastigial impression are all variable and, apparently, always individually. The eyes show similar extremes of this variation to those occurring in *intertexta*, while the presence or absence of the weak fastigial medio-

[30] The immature material from Nugent, Mississippi, recorded by Morse as *Mermiria bivittata* (Carneg. Inst. Wash. Publ., No. 68, p. 28, (1907)), represents, instead, the present species. The adult material there recorded is, however, true *bivittata*. It is highly probable that the immature specimens recorded at the same time from Biloxi and Hattiesburg, Mississippi, also represent *alacris*, as *bivittata* is, apparently, an earlier maturing species, but we have only immature material from Nugent, kindly loaned by Prof. Morse, before us.

longitudinal carina has no taxonomic significance. McNeill's *rostrata* was based on individuals with the very acute fastigium, but the extensive material now before us shows this condition to be purely individual.

Synonymy.—The synonymy given above is very evident to anyone having before them the typical material of the "species," or even topotypic males. Morse[31] and Rehn and Hebard[32] have already established the synonymy of *vigilans*, which further study has fully confirmed. McNeill's *rostrata* has been the subject of considerable study, particularly as nearly topotypic material showed in part a more acute fastigial form than the average of *alacris*. A careful analysis of the extensive series before us, covering the whole known range of *alacris*, shows clearly and most convincingly that similarly very acute fastigii are found at practically every locality represented by a fair series, and also that Oklahoma and north Texas material is as variable, in this respect, as that from other regions. The variation in the Oklahoma and Texas individuals embraces types with the fastigial angle as rounded as in the more average eastern material. The whole range of fastigial variation is similar to and co-extensive with that occurring in all the other species of the genus. The other features given as diagnostic of *alacris* and *rostrata* by McNeill are variable and untrustworthy. That author had but five specimens of the two "species" before him at the time, so there is little wonder he was led to assign erroneous values.

Measurements (in millimeters).

♂	Length of body.	Length of pronotum.	Length of tegmen.	Length of caudal femur.
New Berne, North Carolina	35.3	6	28	22
New Berne, North Carolina	37.2	6	26	20
Southern Pines, North Carolina	28	4.8	20.8	17.4
Southern Pines, North Carolina	34	5.4	25.2	19.6
Winter Park, North Carolina	32.2	5.2	22.8	18
Winter Park, North Carolina	37	5.7	25.7	21.2
Seven Mile, South Carolina	36	6.1	26	21.2
Seven Mile, South Carolina	39.4	6.5	26.7	21.2
Groveland, Georgia	37	5.3	25.1	19.6
Groveland, Georgia	39	5.6	27.3	22
Bainbridge, Georgia	34	5.4	25	18.8
Bainbridge, Georgia	37	5.4	26.5	19.5
Jacksonville, Florida	35	5	24	19.5
Jacksonville, Florida	36	6	27	20.5
Pomona, Florida	36.2	6.1	26.5	20.9

[31] Carneg. Inst. Wash., Publ. No. 68, p. 27, (1907).
[32] Proc. Acad. Nat. Sci. Phila., 1916, p. 156, (1916).

	Length of body.	Length of pronotum.	Length of tegmen.	Length of caudal femur.
Pomona, Florida	39.5	6.4	28.5	22.4
Gainesville, Florida	35.5	5.2	24.6	19.2
Cedar Keys, Florida	34.6	5.2	25	18.4
Fort Myers, Florida	32.5	5	23.6	18
Fort Myers, Florida	38	5.7	26	21
DeFuniak Springs, Florida	37.5	5.8	26.5	21.5
DeFuniak Springs, Florida	38.3	5.7	28.2	20.4
St. Elmo, Alabama	39.8	6	26.2	21
St. Elmo, Alabama	42	6.5	29.8	21.4
Alexandria, Louisiana	36.2	5.7	25.3	21.2
Alexandria, Louisiana	37	5.7	27.3	21
Elkhart, Texas	37	6	27	21.6
Elkhart, Texas	40	6.4	28.4	22.9
Dallas, Texas	37	5.3	27.7	20.3
Dallas, Texas	40.5	6.4	29.6	23.1
Shawnee, Oklahoma	39.6	6.2	27.2	21.7
Waurika, Oklahoma	36	5.6	26.4	20.4
Hollister, Missouri	33.5	5.2	23.4	18.9
♀				
New Berne, North Carolina	48.2	8	34	26.5
Southern Pines, North Carolina	40.2	6.5	30	22.5
Southern Pines, North Carolina	46.3	7.4	34	25.2
Winter Park, North Carolina	47	7.8	34	25.4
Winter Park, North Carolina	52.8	8	35.5	26.2
Seven Mile, South Carolina	52.2	8.6	36	26.8
Seven Mile, South Carolina	52.7	9.2	37.3	29.2
Groveland, Georgia	55	8.4	35	26.5
Bainbridge, Georgia	45	7.5	31	25.4
Bainbridge, Georgia	49.2	7.7	34.5	27
Jacksonville, Florida	51.6	8	35.2	27.6
Jacksonville, Florida	53.5	8.3	35.8	26.5
Pomona, Florida	47.5	7.7	34	27.7
Pomona, Florida	53.1	8.8	35.6	28.8
Titusville, Florida	52.3	8.2	[33]	27.7
Fort Myers, Florida	51.4	8	36.5	27.5
Fort Myers, Florida	50.5	8	35.2	28.1
DeFuniak Springs, Florida	50	8.2	36.2	27.7
Irvington, Alabaaa	47.3	7.8	34.8	27.7
Irvington, Alabama	53.5	8.9	38.2	29
Alexandria, Louisiana	47.6	7.4	34.5	26.5
Alexandria, Louisiana	47.3	7.6	32.9	25.6
Dallas, Texas	47.5	7.5	32.4	23.8
Dallas, Texas	50	8.4	34.6	26.5
Wilburton, Oklahoma	51.5	7.9	36	27
Stillwater, Oklahoma	44.2	7.5	31	24.4
Hollister, Missouri	45.5	7	31	23.6

These measurements of extremes show there is a great amount of variation at single localities, in both sexes, but particularly in the male sex. The optimum size development of the species is found in the low coastal region of the Carolinas, and in the north Floridian and Gulf Coast regions between Jacksonville and southern Mississippi, although the material continues well above average size into northeastern Texas and eastern and south-central

[33] Damaged.

Oklahoma. The minimum is found in material from the northern limits of the range and inland from the eastern coast, at what is the interior limit of the species in that region. The peninsular Florida individuals show, as a whole, a faint reduction in size compared with north Floridian specimens.

Color Notes.—The coloration of this species is distinctive when compared with most of the others in the genus, although certain individuals of *neo-mexicana* are very similar. The latter can, however, be readily distinguished by the structural characters. The base color in *alacris* ranges from dull lemon chrome to oil yellow and courge green, rarely as dull as sulphine yellow (only in the material from Elkhart, Texas), the abdomen always clearer, purer and more decidedly yellow. The dark bars range in tone from dragon's-blood red to garnet brown, rarely to liver brown and chestnut-brown. The dark markings on the head and pronotum may be of similar depth or those on the head may be distinctly paler and less sharply marked. The usual dark medio-longitudinal line on the head, pronotum and sutural margins of the tegmina may be strongly and uniformly marked, in fact almost as decided as the lateral bars, may be obsolete on the head yet distinct on the pronotum, or may be completely absent except for a narrow lining along the median carina of the pronotum. We find that the maximum reduction of the medio-longitudinal bar is generally accompanied by a slight weakening of the lateral bars, i. e., the specimens having rudimentary medio-longitudinal bars show relatively weaker lateral bars. The tegminal continuation of the dark bar is broad and unbroken by a pale humeral line in one extreme condition, while in the other extreme the dark bar on the proximal portion of the tegmina is narrower than the humeral pale line, and distad it is weaker and suffuses but about one-half of the width of the discoidal field. The face varies from uniformly pale, except for dark lines along the lateral facial carinæ, to uniformly suffused with the color of the dark pattern. The creamy white edgings of the dark lateral head and pronotal bars, the ventral edging of the continuation of the same on the pleura and the line at the ventral edge of the genæ, pronotum and ventrad on the pleura vary in distinctness. The immature specimens show a green or (rarely) brown phase with the dark bars indicated and enclosed between cream-colored callose lines.

The palest material seen is from Alexandria, Louisiana, while specimens from Pass Christian, Mississippi, strongly approach

the Alexandria ones. The Elkhart, Texas, series is very deeply but dully colored, while the single Waurika male is also very dull. From central-northern Florida (Woodville) and southwestern Georgia (Bainbridge) westward in the Gulf Coast region the species averages paler, and with lighter greens than it does along the eastern coast from North Carolina south into peninsular Florida.

Distribution.—In the east the range of this species extends from as far north as central North Carolina (Salisbury and New Berne), south to south-central Florida (Iona, Fort Myers and Okeechobee, St. Lucie County), the Gulf Coast of western Florida, Alabama, Mississippi and interior Louisiana; west to northeastern Texas (Dallas, Longview and Elkhart), northwestward to central Oklahoma (Perkins, Stillwater, Shawnee and Waurika) and extreme southeastern Kansas (Independence), north in the Mississippi Valley to southern Missouri (Hollister). In the east it occurs chiefly below the Fall-line in the Coastal Plain, but immature material, clearly of this species, has been taken at Toccoa, Georgia, over one thousand feet elevation, and at Salisbury, North Carolina, while we have examined one adult from Clemson College, South Carolina, which is at an elevation of eight hundred and fifty feet. The northern limit of the species' distribution in Alabama and Mississippi remains to be determined; we feel confident, from our field experience, that it is either absent or extremely scarce in southwestern Louisiana and southeastern Texas.

The presence of areas of long- and short-leaf pine appears to exercise a decided influence on the distribution of this species, although it occurs to the northwest of the range of these trees in Oklahoma.

Biological Notes.—This beautiful species frequents tall grass in long- or short-leaf pine woods of rolling or flat woods type, or mixed woods; occasionally in wet woods or along the borders of swampy timbered areas. It also occurs in associated gallberry and similar bushes in its preferred environment, and persists in grasses and oak sprouts after the higher covering forest has been removed. Rarely it appears to invade old fields growing up in grasses and bushes, and rather infrequently is found in sandy barrens of low oak and pine, where it occurs in the scant grass and oak sprouts. It is a moderately strong flier and is quite adept at dodging, its conspicuous coloring not rendering it as evident as would be imagined.

The earliest date available for adults is July 16 to 29, at Spring Creek, Georgia, while an adult was taken at Augusta, Georgia, on the latter date and several others at Albany, Georgia, on August 1. We have also seen an adult specimen labelled July, taken at Billy's Island, Georgia. The Spring Creek, Augusta, and Billy's Island specimens were secured with immature specimens of the species, the latter representing two instars in each case, all being in the two instars preceding maturity excepting the immature individuals from Billy's Island, which were chiefly taken in June and much less advanced. June is the earliest month noted for the immature condition, and we have material (females in the instar preceding maturity) taken with adult individuals as late as September 13 to 15. We have seen no immature specimens taken later than August 18 (Longview, Texas) which are not in the instar immediately preceding maturity. The latest date known for adults is November 22, at Smithville, North Carolina. We have seen specimens taken during the same month at Southern Pines, North Carolina, and Titusville, Florida, while the species occurs at the most western known locality (Waurika, Oklahoma) as late as October 14. The earliest northern date for adults is August 4, at Southern Pines, North Carolina, so it is evident the species has a mature season of over three months at its northern limit of distribution in the east.

Specimens examined: 203; 134 males, 55 females, 2 immature males, 12 immature females.

North Carolina: Southern Pines, Moore County; VIII, 4 to 25, X, 13, 1915; (A. H. Manee); 17 ♂, 6 ♀; [Hebard Cln.].

South Carolina: Clemson College, Oconee County; IX, 1 to 2, 1905; 1 ♂; [Somes Cln.]. Lane, Williamsburg County; VII, 20, 1917; (M. Hebard: in grasses in long-leaf pine woods); 1 immature ♂, 2 immature ♀; [Hebard Cln.]. Seven Mile, Charleston County; IX, 23, 1917; (R. & H.; occasional in pine woods); 6 ♂, 4 ♀.

Georgia: Groveland, Bryan County; IX, 21, 1917; (R. & H.; infrequent in undergrowth of sandy oak barrens); 5 ♂, 1 ♀. Bainbridge, Decatur County; IX, 5 to 6, 1915; (R. & H.; occasional in undergrowth of pine and oak woods, particularly in the more grassy areas); 9 ♂, 7 ♀, 1 immature ♀.

Florida: Ocala, Marion County; IX, 19 to 20, 1917; (R. & H.; in sandy barrens and undergrowth of sandy pine and oak flatwoods); 1 ♂, 3 ♀. Pomona, Putnam County; IX, 7 to 8, 1917; (R. & H.; in undergrowth in pine woods); 2 ♂, 2 ♀. Dunnellon, Marion County; IX, 19, 1917; (R. & H.; rare in pine woods undergrowth); 1 ♀. Kissimmee, Osceola County; IX, 10, 1917; (R. &

H.; along edge of cypress bay); 3 ♂. Lakeland, Polk County; IX, 11, 1917; (R. & H.; few in pine woods undergrowth); 1 ♂, 1 ♀. Iona, Lee County; IX, 13, 1917; (R. & H.; in pine woods undergrowth); 1 ♀, 1 immature ♀. Fort Myers, Lee County; IX, 13 to 15, 1917; (R. & H.; in pine woods); 7 ♂, 2 ♀, 1 immature ♀. Okeechobee, St. Lucie County; VII, 1915; (M. Mickle); 1 immature ♀; [Hebard Cln.]. Woodville, Leon County; IX, 1, 1915; (R. & H.; moderately numerous in wire grass in long-leaf pine woods and in oak sprouts); 9 ♂, 3 ♀. Carrabelle, Franklin County; IX, 2 to 3, 1915; (R. & H.; few in grasses on edge of swampy wooded areas); 5 ♂, 2 ♀. River Junction, Gadsden County; VIII, 31, 1915; (R. & H.; few in long-leaf pine woods); 4 ♂. Grand Ridge, Jackson County; IX, 1, 1915; (R. & H.; in wire grass in long-leaf pine woods); 1 ♂. DeFuniak Springs, Walton County; VIII, 30, 1915; (R. & H.; moderately common in wire grass in long-leaf pine woods); 11 ♂, 2 ♀, 1 immature ♀. Pensacola, Escambia County; VIII, 28 to 29, 1915; (R. & H.; occasional in heavy wire grass, ground oak, etc., in long-leaf pine woods); 7 ♂, 2 ♀, 2 immature ♀.

Alabama: Montgomery, Montgomery County; IX, 8, 1915; (H.; in coarse grasses in park-like short-leaf pine woods on ridges); 1 ♀. Mobile, Mobile County; VIII, 26 to 27, 1915; (R. & H.; in tall grasses in long-leaf pine flat-woods); 3 ♂. Irvington, Mobile County; VIII, 26, 1915; (R. & H.; moderately common in grasses of deforested pine flat-woods); 4 ♀. St. Elmo, Mobile County; VIII, 26, 1915; (R. & H.; moderately common in heavy grasses in long-leaf pine flat-woods); 6 ♂, 2 ♀, 1 immature ♀.

Mississippi: Hattiesburg, Forest County; IX, 11, 1915; (R. & H.; in rolling, rather open long-leaf pine flat-woods); 3 ♂, 1 ♀. Pass Christian, Harrison County; VIII, 23, 1915; (R. & H.; one colony in high grasses in swampy pine woods); 3 ♂.

Louisiana: Alexandria, Rapides Parish; VIII, 22, 1915; (R. & H.; very locally common in tall grasses of rather open long-leaf pine-woods); 12 ♂, 2 ♀.

Texas: Longview, Gregg County; VIII, 18, 1915; (R. & H.; in short-leaf pine woods); 1 immature ♀. Elkhart, Anderson County; VIII, 16, 1915; (H.; in tall grass patches along border of woods, chiefly short-leaf pine); 11 ♂, 1 immature ♂, 1 immature ♀. Dallas, Dallas County; IX, 10 (on two specimens); (Boll); 3 ♂, 2 ♀; [M. C. Z.[34] and U. S. N. M.].

Oklahoma: No exact locality; (Ray Painter); 1 ♂, 1 ♀; [U. S. N. M.]. Wilburton, Latimer County; VIII, 27, 1905; (A. P. Morse); 1 ♀; [Morse Cln.].[35] Shawnee, Pottawatomie County; VIII, 26, 1905; (A. P. Morse); 1 ♂; [Morse Cln.].[35] Stillwater, Payne County; (A. N. Caudell); 1 ♀; [U. S. N. M.].[36] Perkins,

[34] The two males and one female from the Scudder Collection [M. C. Z.] are labelled "neomexicana" in Scudder's handwriting. They are clearly *alacris*.

[35] Reported by Morse, Carneg. Inst. Wash., Publ. 68, p. 27, (1907).

[36] Reported by Caudell, Trans. Amer. Entom. Soc., xxviii, p. 84, (1902).

Payne County; VIII, 13, 1901; (N. Caudell); 1 ♀; [U. S. N. M.]. Waurika, Jefferson County; X, 14, 1909; (F. C. Bishopp); 1 ♂; [U. S. N. M.].

Kansas: Independence, Montgomery County; VIII to IX, 1902; (A. Birchfield); 1 ♀; [U. S. N. M.].

Missouri: Hollister, Taney County; VIII, 1909 and 1913; (M. P. Somes); 1 ♂, 1 ♀; [Somes Cln.].

Rehn and Hebard have recorded the species from the following localities: Fayetteville, New Berne, Southern Pines, Wilmington, Winter Park, Wrightsville and Lake Waccamaw, North Carolina; Columbia, Ashley Junction and Yemmassee, South Carolina; Toccoa, Augusta, Macon, Jesup, Billy's Island, Albany, Bainbridge and Spring Creek, Georgia; Jacksonville, Pablo Beach, San Pablo, Gainesville, Cedar Keys, and Titusville, Florida.

Mermiria intertexta Scudder. Plate VI, figs. 5-14.

1897. *Mermiria bivittata* McNeill (in part), Proc. Davenp. Acad. Nat. Sci., vi, pp. 204, 205. [Apparently the single Virginia record applies to this species.]

1899. *Mermiria intertexta* Scudder, Proc. Amer. Acad. Arts and Sci., xxxv, pp. 41, 42. [♂, ♀: Georgia; Eagle Pass, Texas.]

1904. *Mermiria intertexta* Bruner, Biol. Cent.-Amer., Orth., ii, p. 39. [Eagle Pass, Texas.]

This striking species occupies a rather intermediate position between the two types of the genus, having appreciable, though not strongly marked, lateral carinæ on the dorsum of the pronotum, yet lacking supplementary carinæ on the lateral lobes of the pronotum. The form is very elongate, with the pronotum unusually elongate, yet regularly, though weakly, enlarging caudad. The species is entirely hygrophilous, and as far as known, found only on the eastern and Floridian coasts.

Type.—♂; Georgia. (Morrison.) [Scudder Collection.] *Allotype.*—♀; same data.

The species was based on two males and two females from Georgia and Eagle Pass, Texas (Schott), all in the Scudder Collection. Of these we have examined two males and one female from the former locality.[37]

The present species, like *M. texana*, is so sharply defined from the other forms of the genus that, with the basic differential fea-

[37] We have not had an opportunity recently to examine the single female recorded from Eagle Pass, Texas. There is every reason to suppose it belongs to *M. maculipennis maculipennis*, and has nothing to do with the present species, which, in habitat, is absolutely foreign to that locality. The specimen recorded by Caudell (Mus. Brooklyn Inst. Arts and Sci., Sci. Bull., i, p. 110, (1904)) from the Brownsville region, Texas, as this species, is now before us, and, as we had suspected, represents *M. maculipennis maculipennis*.

tures of the species in mind, *intertexta* will not be confused with any other, while its hygrophilous tendencies also serve as an additional aid to its recognition.

Morphological Notes.—In every series of any size of this species we find the most striking extremes in the variation in the outline of the fastigium, particularly of the males. We have figured the extremes of that sex of two series, which will show more graphically than words the variability in the production, degree of angulation or roundness of the outline of the fastigium. The greater or lesser degree of projection of the fastigium has, of course, an evident influence on the form of the fastigio-facial angle, when seen from the side, and with this is correlated some variation in the shape of the basal outline of the eye, the dorso-cephalic section being more strongly acute angulate in those with the fastigium more produced, and more produced rounded in those with the fastigium relatively shorter. Aside from this, however, the form of the eyes varies decidedly and entirely individually, the greatest width contained in one extreme one and one-half times in the greatest depth of the same, and in the other extreme one and three-quarters times in the greatest depth. Considerable individual variation in the width and relative depth of the sulcation of the frontal costa is evident in the series, this being purely individual.

Measurements (in millimeters).

♂	Length of body.	Length of pronotum.	Length of tegmen.	Length of caudal femur.
Anglesea, New Jersey	32	5.1	23	18.6
Anglesea, New Jersey	31.7	5	22.3	17.8
Cape May, New Jersey	30	5	22.5	17.7
Cape May, New Jersey	34.1	5.7	24	18.4
Millenbeck, Virginia	33.5	5.6	25.2	21
Wrightsville, North Carolina	39	5.8	27.3	22
Isle of Palms, South Carolina	37.7	6	25	20.9
Tybee Island, Georgia	36	5.6	26.2	20.5
Tybee Island, Georgia	42.5	6.9	29	22.7
Pablo Beach, Florida	26.3	5.6	25.9	20
Pablo Beach, Florida	40.7	6	28.8	21.9
Homestead, Florida	35.1	5.7	25.3	19.7
Homestead, Florida	39.5	6	27.5	21.2
Big Pine Key, Florida	32.3	5	24	18.7
Big Pine Key, Florida	36.7	5.9	26.4	21.5
Indian Beach, Florida	42	7	29.5	24.5
Indian Beach, Florida	40.6	6.4	27.8	22.6
Cedar Keys, Florida	36.5	5.5	25.5	22.3
Cedar Keys, Florida	38.2	5.8	25	20.5
♀				
Anglesea, New Jersey	46.5	8	32.5	26
Anglesea, New Jersey	47.3	8	34.2	26.9

	Length of body.	Length of pronotum	Length of tegmen.	Length of caudal femur.
Cape May, New Jersey	46.5	7.6	33.3	25.3
Cape May, New Jersey	48.6	8.7	34.6	28
Millenbeck, Virginia	40.5	8.2	35.8	28.4
Smith Island, North Carolina	55	9.5	40	30.3
Isle of Palms, South Carolina	53	9	38.3	31.2
Tybee Island, Georgia	53.2	8.3	37.3	28
Tybee Island, Georgia	57.6	9	42	30.5
Pablo Beach, Florida	48	8	35	25.9
Pablo Beach, Florida	55	9	36.9	29
Homestead, Florida	53.4	8.5	37.3	27.7
Big Pine Key, Florida	58.5	8.9	37.4	30.4
Indian Beach, Florida	54.2	9.2	39.5	30
Cedar Keys, Florida	52.5	9	37.7	30

These measurements, which represent the maximum and minimum where series are available, show there is an average increase in size southward from New Jersey to northern and central Florida, the New Jersey individuals being far and away the minimum in the average of the measurements, while the optimum development of the species is apparently reached in the Georgian and north and central Floridian coast regions. There is, however, at each locality represented by a series, sufficient variation in the material to show that measurements of single individuals are of little value, except where they show the actual maximum or minimum of the species at that locality.

Color Notes.—The species exhibits two color phases, green and brown, between which stand certain individuals annectant in their tonal coloration. The green tone ranges from as pale as olive-yellow and as brilliant as clear dull green-yellow to as dull as citron green, while in the brown phase we find the tonal value connected with the greens and ranging as dark as tawny-olive. The dark markings are always more decided in the male and range from dresden brown to mummy brown. The medio-longitudinal stripe of the head and pronotum is always more apparent in the male, rarely as sharply indicated, and never as solid and dark, in the female as in the male, being entirely absent in several of the former sex. It is occasionally limited to the head and also divided longitudinally by a thread of the pale base color. The dark lateral bars are occasionally very weak in strongly green phase females, and never are as strongly marked in the female as in the male. Rarely the pale subcostal tegminal streak is obsolete. Rehn and Hebard[38] already have given notes on the south Florida material here examined.

[38] Proc. Acad. Nat. Sci. Phila., 1914, p. 390, (1914).

Distribution.—In the maritime region from southern New Jersey (as far north as Ocean City), south to the Florida Keys (Long Key, Big Pine Key), and northwestward along the coast of western Florida as far as Cedar Keys. The species has also been reported from the Brownsville region (Caudell) and Eagle Pass (Scudder), Texas, but we know the former is incorrect, really referring to *M. maculipennis maculipennis*, and the latter is in all probability an erroneous association, as extensive field work by Rehn and Hebard in that region, and in the whole stretch of Gulf territory intervening between the Rio Grande and Cedar Keys has failed to bring the species to light.

Biological Notes.—This species is distinctly hygrophilous, found in both fresh and salt marsh situations, occasionally straying into adjacent dune vegetation. Its preference is for coarse high grasses and reeds in open marsh or marshy depressions, occasionally in more strictly bog conditions (Belleplain) or narrow wet drains (Pablo Beach), while it has been taken in dry areas of low oak, bayberry, palmetto and briars among dunes near extensive salt marsh areas (Isle of Palms), and also in bayberry tangles on sand dunes in New Jersey (Cape May). Morse[39] has well said: "It is a shy and active species, flying freely and far, and on alighting dodges quickly around the grass stems to escape observation, or slipping nimbly downward and backward, seeks to hide itself."

Adults of this species have been taken as early as July 6 (Big Pine Keys, Florida) and as late as November 15 (Punta Gorda, Florida), while immature specimens have been taken as early as March 13 (Long Key, Florida) and as late as September 19 to 20 (Big Pine Key). From the northern portion of the range of the species we have no data on captures of adults earlier than August 9 (Ocean City, Virginia), and from New Jersey, August 18 to 22 is the earliest period, while September 24 is our latest date for the same region (Cape May Point). These northern records probably do not represent actual extremes either way, certainly not for last captures, but they are sufficient to show a season for adults some months longer in Florida than at the northern extremity of the range. Adults taken July 6 at Big Pine Key, Florida, were secured with immature individuals in the three instars preceding maturity. From the fact that Davis secured immature material at the same place September 19 to 20, with adults, it

[39] Publ. No. 18, Carneg. Inst., p. 29, (1904).

would seem very probable that the species has more than a single breed at the southern point of its distribution.

Remarks.—This species has no synonymy, but it has been misidentified on several occasions, chiefly on account of the uncertainty attached to the name *bivittata*, and the efforts of authors to follow Scudder's differential features for the species of the genus. Smith reported it as *bivittata*,[40] and again as *vigilans*,[41] in the latter determination following Rehn and Hebard, who had referred Floridian material of the present species to *vigilans*.[42] By the proper reference of the latter to the synonymy under *alacris*, and a corrected conception of *bivittata*, we are able to clear up the uncertainty surrounding these names. In the Scudder Collection we find one male and two females bearing the same data as the type material of *intertexta*, and arranged under *bivittata*, which are clearly *intertexta*. From this material we have evidence of the extent to which Scudder's failure to recognize individual variation in this genus led him into serious difficulties. By dogmatically assuming the exact degree of fastigial angulation to be a specific criterion, he associated very different forms and disassociated material of the same species.

Specimens examined: Previously unreported, 91; 33 ♂, 43 ♀, 1 immature ♂, 14 immature ♀. Previously reported material listed solely as localities.

New Jersey: Belleplain;[43] Anglesea;[44] Cape May;[44] Cape May, Cape County, VIII, 18–31, 1917, (Witmer Stone; near salt marsh and in bayberry thickets on sand dunes), 28 ♂, 40 ♀, 1 immature ♂, 13 immature ♀, [A. N. S. P.].

Virginia: Millenbeck, Lancaster County, VIII, 8, 1915, (H. Fox), 3 ♂, 2 ♀, 1 immature ♀, [Hebard Cln.].

North Carolina: Wrightsville,[45] Smith's Island.[45]

South Carolina: Coast;[45] Isle of Palms.[45]

Georgia: No exact locality;[46] Tybee Island.[45]

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[40] Ins. New Jersey, p. 154, (1900).

[41] Ann. Rep. N. J. State Mus., 1909, p. 179, (1910).

[42] Proc. Acad. Nat. Sci. Phila., 1907, p. 286, (1907).

[43] Recorded as *vigilans* by Fox (Proc. Acad. Nat. Sci. Phila., 1914, p. 487, (1914)).

[44] Reported by Smith as *bivittata* (Ins. N. J., p. 154, (1900)) and *vigilans* (Ann. Rep. N. J. State Mus., 1909, p. 179, (1910)).

[45] Reported by Rehn and Hebard (Proc. Acad. Nat. Sci. Phila., 1916, p. 157, (1916)).

[46] Portion of original material of Scudder.

Florida: Atlantic Beach;[45] Pablo Beach;[47] Jacksonville;[45] South Jacksonville;[45] Cedar Keys;[47] Indian Beach, Sand Key, Pinellas County, IX, 17, 1917, (R. & H.; in area of high grass on landward border of salt marsh), 2 ♂, 1 ♀; Long Boat Key,[45] Useppa Island;[48] Miami;[49] Homestead;[50] Long Key;[50] Big Pine Key.[50]

Mermiria bivittata (Serville).[51] Plate VI, figs. 15-24.

1839. *Opsomala bivittata* Serville, Hist. Nat. Ins., Orth., p. 589. [♀: North America.]
1877. *M[ermiria] bivittata* Scudder, Proc. Bost. Soc. Nat. Hist., xix, p. 30. [Georgia.]
1897. *Mermiria bivittata* McNeill, Proc. Davenp. Acad. Nat. Sci., vi, pp. 204, 205. (In part.)
1899. *Mermiria bivittata* Scudder, Proc. Amer. Acad. Arts and Sci., xxxv, pp. 41, 42. (In part.) ["Georgia" and "Texas" records only.]
1904. *Mermiria bivittata* Morse, Publ. 18, Carneg. Inst. Wash., p. 29. [♂: Fort Barrancas, Florida.]
1907. *Mermiria bivittata* Morse, Publ. 68, Carneg. Inst. Wash., p. 28. (In part.) [♂, ♀: Cheaha [Chehawhaw] Mountain, Alabama; Nugent, Mississippi; Caddo, South McAlester and Wilburton, Indian Territory (now part of Oklahoma); Cache and Mountain Park, (in part), Oklahoma; Denison, St. Jo and Wichita Falls, (in part), Texas, records.]
1907. *Mermiria intertexta* Rehn and Hebard (not of Scudder), Proc. Acad. Nat. Sci. Phila., 1907, p. 286. [♂: Pablo Beach, Florida.]
1916. *Mermiria bivittata* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1916, p. 157. [♀: Billy's Island, Georgia.]

Comparison.—This species is closely related in general appearance to *maculipennis*, and the two are often very hard to separate, particularly in the female sex. The most conspicuous feature of the species is found only in the male sex and is purely a color character, i. e., the absence of a pale subcostal stripe on the tegmina. In all the other species of the genus this is constantly indicated, although rarely subobsolete in males of *intertexta*, which, however, are quite distinct in other features. The other features of difference in this species from *maculipennis* are: the usual presence of a short, weak, cephalic median carina on the fastigium; the proportionately shorter dorsum of the fastigium in both sexes,

[47] Reported by Rehn and Hebard as *vigilans* (Proc. Acad. Nat. Sci. Phila., 1907, p. 286, (1907)). The material there reported by them as *vigilans* since has been correctly assigned to *bivittata*.

[48] Reported by Hebard (Ent. News, xxvii, p. 17, (1916)).

[49] Reported as *Mermiria* species by Rehn and Hebard (Proc. Acad. Nat. Sci. Phila., 1912, p. 250, (1912)).

[50] Reported by Rehn and Hebard (Proc. Acad. Nat. Sci. Phila., 1914, p. 390, (1914)).

[51] The following references may relate to this species, but their assignment cannot be made positively.

1870. *Opomala bivittata* Walker, Catal. Derm. Salt. Brit. Mus., iii, p. 507. [St. John's Bluff, Florida.] (May refer as well to *M. intertexta* or *alacris*.)
1871. *Opomala bivittata* Scudder, Rep. U. S. Geol. Surv. Nebr., p. 250. [Nebraska City, Nebraska.] (May refer as well to *M. maculipennis*.)
1872. *Opomala bivittata* Glover, Ill. N. A. Ent., Orth., pl. vi, figs. 24, 26, pl. xi, fig. 7.

and the fastigio-facial angle also more broadly rounded; the caudal margin of the pronotal disk being more distinctly angulate and the coloration with a larger percentage of green or greenish.

Type.—The original specimen of this species, on which Serville founded the name, was a female from "l'Amerique septentrionale," labelled by Latreille, from whose collection it was received. The description is sufficient to enable us to locate the species with fair certainty and correlated information assists further. Material in Serville's possession, similarly labelled and of similar origin, formed the basis of, among other species, *Leptysma marginicollis*,[52] *Paroxya clavuliger* and *Psinidia fenestralis*. As the range of these species has been fairly well mapped, and, as the region inhabited by *maculipennis* was largely unexplored, or at most unsettled, in the days of Latreille, we can feel relatively safe in considering the probable origin of the Latreille specimen as the southeastern states, where all the other species from the Latreille Collection occur, where *bivittata* as we understand it also occurs, and *maculipennis* is unknown. The present location of the Serville material is not definitely known to us.[53]

Morphological Notes.—The present species shows a relatively small degree of variation in the dorsal fastigial form, viewed from the standpoint of the genus, although there is quite an appreciable difference between the extremes found in either sex. In the male the extremes measure from about 52° to 84° in their angulation, or from a moderately acute angle to nearly a right angle, with its horizontal apex from narrowly rounded to rather broadly and bluntly rounded. The strength of the very short median carina on the cephalic section of the male fastigium varies greatly; it is never really strongly marked and is occasionally absent. The exact width of the marginal rim of the fastigium, due to the position of the intermarginal depression, varies as much in this as in the other species of the genus. In the female the angle of the horizontal apex of the fastigium varies from about 80° to 95°, or from a slightly acute to a slightly obtuse angle, with much variation in the degree and extent of the rounding of the same.

[52] These are placed in their modern genera.

[53] When comparing the description with *intertexta*, the only other species of the southeastern states to which it might apply, it is evident Serville did not have that species, as he says the postocular bars are black, while in *intertexta* they are always brown in the female, and the subcostal pale tegminal bar is so reduced and relatively weak it would not answer the description. In addition, the size of females of *intertexta* from the southeastern states is always greater than "20 lignes," as described.

The indication of the median fastigial carina in the female is as frequent as in the male, but it is generally, when present, less decided than in the other sex. When seen from the lateral aspect the fastigio-facial angle is always well rounded in the female, and rather narrowly, but still appreciably, rounded in the male. This is, in fact, one of the chief distinguishing features of the species. There is quite a little variation in the basal form of the eye, this ranging from ovoid-elliptical to narrowly elongate ovoid. The pronotum shows some little variation in the relative proportions of the dorsum of the prozona and metazona. The caudal margin of the disk of the pronotum is always angulate, broadly obtuse, varying slightly in its degree. The relative breadth to length of the pronotum shows a negligible amount of variation.

We have made a count of the caudal tibial spines of ten males and seven females, comprising the series from Navasota, Texas, with the following results:

♂

Extremes in numbers on external margin	18–22
Extremes in numbers on internal margin	15–18
Average number on external margin	20
Average number on internal margin	16+
Greatest difference between numbers on same margin in same specimens (external)	18–21
Greatest difference between numbers on same margin in same specimens (internal)	16–17

♀

Extremes in numbers on external margin	19–22
Extremes in numbers on internal margin	17–19
Average number of external margin	21
Average number on internal margin	17+
Greatest difference between numbers on same margin in same specimens (external)	19–22
Greatest difference between numbers on same margin in same specimens (internal)	17–18

Synonymy.—The species *bivittata* in the past has never been properly distinguished from *maculipennis*, and the published references to Serville's species are either erroneous (referring to *maculipennis* alone), in part correct (where the forms were not recognized as distinct), or fortuitously correct (where material of this species alone was in hand). The reference of a Pablo Beach male of this species to *intertexta* by Rehn and Hebard, in 1907, was due to the first recognition by those authors of a species distinct from true *intertexta* (then called by them *vigilans*). At that time Rehn and Hebard continued to use the name *bivittata* for the campestral species here shown to be properly called *maculipennis*.

Measurements (in millimeters).

♂	Length of body.	Length of pronotum.	Length of tegmen.	Length of caudal femur.
Lane, South Carolina	29	4.9	20.5	17.4
Lane, South Carolina	30.3	5.2	23.5	18.5
Billy's Island, Georgia	33.5	5.4	23.8	18.4
Pablo Beach, Florida	34.3	5.7	25.2	19.6
Fort Barrancas, Florida	30.7	5.4	24.4	17.6
Chehawhaw Mountain, Alabama	30	5	23.3	18
Nugent, Mississippi	30	5.1	21.6	17.3
Keokuk, Iowa	29.5	5.2	23	18.7
Keokuk, Iowa	30.8	5	21.5	18.2
West Point, Nebraska	28.3	4.6	21	17
Douglas County, Kansas	31[54]	5	23.4	18
Douglas County, Kansas	30.7	4.8	20.4	16.8
Barber County, Kansas	33.7	5.4	25	19.5
Barber County, Kansas	34.8	6	24.3	20.9
Mountain Park, Oklahoma	32	5.2	24	19.8
Caddo, Oklahoma	36	6	26.3	21
Denison, Texas	34	5.4	25.4	20.8
Denison, Texas	36	5.7	26.6	21.4
Dallas, Texas	33.8	5.3	22.8	18.7
Dallas, Texas	34.3	6	25.5	21
Shovel Mountain, Texas	30.8	5.2	24.2	19.8
Shovel Mountain, Texas	32.3	5.8	25	20.3
Navasota, Texas	35	5.5	26	20.2
Navasota, Texas	35.5	6	27.5	21
Flatonia, Texas	31.8	5	23.8	19.5
Flatonia, Texas	37	6	26.2	22
Rosenberg, Texas	33.3	5.6	25	20.2
Rosenberg, Texas	34.7	6	27.3	20.4
♀				
Lane, South Carolina	44.2	7.3	32	25
Lane, South Carolina	47.2	7.8	34	25.7
"Georgia"	43	7.3	32.3	26.7
"Georgia"	46	8	35	27.4
Chehawhaw Mountain, Alabama	44	6.9	34.5	25
Richmond, Kansas	43	7.6	31.8	26.3
Cache, Oklahoma	47	7.7	34.7	27.5
South McAlester, Oklahoma	47.5	7.7	36.7	29
Wichita Falls, Texas	47.3	7.5	34	28
Wichita Falls, Texas	51.3	8	35	30
Denison, Texas	48.3	8	34	28
Denison, Texas	49	8	35.3	28
Dallas, Texas	47	7	33.5	26.7
Shovel Mountain, Texas	39.5	7	29.7	25.4
Shovel Mountain, Texas	45.9	7.5	35.7	27.1
Navasota, Texas	48.8	7.9	34.4	28.6
Navasota, Texas	51.2	8.4	35.8	30.3
Flatonia, Texas	45.8	7.7	32.4	26.7
Flatonia, Texas	48.6	8	34	29
Rosenberg, Texas	49.6	8	34	27.2
Rosenberg, Texas	53.4	8.4	37	29

From these measurements it is evident that the species reaches its maximum of size in southeastern Texas and in the Red River region of northeastern Texas and southeastern Oklahoma, the

[54] Apex of abdomen abnormally extended.

size decreasing as one passes into higher country and northward toward the northern limit of its distribution. The material from West Point, Nebraska, northeastern Kansas and southeastern Iowa is very small, while that from elevated localities in Alabama, Oklahoma and Texas (i. e., Chehawhaw Mountain, Mountain Park and Shovel Mountain) is relatively small. Regarding the size variation in material from the eastern coast we can say but little, as the most northern material known from that region (Havelock, North Carolina) is not now available, and we possess a fair series from but a single definite locality—Lane, South Carolina. The latter shows equally small size when compared with material from the more northern points in the Mississippi Valley and interior region.

Color Notes.—The present species shares with *M. texana* the distinction of having a more fixed color pattern than the other species of the genus. The one striking feature of color difference is a sexual one and it is, as far as the material before us goes, absolutely constant. In the female sex the subcostal stripe is strongly indicated and relatively broad, while in the male it is entirely absent, the species being unique in this respect. The postocular bars are pronounced in both sexes, in the female almost never, and in the male usually, encroaching on the dorsum of the metazona; never, however, to the extent frequently found in *maculipennis*, and then generally in a dilute intensity. Very rarely is a medio-longitudinal bar present on the dorsum of the head and pronotum, and then it is generally limited to the head, made up of separate points and divided in two by a hair line of the general color. In certain specimens of the series in hand the mediolongitudinal line is indicated on the pronotum as well as on the head, and in those cases it is formed by an infuscation of the median carina. Rarely (three males: "Georgia," Chehawhaw Mountain, Alabama; three females; Lane, South Carolina) the median carina of the pronotum is distinctly hair-lined with fuscous, while the head has almost no indication of a line. Invariably the anal area of the tegmina, suturad of the last axillary vein, is of the pale dorsal color.

The pale base coloration of the male ranges from citron yellow (on the abdomen mustard yellow), through yellowish citrine to oil green, with a few specimens (all from Texas) ochraceous-buff to buckthorn brown. The majority of the Texan males are reed yellow. The pale base coloration of the female ranges from citron

green, through sea-foam green and antimony yellow and ochraceous-buff to pale tawny and even (very rarely) hays russet, the dorsum rarely with a ferruginous wash. The postocular bars in both sexes range from deep blackish fuscous to prout's brown, usually, but not invariably, more contrasted in the male than in the female. The dark area of the tegmina of the male ranges from weak cinnamon-brown proximad, paling distad to very weak snuff brown, to solidly blackish fuscous, as a broad, uniform continuation of the postocular bars. In the female, as in the male, the tegminal coloration is controlled by the depth of coloration of the postocular bars, and in this sex they are invariably of the same tone, regularly weakening distad, much the darkest along the proximal section of the costal margin and along the humeral trunk, thus contrasting the enclosed pale subcostal bar. Rarely, in the female sex, a maculate tendency, such as found in *maculipennis*, occurs[55] in variable intensity and extent. An infuscation of the face occurs more or less distinctly in numerous specimens, but it is strongly contrasted and very striking in eastern males alone. The caudal femora range in coloration from brazil red, through scarlet and carnelian red to hazel.

The geographic correlation of coloration seems best summarized by stating that intensive coloration in its maximum development, i. e. very dark postocular bars, medio-longitudinal bar, very dark tegmina and infuscate face, is developed only in the southeastern states, with Kansas specimens closely approaching it, while Texan material chiefly represents the recessive type and stages approach that extreme, with a factor for maculation, such as found in *maculipennis*, becoming evident in that region. The Texan series is sufficiently extensive to show that local conditions are strong influencing coloration factors, while at the same time individual variation, chiefly in the female sex, is considerable in series as extensive as those from Flatonia, Rosenberg and Navasota.

The hays russet tone of general coloration is found in a single female from Lane, South Carolina.

Distribution.—The range of this species extends from eastern North Carolina (Havelock) and the higher country of northern Alabama (Chehawhaw Mountain), to eastern Georgia (Billy's Island) and northern Florida (Pablo Beach), westward along the Gulf Coast probably continuously to Texas; westward in which

[55] Wichita Falls, Tex. (1); St. Jo, Tex. (1); Shovel Mountain, Tex. (7); Flatonia, Tex. (2).

state it is distributed to the region of the Edwards Plateau (Shovel Mountain), extending south in the same state as far as Flatonia and Rosenberg, while northward the range extends to northeastern Nebraska (West Point) and southeastern Iowa (Keokuk). In the southeastern states we do not know its interior limits, as the few exact localities known are practically coastal, with the exception of Chehawhaw Mountain, northern Alabama, while from between the east coast and Texas we have but two reliable records—Fort Barrancas, Florida, and Nugent, Mississippi. In Oklahoma it extends as far westward as the western base of the Wichita Mountains (Mountain Park), and in Kansas its westward known limit is Sun City, Barber County. The only information we have regarding the occurrence of the species in the central Mississippi Valley is its capture at Keokuk, Iowa, from which evidence its presence in southern Illinois would not be surprising.

The species' occurrence within its range is now known to be governed by the presence of rich grasslands and it does not occur as far west or as high as the Great Plains region, being entirely one of the humid district. Its range in part overlaps that of *maculipennis maculipennis* in eastern Texas, Oklahoma, Kansas, Nebraska and Iowa, but, as *maculipennis* is essentially an arid land type, over most of their respective territories the other species does not occur. Zonally *bivittata* is almost entirely Austroriparian and Sabalian, occuring in the Carolinian zone only in the northwestern portion of its territory.

In vertical distribution this species ranges from sea-level (Pablo Beach and Fort Barrancas, Florida) to at least two thousand feet elevation (Chehawhaw Mountain, Alabama, 2000 to 2400 feet; St. Jo, Texas, 1140 feet; Shovel Mountain, Texas, over 1000 feet; Cache, Oklahoma, 1275 feet; Mountain Park, Oklahoma, 1360 to 1690 feet). In Texas the lowest point represented (Harrisburg) is but a few feet above sea-level.

Biological Notes.—All the available information shows *bivittata* to be a species frequenting areas of rich, high grass, with or without intermingled weeds, where it is at times locally very abundant, and in from distinctly maritime (Fort Barrancas and Pablo Beach, Florida) to relatively hilly or at least rolling (Mountain Park, and Cache, Oklahoma; Dallas and Shovel Mountain, Texas) environments. At Fort Barrancas it occurred in *Juncus* along a tidal inlet, at Navasota and Flatonia its preferred habitat was in or near post-oak groves or forest; at Harrisburg the grassy cover was in

open short-leaf pine woods, at Rosenberg in open park-like country with scattered huisache trees (*Vachellia farnesiana*), and at Lane it occured in high grasses in long-leaf pine woods, where the species was locally abundant.

The earliest date we have for adults of the species is June 30 (Shovel Mountain), from which locality we have a fairly regular series of dates until September 18. By far the greater proportion of our dates are in August. One male from Keokuk, Iowa, was taken as late as October first. We have no nymphal material of the species, having secured adults only in our collecting. The species is the earliest maturing form in the eastern states, apparently having past its seasonal greatest abundance before August.

Remarks.—In the past this species has been universally confused with *maculipennis*, or at least with certain phases of that species, and its present recognition is largely due to the fact that the chromosome differences of the two species were recognized by Dr. C. E. McClung, who called our attention to the two forms. The external morphological differences separating them may seem trivial, particularly in view of the known variability of coloration and fastigial features in this genus, but the more one analyses these diagnostic features the more evident becomes their taxonomic importance in the present instance. The fastigium is broader, shorter and blunter than in *maculipennis*, and from the side more strongly rounded, while the median carina of the dorsum of the same is also well indicated in the male. The pronotal disk is of a different shape, with its caudal margin more angulate and less rounded. The absence of the subcostal stripe in the male is invariable in the large series now before us, and in addition the species generally has a more decided and richer green and a clearer, more transparent red brown in its coloration than the other species.

We feel no uncertainty relative to the determination of the species.

Specimens examined:[56] 225, 144 ♂, 81 ♀.

North Carolina: Havelock.

South Carolina: Lane, Williamsburg County; VII, 20, 1917; (M. Hebard; locally abundant in high grasses in long-leaf pine woods); 33 ♂, 13 ♀; [Hebard Cln.].

Georgia: (H. K. Morrison) 6 ♂, 3 ♀; [M. C. Z. and U. S. N. M.].[57] Billy's Island.

[56] Localities previously recorded by the author or Rehn and Hebard are listed without comment.

[57] Portion of material reported by Scudder.

Florida: Fort Barrancas, Escambia County; VIII, 3, 1903; (A. P. Morse); 1 ♂; [Morse Cln.].[58] Pablo Beach.

Alabama: Chehawhaw Mountain, Talladega County, elevation 2000 to 2400 feet; VII, 13, 1905; (A. P. Morse); 1 ♂, 1 ♀; [Morse Cln.].[59]

Mississippi: Nugent, Harrison County; VII, 20, 1905; 1 ♂; [Morse Cln.].[59]

Iowa: Keokuk, Lee County; IX, 19, 1913 and X, 1, 1915; (M. P. Somes); 2 ♂, [Somes Cln.].

Nebraska: West Point, Cuming County; IX; 1 ♂; [Hebard Cln. ex Bruner].

Kansas: Douglas County, 900 elevation; (C. E. McClung); 2 ♂; [McClung Cln.]. Richmond, Franklin County; 1910; (Taylor); 5 ♂, 1 ♀; [McClung Cln.]. Kingman, Kingman County; 1911; (Carothers); 1 ♂; [McClung Cln.]. Barber County; (F. W. Cragin); 2 ♂; [Hebard Cln. ex Bruner]. Independence, Montgomery County; VIII and IX, 1907; (A. Birchfield); 3 ♀; [U. S. N. M.].

Oklahoma: Mountain Park, Tillman County; VIII, 22, 1905; (A. P. Morse); 1 ♂; [Morse Cln.].[59] Cache, Comanche County; VIII, 23, 1905; (A. P. Morse); 1 ♀; [Morse Cln.].[59] Perkins, Payne County; VIII, 13 and 16, 1901; (Mrs. Nellie Caudell and Vivian Cundiff); 4 ♂, 1 ♀; [U. S. N. M.].[60] South McAlester, Pittsburg County; VIII, 7, 1905; (A. P. Morse) 1 ♀; [Morse Cln.].[59] Wilburton, Latimer County; VIII, 27, 1905; (A. P. Morse); 1 ♂; [Morse Cln.].[59] Caddo, Bryan County; VIII, 8, 1905; (A. P. Morse); 1 ♂; [Morse Cln.].

Texas: (Belfrage); 3 ♂; [M. C. Z. and U. S. N. M.]. Wichita Falls, Wichita County; VIII, 16, 1905; (A. P. Morse); 2 ♀; [Morse Cln.].[59] St. Jo, Montague County; VIII, 14, 1905; (A. P. Morse); 1 ♀; [Morse Cln.].[59] Denison, Grayson County; VIII, 12, 1905; (A. P. Morse); 2 ♂, 4 ♀; [Morse Cln.].[59] Handley, Tarrant County; VIII, 3, 1905; (J. C. Crawford); 1 ♂, 1 ♀; [U. S. N. M.]. Dallas, Dallas County; (Boll); 3 ♂; [M. C. Z. and U. S. N. M.]: VIII, 14 to 16, 1915; (R.; in grassland); 1 ♂, 1 ♀. Shovel Mountain, Burnet County; VI, 30, VIII, 4 and 5, IX, 4 to 18, 1901; (F. G. Schaupp); 3 ♂, 10 ♀; [A. N. S. P.]. Hearne, Robertson County; VIII, 14 and 15, 1915; (H.; in high grass); 2 ♂. Navasota, Grimes County; VIII, 14, 1915; (H.; common in high grassy areas among post oaks); 10 ♂, 7 ♀. Flatonia, Fayette County; VIII, 19 and 20, 1912; (R. & H.; very abundant in tall bunch grass with few weeds, near post oak forest); 30 ♂, 21 ♀. Columbus, Colorado County; 1 ♂; [U. S. N. M.]. Rosenberg, Fort Bend County; VII, 25 and 26, 1912; (H.; locally very abundant in heavy weedy and grassy cover in park-like country); 25 ♂,

[58] Reported by Morse (see references above).

[59] Reported by Morse (see references above).

[60] Recorded by Caudell (Trans. Amer. Entom. Soc., xxviii, p. 84, 1902).

10 ♀. Harrisburg, Harris County; VIII, 13, 1915; (H.; in grassy area in open short-leaf pine woods); 1 ♂.

Mermiria maculipennis maculipennis Bruner. Plate VI, figs. 25 and 26; Plate VII, figs. 1-6, 8-14.

1890. *Mermiria maculipennis* Bruner, Proc. U. S. Nat. Mus., xii, p. 54. [♂, ♀: San Antonio and Carrizo Springs, Texas.]
1893. *Mermiria bivittata* Townsend (not *Opsomala bivittata* Serville, 1839), Insect Life, vi, p. 31. [Sabinal, New Mexico; Las Cruces, New Mexico.]
1897. *Mermiria bivittata* McNeill, Proc. Davenp. Acad. Nat. Sci., vi, pp. 204 and 205. (In part.)
1897. *Mermiria maculipennis* McNeill, Ibid., pp. 204 and 206. [San Antonio and Carrizo Springs, Texas; Risville (err. pro Rioville), Nevada.]
1899. *Mermiria bivittata* Scudder, Proc. Amer. Acad. Arts and Sci., xxxv, pp. 41 and 42. (In part.) [Records from Texas, Arizona, New Mexico and probably Kansas apply to this form.]
1902. *Mermiria bivittata* Scudder and Cockerell (not *Opsomala bivittata* Serville, 1839), Proc. Davenp. Acad. Sci., ix, p. 24. [Sabinal, Las Cruces and Mesilla, New Mexico.]
1904. *Mermiria maculipennis* Bruner, Biol. Cent.-Amer., Orth., ii, p. 39, pl. i, fig. 9. [Carrizo Springs and San Antonio, Texas.]
1904. *Mermiria bivittata* Bruner (not *Opsomala bivittata* Serville, 1839), Ibid., p. 39. [Las Cruces and Mesilla, New Mexico; Arizona; New Mexico and Texas.]
1906. *Mermiria bivittata* Snow (not *Opsomala bivittata* Serville, 1839), Trans. Kansas Acad. Sci., xx, p. 36. [San Bernardino Ranch, Arizona.]
1907. *Mermiria bivittata* Morse, Publ. 68, Carneg. Inst. Wash., p. 28. (In part.) [The following records apply to this form: Amarillo, Bonita, Clarendon, Quanah and (part) Wichita Falls, Texas; Mountain Park (in part) and base of Mount Sheridan, Oklahoma.]

Comparison.—We have given under *M. bivittata* the leading features of difference between the two species, while under *M. maculipennis macclungi* we have discussed the features differentiating the latter race from the typical form of the species.

Type.—♀; San Antonio, Texas. June. (M. Newell.) [Hebard Collection ex Bruner, Type no. 20.]

The species was originally based on an unnumbered series of both sexes from two localities. Rehn and Hebard have already selected[61] the above listed specimen as the lectotype.

The type is of average size for the general region in which it was taken, and its color pattern is much like that seen in individuals in our series from Benevides and Beeville, Texas, but the tone of the pale color is very light and, in a measure at least, due to liquid immersion.

Allotype.—♂; Carrizo Springs, Dimmit County, Texas. June, [1885]. (A Wadgymar.) [Hebard Collection ex Bruner.]

Morphological Notes.—In general form the present race exhibits as a whole a more elongate and relatively slender body, when

[61] Proc. Acad. Nat. Sci. Phila., 1912, p. 62, (1912).

compared with *M. m. macclungi*, but much variation, often of a confusing character, is found in the large series before us. Progressive elongation and slenderness is evident in material from south-central, south to southern Texas, and in the Trans-Pecos region of the same state, particularly emphasized in specimens from the intermontane section of the Rio Grande valley, to at least as far north as Albuquerque, from the northward of which point we have no New Mexico material. From southern Arizona, on the other hand, we find the material unusually robust, in this respect paralleled by *M. neo-mexicana*, which has identical tendencies in the same region.

The variation in general form of the fastigium and of the fastigio-facial angle is parallel to that found in other species of the genus, showing similar variation in single locality series in both sexes, but, as usual, more pronounced in the male than in the female. The extremes of both sexes in three representative fair-sized series show fastigial (horizontal) angles as follows: ♂; Benevides, Texas, 63°, 72°; Dallas, Texas, 62°, 84°; Albuquerque, New Mexico, 72°, 75°; ♀; Benevides, Texas, 73°, 80°; Dallas, Texas, 82°, 88°; Albuquerque, New Mexico, 65°, 82°.

Non-typical material from northern Texas and Oklahoma shows a distinct shortening and relative broadening of the pronotum, particularly the disk, when compared with central and south Texas individuals. In typical material the caudal margin of the pronotal disk is more broadly and weakly angulate than in the non-typical material, which averages with more distinct and produced angulation. The more apparent median constriction of the disk of the pronotum, when compared with typical *M. m. macclungi*, is a feature almost invariably characteristic of *M. m. maculipennis*, while in non-typical northern Texas and Oklahoma material, particularly of the female sex, the tendency is but faintly or not at all indicated.

The caudal femora show to an extreme degree the variation in robustness frequent in the genus, and occasionally the disparity in proportion of length to breadth is very marked.

Synonymy.—Fortunately the species, and more particularly this form, has managed to escape synonyms, which is particularly remarkable when its great variability is known, and when the fact that it was first described from a strongly variant and non-diagnostic color phase is considered. The general practice has been either to use the name *bivittata* for the northern race here called

macclungi, and use *maculipennis* as a distinct name for the southern type, or to consider all inseparable under the name *bivittata*. That the latter name, as used by McNeill and Scudder, covered representatives of three forms is evident to the present day student. Caudell once recorded the species from the Brownsville region of Texas as *intertexta*.[62]

Measurements (in millimeters).

♂	Length of body.	Length of pronotum.	Length of tegmen.	Length of caudal femur.
Katherine, Texas	32.8	5.4	25.4	20.8
Katherine, Texas	38.5	6	28	24
Benevides, Texas	29.8	4.9	22.5	18.6
Benevides, Texas	35.5	5.5	26.6	22.4
Gregory, Texas	36.4	5.6	26	22
Gregory, Texas	41.5	6.5	29.4	25.2
Beeville, Texas	35.8	5.5	27.2	21.5
Beeville, Texas	36	5.9	26.8	22.5
Hearne, Texas	32	5	24	19.4
Hearne, Texas	34.3	5.5	25	21.8
Carrizo Springs, Texas, *allotype*	35.5	6	27	21.7
Marathon, Texas	30	4.7	21.2	18
Marathon, Texas	32.8	5.4	—	20
El Paso, Texas	27.2	4	19.8	17.2
El Paso, Texas	32.5	5.5	24.2	21.5
Albuquerque, New Mexico	24.5	4.2	—	15.4
Albuquerque, New Mexico	29.4	4.9	23	18.2
Douglas, Arizona	33	5.4	25	19.7
Palo Alto Ranch, Arizona	31.2	5.6	24.5	19.8
Rioville, Nevada	39.4	6.3	29.7	23.5
Atypical				
Dallas, Texas	30.5	4.8	23	18.7
Dallas, Texas	38	6.5	28	23.5
Base of Mt. Sheridan, Oklahoma	33.4	5.4	24.8	19.8
Base of Mt. Sheridan, Oklahoma	34.2	5.5		21
♀				
Katherine, Texas	51.2	7.7	33.4	28.8
Katherine, Texas	54	8.2	35.4	29.8
Benevides, Texas	46.8	7.5	34.7	28.4
Benevides, Texas	51.5	8.2	36.6	31.2
Corpus Christi, Texas	44	7.6	33.8	27.6
Corpus Christi, Texas	49.6	7.8	35	30.3
Beeville, Texas	50	8	37.3	30
Beeville, Texas	55.5	8.9	38.2	30.6
Hearne, Texas	43.9	7	31.5	26.5
Hearne, Texas	47	7.2	34	27.5
San Antonio, Texas, *type*	47.6	8	36.4	29.3
Marathon, Texas	43	6.5	30.6	24.5
Marathon, Texas	48.4	7.4	34	28.4
El Paso, Texas	40.8	6.5	32.8	25.6
El Paso, Texas	52.3	8.1	35.5	30.4
Albuquerque, New Mexico	38.4	6.6	30.5	25.3
Albuquerque, New Mexico	43.5	7	33.4	28
Douglas, Arizona	47	7.5	26.7	27
Douglas, Arizona	52	8.7	38	28.9

[62] Brooklyn Inst. Arts and Sci., Sci. Bull., i, p. 110, (1904).

	Length of body.	Length of pronotum.	Length of tegmen.	Length of caudal femur.
Sycamore Wash, Arizona	49.8	7.8	34.5	26.4
Rioville, Nevada	50	8	36	22
Atypical				
Dallas, Texas	41	6.7	28.9	24.7
Dallas, Texas	48.5	8.1	37	30
Mountain Park, Oklahoma	47.5	7.9	34.9	28.5

From the above measurements it is evident there is a very great amount of individual size variation, while at the same time there is a certain amount of geographic correlation of this feature. The maximum sized specimens are from two regions—one, the south-central portion of Texas; the other, the Rio Colorado region of southern Nevada (Rioville). As we have but a single pair from the latter region, this condition may not be supported in a more extensive representation. The species, as well as the race, is, however, distinctly at its maximum size in the mesquite region of south and south-central Texas, west to the vicinity of Carrizo Springs. The minimum sized individuals are from the Rio Grande region of New Mexico and western Texas, these belonging to the markedly attenuate condition found in that region and discussed under "Morphological Notes." The atypical specimens from northern and north-central Texas (Dallas and Hearne) are under the average size for the form.

Color Notes.—The pattern variation in this form covers practically the whole gamut of such fluctuation as found in the genus, the combination of these tendencies or "unit characters" being much the same as in the other species, but the apparent strength of the pattern is very greatly altered by general tonal modifications, which probably are responses to environmental conditions. The relative intensity of the paired cephalic and pronotal postocular bars; the relatively solid coloration or maculate condition of the discoidal field of the tegmina, especially in the female sex; the contrast of the pale subcostal line on the tegmina; the strength, width and continuity of the median dark line on the head and pronotum, and the presence, and intensity and solidity when present, of dark barring on the dorsum of the caudal femora, as well as the depth of the coloration of the caudal tibiæ, are all features which, in a series as large as the present one, show kaleidoscopic variation. Of these there appears to be some geographic correlation in the extent to which the blackish of the postocular bars extends upon the dorsum of the pronotum. In material from central and southern Texas this is usual and more extensive

and pronounced than in that from other regions, while the tendency is infrequent or almost absent in atypical or intermediate (*M. m. maculipennis*×*M. m. macclungi*) individuals. This extension is always narrower on the prozona than on the metazona, and occasionally is very broad on the latter section, leaving the pale coloration as a narrow median line, which may or may not be pencilled with a median dark line. Rarely the blackish on the metazona is pronounced only at its inner margin, and is almost separated from the lateral bars, thus forming additional longitudinal dashes of dark color. Very rarely the postocular bars are subobsolete on the metazona. The width of the actual postocular bars and their solidity are variable entirely independent of the extension of the bars, the former feature in both sexes, the latter in the female alone, the bars being invariably solid in the male sex.

Oblique infra-ocular stripes on the genæ are rarely indicated, never complete or solid. A pale area is generally present in the axillary field of the tegmina, and this is of variable width, occasionally dark along the sutural margin, producing a dark median line on the closed tegmina. The tegmina of the female in typical southern and central Texas material, and north Texas atypical material, is generally maculate to a greater or lesser degree; in material from west of those regions rarely maculate. In the male sex the tegmina are never more than weakly maculate.

One male (base of Mount Sheridan, Oklahoma) has a combination of complete broad dorsal bar and strong lateral bars, which greatly suggests *M. texana*.

In general tonal depth the central and south Texas material is strongly intensive, that from north Texas localities slightly weaker, the west Texas specimens and those from the Mesilla region, New Mexico, paler and more grayish overcast, the Albuquerque series very dull and dark, the few Arizona and Nevada specimens brilliant and clear, with light yellow and green tones.

The general pale color in the male ranges from straw yellow, through barium yellow and amber yellow, light chalcedony yellow, chalcedony yellow to light green-yellow; in the female from light ochraceous-buff, through light ochraceous-salmon, light pinkish cinnamon, dull zinc orange to tawny on one hand; and through ochraceous-buff, barium yellow, mustard yellow to primuline yellow on the other hand. The dark pattern varies from bone brown to blackish brown. The shade of the caudal tibial color

ranges from grenadine red through bittersweet orange to bittersweet pink on one hand, and through light coral red to testaceous on the other hand.

Distribution.—From Navasota and Hearne, east-central Texas, westward to south-central (Altar Valley and Baboquivari Mountains) and central (Fort Whipple) Arizona and southern Nevada (Rioville), and from the Mexican boundary northward typically as far as Hearne, Midland and Amarillo, Texas, and Dimmit Lake and Albuquerque, New Mexico. Material from localities ranging from Dallas, Temple, Ira and Clarendon, Texas, northward over central and western Oklahoma to central Kansas (Clarendon, Belpre and Russell) are atypical or clearly intermediate between *M. m. maculipennis* and *M. m. macclungi.*

The southern race of the species, i. e., typical *maculipennis,* is thus seen hardly to encroach upon the humid section of eastern Texas, while westward its distribution is largely controlled by suitable grasslands, these usually in bolson plains or river valleys.

The vertical distribution of the race is known to extend from approximately sea-level (Corpus Christi and Gregory, Texas) up to at least 5318 feet (Fort Whipple, Arizona). In Texas we know it ranges from the lowest localities here given to approximately 4000 feet (Marathon and Kent). The lowest locality we have for it in Arizona is 3200 feet (Palo Alto Ranch). The Oklahoma localities range between 1360 and 2700 feet above sea-level. The present geographic form, and for that matter the species, reaches sea-level only in the Rio Grande Plain, where, under semi-arid conditions, the species apparently reaches its optimum development.

Biological Notes.—The occurrence of this species as a whole, as throughout the genus, is governed by the distribution of grass patches or continuous grass prairie. The present race is typically one of arid and semi-arid regions and its favorite environment is associated with a number of dominant types of vegetation, as groves of high mesquite and clump *Opuntia* in southern Texas, weedy pastures and prairies in the same region, post oak groves in central Texas, associated with cat-claw (*Acacia*) in west central Texas, and about composites on river plain in the Rio Grande region of western Texas and southern New Mexico. Sun-cured grass is apparently just as attractive to *M. mac. maculipennis* as the more succulent green vegetation.

The period of adult occurrence is slightly more than four months, the earliest date being June 12 (Cotulla, Texas), the latest October 16 (El Paso, Texas). At Marathon, Texas, it occurs adult as early as July 1 and as late as September 2; Rehn and Hebard have reported it from El Paso as early as July 10 and we now have it as late as October 16 from the same locality, while we have from the adjacent Mesilla region of New Mexico material taken June 28 and 30. The span of the species in the adult condition for any one locality can be safely set at about three months. The only immature specimens we have before us were taken July 8 (Spofford and Johnstone, Texas) and August 14 to 16 (Dallas), at the latter locality accompanied by adults.

Remarks.—This race, the typical form of the species, is almost entirely one of the semi-arid and arid grasslands of the southwestern United States, occurring in its extreme development in such situations in the Rio Grande Plain and Fayette Prairie region of Texas, as well as in the bolson plains and river valleys of the southern portions of New Mexico, Arizona and Nevada. Southward and in the Rio Grande region it shows especially pronounced attenuation in form, while Arizona and Nevada material, limited in number though it is, shows a relatively more robust form, retaining, however, the other characteristics of the race. The optimum development of the species is apparently reached in south-central Texas, although the pair from southern Nevada is very large. In northern Texas the material of this race is less typical, the form somewhat shorter proportionately, the head blunter in general form and the pronotum not as elongate, nor the caudal angle of the disk of the same of the typical broadly rounded condition. As material from more northern localities is examined, the divergence from the southern type becomes more pronounced, until in Nebraska and in western Kansas we have typical *mac. macclungi*, which is apparently a more northern Great Plains and Great Basin representative of *maculipennis*, clearly intergrading, as stated above, when material from intervening regions is examined.

In every series of any size of atypical or intermediate material, certain specimens showing instability and, to a greater or lesser degree, the characters of one or the other extreme will be encountered. This is particularly pronounced in the three individuals from Amarillo, Texas, one male of which is essentially typical *m. maculipennis*, while the remaining pair are clearly

atypical. The Clarendon, Texas, male also strongly indicates a tendency toward *macclungi*, in a general region where merely atypical *m. maculipennis* predominates.

From the distributional data available it would seem that, in a general way, true *maculipennis* follows the river valleys northward from the region of its widest occurrence, while the higher ground, the benches and ridges, carry southward tendencies toward the more northern *macclungi*. When typical individuals of the two forms are compared they appear widely separated, but a series such as the present one shows the relationship very clearly.

Specimens examined: 285; 167 ♂, 118 ♀.

Texas: Brownsville region; 1 ♂; [B. I.].[63] Mission, Hidalgo County; VIII, 6, 1912; (H.; in arid section covered with high mesquite and a great variety of *Opuntia*); 1 ♀. Lyford, Cameron County; VIII, 6 and 7, 1912; (R. & H.; few in weedy field with sand spur); 1 ♀. Katherine, Willacy County; VIII, 8, 1912; (R. & H.); 5 ♂, 3 ♀. Gulf Coast of Texas; 1884; (Aaron); 2 ♂, 1 ♀; [M. C. Z. and U. S. N. M.]. Robstown, Nueces County; VIII, 9, 1912; (R. & H.; on plain of low mesquite, *Opuntia* and joint cactus, with dry yellow grass); 2 ♂. Benevides, Duval County; VIII, 9 to 10, 1912; (R. & H.; fairly numerous in cleared pasture overgrown with open stand of woody weeds); 10 ♂, 7 ♀. Corpus Christi, Nueces County; VII, 29, 1912; (H.); 3 ♂, 3 ♀. Gregory, San Patricio County; VII, 30, 1912; (H.; occasional on grassy plain with mesquite); 3 ♂. Beeville, Bee County; VII, 28, 1912; (H.; common in mesquite region with undergrowth solely of dry yellow grass); 12 ♂, 12 ♀. Victoria, Victoria County; VII, 27, 1912; (H.; occasional in field thickly grown up in grasses and other vegetation); 4 ♂, 1 ♀. Flatonia, Fayette County, 475 feet; VIII, 19, 1912; (R. & H.); 2 ♂, 2 ♀. Waelder, Gonzales County; VI, 25, 1897; (A. P. Morse); 1 ♂; [M. C. Z.]. Navasota, Grimes County; VIII, 14, 1915; (H.; in grassy areas among post oaks); 2 ♂. Hearne, Robertson County; VIII, 14 to 15, 1915; (H.; in sparsely grassed area near oak woods); 8 ♂, 3 ♀. Cotulla, Lasalle County; VI, 12, 1908; (E. S. Tucker); 1 ♀; [U. S. N. M.]. San Antonio, Bexar County; VI; (M. Newell); 1 ♀, *type;* [Hebard Collection ex Bruner]. Uvalde, Uvalde County, 1000 to 1100 feet; VIII, 21 to 22, 1912; (R. & H.; scarce on slopes among low *Acacia*); 2 ♂, 2 ♀. Carrizo Springs, Dimmit County; VI, 1885; (A. Wadgymar); 1 ♂, *allotype;* [Hebard Collection ex Bruner]. Del Rio, Valverde County, 900 to 1100 feet; VIII, 22, 1912; (R. & H.); 2 ♂, 2 ♀. Marathon, Brewster County, 3940 to 4160 feet; VIII, 1 to 2, 1916; VIII, 20, 1916; (R.; scarce in moister areas); VIII, 26 to 27 and IX, 2, 1912; (R. & H.; common everywhere on plain where high grass occurred); 9 ♂, 7 ♀. Garden Spring,

[63] Reported by Caudell as *M. intertexta*.

Brewster County; IX, 2, 1912; (R. & H.); 1 ♂. Kent, Culberson County; 3900 to 4200 feet; IX, 17 to 18, 1912; (R. & H.; scarce in tall grasses near water); 2 ♂, 1 ♀. El Paso, El Paso County, 3650 to 3700 feet; IX, 16, 1912 and X, 16, 1910; (R. & H.; fairly abundant in low composites along river plain); 8 ♂, 8 ♀. Midland, Midland County, 2779 feet; (R. & H.; very scarce in prairie area); 1 ♂. Amarillo, Potter County; VIII, 19, 1905; (A. P. Morse); 1 ♂; [Morse Cln.].

New Mexico: Dimmit Lake, near Roswell, Chaves County; (Cockerell); 1 ♂; [U. S. N. M.]. Mesilla, Dona Ana County; VI, 28 and 30, 1897; (A. P. Morse); 3 ♂, 1 ♀; [M. C. Z.]. Mesilla Park, Dona Ana County, 3800 feet; VII, 16 (one specimen); (Cockerell); 2 ♂, 1 ♀; [U. S. N. M. and M. C. Z.]. Las Cruces, Dona Ana County; VIII, 12; 1 ♂; [Hebard Cln.]. Sabinal, Socorro County; VIII, 7; (C. H. T. Townsend); 4 ♂, 1 ♀; [M. C. Z. and U. S. N. M.].

Arizona: Douglas, Cochise County; VIII; (F. H. Snow); 2 ♂, 3 ♀; [U. S. N. M. and A. N. S. P.]. Lower end of Sycamore Wash, Altar Valley, Pima County, about 3400 feet; X, 6 and 9, 1910; (R. & H.; in dry yellow grass); 1 ♀. Palo Alto Ranch, Altar Valley, Pima County, 3200 feet; X, 10, 1910; (R. & H.; in meadow of coarse green bunch grass); 1 ♂. Fort Grant, Graham County; 1882; 1 ♂, 1 ♀; [U. S. N. M.]. Fort Whipple, Yavapai County; (E. Palmer); 1 ♂; [Hebard Cln.].

Nevada: Rioville,[64] Clark County; VIII, 2, 1891; 1 ♂, 1 ♀; [U. S. N. M.].

Atypical

Texas: Ira, Scurry County; VIII, 7, 1901; (E. G. Francis); 1 ♂; [U. S. N. M.]. Amarillo, Potter County; VIII, 19, 1905; (A. P. Morse); 1 ♂, 1 ♀; [Morse Cln.].[65] Quanah, Hardeman County; VIII, 21, 1905; (A. P. Morse); 2 ♂, 1 ♀; [Morse Cln.].[65] Wichita Falls, Wichita County; VIII, 15, 1905; (A. P. Morse); 1 ♂; [Morse Cln.].[65] Byers, Clay County; VII, 1910; (Isely); 1 ♂; [U. S. N. M.]. Bonita, Montague County; VIII, 14, 1905; (A. P. Morse); 1 ♂; [Morse Cln.].[65] Cisco, Eastland County, 1450 to 1550 feet; IX, 21 and 22, 1912; (R. & H.; common in meadow); 9 ♂, 13 ♀.[66] Weatherford, Parker County, 1000 to 1100 feet; IX, 23, 1912; (R. & H.; scarce in high grasses); 1 ♂, 1 ♀. Dallas, Dallas County; VIII, 14 to 16, 1915; (R.; common in grasses in prairie region and in fringe of low oaks and junipers, nymphs also present); 29 ♂, 25 ♀: VII, 16 (two specimens); (Boll); 6 ♂, 3 ♀; [M. C. Z. and U. S. N. M.].[67] Sagamore Hill, Tarrant County, 650 feet; IX, 27, 1912; (R. & H.; grass patches

[64] Erroneously given as Risville by McNeill, on the basis of the same material.
[65] Recorded by Morse (Publ. 68, Carneg. Inst. Wash., p. 28, 1907) as *bivittata*.
[66] A minority of this material is nearly typical, but the majority from this locality is appreciably atypical.
[67] Quite a few of this series are nearly typical of *maculipennis maculipennis*, particularly males, but the majority are atypical, the females almost entirely so.

among skin oaks); 1 ♀. Handley, Tarrant County; VIII, 3, 1905; (J. C. Crawford); 3 ♂; [U. S. N. M.]. Bosque County; IX, 10; (Belfrage); 1 ♂; [M. C. Z.]. Temple, Beal County, 710 feet; IX, 24, 1912; (R. & H.); 2 ♀.

Oklahoma: Mountain Park, Kiowa County; VIII, 22, 1905; (A. P. Morse); 1 ♀; [Morse Cln.].[65] Base of Mount Sheridan, Wichita Mountains, Comanche County; VIII, 24, 1905; (A. P. Morse); 1 ♂; [Morse Cln.].[65]

Intermediate between M. m. maculipennis and M. m. macclungi.

Texas: Clarendon, Donley County; VIII, 18, 1905; (A. P. Morse); 1 ♂; [Morse Cln.].[65]

Oklahoma: Base of Mount Sheridan, Wichita Mountains, Comanche County; VIII, 24, 1905; (A. P. Morse); 1 ♂; [Morse Cln.].[65] Perkins, Payne County, VIII, 13, 1901; (Nellie Caudell); 1 ♀; [U. S. N. M.].

Kansas: Clearwater, Sedgwick County; VIII, 1904; (F. B. Isely); 1 ♀; [U. S. N. M.]. Wichita, Sedgwick County; IX, 19, 1 ♂; [U. S. N. M.]. Belpre, Edwards County; IX, 13, 1909; (H.; in short grass); 1 ♂. Clarendon, Barton County; VII, 26, 1891; 2 ♂; [U. S. N. M.]. Dorrance, Russell County; 1910; (C. E. McClung); 1 ♀; [McClung Cln.]. Russell, Russell County; (C. E. McClung); 3 ♂; [McClung Cln.]. Wellington, Sumner County; VI, 1909; (F. G. Kelly); 1 ♀; [U. S. N. M.]. Barber County; (F. W. Cragin); 1 ♀; [Hebard Cln. ex Bruner]. Hill City, Graham County; 1909; (C. E. McClung); 2 ♂; [McClung Cln.]. Garden City, Finney County, (F. B. Milliken); 1 ♂; [U. S. N. M.].

Mermiria maculipennis macclungi new subspecies.[68] Plate VII, figs. 15-24.

1872. *Opomola bivittata* Dodge (not *Opsomala bivittata* Serville, 1839), Canad. Entom., iv, p. 15. [Between Platte River and Omaha, Nebraska.]
1877. *Opomala bivittata* Bruner (not *Opsomala bivittata* Serville, 1839), Ibid., ix, p. 144. [Nebraska.]
1897. *Mermiria bivittata* McNeill, Proc. Davenp. Acad. Nat. Sci., vi, pp. 204 and 205. (In part.) [State records from Nebraska and probably Illinois apply to this form.]

[68] It is not possible to determine whether the following references relate to true *bivittata* or to *mac. macclungi.*

1865. *Opomala bivittata* Thomas, Trans. Ill. State Agric. Soc., v, p. 447. [Illinois.]
1877. *Opomala bivittata* Bessey, Bienn. Rep. Iowa Agric. Coll., vii, p. 207. [Iowa.]
1880. *Mermiria bivittata* Thomas, Rep. Entom. Ill., ix, pp. 87, 92 and 97. [Illinois.]
1892. *Mermiria bivittatus* Osborn, Proc. Iowa Acad. Sci., i, pt. 2, p. 118. [Iowa.]
1897. *Mermiria bivittata* Ball, Proc. Iowa Acad. Sci., iv, p. 238. [Iowa.]

Isely (Trans. Kansas Acad. Sci., xix, p. 241, (1905)) has recorded *bivittata* from Sedgwick County, Kansas, east of Fairmount and Brown County, Kansas. If these do not refer to true *bivittata*, the first two represent intermediates between *M. m. maculipennis* and *M. m. macclungi*, the last one probably *M. m. macclungi.*

1899. *Mermiria bivittata* Scudder, Proc. Amer. Acad. Arts and Sci., xxxv, pp. 41 and 42. (In part.) [State records from Nebraska, Colorado, Utah and possibly Iowa apply to this form.]
1903. *Mermiria texana* Caudell, Proc. U. S. Nat. Mus., xxvi, p. 780. (In part.) [Material from Fort Collins, Colorado.]
1904. *Mermiria bivittata* Gillette (not *Opsomala bivittata* Serville, 1839), Bull. 94, Colo. Agr. Exp. Sta., p. 23. [Fort Collins, Laporte, Windsor, Greeley, Orchard, Julesburg, Wray, Rockyford and Holly, Colorado.]
1907. *Mermiria bivittata* Hart (not *Opsomala bivittata* Serville, 1839), Bull. Ill. State Labor. Nat. Hist., vii, p. 231. [Havana, Meredosia, Tamaroa and Chatauqua, Illinois.]
1913. *Mermiria bivittata* Vestal (not *Opsomala bivittata* Serville, 1839), Ibid., x, p. 20. [Havana, Illinois.]

This well-marked race can be distinguished in typical material from *M. mac. maculipennis* by the less attenuate and relatively more robust form, the shorter and relatively broader pronotum, which is not appreciably constricted mesad, the caudal angle of the disk of the pronotum being more distinctly produced and angulate, the eyes of the female being less prominent from the dorsum and by the generally smaller size. Under *Mer. mac. maculipennis* we have discussed the relationship and intergradation of the two forms.

Type.—♂; Forsyth, Rosebud County, Montana. July 27, 1909. (Morgan Hebard.) [Hebard Collection, Type No. 445.]

Description of Type.—Form more robust and less attenuate than in *M. mac. maculipennis;* size smaller.[69] Head with fastigiofacial angle less acute, more truncate in lateral aspect, the facial line less strongly declivent. Antennæ proportionately longer, their length equal to at least four-fifths that of the caudal femora. Pronotum distinctly shorter and proportionately broader, the greatest caudal width contained about one and one-half times in the greatest length of the same, narrowing of the dorsum of the prozona less pronounced than in *M. mac. maculipennis;* caudal margin of the disk of the pronotum more distinctly, though very broadly, obtuse-angulate, with the immediate angle less rounded.

Allotype.—♀; same data as type. [Hebard Collection.]

Description of Allotype.—Form and size as in male. Antennæ proportionately longer. Pronotum distinctly shorter, and broader proportionately, the narrowing of the dorsum of the prozona less pronounced than in *M. mac. maculipennis.*

Paratypic Series.—We have before us fourteen males and one female, bearing the same data as the type and allotype, which we

[69] The small individuals of *M. mac. maculipennis* from the Rio Grande region, from El Paso to Albuquerque, are hardly or not at all larger than *M. mac. macclungi,* but they are distinctly more slender in every way.

consider paratypes. These are located in the Hebard Collection and that of the Academy of Natural Sciences of Philadelphia.

Morphological Notes.—As already shown, the present race is a shorter, relatively more robust form than *M. mac. maculipennis.* It shows much less variation in the morphological features mentioned under the typical form of the species than does the latter, while such progressive elongation and slenderness as is there evident is not found in typical *macclungi*, being apparent only in the individuals intermediate in character between *M. mac. maculipennis* and *M. mac. macclungi*. The extremes of both sexes in three representative fair-sized series show variations in the fastigial (horizontal) angle as follows: ♂; Forsyth, Montana, 71.5°, 87°; Fort Collins, Colorado, 68.5°, 76°; North Platte, Nebraska, 77.5°, 87°: ♀; Forsyth, Montana, 84.5° (no variation); Fort Collins, Colorado, 85°, 87°; North Platte, Nebraska, 80.5°, 89.5°.

Synonymy.—The general misidentification of this form as *bivittata* has already been discussed. Caudell's reference of Fort Collins material of this race to *M. texana* was an error in identification, as the material, now before us, shows.

Measurements (in millimeters).

♂	Length of body.	Length of pronotum.	Length of tegmen.	Length of caudal femur.
Forsyth, Montana, *type*	26	4.5	19.7	16.3
Forsyth, Montana, *paratype*	26.2	4.3	18.8	16
Forsyth, Montana, *paratype*	29.3	5	21.6	17.4
Julesburg, Colorado	25.3	4.5	19.6	16
Julesburg, Colorado	27.3	4.3	19.7	15
Fort Collins, Colorado	27.2	4.4	19.2	15.9
Fort Collins, Colorado	30.8	4.8	20.8	16.9
Pueblo, Colorado	29.3	5	21.2	18.1
Pueblo, Colorado	32	4.9	23.6	19
Glen, Nebraska	21	4.2	19.7	15
Glen, Nebraska	27.2	4.5	19.2	16.1
North Platte, Nebraska	25	4.1	18.9	15.8
North Platte, Nebraska	27.4	4.5	19.4	16
West Point, Nebraska	26.1	4.5	19.8	15.6
West Point, Nebraska	28.4	4.9	22	17.8
Salt Lake City, Utah	28	4.6	18.3+	17
Salt Lake Valley, Utah	28.5	4.7	20.5	17.3
♀				
Forsyth, Montana, *allotype*	43.6	6.6	28.5	22.5
Forsyth, Montana, *paratype*	45	6.5	28.5	22.2
Glendive, Montana	41.2	6.5	27.7	21.8
Julesburg, Colorado	37	5.5	27.5	21.2
Fort Collins, Colorado	38.3	6.3	30.8	23.7
Fort Collins, Colorado	40.5	6.5	28.2	22.3
Pueblo, Colorado	40	6.7	31	25.4
Pueblo, Colorado	41	7	32.3	25.2
Glen, Nebraska	36	6.3	27	22.4

	Length of body.	Length of pronotum.	Length of tegmen.	Length of caudal femur.
Glen, Nebraska	41	6.4	29.7	23.2
North Platte, Nebraska	37.8	5.8	26	21
North Platte, Nebraska	42	6.5	30.2	23.9
West Point, Nebraska	38	6.4	27.8	22
West Point, Nebraska	42	6.7	29	23.5
Syracuse, Kansas	48.4	7	32	26
Hollister, Missouri	34	5.5	27	21.2
Muscatine, Iowa	37	6.3	30	23.2
Onawa, Iowa	37.7	6.5	28.5	22.5
Lone Rock, Wisconsin	32.7	5.4	23.8	19.5
Havana, Illinois	39.5	5.5	25.6	22.2
Maple Peak, Utah	43	7	30.5	25.4
Maple Peak, Utah	42.5	6.5	29.2	25
Atypical				
♂				
Clarendon, Kansas	29.5	5	20.5	17.4
Clarendon, Kansas	30.3	5.3	24.2	19.5
♀				
Clearwater, Kansas	42.8	7.5	32	25
Barber County, Kansas	43	7.6	34	26.5

From these measurements it is evident that while the maximum sized individuals are from the more southern portion of the range of the race, as would be expected from the average larger size of *Mer. mac. maculipennis*, the smallest specimens are, as might be inferred, from the more northern localities. Unfavorable environment may be responsible for the minimum sized individuals occurring in the sand-hill regions of Nebraska and Illinois, and the high plains region of northeastern Colorado, but peripheral depauperation may be as responsible for the Illinois cases, as well as the remarkably small size of the Hollister, Missouri; Onawa and Muscatine, Iowa and Lone Rock, Wisconsin, specimens.

Color Notes.—The color description of the race as a whole, based on all of our typical material, is as follows:

Base color ranging from dirty cream-buff through ivory yellow and honey yellow to olive-yellow on one hand, and through pinkish buff, cinnamon-buff and vinaceous-cinnamon to clay color on the other hand. This base color is often clearer and purer ventrad of the lateral bars on the sides of the body, slightly or distinctly suffused on the dorsum. The paired lateral bars range in tone from sepia, through bister and bone brown to brownish black. Antennae varying in tone from pale zinc orange and dull ochraceous-buff, to ferruginous and cinnamon-brown, always somewhat darkened distad; eyes ranging from hazel and dresden brown to chestnut brown; face rarely infuscate, and then not strongly so, with the adjacent portions of the genæ equally or more de-

cidedly infuscate, leaving a narrow pale postocular line ventrad of the dark line; dorsum of the head rarely with a distinct mediolongitudinal dark line, which, when present, is almost never complete, being divided in two longitudinally, and when continued on the pronotum represented only by a hair line on the median carina.

Tegmina with the base color generally more grayish than the general pale color, more approximating drab, benzo brown and hair brown, the proximal half of the marginal and discoidal fields suffused to a greater or lesser degree with the dark color, this weakly maculate in the female, and in both sexes persistent distad only along the humeral trunk; subcostal stripe indicated in both sexes, ranging from sulphur yellow to aniline yellow and buckthorn brown. Caudal femora of the general color, occasionally washed with the darker color along the dorsal section of the external face; transverse dark bars on the dorsal face of the caudal femora are almost never indicated in typical material of *macclungi*, although suggested in many intermediate individuals: caudal tibiæ ranging from carnelian red and mikado brown to coral red, spines black tipped.

There is a geographic correlation in color tone which is fairly evident in the case of the material from the Platte Valley in Nebraska, these being on an average distinctly paler, and this is as true of the few (4) from Kearney as for the extensive sand-hill series from North Platte. Certain other color correlations might be mentioned, but the series, in each case, is not extensive enough to warrant comment.

The extension of the dark lateral bars on the sides of the dorsum of the pronotum, as found in *Mer. mac. maculipennis*, is present in this race, but is not common, three males alone having it indicated. Material intermediate between this race and true *maculipennis* shows this more generally indicated.

Distribution.—Fron the eastern Yellowstone Valley of Montana (Forsyth and Glendive) south typically to southern Nebraska (Lincoln and Haigler), western Kansas (Syracuse), southern Colorado (Holly and Pueblo) and northern Utah (Salt Lake City and Maple Peak). The eastern limit of the range is apparently reached in south-central Wisconsin (Lone Rock), the central axis of Illinois and southern Missouri (Hollister), while westward it is unknown beyond the Utah localities given above. For data on the area occupied by intermediates between *Mer. mac. maculipennis* and *Mer. mac. macclungi* see under the former.

The vertical distribution of the form extends from as low as 454 feet (Meredosia, Illinois) to as high as 5000 to 6500 feet (Maple Peak). Northward it is known only from relatively low elevations (2515 feet; Forsyth), while in Nebraska it occurs up to about 4500 feet (Glen) and in Colorado to at least 5069 feet (Laporte).

The present form is seen to be a Great Plains and Great Basin type, spreading eastward in suitable environments under satisfactory temperature conditions.

Biological Notes.—Grassy patches and stretches of sparse short grass are frequented by this form, these in a variety of situations, i. e. on bench of the Great Plains (Forsyth and Julesburg), on river plain and adjacent sand-hills (North Platte), on the slopes of hills and foothills (Kearney and Salt Lake City) and on gently rolling plains (Syracuse).

The available data shows the species occurs adult as early as July 8 and as late as September 14, at the same locality (Rocky Ford, Colorado). This locality is very near the southern limit of typical material of the form, and therefore probably represents the region of maximum summer conditions within the form's range. From the more northern region the earliest date we have is July 27 (Forsyth), but the deficiency of data prevents us from giving any late records from the same region.

Remarks.—This typically very distinct race is the northern adaptation of *Mermiria maculipennis*, intergrading, as already shown, into true *maculipennis* in Kansas and Oklahoma, the north Texas material being much nearer typical *maculipennis* than *m.macclungi*. Its relationship to the large south Texan *maculipennis* has never been clearly indicated in the past, and material of the present form has almost invariably been recorded as *bivittata*, to which species *macclungi* is not closely related.

We take great pleasure in dedicating this interesting and striking form to Dr. C. E. McClung, of the University of Pennsylvania, who, from cytological evidence, first called our attention to this race, and also to the distinctness of true *bivittata* from the other forms with which it had been confused and associated.

Specimens examined: 113; 56 ♂, 55 ♀, 2 immature ♀.

Montana: Glendive, Dawson County; 1 ♀; [Hebard Cln. ex Bruner]. Forsyth, Rosebud County; VII, 27, 1909; (H.; in canyon in bench of plains); 15 ♂, 2 ♀, *type*, *allotype* and *paratypes*.

Nebraska: Valentine, Cherry County; (L. Bruner); 2 ♂; [Hebard Cln. ex Bruner and U. S. N. M.]. Chadron, Dawes County; (L. Bruner); 1 ♂, 1 ♀; [Hebard Cln. ex Bruner and

U. S. N. M.]. Fort Robinson, Dawes County; VIII, 1888; 1 ♂; [Hebard Cln. ex Bruner]. Glen, Sioux County; VIII, 6 to 20, 1903; (L. Bruner); 3 ♂, 2 ♀; [Hebard Cln. ex Bruner]. Sidney, Cheyenne County; 1 ♀; [Hebard Cln. ex Bruner]. North Platte, Lincoln County, 2850 feet; VII, 28, 1910; (R. & H.; common in short grass on river plains and adjacent sand-hills); 15 ♂, 15 ♀. Broken Bow, Custer County; VII, 1889; 1 ♀; [Hebard Cln. ex Bruner]. Kearney, Buffalo County, 2146 feet; VII, 27, 1910; (R. & H.; uncommon on hills covered with short grasses); 4 ♀. West Point, Cuming County; VII, 10, 1887 (one), IX (three); 6 ♂, 5 ♀, 1 immature ♀ (no date); [Hebard Cln. ex Bruner]. Fontanelle, Washington County; 1876; 1 ♀; [Hebard Cln. ex Bruner]. Lincoln, Lancaster County; VIII & IX; (L. Bruner); 1 ♂, 4 ♀, 1 immature ♀; [Hebard Cln. ex Bruner]. Burnham, Lancaster County; VIII, 30, 1911; (L. Bruner); 1 ♀; [Hebard Cln. ex Bruner]. Haigler, Dundy County; 1 ♂; [Hebard Cln. ex Bruner]. Stratton, Hitchcock County; VII, 14, 1899; 1 ♂; [U. S. N. M.].

Colorado: Julesburg, Sedgwick County, 3460 to 3550 feet; VII, 29, 1910; (R. & H.; on plains escarpment scantily clothed with grass and sage); 2 ♂, 1 ♀. Poudre Canyon; VIII, 30, 1898; 1 ♂; [U. S. N. M.]. Fort Collins, Larimer County; VIII, 9, 1901; (Dyar and Caudell); 1 ♂, 1 ♀; [U. S. N. M.][70]: VIII, 8 and 19, 1898; 1 ♂, 2 ♀; [Hebard Cln. and A. N. S. P.]. Denver, Denver County; (Beale); 1 ♀; [Hebard Cln.]. Pueblo, Pueblo County; VII, 28, 1878; 1 ♂, 2 ♀; [Corneil Univ. Cln.]: 4700 feet; VII, 30 and 31, 1877; 1 ♂; [M. C. Z.]. Rocky Ford, Otero County; VII, 8, 1899 and IX, 14, 1898; 1 ♂, 1 ♀; [A. N. S. P.].

Kansas: Syracuse, Hamilton County, 3230 feet; IX, 12, 1909; (R. & H.; on plain covered with short grass); 1 ♀.

Wisconsin: Lone Rock, Richland County; VIII, 21, 1906; 1 ♀; [Ill. State Lab. Nat. Hist.].

Iowa: Onawa, Monona County; IX, 2, 1914; (M. P. Somes); 1 ♀; [Somes Cln.]. Muscatine, Muscatine County; VII, 10, 1909; (M. R. Somes); 2 ♀; [Somes Cln.].

Illinois: Havana, Mason County; VIII, 7, 1908; 1 ♀; [Ill. State Lab. Nat. Hist.].

Missouri: Hollister, Taney County; VIII, 1913; (M. P. Somes); 1 ♀; [Somes Cln.].

Utah: Salt Lake City, 4500 feet; IX, 7, 1909; (R. & H.; in grasses near base of foothills); 1 ♂. Salt Lake Valley; VIII, 2, 1896; 1 ♂; [A. N. S. P.]. Maple Peak, Wasatch Mountains, Salt Lake County, 5000 to 6500 feet; IX, 7, 1909; (R. & H.); 2 ♀.

[70] Recorded by Caudell (Proc. U. S. Nat. Mus., xxvi, p. 780, (1903)) as *texana*.

Explanation of Plates V, VI, VII.

Plate V.—Fig. 1.—*Mermiria texana.* ♀. Pine Mountain, Davis Mountains, Texas. Lateral view. (×1½.)

Fig. 2.—*Mermiria texana.* ♂. Sanderson, Texas. Lateral view of head and pronotum. (×3.)

Fig. 3.—*Mermiria texana.* ♂. Sanderson, Texas. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 4.—*Mermiria texana.* ♂. Sanderson, Texas. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 5.—*Mermiria texana.* ♂. Persimmon Gap, Santiago Mountains, Texas. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 6.—*Mermiria texana.* ♂. Persimmon Gap, Santiago Mountains, Texas. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 7.—*Mermiria texana.* ♂. Pine Mountain, Davis Mountains, Texas. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 8.—*Mermiria texana.* ♂. Pine Mountain, Davis Mountains, Texas. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 9.—*Mermiria texana.* ♀. Marathon, Texas. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 10.—*Mermiria texana.* ♀. Marathon, Texas. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 11.—*Mermiria texana.* ♂. Sanderson, Texas. Dorsal view of pronotum. (×3.)

Fig. 12.—*Mermiria texana.* ♀. Marathon, Texas. Dorsal view of pronotum. (×3.)

Fig. 13.—*Mermiria texana.* ♀. Marathon, Texas. Dorsal view of pronotum. (×3.)

Fig. 14.—*Mermiria texana.* ♂. Sanderson, Texas. Lateral view of apex of abdomen. (Greatly enlarged.)

Fig. 15.—*Mermiria neo-mexicana.* ♀. Dallas, Texas. Lateral view. (×1½.)

Fig. 16.—*Mermiria neo-mexieana.* ♂. Syracuse, Kansas. Lateral view of head and pronotum. (×3.)

Fig. 17.—*Mermiria neo-mexicana.* ♂. Sycamore Canyon, Baboquivari Mountains, Arizona. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 18.—*Mermiria neo-mexicana.* ♂. Baboquivari Mountains, Arizona. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 19.—*Mermiria neo-mexieana.* ♂. Syracuse, Kansas. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 20.—*Mermiria neo-mexicana.* ♂. Syracuse, Kansas. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 21.—*Mermiria neo-mexieana.* ♂. Dallas, Texas. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 22.—*Mermiria neo-mexicana.* ♀. Havana, Illinois. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 23.—*Mermiria neo-mexicana.* ♀. Dallas, Texas. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 24.—*Mermiria neo-mexicana.* ♀. Dallas, Texas. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 25.—*Mermiria neo-mexicana.* ♂. Syracuse, Kansas. Dorsal view of pronotum. (×3.)

Fig. 26.—*Mermiria neo-mexieana.* ♀. Dallas, Texas. Dorsal view of pronotum. (×3.)

Fig. 27.—*Mermiria neo-mexicana.* ♂. Baboquivari Mountains, Arizona. Lateral view of apex of abdomen. (Greatly enlarged.)

Fig. 28.—*Mermiria alacris.* ♀. Pensacola, Florida. Lateral view. (×1½.)

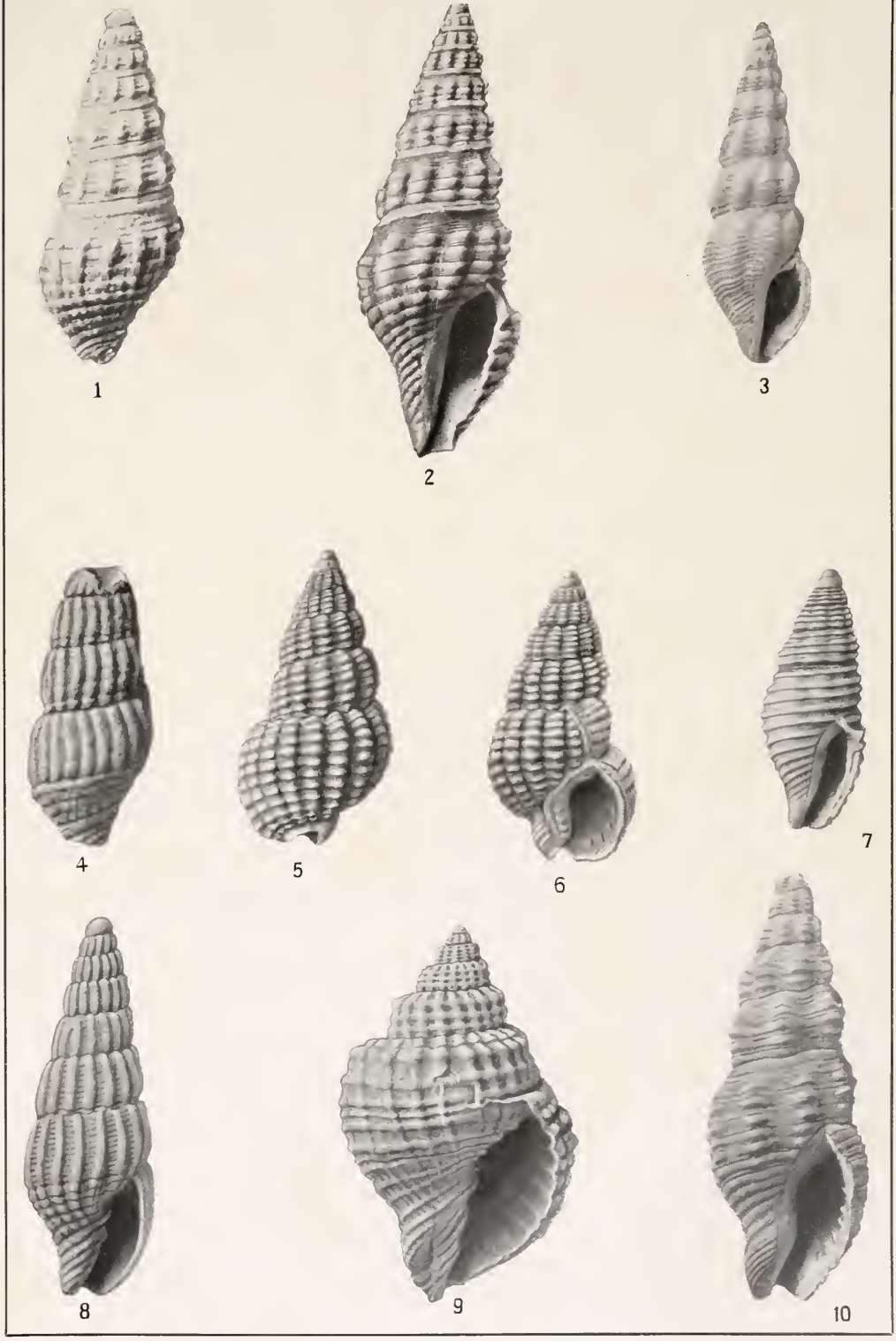
Fig. 29.—*Mermiria alacris.* ♂. Pensacola, Florida. Lateral view of head and pronotum. (×3.)

Fig. 30.—*Mermiria alacris.* ♂. Bainbridge, Georgia. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 31.—*Mermiria alacris*. ♂. Bainbridge, Georgia. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 32.—*Mermiria alacris*. ♂. Dallas, Texas. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 33.—*Mermiria alacris*. ♂. Dallas, Texas. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 34.—*Mermiria alacris*. ♂. Pensacola, Florida. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 35.—*Mermiria alacris*. ♂. Waurika, Oklahoma. Dorsal view of fastigium. (Greatly enlarged.)

PLATE VI.—Fig. 1.—*Mermiria alacris*. ♀. Pensacola, Florida. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 2.—*Mermiria alacris*. ♂. Bainbridge, Georgia. Dorsal view of pronotum. (×3.)
Fig. 3.—*Mermiria alacris*. ♀. Pensacola, Florida. Dorsal view of pronotum. (×3.)
Fig. 4.—*Mermiria alacris*. ♂. Bainbridge, Georgia. Lateral view of apex of abdomen. (Greatly enlarged.)
Fig. 5.—*Mermiria intertexta*. ♀. Tybee Island, Georgia. Lateral view. (×1½.)
Fig. 6.—*Mermiria intertexta*. ♂. Tybee Island, Georgia. Lateral view of head and pronotum. (×3.)
Fig. 7.—*Mermiria intertexta*. ♂. Tybee Island, Georgia. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 8.—*Mermiria intertexta*. ♂. Tybee Island, Georgia. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 9.—*Mermiria intertexta*. ♂. Atlantic Beach, Florida. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 10.—*Mermiria intertexta*. ♂. Atlantic Beach, Florida. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 11.—*Mermiria intertexta*. ♀. Tybee Island, Georgia. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 12.—*Mermiria intertexta*. ♂. Tybee Island, Georgia. Dorsal view of pronotum. (×3.)
Fig. 13.—*Mermiria intertexta*. ♀. Tybee Island, Georgia. Dorsal view of pronotum. (×3.)
Fig. 14.—*Mermiria intertexta*. ♂. Tybee Island, Georgia. Lateral view of apex of abdomen. (Greatly enlarged.)
Fig. 15.—*Mermiria bivittata*. ♀. Flatonia, Texas. Lateral view. (×1½.)
Fig. 16.—*Mermiria bivittata*. ♂. Flatonia, Texas. Lateral view of head and pronotum. (×3.)
Fig. 17.—*Mermiria bivittata*. ♂. Flatonia, Texas. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 18.—*Mermiria bivittata*. ♂. Flatonia, Texas. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 19.—*Mermiria bivittata*. ♀. Navasota, Texas. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 20.—*Mermiria bivittata*. ♀. Navasota, Texas. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 21.—*Mermiria bivittata*. ♂. Flatonia, Texas. Dorsal view of pronotum. (×3.)
Fig. 22.—*Mermiria bivittata*. ♀. Flatonia, Texas. Dorsal view of pronotum. (×3.)
Fig. 23.—*Mermiria bivittata*. ♂. Flatonia, Texas. Lateral view of apex of abdomen. (Greatly enlarged.)
Fig. 24.—*Mermiria bivittata*. ♂. Flatonia, Texas. Lateral view of tegmen. (×2.)
Fig. 25.—*Mermiria maculipennis maculipennis*. ♀. Lyford, Texas. Lateral view. (×1½.)
Fig. 26.—*Mermiria maculipennis maculipennis*. ♂. Benevides, Texas. Lateral view of head and pronotum. (×1½.)

PLATE VII.—Fig. 1.—*Mermiria maculipennis maculipennis*. ♂. El Paso, Texas. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 2.—*Mermiria maculipennis maculipennis*. ♂. El Paso, Texas. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 3.—*Mermiria maculipennis maculipennis*. ♂. Benevides, Texas. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 4.—*Mermiria maculipennis maculipennis*. ♂. Benevides, Texas. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 5.—*Mermiria maculipennis maculipennis*. ♂. Dallas, Texas. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 6.—*Mermiria maculipennis maculipennis*. ♂. Dallas, Texas. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 7.—*Mermiria neo-mexicana*. ♀. Sycamore Canyon, Baboquivari Mountains, Arizona. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 8.—*Mermiria maculipennis maculipennis*. ♀ .El Paso, Texas. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 9.—*Mermiria maculipennis maculipennis*. ♀. Sycamore Canyon, Baboquivari Mountains, Arizona. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 10.—*Mermiria maculipennis maculipennis*. ♀. Katherine, Texas. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 11.—*Mermiria maculipennis maculipennis*. ♀. Katherine, Texas. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 12.—*Mermiria maculipennis maculipennis*. ♂. Benevides, Texas. Dorsal view of pronotum. (×3.)
Fig. 13.—*Mermiria maculipennis maculipennis*. ♀. Katherine, Texas. Dorsal view of pronotum. (×3.)
Fig. 14.—*Mermiria maculipennis maculipennis*. ♂. Benevides, Texas. Lateral view of apex of abdomen. (Greatly enlarged.)
Fig. 15.—*Mermiria maculipennis macclungi*. ♂ (*type*.) Forsyth, Montana. Lateral view. (×3.)
Fig. 16.—*Mermiria maculipennis macclungi*. ♂ (*paratype*.) Forsyth, Montana. Lateral view of apex of abdomen. (Greatly enlarged.)
Fig. 17.—*Mermiria maculipennis macclungi*. ♂ (*type*.) Forsyth, Montana. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 18.—*Mermiria maculipennis macclungi*. ♂ (*paratype*.) Forsyth, Montana. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 19.—*Mermiria maculipennis macclungi*. ♂. North Platte, Nebraska. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 20.—*Mermiria maculipennis macclungi*. ♂. North Platte, Nebraska. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 21.—*Mermiria maculipennis macclungi*. ♀ (*allotype*.) Forsyth, Montana. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 22.—*Mermiria maculipennis macclungi*. ♀. Kearney, Nebraska. Dorsal view of fastigium. (Greatly enlarged.)
Fig. 23.—*Mermiria macclungi*. ♀ (*allotype*.) Forsyth, Montana. Dorsal view of pronotum. (×3.)
Fig. 24.—*Mermiria maculipennis macclungi*. ♀. Kearney, Nebraska. Dorsal view of pronotum. (×3.)



GARDNER AND ALDRICH: MIOCENE MOLLUSCA.

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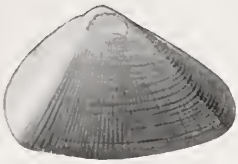
GARDNER AND ALDRICH: MIOCENE MOLLUSCA.



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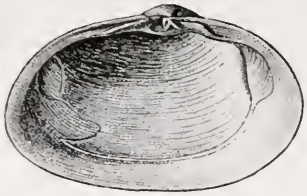

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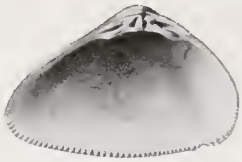

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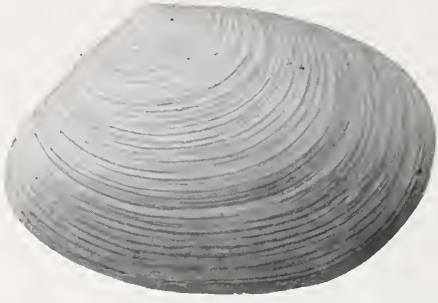

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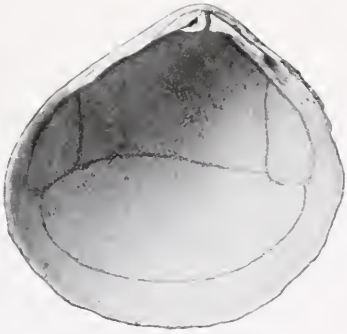

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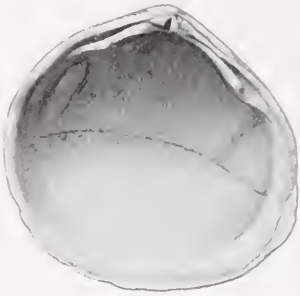

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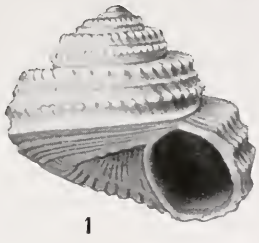
GARDNER AND ALDRICH: MIOCENE MOLLUSCA.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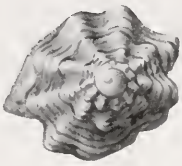
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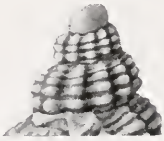
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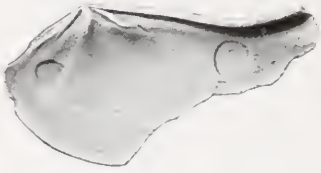
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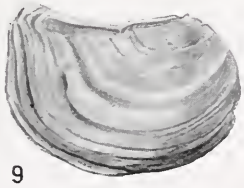
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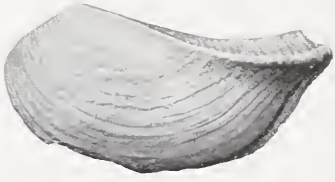
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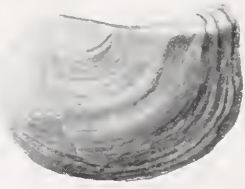
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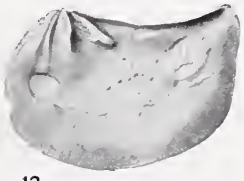
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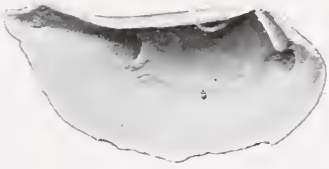
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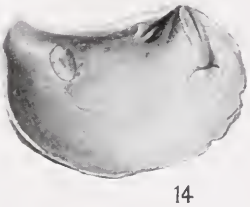
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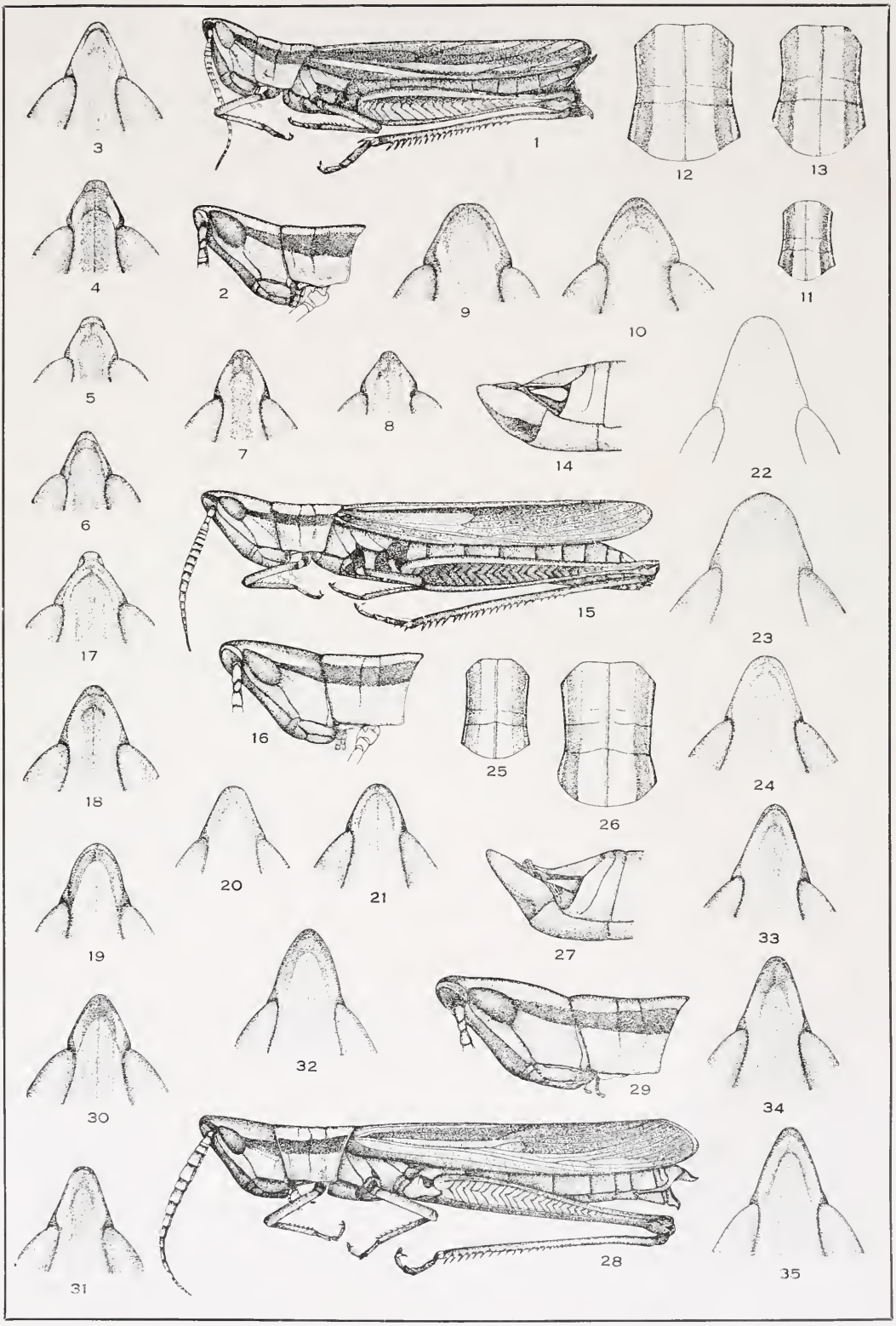
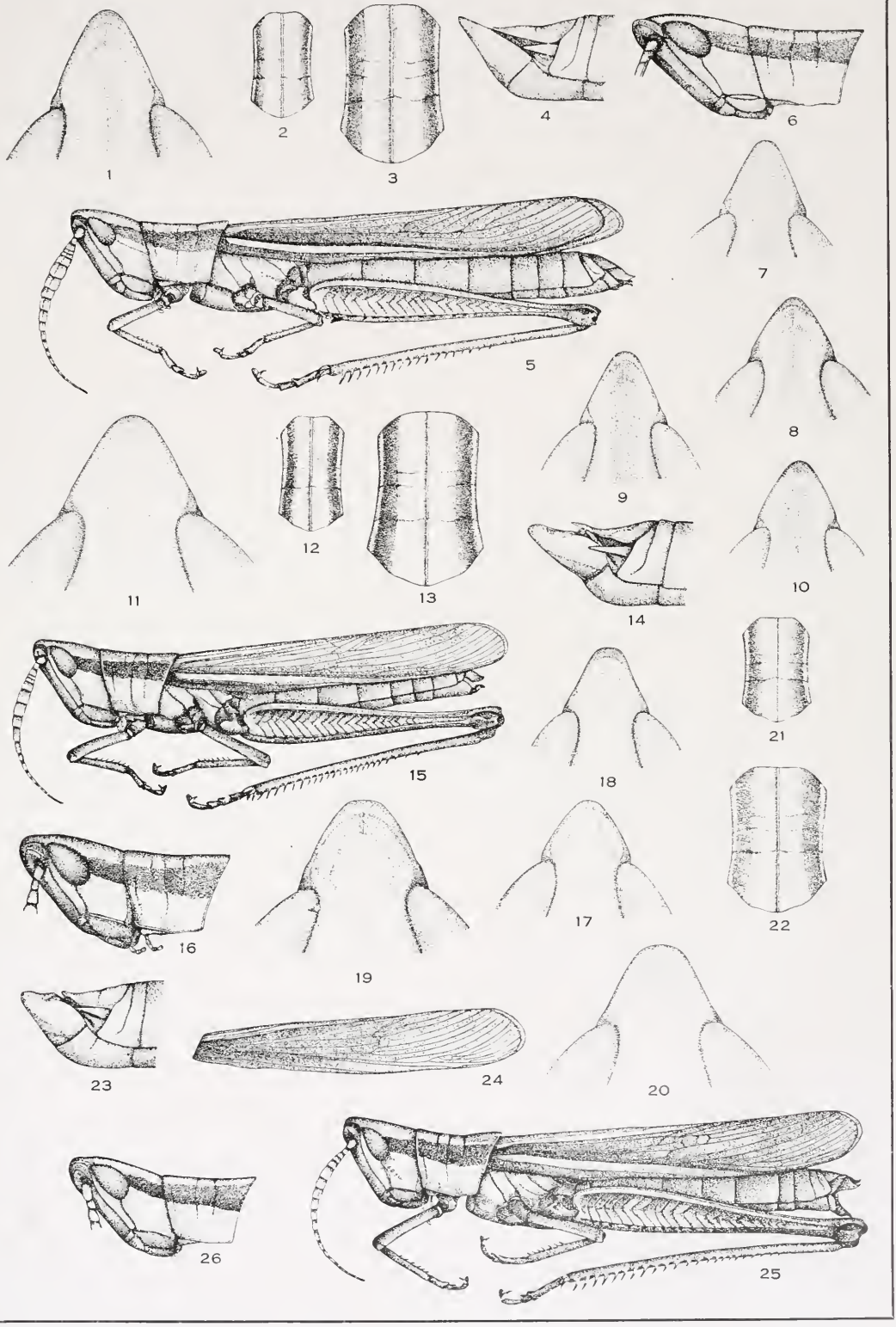
GARDNER AND ALDRICH: MIOCENE MOLLUSCA.



REHN: GENUS MERMIRIA.



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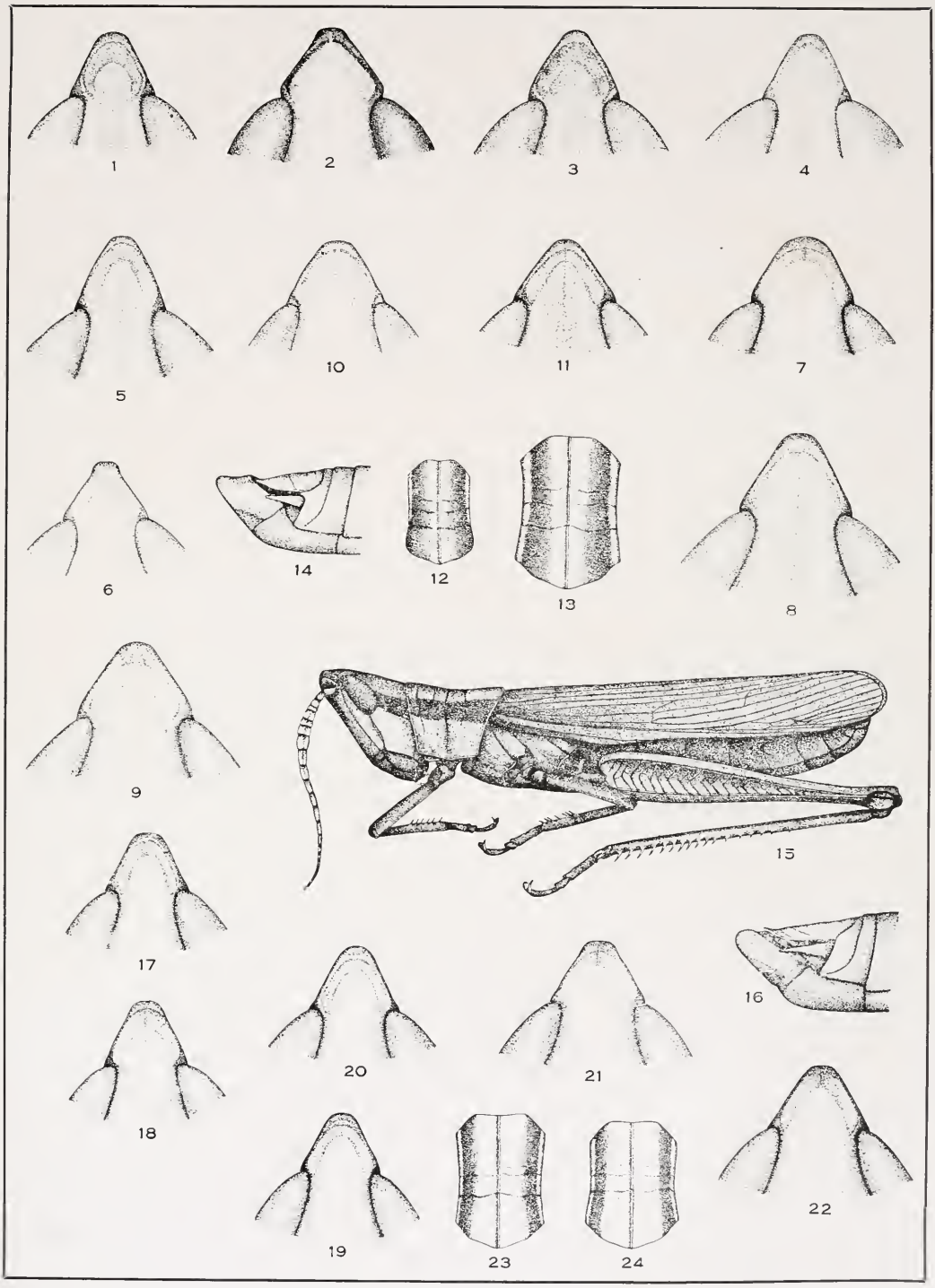


REHN: GENUS MERMIRIA.

April 15.

The President, JOHN CADWALADER, A.M., LL.D., in the Chair.

Forty persons present.

The deaths of David Jayne Bullock, a member, March 19, 1919, and Frederick D. Godman, a correspondent, February 19, 1919.

DR. JOHN W. HARSHBERGER made a communication on "Slope Exposure and the Distribution of Plants in Eastern Pennsylvania." (No abstract.)

Edgar Fahs Smith, Ph.D., LL.D., was elected a member.

The following were ordered to be printed:

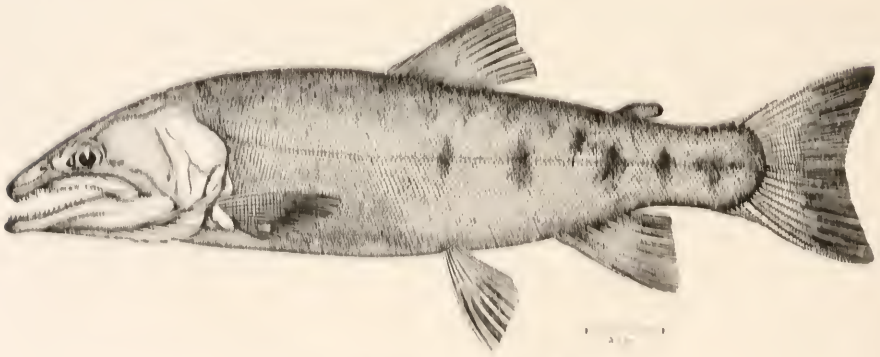
SALMO FORMOSANUS, A NEW TROUT FROM THE MOUNTAIN STREAMS OF FORMOSA

BY DAVID STARR JORDAN AND MASAMITSU OSHIMA.

In a mountain stream of Central Formosa, the junior author, as governmental fishery expert for the Island of Formosa, made the unexpected discovery of a large species of trout, which seems to be new to science. The accompanying figure is drawn by Mr. Oshima.

Salmo formosanus Jordan and Oshima

Head $3\frac{1}{3}$ in length to base of caudal; depth 4; D. III, 11; A. III, 10; P. 12; V. 9; snout $3\frac{2}{3}$ in head; eye 6; interorbital space $3\frac{1}{3}$; maxillary $2\frac{4}{5}$; pectoral $1\frac{1}{5}$; ventral 2; anal $1\frac{2}{3}$; scales in lateral series about 130 (oblique rows) in transverse series 26–22; branchiostegals 13, gillrakers on first arch 7+9.



Salmo formosanus Jordan and Oshima

Body rather deep, moderately elongate, compressed, dorsal profile more strongly curved than that of the ventral; head large, the jaws produced (male example), interorbital space broad, nearly flat; maxillary reaching far beyond the eye, snout pointed; mouth large, slightly oblique, upper jaw shorter than the lower; eye large, anterior; nostrils close together, in front of the eye; vomer nearly flat, the shaft much depressed, the head of the bone with six teeth, the shaft with eleven teeth which are set in a zigzag series, those on

the shaft placed directly on the surface of the bone, not on a free crest; tongue with five pairs of canine-like teeth; premaxillary with eight, maxillary with twenty-five, dentary with sixteen, palatine with eighteen teeth; operculum smooth; branchiostegals well developed; gillrakers rather slender and long.

Dorsal fin inserted midway between the tip of snout and the base of caudal, the longest ray $1\frac{5}{6}$ in head; adipose dorsal nearer to the caudal than to the dorsal; caudal peduncle strongly compressed, its depth $2\frac{1}{3}$ in head; ventral inserted below the 7th branched ray of the dorsal; anal rather high, straight-edged, entirely behind the dorsal, the longest ray 2 in head, longer than the base of the fin.

Body covered with small firm scales; lateral line nearly straight, running along the middle of the side, slightly upcurved in front.

Color (in formalin) brownish gray above, belly and lower parts of the sides whitish; small dark spots scattered along both sides of the dorsal median line, none distinct on head, nor along the base of dorsal; sides with traces of large blackish bars; bases of all the fins except caudal dusky, outer margin of the fins dark; caudal fin uniformly dark; head and inner part of the mouth fuscous. Total length 335 mm.

Described from a specimen from Taiko River at Saramao, Nanto, Formosa.

Saramao is located in the middle part of the Island of Formosa just on the summit of the central mountain range. Until now there was no record in Formosa with regard to the occurrence of salmon or trout, even in the mid stream or estuary of Taiko River. It is said, however, that the aborigines who live in the vicinity of Saramao occasionally catch a trout like fish which they value as food. By the courtesy of Mr. Tomonatsu Tsusaki, policeman at Shikikun, Mr. Oshima has received the present specimen of the species. According to his statement, it was caught by a native and was forwarded to the Police Station at Shikikun in October, 1918.

As the method of preservation was not satisfactory, almost all the markings had disappeared when the specimen was received. There is no doubt that it was actually taken in Formosa, because of the presence of red spots on the back which vanished gradually and of the fresh state of the specimen when it was forwarded to the Government Institute of Science in Taihoku.

The typical specimen is preserved in the Museum of the Institute of Science of the Government of Formosa.

Salmo formosanus belongs to the subgenus *Trutta* L., including the river trout. Two forms related to it have been described by Bleeker from China, the exact locality not known; these are *Salmo leptosoma* and *Salmo pomatops* Bleeker in his paper, "Sur quelques espèces inédites on peu connus de poissons de Chine appartenant au Muséum de Hambourg." *Verh. Akad. Amsterdam, XVIII, 187a, pp. 14, 15.*

All their species are also more or less closely related to the European brook trout (*Salmo trutta* = *S. fario*). *Salmo leptosoma* has perhaps a slenderer body than *S. saramao,* and *Salmo pomatops* has a black spot or ocellus on the opercle.

A NEW SILUROID FISH OF THE GENUS CYCLOPIUM FROM COLOMBIA

BY HENRY W. FOWLER

Cyclopium mariæ new species.

Head $4\frac{1}{3}$; depth $6\frac{1}{4}$; D. I, 6; A. I, 6; P. I, 10; V. I, 4; snout $1\frac{7}{8}$ in head; mouth width $2\frac{1}{3}$; interorbital $5\frac{1}{4}$; least depth of caudal peduncle $2\frac{2}{5}$; caudal 1; pectoral 1; ventral $1\frac{1}{10}$.

Body elongate, rather slender in profile, broadly depressed anteriorly, deepest at dorsal origin. Caudal peduncle well compressed, elongate, or least depth about $1\frac{3}{4}$ its length.

Head broadly depressed, width about 3 times that of body at dorsal origin, rather convex above and flattened below. Snout broad, surface slightly convex, and as seen from above nearly twice as broad as long. Eyes very small, superior entirely, front edge about midway in head length, without distinct eyelids. Mouth broad, slightly crescentic, and end of mandible about first fifth in snout length. Buccal disk wide, that of lower jaw 3 times as wide as upper, its hind edge with slight median emargination, and surface rather coarsely papillose. Lateral barbel begins about midway in snout length, and extends back nearly to gill-opening. About 8 simple conic, rather large teeth each side of upper jaw, and inside forming rather broad band 3 or 4 rows of similarly large bifid teeth. Lower jaw with 3 rows of bifid teeth, about 6 along outer edge of each mandibular ramus, and innermost row of much smaller bifid teeth or about 12 on each ramus. Nostrils about wide apart as eye, rather large simple pores and each with broad cutaneous fold behind. Both internasal and interorbital spaces level. Each cheek with swollen appearance below eye.

Gill-opening lateral, scarcely extends below pectoral base and forward only about half way in postocular. A simple or rudimentary little gill-raker on first arch and only about 4 short simple points or tubercles on second and third arches, and six on last arch. Gill-filaments about twice eye diameter.

Enlarged rays of fins all with very small denticles on their outer surfaces or edges. Basal portions of upper faces of pectoral rays with spinules. Upper surface of head and predorsal with very small and slightly scattered papillæ, which become more minute and crowded at dorsal base and finally obsoletely minute on rest of trunk.

Dorsal origin nearly midway between snout tip and hind anal ray base, and flexible spine largest of rays, depressed fin short or but slightly longer than predorsal space to head. Adipose fin obsolete, only evident as slight ridge along upper edge of caudal peduncle behind anal base. Anal inserted slightly nearer caudal base than ventral origin, median rays longest, or fin extends about half way to caudal base. Caudal emarginate behind, uppermost and lowermost simple rays longest, forming sharp points. Pectoral low, outermost or simple enlarged ray much longest, reaching base of uppermost ventral ray. Ventral inserted about opposite dorsal origin, fin long and slender or $1\frac{3}{5}$ to anal. Anal papilla long, slender, conic, about $\frac{3}{4}$ of anal spine.

Color in alcohol dull brownish generally, with more or less clouded or dull slaty marblings. Under surface of head, breast and belly pale brownish-white, also lower surfaces of fins pale. Iris pale slaty. Pectorals and ventrals with obscure shades of dusky on rays basally, also same tints on dorsal and caudal rays.

Length 95 mm.

Type, No. 49,368, A. N. S. P. ♂. Brook near the small village of Choachi, 25 kilometers east of Bogota and at 1800 meters of altitude, Colombia, 1917. Hermano Apolinar Maria.

Also Nos. 49,369 to 49,384, A. N. S. P., paratypes, with same data, of which seven are females. All show: Head $3\frac{2}{3}$ to $4\frac{1}{8}$; depth $5\frac{1}{6}$ to $7\frac{3}{4}$; D. I, 6; A. I, 6; head width 1 to $1\frac{1}{8}$ in its length; snout $1\frac{4}{5}$ to 2; mouth width $2\frac{1}{4}$ to 3; interorbital 3 to $4\frac{3}{4}$; length 40 to 88 mm. In the males the dorsal spines are damaged, opercle spiny, barbel reaches pectoral origin, caudal much longer than head and no adipose spine. The young show a dark caudal base. The females are variable in depth, often with the adipose ridge of the back better developed than in the male. They have the head about equally papillose and spinescent, though are without the anal papilla.

A male which was dissected had the remains of large dipterous insect larva in its pharynx.

This species appears allied with *C. ventrale* Eigenmann[1] from Dagua, which it represents in the headwater drainage of the Rio Meta basin. *C. ventrale* appears to differ in the presence of an adipose spine, nasal barblet and in having the ventrals reaching slightly beyond the vent. Other Colombian species, *C. chapmani* Eigenmann,[2] *C. trifasciatum* Eigenmann[3] and *C. unifasciatum* Eigenmann[4]

[1] Indiana Univ. Bull., X, No. 8, September, 1912, p. 15.
[2] L. c., p. 13. Boquia.
[3] L. c., p. 14. Caldas and Cisnero.
[4] L. c., p. 15. Caldas.

are excluded on account of their more anterior ventrals, in all of which they are said to be distinctly before the dorsal origin.

(For Hermano Apolinar Maria, of the Instituto de La Salle, Bogota, to whom I am indebted for the opportunity to study this interesting prenadilla.)

Explanation of Plate VIII.

Uppermost figure, male; upper figure to left, dorsal view of head (male); upper figure to right, ventral view of head (male); median figure, young; lowest figure, female.

NOTES ON TROPICAL AMERICAN FISHES

BY HENRY W. FOWLER

While studying certain groups of marine fishes in the museum of the Academy I have recently had occasion to examine several old collections which have never been reported. Some include a few types of Cope, of which additional notes and diagnoses are given below. This has been attempted as most all his originals are too brief and lack many of the details demanded by modern standards. The material representing Cope's "Ichthyology of the Lesser Antilles" is largely extant, and is also included. Material from the Bahamas and Jamaica, sent to the University of Pennsylvania, and now in its Zoological Laboratory, was kindly placed at my disposal by Dr. J. Percy Moore.

Panama.

A small collection received from Dr. W. S. W. Ruschenberger in 1857, another from Captain Field in 1862, and later some small examples from J. A. McNiel. All from Panama City.

1. *Sphyrna zygæna* Linné.
2. *Rhinobatos leucorhynchus* Günther.
3. *Urotrygon mundus* Gill.
4. *Cetengraulis engymen* Gilbert and Pierson.
5. *Dorosoma petenensis* (Günther).
6. *Myrophis vafer* Jordan and Gilbert.
7. *Rabula panamensis* (Steindachner).
8. *Muræna clepsydra* Jordan and Evermann.
9. *Bagre pinnimaculata* (Steindachner).
10. *Mollienisia sphenops* (Valenciennes).
11. *Fodiator acutus* (Valenciennes).
12. *Hemiramphus saltator* Gilbert and Starks.
13. *Hippocampus ingens* Girard.
14. *Sphyræna ensis* Jordan and Gilbert.
15. *Vomer setapinnis* (Mitchill).
16. *Amia retrosella* Gill.
17. *Epinephelus labriformis* (Jenyns). (*E. ordinatus* Cope, Trans. Amer. Philos. Soc. Phila., XIV, 1871, p. 466.)
18. *Rypticus xanti* Gill.
19. *Anisotremus tæniatus* Gill.
20. *Brachydeuterus leusiccus* (Günther).
21. *Polydactylus opercularis* (Gill).
22. *Pomacentrus rectifrænum* Gill.
23. *Chætodipterus zonatus* (Girard).
24. *Canthigaster punctatissimus* (Günther).
25. *Diodon hystrix* Linné.
26. *Prionotus horrens* Richardson.
27. *Leptecheneis naucrates* (Linné).
28. *Batrachoides pacifici* (Günther).
29. *Auchenopterus monophthalmus* (Günther).
30. *Hypsoblennius striatus* (Steindachner).

An old saw from Captain Field is doubtless *Pristis zephyreus* (Jordan and Starks), but without other characters is not certain.

[1] Trans. Amer. Philos. Soc Phila., (new series) XIV, 1871, pp. 445–483.

Rio de Janeiro, Brazil

Dr. Ruschenberger, with Dr. Thomas J. Turner, made a small collection of the market fishes, received in 1854. A few examples were also obtained from William Hyde and E. D. Cope, and some presented by the Museum of Comparative Zoology at Cambridge, at a later date.

1. *Elops saurus* Linné.
2. *Clupanodon pseudohispanicus* (Poey).
3. *Harengula pensacolæ* Goode.
4. *Opisthonema oglinum* (Le Sueur).
5. *Anchovia brownii* (Gmelin).
6. *Cetengraulis edentulus* (Cuvier).
7. *Netuma barbus* (Lacépède).
8. *Fistularia tabacaria* Linné.
9. *Holocentrus ascensionis* (Osbeck).
10. *Trichiurus lepturus* Linné.
11. *Oligoplites saliens* (Bloch).
12. *Alepes amblyrhynchus* (Cuvier).
13. *Caranx hippos* Linné.
14. *C. latus* Agassiz.
15. *Vomer setapinnis* (Mitchill).
16. *Chloroscombrus chrysurus* (Linné).
17. *Seserinus xanthurus* Quoy and Gaimard.
18. *Centropomus constantinus* Jordan and Evermann.
19. *Epinephelus guaza mentzelii* (Valenciennes).
    (*E. brachysoma* Cope, Trans. Amer. Philos. Soc. Phila., XIV, 1871, p. 466.)
20. *Diplectrum formosum* (Linné).
21. *Priacanthus arenatus* Cuvier.
22. *P. cruentatus* (Lacépède).
23. *Lutjanus analis* (Cuvier).
24. *Orthopristis ruter* (Cuvier).
25. *Archosargus unimaculatus* (Bloch).
26. *Eucinostomus pseudogula* Poey.
27. *Gerres rhombeus* Cuvier.
28. *Micropogon opercularis* (Quoy and Gaimard).
29. *Geophagus brasiliensis* (Quoy and Gaimard).
30. *Halichœres poeyi* (Steindachner).
31. *Bodianus rufus* (Linné).
32. *Cryptotomus ustus* (Valenciennes).
33. *Chætodipterus faber* (Broussonet).
34. *Holacanthus tricolor* (Bloch).
35. *Balistes vetula* Linné.
36. *Stephanolepis hispidus* (Linné).
37. *Lactophrys triqueter* (Linné).
38. *Spheroides spengleri* (Bloch).
39. *Dactylopterus volitans* (Linné).
40. *Antennarius scaber* (Cuvier).

Surinam, Dutch Guiana.

Dr. Constantine Hering made a very interesting collection at this locality, which was received at the Academy about 1830. A few fishes obtained by Dr. William Keller in 1856 I have not located.

1. *Eulamia oxyrhynchus* (Müller and Henle).
2. *Sphyrna tudes* (Valenciennes).
3. *S. zygæna* (Linné).
4. *Pristis perotteti* Müller and Henle.
5. *Elops saurus* Linne.
6. *Heringia amazonica* (Steindachner).
7. *Odontognathus mucronatus* Lacépède.
8. *Anchovia lepidentostole* Fowler.
   (Proc. Acad. Nat. Sci. Phila., 1911, p. 214, fig. 3.)
9. *Pterengraulis atherinoides* (Linné).
10. *Lycengraulis grossidens* (Agassiz).
11. *Synbranchus marmoratus* Bloch.
12. *Selenaspis herzbergii* (Bloch).
13. *Netuma aulometopon* Fowler.
    (L. c., 1915, p. 204, fig. 1.)
14. *Rhamdia sebæ* (Valenciennes).
15. *Brachyplatystoma vaillanti* (Valenciennes).
16. *Pseudoplatystoma fasciatum* (Linné)
17. *Doras granulosus* Valenciennes.
18. *D. cataphractus* (Linne).
19. *Trachycorystes galeatus* (Linné).
20. *Pseudauchenipterus nodosus* (Bloch).
21. **Ageneiosus porphyreus** Cope.
    (Trans. Amer. Philos. Soc. Phila., XIII, 1867, p. 404.)

Head $3\frac{7}{8}$; depth 5; D. I, 7; A. IV, 41; head width $1\frac{3}{5}$ its length; snout $2\frac{2}{5}$; eye $7\frac{1}{2}$; maxillary $2\frac{1}{4}$; interorbital $2\frac{1}{8}$; mouth width $2\frac{1}{4}$; dorsal height 2; pectoral $1\frac{4}{5}$; ventral 2; least depth of caudal peduncle $3\frac{1}{4}$; upper caudal lobe $1\frac{2}{5}$. Body greatly compressed, upper profile straight, lower convex. Caudal peduncle about long as deep. Head wide, greatly depressed, depth over eye half its width. Snout greatly depressed, broadly spatulate, length about $\frac{4}{5}$ its width. Eyes lateral, though more inferior, almost covered by adipose-eyelid, midway in head length. Mouth broad, gape about $\frac{4}{5}$ to eye. Upper jaw produced well beyond lower, its teeth broadly exposed. Mouth roof smooth. Upper buccal fold very broad. Tongue wide, thick, fleshy, not free. Fine concealed maxillary barbel about $\frac{4}{5}$ of eye. Front nostril about first $\frac{2}{5}$ in snout. Hind nostril about midway between snout tip and hind eye edge. Interorbital convex, with long median fontanel which broader anteriorly and not extended back to occipital process. Rakers III 3+4 x, short, lanceolate, about $\frac{1}{5}$ of filaments, which nearly long as eye. Body everywhere with smooth skin. Spinous dorsal inserted close behind head or little nearer anal origin than snout tip, fin base about $\frac{1}{3}$ its height. Adipose fin inserted about last third between depressed spinous dorsal tip and caudal base, fin equals $1\frac{1}{2}$ eye-diameters. Anal origin midway between hind eye edge and caudal base, fin long and low, slightly higher anteriorly. Caudal well forked, pointed lobes about equal. Pectoral low, reaches $\frac{3}{4}$ to ventral. Ventral origin at last $\frac{2}{5}$ between pectoral and anal origins, reaches anal. Vent close before anal. Color in alcohol largely dull brownish, paler below. Head above and back with obscure slaty or darker marblings. Fins pale brownish. Length 280 mm. Cotype (type) No. 8,389, A. N. S. P.

Also another cotype: Head $3\frac{3}{4}$; depth $5\frac{2}{5}$; D. I, 5; A. IV, 41; snout $2\frac{1}{8}$ in head; eye $7\frac{1}{4}$; maxillary $2\frac{1}{2}$; interorbital 2; length 178 mm. (caudal tips damaged).

22. *Platystacus cotylephorus* Bloch.
23. *Aspredo aspredo* (Linné).
24. *Callichthys callichthys* (Linné).
25. *Plecostomus plecostomus* (Linné).
26. *Loricariichthys typus* (Bleeker).
27. *Loricaria cataphracta* Linné.
28. *Curimata copei* Fowler.
    (Proc. Acad. Nat. Sci. Phila., 1906, p. 301, fig. 7.)
29. *C. schomburgkii* (Günther).
30. *Curimatella alburnus* (Müller and Troschel).
31. *Astyanax caucanus* (Steindachner).
32. *A. bimaculatus* (Linné).
33. *Gasteropelecus sternicla* (Linné).
34. *Charax gibbosus* (Linné).
35. *Hoplias malabaricus* (Bloch).
36. *Erythrinus unitæniatus* Agassiz.
37. *Gymnotus carapo* Linné.
38. *Sternopygus macrurus* (Schneider).
39. *Anableps anableps* (Linné).
40. *Pœcilia vivipara* Schneider.
41. *Mugil incilis* Hancock.
42. *Trichiurus lepturus* Linné.
43. *Caranx latus* Agassiz.
44. *Selene vomer* (Linné).
45. *Centropomus pectinatus* Poey.

46. *C. parallelus* Poey.
(*C. heringi* Fowler, l. c., 1906, p. 423, fig. 2.)
47. *C. undecimalis* (Bloch).
48. *Anisotremus surinamensis* (Bloch).
49. *Cynoscion acoupa* (Lacépède).
50. *Nebrius microps* Cuvier.
51. *Plagioscion squamosissimus* (Heckel).

52. **Plagioscion monacanthus** (Cope).
(*Corvina monacantha* Cope, Trans. Amer. Philos. Soc. Phila., (2) XIII, 1866, p. 402.)

Head $3\frac{1}{4}$; depth $3\frac{1}{4}$; D. X, I, 33; A. II, 6; pores (enlarged scales) in l. l. to caudal base 50; 11 scales above l. l. to soft dorsal origin, 10 below to spinous anal origin; head width 2 in its length; snout 4; eye $6\frac{2}{5}$; maxillary 2; interorbital $3\frac{1}{2}$; third dorsal spine $2\frac{2}{5}$; second anal spine 2; least depth of caudal peduncle $3\frac{1}{3}$; caudal $1\frac{1}{8}$; pectoral $1\frac{1}{4}$; ventral $1\frac{1}{4}$. Body well compressed, back elevated. Head deep, upper profile slightly concave above eye. Snout convex, length $\frac{3}{5}$ its width. Eye center at first $\frac{2}{7}$ in head. Mouth large, lower jaw slightly included. Maxillary reaches hind eye edge. Teeth in bands in jaws, fine, with outer row enlarged, upper little more so. Tongue free, smooth. Nostrils together, close before eye. Interorbital convex. Hind preopercle edge entire, except 2 short points at angle below. Rakers II 4+10 v, lanceolate, $1\frac{1}{2}$ in eye or longer than filaments. Scales finely ctenoid, in oblique rows on trunk. Large scales on opercle and few behind eye. Of head only lips naked. L. l. of enlarged scales concurrent with dorsal profile to anal, then midway or horizontal, and on caudal to its end. Dorsal spines thin, fourth longest. Soft dorsal inserted slightly nearer caudal base than snout tip, height about uniform. Anal inserted about midway between ventral origin and caudal base, first spine rudiment and second but little less than rays (damaged). Caudal ends in median point behind. Pectoral $1\frac{1}{2}$ to anal. Ventral inserted opposite pectoral origin, first ray ends in filament, spine slightly less than half of fin. Vent well before anal, or at depressed ventral tip. Color in alcohol dull uniform brownish, with brassy and silvery reflections. Caudal and pectoral with three deep brown cross-bars. Length 213 mm. No. 11,519, A. N. S. P., type of *Corvina monacantha* Cope.

The above example has wrongly been referred to *Plagioscion squamosissimus* (Heckel) by Jordan and Eigenmann,[2] and allowed to repose in its synonomy ever since. It appears identical with *Pseudosciaena surinamensis* Bleeker,[3] which name it replaces. In the large anal spine it is allied with *Plagioscion auratus* (Castelnau).

[2] Rep. U. S. Fish Com., XIV, 1886 (1889), p. 382.
[3] Arch. Néerl. Sci. Nat. Harlem, VIII, 1873, p. 458, Pl. 21.

53. *Pachypops grunniens* (Schomburgk).
54. *Ophioscion adustus* (Agassiz).
55. *Sagenichthys ancylodon* (Schneider).
56. *Cichlasoma bimaculatum* (Linné).
57. *Dactylopterus volitans* (Linné).
58. *Dormitator maculatus* (Bloch).

59. **Eleotris amblyopsis** (Cope).

(*Culius amblyopsis* Cope, Trans. Amer. Philos. Soc. Phila., XIV, 1871, p. 473.)

Head $2\frac{3}{5}$; depth $3\frac{3}{4}$; D. VI—8, 1; A. I, 8, 1; scales 42 in median lateral series to caudal base and 6 more on latter; 14 scales transversely between soft dorsal and anal origins; about 38 ? predorsal scales; head width $1\frac{2}{5}$ its length; third dorsal spine $2\frac{3}{5}$; sixth dorsal ray $1\frac{7}{8}$; seventh anal ray 2; least depth of caudal peduncle $2\frac{1}{3}$; pectoral $1\frac{2}{5}$; ventral $1\frac{7}{8}$; snout $4\frac{1}{8}$ in head measured from upper jaw tip; eye $5\frac{1}{4}$; maxillary $2\frac{1}{3}$; interorbital $3\frac{1}{4}$. Body well compressed, contour slenderly ellipsoid. Caudal peduncle strongly compressed, slightly longer than deep. Head robust, muzzle obtuse. Snout convex, length $\frac{2}{5}$ its width. Eye small, elongate, center near first third in head. Mouth oblique, large, lower jaw well protruded. Maxillary reaches about center of eye. Teeth fine, in bands in jaws. Tongue broad, depressed, free. Interorbital slightly depressed in front, slightly convex. Preopercle with strong obscure spine, directed downwards. Rakers 6 low knob-like rudiments on lower limb of first arch. Head scaly, except muzzle. Scales small and crowded on predorsal. About 12 rows of fine scales across cheek. From lower eye edge 6 cutaneous ridges radiate down over infraorbital. On head, predorsal, breast and belly scales cycloid, on trunk ctenoid, and also larger on latter behind. Caudal and pectoral bases with small scales, fins otherwise naked. No trace of l. l. Dorsal spines thin, fin inserted slightly nearer snout tip than caudal base, third spine longest, reaches back slightly beyond soft dorsal origin. Last little nearer caudal base than hind preopercle edge, rays gradually higher towards last, not quite reaching caudal base. Anal opposite soft dorsal, similar. Caudal rounded, median rays longest. Pectoral broad, median rays longest, reaches vent. Ventral inserted slightly before pectoral origin, reaches $\frac{2}{3}$ to anal, with small papilla. Color in alcohol dull uniform brownish generally. Dusky brown to blackish line from hind eye edge horizontally back to opercle above, two obliquely down from lower hind edge, and another more obscurely vertically down over infraorbital. Fins all finely barred with narrow dusky-brown lines. Black blotch, little smaller than pupil, just before pectoral origin. Iris slaty. Length 80 mm. (caudal tip damaged). Cotype (type) of *Culius amblyopsis* Cope, No. 10,577, A. N. S. P.

Also Nos. 10,578 and 10,579, A. N. S. P., cotypes, same data. These show: Head 3; depth 4 to $4\frac{1}{8}$; D. VI—8, 1; A. I, 8, 1; scales 44 or 45 in median lateral series to caudal base and 6 or 7 more on latter; 16 scales transversely between soft dorsal and anal origins; 40 to 43 predorsal scales; snout $4\frac{1}{2}$ to $4\frac{3}{4}$ in head measured from upper jaw tip; eye $5\frac{3}{4}$ to 6; maxillary $2\frac{1}{2}$; interorbital 3 to $3\frac{3}{5}$; length 80 mm.

60. *Batrachoides surinamensis* (Schneider).
61. *Citharichthys spilopterus* Günther.
62. *Achirus achirus* (Linné).
63. *A. lineatus* (Linné).
64. *Oncocephalus vespertilio* (Linné).

St. Martin's Island, West Indies.

Dr. R. E. Van Rijgersma collected in the lower or Dutch portion of the island, likely largely at or about Phillipsburg. The collection was received at the Academy in 1869. This is the most important of Cope's collections embraced in his "Ichthyology of the Lesser Antilles," as it furnished the largest number of his new forms. Cope's account still appears to be the only one dealing with the fish-fauna of this island. Species mentioned by Cope, but which I fail to locate in the collection, are indicated by †. It long appeared clear that a great many specimens were never included in Cope's list, as I recorded some species since, and such as now remain are indicated by the prefixed asterisk. These indications are also applicable to the St. Croix and St. Christopher collections.

1. *Ginglymostoma cirratum* (Bonnaterre).
2. *Albula vulpes* (Linné).
3. *Harengula macrophthalma* (Ranzani).
4. *H. pensacolæ* Goode.
5. *Anchovia platyargyrea* Fowler. (Proc. Acad. Nat. Sci. Phila., 1911, p. 216, fig. 4.)
6. *Anguilla rostrata* Le Sueur.
7. *Myrichthys oculatus* (Kaup).

8. **Enchelycore nigrocastaneus** (Cope).

(*Gymnothorax nigrocastaneus* Cope, Trans. Amer. Philos. Soc. Phila., n. s. XIV, 1871, p. 483.)

Head 8; depth $23\frac{2}{3}$; head width $4\frac{1}{2}$ in its length; snout $5\frac{3}{4}$ from upper jaw tip; eye $9\frac{1}{2}$; upper jaw to rictus $2\frac{1}{4}$; interorbital 9; head $3\frac{5}{6}$ to vent. Body well compressed, also head, latter with flattened sides approximate below. Muzzle slender, acuminate. Snout conic, basal width $1\frac{3}{5}$ its length. Eye slightly advanced. Mouth large, not closing, dentition well exposed. Teeth sharp-pointed, conic or moderately compressed, slightly inclined back. Upper teeth uniserial, erect, vary alternately small or little enlarged, latter but little longer than small lower teeth. Several enlarged erect upper canines at snout tip, another each side and one close before each eye. Inside and little advanced, though close to erect preocular pair of canines, another larger depressible canine each side. Between median and

pair of erect upper teeth at snout tip pair of depressible smaller conic teeth, one each side of median tooth and directed back. Close behind large front erect outer canine each side above 2 inner enlarged depressible conic teeth. Premaxillary teeth large canines, conic, depressible, first close behind median front erect upper tooth, second subequal and median about midway in snout length, last longest and median close before eye. Vomer with one row of low backwardly inclined compressed sharp-pointed teeth, smaller than lateral mandibulars or like smallest along upper jaw edges. Upper teeth begin about opposite eye center, close inside upper laterals inner row of 4 enlarged depressible conic teeth, last well behind eye. Lower teeth largely uniserial, compressed, sharp-pointed, inclined little back, all small except anterior. Pair of erect sharp conic symphyseal canines. In front of mandible each side anteriorly row of 3 enlarged depressible conic canines, first largest in jaw and second shorter than symphyseal pair, third about equal. Mandible elongate, slender, attenuate, protrudes little beyond upper, well curved, surface convex, rami low. Front nostril in short tube near snout tip, hind one long slit about $\frac{2}{3}$ of eye. Interorbital convex. Gill-opening nearly horizontal, about midway in depth, about $\frac{5}{6}$ of eye. Pharynx swollen, grooved below. Pores on head inconspicuous. Dorsal origin about opposite hind edge of gill-opening, like anal moderately high. Caudal $2\frac{1}{2}$ in eye. Vent close before anal. Color in alcohol largely uniform chocolate-brown. At rictus color little darker, or dusky. Edge of gill-opening not noticeably darker. Iris slaty. Fins narrowly edged slightly darker than body-color. Length 610 mm. No. 16,032, A. N. S. P., type of *G. nigrocastaneus* Cope.

9. **Muræna miliaris** (Kaup).

(*Muræna myrialeucostictus* Fowler, Proc. Acad. Nat. Sci. Phila., 1912, p. 18, fig. 4.)

Thyrsoidea miliaris Kaup[4] is likely this species. He had a larger example, without locality, with "arabesque" figures towards end of tail, arising from the dots running into each other, which was 23.98 in. long. The other, from Martinique, appears to agree, though lack of details do not render this certain. *Muraena multiocellata* Poey[5] agrees largely in proportions, but it is said to have the lower teeth more serrated and numerous than the upper. Günther appears to have correctly placed Kaup's *T. miliaris* in *Muraena*,[6] though wrongly includes *Murenophis punctata* Castelnau,[7] as the latter is

[4] Cat. Apodal F. Brit. Mus., 1856, p. 90.
[5] Mém. Hist. Nat. Cuba, II, 1860, p. 324. Cuba.

shown with the dorsal origin about last fourth between mouth-corner and gill-opening. Cope appears the first to wrongly place it in *Gymnothorax*. Obviously in my own account the hind nostril is intended above the front eye edge in a short tube.

10. *Gymnothorax moringua* (Cuvier).
11. *G. carcinognathus* Fowler. (Proc. Acad. Nat. Sci. Phila., 1912, p. 22, fig. 5.)
12. *Echidna catenata* (Bloch).
13. *Fundulus antillarum* Fowler. (L. c., 1916, p. 418, fig. 1.)

*14. **Belone argalus** Le Sueur.

Head $2\frac{3}{4}$; depth $21\frac{3}{4}$; D. II, 13; A. III, 17; scales 200 from shoulder to caudal base and 10 more on latter; 154 scales from occiput to dorsal origin; eye $1\frac{3}{4}$ in postocular; interorbital 2; first branched dorsal ray $1\frac{2}{3}$; caudal peduncle width $2\frac{4}{5}$, least depth $4\frac{1}{2}$; ventral $1\frac{1}{3}$; postocular $5\frac{1}{4}$? in rest of head; pectoral $4\frac{1}{3}$?; lower caudal lobe 5; first branched anal ray $4\frac{1}{3}$. Body subcylindrical, caudal peduncle greatly depressed, with broad keel flaring out each side and continued back over caudal basally for $\frac{2}{3}$. Head large, with very long slender jaws, lower little longer. Eye large, next to upper profile. Maxillary entirely concealed, to front eye edge. Jaws not completely closing basally. Teeth very small. Interorbital broad, depressed, distinctly concave medially. Nasal cavity much smaller than pupil. Rakers 2+5, II, short weak points, about $\frac{2}{5}$ of filaments, latter $2\frac{1}{2}$ in eye. L. l. inferior, extends below keel along caudal peduncle side, but only to caudal base. Head largely scaly. Dorsal origin well behind anal origin, or slightly nearer ventral origin than caudal base, front lobes little elevated. Anal like dorsal, much larger and front lobe greatly longer. Hind caudal edge emarginate, lower lobe slightly longer. Pectoral pointed, reaches 4 to ventral and latter inserted about midway between hind eye edge and caudal base, fin $2\frac{2}{5}$ to anal. Color in alcohol faded dull brownish above, sides and below silvery-white. Line of demarcation from shoulder bounded only by dull leaden line. Side of head, iris and beak silvery-white. Fins all pale. Length 308 mm.

The above example agrees largely with Le Sueur's description,[8] except he says "lateral line very low, interrupted by ventral fins, and beginning to rise above the base of the anal, are then continued along the middle of the tail upon the carina." What is intended by "pectoral fins small, longer than the half of the space which separates

[6] Cat. F. Brit. Mus., VIII, 1871, p. 100. Cuba.
[7] An. Amér. Sud, Poiss., 1855, p. 82, Pl. 42, fig. 3 (head). Rio Janeiro.
[8] Journ. Acad. Nat. Sci. Phila., II, pt. 1, 1821, p. 125, Pl. 10, fig. 1. Island of Guadaloupe.

their base from the tail" is not clear. Now his figure varies in several respects, and the details are slightly obscure. The dorsal has 26 rays and the anal about 24 ?, the eye about $1\frac{4}{5}$ in postocular, first dorsal ray $1\frac{1}{2}$, first anal ray $1+\frac{1}{5}$, least depth of caudal peduncle $6\frac{1}{2}$, ventral $1\frac{1}{6}$, postocular about 5 in rest of head, pectoral $8\frac{2}{3}$ in total head length, lower caudal lobe about $4\frac{7}{8}$, first anal ray 5 and pectoral 7 or 8 times to ventral.

I have recently examined material sent by the United States National Museum from the Azores and Ascension Island, which I identified as *B. trachura* Valenciennes and appears in every way identical. It is also quite evident that *Belone ardeola* Valenciennes and *B. cigonella* Valenciennes are other synonyms. This species is not a *Tylosurus* as Jordan[9] has recently announced, but a *Belone* belonging to my subgenus *Platybelone*.

15. **Strongylura timucu** (Walbaum).

(*Belone diplotænia* Cope, Trans. Amer. Philos. Soc. Phila., n. s., XIV, 1871, p. 481.)

Head $2\frac{2}{3}$; depth 15; D. II, 14; A. III, 15; scales 230 from shoulder to caudal base and 10 more on latter; 155 scales from occiput to dorsal origin; eye $2\frac{2}{5}$ in postocular; interorbital $2\frac{1}{8}$; first branched dorsal ray $1\frac{1}{3}$; first branched anal ray 1; least depth of caudal peduncle $4\frac{1}{4}$; ventral $1\frac{3}{4}$; postocular $3\frac{1}{3}$ in rest of head; pectoral 4; lower caudal lobe about 4. Body subcylindrical, caudal peduncle slightly depressed, width behind slightly less than its depth. Head large, with long slender jaws, lower little longer. Eye large, next to upper profile. Maxillary not quite to pupil, little behind front eye edge, largely concealed. Teeth small. Jaws not completely closing basally. Interorbital depressed, broad, very slightly concave. Nasal cavity little less than pupil. No rakers. L. l. runs along lower body edge, ascends caudal peduncle at middle of side and then straight to caudal base medially. Head largely scaly, over sides at least, also including preorbital, side of mandible and maxillary. Dorsal origin well behind anal origin or slightly nearer caudal base than ventral origin, front lobe well elevated. Anal like dorsal, little larger. Caudal emarginate behind, lower lobe little longer. Pectoral pointed, $2\frac{4}{5}$ to ventral, latter inserted slightly nearer caudal base than hind eye edge, about $\frac{1}{3}$ to anal. Color in alcohol faded pale brown on back, sides and lower surface silvery-white. Line of demarcation along back distinct, leaden, and below closely parallel,

[9] Proc. U. S. Nat. Mus., 55, 1919, p. 398.

narrow, pale yellowish line. Side of head and iris silvery-white. Slight dusky tint on opercle behind and above. Vertical fins and pectoral grayish, ventral paler. Length 305 mm. No. 7,572, A. N. S. P., type of *B. diplotaenia* Cope.

Identical with *S. timucu* (Walbaum), differing apparently in the lateral bluish stripe edged with black and then yellowish all along below. Cope says of *B. diplotaenia* eye 2.5 in postorbital, eye equals interorbital and pectoral equals postorbital, though I find the pectoral about half an eye-diameter longer than postocular.

16. *Hyporhamphus unifasciatus* (Ranzani).
17. *Parexocœtus mesogaster* (Bloch).
18. *Cypselurus heterurus* (Rafinesque).
*19. *Aulostomus maculatus* Valenciennes.
20. *Atherina laticeps* Poey.
21. *Sphyræna barracuda* (Walbaum).
†22. *Hippocampus punctulatus* Guichenot.
23. *Myripristis jacobus* Cuvier.
24. *Holocentrus ascensionis* (Osbeck).
25. *Scomberomorus cavalla* (Cuvier).
26. *Trichiurus lepturus* Linné.
†27. *Blepharis crinitus* (Mitchill).
28. *Vomer spixii* (Swanison).
29. *Trachinotus glaucus* (Bloch).
30. *Pempheris mulleri* Poey.
31. *Epinephelus maculosus* (Valenciennes).
32. *Alphestes chloropterus* (Cuvier).
33. *Mycteroperca acutirostris* (Valenciennes).
(*Epinephelus chalinius* Cope, Trans. Amer. Philos. Soc. Phila. n. s. XIV, 1871, p. 465.)
34. *M. venenosa apua* (Bloch).
35. *Hypoplectrus unicolor crocotus* (Cope).
(*Plectropoma crocota* Cope, l. c., p. 467, fig. 3.)
36. *Rypticus coriaceus* (Cope).
(*Eleutheractis coriaceus* Cope, l. c., p. 467, fig. 3.)
†37. *Lutjanus synagris* (Linné).
38. *Ocyurus chrysurus* (Bloch).
39. *Rhomboplites aurorubens* (Cuvier).
40. *Hæmulon melanurum* (Linné).
41. *Bathystoma aurolineatum* (Cuvier).
42. *Genyatremus luteus* (Bloch).
*43. *Eucinostomus pseudogula* Poey.
44. *E. gula* (Quoy and Gaimard).
45. *Upeneus martinicus* Cuvier.
46. *Bairdiella ronchus* (Cuvier).

47. **Umbrina coroides** Cuvier.

Head $3\frac{3}{5}$ to $3\frac{3}{4}$; depth 3 to $3\frac{3}{5}$; D. X, I, 26 to X, I, 28; A. II, 6; scales 49 in l. l. to caudal base; snout $3\frac{1}{3}$ in head; eye $4\frac{1}{4}$ to $4\frac{1}{3}$; maxillary $2\frac{1}{3}$ to $2\frac{3}{5}$; interorbital $3\frac{2}{3}$ to $3\frac{3}{4}$. Body well compressed, deep, back elevated. Caudal peduncle compressed. Head moderate, compressed. Snout convex, about broad as long. Eye elevated, hind edge midway in head length. Mouth small, inferior, lower jaw included. Maxillary about to front pupil edge. Teeth fine, in bands in jaws. Nostrils together, close before eye. Interorbital convex. Hind preopercle edge finely serrate, and serræ become little enlarged toward angle. Broad preorbital equals eye. Rakers 5 or 6+8 or 9 rudimentary points, fourth or less than filaments, and latter $1\frac{3}{4}$ in eye. L. l. arched nearly concurrent with dorsal profile. Second dorsal spine longest, fin inserted slightly behind

pectoral origin, and depressed tip not quite to soft dorsal origin, which midway between front or hind nostril and caudal base. Soft dorsal nearly uniformly low. Anal inserted about midway between ventral origin and caudal base, second spine enlarged, $2\frac{2}{5}$ to $2\frac{3}{5}$ in head. Pectoral and ventral about equal, $1\frac{1}{3}$ to $1\frac{1}{2}$ in head. In alcohol faded largely uniform brownish, centers of scale rows slightly darker. Lower surface with traces of silvery. Spinous dorsal and caudal tinged dusky. Length of larger 203 mm. (caudal end damaged).

Cope originally separated these two examples as varieties of *U. broussoneti* Cuvier, the smaller and longer example without brown vertical bars and the larger deep one with nine vertical bars.

48. *Eques lanceolatus* (Linné).
49. *Polydactylus plumieri* Lacepede.
†50. *Pomacentrus leucostictus* (Müller and Troschel).
51. *Abudefduf marginatus* (Bloch).
†52. *Microspathodon chrysurus* (Cuvier).
53. *Halichœres cyanocephalus* (Bloch).
54. *H. bivittatus* (Bloch).
55. *Cryptotomus roseus* Cope. (Trans. Amer. Philos. Soc. Phila., n. s., XIV, 1871, p. 462, fig. 1.)

56. **Sparisoma hoplomystax** (Cope).
(*Scarus hoplomystax* Cope, l. c.)

Head 3; depth $2\frac{3}{5}$; D. IX, 10; A. II, 9; scales 23 in l. l. to caudal base and 2 more on latter; 2 scales above l. l. to spinous dorsal origin and 6 below to anal origin; 4 predorsal scales; snout $2\frac{3}{5}$ in head; eye $4\frac{7}{8}$; mouth $4\frac{3}{4}$; interorbital $4\frac{3}{4}$. Body well compressed, ovoid, deepest about middle of pectoral. Caudal peduncle compressed, least depth $2\frac{1}{2}$ in head. Head compressed, upper profile little more inclined. Snout about long as wide, muzzle compressed. Eye elevated, hind edge about midway in head length. Pupil ellipsoid. Mouth gape slightly inclined forward, about $\frac{3}{5}$ to eye or not quite to front nostril. Three canines on outer face of upper jaw, all flaring out, front pair close together and directed forward. Ten oblique rows of teeth along each side of lower jaw. Front nostril about half an eye-diameter before eye, with fleshy filament about $\frac{4}{5}$ same. Interorbital slightly depressed concavely in front, slightly convex behind. Rakers 4+12 flexible points, $\frac{1}{4}$ of filaments and latter about $4\frac{1}{8}$ in head. Tubes in l. l. arborescent. Row of 5 large scales on cheek. Dorsal spines quite pungent, mostly uniform, second $3\frac{1}{5}$ in head, fin edge entire. Soft dorsal similar, inserted about midway between upper end of gill-opening and caudal base. Anal opposite and like soft dorsal. Caudal convex behind. Pectoral $1\frac{2}{5}$ in head, about $\frac{7}{8}$ to anal. Ventral inserted slightly behind pectoral base, fin $\frac{3}{5}$ to anal. Color in alcohol above largely dull brown-

ish, line of demarcation from level with eye to caudal base medially distinct, with paler brownish color below. Body everywhere with obscure paler or whitish dots or specks, and many obscure darker reticulations above and on side of head. Snout, cheek and head above with many brownish dots. An obscure pale streak from rictus across chin. Pectoral axil and suprascapula with dusky-brown tinge. Pectoral base with row of fine whitish dots. Vertical fins pale brownish, specked or dotted with darker and whitish. Pectoral and ventral pale, latter whitish terminally. Length 139 mm. Type (cotype) of *S. hoplomystax* Cope, No. 9,305, A. N. S. P.

Also Nos. 9,306 and 9,307, and 9,283 to 9,285, cotypes, A. N. S. P. These show: Head $2\frac{5}{6}$ to 3; depth $2\frac{2}{5}$ to $2\frac{3}{5}$; D. IX, 10; A. II, 9; scales 23 in l. l. to caudal base and 2 more on latter; snout $2\frac{2}{3}$ to $2\frac{4}{5}$ in head; eye 4 to $4\frac{1}{2}$; mouth $4\frac{1}{8}$ to $5\frac{2}{5}$; interorbital $4\frac{1}{4}$ to $5\frac{1}{6}$; length 112 to 123 mm.

57. *Sparisoma aurofrenatum* (Valenciennes).
58. *S. abildgaardi* (Bloch).
*59. *S. distinctum* (Poey).
60. *S. flavescens* (Schneider). Recorded by Cope as *Scarus radians*.

61. **Callyodon punctulatus** (Valenciennes).

One example, listed by Cope as *Scarus psittacus* and wrongly included as a synonym of *Scarus taeniopterus* Desmarest by Jordan,[10] who thinks *Scarus diadema* Valenciennes a synonym of the present species. While doubtless his material agrees with the account by Valenciennes,[11] *C. punctulatus* is distinguished from *C. diadema* by having its anal fin medianly throughout speckled with dusky. *C. diadema* agrees, however, in the presence of the yellow transverse line connecting the eyes across the interorbital. In *C. taeniopterus* this is not present, though there is a rather broad yellowish band forward from front edge of eye towards end of snout, there meeting its fellow.

62. *C. diadema* Valenciennes.
63. *C. taeniopterus* (Desmarest).

*64. **C. croicensis** (Bloch).

Five small examples appear to belong here as they have 2 rows of cheek scales, a rounded caudal and without hind canines above. Although in bad preservation traces of the 2 dark longitudinal bands may be made out. Largest 64 mm.

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[10] Rep. U. S. F. Com., XV, 1887 (1891), p. 683.
[11] Hist. Nat. Poiss., XIV, 1839, p. 146.

65. *Pseudoscarus guacamaia* (Cuvier).
66. *Chætodon sedentarius* Poey.
*67. *C. striatus* Linné.
†68. *C. capistratus* Linné.
69. *Pomacanthus paru* (Bloch).
70. *Holacanthus tricolor* (Bloch).
71. *Angelichthys ciliaris* (Linné).
*72. *Hepatus cæruleus* (Schneider).

73. **Balistes forcipatus** Gmelin.
(*Balistes moribundus* Cope, Trans. Amer. Philos. Soc. Phila., n. s., XIV, 1871, p. 479.)

Head $2\frac{3}{5}$; depth $1\frac{2}{3}$; D. III—29; A. 26; about 42 indistinct scales in median lateral series between gill-opening and caudal base and 4 more on latter[12]; snout $1\frac{2}{3}$ in head; eye $3\frac{1}{4}$; interorbital $2\frac{4}{5}$; fifth dorsal ray 2; fifth anal ray $2\frac{1}{6}$; least depth of caudal peduncle 3; caudal $1\frac{3}{4}$; pectoral $2\frac{1}{2}$. Body contour ellipsoid, compressed, deepest medially. Caudal peduncle and head compressed, latter with upper profile nearly straight and lower slightly convex. Muzzle well compressed, preorbital slightly concave, width about half its length. Mouth small, very slightly superior. Teeth in jaws enlarged medially, each with concave edge. Nostrils together, close before upper front eye edge. Interorbital convex. Gill-opening slightly oblique, about $\frac{4}{5}$ of eye. Body finely spinescent, each scale with about 2 uneven rows of spinules. First dorsal spine robust, spiny in front and spines larger above, its length (broken) at least twice that of third. Soft dorsal origin midway between hind pupil edge and caudal base, front rays highest and fin rounded. Anal similar, opposite. Caudal rounded. Pectoral small. Ventral spine spinescent and flap with 10 slender, pointed spines. Color in alcohol brownish generally, sides of head and trunk with numerous pale bluish spots. Underlaid cloudings of deeper brown and 3 dark brown blotches on back below soft dorsal, larger and more indistinct one below spinous dorsal, and all reflected slightly on fins basally. Membranes of spinous dorsal dusky. Iris deep brown. Fins pale brownish, basally with several somewhat irregular rows of whitish spots. Length 56 mm. No. 781, A. N. S. P., type of *B. moribundus* Cope.

74. *B. vetula* Linné.

75. **Canthidermis sobaco** Poey.
(*Balistes asperrimus* Cope, Trans. Amer. Philos. Soc. Phila., n. s., XIV, 1871, p. 478.)

Head $2\frac{2}{3}$; depth $1\frac{3}{5}$; D. III—26; A. 24; scales about 51 in median lateral series between gill-opening and caudal base and 4 more on latter; snout $1\frac{2}{3}$ in head; eye $3\frac{4}{5}$; interorbital $2\frac{2}{3}$; first dorsal spine

[12] Not 60 as given by Jordan and Evermann, Bull. U. S. Nat. Mus., Bull. 47, II, 1898, p. 1702.

$1\frac{2}{3}$; eighth dorsal ray $1\frac{4}{5}$; fifth anal ray $1\frac{4}{5}$; least depth of caudal peduncle $2\frac{4}{5}$; free caudal rays 2; pectoral $2\frac{2}{5}$. Body deep, well compressed, deepest medially. Caudal peduncle and head compressed, profiles of latter alike. Muzzle well compressed, preorbital depressed, width $1\frac{3}{4}$ its length. Mouth small, terminal. Teeth enlarged medianly in jaws, each with slight concave edge. Nostrils close together, close before front eye edge medially. Interorbital depressed concavely, rather blunt, occipital ridge extending up behind. Gill-opening rather slightly oblique, about $\frac{4}{5}$ of eye. Body everywhere roughly spinescent, spinules largest on middle of side below and about ventral flap. All unpaired fin-rays with row of fine spinules laterally, rows dividing and following branches terminally. Humeral region finely spinescent. First dorsal spine inserted slightly behind eye over gill-opening. Double row of spines down front and one row down each side of first dorsal spine, second and third spines barely $\frac{1}{3}$ of first. Soft dorsal origin about midway between hind pupil edge and caudal base, front median rays highest, fin rounded. Anal similar, opposite. Caudal small, hind edge convex. Pectoral small. Ventral spine spinescent, flap with about 7 irregular small spines not larger than adjacent ones. Color in alcohol rather warm brownish generally, scarcely paler below, and clouded pattern of broad, dark variable lines or reticulations. Dorsal and anal bases each with 3 dark brown blotches, extending as irregular lines on fins. Iris brown. Length 82 mm. Type, of *B. asperrimus* Cope, No. 800, A. N. S. P.

Though Cope gives the type "locality uncertain, but probably St. Martins, W. I.," the original label says "Darien."

76. *Canthidermis sufflamen* (Mitchill). An adult example recorded by Cope as *Balistes sobacus*.
†77. *Xanthichthys ringens* (Linné).
78. *Cantherines pullus* (Ranzani).
79. *Monacanthus ciliatus* (Mitchill). Listed as *M. tomentosus* by Cope.

80. **Pseudomonacanthus amphioxys** (Cope).

(*Monacanthus amphioxys* Cope, Trans. Amer. Philos. Soc. Phila., n. s., XIV, 1871, p. 477.)

Head $2\frac{3}{5}$; depth $1\frac{7}{8}$; D. II—35; A. 30; snout $1\frac{1}{5}$ in head; eye $3\frac{1}{2}$; interorbital $3\frac{1}{4}$; first dorsal spine $1\frac{1}{4}$; least depth of caudal peduncle $3\frac{1}{4}$; free caudal rays $2\frac{1}{5}$; pectoral about $2\frac{3}{4}$. Body rather elongately ellipsoid, compressed, deepest medially. Caudal peduncle and head well compressed, latter with upper profile slightly concave, lower equally convex. Muzzle well compressed, preorbital strongly concave, width about 3 in length. Mouth small, very slightly superior. Median enlarged lower teeth larger than upper, all with well-notched

edges. Nostrils together, close before front eye edge. Interorbital convex. Gill-opening little inclined, below hind part of eye and equals eye. Body minutely spinescent, slightly rough to touch. First dorsal spine inserted over middle of eye, with row of antrorse serræ along each front edge and another on each hind edge, all becoming smaller towards spine base. Second dorsal spine barely $\frac{1}{4}$ of first. Soft dorsal inserted about midway between front eye edge and caudal base, front median rays longest, apparently (damaged) not over half of first dorsal spine. Anal largely opposite, its origin slightly behind dorsal origin. Caudal slightly convex behind. Pectoral small. Ventral spine rigid, with pair of spines in front, another pair behind and several each side. Color in alcohol pale uniform brownish generally, with brassy reflections below. Iris whitish. Length 61 mm. Cotype (type) of *M. amphioxys* Cope, No. 777, A. N. S. P.

No. 778, same data, cotype in poor condition, about same size. Also No. 779, cotype, same size. It has: Head $2\frac{3}{5}$; depth $1\frac{7}{8}$; D. II—35; A. 32; snout $1\frac{1}{4}$ in head; eye $3\frac{1}{4}$; interorbital $3\frac{1}{4}$; first dorsal spine $1\frac{1}{8}$.

†81. *Alutera scripta* (Osbeck).
82. *Laetophrys triqueter* (Linné).
†83. *L. biaudalis* (Linné).
†84. *L. trigonus* (Linné).
85. *L. tricornis* (Linné).
86. *Spheroides spengleri* (Bloch).

*87. **S. marmoratus** (Ranzani).

Recorded as *Tetrodon reticularis* by Cope. On comparison with an example from Pine Island, Florida, which I recorded as the preceding species,[13] I find such to be wrong and that it agrees with Cope's St. Martin's example.

*88. *S. testudineus* (Linné).
89. *Canthigaster rostratus* (Bloch).
90. *Chilomycterus atinga* (Linné).

91. **Eleotris perniger** (Cope).

(*Culius perniger* Cope, Trans. Amer. Philos. Soc. Phila., n. s., XIV, 1871, p. 473.)

Head $3\frac{1}{3}$; depth 4; D. VI—I, 8, 1; A. I, 8, 1; scales 66 from head to caudal base and 4 more on latter; 22 scales transversely between soft dorsal and anal origins; 58 predorsal scales; head width $1\frac{2}{5}$ its length; mandible $2\frac{1}{5}$; third dorsal spine $2\frac{1}{3}$; seventh dorsal ray $1\frac{1}{2}$; seventh anal ray $1\frac{3}{5}$; least depth of caudal peduncle $2\frac{1}{8}$; pectoral $1\frac{1}{3}$; ventral $1\frac{1}{2}$; snout $4\frac{1}{4}$ in head from upper jaw tip; eye $6\frac{3}{5}$; maxillary $2\frac{3}{5}$; interorbital $3\frac{1}{2}$. Body compressed, deepest at soft dorsal origin. Caudal peduncle well compressed, least depth $1\frac{1}{3}$ its length. Head

[13] Proc. Acad. Nat. Sci. Phila., 1915, p. 251.

about deep as wide, upper profile deeply concave over eyes. Snout broad, convex, length $\frac{3}{5}$ its width. Eye small, ellipsoid, high, hind edge at first $\frac{2}{5}$ in head. Teeth fine, in bands in jaws, inner row in each enlarged little. Maxillary reaches eye. Lower jaw well protruded. Nostril small, inconspicuous, near snout edge. Interorbital broadly convex, elevated behind. Preopercle with strong spine down and forward. Gill-opening forward last $\frac{2}{5}$ in head. Rakers 2+6 low knobs, and filaments about equal eye. Scales largely uniform, except along body edges where small and crowded. Also small on caudal base, predorsal, top of head and breast. Snout, preorbital and jaws naked, head otherwise scaly. About 15 rows of cheek scales. Dorsal spines fine, slender, fin inserted much nearer hind opercle edge than soft dorsal origin. Latter little nearer hind opercle edge than caudal base, rays elevated gradually to last, which longest. Anal similar, only its insertion little back. Pectoral long, pointed, reaches vent. Ventral pointed, $\frac{4}{5}$ to vent. Ventral papilla long as eye. Color in alcohol largely dark brown, mottled obscurely and finely with darker. Dark brown streak from behind eye to upper opercle edge, another from lower eye edge to median preopercle edge. All fins except first dorsal finely barred with narrow dark brown wavy lines. First dorsal pale, with about 5 dark lines apparently, though very faint. Iris slaty. Length 128 mm. (caudal end damaged). Type of *C. perniger* Cope, No. 10,575, A. N. S. P.

Cope says "first dorsal with white extremity and two longitudinal black bars, one along the base," though more appear present.

92. *Mapo soporator* (Valenciennes). *93. *Gobiesox cephalus* Lacépède.

94. **G. cerasinus** Cope.

(Trans. Amer. Philos. Soc. Phila., n. s., XIV, 1871, p. 473.)

Head $2\frac{2}{5}$; depth $5\frac{4}{5}$; D. 7; A. 6; head width about $1\frac{1}{5}$ its length; head depth at occiput about $2\frac{1}{4}$; snout $3\frac{2}{5}$; eye $4\frac{3}{5}$; mouth width about $2\frac{1}{8}$; interorbital 5; third dorsal ray $2\frac{1}{2}$; third anal ray $3\frac{1}{5}$; least depth of caudal peduncle $5\frac{1}{5}$; caudal 2; pectoral $2\frac{2}{5}$. Body strongly depressed, depth about uniform. Caudal peduncle compressed, about long as deep. Head greatly depressed, convex above, flattened below. Snout depressed, broad, length $\frac{3}{5}$ its width. Eye slightly advanced from head center, directed above and forward. Mouth broad, lower jaw much shorter. Lips thick, fleshy. Upper teeth in 4 rows in front, outer row largest, compressed and ends slightly convex. Nostrils superior on side of snout, alike, close before eye. Interorbital level. Gill-opening forward about to hind eye edge.

Rakers 6 low rudimentary knobs. Skin everywhere smooth. Lower edge of head, front disk edge (lower pectoral rays) and inner ventral faces papillose. Dorsal inserted about last third between hind eye edge and caudal base, fin $1\frac{3}{5}$ to caudal base. Anal like dorsal, only slightly backward. Caudal truncate. Pectoral broad, not quite far back as ventral. Ventral disk rounded, about $1\frac{1}{3}$ in head. Color in alochol pale uniform brownish. Length 72 mm. Type, No. 10,363, A. N. S. P.

Cope gives the eye as $3\frac{1}{2}$ in the head, and says it equals the frontal width, which agrees if the bony interorbital is intended.

95. *Malacoctenus biguttatus* (Cope).
96. *Labrisomus nuchipinnis* (Quoy and Gaimard).
97. *Platophrys lunulatus* (Linné).
†98. *Histrio histrio* (Linné).
99. *Antennarius multiocellatus* (Valenciennes).
100. *Oncocephalus vespertilio* (Linné).

St. Croix Island.

Of Cope's material, reported in his memoir previously noticed, two collections were studied. The first consisted of dried skins, made by Dr. R. E. Griffiths, and the alcoholic preparations were largely from Captain Thomas Davidson, U. S. N.

†1. *Harengula pensacolæ* Goode.
2. *Synodus intermedius* (Agassiz).
3. *Chilorhinus sucnsonii* (Lütken).
4. *Hemiramphus brasiliensis* (Linné).
5. *Aulostomus maculatus* Valenciennes.
6. *Hippocampus punctulatus* Guichenot.
7. *Mugil curema* Valenciennes. Recorded as *M. brasiliensis* by Cope.
8. *Myripristis jacobus* Cuvier. (*Rhinobcryx chryseus* Cope, Trans. Amer. Philos. Soc. Phila. n. s., XIV, 1871, p. 464, fig. 2.)
9. *Holocentrus ascensionis* (Osbeck).
10. *Selar crumenophthalmus* (Bloch).
11. *Caranx ruber* (Bloch).
12. *C. hippos* (Linné).
13. *Vomer spixii* (Swanison).
14. *Trachinotus glaucus* (Bloch).
15. *T. falcatus* (Linné).
16. *Petrometopon cruentatus* (Lacépède).
17. *Cephalopholis fulvus* (Linné).
18. *Epinephelus striatus* (Bloch).
19. *Alphestes chloropterus* (Cuvier).
20. *Myctroperca rubcr* (Bloch).
21. *Hypoplectrus unicolor* (Walbaum).
22. *H. unicolor guttavarius* (Poey).
23. *Paranthias furcifer* (Valenciennes)
24. *Rypticus saponaccus* (Schneider).
†25. *Priacanthus arenatus* Cuvier.
†26. *Lutjanus griseus* (Linné).
†27. *L. vivanus* (Cuvier).
†28. *Ocyurus chrysurus* (Bloch).
†29. *Apsilus dentatus* Guichenot.
†30. *Hæmulon melanurum* (Linné).
†31. *H. sciurus* (Shaw).
†32. *H. plumieri* (Lacépède).
33. *H. flavolincatum* (Desmarest).
†34. *Bathystoma striatum* (Linné).
35. *Anisotremus virginicus* (Linné).
†36. *Calamus calamus* (Cuvier).
37. *Eucinostomus gula* (Quoy and Gaimard).
†38. *Upeneus maculatus* (Bloch).
39. *Eques acuminatus* (Schneider).
40. *E. punctatus* (Linné).
41. *E. lanceolatus* (Linné).
42. *Pomacentrus leucostictus* (Müller and Troschel).
43. *Abudefduf marginatus* (Bloch).
44. *Microspathodon chrysurus* (Cuvier).
45. *Bodianus rufus* (Linné).
*46. *Decodon puellaris* (Poey).
47. *Clepticus parræ* (Schneider).
48. *Halichæres radiatus* (Linné).
49. *H. poeyi* (Steindachner).
50. *H. garnoti* (Valenciennes).
51. *Chlorichthys bifasciatus* (Bloch).
52. *Sparisoma aurofrenatum* (Valenciennes).

53. *S. abildgaardi* (Bloch).
54. *S. flavescens* (Schneider).
Recorded as *Scarus chrysopterus* by Cope.
55. *S. rubripinne* (Valenciennes).
56. *Callyodon diadema* (Valenciennes).
57. *C. taeniopterus* (Desmarest).
58. *C. croicensis* (Bloch).
59. *C. vetula* (Schneider).
60. *Chætodon ocellatus* Bloch.
*61. *C. sedentarius* Poey.
62. *C. striatus* Linné.
63. *C. capistratus* Linné.
64. *Pomacanthus arcuatus* (Linné).
65. *Holacanthus tricolor* (Bloch).
66. *Angelichthys ciliaris* (Linné).
67. *Hepatus caerulens* (Schneider).
68. *H. hepatus* (Linné).
69. *Balistes vetula* Linné.
†70. *Xanthichthys ringens* (Linné).
†71. *Melichthys piceus* Poey.
†72. *Cantherines pullus* (Ranzani).
73. *Lactophrys triqueter* (Linné).
74. *L. tricornis* (Linné).
†75. *Scorpæna grandicornis* Cuvier.
*76. *Labrisomus nuchipinuis* (Quoy and Gaimard).
77. *Platophrys lunulatus* (Linné).
†78. *Antennarius multiocellatus* (Valenciennes).

St. Christophers, British West Indies.

Cope also had a small collection from this island, sometimes called St. Kitts, obtained by Benjamin H. Lightfoot.

†1. *Gymnothorax moringua* (Cuvier).
Recorded as *G. rostratus* by Cope.
2. *Ablennes hians* (Valenciennes).
3. *Hemiramphus brasiliensis* (Linné).
†4. *Caranx hippus* (Linné).
*5. *C. latus* Agassiz.
6. *Cephalopholis fulvus* (Linné).
†7. *Epinephelus maculosus* (Valenciennes).
Cope mentions it as *E. lunulatus*.
8. *Lutjanus vivanus* (Cuvier).
(*Lutjanus torridus* Cope, l. c., p. 469; *Ocyurus torridus* fig. 5).
9. *Ocyurus chrysurus* (Bloch).
(*O. rijgersmaei* Cope, Trans. Amer. Philos. Soc. Phila., n. s., XIV, 1871, p. 468, fig. 4.)
10. *Aprion macrophthalmus* (Müller and Troschel).
11. *Conodon nobilis* (Linné).
*12. *Calamus calamus* (Cuvier).
13. *Upeneus maculatus* (Bloch).
14. *U. martinicus* Cuvier.
15. *Sparisoma chrysopterum* (Schn.).
16. *Pomacanthus paru* (Bloch).
17. *Holacanthus tricolor* (Bloch).
†18. *Hepatus hepatus* (Linné).
†19. *Balistes vetula* Linné.

Jamaica.

In 1892 Prof. T. D. A. Cockerell compiled "A Provisional List of the Fishes of Jamaica,"[14] the first attempt to collect in orderly arrangement the species mentioned in the various scattered works. The list by Richard Hill in 1855 is allocated, but as it "is little more than a catalogue of names, many of which are but doubtfully correct," it had best be discarded. As Cockerell gives a short bibliography at the end of his paper, only subsequent papers are mentioned here. *Aulostoma maculatum* and *Rhinobatos undulatus* are recorded by Cockerell[15] the next year, and a little later J. E. Duerden mentions a number of food fishes[16] and C. H. T. Townsend has remarks on *Sicydium*.[17] Jordan and Rutter report the collection of fishes

[14] Bull. No. 1, Inst. of Jamaica (Kingston), 1892, pp. 1–16.
[15] Journ. Inst. Jamaica, I, No. 5, January, 1893, p. 178.
[16] L. c., II, April, 1895, No. 11, pp. 166–7; March, 1899, No. 6, p. 614.

made by Joseph Seed Roberts in Kingston.[18] Boulenger describes *Ceratobatis robertsi*,[19] and finally the writer has given a list of a small collection of fishes obtained at Port Antonio by Charles W. Johnson and William J. Fox.[20]

During the early winter of 1891 Dr. J. Percy Moore made a collection of the fishes, listed below, in Jamaica. All are now contained in the University of Pennsylvania. Most are food-fishes, or such as were abundant at the time. Locality labels, other than simply Jamaica, are Kingston, Lucea, Port Antonio, and Port Moran, indicated by the letters K., L., A. and M., respectively.

1. *Ginglymostoma cirratum* (Bonnaterre).

2. **Eulamia platyodon** Poey. "Black Shark."

Teeth narrow, entire, at least below. Pectoral width half its length, reaches opposite hind basal dorsal edge. Snout length $\frac{3}{4}$ its width. Length 1012 mm.

3. *Scoliodon terræ-novæ* (Richardson). K.
4. *Sphyrna zygæna* (Linné). L.
5. *Elops saurus* Linné.
6. *Albula vulpes* (Linné). L.
7. *Synodus fœtens* (Linné). K.
8. *Gymnothorax funebris* (Ranzani). A.
9. *Strongylura timucu* (Walbaum). L.
10. *S. raphidoma* (Ranzani). L.
11. *Hemiramphus brasiliensis* (Linné).

12. **Cypselurus lutkeni** (Jordan and Evermann). L.

Head $4\frac{1}{8}$; depth $5\frac{3}{5}$; D. II, 11; A. II, 8; snout $4\frac{1}{4}$ in head; eye $3\frac{1}{8}$; maxillary 4; interorbital $2\frac{1}{2}$. Anal base $1\frac{3}{4}$ in dorsal base. Uppermost pectoral ray simple, second divided, third and fourth longest. Pectoral uniform dusky-brown medially, edges pale. Ventral inserted about midway between last fourth of opercle and caudal base. In alcohol dorsal pale at present, but with traces of dusky above. Length 220 mm. (caudal lobe damaged).

13. **Syngnathus mackayi** (Swain and Meek).

Head $6\frac{1}{4}$; D. 30; rings 16+32; dorsal on two body rings and 6 caudal rings. Snout about $1\frac{2}{5}$ in head. Median snout line with slight keel above and below and smaller lateral keels. Opercle with radiating striæ, not keeled. Dorsal about high as body-ring width, base $1\frac{1}{3}$ in head. Pectoral longer than base. Tail $1\frac{3}{4}$ in total length. Body moderately deep. In alcohol uniform brown. Length 134 mm. Probably Jamaica ?.

14. **Hippocampus punctulatus** Guichenot.

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[17] l. c., II, April, 1895, No. 11, pp. 175–6.
[18] Proc. Acad. Nat. Sci. Phila., 1897, pp. 91–134.
[19] Ann. Mag. Nat. Hist., (6) XX, 1897, pp. 227–8.
[20] Proc. Acad. Nat. Sci. Phila., 1899, pp. 118–119.

D. 17. Snout $2\frac{1}{5}$ in head. Length 65 mm. K.

15. **Fistularia tabacaria** Linné.

Upper lateral snout edges entire. About 350 mm. to end of caudal fin. A.

16. *Mugil curema* Valenciennes. L.
17. *Sphyræna barracuda* (Walbaum). Jamaica?
18. *S. guachancho* Cuvier. L.
19. *Trichiurus lepturus* Linné. K.
20. *Oligoplites saurus* (Schneider). L.
21. *Selar crumenophthalmus* (Bloch .
22. *Caranx ruber* (Bloch).
23. *C. hippos* (Linné).
24. *C. crysos* (Mitchill).
25. *C. latus* Agassiz. K. L.
26. *Vomer setapinnis* (Mitchill). L.

27. **Chloroscombrus chrysurus** (Linné).

Head $4\frac{1}{5}$; depth $2\frac{2}{3}$; snout $3\frac{2}{3}$ in head measured from upper jaw tip; eye 4; maxillary $2\frac{3}{4}$; interorbital $3\frac{4}{5}$. Length 290 mm. K. It differs from the nominal *C. ectemurus* Jordan and Rutter in the snout longer than the eye. Also 2 from L.

28. *Trachinotus glaucus* (Bloch). L.
29. *Astrapogon stellatus* (Cope).
30. *Centropomus pedimacula* Poey. K.
31. *C. mexicanus* Bocourt.
32. *C. parallelus* Poey.
33. *Cephalopholis punctatus* (Linné).
34. *Epinephelus flavolimbatus* Poey.
35. *E. striatus* (Bloch).
36. *E. maculosus* (Valenciennes).
37. *E. morio* (Valenciennes). L.
38. *Rypticus arenatus* Cuvier.
39. *Priacanthus cruentatus* (Lacépède).
40. *Lutjanus griseus* (Linné).
41. *L. jocu* (Schneider). K.
42. *L. analis* (Cuvier). K.
43. *L. synagris* (Linné). L. K.
44. *Ocyurus chrysurus* (Bloch). K. L.
45. *Hæmulon parra* (Desmarest). K.
46. *H. melanurum* (Linné).
47. *H. sciurus* (Shaw). L.
48. *H. plumieri* (Lacépède). A.
49. *Bathystoma rimator* (Jordan and Swain). K.
50. *Brachydeuterus corvinæformis* (Steindachner). M.
51. *Eucinostomus pseudogula* Poey. K.
52. *E. gula* (Quoy and Gaimard). K.
53. *Gerres rhombeus* Cuvier. L. A.
54. *G. plumieri* Cuvier. L. K.
55. *Micropogon furnieri* (Desmarest). K.
56. *Umbrina coroides* Cuvier.
57. *Polydactylus virginicus* (Linné). M.
58. *Lachnolaimus maximus* (Walbaum). L.
59. *Sparisoma rubripinne* Valenciennes. L.

60. **Callyodon acutus** Poey.

Head $2\frac{4}{5}$; depth 3; D. IX, 10; A. II, 9; scales 17+6 and 1 more on caudal base; 2 scales above l. l., 6 below; 8 predorsal scales; snout $2\frac{2}{3}$ in head; eye $5\frac{2}{5}$; mouth $5\frac{1}{4}$; interorbital $2\frac{4}{5}$. Body elongate, well compressed, profiles alike. Head compressed, rather pointed. Snout about long as wide. Eye slightly advanced. Mouth half way to eye. No posterior canines. Interorbital convex. Cheek with 3 rows of scales, lowest row of 4 scales on preopercle limb. L. l. interrupted by scale behind, tubes with several slight inconspicuous bifurcations. Caudal scaly basally $\frac{3}{5}$ its length. Dorsal spines flexible. Color in alcohol with broad sulphur-yellow shade as streak below first, then widens above pectoral and extends back to caudal peduncle. Above on head leaden hand as if through eye, though little wider than pupil and bordered above with sulphur-yellow,

extending back to about opposite depressed pectoral tip. Back lilac-brown, largely pale. Belly and below very pale brown. Teeth whitish. Iris yellowish. Dorsal pale hyaline greenish, base broadly and edge narrowly yellowish-brown. Anal hyaline-greenish, with narrow basal yellowish-brown line and broad submarginal band. Pectoral and ventral pale. Caudal brownish, upper and lower edges pale. Length 180 mm. L.

61. *C. caeruleus* (Bloch).

62. **C. emblematicus** (Jordan and Rutter).

Head 3; depth 3; D. IX, 10; A. III, 9; scales 17+5 and 2 more on caudal base; 2 scales above l. l., 6 below; snout $2\frac{3}{5}$ in head; eye 5; mouth $4\frac{3}{5}$; interorbital $3\frac{1}{8}$. Body well compressed, profiles alike, evenly ellipsoid. Head compressed. Snout long as wide. Eye slightly advanced. No posterior canines. Interorbital convex. Cheek with 3 rows of scales, lowest row on preopercle limb of 4. Scales on caudal base over $\frac{3}{5}$ of fin. Dorsal spines rather pungent, with flexible ends. Color in alcohol pale buff-brown generally. Broad lengthwise deep brown band from above eye to last dorsal ray bases, another from snout tip through eye to upper caudal lobe medially. Fainter third parallel band begins in cheek below preorbital, extends to pectoral base and then to lower caudal lobe medially, where ending in slight spots. Rows of scales below pectorals each with median white line, which extends from gill-opening till opposite vent, and rows number three. Fins all pale brownish, edges of dorsal and caudal, also caudal base, same. Length 150 mm. L.

Callyodon margarita Fowler,[21] from Panama, is undoubtedly a synonym, the four upper posterior canines simply a variation. Jordan and Evermann do not indicate the lower dark band along the lower side of the head or distinct at caudal base, and there is no indication of white abdominal lines, nor are they mentioned by Jordan and Rutter.

63. *Chætodon striatus* Linné. L.
64. *C. capistratus* Linné. L.
65. *Pomacanthus arcuatus* (Linné). L.
66. *Angelichthys ciliaris* (Linné).
67. *Hepatus cæruleus* (Schneider). A.

68. **Melichthys piceus** Poey.

D. III—34; A. 32; scales 55 from gill-opening to caudal base; snout $1\frac{1}{4}$ in head; eye $4\frac{1}{2}$ in snout; interorbital $1\frac{5}{6}$; first dorsal spine $1\frac{2}{5}$; pectoral $1\frac{5}{6}$. Caudal truncate, ends pointed. Color in alcohol

[21] Proc. Acad. Nat. Sci. Phila., 1917, p. 133, fig. 2. Colon.

black, with narrow white line along dorsal and anal bases. Caudal entirely black. Length 295 mm. L.

69. *Monacanthus hispidus* (Linné). K.
70. *Alutera punctata* Agassiz. K.
71. *Lactophrys triqueter* (Linné).
72. *L. tricornis* (Linné). K. A. L.
73. *L. bicaudalis* (Linné). L.
74. *Spheroides testudineus* (Linné). K.
75. *Chilomycterus atinga* (Linné). L. K.
76. *Scorpæna plumieri* Bloch. L.
77. *Prionotus rubio* Jordan. K.
78. *Dactylopterus volitans* (Linné). K.
79. *Philypnus dormitor* (Lacépède). L.
80. *Mapo soporator* (Valenciennes). L.
81. *Ctenogobius lyricus* (Girard). L.
82. *Gobionellus oceanicus* (Pallas). L.
83. *Leptecheneis naucrates* (Linné). K.
84. *Malacanthus plumieri* (Bloch).

85. **Gobiesox cerasinus** Cope.

D. 6. A. 7. Upper teeth irregularly in several series, and lower teeth entire incisors. Head broad as long. Color in alcohol pale brownish, apparently reddish when fresh.

86. *Malacoctenus gillii* (Steindachner).
87. *Citharichthys spilopterus* Günther. L.
88. *Achirus lineatus* (Linné). L.
89. *Oncocephalus vespertilio* (Linné).

Hayti.

While at Port-au-Prince in December, 1917, Mr. P. C. Houseman secured a few fishes which he presented to the Academy. They are listed below. The few papers relative to the fish-fauna of Hayti-Santo Domingo, are chiefly Hilgendorf's account[22] and the notes on the Eckman collection by Lönnberg.[23] Various scattered records and descriptions are found in the principal works of Cuvier, Valenciennes, Dumeril, Gunther and Vaillant and Bocourt. Evermann and Clark[24] described several new forms more recently and the viviparous cyprinodonts are included in Regan's paper,[25] while *Rivulus heyei* is described by Nichols.[26] Finally, the writer[27] reported the Gabb collection from Santo Domingo, received at the Academy in 1871, 1872 and 1874.

1. *Atherina laticeps* Cuvier.
2. *Gerres rhombeus* Cuvier.
3. *Abudefduf mauritii* (Bloch).

Bahamas.

Cope gives the first faunal list in his "Ichthyology of the Lesser Antilles," already referred to. This was based on the collection made by Dr. H. C. Wood at Nassau, and received at the Academy

[22] Sitz. Ges. Naturf. Freunde Berlin, 1889, pp. 51–55.
[23] Oefvers. Svensk. Vet. Akad. Förh., LII, 1895, pp. 657–663.
[24] Proc. U. S. Nat. Mus., XXX, 1906, pp. 851–855, figs. 1–3.
[25] Proc. Z. S. London, 1913, pp. 977–1018, Pls. 99–101.
[26] Bull. Amer. Mus. N. Hist. N. Y., XXXIII, 1914, pp. 143–144.
[27] Copeia, No. 24, November 19, 1915, p. 50.

in 1861. Such material as is still extant and which I examined is indicated by the prefixed asterisk. Several subsequent papers by Jordan and Bollman,[28] Garman[29] and B. A. Bean[30] are important contributions. In November and December of 1890 Dr. J. Percy Moore visited New Providence Island at Port Nassau, Grand Inagua, Fortune Island, Eleuthera, and Grand Cayman, localities indicated respectively by P., G., F., E. and C. This material, with a few fishes obtained at Port Nassau by the late Prof. C. S. Dolley, is in the University of Pennsylvania.[41]

*1. *Harengula pensacolæ* Goode. E.
*2. *H. macrophthalma* (Ranzani).
3. *Conger conger* (Linné). C.
*4. *Gymnothorax moringua* (Cuvier).
5. *Exocœtus volitans* Linné. North of Bahama Bank.
*6. *Hippocampus punctulatus* Guichenot.
One from Mrs. G. A. Hubbell.
*7. *Holocentrus ascensionis* (Osbeck). F.
*8. *H. siccifer* Cope.
(*Holocentrum sicciferum* Cope, Trans. Amer. Philos. Soc. Phila. XIV, 1871, p. 465.)
*9. *Selar crumenophthalmus* (Bloch).
*10. *Caranx ruber* (Bloch).
*11. *Trachinotus glaucus* (Bloch).
*12. *Astrapogon stellatus* (Cope).
(*Apogonichthys stellatus* Cope, l. c., p. 400.)
*13. *Petrometopon cruentatus coronatus.*
*14. *Cephalopholis fulvus* (Linné). G., P., E., F.
*15. *C. fulvus ouatalibi* (Valenciennes).
16. *Epinephelus niveatus* (Valenciennes). P.
*17. *E. striatus* (Bloch).
Several examples in the University collection, one from Nutria and one from Prof. Dolley.
*18. *E. maculosus* (Valenciennes).
19. *E. ascensionis* (Osbeck). Conez (Dolley).
20. *Diplectrum formosum* (Linné). E.
21. *Rypticus saponaceus* (Schneider). G.
22. *Lutjanus griseus* (Linné). G., P.
23. *L. apodus* (Walbaum). F.
*24. *L. analis* (Cuvier). F.
*25. *L. brachypterus* Cope.
(*Lutjanus brachypterus* Cope, l. c., p. 470.)
*26. *Ocyurus chrysurus* (Bloch). P.
*27. *Hæmulon album* Cuvier. G., P.
*28. *H. melanurum* (Linné). P.
29. *H. sciurus* (Shaw).
*30. *H. plumieri* (Lacépède). P., G.
*31. *H. flavolineatum* (Desmarest). F.
*32. *Anisotremus virginicus* (Linné).
33. *Calamus calamus* (Valenciennes). F., P.
*34. *C. bajonado* (Schneider). P.
35. *C. proridens* Jordan and Gilbert. E.
*36. *Eucinostomus pseudogula* Poey.
*37. *E. gula* Quoy and Gaimard.
*38. *Upeneus martinicus* Cuvier. G.
39. *U. maculatus* (Bloch). P.
40. *Micropogon furnieri* (Desmarest). F.
*41. *Pomacentrus leucostictus* (Müller and Troschel).
*42. *Abudefduf marginatus* (Bloch).
*43. *Lachnolaimus maximus* (Walbaum).
*44. *Bodianus rufus* (Linné).
45. *Halichæres bivittatus* (Bloch). F.
*46. *Chlorichthys bifasciatus* (Bloch).

47. **Sparisoma niphobles** Jordan and Bollman.

Upper canine each side. Caudal truncate when expanded, slightly emarginate when closed. No scarlet stripe below eye to mouth

[28] Proc. U. S. Nat. Mus., 1889, pp. 549–553.
[29] Bull. Lab. Univ. Iowa, IV, 1896, pp. 76–93, 4 Pls.
[30] The Bahama Islands (Baltimore), 1905, pp. 293–325. Pl.
[31] I also found *Exocœtus volitans* Linné, *Atherina laticeps* Poey and *Mugil curema* Valenciennes, in the University collection labeled Crooked Island, French West Indies.

angle. Pectoral $4\frac{1}{2}$ in total length. Pectoral base dusky, axillary spot obsolete. Opercular edge brownish, not dusky. Chin and head below pale uniform brownish. Length 190 mm. G.

48. *S. aurofrenatum* (Valenciennes). G.
49. *S. abildgaardi* (Bloch). P.
50. *S. rubripinne* (Valenciennes). G.
51. *Callyodon tæniopterus* (Desmarest). G.
*52. *Chætodon ocellatus* Bloch.
53. *C. capistratus* Linné. G.
*54. *Pomacanthus arcuatus* (Linné).
*55. *Angelichthys ciliaris* (Linné). G.
*56. *Hepatus cæruleus* (Schneider).
*57. *H. hepatus* (Linné).
58. *H. bahianus* (Castelnau). P.
*59. *Alutera schoepffii* (Walbaum).
60. *Lactophrys triqueter* (Linné). G.
*61. *L. tricornis* (Linné). G.
*62. *Spheroides spengleri* (Bloch).
*63. *Chilomycterus atinga* (Linné).
*64. *Dactylopterus volitans* (Linné).
*65. *Mapo soporator* (Valenciennes).
*66. *Leptecheneis naucrates* (Linné).
67. *Malacanthus plumieri* (Bloch). P., C.
68. *Carapus affinis* (Günther). Two from the Bahamas, in 1877 (Dolley).
*69. *Malacoctenus biguttatus* (Cope). (*Labrisomus biguttatus* Cope, Trans. Amer. Philos. Soc. Phila. n. s., XIV, 1871, p. 473.)
70. *Pla'ophrys lunatus* (Linné).

Florida.

During March and April, 1918, a small collection of rather large commercial fishes was sent to the Academy for determination in fresh state. As several were desiderata they were placed in the museum. In the summer of 1916 a number of live fishes as sent to the Philadelphia Aquarium from Key West, and afterward several were received at the Academy. The latter are indicated below by the prefixed asterisk. On March 10, 1917, Mr. Morgan Hebard collected a few fishes at Biscayne Bay and Soldier Key. During May of 1919 Mr. Hebard made another collection, at Useppa Island in Charlotte Harbor. All his material has kindly been presented to the Academy, and I am further indebted to him for the field-notes, common names, etc., included below. Localities given below refer to his material exclusively.

1. **Jenkinsia stolifera** (Jordan and Gilbert).

Color in life translucent. Found in large schools in deep water. Useppa Island.

2. **Harengula pensacolæ** Goode and Bean. "Hard-scaled Sardine."

With the next in large schools in deep water. Both shy and taken in cast-nets. Useppa Island.

3. *Opisthonema oglinum* (Le Sueur). "Soft-scaled Sardine."

4. **Fundulus grandis** Baird and Girard. "Chub."

Largest female 145 mm. and male 103 mm. When fresh male with hind caudal edge rather broadly gray-white, though pale bluish in the live fish while in the water. Anal and dorsal basally, and

caudal, with fine white dots. Upper dorsal edge, most of anal, and all of ventral and pectoral rich orange. In life each scale on sides with the pale or median areas of the preserved fish brilliant metallic greenish-blue.

These fish live in polluted shallow water, not roving about, and where the bottom is a dark ooze. The larger females were found in the deeper shoals in schools, usually about sandy bottoms. They were active, constantly moving about. In life much paler. Useppa Island.

5. **Cyprinodon mydrus** Goode and Bean.

Lives on sandy bottoms in shoals. Though shy during the day they were easily captured at night with a light. Like the "sand perch" the dark vertical bands are conspicuous features at night as viewed from above with the aid of an artificial light. The bands disappear, however, as soon as the fish are lifted from the water. In life the spots on the head and trunk are very brilliant golden. Useppa Island.

6. **Mollienisia latipinna** Le Sueur.

Local in polluted water with bottom of dark ooze. Useppa Island.

7. **Strongylura notata** (Poey). "Needle Fish."

A number of young examples without scales. Found on the surface is shoals. Useppa Island.

8. **Hyporhamphus roberti** (Valenciennes). "Bally-hoo." "Hound-fish."

When fresh end of mandible deep blood-red. Dorsal and anal lobes and most of caudal blackish, and former conspicuously contrasted with whitish bases. Sides of body and eye brilliant silvery-white. Back pale olive-green, each scale with broad dark olive submarginal streak. Pectoral grayish. Ventral white. Length 222 mm. Useppa Island.

9. **Hemiramphus brasiliensis** (Linné).

Ocean off Biscayne Bay. Although Jordan recently contends *H. balao* Le Sueur is distinct I have been unable to distinguish it among my collections.

I have seen this species, while in the Florida Keys in 1904, rise out of the water and with a peculiar sculling motion of the tail, all the time the fish appearing nearly vertical in the air, move along the surface a hundred feet or more. Mr. Hebard recently saw numbers of the preceding also rise out of the water, as his boat pushed on, and elevate their bodies about 60° and move off in similar manner

for 50 to 100 feet. Sometimes they would leave the water completely, though only for very short intervals or spaces of about 4 to 8 feet. The whole performance is quite suggestive of flying-fishes.[32]

*10. *Holocentrus ascensionis* (Osbeck). 11. *Mugil cephalus* Linné.

12. **M. curema** Valenciennes.

Six young in the Querimana stage from Useppa Island 18 to 20 mm. long, and having 10 branched anal rays. A larger example, also in the same stage or about 45 mm. long and which I assigned to *M. cephalus*[33] agrees. It is also likely that the one I identified as the young of *M. curema*[34] from Santo Domingo is really *M. cephalus*.

Mr. Hebard found the young mullets in very small schools, of about 5 to 20 individuals, at the surface. A small quadrate area of the dorsal portion of the back was out of the water, conspicuously shining silvery, though other parts of the body hardly noticeable. These fish dart forward, all together, in short jerks, and would not leave the surface unless greatly alarmed. When disturbed or scattered they reassembled in a few moments at the surface.

13. *Menidia peninsulæ* Goode and Bean. "Glass Minnow."
Found in schools on sandy bottoms in the shoals. Useppa Island.
14. *Caranx hippos* (Linné).
15. *Trachinotus falcatus* (Bloch).
16. *T. carolinus* (Linné).
17. *Centropomus undecimalis* (Bloch).
*18. *Epinephelus striatus* (Bloch).
*19. *E. maculosus* (Valenciennes).
20. *E. morio* (Valenciennes).
*21. *Mycteroperca bonaci* (Poey).
22. *M. microlepis* (Goode and Bean).
23. *Diplectrum formosum* (Linné).
Biscayne Bay.
24. *Lutjanus griseus* (Linné). "Mangrove Snapper."
Soldier Key and Useppa Island. Young, numerous under docks at latter locality.
25. *L. synagris* (Linné).
26. *Hæmulon sciurus* (Shaw).
Soldier Key.
27. *H. plumieri* (Lacépède).
*28. *Bathystoma rimator* (Jordan and Swain).
*29. *Anisotremus virginicus* (Linné).
30. *Orthopristis chrysopterus* (Linné). "Grunt."
Useppa Island. Very abundant in deep water about docks.
31. *Calamus proridens* Jordan and Gilbert.
32. *Lagodon rhomboides* (Linné). "Pinfish."
Useppa Island. Common in shoals, among weeds and under docks.
33. *Archosargus probatocephalus* (Walbaum).
34. *Diplodus holbrooki* (Bean). "Sailor's Choice."
Useppa Island. Locally with the grunts in deep water about docks.
35. *Eucinostomus harengulus* (Goode and Bean). "Sand Perch." "Sand Bream."
Useppa Island. These vernaculars also applied to the next, though the species not distinguished by the fishermen. Both were moderately common in shoals, particularly on sandy bottoms.
36. *E. gula* (Valenciennes).
37. *Cynoscion nebulosus* (Cuvier).
38. *Bairdiella chrysura* (Lacépède).
Useppa Island. Young examples, all showing 3 large spines at preopercle angle.
39. *Sciænops ocellatus* (Linné).

[32] Proc. U. S. Nat. Mus., 55, 1919, p. 397, fig. Havana.
[33] Proc. Acad. Nat. Sci. Phila., 1903, p. 744, fig. 1.
[34] L. c., fig. 2.

40. *Leiostomus xanthurus* Lacépède. "Spot." Useppa Island.
*41. *Chætodipterus faber* (Broussonet).
*42. *Pomacanthus arcuatus* (Linné).
*43. *Angelichthys ciliaris* (Linné).
44. *Balistes vetula* Linné.
45. *B. carolinensis* Gmelin.
46. *Monacanthus hispidus* (Linné).
47. *Spheroides harperi* Nichols.
48. *Lactophrys tricornis* (Linné).
49. *Chilomycterus schœpfi* (Walbaum).
50. *Opsanus tau* (Linné). Biscayne Bay.

51. **Rhombochirus osteochir** (Cuvier).

Head $4\frac{1}{3}$; depth 8; D. XVIII—III, 22; A. III, 22; P. I, 22; snout $2\frac{1}{3}$ in head measured from upper jaw tip; eye 7; maxillary 3; interorbital $1\frac{1}{3}$. Body slender in profile, depressed in front and moderately elongate, slender caudal peduncle compressed. Head width about $1\frac{1}{4}$ its length. Snout broad, half long as wide. Eye small, high, hind pupil edge about midway in head length. Mouth broad, gape about half way to eye. Maxillary ends before eye slightly less than eye diameter. Upper teeth in 3 rows, inner largest, well spaced and fewest, median irregular, and very minute outer close-set, even, simple, conic, forming lashed or ribbed appearance, especially along each side of jaw within mouth. Outer upper teeth also extend on premaxillary, followed by 4 or 5 large well-spaced teeth on maxillary edge. Band of fine teeth in lower jaw, most pronounced on sides of jaw anteriorly but not evident posteriorly or at symphysis so none extend back beyond fine teeth on premaxillary. Broad band of minute vomerine teeth edged in front and anteriorly with row of larger teeth. Tongue narrow, free in front and covered with fine teeth. Gill-opening extends forward about opposite maxillary tip. Rakers I, 1+9 III, lanceolate, about half length of filaments. Skin smooth, apparently scaleless. Disk width about $2\frac{1}{4}$ its length, which $2\frac{1}{2}$ from snout tip to caudal base, laminæ quite spinescent. Dorsal origin midway between twelfth disk lamina and caudal base, fin elevated from first dorsal ray. Anal inserted very slightly behind dorsal origin, similar. Caudal $1\frac{2}{5}$ in head, hind edge concave and lobes convex, though lower slightly longer. Pectoral rhomboid, rays very rigid or stiff, fin rhomboid, $1\frac{2}{5}$ in head. Ventral inserted directly behind pectoral base, $2\frac{1}{4}$ in head. Color when fresh in alcohol largely pale to whitish on disk and variably over upper left side, including eye and most of pectoral. Pale area also gives off pale line down to vent and inside gill-opening. Iris whitish with pale yellowish tint. Though left pectoral largely white, except gray border, and basal blotch, right pectoral dull purplish-brown with pale inferior blotch. Dorsal and anal slaty-black or nearly whitish narrowly along bases. Caudal dusky to blackish medially, lower

lobe marginally pale gray, upper darker. Anterior to vent dark body color mostly purplish-gray, posteriorly brownish. Ventral neutral dusky with very narrow pale edge behind. Length 133 mm.

The above example of this rare fish was found on an adult *Istiophorus nigricans* captured in the Gulf Stream $1\frac{1}{2}$ miles south of Fowey Rock Light, Florida, in March, 1919. It was secured for the Academy by Mr. Morgan Hebard. He tells me the *Istiophorus* was 6 feet 8 inches long and when hauled on board the *Rhombochirus* continued to adhere to the post-pectoral region of its host, remaining quiet. When pulled off by the tail it became quite active. Mr. Hebard also notes that in life the color had a smooth and immaculate mouse-brown appearance, strikingly marked about the pectoral, head and disk with whitish. While alive these markings were symmetrical, though now as described previously, the change took place immediately after death. In life the pectorals had conspicuous dark borders and pale centers.

Valenciennes figures the species from the sea of the Antilles, showing the dorsal origin about midway between the sixth dorsal lamina and the caudal base, color largely uniform brownish with neutral tints or only disk pale, pectoral brown, ventral pale or gamboge and the eye much smaller than in my example.[35] Poey examined several examples which he named *Echeneis tetrapturorum*[36] up to 300 mm. long. As may be inferred, Poey's examples were all from *Tetrapturus*, while the present one seems to indicate a new host for the species.

[35] Cuv. Règne Animal (Ed. Ill.,) 1839, 312, Pl. 108, fig. 3.
[36] Mém. Hist. N. Cuba, II, 1858, p. 256, Pl. 18, fig. 2 (pectoral fin). Cuba.

SYNONYMIC STUDY ON THE MOLLUSKS OF THE DEPARTEMENT DES ALPES-MARITIMES MENTIONED BY ANTOINE RISSO[1] WITH NOTES ON THEIR CLASSIFICATION

By Commandant E. Caziot

(Translated, and with Introductory Note, by William Healey Dall)

[The work of Risso is important, apart from its monographic character, for the reason that the author introduced many new generic and specific names, thus modifying the current nomenclature. During a brief visit to Nice in 1906, I found that the Risso collection was still in the possession of his heirs, and not in any public museum. As criticisms of subsequent authors indicated that several of the species upon which some of Risso's new names were founded had been incorrectly determined by him, it was highly important that their identity should be fixed. No living author is more familiar with the landshells of the district than the present distinguished Director of the Municipal Museum at Nice, and, after some correspondence, he kindly consented to summarize his conclusions from a study of the original collection, now unfortunately not in the best state of preservation. The shells of the Risso collection had originally been mounted in cartons, but in the course of more than ninety years many of them have been detached and others lost through the natural accidents to which such a collection is liable when not in expert custody. Hence a certain number of identifications are irretrievably lost. For such as still remain practicable students of the subject will be under deep obligations to the author of this paper. W. H. D.]

Risso is the first author to publish a general review of the land and fresh-water shells of the Maritime Alps.

His work has been the subject of a review by two critics, first, that of Gabriel Mortillet, who, in 1851, in the *Bulletin de la Société d'Histoire Naturelle de Savoie* (p. 72), said that the descriptions of shells by Risso left much to be desired; and secondly by Bourguignat,

[1] Histoire Naturelle des Principales Productions de l' Europe Méridionale, et Particulièrement de celles des Environs de Nice et des Alpes Maritimes, vol. IV, Paris, Levrault, 1826. 8° pp. 440, pl. 11.

ten years later, in his *Étude Synonymique sur les Mollusques des Alpes-maritimes.* He treated the author with great severity, calling him a writer without judgment, an indefatigable but absurd innovator, etc.

It is evident that Antoine Risso was imperfectly acquainted with the works of his predecessors, and that he attempted to cover too wide a field, including plants, crustaceans, fish, mammals, birds, geology, mineralogy, etc, etc.

One cannot be a universal naturalist. If one desires to produce authoritative work, it is necessary unless one is a genius of the first order, to study but a single chapter of natural history, since the field is too vast. The division of work is necessary even to those of exceptional intelligence, and the subdivision of that which is now regarded as a specialty will naturally be necessary in the future.

In his synonymical study Bourguignat has used a criticism too bitter and acrimonious. It is not the language which a master should employ with regard to the errors of his predecessors. Draparnaud, the creator of French conchology, said truly that he who opens the way has a right to indulgence, even if he has done poorly; to glory if he has done well; and to gratitude when his successor has done better than he. Risso was not conscious of the errors that he committed. He must have been satisfied of the correct determination of his species, since in the introduction to his fourth volume he realizes the importance of this point in citing the words of Cuvier that "the precise determination of species and their distinctive characters forms the fundamental basis on which all the investigations in natural history should rest."

The Risso collection remains in the possession of the son of the nephew of the great naturalist at his estate of St. Roch at the gates of Nice. It is visited by passing naturalists who experience serious disappointment on discovering the absence or loss of many specimens mentioned and described as new by Risso.

At the death of the eminent naturalist the person charged with the care of his collections at St. Roch was, I have been told, completely ignorant of natural history; she made grave mistakes; mixed exotic and native species, many among them bear no indication of habitat, and a great number have become detached from their cartons and scattered through the cases. It is impossible now to recognize the greater part of the specimens which served Risso as types.

In his introduction to the fourth volume Risso states in a final note (p. VII) that his new genera and species of shells will be de-

posited in the Muséum d' Histoire Naturelle, in order that zoologists may assure themselves of the exactitude of his observations.

However, none exists in the Museum at Nice, nor in the Museum at Turin, and I believe it is certain that none is found either at Genoa or Paris. The study of his species can therefore only be undertaken in the private collection itself.

In the following pages I have noted the conclusions which have resulted from my study of the specimens, and the differences of opinion which I have with his previous eminent critics. The synonymic study which I have undertaken before publishing the Fauna of the Terrestrial and Fluviatile Mollusks of the Principality of Monaco and of the Departement des Alpes-Maritimes, in 1910, relates only to this part of the volume on Conchology. In the present notes I review only the species mentioned by Risso, and in the order in which they were placed by him.

In taking up the slugs I can make but few notes because the specimens, long since deprived of alcohol, are absolutely dessicated and indeterminable.

The numerals following the names are those of the original pagination in Risso's fourth volume.

Arion lineatus Risso (55). Bourguignat asserts that this is the *Arion hortensis* of Férussac, since Risso's species differs only from that of Férussac by its lateral zones of a more orange tint. This is not sufficient to establish their identity. Pollonera, in his *Recensement des Arions de la Region Paléarctique*, has retained Risso's species, as that author specifies that his *Arion* had blackish eyes and the foot of a dirty gray, and this color does not agree with that of *A. hortensis*. It is probable, however, that Risso confused several species under one name.

Limax antiquorum (Fer.) Risso (55). Bourguignat states that it is by an error that Risso said of this slug "clypes levi," because the entoconch of this species is always concentrically striated. In their monograph of Italian limaces M. M. Lessona and Pollonera have demonstrated that this *Limax antiquorum* (pars) Férussac[2] is a synonym of *Limax maximus* (pars) Moquin Tandon, and also a synonym of *Limax cellarius* d'Argenville. Therefore Risso's species should be called by this name. Under the name of *antiquorum* Férussac has moreover united in a single species all the large limaces, *cellarius, cinereo-niger*, and their varieties.

[2] Hist. Moll. 1819, p. 4, figs. 2, 7 and 8.

Limax gagates (Drap.) Risso (55). This is the true *gagates* of Draparnaud, the type of the genus *Milax* Gray.

Limax variegatus (Drap.) Risso (56). Bourguignat considers this slug as merely a variety of *Limax maximus* Linné, or *L. cinereus* (pars) Müller. The *L. maximus* of Linnæus is identical with the above mentioned *L. cellarius.*

Limax marginatus (Drap.) Risso (56). Bourguignat regards this as the *L. marginatus* of Müller (1774) and Draparnaud. The *Limax martinianus* Bourg. (1869) is certainly one of the numerous varieties of *L. marginatus.*

Limax agrestis (L.) Risso (56). This is recognized by Bourguignat as correctly determined. The *Limax niciensis* and *mentonicus* mentioned by Nevill[3] from the Maritime Alps are mere varieties of *L. agrestis,* which in Liguria as in Tuscany varies much in coloration and pattern.

Limax carinatus Risso (56). The brief description given by Risso has been completed by Bourguignat. The species is common in Liguria. It should not be confused with *Limax carinatus* (Leach, 1820), Turton, 1831, renamed by Férussac *L. sowerbyi,* the validity of Leach's publication being doubtful, though the name was current among authors 1820–23. There is also a *Limax carinatus* of Orbigny, 1839, which has been renamed *polyptychus* by Bourguignat, 1859.

This species should be included under the genus *Milax* Gray (better known as *Amalia* Moquin Tandon) as pointed out by Bourguignat, 1854, and B. B. Woodward, 1903. The anatomical differences from *Limax* have been exposed by Sordelli in his Anatomy of *Limax etruscus* Issel.[4]

Limax lineolatus Risso (57). I have not discovered this species in the district. The original specimen is decayed beyond recognition.

Oris ferussaci Risso (57). A marine slug of the family Onchidiidae according to Bourguignat. Risso describes its habitat as in moderate depth of water on muddy bottom. Not later recognized.

Testacellus bisulcatus Risso (58). Mortillet united this species with *T. haliotidea* Draparnaud, but since the latter does not

[3] *Landshells of the Neighborhood of Mentone,* Proc. Zool. Soc. London for 1880, p. 103.

[4] Bull. Mal. Ital. 1872, p. 5.

occur in the district nor in the Departement du Var. Bourguignat has retained the name as valid. It has since been reported from Morocco at Tangier by M. Hesse, in 1880.

Testacella episcia Bourguignat. This species described from the entoconch alone, no longer exists in the Risso collection.

Succinea major Risso (59). The carton containing specimens of this species also includes one specimen of *Succinea putris* L., which must have come from elsewhere, as it is not known from the Alpes-Maritimes, nor even from the adjacent Departement du Var.

The dimensions given by Risso for this species are 18.0 mm. in length and for the *S. elegans* 10.0 mm. The two forms are identical, and the species is common in the environs of Nice, varying from ten to eighteen millimeters in length.

The species was subsequently named *S. corsica* by Shuttleworth, but the name *elegans* has generally been adopted for it. The name *major* does not appear in Clessin's Nomenclator of Pfeiffer, who referred both of Risso's species to varieties of *S. putris* L.

Succinea elegans Risso (59). See remarks under the preceding. In 1842, Pfeiffer named a species of *Bulimulus, Succinea elegans.*

Helicogena pomatia (L.) Risso (60). This species exists in the Alpes-Maritimes, but only in the high valleys of the Var, of the Vesubie, and of the Tinée.

Helicogena nemoralis (L.) Risso (60). Common in the Department. It has not varied in form since the middle Pleistocene.[5]

Helicogena candidissima (Drap.) Risso (61). Common in the Alpes-Maritimes below the altitude of 1200 meters. Risso's variety is a scalar form.

Helicogena splendida (Drap.) Risso (61). Risso says that this species lives on the hills about Nice. He must have confused it with *H. niciensis* of Férussac. The *H. splendida* has not crossed the Var and I have found no trace of it in the numerous quaternary deposits of this region. It does exist on the right bank of the Var, locally, at the extreme limit of the Department. Risso gives to specimens which he had collected or which had been given to him a diameter of 10 mm., there are none of this size in his collection.

[5] See: Caziot et Maury, *Tableau des Mollusques terrestres et fluviatiles du Pléistocène de la Ligurie occidentale et du Département des Alpes-Maritimes*, Journ. de Conchyl., vol. 57, p. 317, 1909.

The smallest specimens I have seen come from Spain or from the Moorish range, and have not over 12 mm. diameter and 8 mm. height.

Helicogena nicoeensis (Fér.) Risso (61, figs. 19, 20). Férussac described a *Helix* under this name in 1822, from Nicaea, Greece, near Mount Olympus. His use of the form *niciensis* for the shell from southern France was later. The former was regarded by Pfeiffer as a variety of *Helix desertorum*, which is perhaps the reason why no one has proposed a new name for the French shell.

Helicogena libellula Risso (62, f. 21). This is the yellow mutation of *H. nemoralis* without bands.

Helicogena imperfecta Risso (62). A yellow variety of *H. nemoralis* with the bands indicated by rows of imperfectly connected brown spots or flecks.

Helicogena olivacea Risso (63). Bourguignat considers that Mortillet erred in regarding *H. olivacea* as a variety of *H. nemoralis*. He considers it to be the *H. sylvatica* of Draparnaud. In this I agree with him, although *H. sylvatica* lives only in Italy on the confines of the Department, near the Col de Tende.

Helix aspersa (L.) Risso (63). Very common.

Helix vermiculata (L.) Risso (63). Very common.

Helix rugulosa Risso (64). This species is really *H. vermiculata* variety *concolor* Cristofori and Jan. Bourguignat referred it to *H. lactea*, which does not occur in the region under consideration. Cantraine regarded it erroneously as a synonym of *H. muralis* Müller, which also does not inhabit the Department.

Cantareus naticoides (Drap.) Risso (64). This is the *Helix aperta* Born, very common at Nice.

Helicodonta obvoluta (L.) Risso (65). *Helix obvoluta* Müller. Common.

Helicigona lapicida (L.) Risso (66). This species seems to be confined to the mountainous part of the right bank of the River Var.

Helicigona cornea (L.) Risso (66). This is only found in the Departement du Var, localized at Moissac and, according to Bérenguies, rarely. A variety of it is found in the Alpes-Maritimes.

Hygromia cinctella (Drap.) Risso (67). This is correctly identified by Risso.

Hygromia follículata Risso (67). This is correctly identified by Mortillet and Bourguignat with *Helix ciliata* Venetz. It is found in the environs of Nice, localized to the north of St. André.

Helicella algira (L.) Risso (68). This is very common in the Alpes-Maritimes below 1500 meters altitude and in the Var below 900 meters. It never exceeds 45 mm. in diameter.

Helicella albella (L.) Risso (68). The *H. albella* Draparnaud is identified with the *Helix explanata* Müller. It is now found only on the right bank of the Var, very rarely, and seems to be on the way to extinction. I have not found it in the quaternary beds of the region.

Helicella conica (Drap.) Risso (68). This is really *Helix cornea* Draparnaud, broken and bleached by the loss of its epidermis. It was referred to *H. variabilis* by Mortillet, and to *H. lineata* Olivi, by Bourguignat. I have shown elsewhere that the latter species does not exist in France.

Helicella elegans (Drap.) Risso (69). Very common in the lowlands near the sea. Risso's specimens belong to *Helix scitula* Cristofori and Jan.[6] Bourguignat considered this species as a synonym of *Helix terrestris* Pennant, but according to St. Simon, *terrestris* and *elegans* are distinct species.

Helicella rupestris (Drap.) Risso (69). I have not found this species near Nice, but it occurs on the Italian frontier on the banks of the Roya, and also at the entrance to the gorges of the Cians.

Helicella radiatus (L.) Risso (69). I have seen on his carton only a slightly flattened variety of *Helix rotundata* Müller. Bourguignat however regarded the species as a somewhat elevated variety of *Helix apicina* Lamarck.

Helicella solarium Risso (70). This is really *Helix elegans* Draparnaud, already referred to.

Helicella mamillata Risso (70). This is as remarked by Bourguignat, the *Helix lapicida* Linné, which is now confined to the right bank of the Var, but which I have found fossil in the quaternary deposits of Cape Martin near Mentone.

Helicella varians Risso (70). On the carton labelled *varians* I find two *H. ciliata* Venetz, and a very young *Helix rotundata*

[6] Cf. Caziot, Bull. Soc. Zool. de France, XXXIII, No. 10, 1908.

Müller. It is curious that Bourguignat should have considered them as young whitish specimens of *H. cespitum* Müller. The latter is however common near Nice and in the quaternary deposits of the region.

Helicella ericetorum (L.) Risso (71). Risso's specimens represent, not the *H. cespitum* as claimed by Bourguignat, but *H. mantinica* Mabille of the group *Cespitana*, a rather rare species in the Alpes-Maritimes. The *H. ericetorum* does not occur in this region where it is at present replaced by the *H. ericetella* Jousseaume, which is smaller, less depressed, with a larger umbilicus.

Helicella variabilis (Drap.) Risso (71). Bourguignat considered that there were two species on Risso's carton, *H. variabilis* of Draparnaud and *H. submaritima* of Desmoulins. I have established the truth of the first identification but the second is not correct, it being the *H. pilula* Locard, which also belongs to the group of *variabilis*.

The *H. submaritima* Desmoulins[7] has been sent to me from various places in France, always in the neighborhood of the ocean: Isle de Ré, Brest, Honfleur, Royan, etc. It is very distinctly marked by its form and small size, hardly greater than that of *H. striata* Draparnaud. It is very distinct from *H. maritima* and *pyramidata* and does not occur in the Risso collection.

Helicella nitida (Drap.) Risso (72). Mortillet wrongly identifies this species with the *Zonites* (*Hyalina*) *nitens* Michaud. For Bourguignat Risso's specimens constitute a new species close to *Z. cellarius* Müller. The differences are very slight.

Helicella fasciata Risso (72). Young specimens of *Helix cespitum* Draparnaud.

Helicella ferruginea Risso (72). This is the *Helix lenticula* Férussac, which is found in the neighborhood of Nice.

Helicella hispida Risso (72). This is the *Helix hispida* Linné, very common on all the prairies.

Helicella hispidula Risso (73). This is *Helix apicina* Lamarck.

Helicella prevostiana Risso (73). A variety of *Helix hispida* Linné.

THEBA (Leach Ms.) Risso (73). Theba pisana (L.) Risso (73). Very common on all the shores.

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[7] *Suppl. Moll. Gironde*, p. 6, 1851.

THEBA PYRAMIDATA (Drap.) Risso (74). Risso's specimens belong to the *Helix subpyramidata* Caziot. The typical *pyramidata* is localized to the north of Villefranche-sur-Mer.

THEBA CONSPURCATA (Drap.) Risso (74). Correct.

THEBA CARTHUSIANA (Drap.) Risso (74). Correct.

THEBA CARTHUSIANELLA (Drap.) Risso (75). Bourguignat remarks that *H. carthusiana* Müller (1774) should not be confused with Draparnaud's species of the same name (1805) which, he says, should be referred to *H. cantiana* Montagu. I regard this as an error. The *H. cantiana* is a northern species of which the variety *minor* has a striking analogy with the *H. rubella* Risso, while the *H. carthusianella* of Draparnaud is a minor variety of his *H. carthusiana*.

THEBA CEMENELEA Risso (75). Two species were placed by Risso in this carton, the second of which is *H. carthusiana* Müller.

THEBA RUBELLA Risso (75). The specimens agree well with his description.

THEBA CHARPENTIERA Risso (76). This is a dirty white or yellowish ash colored variety of the *Helix rubella*.

THEBA MERIDIONALIS Risso (76). Young specimens of *Helix vermiculata* Müller.

THEBA LUCOSTOMA Risso (76). Young examples of *Helix pisana* Müller.

COCHLICELLA VENTROSA (Drap.) Risso (77). This species is synonymous with *Helix acuta* Müller.

COCHLICELLA TENUIS Risso (77). Smaller and darker specimens of the last mentioned.

COCHLICELLA MERIDIONALIS (Drap.) Risso (78, fig. 26). Very large specimens of *Helix barbara* Linné, which Bourguignat has confused with *H. acuta*.

COCHLICELLA TURRICULA (Drap.) Risso (78). These specimens have disappeared from the collection. According to Bourguignat they were smaller banded specimens of *H. barbara*.

BULIMULUS RADIATUS (L.) Risso (78). The *Buliminus radiatus* is found locally, in the northern part of the Department.

RUMINA Risso (79). RUMINA DECOLLATA (L.) Risso (79). This is the *Bulimus decollatus* of Bruguière.

Cochlicopa lubrica (L.) Risso (80). The *Bulimus lubricus* of early writers.

FERRUSSACIA Risso (80). Ferrussacia gronoviana (Fér.) Risso (80). This has been described and figured by Bourguignat in his "*Étude Synonymique*," p. 41, pl. 1, figs. 8, 9, 10. The double "r" in the name is doubtless a misprint.

Ferrussacia sayea Risso (80). Risso states that this shell is sinistral, but Bourguignat and I have shown that it is dextral and belongs to the genus *Cæcilianella*.

ACICULA Risso (81). Acicula eburnea (Müll.) Risso (81). A *Cæcilianella* which has been described and figured by Bourguignat, p. 43, pl. 1, figs. 20, 21, 22.

VEDIANTIUS Risso (81). Vediantius eristalius Risso (82, fig. 24). The specimen figured by Risso is an indeterminable *Férussacia*.

ORBITINA Risso (82). Orbitina incomparabilis Risso (82, fig. 23), and Orbitina truncatella Risso (82, fig. 25), are founded on immature specimens of *Rumina decollata*.

CRENEA Risso (83). Crenea vitrea Risso (83). Founded on immature specimens of an indeterminable species of *Cæcilianella*.

SARAPHIA Risso (83). Saraphia uniplicata Risso (83), Saraphia unidentata Risso (84), Saraphia bidentata Risso (84), and Saraphia pleyfelia Risso (84), have disappeared from the collection.

Saraphia tridentata Risso (84). This is a species of *Carychium* which has been figured by Bourguignat (pl. 1, figs. 27, 28), who has given a full description with synonymy.

Clausilia cinerea (Drap.) Risso (85). This is the *Pupa similis* of Bruguière.

Clausilia bidens (L.) Risso (85). This is the *Clausilia solida* Draparnaud, very common in the district, while the *C. bidens* of Linné does not occur there.

Clausilia charlotia Risso (86, fig. 22). This is *Pupa variabilis* Draparnaud.

Clausilia crenulata Risso (86). Mortillet has erroneously compared this with *C. plicatula* Draparnaud, but it is more properly associated with *C. rugosa* Draparnaud, though distinct. The later

C. crenulata Rossmässler (1835) from Dalmatia was renamed by Bourguignat *C. thamnophila*. The latter author, in his monograph of the Clausilias of France, has however figured *C. pyrenaica* of Charpentier under the name of *crenulata* (figs. 11, 12) in which error he has been followed by Locard in his "*Mollusques de France*" (p. 287). I have described the varieties of this species in my "*Faune des Alpes-Maritimes*"

Clausilia marcelia Risso (86). This has been referred to *C. parvula* Studer, by Mortillet, to *C. nigricans* Pulteney, by Bourguignat and I prefer the name of *C. bidentata* Ström, given in 1765,[8] while Pulteney's "*Dorset Catalogue*" dates only from 1799.

Clausilia heterostropha Risso (87) and Clausilia macluriana Risso (87), are merely varieties of *C. solida* Drap.

Clausilia polita Risso (87, fig. 36). This is a good species. Bourguignat referred it to *Pupa multidentata* Moquin Tandon (1855), which is identical with *Turbo multidentatus* Olivi, 1792, but the characters are different and the name *polita* should be retained.

PEGEA Risso (88). Pegea carnea Risso (88, fig. 29). This is a Tunisian *Férussacia*, given to Risso as coming from the environs of Nice. It probably was brought to the port with grain from Tunis which at that epoch was unloaded at Nice. Bourguignat has redescribed and figured it.

JAMINIA (Leach Ms.) Risso (88). Jaminia muscorum (Drap.) Risso (88), and Jaminia marginata (Drap.) Risso (89). These two species are the same thing, namely *Pupa umbilicata* Draparnaud (= *Pupa cylindracea* DaCosta). Bourguignat erroneously identifies the *J. muscorum* Risso with *Turbo muscorum* of Linné and Carl Pfeiffer.

Jaminia edentula (Drap.) Risso (89). This species exists at present in the northern part of the Department. It is a *Buliminus*.

Jaminia secale (Drap.) Risso (89). This is *Pupa secale* Draparnaud.

Jaminia tridens (L.) Risso (90). This is *Helix tridens* of Müller.

Jaminia granum (Drap.) Risso (90). *Pupa granum* Draparnaud.

Jaminia sulculata Risso (90). A broken and unidentifiable species of *Pupidæ*.

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[8] Trondhjems Skrift., III, p. 376, pl. 6, fig. 7.

Jaminia trilamillata Risso (91). No longer exists in the collection.

Jaminia heterostropha Risso (91, fig. 31). From the figure and description this is certainly the *Bulimus quadridens* of Bruguière, but the specimens in the collection now bearing the label of *J. heterostropha* are *Pupa lunatica* of Jan.

Jaminia quinque lamellata Risso (91). This is *Pupa* (*Torquilla*) *similis* of Bruguière.

Jaminia septem dentata Risso (91). *Pupa avenacea* Bruguière.

Jaminia heptodonta Risso (92). Not now to be found in the collection.

Jaminia multi dentata Risso (92). I have determined this to be identical with *Clausilia polita* Risso, (= *Pupa polita*).

Jaminia niso Risso (92). A variety of *Pupa quadridens* Müller.

Auricula myosotis (Drap.) Risso (93). *Alexia myosotis* Mörch.

Pyramidella gracilis (Brocchi) Risso (93), and Pyramidella carinata Risso (94). These two fossil species I leave without comment.

Ancylus lacustris (Müll.) Risso (94). The *Ancylus* which is actually in the collection is the *A. gibbosus* Bourguignat, common at Nice. But Risso's description does not accord with the specimens of the carton labelled *lacustris*. Bourguignat has fully discussed the case in his synonymical study and figured the shell.

Lymnea pereger (Müller) Risso (95). Correct.

Lymnea auricula Risso (95). *Limnæus vulgaris* Carl Pfeiffer.

Lymnea minuta (Drap.) Risso (95). The carton contains a mixture of *L. truncatula* and young *L. palustris* Müller.

Lymnea leachiana Risso (95, fig. 32). *Lymnæa palustris* Müller.

Lymnea labrosa Risso (96). The shell described by Risso is apparently no longer in the collection. The carton is occupied by *Physa fontinalis*, which is not a native of the Department and does not agree with Risso's description.

Phyza fontinalis (L.) Risso (96). This is *Physa subopaca* Lamarck, which is no longer found in the Department.

Phyza hypnorum (L.) Risso (96). This species is rare in the Department.

Planorbis marginatus (Müll.) Risso (97). This is *Planorbis submarginatus* Cristofori and Jan. and, according to Bourguignat, *Helix complanata* Linné (var. B.).

Planorbis carinatus (Müll.) Risso (97). Correct.

Planorbis spirorbis (L.) Risso (97). Very poor specimens which might be *P. spirorbis* Linné, or *P. albus* Müller.

Planorbis vortex (Müll.) Risso (98). Correct according to Mortillet, but the shell has now disappeared from the collection.

Planorbis nitidus (Müll.) Risso (98). The specimens in the collection belong to two species, *P. rotundatus* Poiret, and *P. vortex* Müller. I have not found *P. nitidus* in the Alpes-Maritimes.

Planorbis cristatus (Drap.) Risso (98). Correct.

Planorbis reticulatus Risso (98). No longer in the collection. Moquin Tandon confuses it with *P. albus* Müller, but it is not probable that he was able to examine the type before its disappearance. Risso queries its relation to that species.

BITHYNIA Risso (100). This name was spelled *Bithinia* by Gray in 1821 when he applied it to an undescribed new species (*B. ventrosa*), but in 1824[9] he states that *Helix tentaculata* is the type and names Prideaux as the author of the genus. It is very probable that the English naturalist, Dr. Leach, communicated the name to Risso when he came to pass the season at Nice in 1820. Many authors write *Bythinia*, deriving the name from the Greek word signifying "those who live at the bottom of the water."

Bithynia jaculator (Müll.) Risso (100). This is the *Helix tentaculata* Gmelin, very common in the Department.

Bithynia meridionalis Risso (100, fig. 28). *Amnicola similis* (Drap.).

Valvata planorbis (Drap.) Risso (101). Bourguignat notes three species in this carton, *V. piscinalis* Férussac père, *V. spirorbis* Draparnaud, and a species near *V. cristata* Müller. The latter has never been announced from the Alpes-Maritimes.

Valvata minuta (Drap.) Risso (101). Extremely young specimens of *Bithinia tentaculata* Linné.

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[9] Phil. Mag. & Journ., lxiii, 1824, p. 277.

VALLONIA Risso (101). If the circulation of Leach's proof sheets between 1820 and 1823 constituted publication, his name *Zurama* would take precedence of *Vallonia*, but this view has not generally been accepted and is not in accordance with the international rules for nomenclature. There seems to be no doubt, however, that the proof sheets were communicated to several of Leach's correspondents and some of his names thus came into use before the effectual publication of his manuscript by Gray in 1852.

VALLONIA ROSALIA Risso (102, fig. 30). Under this name Risso included, as did many other naturalists before and later, *Helix pulchella* and *H. costata* of Müller, which are now accepted as distinct species.

LEACHIA Risso (102). The name *Leachia* had already been applied to a cephalopod by Lesueur in 1821.

LEACHIA VIRIDESCENS Risso (102, fig. 35), LEACHIA CORNEA Risso (102, fig. 33), LEACHIA VITREA Risso (103), and LEACHIA LINEOLATA Risso (103). These four species are very puzzling. Bourguignat was uncertain, and only gave a decided opinion in regard to *L. lineolata* which he regarded as the *Cyclostoma patulum* of Draparnaud (var. A) a species of *Pomatias*. Gustave Dollfus believed that Risso had in hand the *Hydrobia acuta* (Draparnaud), and that the first two of his species should be united, differing only in color. The third species, as Locard has admitted, may be the *Belgrandia vitrea* (Draparnaud). I think after an examination of these little shells that Dollfus is right.

CYCLOSTOMA ELEGANS (L.) Risso (103). Correct.

CYCLOSTOMA AFFINIS Risso (104). Risso's carton carries both *C. elegans* and *C. sulcatum* Draparnaud. I have only found this species, living, on the right bank of the Var between Mougins and Antibes, but apparently on the road to extinction. It occurs fossil in the quaternary deposits of the region.

CYCLOSTOMA OBTUSUM (Drap.) Risso (104). Very young specimens of *Cyclostoma sulcatum* Draparnaud.

CYCLAS VITREA Risso (338). This is *Pisidium casertanum* Poli, according to Bourguignat.

CYCLAS AMNICA (L.) Risso (338). *Pisidium amnicum* of authors.

Having passed in review all of Risso's fresh-water and terrestrial species, it should be clearly understood that he had made known

only a small portion of the fauna of the Department, which is certainly one of the richest and most interesting in France, giving asylum on the plains and lowlands near the coast to mollusks requiring a warm habitat; while on the mountains and the high ranges species peculiar to cold and very cold regions find a congenial home.

DIPTEROLOGICAL NOTES AND DESCRIPTIONS.

BY EZRA T. CRESSON, JR.

This paper is a collection of notes on, and descriptions of, North American Diptera, made at various times while working over material sent to the writer for determination. It may here be explained that the data within brackets, [ ], refer to the owners of the material in question.

STRATIOMYIDÆ.

Zabrachia magnicornis new species.

Similar to *polita*, but differing in having the frons more curving, without the median longitudinal sulcus; the antennæ are much larger, the scutellum more strongly developed, and the legs darker.

♀. Black; antennae brownish, appearing lighter from the dense, appressed, pubescense or minute granulations. Halteres white with stalk fuscous. Apex of femora, entire middle and hind tibiæ, tawny; apex of fore tibiæ, and tarsi, darker; middle and hind tarsi yellow. Wings hyaline. All pile white and appressed, sometimes appearing silvery. Ovipositor yellow. Frons not sulcate medianly, convex and distinctly protruding above. Antennæ typical but large, situated in the depressed portion of the face and lower frons; third joint nearly as broad as the frons, twice as broad as long; arista straight, two and a half times as long as third. Scutellum strongly convex and subtuberculate above. Stigma hardly twice as long as broad; discal and posterior veins colorless. Length, 3.5 mm.

Type.— ♀ ; Alamogordo, New Mexico, June 6, 1902, (Viereck & Rehn), [A. N. S. P. No. 9192].

A male (2 mm. long) from the same locality may belong here, but in general appearance it seems as though it should be associated with *polita*. However, in the short stigma and third vein it suggests the present species. In this male the head is nearly round in profile. Antennæ dark tawny. All pile erect and white, otherwise similar to *polita*. Apices of all femora all tibiae and tarsi, yellow.

A small female (head wanting) seems to agree with this male in all respects as to color.

EUPARHYPHUS Gerst.

The furcation of the third vein is apparently of no specific value; a female of *tetraspilus* from Aweme, Manitoba, Canada (E. Criddle,

June), has the furcation in one wing but not in the other. Perhaps *bellus* Loew is only a synonym of *tetraspilus* Loew. The extent of yellow, or even the presence or absence of such, on the scutellum is a variable character.

Euparyphus quadrimaculatus new species.

I cannot remark on the relationship of this species on account of the lack of material in this genus. It runs, in Adams's table (*Kans. Univ. Quart.*, II, 28), to *crucigerus* Coq., or *atriventris* Coq., but the abdominal markings are different.

♀. Eyes bare. Head yellow, with occiput except orbits, ocellar transverse band, an orbital spot and a fine dash above antennæ on frons, and antennæ, black. Two brown facial stripes covered by the broad silver along orbits. Cheeks and lower post. orbits silvery. Mesonotum black, with yellow as follows: Two median irregular or interrupted stripes, originating from spot above humeri, but not attaining posterior margin; broad lateral margins including upper half of pleura, but interrupted above base of wings. Scutellum and spines, and halteres also yellow. All pile short and white. Dorsum of abdomen black; lateral margins, a large lateral spot confluent with margin on third segment, and smaller, similar spots on apical margin of fourth, entire fifth, and venter, yellow. Legs yellow, with fore tarsi, hind tibiæ above, four apical joints of middle and hind tarsi, black; base of middle and of hind tarsi white. Wings hyaline with veins and stigma yellow. Mostly micro-granulose. Frons with parallel orbits. Face not prominent at antennæ. Antennæ not longer than head, with first and second joints subequal. Scutellum short, two or three times as broad as long. Third vein short, not furcate; costal distance between stigma and third not longer than stigma, and hardly longer than discal cell; four posterior veins faintly distinct, the last arising near base of discal cell. Length, 4 mm.

Type.— ♀; Alamogordo, New Mexico, June 6, 1902, (Viereck & Rehn), [A. N. S. P. No. 6202].

A male from Santa Clara County, California, June, (W. M. Giffard, No. 7), [Cal. Ac. Sci.], is similar but the upper pleural band is narrower.

AOCHLETUS O. S.

The discovery of two species evidently belonging to this genus, but having the eyes pilose, necessitates including other characters, or establishing the genus upon other than those used heretofore, especially in Williston's "Manual." Osten Sacken ("Biologia," i, 38)

was correct in recognizing the antennæ as holding the most important characters in this genus. Three species have been placed in the genus of which I have seen but one, although all seem to agree in the general form of the antennæ and in having the eyes bare. Both *cinctus* O. S. and *bistriatus* Will., are more or less yellow vittate on mesonotum. The former having the face and frons also yellow, while *obscurus* Coq. has the mesonotum entirely black and no yellow on the entire body, although somewhat fuscous beneath the antennae. *Obscurus* also differs from the others in having two polished gibbous calli above the antennæ; the scutellar spines are short, closely approximate with tips curving up. The two species described below differ from all in having the eyes pilose.

The antennæ in this genus, typically, have the first and second joints short, subequal, about as long as broad, or somewhat longer; the third composing of six to eight closely united segments, of which the first three or four are as stout or stouter than the second joint, each about as broad as long, the last tapering to the slender apical segments which seem to vary in length with the different species, and are tipped with one or more minute hairs.

Aochletus albopilosus new species.

This and the following species are apparently allied to *obscurus* Coq., but there are no calli on the frons and the scutellum is broader with well separated spines.

♂. Black; margin of abdomen, knees, and bases of tarsi brown. Halteres white. Eyes black pilose. Pile of ocellar tubercle black, of face black and white, erect. Frontal triangle, facial orbits and post. orbits with appressed white pile. Thorax and scutellum with erect white pile, and appressed silvery white tomen, which on mesonotum leaves three longitudinal bare stripes appearing black. Abdomen with sparse erect pile and tomen as on the mesonotum, leaving the bases of segments bare and black; venter likewise clothed. Legs sparsely white pilose. Head broader than high, and slightly higher than long. Eyes contiguous for nearly full length of frons from the prominent ocellar tubercle; line of demarcation of facets distinct and opposite antennæ. Face short, broad, convex, but not prominent. Antennæ situated slightly below middle of profile, as long as head; third joint more than twice as long as first two together, of about six segments. Thorax robust, slightly longer than broad. Scutellum broader than long, broadly truncate, with two long well separated spines. Abdomen round; lateral margins sharp and thin.

Legs slender, normal. Third vein furcate near tip; four posterior veins of which the last arises at base of discal cell. Discal cell as long as stigma. Length, 8 mm.

Type.—♂; Alamogordo, New Mexico, May 13, 1902, (Viereck & Rehn), [A. N. S. P. No. 6193].

Aochletus nigropilosus new species.

Similar to *albopilosus*, but all erect pile black except a little on the face. Antennæ shorter and stouter, and the scutellum broader with the spines more broadly separated. Length, 9 mm.

Type.—♂; Sonoma County, California, July, [A. N. S. P. No. 6194].

Neorondania scutellata new species.

♂. Black, slightly steel blue, shining; frontal triangle, first, second, and base of third antennal joints, scutellum and spines, apices of femora, yellow or tawny. Halteres and bases of tarsi, white. Eyes black pilose. All erect pile black except on occiput and lateral tufts on second abdominal segment. Otherwise marked with appressed white pile as follows: Face, especially the orbits, three mesonotal vittae interrupted at suture, supra-alar dash, posterior mesonotal margin, notopleural spot, pleura, lateral transverse spot on abdominal segments three and four, larger lateral spot on fifth, venter and more or less of femora and tibiæ. Eyes (moistened) with three horizontal purple lines. Head hemispherical. Eyes contiguous. Face convex above, depressed below. Antennæ as long as head; first joint twice as long as second; third quadrate, three and a half times as long as first and second together. Scutellar spines as long as scutellum, of light color and long black pilose. Abdomen broadly rounded, minutely granulose discally, with distinct impressed sutures. Legs slender, but hind femora somewhat flattened and enlarged beyond middle. Wings brownish hyaline; stigma and cross veins below, faintly fuscus. Length, 8–10 mm.

♀. Similar, but eyes bare. Head entirely tawny; frons as wide as length of first and second antennal joints together. No erect black pile, but design of appressed white pile as in male.

Type.—♂; Costa Rica, (W. M. Gabb), [A. N. S. P. No. 6195]. *Paratypes.*—4 ♀; topotypical.

Actina canadensis new species.

This species is readily distinguished from *viridis* Say by the low situated antennae, which is also shorter and more robust than in that

species. It is further characterized by the dark scutellar spines and the longer stigma. The latter in *viridis* is but little longer than the discal cell and but half again longer than broad.

♀. Similar to *viridis* Say. Frons shining, black with slight greenish tinge, sparingly short white pilose. Face more shining, black with long white pile. Palpi black. Antennæ situated below middle of profile, so that the frons is twice as long as the face, black with basal annulus of third joint brownish and distinctly swollen. Thorax and scutellum shining metallic green, becoming black below, sparingly yellow pilose; spines of the latter also metallic colored. Abdomen shining black. Legs yellow, but fore coxæ and four apical joints of tarsi black. Wings brownish, veins darker; stigma about twice as long as discal cell, and twice as long as broad. Length, 6 mm.

Type.— ♀ ; Aweme, Manitoba, Canada, July 24, 1911, (E. Criddle), [A. N. S. P. No. 6196].

TABANIDÆ.

Silvius jonesi new species.

In general appearance this interesting species does not suggest any affinity with *gigantulus* Loew, but more critical examination makes it reasonably certain that it belongs to a group including that species and is very distinct from any yet described, to my knowledge. It is much larger than that species and the abdomen has black or dark bases to all segments. The tibial and antennal characters certainly place this species in *Silvius*, although in general appearance it suggests some of those in *Pangonia*. The eyes are uniformally green when moistened.

♂. Black; antennæ except four black terminal annuli of third joint, palpi, abdomen except dark bases of dorsal and ventral segments especially towards apex of abdomen, femora except bases, bases of tibiae, tawny or brown. Halteres pale. Wings blackish, more intense along costa. Subopaque. Yellow pruinose above, becoming gray below. All pile on head and thorax yellow and rather abundant, also on the narrow apices of abdominal segments; the broad bases of the segments with appressed black pile, similar on venter. Femora with pale pile which on the tibiæ becomes darker. Pile on first antennal joint and base of palpi, yellow; on second, and apices of palpi, black. No mesonotal vittae. No denuded areas on face. Proboscis not longer than head, and palpi is slightly more than half as long as proboscis. First antennal joint twice as long as second; third twice as long as first and second together; the

thickened basal annulus nearly broad as long, the following annuli together as long as the basal one. Neuration as in *gigantulus*. Length, 17 mm.

♀. Similar but frons twice as broad as width of antennæ, entirely pruinose. Mesonotum more grayish.

Type.—♂; Keddie, Plumas County, California, July 6, 1918, (F. M. Jones), [A. N. S. P. No. 6197]. *Paratype.*—1 ♀; topotypical.

LEPTIDAE.

Arthropeas jonesi new species.

Differs from *americana* Lw., and *magna* Johns., the other known species, in having the legs entirely black. In build resembling *magna*, with a median globose swelling on the face similar to that in *Chrysopila* and nearly visible in profile. *Jonesi* probably represents a distinct genus or subgenus.

♂. Black; antennæ, palpi, and halteres pale, also a small spot on humeri. All pile black and rather long and abundant, including the cilia of the white squamæ. Face, and sparingly on mesonotum, grayish pruinose. Wings blackish, becoming more intense along costa. Thorax and abdomen, shining. First and second antennal joints short, subglobose; third, three to four times as long as first two together, and broader than second, gradually tapering to a minutely truncated apex, bearing a few hairs, not a terminal style, composed of eight annuli, of which the basal and apical ones are longer and subequal. Fore tibiæ with one small apical spur, middle and hind ones with two each. Length, 13 mm.

Type.—♂; Keddie, Plumas County, California, June 6, 1918, (F. M. Jones), [A. N. S. P. No. 6198].

Chrysopilus nudus new species.

This species suggests *flavibarbis* Adams, but the mesonotum of the female is not velvety and the pile and tomen are not yellow.

♂. Black; stalk of halteres, tibiae and bases of tarsi, pale. Wings slightly brownish. Opaque, grayish. Mesonotum dorsum, broad bases of abdominal segments, brownish. All pile and tomen sparse and white. Antennæ bare. Eyes narrowly separated. First antennal joint shorter than second. Palpi long, falciform, white pilose. Branch of third vein originating opposite end of first vein. Length, 5 mm.

♀. Similar, but stouter. Frons broad and brownish medianly. Mesonotum with a broad median stripe and two large sublateral

spots brown. Hind femora sometimes pale. Branch of third vein originating before tip of first; anal cell closed before margin.

Type.—♂; San Jacinto, California, May 29, 1917, (E. P. Van Duzee), [Cal. Acad. Sci.]. *Paratypes.*—1♂, 2♀; topotypical.

Chrysopilus dilatus new species.

Differing from all known species by the enlarged first antennal joint. Thus suggesting *Symphoromyia* but the arista is terminal and the anal cell is closed.

♂. Black; stalk of halteres, knees, tibiæ and bases of tarsi, paler. Opaque. Blackish brown, with face, pleura below, and venter more grayish. Erect pile of ocellar tubercle, face, palpi, antennæ, mesonotum, scutellum, sternopleura, fore coxæ, and femora, black; of occiput, pteropleura, and abdomen, pale. Sparse tomen on mesonotum, abdomen and femora, pale yellow or whitish. Wings hyaline; stigma brown. Eyes narrowly separated or contiguous. First antennal joint much enlarged, twice as long as second and third together, nearly as broad as long, with dense, long pilosity. Palpi long, falciform, densely long pilose. Anterior branch of third vein originating before tip of first vein. Anal cell closed before margin. Length, 6 mm.

Type.—♂; Berkeley Hills, Alameda County, California, April 11, 1908, (E. T. Cresson, Jr.), [A. N. S. P. No. 6199]. *Paratypes.*—2♂; topotypical.

BOMBYLIIDÆ.

Exoprosopa fumosa new species.

This species suggests some of those belonging to *Poeciloanthrax*. It belongs to the group, in this genus, having the second abdominal segment black tomentose. The wings are fumose with the cells in the inferior part of the wings sub-hyaline.

♀. Black; oral margin and scutellum, paler. Knob of halteres whitish. Pile black on: head, disk of mesonotum, scutellum, pectus, apex of abdomen. Yellow on: collar, lateral mesonotal margins, meso- and meta-pleura, lateral margins of abdominal segments 1–5. Tomen all yellow except dorsum of second abdominal and bases of third to fifth segments. All bristles black. Wings uniformly brown except subhyaline areas in: apex of marginal, apex of first submarginal, second and third submarginals, discal, second to fourth posteriors, anal, and axillary. (In other words, the veins traversing the subhyaline inferior portion of the wings are broadly clouded

with brown.) Style one half as long as third antennal joint. Face conical; epistoma narrow, pilose. Proboscis not protruding. Fore tibiæ slender, bare; hind femora slender, with long bristles. First posterior cell open. Length, 9 mm. Wings, root to tip, 18 mm.

Type.— ♀ ; Nogales, Sonoma, Mexico, August 12, 1906, (P. P. Calvert), [A. N. S. P. No. 6200].

Exoprosopa jonesi new species.

Allied to *doris* O. S., but the antennae are entirely black, and the second band of the wings is more extensively developed towards the margin. In the paratype this band broadly attains the margin. The yellow tomentose design of the abdomen suggests *grata* Coq.

♀. Black; lower frons, face, scutellum, lateral abdominal margins, venter, femora, tibiæ, bases of tarsi, tawny. Club of halteres pale. Wings with bases of first and second basals, anal, and axillary cells, hyaline. Bases of first submarginal, first posterior, discal, third and fourth posteriors, and more or less of apices of anal and axillary cells, infuscated. Second band of infuscation includes base of second posterior nearly to margin along the veins. Base of third submarginal also infuscated, but apex of marginal is hyaline. Pile black on: frons, face in part, first and second antennal joints, mesonotum; lateral margins of second and following abdominals slightly mixed with black, pale. Pile pale on face in part, collar, mesonotum laterally, pleura, coxæ, lateral margins of first abdominal segment and venter. Tufts of white pile above and below roots of wings. All tomen yellow except silvery along orbits, and black on some parts of pleura and on apices of second to fifth abdominal segments; also medially almost to bases of third to fifth segments, becoming stronger on base of fifth. No white tomen on abdomen except some on venter, but that on the second segment is slightly paler than on the other segments. Tomen on legs yellow. Second antennal joint twice as long as first; third as long as first two together, long, conical; style rather thick and slightly flattened, a fourth to a third as long as third joint. First posterior cell open. Tooth of claws small. Length, 12 mm.

Type.— ♀ ; Keddie, Plumas County, California, July 3, 1918, (F. M. Jones), [A. N. S. P. No. 6214]. *Paratype.*—1 ♀ ; topotypical.

These specimens were captured hovering over nests of a species of *Bembex.*

Exoprosopa (Exoptata) ingens new species.

Similar to but much larger than *divisa* Coq. The pile of the mesopleura is mostly black as is also the tuft beneath the wings.

The legs are entirely black. The wing pattern is more extensively developed, and the cross veins not noticeably subhyaline.

♀. Black; frons and face, first and second antennal joints (third wanting), scutellum, second and third abdominal segments laterally, bases of ventral segments, tawny to rufous. Knob of halteres pale. Wings brown or grayish brown, hyaline as follows: apex of marginal cell to base of second submarginal, apex of first submarginal, entire second and third submarginal, apices of first to fourth posteriors, and large median area in discal. Somewhat subhyaline areas on the cross-veins. Opaque. Pile black on: frons, face, first and second antennal joints, mesonotum, humeri, notopleura, mesopleura below, pteropleura, lateral margins of second and following segments, apex of abdomen, fourth and following ventrals, and all coxæ. All bristles black. Pile yellow on: collar, upper mesopleura, lateral margins of mesopleura, scutellum laterally, propleura, sternopleura, and lateral margin of first segment. Pile white on roots of wings, and second and third abdominal segments. Tomen mostly yellow, but black on: legs, broad apex of second abdominal, narrow apex of third, all of fourth and fifth except basal angles, medianly on sixth and seventh, and fourth and following ventrals. Narrow base of second abdominal, yellow; broad base of, third especially laterally, whitish; second and third ventrals white. Posterior orbits whitish.

Structurally same as *divisa* (by comparison with my specimens of that species) but more robust. Length, 20 mm.

Type.— ♀ ; Florence, Arizona, (C. F. Biedermann), [A. N. S. P. No. 6201]. *Paratype*.—1 ♀ ; topotypical.

Anastoechus barbatus.

1877. Osten Sacken, Bul. U. S. Geol. Surv., III, 252.

The species of this genus are easily separated from those of *Systoechus* by the thick, facial pile. Material before me consisting of 11♂, 14♀, from Long Island, N. Y., North Carolina, Texas, Colorado, and New Mexico, fall into two groups. One having the knob of halteres pale yellow, the other with the knobs black or brown. There seems to be no corelation of these characters with the difference in locality. The only two from the eastern Atlantic region have the knobs pale; others from Colorado and Texas have the same.

A male from Europe, determined as *nitidulus* Fab., has a distinct, dorsal median line of dense white tomen on the abdomen which is not present in any of the other males before me from the

above cited localities. As this character may be typical of *nitidulus*, we had better adhere to Osten Sacken's name for our form.

Spogostylum vierecki new species.

Similar to *vandykei* Coquillett. Pile of face black, but a few pale hairs near oral margin, margins of mesonotum, and pleura mostly black. Thorax, scutellum, and abdomen with yellowish white tomen. The wings also differ from each other in their maculation.

♂. Black; tibiæ, bases of tarsi, knob of halteres, lateral margins of abdomen, part of venter, and genitalia, tawny. Wings hyaline; basad of humeral cubital vein, middle spot in first basal, veins at bases of first, second and third submarginals, first and fourth posteriors, broadly clouded. Costa to tip grayish. Opaque; mesonotum slightly shining. Pile of head black, with slight mixture of pale along oral margin. Collar and pleural pile pale. Some stiff black hairs or bristles along margins of mesonotum, of scutellum, and on pleura at roots of wings. Pile of lateral margins of first abdominal segment white, of remainder of abdomen, black. Legs with black bristles. Tomen pale yellow on: head, thorax, scutellum, and legs. On second and following abdominal segments, nearly white, and dense. Three or four spots of black tomen on apical margins of second to fourth segments. Structurally normal of *Argyramoeba*, with veins connecting second and anterior branch of third veins; fifth vein between discal and third posterior cells withan angulation, sometimes with a small stump into latter cell. Length, 6–9 mm.

♀. Similar, but the tomen of abdomen is mostly yellow with the series of black spots more pronounced on other segments.

Type.—♂; Alamogordo, New Mexico, April 25, 1902, (Viereck & Rehn), [A. N. S. P. No. 6203]. *Paratypes.*—3♂, 6♀; topotypical, 7♂, 1♀; El Paso, Texas, April 4–5, 1902, (Viereck & Rehn).

ANISOTAMIA Macq.

1840. Macquart, Dipt. Exot., II, (1), 81.

Some confusion exists regarding the validity of this and *Ogcodocera* Macq. (1840). There is general agreement that the two may be synonymous, and for the present they had better be considered so. Becker[1] tries to separate them, but apparently, judging from an examination of his descriptions and table, he did not know either material or literature regarding these genera. *Anistomia* has priority

[1] 1913. An. Mus. Zool. Ac. Imp. Sci. St. Petersb. XVII, 421–502. 1912.

of two pages over *Ogcodocera* (= *Oncodocera* O. S., 1878) and so must be used for our species. Further study of material from all countries will probably result in a different nomenclature for our forms. North America has *Mulio leucoprocta* Wied. (1828), *Anthrax valida* Wied. (1830), and *Anisotomia fasciata* Will. (1901), now credited to this genus.

Genotype.—*Anisotamia ruficornis* Macq. (1840). [Coq. 1910].

EPACMUS O. S.

I should keep this genus separated, at least subgenerically, from *Aphoebantus* on account of the projecting face.

Epacmus modestus Loew?

1872. *Leptochilus modestus* Loew, Berl. Ent. Zeit., xvi, 77. (Cent. x, 40.)

A female from Alamogordo, New Mexico, May, (Viereck), apparently belongs to this species, but the bristles of the hind margin of mesonotum (not of postalar calli), and scutellum are black. Lower part of face is polished. Pile and tomen of occiput, pleura and venter, white; of mesonotum and scutellum, yellow. Scutellum not noticeably emarginated. Length, 8 mm.

Epacmus pallidus new species.

Similar to *modestus*, according to description, in having the eyes contiguous, but differs in having the palpi pale and lacking the black bristles or tomen on the abdomen.

♂. Black; oral margin, palpi, halteres, part of genitalia, tibiæ, bases of tarsi, pale tawny. Wings clear, veins yellow. Opaque, with two polished swellings on apex of scutellum. All bristles pale. Pile except on ocellar tubercle, and tomen on thorax and abdomen, white or slightly yellowish. A dorsal, median transverse fascia of brown tomen on segments 2–5, not attaining lateral margins (absent in some specimens). Genital segments not tomentose. Eyes contiguous for about a distance equalling length of ocellar tubercle. Third antennal joint longer than first and second together, gradually attenuating to a rather truncate apex which bears a short style. Face projecting beyond second antennal joint. Proboscis projecting equal to length of antennae. Scutellum emarginated. Length, 4–5 mm.

♀. Similar but pile on frons above dark. Third antennal joint more slender apically.

Type.—♂; El Paso, Texas, April 5, 1902, (Viereck & Rehn), [A. N. S. P. No. 6204]. *Paratypes.*—3♂, 1♀; topotypical.

ECLIMUS Loew.

1844. Loew, Stet. Ent. Zeit., v, 154.
1877. *Epibates* Osten Sacken, Bul. U. S. Geol. Surv., III, 268.

A large number of species of this genus have been described from our fauna, and it may be inadvisable to add to the list, especially as most of the species described are represented by only one sex. Some of the species seem to be sexually dimorphic, which is more reason why care should be taken in describing new forms. The two species herein described are apparently represented by both sexes.

Eclimus laniger new species.

Apparently near *funestus* O. S., but no mention is made in the description of that species of the conspicuous golden yellow, appressed, wooly hair of the mesonotum and abdomen which is present in this species. It is also not likely that the present species is conspecific with the eastern *funestus*.

♂. Black; squamæ, stalk of halteres, pale. Legs light to dark brown. Wings brownish, becoming more intense along costa beyond anterior cubital vein, and diluting to hyaline basally especially in anal cell. There is a distinct infuscation in submarginal above anterior cubital vein where the wing is slightly wrinkled. Opaque, velvety black. Frons, face slightly, cheeks, occiput below, pleura, white to gray. Pile black on ocellar tubercle, upper occiput, face, first and second antennal joints, mesonotum, pleura above, scutellum, and fourth and following abdominals. White on cheeks and occiput below, pleura below, and venter of first to fifth segments. First to third abdominal segments yellowish laterally. Mesonotum, scutellum, abdomen (especially apices of first to fifth segments) sparsely golden yellow lanuginose. All bristles black, also tuft of metapleural pile. Head not much broader than high, hemispherical in profile. Eyes contiguous for nearly full distance to antennæ. Third antennal joint longer than first and second together. Mesonotum distinctly mucronate, but costa smooth. Length, 7–9 mm.

♀. Similar, but all pile except on frons white. Infuscation of wings more even except that the stigma, marginal, and first basal cells are more intense, and there is some clouding on the cross veins; second basal, anal, and axillary cells hyaline.

Type.—♂; Mesa Grande, Sonoma County, California, June, 1908, (J. P. Baumberger), [A. N. S. P. No. 6205]. *Paratypes.*—1♂, 1♀; topotypical.

Eclimus yosemite new species.

The two specimens representing this species are so different in coloration that, were they not taken at the same place and time, one would be certain to consider them distinct species. Of course, it is possible that they are distinct, but it would be inadvisable to consider them as such. The male differs from the description of *luctifer* O. S., in that the mesonotum is not mucronate. The female differs from *magnus* O. S., in that the pile of the mesonotum is white.

♂. Black; squamæ and stalk of halteres, pale. Wings nearly uniformly intense brown, becoming most intense along costa, with slight dilutions basally towards axillary cell, Opaque, velvety black, but oral and scutellar margins shining. All bristles black. Pile black on ocellar tubercle, first and second antennal joints, frons, face, occiput medianly as a continuation of the notopleural stripe, lateral margin of abdomen, all of sixth and following segments, ventral segments, and legs. White on cheeks, occiput below, pleura, metapleural tuft, and squamæ. Yellowish on occiput above, mesonotum, scutellum, dorsum of segments one to five. Some pile on mesonotum laterally; apices of abdominal segments one to five, wooly and somewhat appressed. Head much broader than high, subhemispherical in profile. Eyes separated for about width of first antennal joint. Third antennal longer than first. Mesonotum not mucronate. Costa smooth. Length, 8 mm.

♀. Similar but larger (12 mm.) and more robust. Wings dilute brown, becoming intense at costa and on anterior cubital vein. Bristles pale. Pile on occiput above, mesonotum, scutellum, squamæ, metapleural tuft, and dorsum of segments 1–4, white, and generally long, becoming appressed and curly on lateral mesonotal margins and apical margins of abdominal segments. All other pile on head, pleura, venter, and fifth and following segments, black and abundant. Length, 12 mm.

Type.—♂; Yosemite Valley, California, May 22, 1908, (E. T. Cresson, Jr.). [A. N. S. P. No. 6206.] *Paratype.*—♀; topotypical.

GERON Meigen.

Were it possible to have all material of this genus in perfect, unabraded condition, there might be some chance of finding more characters of differentiation than one is able to do with the specimens usually met with in collections. The study and examination of the small amount of material before me, however, gave some results worthy of note, and which will at least separate several species

without much trouble. The types of Loew, Coquillett, and others, should be studied in conjunction with the few notes given below in order to fix more definitely the status of some of the species of those authors. To eliminate the chances of misidentification, I give new names to the forms herein described, knowing full well that there is a possibility of synonymy regarding some of them.

The form of the genitalia of the male and of the seventh ventral segment of the female, offers the most satisfactory characters for separating several species, or, possibly, groups of species. The venation, with one exception, offers no usable characters, but the color of the vesture may prove to be more valuable if perfectly preserved specimens are available for study. In other respects, in structure and color, there seems to be very little of value. The genitalia of the male offers two distinct types, which may, on more detailed study, show still other characters of value. The organs mentioned are generally well exposed and easily seen. One type has the "claspers" well developed, paired, upper and lower, finger-like. The other type has no distinctly developed "claspers," but the parts corresponding to these are developed into a polished, chitinous, half disk-like organ, with a rosette of two to four thorn-like processes or filaments. As mentioned above, there are probably, within these two types, other characters which may prove valuable. In the present study this detailed examination is not undertaken.

Geron digitaria new species.

♂. Black; oral margin, halteres including stalk, squamæ, bases of wings, pale yellowish. Tibiæ brownish. Opaque. Frons, face, occiput below, lateral margins of mesonotum, pleura, venter, femora, gray to white pruinose. All pile silvery white, becoming slightly dusky on dorsum where it is sparse. Dorsum also sparsely golden lanuginous, becoming silvery below. First antennal joint black, pilose. Third longer than first two together, slender, conical. Ultimate section of fourth vein longer than preceding. Claspers of hypopygium finger-like. Length, 5 mm.

Type.—♂; Highrolls, New Mexico, June 11, 1902, (Viereck), [A. N. S. P. No. 6207.]

A series of eight males from New Jersey, Pennsylvania, Maryland, Delaware, and Virginia, varying in size from 3–5 mm. are apparently conspecific. The pile on the dorsum, when present, is generally golden brown. A series of seven females from Pennsylvania and Maryland may be associated with the above males, and are similar,

with the frons brown and golden lanuginose medianly; orbits cinereous. The seventh ventral with sublateral, rounded lobes, which, at most, slightly overlap.

The above specimens may be *subaurata* Lw., or *vitripennis* Lw., while *albipennis* Lw., may be represented by a series of 6♂, 12♀ from Cloudcroft, (May), Alamogordo, (April), Highrolls, (June), East Las Vegas, (June), all of New Mexico, and Ysleta, Texas, (April), this specimen differing from the above as follows: Dorsal pile white; the lanuginose vesture not so yellow, that of the frons in ♀ being entirely silvery.

The two forms seem to be more or less intergradant but may prove to be distinct species upon more detailed study.

Geron digitaria var. **robusta** new variety.

Ranging larger than the typical form, and very similar except that the pile of first antennal joint is white; of the dorsal surfaces of the body, golden yellow as is also the lanuginose vesture above. The lobes of the seventh ventral are somewhat pointed and are more distinctly developed, apparently as separated developments of the ventral segment. The male of this form may be difficult to separate from those of *digitaria*, but the female certainly represents a distinct variety. Length, 5–7 mm.

Type.—♀; Hancock, Maryland, August 15, (F. R. Cole), [A. N. S. P. No. 6208]. *Paratype.*—1♀; topotypical.

Geron nivea new species.

Similar to *digitaria* but all pile snow white; the lanuginose vesture white and yellow mixed on the dorsum; middle tibiæ pale. Genitalia of male broad when seen from above, with a lateral, subapical, conical tubercle and a lateral subbasal spine-like filament. The females have no golden tomen on the frons, and the lobes of the seventh ventral overlap, appearing as a ventral segment.

Type.—♂; East Highlands, California, September 15, 1914, (F. R. Cole), [A. N. S. P. No. 6209]. *Paratypes.*—1♂, 1♀; topotypical. A male from Alamogordo, New Mexico, April, (Rehn & Viereck), seems to be conspecific.

A series of 6♂, 3♀, Manayunk, Pennsylvania, Jamesburg, New Jersey, and Linnieville, Maryland, July, (R. C. Shannon), are probably a variety of this species. The dorsal pile is yellow and the lanuginose vesture yellow.

Phthiria psi new species.

This form runs to *divisa* in Coquillett's table (*Trans. Amer. Ent. Soc., xxi, 102*) but differs considerably from that species.

♀. Yellow, with black as follows: Spot on ocelli, frons medianly, tip of third antennal joint, proboscis, three broad, more or less coalescing mesonotal stripes, the lateral ones abbreviated anteriorly and somewhat interrupted at suture, the median one abbreviated posteriorly also, spot on mesopleura, sternopleura and on hypopleura, and apices of tarsi. Wings hyaline. Pile sparse, short and pale. Head much broader than long. Vertex one-third width of head. Proboscis extending twice length of head; palpi a little beyond epistoma. Costal length between second and fork of third three times that between first and second; anterior cross vein far beyond middle of discal cell. Length, 3.5 mm.

Type.—Redlands, California, 1912, [F. R. Cole Coll.].

In some specimens the frons may prove to be dark medianly and the abdomen shows dark bases to segments.

Lordotus divisus new species.

Distinguished from all known species by the entirely black pile on the thorax and abdomen.

♂. Black; knob of halteres and squamæ whitish yellow. Wings clear; veins yellow; antecostal cell black. All pile black, becoming brownish on scutellum. Cilia of squamæ alaris white, of squamæ thoracalis brown. First antennal joint nearly as long as third; second not longer than broad. Proboscis extending in length equal to that of head and thorax together; palpi as far as second antennal joint. Length, 6–8 mm.

Type.—♂; Alamogordo, New Mexico, April 30, 1902, (Viereck), [A. N. S. P. No. 6215].

Heterostylum vierecki new species.

Differing from *robustum* O. S., in having the scutellum black, and the pile of the second abdominal segment wholly black. Differing from *sackeni* Will., in having the facial pile white.

♂. Black; face, halteres, fourth and fifth abdominal segments excepting a medial stripe, fore and middle tibiæ, pale. Wings entirely brown, becoming diluted along inferior margin. Pile black on ocellar tubercle, frons, first antennal joint, scutellum in part, all on second, sixth and genital segments, third except basal row, medially on segments 4–5, and most of venter. White on face, occiput, pleura, first abdominal segment. Yellow on mesonotum, scutellum in part, and remainder of abdomen, but on latter mixed with white. No bristles except the red ones at roots of wings. Opaque. Frons, face, first

and second antennal joints, occiput and pleura, gray to white pruinose. Mesonotum rather brownish. Scutellum slightly shining. Femora and tibiæ yellow tomentose. First antennal joint one-half as long as third; second globose; third gradually tapering to a minutely styled apex. Proboscis extending, in length equal to head and thorax together. Palpi short. Length, 7–9 mm.

♀. Similar, but pile on mesonotum mostly black.

Type.—♂; Alamogordo, New Mexico, April 22, 1902, (Viereck), [A. N. S. P. No. 6216]. *Paratypes.*—1 ♂, 1 ♀; topotypical. 4 ♀; El Paso, Texas, April 5–26, 1902.

The series shows little variation. The line of fine white hairs of the third abdominal segment is sometimes wanting, and the black pile of the fourth segment sometimes extends to basal half; the pale pile limited to the mixture on the lateral margin and on the pale ground-part of the fourth and fifth segments.

Bombylius facialis new species.

♂. Black; face brown; halteres whitish; apices of middle and hind femora, all tibiæ, yellow to tawny. Wings infuscated basally and along costa, becoming hyaline apically and inferiorly. Face shining; mesonotum and scutellum subopaque. Frons yellowish pilose, and yellow tomentose; tubercle, face and antennæ, black pilose; occiput, mesonotum, and scutellum, pale yellowish pilose; abdomen also pale except narrow apices of segments 2, 3, 4, which are black. Cheeks, pleura, pectus and venter, white pilose. Femora white tomentose; fore and middle ones with white hairs, and hind one with black bristles, below. Apices of second to fifth abdominal segments pale yellow tomentose which is slightly more dense medially, suggesting a medial dorsal line. Third antennal joint longer than first two together, cylindrical, narrower than second, with short terminal style. Proboscis as long as head, thorax, and abdomen together. First submarginal cell not broader at apex than at base of second submarginal. Length, 7–8 mm.

Type.—♂; Rim of Grand Canyon, Arizona, 7000 feet, alt., May 23, 1918, (F. M. Jones), [A. N. S. P. No. 6213].

A female from Oracle, Arizona, April 28, (F. M. Jones), is apparently conspecific with the above male. It has the dorsal pile more yellowish; tomen of abdomen covering the entire segments; pile at vertex black; anterior part of frons with pale pile and pale tomen; a little pale pile at epistoma; third antennal joint broader and suddenly pointed apically.

I cannot associate these specimens with any description, but realize that in this little understood genus they may have been described previously. However, I hesitate to let these well-preserved specimens remain in the collection without a name or with a temporary determination.

MYDAIDÆ.

Ecthypus limbatus Will.

1886. Williston, Trans. Am. Ent. Soc., XIII, 292.

Before me is a male from Waterman Canyon, Amador County, California, May, (J. C. Martin), [Cal. Acad. Sci.], which is apparently this species. The species is based on a female from Arizona. The male is herewith briefly described.

Rufous; occiput, frons, proboscis, apex of third antennal joint, three mesonotal stripes, notopleural stripe, pectus, bases of first and second abdominal segments, lateral margins of remaining segments, bases of ventral segments, and apical appendages of hypopygium, black. Apical margins of dorsal and ventral segments conspicuously yellow. Wings except apices yellowish tinged. Proboscis projecting slightly beyond second antennal joint; third antennal joint slender, five or six times as long as first two together; club consists of about three-fourths of third joint, robust, of about equal width throughout, except at apical fourth, which tapers. Hind femora thickened at apical three-fourths and spinose beneath; tibiæ straight. First posterior cell open. Length, 24 mm.

Leptomydas pantherinus Gerst.

1868. Gerstaecker, Stet. Ent. Zeit., XIX, 85.

The males here are black except the knees, tibiæ, tarsi, and posterior margins of the abdominal segments especially the apical ones.

Before me are 4 ♂, 4 ♀, from the following localities in California: Colma, July to August, (J. A. Kusche), [Cal. Acad. Sci.]. San Francisco, March, (J. A. Kusche), [Acad. Cal. Sci.]. Mesa Grande, Sonoma County, June, (J. P. Baumberger), [A. N. S. P.].

Leptomydas sponsor O. S.?

1886. Osten Sacken, Biol. Cent. Amer., Dipt., I, 68.

A male from Coronado, May, (F. E. Blaisdell), [Cal. Acad. Sci.], which seems to be this species has the following characters:

Head and thorax entirely black with white polished pilose markings. First abdominal segment and following ones, laterally, black;

lateral apical angles of two to six white; remainder of abdomen rufous. Fore and middle femora dark basally; apices of their tibiæ, and tarsi yellow. Hind legs except coxae rufous. Wings brownish with darker borders to the veins. Proboscis as long as the black antennæ. Halteres black.

Leptomydas brachyrhynchus O. S.?

1886. Osten Sacken, Biol. Cent. Am., Dipt., I, 69.

There are before me from the following California localities: 3♂, San Diego, and Mokelumne Hill, Calaveras Co., (F. E. Blaisdell), [Cal. Acad. Sci.]; 1♀, Barstow, San Bernardino Co., June, (J. R. Haskin), [Cal. Acad. Sci.]. Although these were collected from widely separated localities, they seem to be conspecific. The only difference in the Mokelumne Hill specimen is the narrow, dark, bases of the abdominal segments and the slight paling in the color of the apex of the antennal club.

A brief description of the male is given below. The species is based on a female from Mexico.

♂. Wax yellow; head except middle of face, apices of third antennal joint and entire club, mesonotum except humeri and lateral margins, scutellum, more or less of pectus, metanotum, first abdominal segment, stigmatic spot on second, spot on lateral margins of all segments, and halteres, black. All pilosity yellow. Two median and lateral mesonotal stripes and sometimes apex of club, pale. Wings yellow. Bases of abdominal segments sometimes narrowly black. Third antennal joint three times as long as first two together, equalling the club; the latter tapering to near apex, then abruptly attenuating to a rather blunt apex. Proboscis short. Hind femora slightly thickened on apical half, with few flexor bristles; tibiæ without spurs. First posterior cell closed. Length, 17 mm.

SYRPHIDÆ.

Omegasyrphus baliopterus Loew.

1872. *Microdon baliopterus* Loew, Berl. Ent. Zeit., XVI, 86. (Cent., X, 56.)

Originally described from Texas. I can report the following: One male from Mexico with the first posterior cell completely divided by the extension of the stump from the third vein. One female from Round Mountain, Texas. One female, Mill Valley, California, June, (E. P. VanDuzee), [Cal. Ac. Sci.]. The last is a dark specimen showing the antennæ black, or, in certain angles the first joint brownish; femora black with tibiæ and tarsi brownish.

Otherwise similar to, and apparently conspecific with, the two first noted specimens.

Mixogaster breviventris Kahl.

1897. Kahl, Kans. Univ. Quart., VI, 137.

Originally described from Kansas. Before me are two specimens from Yaphank, Long Island, New York, September, (W. T. Davis).

Callicera johnsoni Hunter.

1896. Hunter, Can. Ent., XXVIII, 87.

One male from Round Mountain, Texas, differs somewhat from the original description. It wants the opaque marks on the face, cheeks, and abdomen, except that there are faint indications of narrow, semi-opaque bands on second and third segments.

Callicera montensis Snow.

1892. Snow, Kans. Univ. Quart, I, 34 (pl. VII, f. 4).

One specimen, Grand Canyon, Arizona, 7000 feet alt., May, (F. M. Jones). This agrees with the original description but the pile of the pleura, pectus, and venter of the abdomen is black. Snow says that the pile of the thorax and abdomen is "everywhere" golden red. The pile of the eyes in this specimen is blackish brown, not golden. The third antennal joint is at least four times as long as the first and second together. No pale articulations on the tarsi.

Can this be distinct from *montensis*? The species was originally described from Colorado, 9000 feet alt., and subsequently reported from New Mexico, at 9500 feet alt.

Merodon equestris var. **validus** Verr.

1822. *Merodon validus* Meigen, Syst. Beschr., III, 365.
1901. *Merodon equestris* Fab. var. *validus* Verrall, Brit. Flies, VIII, 559.

One female, San Francisco, California, April, (C. L. Fox), [Cal. Ac. Sci.].

CONOPIDÆ.

Dalmannia blaisdelli new species.

Differs from *picta* Will. and *nigriceps* Lw. in having the pilosity black, although on the second and third abdominal segments of the male it is somewhat paler.

♂. Abdominal segments 2, 3, 4, narrowly yellow at apices, which color extends basally at the middle as a wedge but not attaining the bases of the segments; fifth segment with a medial yellow spot. All

femora black except the broad apices. All pile black except on second and third abdominal segments. Length, 6–7 mm.

♀. Similar but the yellow on segments 3, 4, 5, with sublateral, rectangular prolongations basally and the medial wedge attains base of fifth; sixth segment yellow with two black apical converging stripes. Femora yellow except fore one above; and hind one with subapical black ring. All pile black.

Type.—♂; Colorado [A. N. S. P. No. 6211]. *Paratype.*—1 ♀, Mokelumne Hill, Calaveras Co., California, August, (F. E. Blaisdell), [Cal. Acad. Sci.].

ORTALIDÆ.

Rivellia cognata new species.

Same as *flavimana* Lw. but the legs are entirely yellow excepting that the hind tibiæ and apices of tarsi are brownish, but never black. The wing markings are similar.

Type.—♂; Swarthmore, Pennsylvania, June 11, 1905, (E. T. Cresson, Jr.), [A. N. S. P. No. 6212]. *Paratypes.*—2♂, 1♀; topotypical.

A series of seventeen specimens from the following localities: Pennsylvania: Manayunk, Philadelphia, Swarthmore. New York: Ithaca. New Jersey: Medford. Georgia. Florida: St. Petersburg. Wisconsin: Beaver Dam. It seems to be more common than *flavimana* in collections. There is much to suggest *Herina metallica* v. d. Wulp, but I cannot find any reference in the description of or in the figure of that species that the costal cell is entirely infuscated. The figure shows the infuscation only at the extreme base, while with the present form this color extends to the first band as it does in *flavimana*. There should not be any confusion between the present form and *quadrifasciata*. In that species the first basal cell is entirely infuscated and the abdomen often rufous, and on the whole is a much more robust species.

SEIOPTERA Kirby and Spence.

1817. Kirby and Spence, Intro. Ent., II, 305.
1830. *Myodina* Desvoidy, Essai Myod., 727.
1867. *Seoptera* Loew, Berl. Ent. Zeit., XI, 295.

This genus was proposed in a very meagre way, but as a species is included in the original citation, the name is valid. It is based on *Musca vibrans* Linn. (1761). The limit of the genus has been very much restricted as only one or two species are known to belong to it.

In the study of some North American material in conjunction with typical *vibrans* from Europe, I have made some notes on the genus and the species included, and have found a new form which seems to belong here. The form found within our fauna has been listed in the catalogues and placed in collections as *colon* Lw., and sometimes as *vibrans* Linn. For some time I have been endeavoring to separate these by means of the descriptions, notes given by Loew, and examination of material, but with no degree of satisfaction. A critical study of a specimen of *vibrans* from Europe has given the same result, and so it is evident to me that *colon* and *vibrans* are synonymous. The examination of the types of these two species may give contradictory results.

Seioptera vibrans Linn.

1761. *Musca vibrans* Linnaeus, Faun Suec., 1867.
1867. *Seioptera colon* Loew, Berl. Ent. Zeit., xi, 296, (Cent., ii, 6).

In this species we have the frons one-third to one-fourth width of head, opaque, red orange, not with conspicuous silvery orbits; median orange portion black setulose. Face slightly lighter, more yellowish, in profile nearly straight on account of the prominent, obtuse keel; orbits silvery. Cheeks concolorous. Occiput, thorax and abdomen, shining black. Legs black but tarsi brown, especially basally. No supraalar bristles. Mesopleura with pale micro-pubescence; sternopleura with 1–2 bristles well separated. Ovipositor with basal segment narrow, much narrower than long. Wings hyaline with stigma and spot at apical margin infuscated. First posterior cell narrowed so that its apex is no broader than its base. Anal cell with slight point at apex.

The specimens from our fauna, with one or two exceptions, seem to have only one sternopleural bristle. These bristles are so slender and hair-like that they are probably variable. Seventeen male and six females have been examined from Canada, Rhode Island, New York, Pennsylvania, Illinois, and Montana.

Seioptera albipes new species.

Here we have a species offering a different facial profile from that of *vibrans*, being distinctly concaved with a weak carina. The frons is broader than in that species, with shining orbits which are only very narrowly silvery. There is a distinct supraalar bristle and the mesopleura are black, setulose or pubescent; sternopleura with two hair-like bristles close together. The fore tibiæ and tarsi,

and middle and hind tarsi are white; the latter not at all darkened apically. The fore tibiæ may be darkened at bases and the middle tibiæ may be light brown. The basal segment of ovipositor is very large, about one-half as long as the abdomen and as broad as long. The first posterior cell is broader at apex than at base, almost twice as broad; anal cell truncate, not acute. In other respects similar to *vibrans*.

Type.— ♀ ; Swarthmore, Delaware County, Pennsylvania, May 25, 1912, (E. T. Cresson, Jr.), [A. N. S. P. No. 6210]. A series of 1 ♂, 3 ♀, from Ithaca, New York, May to June, [Cornell] are conspecific.

That this species may not be congeneric with *vibrans* is possible, but I am unable to place it in any other genus. The fact that *Sieoptera* is not a typical Ulidiinæ, especially in the construction of the anal cell, allows one to enlarge somewhat on its limits. The present species will no doubt be found in many collections under *colon* or *vibrans*.

PSILIDÆ.

Psila angustata new species.

Similar to *lateralis* Lw., but larger and the third antennal joint is much longer. In *lateralis* the size is 3.5–3.9 mm., and the third antennal joint is scarcely longer than the second. Tawny to yellow; third antennal joint apically, occiput spot, face medianly, faint spot behind vetrical bristles, pleural stripe under humeri to base of halteres, and entire abdomen, black. Lower part of pleura, coxæ, and legs, pale yellow. Wings hyaline, yellowish to brownish along costa and veins. Arista white pubescent. Third antennal joint slender, three times as long as second. Length, 4.7–5.9 mm.

Type.—♂; Ithaca, New York, August 23, 1904, [Cornell University]. *Paratypes*.—3 ♂, 5 ♀ ; topotypical.

PIOPHILIDÆ.

Mycetaulus hornigi new species.

Agreeing with the generic description of *Mycetaulus*, but superficially simulating *Piophila nigriceps* Meig. The two dorsocentral bristles each with a stout setula before it, but behind the suture, and are readily distinguished from the short abundant pile. Fore femora with 3–4 flexor bristles at apical end of the posterior flexor series of hairs.

♂. Black, polished. Occiput subopaque but not polished. Propleura with silvery dot. Second antennal joint, base of third, base

of fore femora, middle and hind legs including coxæ entirely, and veins, yellow. Fore coxæ, squamæ, and halteres white. Wings entirely clear. Frons one-third width of head, but slightly narrowed at antennæ. Cheeks broad as third antennal joint. Scutellum flat. Posterior cross vein slightly longer than ultimate section of fifth; anal vein slightly curved, not attaining margin.

Type.—♂; Philadelphia, Pennsylvania, June 3, (H. Hornig), [A. N. S. P. No. 6217]. *Paratype.*—♀; topotypical.

MOLLUSCA OF GLACIER NATIONAL PARK, MONTANA.

BY S. STILLMAN BERRY.

Introduction.

During the month of August, 1916, in the course of a brief vacation in the Glacier National Park, Montana, the writer incidentally made a small collection of mollusks, which, though doubtless not in any way complete for even those portions of the region visited, is none the less of considerable interest, particularly from the standpoint of the zoogeographer. The facts, that within the boundaries of this Park the three principal continental watersheds find their point of junction, and that collections were made on all three sides of the continental pinnacle thus formed, give a peculiar interest to the records. To the great, rough, triangular rock called Triple Divide Peak, belongs the honor of being, at least so far as drainage goes, the top of the North American Continent. One of its three faces drains into Norris and Red Eagle Creeks, and thence via the St. Mary's and Saskatchewan Rivers into Hudson's Bay; one drains into Cut Bank Creek and thence via the Marias River and the Missouri-Mississippi into the Gulf of Mexico; the third drains via Nyack Creek and the Flathead and Columbia Rivers into the Pacific.

This will suffice to indicate why the student of geographical distribution must find a peculiar interest in the elucidation of the fauna of the region, though unfortunately the present collections are not sufficiently complete that any very general conclusions may be safely drawn, even for the single phylum Mollusca. They were carried out at odd moments along the trail or while stopping to rest, and nowhere was it possible to make them reasonably exhaustive.

The writer was accompanied on the entire expedition by Mr. Elwyn H. Dole, of Winnecook, Montana, and during the latter part of the tramp by Dr. A. H. Warthin, of the University of Michigan, and his son, Master Aldred Warthin. His thanks are due to each of these gentlemen for help in the work of collecting, as well as to Mr. E. G. Vanatta, of The Academy of Natural Sciences of Philadelphia, for his critical comparison of certain specimens with others in the collections of the Academy.

The total number of species taken was not large—some eleven of land snails and a single freshwater bivalve—but several con-

stitute new records for the state, and one, the interesting *Polita chersinella* (Dall), has previously been known only from the Californian Sierras. One subspecies, *Oreohelix cooperi apiarium* is here described as new. *Euconulus fulvus* (*alaskensis* ?) proved by all odds the most abundant and widely distributed species in the Park, being taken at 14 of the 18 stations. Other relatively abundant forms are *Vertigo modesta parietalis* (a good second to *Euconulus*), *Oreohelix cooperi apiarium*, and *Thysanophora ingersolli* (though for both of these last two species the figures to be quoted include dead shells). We did not discover how to find the *Oreohelix* or the *Polita binneyana* until toward the end of the trip, else the figures for each of these might have been larger.

It is evident that the fauna as a whole exhibits a markedly boreal or Hudsonian aspect, in which the occurrence of such species as *Oreohelix cooperi apiarium*, *Polita chersinella*, and *Punctum californicum* seems more or less anomalous. Quite unexpectedly the list is an altogether different one from that collected by the late Mr. L. E. Daniels in the Bitter Root Mountains and reported upon by Mr. Vanatta in these Proceedings for 1914 (Vanatta :14). Though his list is a much more extensive one, some seven species, or just one more than half of those here recorded, fail to appear therein.

A first duplicate series of the specimens taken has been deposited in the collections of the Academy.

Historical.

In my search of the literature I have been unable to discover any previous record of Mollusca taken within the actual confines of the Glacier National Park with the single exception of a note by F. C. Baker (:14, p. 106), wherein he mentions finding some dead shells of *Oreohelix cooperi* "at Glacier National Park, Montana, in a ravine about a mile west of the hotel."

Some collecting was done by Dr. G. M. Dawson in 1874, and Mr. J. B. Tyrrell in 1883, just north of the present Park near Waterton Lake on the Canadian side of the boundary, and *Oreohelix cooperi limitaris* (*Helix limitaris* Dawson) was described from the material taken, but most of the records seem never to have been published.

List of Stations with Data.

The recorded stations from which mollusks were taken on this expedition are eighteen in number, being in consecutive order as

follows. Two of the stations (I and XVIII) are really extralimital to the Park:

Station I. Mt. Henry Trail, 3 miles northwest of Glacier Park Station, just outside the eastern boundary of the Park; alt. 5300 ft.; August 20, 1916; under sticks and bits of bark in moist places along the trail.

Station II. Mt. Morgan Trail, Dry Fork Canyon; alt. 5200–6000 ft.; August 21, 1916; under sticks, stones, etc., at various intervals along trail; most of the Vertigos found under one small log.

Station III. Cut Bank Creek; alt. 5800 ft.; August 21, 1916; under sticks not far from creek.

Station IV. North Slope Triple Divide Pass; alt. 6600 ft.; August 22, 1916.

Station V. Near Going-to-the-Sun Chalets, Gunsight Trail; alt. 4600 ft.; August 25, 1916; among loose rocks on slope near trail. (Plate IX, fig. 1.)

Station VI. Piegan Pass Trail, on west slope of Going-to-the-Sun Mountain; alt. 6000 ft.; August 26, 1916; under sticks except *Oreohelix*, which was crawling on surface.

Station VII. Lower end of Grinnell Lake; alt. 5000 ft.; August 26, 1916; under sticks.

Station VIII. Southeast shore of Lake Josephine; alt. 5000 ft.; August 26, 1916; under sticks.

Station IX. Along road northwest of Lake McDermott; alt. 5000 ft.; August 27, 1916; under sticks and bark. (Plate IX, fig. 2.)

Station X. Ptarmigan Falls; alt. 5600 ft.; E. H. Dole, August 27, 1916; under sticks, bark, etc.

Station XI. Pool near lower end of Iceberg Lake; alt. 6000 ft.; August 27, 1916. (Plate IX, figs. 2–3.)

Station XII. Upper end of Swiftcurrent Canyon; alt. 5200 ft.; August 28, 1916; under sticks and small logs on floor of canyon along trail. This station proved one of the most prolific of any at which collecting was done. (Plate IX, fig. 2.)

Station XIII. Granite Park Trail, just below Granite Park Chalets; alt. 6000 ft.; August 29, 1916; under sticks and small logs along trail.

Station XIV. Granite Park Trail, near Mineral Creek, at bottom of canyon below Granite Park; alt. 3859 ft.; August 29, 1916; mainly under sticks and pieces of bark around fallen logs along the trail. The best locality for small land snails we found in the Park. The forest in this canyon is magnificent and very dense.

Station XV. Granite Park Trail, bottom of McDonald Creek Canyon under Haystack Butte; alt. 3650 ft.; August 29, 1916; the Oreohelices found aestivating among a growth composed principally of *Rubacer, Ribes, Urtica, Fatsia,* and cow parsnip, the *Polita binneyana* in association.

Station XVI. Granite Park Trail, bottom of McDonald Creek Canyon opposite Glacier Wall; alt. 3550 ft.; August 29, 1916; same characteristic plant association as for preceding station.

Station XVII. Granite Park Trail, bottom of McDonald Creek Canyon, under Mt. Cannon; alt. 3450 ft.; August 29, 1916; same characteristic plant association as for preceding two stations.

Station XVIII. Belton, Montana, just outside southwestern boundary of Park; alt. 3300 ft.; E. H. Dole, August 30, 1916.

Reference to a map will show that Stations I–III are in the Atlantic drainage basin, IV–XII in the Arctic drainage basin, and XIII–XVIII in the Pacific drainage basin. The terrestrial species as a rule were found to occur in all three watersheds, but *Polita binneyana* and *Striatura milium pugetensis* were noted only on the Pacific side.

Census of Species Taken.

The accompanying table gives a good idea of the relative abundance of the various species collected, both absolutely and with reference to the station and drainage data.

Notes on the Species.

Oreohelix cooperi apiarium new subspecies. Plate X.

The shell is large for this group of Oreohelices, strongly elevated, with an obtuse apex. The spiral sculpture is obsolete below, but strong on the upper half of the whorls where it consists of numerous fine striations, quite visible to the naked eye, which are interrupted by the coarse and very irregular lines of growth. The periphery is obtusely angular in front, becoming rounded or with just the faintest suggestion of angulation on the remainder of the last whorl. The umbilicus is narrow and deep, contained in the diameter about six times, its circular outline partially interfered with by the slightly reflexed inner lip.

The color is extremely variable, the ground color of the shell ranging from a very light brownish cream, almost white, through shades of yellowish brown to dark chestnut, and tones of gray to a livid brownish slate. The adult shell usually shows two narrow

TABLE SHOWING RELATIVE ABUNDANCE OF SPECIES TAKEN.

Drainage Stations	Atlantic			Arctic									Pacific						Total No. Specimens	No. Stations Collected	No. Watersheds
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII			
Oreohelix cooperi apiarium Berry					11[1]	4									45	37	15		112	5	2
Thysanophora ingersolli (Bland)		19			48	3				2[1]		9	1	25		2			109	8	3
Pyramidula cronkhitei (Newcomb)	7	2										2		13					24	4	3
Punctum californicum Pilsbry	4		3		1			3	4	5		30		7	1				58	9	3
Zonitoides arborea (Say)		1			2[1]				1					20	1			3	28	6	3
Euconulus fulvus alaskensis Pilsbry	8	13	1		22	4	1	5	27	3		24	2	40	2			5	157	14	3
Polita binneyana (Morse)														2	8	1			11	3	1
Polita chersinella (Dall)	2					3			1			3		1					10	5	3
Striatura milium pugetensis (Dall)														5	1	1			7	3	1
Vitrina alaskana Dall	1	2		1				1	1				1	1	1				9	8	3
Vertigo modesta parietalis (Ancey)	8	23			3		2	3	7			70		39					155	8	3
Pisidium abditum Haldeman											81								81	1	1

[1] Dead shells only.

Total 761

darker bands, one on the shoulder, the other just below the periphery, with sometimes a broader light band between, and several weaker and narrower bands below extending upon the base of the shell. Entirely bandless specimens seem to occur but rarely.

Fig. 1. *Orcohelix cooperi apiarium* new subspecies. Apical and basal views of shells of unborn young, taken from specimen shown in Pl. X, Fig. 2- 2b (type). ×13.

The embryonic shell is lenticular in outline and strongly carinate as usual in the genus. It is sculptured with numerous very fine, crowded, wavy, spiral striae, crossed on the neanic portion by coarser, but still narrow, rather irregularly spaced, wrinkle-like, incremental ridges, some of them eventually becoming almost rib-like above, but practically obsolete below the periphery, where, however, the fine spiral striation is in these young specimens beautifully developed.

	Largest from Station XVI (Type)	Smallest Adult Station XVI	Largest, Station XV
Maximum diameter	22.0 mm.	15.6 mm.	23.2 mm.
Minimum diameter	21.3 mm.	15.1 mm.	20.3 mm.
Altitude	19.6 mm.	15.4 mm.	18.0 mm.
Diameter of umbilicus	3.5 mm.	2.5 mm.	3.7 mm.
Number of whorls	$6\frac{1}{3}$	6	6
Illustration, Plate X	Figs. 2–2b	Figs. 7–7b	

Type.—Cat. No. 4130 of the writer's collection; paratypes in The Academy of Natural Sciences of Philadelphia, the University of Colorado Museum, and the California Academy of Sciences.

Type Locality.—Station XVI, altitude 3550 ft., McDonald Creek Canyon, opposite Glacier Wall, Granite Park Trail, Glacier National Park, Montana; 37 specimens.

Remarks.—Despite its great size, *O. c. apiarium* is nearer, I think, to *O. c. limitaris* (Dawson) than to any of the other described races of the *cooperi* complex. The latter differs in its very much smaller size, less elevation, rather greater carination of the front part of the last whorl, and very much weaker spiral striation on the upper portion of the whorls. Relative to the size of the shell the lines of growth are coarser in *limitaris*, and the adult shell has from $\frac{1}{2}$ to $\frac{3}{4}$ of a whorl less.

Limitaris has long been greatly misunderstood, and for a time I thought the Glacier Park race might prove to be identical with it, but the recent receipt of good comparative material from the type locality of *limitaris*, through the kindness of Mr. Frits Johansen, of the Geological Survey of Canada, has led me to the conclusion that the two are measurably distinct, though *limitaris* comes from near Waterton Lake, just over the border from Glacier Park, Montana.

If these conclusions are correct, both *apiarium* and *limitaris* will stand as reasonably well differentiated subspecies of *O. cooperi* (Binney). The McDonald Creek Canyon shells are among the most elevated and largest *cooperi* I have seen, being surpassed in bulk only by Pilsbry's *O. c. maxima* from the Yellowstone National Park. *Maxima* further differs in its more depressed contour and much more capacious umbilicus. For the loan of a specimen of *maxima* permitting my direct comparison of the two I am indebted to Dr. Pilsbry.

Another shell which is probably quite close is that represented by the three largest figures given by Elrod in his "Biological Reconnaissance in the vicinity of Flathead Lake" (:02, pl. 27), over the name of *Pyramidula strigosa, var.* They are from McDonald Lake, Mission Mountains, Montana, which should not be confused with the lake of the same name in Glacier Park near the type locality of *apiarium*. Not any of the shells he figures on the plate cited appear to me to be correctly referred to *strigosa*.

Most of the living specimens taken were found to contain unborn young. The number of embryos per adult varied so greatly that it is evident the smaller numbers did not represent entire broods, probably the last members of a clutch in progress of birth. Twenty specimens from Station XV yielded from 2 to 18 embryos each, the average being 11.6. At Station XVI 12 specimens yielded from 3 to 23 embryos each, the average being 14.5. Where but few embryos were found they proved generally to be above the average in size, which accords with the supposition that in such cases parturition was more advanced.

The dead shells from Station V on the Arctic side of the Divide are not typical of the race as here described. The same would probably be true of those taken at Station VI, were any of them adult.

Thysanophora ingersolli (Bland).

I do not recall having seen *Thysanophora* reported from so far north. However no special peculiarities have been detected in these specimens.

Pyramidula cronkhitei (Newcomb).

Not found as commonly as would naturally have been expected.

Punctum californicum Pilsbry.

This determination is due to Mr. Vanatta. The specimens are distinctly smaller, are much darker brown in color, and appear somewhat more coarsely striate than any Californian specimens of the species before me, and further, although the embryonic whorls are in both instances weakly spirally striate, they are much less distinctly so in the Montana form.

Zonitoides arborea (Say).

Found commonly only in McDonald Creek Canyon; scattering specimens elsewhere.

Euconulus fulvus alaskensis Pilsbry.

Wherever we went in the Park *Euconulus* was found not only to be ubiquitous but abundant.

Mr. Vanatta referred the shells sent him to typical *fulvus* rather than to *alaskensis*, but I am unable to effect a satisfactory separation of the remainder of the specimens from other Rocky Mountain *Euconulus* referred unquestioningly to the subspecies. Under a fairly high power (82 diameters), I can discover no trace of spiral sculpture on the earlier turns as in specimens of *fulvus* s. s. from Unity, Maine. Also there is "about one whorl more in shells of similar size"[2] for the Maine form, the color is noticeably paler, the axial sculpture finer, and the luster brighter.

Polita binneyana (Morse).

This was found principally in connection with the same peculiar plant association as *Oreohelix cooperi apiarium*, and attention to this fact should lead to its discovery at many other Stations than those

[2] Cf. Pilsbry and Ferriss, :10, p. 132.

at which we eventually ran across it, in which case it may prove to be of greater relative abundance than my figures indicate. The record is apparently a new one for the state.

Polita chersinella (Dall).

There is a decided discrepancy in the respective descriptions and figures given of *chersinella* by Dall and Binney, and it is perhaps not yet just certain what *chersinella* really is. However that may be, I am unable to distinguish the present specimens from material taken in the Californian Sierras, in spite of the tremendous jump in range. Compared with a somewhat larger specimen of the latter taken near Lake Tahoe by Mr. Allyn G. Smith, the largest of the Glacier Park shells has about one-half a whorl more, has rather more evenly rounded whorls and aperture, and a rounder, flatter spire. The generic position here adopted for the species is at best doubtful, but I feel convinced that it is *not* a *Euconulus*, a certain ease of confusing one's shells in the field with *E. f. alaskensis* notwithstanding. It has not been reported previously outside of California, where it is a characteristic alpine form.

Striatura milium pugetensis (Dall).

One would naturally anticipate that these shells would fall in line with their Washington neighbor, *pugetensis*, rather than with the far eastern form, yet Mr. Vanatta considers them "not typical of the var." but "nearer the regular *milium*." With the first part of the opinion quoted I concur, but not with the second. The Glacier Park shells are not only larger on the average (major diameter 1.67-1.85 mm.) than any (e. g.) Maine or Massachusetts *milium* I have seen, but possess the *strong spiral sculpture* of the first whorl and a half which is one of the striking features of the otherwise weakly differentiated *pugetensis*. Nor is the beautiful silky sculpture of the later whorls, particularly the last, which one sees in New England specimens and which has been so carefully described and figured by Morse ('64, p. 19, pl. 2, fig. 7), at all so exquisitely developed in the western shells.

As compared with specimens of typical *pugetensis* from Seattle, the Montana shells are notably larger, flatter, and coarser in appearance, slightly approaching in some respects the giant southern *meridionalis* Pilsbry and Ferriss. It may be that one day this mountain race will require a name of its own. Meanwhile the record is a new one for the state.

Vitrina alaskana Dall.

Noted frequently as indicated in the table, but nowhere observed in any abundance.

Vertigo modesta parietalis (Ancey).

The shells of this series show considerable variation. In some cases a considerable proportion of the shells (a respectable minority of those from Station XII, and a large majority of those from Stations I, II, and IX) have the angular lamella reduced to a mere trace or obsolete, thus approximating the typical *modesta*. Somewhat less than a third of all the adult shells taken are of this type, the balance being distinctly 5-toothed shells, i. e., true *parietalis*.

This *Vertigo* is abundant at suitable stations all through such portions of the Park as were visited.

Pisidium abditum Haldeman.

The specimens were hand picked from a small and very cold pool, but a few score feet from the partly frozen and perpetually frigid Iceberg Lake, at 6000 feet altitude, the highest elevation at which any Mollusca were obtained in the Park. Here they were abundant, and with a small sieve of the proper mesh many specimens could have been taken.

The specific determination is due to Mr. Vanatta.

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Explanation of Plates

(Note: The illustrations on Plate IX are from photographs by the author. The specimen figures on Plate X were prepared by Mr. John Howard Paine.)

Plate IX.—Fig. 1.—St. Mary Lake and Going-to-the-Sun Mountain from Going-to-the-Sun Chalets. Station V is in the woods above the Lake in the right foreground.

Fig. 2.—McDermott Lake, Mount Wilbur, Upper Swiftcurrent Valley, and the Continental Divide, from near the lower end of McDermott Lake. Station IX is in the woods beyond the tepees in the right center. Station XII is at the far upper end of the valley around the mountain shoulder at the left of the picture. Station XI is high up at the base of the steep glacial cirque in the distance to the right of Mount Wilbur.

Fig. 3.—Iceberg Lake. Station XI is a small pool a few rods from where the picture was taken.

Plate X.—*Oreohelix cooperi apiarium* n. subsp. Series of nine specimens from the type locality, Station XVI, Cat. 3613 (excepting the type), Berry Collection. The type (Cat. 4130) is the shell shown in Fig. 2–2b. All figures natural size.

A PECULIAR VENEZUELAN LAND SNAIL.

BY HENRY A. PILSBRY.

Xenodiscula venezuelensis n. gen. and sp. Fig. 1.

The shell is minute, discoidal, being concave above and below, whitish-transparent, glossy, with sculpture of spaced radial grooves after the first half whorl. These grooves become closer near the aperture, and in the largest and freshest specimens they are occupied

Fig. 1.—*Xenodiscula venezuelensis.* Three views of the shell, and aperture more enlarged.

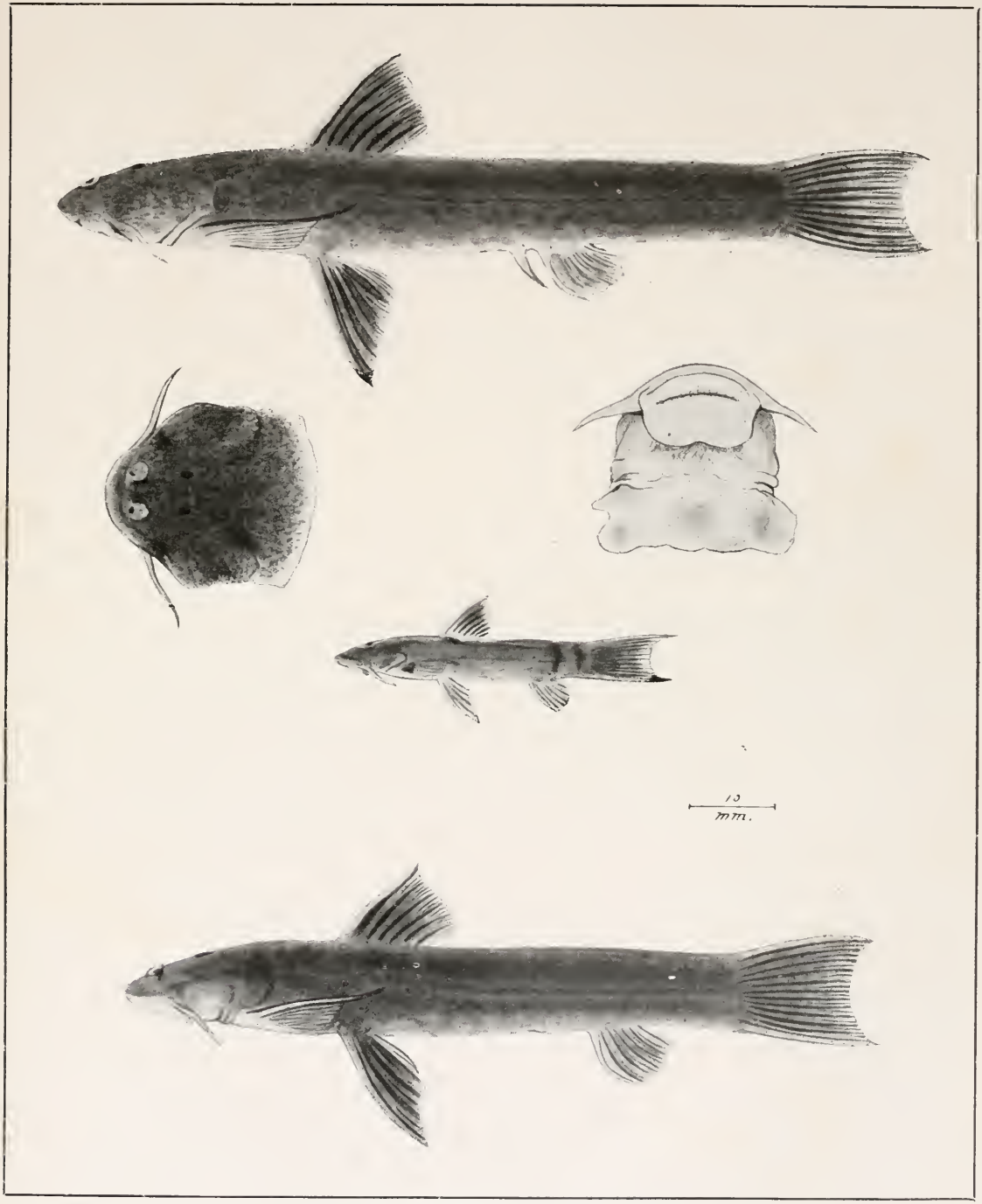
there by projecting riblets (which may be partly cuticular and deciduous). There are not quite three whorls, rapidly increasing, convex, most strongly so above. The aperture is oblique, wide, of irregular shape. On the parietal wall there is a high, thin median, emerging lamella, which penetrates only a short distance, and near the columella there is an oblique, much smaller lamella. The outer and lower margins of the lip are thickened within and toothed. On the columella there is a small blunt tooth followed by a more tapering one, with a low third prominence in fully adult shells. Within the outer lip, above the periphery, there is a group of three small teeth, the upper one largest, the other two sometimes lacking, or developed later.

Alt. 0.55, diam. 1.6 mm.

Cariaquita, Venezuela, S. Brown, Bond Venezuela Expedition, 1911. Type and paratypes, No. 105,209, A. N. S. P.

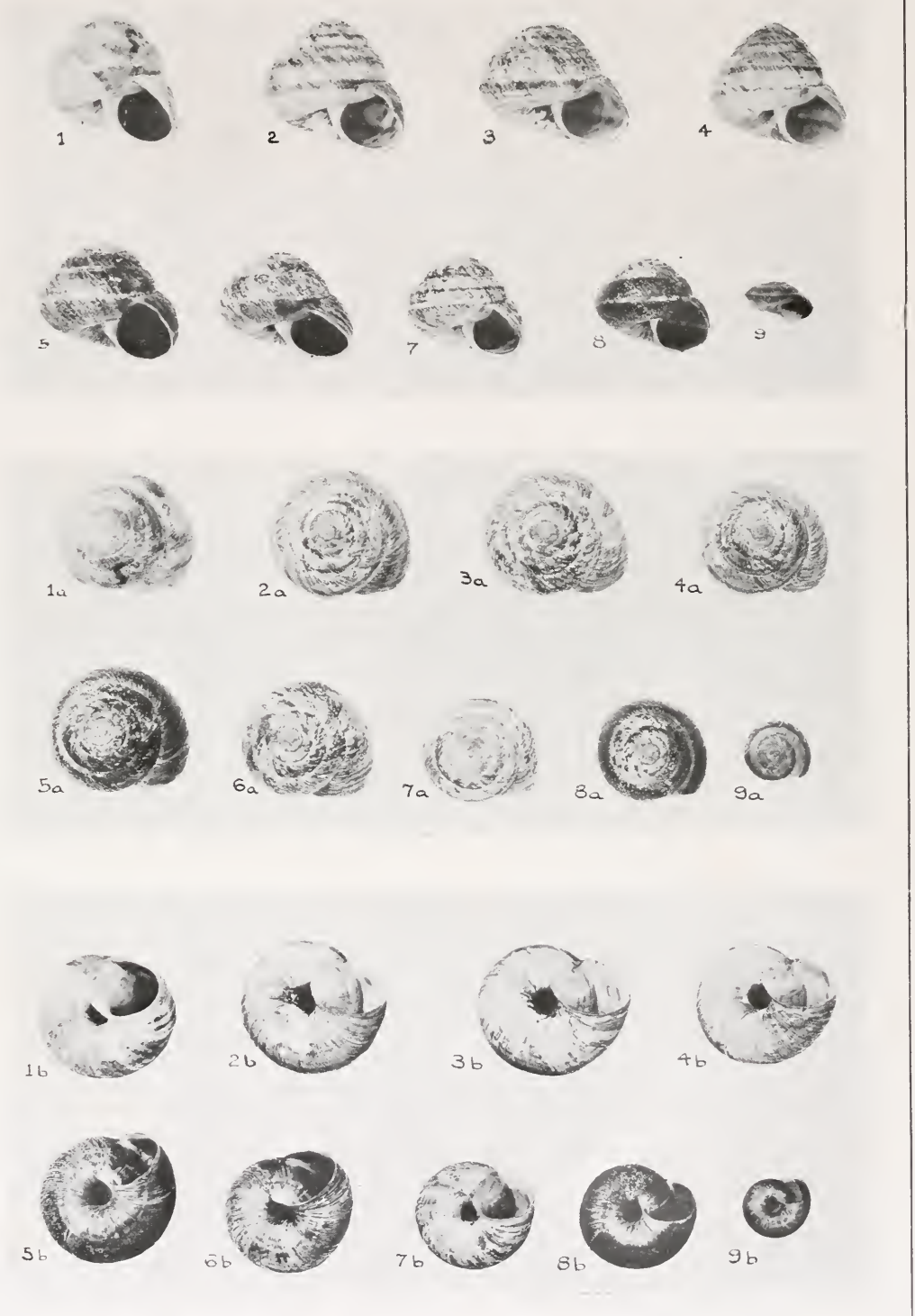
All of the specimens are empty shells, obtained by sifting leaf debris. The affinities of the species remain uncertain, as it is very unlike any described form, but it doubtless belongs to a new genus, which may provisionally be placed near *Proserpinula* or *Volvidens*, both Antillean genera.

In the type specimen there is a very minute lamella above the parietal, lacking in the other examples.



FOWLER: A NEW SILUROID FISH.

BERRY: MOLLUSCA OF GLACIER NATIONAL PARK.



BERRY: MOLLUSCA OF GLACIER NATIONAL PARK.

November 18, 1919

The President, John Cadwalader, A. M., LL. D., in the Chair.

One-hundred and forty-two persons present.

Dr. Witmer Stone made a communication on "A Naturalist's Camp in the Chiracahua Mountains of Southern Arizona," illustrated by lantern slides. (No abstract.)

The Publication Committee reported the receipt of the following papers for the Proceedings:

"A New Trout from the Mountain Streams of Formosa," by David Starr Jordan and M. Oshima.

"Notes on Tropical American Fishes," by Henry W. Fowler.

"Description of a New Siluroid Fish from Colombia," by Henry W. Fowler.

"Dipterological Notes and Descriptions," by Ezra T. Cresson, Jr.

"Mollusca of Glacier National Park, Montana," by S. Stillman Berry.

"New Genera of Fossil Fishes from Brazil," by David Starr Jordan.

"A Peculiar Venezuelan Land Snail," by Henry A. Pilsbry.

Nominations for Officers, Councillors, and members of the Committee on Accounts were made.

The deaths of Thomas Skelton Harrison, J. Ewing Mears, William C. Stevenson, Jr., George B. Cresson, and Miss Harriet Blanchard, members, and of Gustav Retzius and Ernst Haeckel, correspondents, were announced.

Miss Anne Hinchman, Walter Palmer, W. H. Van Sickel, Arthur Cope Emlen, and Hampton L. Carson, were elected members.

The following paper was ordered to be printed:

NEW GENERA OF FOSSIL FISHES FROM BRAZIL

BY DAVID STARR JORDAN

In the year 1909, through the courtesy of Dr. John C. Branner, the collection of fossil fishes of the Serviço Geologico e Mineralogico do Brazil was sent to me for study by the late Orville A. Derby, then head of the Survey and director of the Museu Nacional at Rio de Janeiro. For reasons, easily understood in these days of confusion, my report on these fishes has been delayed. As, however, reference is made to the new genera concerned in a forthcoming treatise by Dr. Branner on the geology of Brazil, it seems desirable to publish the three new genera named in this report.

The specimens concerned are of the Cretaceous age and came from Barra do Jardim, Serra do Araripe, at Ceará, Brazil, the locality from which Gardner secured for Agassiz the original specimens of several species. These examples, like those of Agassiz, were originally rolled on the beach between tide marks, each becoming the nucleus of a clay concretion.

We may note in this connection that *Notelops brama* (Agassiz) is identical with *Calamopleurus cylindricus* Agassiz. It should apparently stand as *Calamopleurus brama*. *Cladocyclus gardneri* Agassiz is probably one of the Osteoglossidæ, and not related to the European species, *lewisiensis*, called *Cladocyclus* by Agassiz and others.

Family ELOPIDÆ.

ENNELICHTHYS new genus.

Type: *Ennelichthys derbyi* Jordan.

In the collection are two large skulls (No. 55 Jardim, and No. 57 Jardim, the latter with counterpart) of a large elopine fish evidently allied to the genus *Enneles* of Jordan and Branner. From the latter it is distinguished by its smaller mouth, the maxillary scarcely extending beyond eye, and by its excessively strong dentition, the anterior teeth in the lower jaws being long, sharp and fang like; those of the upper jaws similar but smaller.

Ennelichthys derbyi new species.

The species named *Ennelichthys derbyi* in honor of the late Orville Adelbert Derby, formerly a fellow student in Cornell University,

and later the head of the Serviço Geologico e Mineralogico do Brazil at Rio de Janeiro. The type of *Ennelichthys derbyi*, No. 55, is a head about 6 inches long, the left side somewhat crushed down, the right side intact, but more or less battered, especially posteriorly. Opercle battered, the subopercle not evident; bones of top of head rugose; preopercle broad, with radiating striae at angle; cheek covered by a large bone; two bones behind eye.

Mouth very large, very oblique, the lower jaw projecting; snout very short, about $5\frac{1}{2}$ in head; eye 5 in head; maxillary $2\frac{1}{2}$, mandible about 2. Both jaws with long, sharp, fang-like teeth anteriorly, the longest in front of lower jaw about $\frac{2}{3}$ to $\frac{1}{3}$ diameter of eye, the next longest on sides of mandible, about 8 of these evident. Posterior teeth of both jaws rather smaller, and the upper teeth apparently smaller, than lower and more widely set, but no small teeth and no broad teeth visible anywhere. A pit filled with stone on each side corresponding to the nostril. While most of the teeth are lost, fang-like teeth are seen at intervals in both jaws.

BRANNERION new genus.

Type: *Calamopleurus vestitus* Jordan and Branner.

The species described by Jordan and Branner under the name of *Calamopleurus vestitus*, should form the type of a distinct genus of Elopidæ, distinguished by the long anal fin which begins under the last ray of the dorsal, and the deep short body with correspondingly long ribs. The scales are large, but of the same character as in *Calamopleurus*, and the lateral line is well developed.

The genera of Brazilian Cretaceous Elopidæ may be thus compared with the living genera:

a. ELOPINÆ: Pseudobranchiæ large (in living species) scales relatively small; last ray of dorsal not prolonged; anal smaller than dorsal; base of caudal more or less scaly.
  b. Dentition even, the teeth slender and close-set; dorsal with a sheath of scales.
    d. Anal fin long, beginning under last rays of dorsal, its rays 15 or more; ventrals below or before dorsal; scales rather large, 20 in a cross series below dorsal; lateral line well developed. (Teeth unknown). *Brannerion.*
    dd. Anal fin short, beginning well behind dorsal.
      e. Ventrals inserted under last rays of dorsal.
        f. Body compressed; subopercle nearly as large as opercle; scales small, about 35 in a cross series; lateral line well developed in perfect specimens (obsolete in those poorly preserved). *Calamopleurus,*

ff. Body cylindrical, fusiform, scales firm, more or less crenulate, about 25 in a cross series; no lateral line, opercle very large, convex, much larger than subopercle. *Rhacolepis.*

ee. Ventrals inserted under first ray of dorsal; lateral line well developed; body elongate; teeth small, even. *Elops.*

bb. Dentition uneven, but weak; mouth moderate, oblique; scales large; caudal fin with about 10 broad, much-branched rays. *Anædopogon.*

bbb. Dentition uneven, some of the teeth large, canines robust.

g. Maxillary extending far beyond eye; front of jaws with very broad teeth; posterior teeth in lower jaw small and even. *Enneles.*

gg. Maxillary scarcely extending beyond eye; front and middle of lower jaw with very long fangs; no broad teeth. *Ennelichthys.*

aa. MEGALOPINÆ: Pseudobranchiæ none; scales large, firm; anal fin larger than dorsal; last ray of dorsal produced into a long filament; postorbital bones very thin, membranaceous; teeth uniform; body compressed.

h. Dorsal fin inserted above ventrals. *Megalops.*

hh. Dorsal fin inserted behind ventrals. *Tarpon.*

Family ASPIDORHYNCHIDÆ.

VINCTIFER new genus.

The Brazilian Cretaceous species hitherto referred to *Belonostomus* differs from the type of the genus in the very much greater depth of the scales composing the lateral line. These are anteriorly about five times as deep as long. The jaws are also more robust than in the typical species.

In the type of the genus *Belonostomus* (*B. tenuirostris*) the jaws are excessively elongated and the scales of the lateral line are scarcely larger than the others. I propose to separate *Belonostomus comptoni*, and the European species allied to it, as a distinct genus which may be called *Vinctifer*. It is characterized by the very deep band-like scales along the sides, the relatively short jaws, and the relatively robust body.

December 16.

The President, JOHN CADWALADER, LL.D., in the Chair.

Twenty persons present.

Officers, Councillors, and members of the Committee on Accounts were elected for the ensuing year.

Annual Reports were received from the Recording Secretary, the Corresponding Secretary, the Librarian, the Curators, the Treasurer, the auditors of the Treasurer's accounts, the Treasurer of the *Manual of Conchology*, the Biological and Microscopical Section, the Entomological Section, the Botanical Section, the Ornithological Section, and the Curator of the William S. Vaux Collections; and a verbal report on the Mineralogical and Geological Section by MR. F. J. KEELEY.

The reception of the following papers was reported:

MOLLUSCA FROM CENTRAL AMERICA AND MEXICO.

BY HENRY A. PILSBRY.

Most of the forms described herein were collected by Mr. A. A. Hinkley during two visits to Guatemala. A few are added from various other localities, collected by Mr. S. N. Rhoads and others.

With the exception of *Neritilia*, a peculiar Neritid mollusk with a more specialized radula than others of its family, the species belong to genera already well represented in Mexico and Central America.

Salasiella hinkleyi n. sp. Fig. 2.

The shell is cylindric with tapering spire, glossy, finely, arcuately striate, with numerous irregularly spaced grooves indicating former peristomes. First three whorls rather slowly widening, after which the suture descends more rapidly, oblique to the previous whorls, each succeeding whorl at least double the width of that above it. The last whorl is flattened laterally. Aperture half the length of the shell. Outer lip arching very strongly forward in the middle. Columella very deeply concave above the truncation.

Length 8.5, diam. 3 mm.; $5\frac{1}{2}$ whorls.

Mountain side near the Tamosopo Sugar Company's place, San Luis Potosi. Also at El Abra.

This species changes so much with age that without a good series one would not readily connect the half-grown and the mature stages. After the third whorl the suture descends very rapidly, and the aperture becomes shorter in comparison with the total length. Moreover, the deep, arcuate grooves which characterize the fully adult shell are far weaker and less numerous in specimens of 6 mm. length or smaller.

It is closely related to *S. joaquinæ* Strebel, but adult specimens of the same length have a half whorl more and a shorter aperture. Probably the specimens from Diente, near Monterey, Nuevo Leon, referred to *joaquinæ* are immature *S. hinkleyi*.

16 specimens were taken at El Abra, the largest measuring, length 6, diam. 2 mm. The aperture is decidedly over half the total length at this stage. It is quite possible that the largest shell from the type locality (fig. 2) is an exceptionally large and old individual.

A review of the species of *Salasiella* known up to 1907 was given in the Manual of Conchology XIX, pp. 170–174. Since that time *S. browni* Pils., of the Canal Zone, has been described.

Fig. 1.
Salasiella guatemalensis.

Fig. 2.
Salasiella hinkleyi.

Fig. 3.
Leptinaria livingstonensis Hinkley.

Salasiella guatemalensis n. sp. Fig. 1.

The shell is oblong, pale yellowish, glossy, with fine, unequal growth-ripples. Spire rather short, conic, the apex obtuse. Whorls convex, the third hardly wider than the second, the rest rather rapidly widening, the last somewhat compressed laterally. Aperture more than half the total length. Outer lip strongly arching forward. Columella concave as usual.

Length 9.9, diam. 4, length of aperture 5.6 mm.; $5\frac{1}{2}$ whorls.

Gualan, Guatemala, S. N. Rhoads. Type and paratypes, No. 114,838, A. N. S. P.

This species stands near *S. browni* of the Canal Zone, but is stouter with shorter spire.

A few specimens, not fully mature, were taken by Mr. Hinkley at Jocolo.

Spiraxis livingstonensis n. sp. Pl. XI, fig. 1.

The shell is subulate, its diameter contained 3.7 times in the length, very pale yellow, composed of $9\frac{1}{2}$ rather strongly convex

whorls. First $2\frac{1}{2}$ whorls are smooth, following whorls sculptured with axial (vertical) ribs less than half as wide as their intervals, about 44 on the penultimate whorl. The upper ends of the ribs project, crenulating the suture. Aperture ovate; columella a little thickened, moderately sigmoid.

Length 9.25, diam. 2.5, aperture 2.3 mm.

Mountains west of Livingston, Guatemala (A. A. Hinkley).

This species is related to *S. sulciferus*, but it has less crowded, thinner ribs.

Spiraxis longior n. sp. Pl. XI, fig. 2.

The shell is subulate, very slender, the diameter contained about 3.8 times in the length, composed of $9\frac{1}{2}$ moderately convex whorls, of which the first $2\frac{1}{2}$ are smooth; apex obtuse; subsequent whorls sculptured with axial (vertical) ribs, which are just perceptibly sinuous, almost straight, and nearly as wide as their intervals. There are about 35 ribs on the penultimate whorl. On the last third of the last whorl the ribs become a little weaker in fully adult shells. Aperture ovate. Columella thin, weakly sinuous.

Length 8, diam. 2.1, length of aperture 2 mm.

Mountains west of Livingston, Guatemala (A. A. Hinkley).

A very slender form with small aperture, only one-fourth the length of the shell.

Pseudosubulina martensiana n. sp. Pl. XI, fig. 3.

The shell is slender, a little attenuated near the obtuse apex, corneous-buff, composed of 9 whorls, the first three strongly convex, the convexity diminishing subsequently, the later whorls being flattened, convex only near the sutures. The initial $\frac{3}{4}$ whorl projects and is smooth; the next two whorls are of about equal diameter, with sculpture of widely spaced axial ribs; on subsequent whorls the ribs are close, rounded, and as wide as their intervals, 40 standing on the penultimate whorl. On the last whorl the ribs disappear on the base, which is smooth. Apertures rhombic; columella moderately concave, deeply excised at the base.

Length 11, diam. 3, length of aperture 3 mm.

Mountains west of Livingston, Guatemala (A. A. Hinkley).

In the related *P. lirifera* Morel. the columella is represented as deeply concave, and there are more smooth whorls at the summit. Whether the shell described and figured as *P. lirifera* by Professor von Martens is really the species of Morelet is not quite certain.

Guppya elegantula n. sp. Fig. 4.

The shell is narrowly perforate, pyramidal, resembling *G. elegans* (Strebel) in form; pale cinnamon, fading at the summit. Surface above the periphery having a microscopic sculpture of fine, close, nearly vertical striae, cut by equally close spiral lines, but the latter are not everywhere developed; the base glossy, with engraved spirals only, far more widely spaced than on the upper surface. Outlines of the spire are slightly convex. Whorls quite convex, the last rounded peripherally in the adult stage (angular in the young). Aperture semilunar, not very wide.

Fig. 4.

Alt. 3.2, diam. 3.3 mm.; $6\frac{1}{2}$ whorls.

State of Vera Cruz, Orizaba, 500 ft. above the town (Heilprin exped.). San Luis Potosi, canyon and falls below Valles (Hinkley, type loc.). Nuevo Leon, Diente near Monterey (S. N. Rhoads). Tamaulipas, in a canyon 4 miles west of Victoria, at about 3000 ft. (S. N. Rhoads.)

This is the species which was formerly identified as *G. elegans* (Strebel) by the writer. It is nearer that than to any other described species of the region, but on account of the smaller size, in some hundreds of specimens, the identification was not satisfactory. Specimens of the real *elegans* have now turned up, found in a vial labelled *H. selenkai*, from Mirador, one of the localities given by Strebel for *elegans*. It is a decidedly larger shell than the present species, probably confined to a warmer zone.

Specimens from Uruapam and other places in the State of Michoacan (S. N. Rhoads, 1899), have closer spirals on the base. A single immature specimen from Yautepec, Moreles (Heilprin exped.) probably belongs here. It was recorded by the writer as *elegans*.

G. elegantula was collected at Guadalajara, Jalisco, by McConnell and Crawford, 1909. It was taken in river drift at Tampico by Mr. Hinkley, but may have floated there from inland. It appears to be common and widely distributed.

A closely related form having about one whorl less, and with the aperture a little wider, was taken by Mr. Hinkley about old logs in the banana plantation, Maya farm, Quirigua (No. 28 of his 1913 collection). It is more highly conic than *G. pittieri* v. Marts., and may perhaps be a new species between *pittieri* and *elegantula*, or a subspecies of the latter.

Guppya gundlachi (Pfr.) was taken by Mr. Hinkley at Tampico and near San Dieguito, San Luis Potosi, and at the Maya Farm, Quirigua, Guatemala.

Guppya jalisco n. sp. Pl. XI, fig. 6.

The shell is minute, umbilicate (the umbilicus small, round, about one-ninth the diameter of the shell), light brown, somewhat glossy, very minutely striate, the striae decussated by close, microscopic spirals on the spire. The spire is somewhat dome-shaped, the outlines convex, summit obtuse. The whorls are closely coiled, nearly equal, very convex, the last one rounded peripherally and convex below. Aperture rather narrow, somewhat lunate. Columellar margin a little dilated.

Alt. 1.7, diam. 1.9 mm.; 5 whorls.

Guadalajara, Jalisco, Mexico. Type, No. 44,839 A. N. S. P., collected by R. A. McConnell, 1909.

A very small, compactly coiled shell, much smaller than *G. elegantula*.

Pseudohyalina maya n. sp. Pl. XI, figs. 5, 5a.

The shell is very minute, shaped much like *Z. nitida* (Müll.); pale yellow; openly umbilicate, the width of umbilicus somewhat more than one-fourth of the diameter of shell. Surface glossy, showing very faint growth lines under the microscope, but without spirals. Whorls well rounded, slowly increasing. Aperture lunate, somewhat oblique.

Alt. 1.1, diam. 1.75 mm.; very nearly 4 whorls.

Maya farm, Quirigua, Guatemala (A. A. Hinkley). Type and paratypes, No. 107,511 A. N. S. P.; also in coll. Hinkley.

This form is smaller than *Hyalinia permodesta* var. *minor* v. Martens.

Pseudohyalina opal n. sp. Pl. XI, figs. 7, 7a.

Shell very minute, corneous, smooth except for faint lines of growth, having a somewhat silky luster above, glossy beneath; rather narrowly umbilicate, the width of umbilicus contained about $6\frac{1}{2}$ times in the diameter of the shell. Whorls $4\frac{1}{4}$, convex, the last well rounded; suture compressed, narrowly margined. Aperture lunate.

Alt. 1.2, diam. 1.95 mm.

Polvon, Nicaragua. Types, No. 48, 523 A. N. S. P., collected by the McNeil expedition.

This little shell has been in the collection for many years under the name "*H. opal* McNeil Ms." It is more narrowly umbilicate than *Z. maya*, with the last whorl wider, viewed from above.

Averellia (Trichodiscina) hinkleyi n. sp. Fig. 5.

The shell is broadly and openly umbilicate, discoidal, the spire sunken a little; between cinnamon and cinnamon-brown, not banded. Surface dull, very densely and minutely papillose, and sparsely covered with long hairs arranged in oblique lines. These hairs are about 0.75 mm. long and about 1 mm. apart.

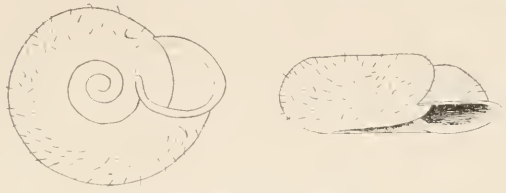


Fig. 5.—*Averellia hinkleyi.*

On the penult whorl they persist in the sutural region only, and the first $1\frac{1}{2}$ whorls are smooth, without papillæ or hairs. The whorls are convex, the last rounded peripherally, the periphery above the middle; very deeply descending in front. The aperture is subhorizontal. Peristome pale vinaceous, narrowly reflected, the insertions of the lip remote, parietal callus very thin.

Alt. 5, diam. 12.3 mm.; width of umbilicus 3.7 mm.; of aperture 5 mm.; $4\frac{1}{3}$ whorls.

Mountains west of Livingston, Guatemala, A. A. Hinkley, 1913. Type and paratype, No. 107,533 A. N. S. P.

Distinct by its concave spire, very deeply descending last whorl and long hairs. The form and peristome are much as in *A. macneili* (Crosse), but there is no trace of the peculiar pits of that species.

Thysanophora rhoadsi n. sp. Fig. 6.

The shell is perforate, conic, light brown, dull. The spire is high, a little convexly conic. Whorls very convex, the suture deeply impressed. Sculpture of light, fine, somewhat oblique growth wrinkles, with much more strongly retractive cuticular raised threads superposed over them, but mainly worn from the type specimen. The last whorl has rather strong, irregular growth-wrinkles, and only slight traces of the retractive threads. The aperture is oblique, broad, columellar margin reflected.

Fig. 6.
Thysanophora rhoadsi.

Alt. 2.8, diam. 2.5 mm.; 5 whorls.

Gualan, Guatemala, collected by S. N. Rhoads. Type, No. 114,836 A. N. S. P.

It is related to *T. cæcoides* (Tate), but differs by the more elevated shape, the altitude exceeding the diameter.

Drymaeus dombeyanus (Pfr.).

In a variety from Guadalajara, Jalisco, the last 2 or $2\frac{1}{2}$ whorls are white, the preceding 2 having some indistinct brown spots; lip and interior white; the spire is longer and aperture smaller than in the typical form.

Length 55, length of aperture with peristome 33 mm.; nearly 7 whorls.

Another variety from the same neighborhood resembles *D. dunkeri forreri* (Mouss.) in shape and coloration, but has the coarse sculpture of *dombeyanus*. It is streaked copiously with dull purplish brown, with scattered whitish spots on the streaks. Lip broadly expanded, as in *dombeyanus*. This variety may be called *D. dombeyanus ornatus*.

Length 41, diam. 22, aperture 24 mm.
" 43 " 26 " 27 "

Brachypodella subtilis pulchella (Martens).

This shell, which Mr. Hinkley has obtained in large numbers in the mountains west of Livingston, Guatemala, is not a form of *B. morini* as I formerly supposed. It is closely related to *B. subtilis* (Morel.), from which it differs by the smaller size and decidedly stronger sculpture. As in *B. subtilis*, the early whorls are smooth, while in *B. morini* they are finely striate. *B. subtilis*, of which I have an author's specimen, was described from northern Guatemala, and *pulchella* from Livingston.

Succinea panamensis n. sp. Pl. XI, fig. 4.

The shell is narrowly ovate with produced spire, pale yellow, not very glossy, with uneven sculpture of striæ and low folds. Whorls $2\frac{3}{4}$ to nearly 3, those of the spire convex, the last whorl weakly convex above, strongly so below the periphery. Aperture symmetrically ovate.

Length 13.3, diam. 4.5, length of aperture 5.7 mm.

Panama (Capt. Field); Las Cascades, C. Z. (Dr. A. P. Brown, 1910). Type and paratypes, 48,522 A. N. S. P.

I formerly identified this as "*S. recisa* Morel.?," but having now seen specimens of Morelet's species from the type locality, it is easy to see that the Panamic species is different. There are 26 specimens in the two lots, the largest 14.6 mm. long. As I cannot exactly match the form with any of the numerous Central American or Mexican species, it seems best to describe it as new, in order to have a name for the particular form of the Canal Zone.

Vaginulus moreleti C. & F.

Jocolo and Esmeralda Plantation, Rio Dulce, Guatemala (A. A. Hinkley).

Physa solidissima n. sp. Pl. XI, fig. 8.

The shell is imperforate, subglobular with very short spire, very thick and solid, composed of $4\frac{2}{3}$ whorls, the last one a little fuller above, convexly tapering downwards. Aperture semicircular; outer lip evenly arcuate, thick. Columella very heavy, with a low thick fold or convexity in the middle.

Length 8.2, diam. 6.3, length of aperture 6.9 mm.

Guadalajara, Jalisco, Mexico (McConnell and Crawford).

This is very unlike any American species I have seen, not only by its extreme solidity, but also by the very short contour. The surface is marked by a few growth-lines, but the minute sculpture, if any, and the color, cannot be ascertained until fresh specimens come to hand.

Planorbula obstructa (Morelet).

In a reservoir four miles north of Guatemala City, Mr. Hinkley took a large series of shells agreeing with the small typical form of *S. obstructa* except in the absence of internal "teeth" in the great majority of specimens, though a few show them. This form, which may be called mutation *anodonta*, is analogous to *S. dentiens* var. *cannarum* Morel. It measures 5 to 6 mm. in diameter and has only 4 whorls. There are also several other lots in the collection of the Academy, from places between Guatemala and Panama.

NERITILIA v. Martens.

The shell is neritiniform, with smooth columellar margin. Operculum with, on the calcareous internal face, a raised ledge along the basal and columellar edges, rising in a point or "peg", but without a distinct "rib." Radula with no central tooth, three laterals on each side, the outer one, or major lateral, large, oblique, with serrate cusp. Uncini or marginal teeth are extremely numerous with wide, short, serrate cusps. Genotype, *N. rubida* Pse.

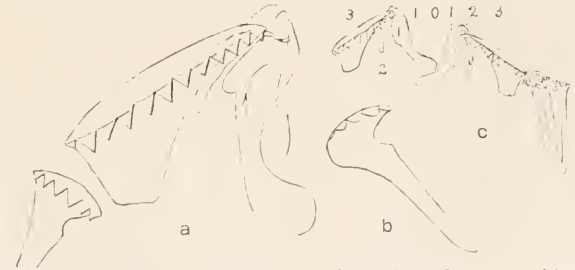


Fig. 7.—Teeth of *Neritilia*. A, lateral teeth of one side, with part of the first uncinus. B, the first uncinus lying flat, the cusps foreshortened. C, laterals of both sides with four uncini; 1, 2, 3, first, second and third or major laterals.

The operculum is unlike that of any known Neritid snail, but the chief peculiarity of the genus is in the radula. There is no central tooth whatever, the arrangement being as figured by Fischer for *Neritopsis*, the formula being ∞-3-0 3-∞, that of *Neritina* and *Nerita* being ∞-1-1-1-∞. The large inner lateral tooth is low, of very irregular form, without cusp and hard to see on account of its low relief. The second lateral is also low, narrow, without cusp, and interlocking with the larger lateral. The major lateral (*Hut* or *Schirmplatte* of German authors) resembles somewhat that of *Neritina reclivata* as figured by Troschel. The uncini are exceedingly numerous. Only the inner ones are drawn in the figure (fig. 7).

While the shell has some resemblance to that of *Lepyrium*, the operculum and radula are very different, and strikingly unlike *Neritina* (or *Theodoxus*).

Neritilia succinea guatemalensis subsp. Fig. 8.

The shell is Neritiform, hemispherical, solid, buff, the spire projecting very slightly. Embryonic shell very small, glossy; subsequent whorls not quite 2, rather dull, and smooth except for faint growth lines and on the latter part some impressed lines. The aperture is semi-circular, yellowish and smooth within, the lip sharp. The columellar margin is straight without teeth or notches. Callus flattened and plain, not very extensive, whitish towards the edge.

Alt. 3, greatest (oblique) diam. 4.7 mm.

Alt. 4. greatest (oblique) diam. 5 mm.

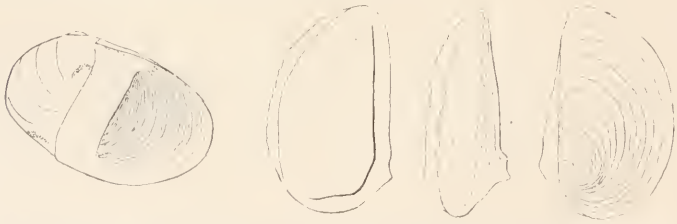


Fig. 8. *Neritilia succinea guatemalensis*, shell and three views of operculum, the middle one an oblique view of the inside from the outer edge, showing greatest height of the ledge.

The operculum is slightly reddish towards the outer margin, a little concave, marked with growth lines, the nucleus near the basal end of the straight edge. The interior face is covered with a calcareous layer except for a reddish border along the outer arc. The basal and columellar margins have a raised ledge, which rises in a rather high summit at the basal end of the straight columellar edge; this

prominence is probably homologous with the peg of ordinary Neritid opercula, and the very slight projection above and connected with it may be the remnant of a rib. At each end there is an impressed scar of attachment.

Cavech River, Guatemala, at or near high tide, rare: found with *Neritina virginea* and *N. punctulata*, the latter in abundance. Collected by A. A. Hinkley.

The process of the operculum is so much shorter than that of *N. succinea* that we have possibly a new species; but very few have been examined.

Schasicheila hinkleyi, n. sp. Figs. 9, 10.

The shell resembles that of *S. pannucea* Morelet except that it is larger. It is thin, between chamois and cream-buff when clean; densely clothed with subequal spiral cuticular threads. The last whorl is indistinctly angular in front. The lip is somewhat ex-

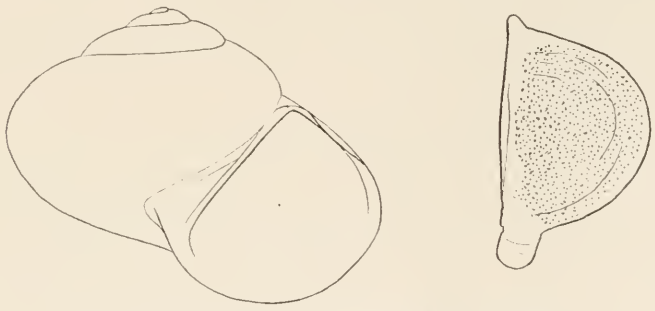


Fig. 9.—*Schasicheila hinkleyi*, shell and operculum.

panded, rather deeply notched above (about as in *S. pannucea*). The straight inner margin forms a raised ledge.

Alt. 8.5, diam. 11 mm.; $3\frac{2}{3}$ whorls.

The operculum has a short, obliquely projecting process at the upper, and a long one, parallel to the straight margin, at the lower angle; the concave outer face is papilose.

Chama, Guatemala, collected by A. A. Hinkley.

The operculum of *S. pannucea*, as figured by Fischer and Crosse, has no superior projection, and the lower process is far shorter than in this species.

Cyrenoidea guatemalensis n. sp. Pl. XI, fig. 9.

The shell is orbicular, rather plump, whitish under a very pale brown cuticle. Sculpture of very fine concentric striae with thin cuticular edges. It resembles *C. floridana* Dall except that the hinge plate is shorter and wider anteriorly, and the posterior end

of the shell is well rounded, while in *floridana* it is indistinctly truncate. The interior has numerous small solid lumps. The beaks are smooth.

Length 8.7, alt. 8.3, diam. 5.2 mm.

Livingston, Guatemala, A. A. Hinkley, 1913. Type, No. 107,532, A. N. S. P.

Eupera yucatanenenis minima n. subsp.

The shell resembles *E. yucatanensis* in contour, having a very narrow anterior and broad posterior end; of a uniform buff-corneous tint, sometimes (seven out of thirty-one specimens examined) maculate with dark gray. It differs from *E. singleyi* by the narrower anterior end and the more projecting beaks.

Length 5, alt. 3.3, diam. 2.5 mm.

Valles river, Valles, State of San Luis Potosi, Mexico, on the under side of rocks in shallow water, where there is a strong current in mid-stream (A. A. Hinkley).

Probably a distinct species. *E. yucatanensis* measures: length 10, alt. 7, diam. 5 mm.

Donax mediamericana n. sp. Pl. XI, fig. 10.

A species related to *D. striata* L., from which it differs by being smaller, comparatively longer, the alt. being three-fifths of the length; the angle between the anterior dorsal border and the posterior keel is decidedly and constantly larger; the anterior end is longer and tapers rapidly. The beaks are at the posterior four-tenths of the length. The keel is not so strongly expressed as in *D. striata*, and the posterior area is much more convex. The surface is shining, sculptured about as in *D. striata*. There are many radial riblets on the posterior end and extending on the valve about to the middle, whence they diminish gradually to the anterior end. The anterior-dorsal slope is almost smooth. The riblets crenulate the basal edge near the posterior angle, but less strongly than in *D. striata*. The teeth resemble those of *D. striata* except that the laterals are lower and much less robust.

The color is variable: white throughout; pink with concentric zones of a deeper shade, the interior pink, often violet at the ends; yellow, the interior white or pink and white, with violet ends; or yellow with dull bluish zones and beaks, the interior deep violet.

Length 22. alt. 12.5, diam. 7.9 mm. cotype.
" 21.5, " 13. " 7.9 " "
" 24.9, " 15. " 8.3 " "
" 25. " 14.9, " 9 " "

Livingston, Guatemala, collected by A. A. Hinkley. Type and cotypes, No. 45178 A. N. S. P.

This species was collected in considerable quantity by Mr. Hinkley; but although locally common, and belonging to a group in which species usually have a wide distribution, I have been unable to trace this shell in the literature. It is certainly distinct from *D. striata*, the common *Donax* of the Mosquito Coast. It resembles Roemer's figures of his *D. siliqua*, from an unknown locality, but in that species the beaks are more posterior (at the posterior fourth), and the posterior carina is therefore steeper; the posterior area is somewhat granulose and its outline more convex. Moreover, the teeth differ. None of the new forms in Bertin's monograph (Nouv. Arch. du Mus.) is nearly related.

NOTE.—Since this article was in type I have found that Schepman, in his Prosobranchia of the Siboga Expedition, Part I, 1908, p. 13, has already noticed the peculiarities of *Neritilia*, and figured the teeth of *N. rubida*, from Celebes. It is interesting to find American species with a similar radula.

EXPLANATION OF PLATE XI.

Fig. 1.—*Spiraxis guatemalensis* n. sp.
Fig. 2.—*Spiraxis longior*, n. sp.
Fig. 3.—*Pseudosubulina martensiana* n. sp.
Fig. 4.—*Succinea panamensis* n. sp.
Figs. 5, 5a.—*Pseudohyalina maya* n. sp.
Fig. 6.—*Guppya jalisco*, n. sp.
Figs. 7, 7a.—*Pseudohyalina opal*, n. sp.
Fig. 8.—*Physa solidissima* n. sp.
Fig. 9.—*Cyrenoidea guatemalensis* n. sp.
Fig. 10.—*Donax mediamericana* n. sp.

SCROPHULARIACEÆ OF THE SOUTHEASTERN UNITED STATES

BY FRANCIS W. PENNELL.

The present revision of the species of the Scrophulariaceæ occurring in the southeastern portion of the United States, from North Carolina to Florida and westward to the Mississippi River, is the outgrowth of a long-continued and especial interest. Nearly fifteen years ago, when the writer was a student in the Botanical Section of The Academy of Natural Sciences of Philadelphia, certain problems in this field appeared, and have waited for the solutions now proposed. Perhaps this early connection will make more fitting the appearance of this paper in these PROCEEDINGS.

During the late summers and early autumns of 1912 and 1913, I collected extensively through every state of this area. This was in pursuit of a monographic study of the genera now called *Macranthera, Dasistoma, Afzelia, Aureolaria, Agalinis* and *Otophylla.* Nearly every species was found, and descriptions made of the form and color of the corolla of each. Later, almost every herbarium of significance for these species has been reviewed, and the results are presented with some confidence. A preliminary paper, dealing with the species of the Coastal Plain, was published in the "Torrey Bulletin" in 1913, and a summary of this group for North America is now awaiting publication in the Contributions from the Botanical Laboratory of the University of Pennsylvania.

In the course of these two trips many collections were made of the nearly related *Buchnera,* and, less consistently, attention was given to other genera of the family. But, to obtain field-descriptions and to collect for the first time the spring-flowering species, another trip was necessary. In the Spring of 1917 I traveled as far south as Key West, and from the Coast into the Appalachians. The expedition was peculiarly successful, so that now, excepting for a few local species of the lowland, as *Herpestis rotundifolia* and several of *Agalinis,* or of the upland, as *Ilysanthes saxicola* and *Penstemon smallii,* or of the mountains in late summer, as *Chelone lyoni,* practically every species has been described from flowering plants.

Excluding *Agalinis* and its allies, specimens preserved in eastern herbaria only have been reviewed. I have studied all in the her-

baria of The New York Botanical Garden, the Brooklyn Botanic Garden, The Academy of Natural Sciences of Philadelphia, the University of Pennsylvania, the United States National Museum, (including the former Biltmore Herbarium), and the Charleston Museum. In all institutions I have received the kindest attention and assistance.

The present revision follows a plan which should lead to a simple and helpful presentation of our taxonomic knowledge of this family within the area considered. Keys are given throughout, and these are made so ample as to include all features of evident contrast noted. Effort is made to group species and genera according to real relationship, hence giving the keys a phylogenetic value. To accomplish this, and to show what appears to have been the evolutionary progress within this family, a rearrangement of the whole has been made. This was first attempted in my "Scrophulariaceæ of the Local Flora,"[1] but the placing of the Gratioleæ as introductory to the genuine Scrophulariaceæ now appears to me more satisfactory. While of theoretic suggestiveness, it is hoped that these keys may prove of practical service.

Synonomy is given, so far as to explain the origin and application of each specific and varietal name used, and to account for every such name ever proposed from within this area. The original statement as to the type or to typic distribution is quoted, and consequent discussion is given. Practically all typic or isotypic[2] material known to occur in this country has been verified, and in *Agalinis* and allies much of that abroad. Especially rich in types are the herbaria of The Academy of Natural Sciences of Philadelphia, where Nuttall's and de Schweinitz's plants are preserved, and of the Charleston Museum, containing Elliott's collection.

The statements of distribution, variability, season of flowering and of fruiting, corolla-color, and other comment scarcely need explanation. For *Agalinis* and allies, which I have collected repeatedly and over a wide range, my forthcoming monograph will give a more detailed analysis of the range of each species. At present for all species I am stating range in general terms, and shall trust to receive corrections from workers who find this treatment partial or erroneous. The detailed noting of corolla-color will be of interest to students in the field. In every case, unless otherwise stated,

[1] Torreya 19: 109-114. 1919.

[2] The word "isotype" is used to designate a specimen of the original collection, other than the type itself. See Torreya 19: 13. 1919.

this has been recorded from notes made with fresh flowers before me.

A last insertion may require more justification. This is of the collection-numbers of the specimens made by me, grouping these by states. While not attempting to list collections, because of space-limitation, it does seem advisable to present this series, showing specimens considered authentic. For *Agalinis* and allies my forthcoming monograph will state fully the herbaria in which each may be consulted; for these and for the other genera, the numbers between 4,000 and 6,000 may be seen in the herbarium of the University of Pennsylvania at Philadelphia and numbers between 9,000 and 10,000 in that of the New York Botanical Garden. Duplicates are in many collections.

Corolla with the posterior lobes external in the bud.

(ANTIRRHINOIDEÆ.)

Tree. Leaves cordate, 15–20 cm. long. Inflorescence a panicle. Sepals leathery, clothed with stellate hairs. Corolla 50–60 mm. long. Capsule 40 mm. long, with broadly winged overlapping seeds. I. Paulownieæ.

Herbs. Leaves smaller. Sepals membranous (with stellate hairs only in *Verbascum*.) Corolla smaller. Capsule smaller, and seeds not overlapping.

Capsule septicidal or loculicidal by a simple median slit, the septum rupturing or deciduous. Corolla not spurred.

Corolla not saccate anteriorly, not horned.

Stigma two-lipped. Leaves usually more or less glandular-punctate. Pedicels frequently bibracteolate. II. Gratioleæ.

Stigma capitate. Leaves not glandular-punctate. Pedicels not bracted (or with a varying number of bractlets in *Chelone*).

Filaments five. Capsule without placental hairs. Leaves opposite, ternate or alternate, with blades much wider than the stem.

Corolla rotate, slightly zygomorphic, its lobes much longer than the tube. Filaments all with fertile anthers. Leaves alternate. III. Verbasceæ.

Corolla tubular-campanulate, zygomorphic, its lobes shorter than the tube. Posterior filament without anther, the others didynamous. Leaves opposite or ternate. IV. Cheloneæ.

Filaments four. Capsule filled with tortuous hairs, between which are the scattered seeds. Leaves in fours, sixes or eights, with rudimentary blade which is narrower than the stem. V. Russelieæ.

Corolla saccate anteriorly, and with a fine horn at the base of the anterior lobes. Leaves opposite.

VI. ANGELONIEÆ.

Capsule loculicidal, the septum and adjacent capsule-wall persisting, the remaining wall splitting irregularly. Corolla with a spur at the base of the anterior petal. Leaves alternate. VII. ANTIRRHINEÆ.

Corolla with the anterior lobes external in the bud. Herbs. (RHINANTHOIDEÆ.)

Stamens two, the postero-laterals present, the antero-laterals completely lost. Antero-lateral lobes of corolla external in bud. Not parasitic. Sepals four, the posterior lost. Posterior lobes of corolla completely united.

VIII. VERONICEÆ.

Stamens four, didynamous, the antero-laterals usually slightly the longer. Usually, perhaps always, parasitic on the roots of other plants.

Sepals five, alike, more or less united. Corolla-lobes all somewhat distinct, the two posterior spreading or broadly arched; anterior lobe external in the bud.

IX. BUCHNEREÆ.

Posterior sepal shorter or wanting. Corolla decidedly two-lipped, the posterior lobes united and arched nearly to apex, the anterior lobes usually shorter; anterior or one antero-lateral lobe external in the bud.

X. RHINANTHEÆ.

I. PAULOWNIEÆ 1. *Paulownia.*

II. GRATIOLEÆ.

Leaves alternate. Stamens five. Corolla essentially regular. Pedicel not bibracteolate. 2. *Capraria.*

Leaves opposite. Stamens four or two (the posterior stamen lost). Corolla more or less zygomorphic.

Leaves entire to serrate. Seeds brown or yellow.

Seeds reticulate. Corolla with the ridges to the antero-lateral sinuses low and not projecting beyond those points (so anterior filaments simple). Posterior lobes of the corolla little, if at all, shorter than the anterior.

Leaves uniform. Capsule longer than wide, acute or obtuse, its dehiscence septicidal, or septicidal plus loculicidal.

Sepals all alike. Pedicels never bibracteolate. Stamens four. First splitting of capsule loculicidal.

Corolla white, rotate, 3–5 mm. long, densely hirsute within over bases of all lobes; lobes longer than tube, the two posterior united throughout. Sepals four, distinct. Lips of stigma united, but line of union stigmatic. Placentæ fused with septum. Upper leaves alternate.

3. *Scoparia.*

Corolla lavender, personate, 20–35 mm. long, pubescent within below bases of the anterior lobes; lobes shorter than tube, the two posterior united about three-fourths length. Sepals five, united over one-half length. Lips of stigma distinct. Placentæ wide, peltate in cross-section, attached by a narrow line to the septum. Leaves all opposite. 4. *Mimulus.*

Sepals unequal, all distinct. Pedicels frequently bibracteolate. First splitting of capsule septicidal.

Pedicels bibracteolate at base. Stamens four. Corolla pubescent within at base of posterior lobes. 5. *Mecardonia.*

Pedicels bibracteolate at apex or not at all.

Erect. Outer sepal not more than twice the width of the innermost. Corolla 8–20 mm. long, with tube much longer than the lobes. Pedicels bibracteolate. Postero-lateral stamens fertile, the antero-laterals rudimentary or wanting.

Corolla-tube broad, within densely pubescent on the posterior side. Sepals of nearly uniform length. Plants relatively lax or succulent, the leaves and sepals plane. 6. *Gratiola.*

Corolla-tube very narrow, within uniformly short-pubescent on all sides. Sepals very unequal in length. Plant stiff, the leaves and sepals revolute. 7. *Sophronanthe.*

Extensively repent. Outer sepal over twice the width of the innermost. Corolla 3–11 mm. long, with tube little longer than the lobes.

Stamens four. Corolla 7–11 mm. long. Outer sepal not deeply cordate nor conspicuously reticulate.

Corolla glabrous within, the throat yellow, the lobes white; posterior lobes distinct. No hypogynous bristles. Outer sepal oval or ovate, scarcely exceeding the oblong or lanceolate innermost. Capsule over one-half as broad as long. Leaves widening distally, very entire. Pedicels reflexed in fruit. Plants inodorous.

Stem pubescent. Leaves spatulate-oval to nearly orbicular, with seven to nine longitudinal nerves. Pedicel not bibracteolate. Sepals obtuse, scarcely longer than the rounded capsule. Styles distinct at apex. 8. *Ranapalus.*

Stem glabrous. Leaves spatulate-oblong, with one evident longitudinal nerve. Pedicel bibracteolate. Sepals acute or acutish, much exceeding the acute capsule. Styles united to apex, and stigmas short, semi-capitate. 9. *Bramia.*

Corolla pubescent within over bases of all lobes, blue throughout; posterior lobes united to apex. A circle of bristles surrounding the base of the ovary. Outer sepal slightly cordate, evidently exceeding the linear-attenuate innermost. Capsule less than one-half as broad as long. Leaves clasping, broadest proximally, crenate. Pedicels bibracteolate, spreading in fruit. Stem pubescent. Plant lemon-scented. 10. *Hydrotrida.*

Stamens two, the antero-laterals lost. Corolla 3 mm. long, white. Outer sepal deeply cordate and conspicuously reticulate. Stem finely pubescent. Pedicels not bibracteolate. 11. *Herpestis.*

Leaves dimorphic; several lanceolate ones borne on the abbreviated basal portion of the stems, and a pair of oval ones at the apex of the slender distal portion. Capsule wider than long, deeply notched, with rounded flattened lobes, only dehiscing loculicidally. 12. *Amphianthus.*

Seeds with fine transverse lines. Corolla with two raised ridges (each formed by the adherence of the filament) to the antero-lateral sinuses, and which project as knob-like processes beyong this point (the free portion of the filament appearing as a lateral outgrowth of the adherent portion). Posterior lobes of the corolla less than two-thirds the length of the anterior.

Corolla violet-blue, 6–11 mm. long, the posterior lobes $\frac{1}{3}$–$\frac{2}{3}$ length of the anterior. Postero-lateral stamens perfect, antero-lateral filaments without anthers. Style with an enlarged callose base. Sepals five, united at base. Capsule two-celled, oval in outline, 2–5 mm. long. Ascending or repent. 13. *Ilysanthes.*

Corolla pale-lavender or white, 1.5–2 mm. long. Postero-lateral stamens lost, antero-lateral filaments with anthers. Style filamentous to base. Sepals four, the posterior lost. Capsule one-celled at maturity (by loss of septum and shortening of the placentæ), globose, 1 mm. long. Repent.

Sepals united only at base. Corolla with posterior lobes evident, united one-half length of anterior. Styles distinct less than one-fourth length. Leaves orbicular. 14. *Globifera.*

Sepals united $\frac{1}{2}$–$\frac{2}{3}$ length, split nearly to base on the anterior side. Corolla with the posterior lobes lost, the tube split nearly to base on posterior side. Styles distinct $\frac{1}{3}$–$\frac{1}{2}$ length. Leaves elliptic-obovate. 15. *Hemianthus.*

Leaves bipinnatifid. Seeds pale greenish-yellow, ridged, with faint transverse lines. Pedicel not bibracteolate. Corolla lavender. Erect. 16. *Leucospora.*

III. VERBASCEÆ 17. *Verbascum.*

IV. CHELONEÆ.

Seeds angled or winged, maturing many to each cell. Corolla-lobes uniformly colored, shorter than the tube which is not conspicuously pouched at base posteriorly. Posterior filament a conspicuous process. Sepals nearly or quite distinct. Plants stiff, 4–20 dm. tall.

Corolla white or pink-red, pubescent or glabrous within, its anterior lobes projecting. Sepals distinct. Sterile filament slender, filiform, white.

Corolla membranous, somewhat pubescent or glabrous within over base of anterior lobes. Sterile filament as long as the others, pubescent on its posterior face. Anther-sacs distinct, glabrous or barbate with short hairs. Sepals lanceolate to ovate, acute to acuminate. Seeds wingless. Inflorescence compound, a raceme of cymosely branching lax flower-clusters. 18. *Penstemon.*

Corolla semi-fleshy, densely pubescent within over base of anterior lobes. Sterile filament much shorter than the others, glabrous. Anther-sacs becoming confluent, densely lanate. Sepals ovate-orbicular, rounded. Seeds winged. Inflorescence simple, a spike-like raceme of single flowers on short several-bracted pedicels. 19. *Chelone.*

Corolla red-brown, glabrous within, its antero-lateral lobes vertically projecting, the anterior lobe deflexed. Sepals obviously united at base. Sterile filament shorter than wide, two-lobed, red-brown. Inflorescence compound. 20. *Scrophularia.*

Seeds rounded, smooth, maturing one to each cell. Anterior corolla-lobes blue, posterior white, all longer than the tube which is strongly pouched at base posteriorly. Posterior filament a crescentic scarcely raised process. Sepals united over one-third length, enclosing over half the capsule. Plant lax, 1–3 dm. tall. 21. *Collinsia.*

V. RUSSELIEÆ. 22. *Russelia.*

VI. ANGELONIEÆ. 23. *Angelonia.*

VII. ANTIRRHINEÆ.

Plants glabrous. Flowering stems erect. Leaves linear, only the uppermost small ones with axillary flowers. Pedicels not over 10 mm. long. 24. *Linaria.*

Plants hirsute. Flowering stems prostrate. Leaves ovate to orbicular, nearly all with axillary flowers. Pedicels over 10 mm. long. 25. *Kickxia.*

VIII. VERONICEÆ.

Leaves whorled. Corolla white, its lobes shorter than the tube. Capsule acute, longer than broad, not flattened. Plant 10–20 dm. tall. 26. *Veronicastrum.*

Leaves opposite or alternate. Corolla blue or white, its lobes longer than the tube. Capsule acute to deeply notched, broader than long, flattened. Plants lower. 27. *Veronica.*

IX. BUCHNEREÆ.

Corolla not blue, with open orifice. Stamens all with anthers two-celled, lanate. Filaments and style nearly as long as or longer than the tube of the corolla. Capsule exserted from the calyx-tube. Pedicels not bracted.

Corolla tubular, orange, with thickened base, fleshy, semi-persistent, shriveling and blackening before falling. Filaments equal, long-exserted, pubescent with beaded hairs. Anther-sacs closely parallel, 6–7 mm. long. Pedicels deflexed in fruit. 28. *Macranthera.*

Corolla with inflated throat and spreading lobes, yellow or pink, membranous, soon falling. Filaments not long-exserted, pubescence not beaded. Anther-sacs less than 5 mm. long. Pedicels erect or permanently spreading.

Anther-sacs glabrous or with a few bristle-like hairs at apex. Stigma short, punctiform or capitate. Filaments dilated-flattened and pubescent. Corolla yellow.

Corolla densely pubescent within on all sides, its lobes all distinct and slightly shorter than the tube. Filaments clearly didynamous, dilated and pubescent throughout. Anther-sacs each opening by a slit its entire length. Style short, thick, more or less bilobed, persistent and reflexed on the capsule. Pedicels 1–2 mm. long. Plant stout, 15–20 dm. tall, the leaves 10–30 cm. long. 29. *Dasistoma.*

Corolla slightly pubescent within (in a ring about the base of the filaments and below posterior sinus), its lobes longer than the tube, the two posterior united nearly one-half their length. Filaments nearly equal, dilated and pubescent at base. Anther-sacs each opening by a slit one-sixth to one-fourth its length. Style long, slender, entire, deciduous,

straight. Pedicels 4–10 mm. long. Plants slender, 2–10 dm. tall, the leaves 1–3 cm. long.
30. *Afzelia.*

Anther-sacs lanate on the valvular surface. Stigma linear, consisting of a line down each side of the linguiform style-apex. Filaments slender, not dilated, more or less lanate.

Corolla yellow. Capsule acute to acuminate. Leaves lanceolate to ovate, entire to bipinnatifid, petioled. Stem stout, over 4 dm. tall. 31. *Aureolaria.*

Corolla pink, with red spots within on the anterior side. Capsule rounded, with a mucro. Leaves filiform to lanceolate, entire or auriculate-lobed at base, sessile. Stem usually slender.

Stem ascending-scabrous to glabrous. Leaves linear to filiform, entire. Pedicels over 1 mm. long. Calyx-lobes linear to subulate, slightly longer to much shorter than the tube. Anther-sacs of both pairs of stamens uniform. Capsule globose to globose-ovoid, 3–7 mm. long. Seeds closely reticulate. 32. *Agalinis.*

Stem retrorse-hispid. Leaves lanceolate, usually auriculate-lobed at base. Pedicels less than 1 mm. long. Calyx-lobes ovate, longer than the tube. Anther-sacs of posterior stamens shorter. Capsule broadly ovate in outline, 10–13 mm. long. Seeds reticulate with raised ridges.
33. *Otophylla.*

Corolla purple-blue or white, salverform, the tube very narrow and densely pilose within, the lobes widely spreading. Stamens each with but one anther-sac developed. Filaments and style less than one-half length of corolla-tube. Capsule mostly or quite enclosed within calyx-tube. Pedicels bibracteolate. 34. *Buchnera.*

X. RHINANTHEÆ.

Posterior sepal shorter than the others. Pedicels bibracteolate at apex. Capsule turgid, septicidal, only tardily slightly loculicidally dehiscent. Seeds linear, flat, 2 mm. long.
35. *Schwalbea.*

Posterior sepal wanting. Pedicels not bracted. Capsule flattened, loculicidal, splitting through septum. Seeds turgid.

Corolla with posterior lobes projecting, not hooded at apex, the anterior lobes very short, thickened, deep-green. Capsule cylindric, equally two-celled, in dehiscence splitting on both posterior and anterior sides. Seeds many, reticulate. Bracts foliaceous, distally scarlet.
36. *Castilleja.*

Corolla with posterior lobes arched, hooded at apex, the anterior lobes membranous, flat, colored. Capsule ensi-

form, unequally two-celled, splitting only on the posterior side. Seeds few, not reticulate. Bracts not colored.

Corolla yellow or pink throughout, the anterior lip not raised into a palate. Anthers glabrous. Seeds maturing more than four to a capsule. Sepals of each side united nearly or quite to apex. Leaves bipinnatifid-lobed. 37. *Pedicularis.*

Corolla white, the anterior lip raised into a yellow densely pubescent palate. Anthers pubescent. Seeds maturing two to four to a capsule. Sepals united at base only, the two postero-laterals longer. Leaves lanceolate, entire or setaceous-toothed near base. 38. *Melampyrum.*

1. PAULOWNIA Siebold and Zuccarini.

Paulownia Sieb. and Zucc., Fl. Jap. 1: 25. pl. 10. 1835. Type species, *P. imperialis* S. & Z., of Japan.

1. Paulownia tomentosa (Thunb.) Baill.

Of Japan. Is occasionally found, along roads, railways, etc. A frequently cultivated tree.

2. CAPRARIA Linné.

Capraria L., Sp. Pl. 628. 1753.

Type species, *C. biflora* L.

1. Capraria biflora L.

Capraria biflora L., l. c. 628. 1753. "Habitat in Curassao." Specimens from Curaçao seen in Herb. New York Botanical Garden.

Sandy soil, mostly along the beach, somewhat in waste ground and on edges of hammocks inland, subtropical Florida. A widespread species of lowland Tropical America. Very variable; varies with us mainly in size and proportions of leaf, and in the length of the hairs on the stem and pedicels, such hairs in the plant considered to be typical are entirely wanting. The pubescent state may be called forma *hirta* Loes., in Bull. Herb. Boiss., ser. II, 3: 284. 1903. ("Habitat in Guatemala, in dept. Chiquimula in ruderalibus ad S. Juan Ermita—Sel[er] n. 3314." Isotype seen in herbarium New York Botanical Garden.)

Flowering and fruiting probably throughout the year, although all specimens seen were collected between November and June. Corolla white or violet-tinged and slightly spotted with violet within throat. Normally the five stamens are fertile, but any, and as many as four, may become rudimentary. Examination of fresh flowers shows that both in *Capraria* and *Scoparia* the posterior lobes of the corolla are external in the bud, thus confirming the

impression gained from distribution and the nature of the glands in the leaves of the latter, that these genera belong to the *Gratioleae*.

Pennell (Florida)—9559, 9598, 9610, 9633.

3. SCOPARIA Linné.

Scoparia L., Sp. Pl. 116. 1753.

Type species, *S. dulcis* L.

1. Scoparia dulcis L.

Scoparia dulcis L., l. c. 116. 1753. "Habitat in Jamaica, Curassao . . . Hort. Cliff. 320." ex L., Hort. Cliff. 320. 1737. "Crescit in Curassao & Jamaica." No specimens from Curaçao seen, but the plant here considered unquestionably occurs there.

Gratiola micrantha Nutt., Amer. Jour. Sci. 5: 287. 1822. "Collected in East Florida, during October and November, 1821, by A. Ware, Esq." Type, collected by Nathaniel A. Ware, seen in Herb. Academy of Natural Sciences of Philadelphia.

Scoparia grandiflora Nash, Bull. Torr. Bot. Club 23: 105. 1896. "Collected in the flatwoods at Tampa [Florida], where it was quite frequent. [G. V. Nash] No. 2417." Type seen in Herb. Columbia University at the New York Botanical Garden. I have collected this at Tampa, my number 9643. *Scoparia dulcis* varies considerably in size of corolla, but no other character correlates with this, nor do larger-flowered plants occur in an environment distinct ecologically or geographically. Wide gradation in corolla-size may be found within one colony.

Waste places, cultivated ground, especially in sandy soil, southern Georgia to southeastern Texas and southward; wholly within the Coastal Plain. A wide-spread weed of lowland Tropical America.

Flowering and fruiting in subtropical Florida throughout the year, northward flowering in summer (from about May to September), and soon ripening fruit. Corolla white, at times the lobes slightly pinkish.

Pennell (Florida)—9643, 9656, 9678, 9702. (Louisiana)—4254.

4. MIMULUS Linné.

Mimulus L., Sp. Pl. 634. 1753.

Type species, *M. ringens* L.

Leaf-blades ovate, petioled. Angles of stem slightly winged. Pedicels stout, in fruit 5–10 mm. long. Calyx-lobes setaceous-tipped, 1–2 mm. long. Corolla 35 mm. long. Seeds pale-yellow. 1. *M. alatus.*

Leaf-blades lanceolate, not petioled. Angles of stem not winged. Pedicels slender, in fruit 30–60 mm. long. Calyx-lobes lanceolate, 3–5 mm. long. Corolla 20–30 mm. long. Seeds brownish yellow.

Cauline leaves with the blades narrowed at the base, not clasping. Corolla 20–25 mm. long. 2. *M. minthodes.*

Cauline leaves with the blades broader and clasping at the base. Corolla 25–30 mm. long. 3. *M. ringens.*

1. Mimulus alatus Ait.

Mimulus alatus Ait., Hort. Kew. 2: 361. 1789. "Nat. of North America. Introd. 1783, by Mr. William Malcolm."

Wet woods and shaded river-bottoms, loam soil, throughout the area above the Fall line, but not extending into the higher Appalachians; and along river-bottoms in the Coastal Plain. Ranges from Connecticut to Ontario and Kansas, south to northern Florida (along the Apalachicola River), Mississippi and Oklahoma.

Flowering from late July to late August, probably ripening fruit in September and October. Corolla lavender pink, within throat essentially as in *M. ringens* but the spots are smaller and the coloring fainter.

2. Mimulus minthodes Greene.

Mimulus minthodes Greene. Leaflets Bot. Obs. & Crit. 2: 1. 1909. "The type specimens are in U. S. Herb. and were collected at Birmingham, Ala., Aug., 1888." Type seen in United States National Herbarium.

Meadows, northern Georgia and northern Alabama; Piedmont region.

Not seen growing. Possibly not distinct from *M. ringens*.

3. Mimulus ringens L.

Mimulus ringens L., Sp. Pl. 634. 1753. "Habitat in Virginia, Canada . . . Hort. ups. 176. t. 2." In the Hortus Upsalensis 176, pl. 1, 1748, Linné described and figured our plant.

Swales and along streams in woodland, in loam, through the area above the fall line, reaching at least to 4400 feet altitude in the southern Appalachians, mostly more common northward; apparently not descending into the Coastal Plain. Ranges from Nova Scotia to Minnesota, south to upper South Carolina, northern Florida[3] and Kansas.

Flowering from mid July to late August, fruiting in September and October. Corolla lavender, paler externally, within on anterior side two ridges which distally bear purple-red spots and proximally two yellow areas mottled with faint brownish patches.

5. MECARDONIA Ruiz and Pavon.

Mecardonia R. and P., Syst. Veg. Fl. Per. et Chil. 164. 1798.

Type species, *M. ovata* Ruiz & Pavon, of Peru.

Corolla white, its posterior lobes united $\frac{1}{2}$–$\frac{2}{3}$ their length. Outer sepals lanceolate, rarely more than twice width of inner. Leaf-blades prevailingly lanceolate, conspicuously cuneate at base. Erect or somewhat diffuse.

[3] Reported from Quincy, Florida, by A. W. Chapman in West. Jour. Med. & Surg. 3: 473. 1845.

Leaf-blades mostly oblanceolate, long-cuneate at base. Pedicels mostly over 15 mm. long. Corolla-lobes less widely spreading.

Main stem-leaves 3–4.5 cm. long. Outer sepals 6–8 mm. long. Corolla about 10 mm. long. Plant branched above, usually 3–4 dm. tall, erect or nearly so. 1. *M. acuminata.*

Main stem-leaves 1.3–2 cm. long. Outer sepals 5–6 mm. long. Corolla 7–8 mm. long. Plant much branched from the base, 1–2 dm. tall, diffusely spreading and ascending. 1a. *M. acuminata peninsularis.*

Leaf-blades ovate, more shortly cuneate at base, 1–1.7 cm. long. Pedicels mostly 8–12 mm. long. Corolla 7–8 mm. long, its lobes relatively widely spreading. Plant apparently laxly ascending. 1b. *M. acuminata brevifolia.*

Corolla yellow, its posterior lobes united nearly to apex. Outer sepals ovate, more than four times width of inner. Leaf-blades often ovate, more shortly cuneate at base. Procumbent or ascending.

Corolla lemon-yellow, 6 mm. long, glandular-puberulent within. Outer sepals broadly ovate. Pedicels 1–2 times the length of the ovate bracts. 2. *M. procumbens.*

Corolla deep lemon-yellow, 7–8 mm. long, short-pubescent within. Outer sepals ovate. Pedicels several times the length of the lanceolate-ovate bracts. 3. *M. tenuis.*

1. **Mecardonia acuminata** (Walt.) Small.

Gratiola acuminata Walt., Fl. Carol. 61. 1788. Type not verified, but description evidently of plant here considered. Doubtless from lower South Carolina where this plant is common.

Gerardia cuneifolia Pursh, Fl. Amer. Sept. 422. 1814. "In Georgia. Bartram. v. s. in Herb. Banks." Type not verified. Description appears to be of our plant, but the statement is made that the leaves are alternate above while in *acuminata* they are opposite throughout.

Matourea nigrescens Benth., Comp. Bot. Mag. 1: 173. 1836. "(*Gratiola acuminata* Ell., non Pursh.)" ex Ell., Sketch Bot. S. C. & Ga. 1: 15. 1816. "Grows in ditches and wet places, extensively diffused." Elliott interpreted correctly the species of Walter, but Pursh had confused with this *Gratiola virginiana* L.

Mecardonia acuminata (Walt.) Small, Fl. S. E. Un. St. 1065, 1337. 1903.

Moist sandy loam, or heavier loam soil, usually near streams, in pineland or deciduous woodland, frequent or common in most portions of the Coastal Plain (although absent from such an area as the Altamaha Grit of southern Georgia), extending to Cape Canaveral in southern Florida although through the Everglade Keys mostly replaced by var. *peninsularis;* and also reaching the mountain valleys of western North Carolina and northern Georgia. Ranges from Maryland to Florida and eastern Texas, extending inland to western Kentucky, southern Missouri and eastern Oklahoma.

Flowering from May to September, and soon ripening fruit. Corolla white, within with longitudinal pink veins on the posterior side.

Pennell (Georgia)—4088. (Florida)—9658. (Louisiana)—4283.

1a. Mecardonia acuminata peninsularis Pennell, var. nov.

Plants much branched from the base, diffusely spreading and ascending. Main stem-leaves oblanceolate, long-cuneate at base, 1.3–2 cm. long. Outer sepals 5–6 mm. long. Corolla 7–8 mm. long.

Type, in hammocks and pine-lands, Black Point, below Cutler, Florida, collected in fruit and late flower, November 13, 1903, J. K. Small & J. J. Carter 824, in Herb. New York Botanical Garden; isotype in Herb. Academy of Natural Sciences of Philadelphia.

Moist places, pine-land, hammocks and everglades, southern Florida.

Pennell (Florida)—9542.

1b. Mecardonia acuminata brevifolia Pennell, var. nov.

Plants apparently laxly ascending, slightly branched, 1–4 dm. tall. Main stem-leaves ovate, cuneate at base, 1–1.7 cm. long. Outer sepals 5–6 mm. long. Corolla 7–8 mm. long.

Type, Gulfport, Mississippi, collected in flower September 8, 1900, F. E. Lloyd & S. M. Tracy 94; in Herb. New York Botanical Garden.

Moist places in longleaf pine-land, southern Georgia and northern Florida to southern Texas.

2. Mecardonia procumbens (Mill.) Small.

Erinus procumbens Mill., Gard. Dict. ed. VIII. n. 6. 1768. " . . . Houst. MSS." Type not known to exist, but description appears to be of the plant here considered. Houston collected in tropical America.

Mecardonia procumbens (Mill.) Small, Fl. S. E. Un. St. 1065, 1338. 1903.

Moist soil, loam or sand, meadows and edges of hammocks, subtropical Florida.[4] A wide-spread weed of lowland Tropical America, perhaps introduced into our flora.

Flowering and fruiting probably throughout the year. Corolla externally greenish-yellow, within on the lobes lemon-yellow, and with more or less evident longitudinal dark veins on the posterior side.

Pennell (Florida)—9549.

[4] Reported as "*Monniera chamaedryoides peduncularis*" by Mohr, Contrib. Nat. Herb. 6: 721. 1901, as occurring in Alabama from "Upper Division Coast Pine belt to Coast Plain." Surely confused with a form of *Mecardonia acuminata*.

3. Mecardonia tenuis Small.

Mecardonia tenuis Small, Fl. S. E. Un. St. 1065, 1338. 1903. "Type, Key West, Fla., Blodgett, in Herb. C. U." Type seen in Herb. Columbia University at the New York Botanical Garden.

Light loam over limestone, hammock and thickets, Key West, Florida Keys, Subtropical Florida. Endemic, but so close to *M. procumbens* and to *M. peduncularis* (Benth.) Small of Texas that the actual relationship of these species should be more fully investigated in the field.

Pennell (Florida)—9555, 9599.

6. GRATIOLA Linné.

Gratiola L., Sp. Pl. 17. 1753.

Type species, *G. officinalis* L., of Europe.

Corolla slightly exceeding calyx, externally glabrous. Capsule nearly pyramidal, acuminate. Pedicels very short.

Plant pubescent with several-celled hairs. Leaves 1–2 cm. long; bracts usually much exceeding the flowers. 1. *G. pilosa.*

Plant glabrous. Leaves .8–1.2 cm. long; bracts not exceeding the flowers. 1a. *G. pilosa epilis.*

Corolla more than twice as long as the calyx, externally more or less puberulent. Capsule broader, acute to rounded. Pedicels longer. Stem glabrous or puberulent with one-celled hairs, these frequently gland-bearing.

Pedicels exceeding 10 mm. in length. Corolla within throat on posterior side densely pubescent with knobbed hairs. Capsule ovate in outline, 1–5 mm. long, equaled or exceeded by the sepals. Seeds .3–.5 mm. long, semi-globose to oblong.

Capsule 1–3 mm. long, much exceeded by the sepals. Stem-leaves clasping by a broad base, usually at least the upper with resinous dots. Roots perennial, slender. Stoloniferous.

Corolla golden-yellow throughout. Capsule 3 mm. long. Seeds brown. Leaves with blackish glandular dots. 2. *G. georgiana.*

Corolla with throat dull-yellow, the lobes white. Capsule 1–2 mm. long. Seeds paler. Leaves with brown glandular dots, these usually more sparsely distributed.

Leaf-blades linear-lanceolate to lanceolate, usually with a few coarse serratures. Sepals linear to linear-subulate. Capsule 1–2 mm. long. 3. *G. ramosa.*

Leaf-blades ovate, with many usually finer serratures. Sepals lanceolate to oblong-lanceolate. Capsule 2 mm. long. 4. *G. viscidula.*

Capsule 4–5 mm. long, about equaled by the sepals. Stem-leaves narrowed to a sessile or slightly clasping base, not

resinous-dotted. Roots apparently annual, the main root thick, and giving off numerous fibers. Not stoloniferous.
Corolla of earlier flowers 8–12 mm. long, not lined within, pubescent below anterior lobes with unknobbed hairs. Leaves prevailingly lanceolate. 5. *G. neglecta.*
Corolla of earlier flowers 15–20 mm. long, purple-lined within, pubescent below anterior lobes with knobbed hairs. Leaves prevailingly ovate. Pedicels more slender and usually longer. 6. *G. floridana.*
Pedicels less than 10 mm. long. Corolla within throat on posterior side pubescent with unknobbed hairs. Capsule globose, 5–6 mm. long, slightly exceeding the sepals. Seeds .7 mm. long, linear. Leaves and root as in *neglecta.* 7. *G. virginiana.*

1. Gratiola pilosa Michx.

Gratiola pilosa Michx., Fl. Bor. Amer. 1: 7. 1803. "Hab. in Carolinae inferioris uliginosis [A. Michaux]." Description sufficiently distinctive.

Moist or rather dry sandy pineland, common nearly throughout the Coastal Plain, south to central Florida; occasional inland, reaching the mountain-valleys of North Carolina and northern Alabama. Ranges from New Jersey to Florida, central Arkansas and eastern Texas.

Flowering from late May to September, and soon ripening fruit. Corolla white, throat distally with faint bluish-purple lines on all petals.

Pennell (Georgia)—10172. (Florida)—9671, 9682, 9709. (Alabama)—9721.

1a. Gratiola pilosa epilis Pennell, var. nov.

Plant throughout glabrous, or the sepals rarely with a few hairs. Leaves shorter, less evidently serrate. Corolla 7–9 mm. long. Calyx-lobes 4.5 mm. long, scarcely exceeding the capsule. Capsule browner than in the species.

Type, Myers, Lee Co., Florida, collected in flower and fruit July-August, 1900, A. S. Hitchcock 258, in United States National Herbarium; isotype in Herb. New York Botanical Garden.

Around ponds, southern Florida. Only the above specimens seen.

2. Gratiola georgiana Pennell, sp. nov.

Stem fleshy, glabrous, repent, ascending, 2–4 dm. long. Leaf-blades lanceolate to lanceolate-ovate, 1.5–2.5 cm. long, serrate to nearly entire, acute or acutish. Pedicels 7–15 mm. long. Calyx-lobes linear or nearly so, 4–8 mm. long. Corolla 8–12 mm. long, bright yellow. Capsule not seen.

Type, Augusta, Georgia, collected in flower by Dr. William Baldwin; in Herb. Academy of Natural Sciences of Philadelphia.

Wet pine-barrens, North Carolina[5] to Florida and Alabama; also in southern Delaware. Not seen growing.

This has been confused with the northern *Gratiola aurea* Pursh, of which perhaps it should be counted a southern variety. They may be separated as follows:

Plant erect or repent-ascending, 1–3 dm. long. Leaf-blades linear to lanceolate, frequently denticulate distally. Pedicels 10–25 mm. long, usually equaling or exceeding the bracts. *G. aurea.*

Plant repent and ascending, 2–4 dm. long. Leaf-blades lanceolate to lanceolate-ovate, usually more uniformly serrate. Pedicels 7–15 mm. long, shorter than the bracts. *G. georgiana.*

Beside the collection of Baldwin, Rugel 99 (U, Y) from an unstated locality on Florida, and also collected very many years ago, is this species. The plant is also well described by Elliott, "Sketch Bot. S. C. & Ga.," 1: 13. 1816. It should be re-collected.

3. Gratiola ramosa Walt.

Gratiola ramosa Walt., Fl. Carol. 61. 1788. Type not verified, but descriptive of this plant common in lower South Carolina.

Gratiola quadridentata Michx., Fl. Bor. Amer. 1: 6. 1803. "Hab. in Carolina inferiore [A. Michaux]." Type not verified, but description sufficiently distinctive.

Moist or wet sandy pineland, edge of ponds, common in the Coastal Plain, South Carolina to southern Florida, west to southern Mississippi. Varies with frequently broader leaves inland, and with shorter fleshier leaves in southern Florida. In the spring erect, but later in the season the stems become lax, long and much branched.

Flowering from March to September, and soon ripening fruit. Corolla with tube dull-yellow, the lobes dull-white, the tube with longitudinal brown lines.

Pennell (Georgia)—9523. (Florida)—9657, 9669.

4. Gratiola viscidula Pennell.

Gratiola viscosa Schwein., Le Conte, Ann. Lyc. N. Y. 1: 106. 1824. "Inhabits Virginia, and the upper parts of North Carolina." The plant now considered, although the description appears inaccurate in stating that the capsule is as long as the sepals. Type, from Salem, North Carolina, seen in Herb. Academy of Natural Sciences of Philadelphia. Not *G. viscosa* Hornem., Enum. Pl. Hort. Hafn. 19. 1807.

Gratiola viscidula Pennell, Torreya 19: 145. 1919. New name for *G. viscosa* Schwein.

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[5] Reported as "*Gratiola aurea* Muhl." in Hyam's "Flora of North Carolina," N. C. Coll. A. & M. Arts, Bull. 164: 327. 1891; and in Mohr, Contrib. Nat. Herb. 6: 720. 1901, as from the Coast Plain of southern Alabama.

Swales and along streams, above the fall-line, through the Piedmont, ascending to the valleys of the southern Appalachians. Delaware to northern Georgia and eastern Tennessee.

Flowering from late June to September, and soon ripening fruit. Not seen growing.

5. Gratiola neglecta Torr.

Gratiola neglecta Torr., Cat. Pl. N. Y. 89. 1819. "Within thirty miles of the City of New York." Type probably seen in herbarium of Columbia University at the New York Botanical Garden. For discussion see Torreya 19: 146. 1919.

Wet loam, usually in deciduous woodland, frequent through the Piedmont, both east and west of the Appalachians; apparently not in the Coastal Plain, nor ascending appreciably into the mountains. Ranges across the continent northward, south in the East to northern Georgia and northern Alabama.

Flowering from April to June, and soon ripening fruit. Corolla with tube greenish-yellow, the lobes white, at times pinkish-tinged.

Pennell (Georgia)—9509. (Alabama)—9760, 9769, 9784.

6. Gratiola floridana Nutt.

Gratiola floridana Nutt., Jour. Acad. Nat. Sci. Phila. 7: 103. 1834. "Hab. near Chipola, in West Florida [in Herb. Academy of Natural Sciences]." Type, labeled "*Gratiola * grandiflora,*" collected in 1830, seen in Herb. Academy of Natural Sciences of Philadelphia.

Gratiola macrantha Chapm., Fl. S. Un. St. ed. III. 311. 1897. "Cool springs near Quincy, Middle Florida." Distinguished from *G. floridana* by having the staminodia present and relatively conspicuous. In this species, as in *G. neglecta*, the size of the rudiments of the antero-lateral stamens is quite variable.

Muddy banks and in wet woods, loam soil, in river-bottoms in the Coastal Plain, southern Georgia, southern Alabama and northern Florida; apparently occurring inland to the base of the mountains of northeastern Georgia and northeastern Alabama.

Flowering in April and May, fruiting in May and June. Corolla white, or pinkish on the lobes, yellow over base of the posterior lobes, and marked with longitudinal fine purple lines.

Pennell (Florida)—9704.

7. Gratiola virginiana L.

Gratiola virginiana L., Sp. Pl. 17. 1753. "Habitat in Virginia." For discussion of the type of this see S. F. Blake in Rhodora 20: 65. 1918.

Gratiola sphaerocarpa Ell., Sketch Bot. S. C. and Ga. 1: 14. 1816. "Grows in ponds 4 miles from Charleston [South Carolina], on the neck." Description distinctive, made from plants which flowered in the autumn. Type seen in the Elliott Herbarium at the Charleston Museum.

Gratiola megalocarpa Ell., l. c. 16. 1816. "Grows in ditches and pools from Pennsylvania to Carolina. Pursh." Ex Pursh, Fl. Amer. Sept. 12. 1814. "In ditches and pools: Pensylvania to Carolina . . . v. v." With a plant of his own, Pursh combined an account of Walter's *Gratiola acuminata;* his own plant would appear to have been the species now

considered, although any extant type should be examined. Specimens from Salem, North Carolina, collected by Schweinitz and labeled "*megalocarpa*," seen in Herb. Academy of Natural Sciences of Philadelphia.

Gratiola caroliniensis Le Conte, Ann. Lyc. N. Y. 1: 105. 1824. "Inhabits in wet grounds from Carolina to Florida." Description sufficiently distinctive. Probable type, collected by Le Conte at "Shallowford," seen in Herb. Academy of Natural Sciences of Philadelphia.

Wet loam, in shade, usually along streams, common through the Piedmont, not ascending into the Appalachians; and through the Coastal Plain south to central Florida. Ranges from New Jersey to Florida and Texas, inland in the Mississippi Valley to Illinois and Missouri.

Flowering from March to May, fruiting May to June. Corolla white, within with longitudinal purple lines, more pronounced on posterior side.

Pennell (Georgia)—9506. (Florida)—9705, 9714. (Alabama)—9726.

7. SOPHRONANTHE Bentham.

Sophronanthe Bentham; Lindl., Nat. Syst. Bot., ed. II, 445. 1836.

Type species, *S. hispida* Benth.

1. Sophronanthe hispida Benth.

Sophronanthe hispida Benth., l. c. 445. 1836. "The plant was gathered by Drummond at Apalachicola." Isotype, Drummond 20, seen in Herb. Columbia University at the New York Botanical Garden.

Gratiola subulata Baldwin; Benth., in DC. Prod. 10: 405. 1846. "In Florida (. . . Baldwin! . . .)." Specimen collected by Baldwin, labeled "W. Florida, St. Marys river, south side," so probably an isotype, seen in Herb. Academy of Natural Sciences of Philadelphia.

Dry sandy pineland, Coastal Plain, southern Georgia to Louisiana, south through the Florida peninsula to Dade County.

Flowering from late April to September, and soon ripening fruit; in southern Florida flowering and fruiting throughout the year. Corolla with tube externally yellowish-white, on lobes and within white.

Pennell (Georgia)—9528. (Florida)—9660, 9676, 9689, 9700.

8. RANAPALUS Kellogg.

Ranapalus Kellogg, Proc. Calif. Acad. 7: 113. 1877.

Type species, *R. eisenii* Kell., of California.

1. Ranapalus rotundifolius (Michx.) Pennell, comb. nov.

Monniera rotundifolia Michx., Fl. Bor. Amer. 2: 22. 1803. "Hab. in regione Illinoensi [A. Michaux]." Type not verified, but description sufficiently distinctive.

Aquatic in shallow mud-bottomed open ponds, central and western Tennessee. Through the Mississippi Valley from Indiana and Tennessee to North Dakota, eastern Colorado and northern Texas.

Flowering from July to September, and soon ripening fruit. Corolla with throat yellow within, the lobes white.

9. **BRAMIA** Lamarck.

Bramia Lam., Encyc. Meth., Bot. 1: 459. 1785.

Type species, *B. indica* Lam., of India.

1. Bramia monnieri (L.) Pennell, comb. nov.

Lysimachia monnieri L., Cent. Pl. 2: 9. 1756. "Habitat in America meridionali. Hallman." D. Z. Hallman sent to Linné specimens from Spain, so it would appear that the type of this was probably transmitted through him from some source in Spanish America.

Monniera cuneifolia Michx., Fl. Bor. Amer. 2: 22. 1803. "Hab. in locis mari inundatis Carolinae inferioris [A. Michaux]." Description sufficiently distinctive. Type of the genus *Habershamia* Raf., Neogyn. 2. 1825.

Bramia monnieria (L.) Drake, Fl. Polyn. Franc. 142. 1892.

Sandy beaches, especially where subject to inundation, common within tidewater, both where brackish and where fresh, growing also in pools in the sand dunes, in the coastal pine-land, and inland up the river-courses as far as Lake Okeechobee; on and near the coast, North Carolina to Florida and Texas. A widespread maritime plant of both the New World and Old World Tropics. Variable in size of its vegetative parts, and even of its flowers, plants everyway smaller occurring especially in drier situations and around the pineland pools.

Flowering in southern Florida throughout the year, northward from April to November; soon ripening fruit. Corolla with tube yellowish within, elsewhere white, or frequently tinged with pink. Anthers dark-purple.

Pennell (Florida)—9534, 9537, 9665.

10. **HYDROTRIDA** Small.

Hydrotrida Small, Fl. Miami 165. 1913.

Type species, *Obolaria caroliniana* Walt.

1. Hydrotrida caroliniana (Walt.) Small.

Obolaria caroliniana Walt., Fl. Carol. 166. 1788. Type not verified, but description sufficiently distinctive. Doubtless from lower South Carolina, a district where the species now considered is frequent.

Monniera amplexicaulis Michx., Fl. Bor. Amer. 2: 22. 1803. "Hab. in fossis, stagnis Carolinae [A. Michaux]." Type not verified, but description sufficiently distinctive.

Monniera crenulata Small, Bull. Torr. Bot. Club 22: 46. 1895. "Found by Mr. A. H. Curtiss, growing in the bottom of ditches between Jacksonville and Trout Creek, Florida, on July 13, 1893." Type seen in Herb. Columbia University at the New York Botanical Garden. This represents but a robust, broad-leaved state of the species.

Hydrotrida caroliniana (Walt.) Small, Fl. Miami 165. 1913.

Aquatic in shallow water, sandy soil, edges of ponds and in small streams, in pineland in the Coastal Plain, North Carolina to Florida

and Louisiana, south through the Florida peninsula to the Everglades.

Flowering from May to September, and soon ripening fruit; in southern Florida flowering and fruiting throughout the year. Corolla uniformly sky-blue.

In the herbarium of Columbia University is a memorandum description of this by Boykin. He proposed it as a new genus, but his name "Beyrichia" was preoccupied, and unfortunately no name was substituted and his suggestion has lain unheeded.

Pennell (Florida)—9675, 9683.

11. **HERPESTIS** Gaertner, f.

Herpestis Gaertn. f., Fruct. et Sem. Pl. 3: 186. 1807.

Type species, *H. rotundifolia* Gaertn. f.

1. **Herpestis rotundifolia** Gaertn. f.

Herpestis rotundifolia Gaertn. f., l. c. 186. pl. 214. 1807. "E America septentrionali a Dno Bosc, ex collectione Desfontaines." Bosc collected in Carolina, and his plant, as shown from the parts described, is certainly the species now considered. While Gaertner was doubtless influenced in his selection of a name by Michaux' *Monniera rotundifolia*, 1803, Bosc's plant is stated to be only perhaps this. Moreover Michaux' name is not connected with the phrase "*Herpestis rotundifolia*," so that we must consider this combination as here originating for the plant of Bosc. This has been confused with *Gratiola repens* Sw., a species of *Ranapalus*.

In shallow water, muddy shores, within the Coastal Plain, Maryland to Florida. Also in the West Indies. Very few collections are known, and in our area only the following stations have been noted: Wilmington, North Carolina; Ogeechee, Georgia; Jacksonville and Eustis, Florida. While doubtless often overlooked, the plant is certainly of scattered and rare occurrence.

Flowering at least from July to September, and soon ripening fruit. Not seen growing.

12. **AMPHIANTHUS** Torrey.

Amphianthus Torr., Ann. Lyc. N. Y. 4: 82. 1837.

Type species, *A. pusillus* Torr.

1. **Amphianthus pusillus** Torr.

Amphianthus pusillus Torr., l. c. 82. 1837. "Hab.—In small excavations on flat rocks, where the soil is wet during the flowering season; Newton County, Georgia . . . Dr. M. C. Leavenworth!" Type seen in Herb. Columbia University at the New York Botanical Garden.

"Growing in water in very shallow depressions in granite rock," Stone Mountain and nearby granite hills of Dekalb and Newton counties, central Georgia.

Flowering in April, fruiting in May. Not seen growing.

Apparently this plant only flourishes during wet seasons. On April 25, 1917, I searched most carefully for it on the summit and slopes of Stone Mountain (Canby's record of May 15, 1869, specifies "the summit"), but found no trace whatever. The season had been dry and there were no pools.

A remarkable plant with a unique dimorphic habit. It should be carefully studied living in order to assist in discovering its real relationship. Certainly aberrant in *Gratioleæ*, it may possibly belong to the *Veroniceæ*, as is suggested by the fruit. This was long ago the thought of Dr. Leavenworth as shown by his notes preserved in the herbarium of Columbia University.

13. ILYSANTHES Rafinesque.

Ilysanthes Raf., Ann. Nat. 13. 1820.

Type species, *I. riparia* Raf., of the banks of the Ohio.

Stem erect or ascending. Leaf-blades more or less elongate, the lower ones narrowed at the base.

Pedicels stout, shorter than the subtending bracts. Sepals usually as long as the capsule. 1. *I. dubia.*

Pedicels filiform, longer than the subtending bracts. Sepals shorter than the capsule.

Upper leaves or bracts but slightly smaller than the lower. Pedicels erect or ascending (or in fruit rarely slightly reflexed). Leaves mainly cauline.

Stem-leaves partially clasping, all opposite, none of the leaves obviously punctate. Sepals decidedly shorter than the capsules. 2. *I. inaequalis.*

Stem-leaves sessile or narrowed at base, frequently in threes, the leaves all evidently glandular-punctate. Sepals scarcely shorter than the capsule. 3. *I. saxicola.*

Upper leaves or bracts reduced to scales. Pedicels conspicuously reflexed in fruit. Leaves mainly basal. 4. *I. refracta.*

Stem repent or prostrate throughout. Leaf-blades orbicular or ovate-orbicular, rounded at the base and closely sessile. 5. *I. grandiflora.*

1. Ilysanthes dubia (L.) Barnhart.

Gratiola dubia L., Sp. Pl. 17. 1753. "Habitat in Virginiae aquosis. . . . Gron. virg. 129." Type, Clayton 164, identified by Dr. B. L. Robinson in Rhodora 10: 67. 1908, as the species here considered.

Capraria gratioloides L., Syst. ed. X. 1117. 1759. Based upon *Gratiola dubia* L.

Gratiola tetragona Ell., Sketch Bot. S. C. and Ga. 1: 15. 1816. "Grows in ponds and ditches four miles from Charleston [South Carolina]." Type seen in the Elliott Herbarium at the Charleston Museum.

Lindernia attenuata Muhl.; Ell., l. c. 17. 1816. "Grows in wet places. Vall' Ombrosa, Ogechee, Georgia. Type seen in the Elliott Herbarium at the Charleston Museum. Isotype in Herb. Columbia University at the New York Botanical Garden.

Ilysanthes dubia (L.) Barnhart, Bull. Torr. Bot. Club 26: 376. 1899.

Swamps, and stream margins, especially in groves or woodland, loam soil, through the southern Appalachians and the Piedmont, both east and west of the mountains, apparently more frequent northward; in the Coastal Plain occasional or local, in heavier soils, along river-bottoms and along the coastal bays. Ranges from New Brunswick and Ontario south to northern Florida; also in the West Indies and South America. In the lower Piedmont and Coastal Plain forms transitional to *I. inaequalis* occur.

Flowering from May to September, and soon ripening fruit. Corolla pale lavender, deeper in color near margin of lobes, and within along the antero-lateral ridges with short yellow hairs.

Pennell (Florida)—9707. (Alabama)—9723.

2. Ilysanthes inaequalis (Walt.) Pennell.

Gratiola inaequalis Walt., Fl. Carol. 61. 1788. Type not verified, but is from lower South Carolina where the plant here considered is frequent. Walter's species was interpreted as this plant by Elliott, the most critical student of the Carolina flora.

Gratiola anagallidea Michx., Fl. Bor. Amer. 1: 6. 1803. "Hab. in humidis Carolinae [A. Michaux]." Type not verified.

Lindernia dilatata Muhl.; Ell., Sketch Bot. S. C. and Ga. 1: 16. 1816. "Grows in ditches, around ponds." Type seen in the Elliott Herbarium at the Charleston Museum. It is labeled "Vall Ombrosa," whereas that of *L. attenuata* bears no definite indication of locality. The first good characterization of this species.

Gratiola dilatata Muhl.; Spreng., Syst. 1: 39. 1825. "Carolin[a]." Surely based upon *Lindernia dilatata* Muhl., but this not cited.

Ilysanthes inaequalis (Walt.) Pennell, Torreya 19: 149. 1919.

Swamps, loam and more usually in sandy soil, frequently in open situations, pineland pools and edges of hammocks, through the Coastal Plain, frequent or local; extending inland locally into the Piedmont. Ranges from Massachusetts to Florida and Texas; apparently also in Colorado, the Pacific Coast states, in Mexico, the West Indies, Central and South America. Intergrades with *Ilysanthes dubia.*

Flowering from March to September, and soon ripening fruit. Corolla as in *I. dubia.*

Pennell (Florida)—9649, 9673. (Alabama)—9768.

3. Ilysanthes saxicola (M. A. Curtis) Chapm.

Lindernia saxicola M. A. Curtis, Amer. Journ. Sci. 44: 83. 1843. "On rocks in the Hiwassee River [North Carolina] [M. A. Curtis]. . . ." Isotype seen in Herb. Columbia University at the New York Botanical Garden.

Ilysanthes saxicola (M. A. Curtis) Chapm., Fl. S. Un. St. 294. 1860.

On rocks in rapid mountain-streams, known only from the Hiwassee River in North Carolina, and from the headwaters of the Savannah River at Tallulah Falls, northern Georgia.

Flowering at least in August and September, and soon ripening fruit. Not seen growing.

4. Ilysanthes refracta (Ell.) Benth.

Lindernia refracta Ell., Sketch Bot. S. C. and Ga. 1: 579. 1821. "Grows around the margins of ponds in Barnwell district, South Carolina; in Burke County, and near Milledgeville, Georgia." Type, "Hab. in sphagnis, Barnwell Co., So. Car.," seen in Elliott Herbarium at the Charleston Museum.

Tittmannia monticola Spreng., Syst. 2: 800. 1825. "Carolina bor. (*Lindernia monticola* Nutt.)." The name of Nuttall was a *nomen nudum*, and Nuttall (Gen. Am. 1: 9. 1818) says, perhaps due to a typographic slip, "from the hills of New Hampshire." But that the name *monticola* was in use before the date of Sprengel's publication is proven by the existence of old specimens labeled "*Lindernia monticola*," collected by Schweinitz probably in North Carolina. Such a specimen, in the herbarium of Columbia University at the New York Botanical Garden, is probably an isotype of *T. monticola*, and is *Ilysanthes refracta*.

Ilysanthes refracta (Ell.) Benth., in DC. Prod. 10: 419. 1846.

Moist sandy soil, shallow depressions in pineland, in the Coastal Plain from South Carolina to northern Florida and eastern Alabama; inland on the granite of central Georgia and eastern Alabama, and likewise in the Piedmont of central North Carolina, doubtless also on granite.

Flowering from March to September, and soon ripening fruit. Corolla externally violet-purple, paler on the anterior side, within paler, but with three violet-purple streaks below the posterior sinuses, a horizontal band of violet-purple on anterior side just within the mouth, and with darker blotches below the anterior sinuses.

Pennell (Georgia)—4053, 9510, 9522.

5. Ilysanthes grandiflora (Nutt.) Benth.

Lindernia grandiflora Nutt., Gen. Amer. 2: 43. 1818. "Hab. On the spongy margins of sandy springs and ponds in Georgia, (betwixt Savannah and Augusta in many places)." Type seen in Herb. Academy of Natural Sciences of Philadelphia.

Ilysanthes grandiflora (Nutt.) Benth. in DC. Prod. 10: 418. 1846.

Moist sandy soil, especially along streams, in longleaf pineland, and southward in the Everglades, southern Georgia to southern Florida.

Flowering from March to at least July, probably to September, and soon ripening fruit. Corolla externally violet-blue, paler on anterior side; posterior lobes externally pale purplish-blue, within very pale and with light-violet median line; anterior lobes white externally and within, excepting for two violet-blue blotches near the bases of the lobes.

Pennell (Florida)—9654, 9670, 9672.

14. GLOBIFERA J. F. Gmelin.

Globifera J. F. Gmel., Syst. 2: 32. 1791.

Type species, *Anonymos umbrosa* Walt.

1. Globifera umbrosa (Walt.) J. F. Gmel.

Anonymos umbrosa Walt., Fl. Carol. 63. 1788. Type, probably from lower South Carolina, identified by Dr. S. F. Blake, in Rhodora 17: 131. 1915, as the species here considered.

Micranthemum orbiculatum Michx., Fl. Bor. Amer. 1: 10. pl. 2. 1803. Type not verified, but description and plate evidently of species here considered. Type of genus *Micranthemum* Michx.

Micranthemum emarginatum Ell., Sketch Bot. S. C. and Ga. 1: 18. 1816. "Grows in ditches and wet places—Vall'Ombrosa, Great Ogechee." Type seen in Elliott Herbarium at the Charleston Museum. Said to be "in the upper country, common," and characterized from the "very common" (and evidently lowland) *M. orbiculatum* by its more remote and larger leaves. *Globifera umbrosa* varies considerably in size of leaves, but the ample collections at hand show this to be ecologic, and not to distinguish plants of differing range.

Wet loam or in shallow water, in woodland, especially in river-bottoms, locally common throughout the Coastal Plain, especially near the ocean, North Carolina to central Florida and eastern Texas; rarely reported from above the fall-line. Also in eastern Mexico and the West Indies.

Flowering from May to October, and soon ripening fruit. Corolla uniformly dull-white. Anthers red-brown.

Pennell (Florida)—9706.

15. HEMIANTHUS Nuttall.

Hemianthus Nutt., Journ. Acad. Nat. Sci. Phila. 1: 119. pl. 6. 1817.

Type species, *H. micranthemoides* Nutt., of Pennsylvania.

1. Hemianthus glomeratus (Chapm.) Pennell, comb. nov.

Micranthemum nuttallii glomeratum Chapm., Fl. S. Un. St. ed. III. 313. 1897. "Rivers and wet banks, South Florida." Type not verified.

Sandy shores of lakes and rivers, known from Lake Okeechobee and along the Gulf coast from Tampa to the Caloosahatchee River, southern Florida.

Flowering and fruiting probably throughout the year, the specimens seen collected in May and November. Not seen growing.

This may be distinguished from the other species of the eastern United States, *Hemianthus micranthus* (Pursh) Pennell (*H. micranthemoides* Nutt.) of the Delaware and Chesapeake drainage by the following contrast:

Calyx-lobes obtuse or obtusish, less than one-fourth the length of the tube. Anterior lobe of the corolla nearly as long as the portion of the anterior lip below the base of the lateral lobes.
H. micranthus.

Calyx-lobes acute, one-third to one-half the length of the tube. Anterior lobe of the corolla about half as long as the portion of the anterior lip below the base of the lateral lobes.
H. glomeratus.

16. LEUCOSPORA Nuttall.

Leucospora Nutt., Journ. Acad. Nat. Sci. Phila. 7: 87. 1834.

Type species, *Capraria multifida* Michx.

1. Leuscopora multifida (Michx.) Nutt.

Capraria multifida Michx., Fl. Bor. Amer. 2: 22. pl. 35. 1805. "Hab. in ripis arenosis fluminum amniculorumque, in *Tennassée* et Illinoensi regione." Type not verified, but description and plate certainly of species here considered.

Leucospora multifida (Michx.) Nutt., l. c. 87. 1834.

Sandy or loam banks of brooks or rivers, in open meadows or along shores, also in "Cedar Glades," Tennessee west of the Cumberland Mountains, to western Alabama and central Mississippi. Ranges from southwestern Ontario to Kansas, south to Alabama and Texas.

Flowering from June to October, and soon ripening fruit. Corolla pale-lavender, deeper on lobes, and lined with deeper lavender; tube within at base greenish-yellow, then yellow on the anterior side, and toward mouth with a purplish ring; white at base of the lavender anterior lobes. This plant has been placed in the very different tropical genus *Conobea* Aubl.

17. VERBASCUM Linné.

Verbascum L., Sp. Pl. 177. 1753.

Type species, *V. thapsus* L., of Europe.

Stem glabrous or with simple gland-tipped hairs above. Leaves glabrous. Pedicels 10–15 mm. long. Filaments all densely lanose with knobbed purple hairs. Capsule subglobose, glandular-puberulent. Seeds .8–.9 mm. long, dark-gray.
1. *V. blattaria.*

Stem pubescent with stellate glandless hairs. Leaves, at least beneath, pubescent. Pedicels less than 10 mm. long. Filaments: three posterior lanose, two anterior sparingly lanose to glabrous, with filiform yellow hairs. Capsules ovoid to oblong, stellate-pubescent. Seeds .4–.7 mm. long, brownish-gray.

Leaf-blades crenate, glabrate above, those of the stem sessile. Pedicels usually several in an axil. Sepals about one-half length of capsule. Inflorescence not densely crowded.

Inflorescence a simple raceme, the pedicels 1–5 to an axil. Capsule globose, 7–8 mm. long. Leaves green and slightly pubescent beneath. 2. *V. virgatum.*

Inflorescence a panicle of racemes, the pedicels 3–12 to an axil. Capsule oblong or oblong-ovoid, 4–5 mm. long. Leaves white and densely stellate-tomentose beneath. 3. *V. lychnitis.*

Leaf-blades entire or but obscurely crenate, densely pubescent above, those of the stem decurrent. Pedicels one to an axil. Sepals equaling the capsule. Inflorescence densely crowded. 4. *V. thapsus.*

1. Verbascum blattaria L.

Old fields and roadsides, throughout area north of central Florida. Naturalized from Eurasia.

2. Verbascum virgatum With.

Berkeley Co., South Carolina. Naturalized from Eurasia.

3. Verbascum lychnitis L.

Old fields and roadsides, occasional in North Carolina. Naturalized from Eurasia.

4. Verbascum thapsus L.

Old fields, roadsides and thickets, throughout area north of central Florida, usually common. Naturalized from Eurasia.

18. PENSTEMON [Mitchell] Schmidel.

Penstemon Schmidel, Icon. Pl. 2. 1762.

Type species, *Chelone pentstemon* L.

Leaf-blades dimorphic, those of the prostrate wintering stems entire or few-toothed, those of the erect flowering stems bipinnatifid with linear segments. Corolla pink-purple, its throat strongly inflated and but obscurely ridged anteriorly. Anther-sacs shallowly saccate. Sterile filament conspicuously exserted. 1. *P. dissectus.*

Leaf-blades uniform, entire or merely toothed. Corolla reddish-purple to white, its throat moderately to slightly inflated, obviously ridged anteriorly. Sterile filament included or slightly exserted.

Anther-sacs dehiscent by short proximal slits, the distal portion of each remaining pouch-like. Leaf-blades entire or essentially so. Branches of the inflorescence elongate. Corolla white, unlined, nearly glabrous within the throat. 2. *P. multiflorus.*

Anther-sacs dehiscent their entire length, so never pouch-like. Leaf-blades more or less serrate. Branches of the inflorescence less elongate. Corolla lanose within, nearly always with more or less conspicuous lines of deeper color within on the anterior side.

Corolla with throat relatively inflated, its mouth open, not closed by the anterior lip. Sterile filament slightly to moderately densely bearded. Plants taller.

Corolla white, rather strongly inflated. Anther-sacs usually barbate. Stem glabrous or nearly so.....3. *P. digitalis.*

Corolla more or less violet-purple, moderately inflated. Anther-sacs glabrous. Stem usually puberulent.

Corolla more open, its throat anteriorly shallowly two-ridged, and with broader less evident lines. Anther-sacs grayish. Sterile filament included, slightly bearded. Stem finely puberulent.

Calyx-lobes becoming 4–7 mm. long, one-half to two-thirds the length of the capsule. Corolla 20–25 (–28) mm. long, usually light violet-purple. Leaf-blades lanceolate, sparsely serrate. 4. *P. pentstemon.*

Calyx-lobes becoming 8–10 mm. long, equaling the capsule. Corolla 25–35 mm. long, usually deeper violet-purple. Leaf-blades broadly lanceolate, usually more serrate. 5. *P. calycosus.*

Corolla narrower, its throat within strongly two-ridged anteriorly, and (at least in *P. canescens*) with narrow sharply defined lines. Anther-sacs violet-purple. Sterile filament slightly exserted, moderately bearded. Stems more loosely puberulent.

Blades of the cauline leaves tapering from the broad base, more serrate, glabrous or nearly so. Corolla "bright pink-purple." Capsule broadly ovoid. 6. *P. smallii.*

Blades of the cauline leaves usually narrowed from above the narrower base, less serrate, more pubescent. Corolla faint violet-purple, conspicuously lined within throat. Capsule ovoid. 7. *P. canescens.*

Corolla with throat scarcely inflated, its mouth closed by the anterior lip, which rises as a convex arc. Sterile filament very densely bearded. Plants lower.

Corolla 20–25 mm. long, broader, red-purple, throat deeply lined within, white on anterior lobes within. Sterile filament bearded with golden-yellow hairs. 8. *P. australis.*

Corolla 25–30 mm. long, very narrow and slender, white throughout. Sterile filament bearded with lemon-yellow hairs. 9. *P. tenuiflorus.*

1. Penstemon dissectus Ell.

Penstemon dissectus Ell., Sketch Bot. S. C. and Ga. 2: 129. 1822. "This . . . species was sent me . . . from Louisville, Georgia, by Mr. Jackson." Type seen in the Elliott Herbarium at the Charleston Museum.

Light gravelly soil, rock-ledges, rock outcrops of Altamaha Grit, southern Georgia.

Flowering in April and May, fruiting in June. Corolla violet-purple, externally slightly redder, paler on anterior side, within

bluer on lobes, paler within throat and in a triangle at base of each lobe, the throat within with fine longitudinal violet-purple lines. Sterile filament with slightly yellowish hairs.

The peculiar dimorphism of the leaves of this species, as well as the occurrence of bipinnatifid leaf-blades, is unique in this genus.

Pennell (Georgia)—9527.

2. Penstemon multiflorus Chapm.

Penstemon pubescens multiflorus (Chapm.) Benth. in DC. Prod. 10: 327. 1846. "In Louisiana et Florida. *P. multiflorus* Chapm. mss." Specimen seen in Herb. Columbia University at the New York Botanical Garden, from "sandy pine woods, between Mariana & St. Andrew's Bay," collected by A. W. Chapman "Oct., 1838," and labeled "probably a distinct species," is probably an isotype.

Penstemon multiflorus Chapm.; Small, Fl. S. E. Un. St. 1061. 1903.

Sandy or gravelly soil, scrub-oak land or pine land, through peninsular Florida, and westward through Middle Florida to the West Florida Pine Hills, and in extreme southern Georgia.

Flowering from May to July, and soon ripening fruit, southward flowering and fruiting throughout the year. Corolla white, within slightly purple on proximal part of tube, and sometimes on the lobes.

Pennell (Florida)—9539, 9548, 9644.

3. Penstemon digitalis Nutt.

Chelone digitalis (Nutt.) Sweet, Brit. Fl. Gard. pl. 120. 1825. "*Pentstemon Digitalis* Nutt. . . . Found by Mr. Nuttall in the Arkansas territory of North America. . . . The plant from which our drawing was taken was received last autumn from New York, by Mr. Anderson, of the Apothecaries' Garden at Chelsea, to whom it was sent by Mr. Hogg." A careful description and illustration, certainly of the plant now considered, the description being apparently more accurate than Nuttall's own in mentioning the pubescence of the anthers.

Penstemon digitalis Nutt., Trans. Amer. Phil. Soc. ser. II. 5: 181. 1837. "Hab. in wet woods and prairies [Arkansas Territory]; common. [T. Nuttall.]" Possible type, labeled "*Pentstemon latifolium*, Arkansa, Nuttall," seen in Herb. Columbia University at the New York Botanical Garden. Described without reference to *Chelone digitalis*.

Fields and edges of woodland, loam, western Tennessee and near Birmingham, Alabama, probably elsewhere northward. Native in the southwestern Mississippi valley; extensively introduced into the northeastern United States, and probably an introduction into the southeastern flora.

Flowering in May and June, fruiting in August and September. Corolla white throughout, or within on the anterior side with more or less evident violet lines.

4. Penstemon pentstemon (L.) Macm.

Chelone pentstemon L., Sp. Pl. 612. 1753. "Habitat in Virginia." Type not verified, but must have been the species here considered, because in 1753 this was certainly the only essentially glabrous species of the Atlantic seaboard.

Penstemon laevigatus Ait., Hort. Kew. 2: 361. 1789. "*Chelone Pentstemon* J. F. Miller ic. 4. . . . Nat. of North America. Cult. 1776, by John Fothergill, M. D." The description, and also the plate of Miller, clearly denote the species now considered.

Bartramia pulchella Salisb., Prod. Stirp. Chapel Allerton 99. 1796. New name for *Penstemon laevigatus* Ait. Type of genus *Bartramia* Salisb.

Penstemon pentstemon (L.) Macm., Bull. Torr. Bot. Club 19: 15. 1892.

Meadows, river-banks and edges of forest, loam or clay, frequent or common through the Piedmont, both east and west of the mountains, and through the lower valleys of the southern Appalachians: descending along river-banks slightly into the Coastal Plain. Ranges from Virginia to northern Florida and Louisiana, and inland probably to Illinois; perhaps introduced westward.

Flowering from mid-May to mid-June, fruiting in July and August. Corolla externally violet-purplish, deepest on tube, on throat and lobes pale-purplish, nearly white on anterior side; within white, and within throat on anterior side with more or less evident violet lines. Sterile filament with yellow hairs.

Pennell (Georgia)—9787. (Alabama)—9746, 9756, 9780.

5. **Penstemon calycosus** Small.

Penstemon calycosus Small, Bull. Torr. Bot. Club 25: 470. 1898. "Nashville, Tennessee." This refers to a note in Bull. Torr. Bot. Club 21: 304. 1894, reporting the occurrence of "*Penstemon Smallii*" and stating: "Mr. Bicknell has lately discovered this . . . at Nashville, Tennessee. He remarks that it grows plentifully on the bluffs of the Cumberland River about that city." Type seen in Herb. Columbia University at the New York Botanical Garden.

Rocky places, limestone ledges, in forest, Tennessee Basin and lower slopes of the Cumberland Mountains, central and eastern Tennessee, and northern Alabama. Ranges northward to Indiana and Illinois.

Flowering from mid-May to mid-June, fruiting in July. Corolla externally violet-purple (redder than in *P. pentstemon*), deeper posteriorly, fainter to white on anterior side; within nearly white within throat, on lobes faintly violet-purple, and with a few obscurely violet-purple lines within throat on anterior side. Sterile filament with yellowish hairs.

Pennell (Alabama)—9772.

6. **Penstemon smallii** Heller.

Penstemon smallii Heller, Bull. Torr. Bot. Club 21: 25. 1894. "Collected by the writer on Blowing Rock Mountain, Caldwell County, N[orth] C[arolina], July 21, 1890, at an elevation of 4000 feet. . . . Early in June, 1891, the locality was again visited in company with Mr. John K. Small." Type, Blowing Rock Mountain, Watauga Co., collected in flower June 10–20, Small & Heller 451, seen in Herb. Columbia University at the New York Botanical Garden. Isotype in Herb. Academy of Natural Sciences of Philadelphia.

Rocky lower mountain-slopes and on river-bluffs, in forest, Appalachians of North Carolina, eastern Tennessee and northernmost Georgia. Ranges northward into southwestern Virginia.

Flowering from late May to late June, fruiting in July. Not seen growing.

7. Penstemon canescens (Britton) Britton.

Penstemon laevigatus canescens Britton, Mem. Torr. Bot. Club 2: 30. 1890. "High, rocky banks of the Roanoke River [near Roanoke, Virginia, May, 1890, A. M. Vail and others]." Type, collected May 29, labeled by Dr. Britton who was of the party, seen in Herb. Columbia University at the New York Botanical Garden.

Penstemon canescens (Britton) Britton, l. c. 5:291. 1894.

Rocky loam, in open forest, lower mountain slopes, in the eastern Appalachians seen only from near the French Broad River in North Carolina; through at least the southern Cumberlands (abundant on Lookout Mountain), and in extreme northwestern Georgia (and doubtless northeastern Alabama).

Flowering in May and June, fruiting in July and August. Corolla externally faint violet-purple, within nearly white, and on the anterior side with eleven narrow sharply defined deep violet purple lines. Sterile filament with pale brownish yellow hairs.

Pennell (Georgia)—9785. (Tennessee)—5717, 9788.

8. Penstemon australis Small.

Penstemon australis Small, Fl. S. E. Un. St. 1060, 1337. 1903. "Type, Nash, Pl. Fla., 1822, in Herb. C. U." Type, Eustis, Lake County, Florida, collected in flower and fruit May 28–June 15, 1895, seen in Herb. Columbia University at the New York Botanical Garden.

Dry sandy soil, fields, scrub oak and pine land, through the Coastal Plain from North Carolina to central Florida and eastern Texas, mostly common; inland to the granite of central Georgia, and in upper South Carolina. Usually with broader leaves inland, while in the pine-barrens of the Coastal Plain the cauline may be fewer and usually much smaller so that the stem appears somewhat scapose.

Flowering in April and May, fruiting in June and July. Corolla externally reddish-purple, paler on anterior side; within red-purple on posterior lobes with on each a fine median line of deeper color, anterior lobes white, with deep red-purple streaks, three to each lateral lobe, and five, which anastomoze distally, to the median lobe. Sterile filament with yellow hairs.

This and other southern species have been freely listed as "*Penstemon pubescens*" or "*P. hirsutus*," a northern plant, with lavender corollas, and not definitely known from our area.

Pennell (North Carolina)—4944. (Georgia)—4032, 9515, 9525. (Florida)—9680, 9694, 9708.

9. Penstemon tenuiflorus Pennell.

Penstemon tenuiflorus Pennell, Addisonia 4: 79. pl. 160. 1919. "The type specimen was collected in loam soil in open pineland, three miles southeast of Albany, Morgan County, Alabama, on May 27, 1917, my number 9753, and is preserved in the herbarum of the New York Botanical Garden."

Stem 3–6 dm. tall, whitish-puberulent. Blades of the cauline leaves 3–9 cm. long, obscurely serrulate, puberulent to pubescent. Panicle narrow, its branches glandular-pubescent. Calyx-lobes ovate, 3–5 mm. long. Corolla 25–30 mm. long, its throat narrowly arched and keeled posteriorly, flattened and strongly two-ridged within anteriorly; externally glandular-puberulent, within pubescent with yellow hairs over the projecting bases of the anterior lobes; white, faintly tinged externally and on margins of lobes with violet, not lined within throat. Posterior lobes united two-thirds their length, their free portions erect-recurved. Sterile filament distally densely bearded with short lemon-yellow hairs. Capsule not seen.

Open woodlands, in loam soil, western Tennessee and northern Alabama. Ranges north to Illinois and west to Oklahoma.

Pennell (Alabama)—9753.

19. CHELONE Linné.

Chelone L., Sp. Pl. 611. 1753.

Type species, *C. glabra* L.

Leaf-blades sessile and somewhat clasping. 1. *C. cuthbertii.*

Leaf-blades manifestly petioled.

Leaf-blades of a lanceolate type, narrowed to short petioles. Corolla cream-white, white-lanose within the throat. Sepals obscurely or not ciliate. 2. *C. glabra.*

Leaf-blades of an ovate type, slightly cordate or narrowed into petioles 1.5–3 cm. long. Corolla rose-purple, yellow-lanose within the throat. Sepals evidently ciliate. 3. *C. lyonii.*

1. Chelone cuthbertii Small.

Chelone cuthbertii Small, Fl. S. E. Un. St. 1058, 1337. 1903. "Type, Highlands, N. C., Cuthbert, no. 283, in N. Y. B. G." Type, collected in flower August, 1897, in a wet meadow, at an altitude of 3800 feet, seen in Herb. New York Botanical Garden.

Wet meadows, western North Carolina. Little known, and the relation between this and *C. glabra* should be studied in the field.

Flowering in August. Not seen growing.

2. Chelone glabra L.

Chelone glabra L., Sp. Pl. 611. 1753. "Habitat in Virginia, Canada." Based upon a plant grown in the Clifford Garden in Holland. Description sufficiently distinctive.

Wet meadows and woodland swamps, through the southern Appalachians and Piedmont, common northward; descending into

the Coastal Plain in river-valleys, reaching Florida, probably near the Apalachicola River. Ranges from Newfoundland to Manitoba, south to northern Florida, and Kansas.

Flowering in late September and October, fruiting probably in October and November. Corolla cream-white, more or less pink-tinged within posterior lip, on anterior lobes, and laterally along anterior lip; occasionally entirely pink.

The forma *tomentosa* (Raf.) Pennell (in Torreya 19: 117. 1919), with leaves tomentose or pubescent beneath, is to be looked for in our area.

3. Chelone lyonii Pursh.

Chelone lyonii Pursh, Fl. Amer. Sept. 2: 737. 1814. "In Upper Carolina and Georgia. Lyon. . . . v. s. in Herb. Lambert."

Chelone major Sims, Bot. Mag. 44: pl. 1864. 1816. "Introduced by the late Mr. Lyons, from Carolina. . . . Communicated by Mr. Lambert, from Boyton, . . ." Obviously of the same origin as *C. lyonii* Pursh, and with a distinctive illustration.

Chelone latifolia Muhl.; Ell., Sketch Bot. S. C. and Ga. 2: 127. 1822. "This plant . . . was discovered . . . by Mr. Lyon along the base of the mountains of Carolina, but principally in Burke County, N. C." Description obviously of the species now considered. Described as having ovate leaf-blades, tapering at base, in contrast to the cordate blades of *C. lyonii* Pursh. This species shows complete gradation in leaf-form between these two states.

Moist mountain-woodland, eastern Appalachians, North Carolina and Tennessee, said to occur southward to northeastern Alabama.[6]

Flowering from mid-July to mid-September, fruiting in September and October. Not seen growing.

20. SCROPHULARIA Linné.

Scrophularia L., Sp. Pl. 619. 1753.

Type species, *S. nodosa* L., of Europe.

1. Scrophularia marilandica L.

Scrophularia marilandica L., l. c. 619. 1753. "Habitat in Virginia." Based upon a plant grown in the Upsala Garden, which from the description in the Hortus Upsalensis 177, 1748, would appear to have been the species now considered.

Open woodland, loam soil, Appalachians, and Piedmont both east and west of the mountains. Ranges from Massachusetts, southern Ontario and eastern Nebraska, south to Florida,[7] central Alabama and Arkansas.

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[6] Reported from Jackson Co., Alabama, by Mohr, Contrib. Nat. Herb. 6: 718. 1901.

[7] Reported from Quincy, Florida, by A. W. Chapman in West. Jour. Med. and Surg. 3: 473. 1845; and from the Marianna Red Lands of northern Florida by R. M. Harper, Fla. Geol. Surv. Rep. 6: 199. 1914.

Flowering in July and August, fruiting in August and September. Corolla externally pale-greenish, on posterior side brownish, within purple-brown on posterior side (on and below posterior lobes, and posterior half of antero-lateral lobes), anteriorly (elsewhere) pale-greenish. Sterile filament dark purple-brown.

The northern *Scrophularia leporella* Bickn., easily distinguished by its yellow sterile filament, its more cut leaves and its earlier flowering season (for fuller contrast see Torreya 19: 118), is to be looked for in upland North Carolina[8] and Tennessee.

The type of *Scrophularia serrulata* Small, Fl. S. E. Un. St. 1058, 1337. 1903, "Type Ga., Chapman, in Herb. C. U.," appears to be a specimen of the Palæarctic *Scrophularia nodosa* L. The plant is from the Chapman herbarium but without indication of collector; certainly some confusing of data has occurred, or perhaps the specimen is from Georgia in the Caucasus.

21. **COLLINSIA** Nuttall.

Collinsia Nutt., Journ. Acad. Nat. Sci. Phila. 1: 190. 1817.

Type species, *C. verna* Nutt.

1. **Collinsia verna** Nutt.

Collinsia verna Nutt., l. c. 190. pl. 8. 1817. "On descending the Ohio . . . nearly to Galiopolis, . . . I recognized it on the more open alluvions of the river, withered and nearly past affording seed. . . . From these seeds . . . I have been fortunate enough to obtain the plant from which the accompanying drawing was taken by . . . M. C. A. Le Sueur." Type seen in Herb. Academy of Natural Sciences of Philadelphia.

Moist woods, alluvial river-bottoms, in central or western Tennessee. Ranges from western New York to southern Minnesota, south to Tennessee and Missouri.

Flowering in late April and early May, and soon ripening fruit. Not seen growing.

22. **RUSSELIA** Jacquin.

Russellia Jacq., Enum. Pl. Carib. 25. 1760.

Type species, *R. sarmentosa* Jacq., of Cuba.

1. **Russelia juncea** Zucc.

Occasional in pineland and hammock, Dade County, southern Florida. Escaped from gardens. Introduced from Mexico.

23. **ANGELONIA** Humboldt & Bonpland

Angelonia H. & B., Pl. Aequin. 2: 92. pl. 108. 1809.

Type species, *A. salicariaefolia* H. & B., of Venezuela.

[8] Reported from western North Carolina by Hyams, N. C. Coll. A. & M. Arts, Bull. 164, 326. 1899.

1. Angelonia angustifolia Benth.

Occasional in pineland, Dade County, southern Florida. Escaped from gardens. Introduced from Mexico.

24. LINARIA Miller.

Linaria Mill., Gard. Dict. ed. IV. 1754.

Type species, *Antirrhinum linaria* L., of Europe.

Corolla, excluding spur, 4–12 mm. long, blue, posterior lip erect; anterior lip broadly spreading, but not forming a definite raised palate. Capsule 2–3.5 mm. long, equaling to exceeding the sepals. Seeds .3–.4 mm. long, cylindric, prismatic-angled, not winged. Stem less leafy, the younger stems spreading-prostrate from base. (*Leptoplectron.*)

Pedicels glandular-pubescent, longer than the corollas. Spur very short. 1. *L. floridana.*

Pedicels nearly glabrous, shorter than the corollas. Spur slender.

Corolla less than 8 mm. long, excluding the spur. Surface of seeds smooth to slightly tuberculate. 2. *L. canadensis.*

Corolla over 10 mm. long, excluding the spur. Surfaces and angles of seed densely tuberculate. 3. *L. texana.*

Corolla, excluding spur, 15–18 mm. long, yellow; posterior lip arched over anterior; anterior lip forming a conspicuous protruding orange palate; spur stout. Capsule 10 mm. long, much exceeding the sepals. Seeds 1.7 mm. long, flattened and circularly broadly winged. Stem densely leafy, always erect. 4. *L. linaria.*

1. Linaria floridana Chapm.

Linaria floridana Chapm., Fl. S. Un. St. 290. 1860. "Drifting sands near the coast, West Florida." Several specimens, collected by Dr. Chapman at Apalachicola, seen in Herb. New York Botanical Garden and Academy of Natural Sciences of Philadelphia.

Dry sandy soil, sand ridges along rivers and near the coast, southern Georgia to central Florida, westward near the Gulf Coast to southern Mississippi.

Flowering in March and April, and soon ripening fruit, the late flowering and fruiting plants persisting through May. Corolla light-blue, the palate paler.

Pennell (Florida)—9579, 9581.

2. Linaria canadensis (L.) Dum.-Cours.

Antirrhinum canadense L., Sp. Pl. 618. 1753. "Habitat in Virginia, Canada." Type probably from southern New Jersey, and certainly the species now considered. For discussion see Torreya 19: 151. 1919.

Linaria canadensis Dum.-Cours. Bot. Cult. 2: 96. 1802. "Lieu, Le Canada, la Virginie." Doubtless based upon *Antirrhinum canadense* L.

Open sandy soil, usually a weed, mostly common in the Atlantic Coastal Plain south to central Florida (intergrading somewhat with *L. texana* in Georgia and Florida); in the Piedmont on the

Granite of the Carolinas and central Georgia, and on other sandy soils, where probably introduced, inland to the southern Appalachians. Ranges northward to Massachusetts. Westward and inland at occasional stations where probably introduced.

Flowering from March to May, and soon ripening fruit. Corolla purplish-blue, the palate pale to white. Occasionally a pink-flowered form occurs.

Pennell (Georgia)—9502. (Florida)—9533, 9536, 9577, 9701.

3. Linaria texana Scheele.

Linaria texana Scheele, Linnaea 21: 761. 1848. "Zwischen Houston und Austin [Texas] haufig: Römer." Description sufficiently distinctive.

Open sand or sandy loam, frequently a weed, in the Coastal Plain from South Carolina to southern Mississippi, probably more common westward. Ranges widely through western North America, and into South America. Probably *Linaria canadensis* is a derivative of this.

Flowering from March to May and soon ripening fruit. Corolla pale-blue, reticulate-veined with slightly darker color, essentially as in *L. canadensis* but larger throughout.

Pennell (Georgia)—9512, 9521. (Alabama)—9724, 9727.

4. Linaria linaria (L.) Karst.

Linaria vulgaris Mill.

Loam or sandy soil, fields and waste ground, a weed; mostly above the Fall-line, probably common northward. Naturalized from Eurasia.

25. KICKXIA Dumortier.

Kickxia Dum., Fl. Belg. 35. 1827.

Type species, *Antirrhinum elatine* L., of Europe.

Leaf-blades rounded-cordate at base. Calyx-lobes ovate. 1. *K. spuria.*

Leaf-blades hastate. Calyx-lobes lanceolate. 2. *K. elatine.*

1. Kickxia spuria (L.) Dumort.

Waste places and roadsides, occasional eastward. Naturalized from Eurasia.

2. Kickxia elatine (L.) Dumort.

Waste places, roadsides and stone-walls, occasional eastward. Naturalized from Eurasia.

26. VERONICASTRUM Heister.

Veronicastrum Heist.; Fabr., Enum. Meth. Pl. Hort. Helmstad. 111. 1759.

Type species, *Veronica virginica* L.

1. Veronicastrum virginicum (L.) Farwell.

Veronica virginica L., Sp. Pl. 9. 1753. "Habitat in Virginia." Grown in the Clifford Garden. Certainly the species here considered.

Veronicastrum album Moench., Meth. 437. 1794. ". . . *Veronica virginica* L."

Calistachya alba Raf., Med. Repos. N. Y. IInd Hex. 5: 352. 1808. Based on *Veronica virginica* L. Type of *Calistachya* Raf., not *Callistachys* Vent., 1804.

Eustachya alba (Raf.) Raf., Cat. 14. 1824. *Eustachya* Raf., Amer. Mo. Mag. 4: 190. 1819, was a new name for *Calistachya* Raf. Preoccupied by *Eustachys* Desv., 1810.

Leptandra alba (Raf.) Raf., Med. Fl. 2: 21. 1830. "The true *V. virginica* of L. . . . The most common species being found all over the United States."

Leptandra villosa Raf., l. c. 21. 1830. "Mr. Schweinitz has found it in North Carolina." If the state with the leaves pubescent beneath be distinguished as a forma, this name should be used.

Veronicastrum virginicum (L.) Farwell, Drugg. Circ. 61: 231. 1917.

Varying, in number of leaves in whorl, in inflorescence of one or several racemes, and in leaves from lanceolate to nearly ovate, pubescent to nearly or quite glabrous beneath.

Sandy or loam soil, swales or moist meadows, hillside thickets, through the southern Appalachians and Piedmont, both east and west of the mountains, apparently scarce; rarely descending into the Coastal Plain. Ranges from Connecticut and Ontario and Minnesota, south to Mississippi and Texas.

Flowering in August, fruiting in September. Corolla white throughout, anthers brown.

27. VERONICA Linné.

Veronica L., Sp. Pl. 9. 1753.

Type species, *V. officinalis* L., of Europe.

Flowers solitary, axillary, frequently approximating so as to form a terminal raceme. Leaves alternate through the inflorescence.

Pedicels longer than the sepals, usually exceeding the bracts. Sepals ovate. Capsule turgid. Seeds few, 1.3–3 mm. long, convex-arched, roughened. Leaves petioled (rarely the uppermost sessile), primarily palmately 5–7 nerved, the midvein usually with some radiating pinnate veins; mainly alternate, the lower sometime opposite.

Leaves broadly cordate, 3–5 lobed, the lobes rounded. Sepals broadly ovate, conspicuously ciliate. Capsule very turgid, scarcely notched at apex, only slightly 2-lobed. Seeds 2.5–3 mm. long, blackish. 1. *V. hederaefolia.*

Leaves ovate, serrate to dentate. Sepals more shortly ciliate. Capsule slightly flattened, deeply notched at apex, thus strongly two-lobed. Seeds 1.3–1.5 mm. long, brown.

Petals not exceeding the ovate sepals. Capsule-lobes rounded, the most distal point of each about midway between the style and the lateral margin. 2. *V. agrestis.*

Petals exceeding the narrowly ovate sepals. Capsule-lobes acutish, the most distal point of each near the lateral margin. 3. *V. persica.*

Pedicels shorter than sepals or bracts. Sepals linear to narrowly ovate. Capsule flattened. Seeds many, less than 1 mm. long, flat, smooth or nearly so. Leaves sessile (or the lower petioled), scarcely palmate, alternate only through the inflorescence.

Perennial. Repent, with ascending stems. Leaves oval or ovate, obscurely crenate. Inflorescence spike-like, restricted to the distal portion of the stem. Sepals ovate. Corolla white, with blue lines on posterior side. Capsule retuse or shallowly notched, glandular-pubescent. 4. *V. serpyllifolia.*

Annuals. Erect, much branched below. Most leaf-axils flower-bearing. Sepals lanceolate to linear. Capsule deeply notched.

Lower stem-leaves ovate, crenate-serrate, the lowermost frequently petioled. Corolla deep violet-blue. Capsule pubescent with slightly gland-tipped hairs. Plant pubescent with glandless hairs. 5. *V. arvensis.*

Lower stem-leaves oblanceolate, entire or distally remotely toothed, all sessile. Corolla whitish throughout. Capsule glabrous. Plant glabrous or with short gland-tipped hairs.

Plant glabrous. 6. *V. peregrina.*

Plant pubescent with gland-tipped hairs. 6a. *V. peregrina xalapensis.*

Flowers all in axillary small-bracted racemes. Leaves opposite throughout. Perennials.

Capsule glandular-pubescent, strongly two-lobed, longer than the sepals. Stems, pedicels, leaves and sepals pubescent. Leaves oval, crenate-serrate, narrowed to a petiolar base. Extensively repent, at apex ascending. Plant of dry soil. 7. *V. officinalis.*

Capsule glabrous, scarcely or not two-lobed, equaling the sepals. Plant glabrous or with scattered gland-tipped hairs. Leaves oblong-ovate to broadly lanceolate, obscurely crenate-serrate. Ascending or wholly erect. Aquatics.

Stem distally, rhachis and pedicels glabrous. Leaves oblong-ovate, all petioled, mostly emersed. Racemes usually 10–25 flowered. Plant emersed. 8. *V. americana.*

Stem distally, rachis and pedicels sparsely pubescent with glands, borne upon jointed stalks. Leaves lanceolate, clasping. Racemes usually 25–50 flowered. Plant nearly submersed. 9. *V. glandifera.*

1. Veronica hederaefolia L.

Waste places, mostly near cities, occasional. Naturalized from Eurasia.

2. Veronica agrestis L.

Waste places and fields, mostly near cities, occasional. Naturalized from Eurasia.

3. Veronica persica Poir.

Fields, roadsides and waste places, occasional or local. Naturalized from Eurasia.

Corolla with tube and base of lobes white, anterior lobes pale, lateral darker, posterior sky blue; lobes all with blue longitudinal veins.

4. Veronica serpyllifolia L.

Fields, thickets and waste places, common at least northward. Naturalized from Eurasia.

Corolla white or nearly so, on posterior side with blue lines.

5. Veronica arvensis L.

Fields, cultivated soil, and waste ground, common at least northward. Naturalized from Eurasia.

Corolla with all lobes deep sky-blue, whitish at base, veined with deeper sky-blue.

6. Veronica peregrina L.

Veronica peregrina L., Sp. Pl. 14. 1753. "Habitat in Europae hortis, arvisque." Described, as the specific name would suggest, from specimens of an introduced plant.

Fields and cultivated soil, especially where moist, common. Certainly American in origin, but now wholly weed-like.

Corolla uniformly dull-white.

Pennell (Florida)—9712. (Alabama)—9725, 9758.

6a. Veronica peregrina xalapensis (H.B.K.) Pennell.

Veronica xalapensis H. B. K., Nov. Gen. et Sp. 2: 389. 1817. "Crescit in Regno Mexicano prope Xalapa (alt. 630 hex. [ca. 1200 m.]), in nemoribus Liquidambaris Styracifluae."

Veronica peregrina xalapensis (H. B. K.) Pennell, Torreya 19: 167. 1919.

Occasional in cultivated soil. In the western half of the continent this glandular-pubescent variety quite replaces true *peregrina*. In the East it is only occasionally seen, and that probably as an introduction.

7. Veronica officinalis L.

Dry fields, open woods, and stony hillsides, common at least northward. Naturalized from Eurasia.

Corolla very pale-lavender, on posterior side with seven lavender-blue lines.

8. Veronica americana Schwein.

Veronica americana Schwein., Benth. in DC. Prod. 10: 468. 1846. "*Veronica americana* (Schweinitz! mss.). . . . In America boreali a

Canada et Carolina usque ad flum. Oregon et in ins. Sitcha . . . (v. s.)." Specimen seen in Herb. Academy of Natural Sciences of Philadelphia, labeled "Bethl." [Bethlehem, Pennsylvania], collected by Schweinitz, may be of collection sent Bentham.

Springheads in woodland, and along streams, in the southern Appalachians of North Carolina and eastern Tennessee, in the Piedmont of South Carolina, likely occasional in this zone both east and west of the mountains. Ranges from Quebec to Alaska, south to South Carolina, New Mexico and California.

Flowering from June to August, and soon ripening fruit. Corolla pale-blue, distally with few rather faint deeper-blue lines.

9. Veronica glandifera Pennell.

Veronica glandifera Pennell, Torreya 19: 170. 1919. "Type, vicinity of Suffolk, Nansemond County, Virginia, collected in flower and fruit May 27, 1893, N. L. Britton and J. K. Small; in herbarium Columbia University at the New York Botanical Garden."

Shallow flowing streams, mostly in calcareous soil, Appalachians of North Carolina and eastern Tennessee. Ranges from New Jersey to North Carolina, Minnesota and Kentucky.

Flowering in June and July, and soon ripening fruit. Corolla pale-blue, with few deeper-blue lines.

28. MACRANTHERA Torrey.

Macranthera Torr.; Benth., Comp. Bot. Mag. 1: 174. 1836.

Type species, *Conradia fuchsioides* Nutt.

1. Macranthera flammea (Bartram) Pennell.

Gerardia flammea Bartram, Trav. 410. 1791. "Stony gravelly heights [along Tensaw River near] Taensa" In Alabama. No type known to exist. Identified by Mohr in Contr. U. S. Nat. Herb. 6: 15. 1901.

Conradia fuchsioides Nutt., Journ. Acad. Nat. Sci. Phila. 7: 88. pl. 12. 1834. No locality given. Type, without data, seen in Herb. Academy of Natural Sciences of Philadelphia. Type of genus *Conradia* Nutt., not *Conradia* Mart., 1829.

Macranthera lecontei Torr., Ann. Lyc. Nat. Hist. N. Y. 4: 80. pl. 4. 1837. "In dry pine woods on the Alatamaha, in Liberty County, Georgia, Major Le Conte!" Type, without data, seen in Herb. Columbia University at the New York Botanical Garden.

Dasystoma tubulosa Bertol., Mem. Accad. Sci. Instit. Bologna 4: 75. pl. 4. 1853. "Ex Alabama, Dr. Gates." Probable isotypes seen in Herb. New York Botanical Garden, Herb. Academy of Natural Sciences of Philadelphia and Gray Herbarium.

Macranthera flammea (Bartram) Pennell, Bull. Torr. Bot. Club 40: 124. 1913.

Borders of wet sandy thickets, in the Coastal Plain, southern Georgia and northern Florida to eastern Louisiana.

Flowering from August to October, fruiting September and October. Corolla orange throughout.

Pennell (Florida)—4564, 4595, 4681. (Alabama)—4406, 4459, 4462, 4534, 4553, 4641.

29. DASISTOMA Rafinesque.

Dasistoma Raf., Journ. de Phys. 89: 99. 1819.

Type species, *D. aurea* Raf., of Kentucky.

1. Dasistoma macrophylla (Nutt.) Raf.

Seymeria macrophylla Nutt., Gen. N. Amer. Pl. 2: 49. 1818. "Hab. In shady alluvial soils of the banks of the Little Miami, near the town of Lebanon." In Ohio. Specimen in Kew Herbarium labeled "Ohio Nuttall misit Mart. 1824," may stand as the type; this seen.
Dasistoma macrophylla (Nutt.) Raf., New Fl. Amer. 2: 67. 1837.
Brachygyne macrophylla (Nutt.) Small, Fl. S. E. Un. St. 1073, 1338. 1903. Type of genus, *Brachygyne* Small.

Sandy to clay soil, mostly in rich woods, usually along streams, western North Carolina,[9] central Tennessee and northern Alabama. Ranges from Ohio to eastern Nebraska, south to northern Alabama and northeastern Texas.

Flowering in July and August, fruiting August and September. Corolla yellow, externally tinged or marked with purple-red.

30. AFZELIA J. F. Gmelin.

Afzelia J. F. Gmel., Syst. 927. 1791.

Type species, *Anonymos cassioides* Walt.

Stem closely pubescent, viscid. Leaf-segments lanceolate or broader. Calyx-lobes lanceolate. Corolla deep-yellow, externally pubescent, its lobes ovate, 3–3.5 mm. wide. Distal portion of filament and connective of anther lanose. Anther-sacs opening one-fifth to one-fourth length. Capsule ovate, 6–7 mm. long, densely tomentose with short brown more or less glandular hairs. Seeds winged. Plant low, 2–6 dm. tall, widely branched.

Stem lanose to pubescent with reflexed-incurved to -appressed hairs. Pedicels 6–7 mm. long. Capsule densely glandular-tomentose, with hairs dark-jointed, some of them glandular-knobbed at tip. Seeds 1–1.2 mm. long. 1. *A. pectinata.*

Stem finely pubescent to puberulent in lines with ascending-incurved to -appressed hairs. Pedicels 7–10 mm. long. Capsule less tomentose to nearly glabrous, with hairs slightly dark-jointed, most or all of them glandular-knobbed at tip. Seeds 1.2–1.4 mm. long. 1a. *A. pectinata peninsularis.*

Stem sparingly pubescent, with ascending-incurved hairs, scarcely glandular. Leaf-segments filiform. Calyx-lobes linear. Corolla pale-yellow, externally glabrous, its lobes lanceolate, 1.5–2 mm. wide. Distal portion of filament and connective of anther glabrous. Anther-sacs opening one-sixth to one-fifth length. Capsule urceolate-acuminate, 4–4.5 mm. long, glabrous. Seeds not winged, .5–.7 mm. long. Plant 5–10 dm. tall, virgately branched. 2. *A. cassioides.*

[9] Reported from western North Carolina by Hyams, N. C. Coll. A. & M. Arts, Bull. 164: 327. 1899.

1. Afzelia pectinata (Pursh) Kuntze.

Seymeria pectinata Pursh, Fl. Amer. Sept. 2: 737. 1814. "In South Carolina. Catesby. v. s. in Herb. Sherard." Type not seen, but description distinctive.

Seymeria jacksoni Ell., Sketch Bot. S. C. and Ga. 2: 123. 1824. "Sent to me from Louisville, Ga., by Mr. Jackson." Type seen in the Elliott Herbarium at the Charleston Museum.

Seymeria heterophyla Raf., New Fl. Amer. 2: 68. 1837. "Alabama and Georgia, my specimen from Le Conte." Type not known to exist.

Afzelia pectinata (Pursh) Kuntze, Rev. Gen. 1: 457. 1891.

Dry sandy longleaf pineland, in the Coastal Plain from South Carolina[10] to Louisiana, south in the Florida peninsula to Brevard County; inland reported from the Pine Mountains of Meriwether County, Georgia,[11] and from the metamorphic region of northeastern Alabama.[12]

Flowering in August and September, fruiting September and October. Corolla deep golden-yellow, more or less marked with purple-red within throat and at the bases of the lobes.

Pennell (Georgia)—4732, 4760, 4780, 4845. (Florida)—4568, 4585, 4645, 4656, 4674, 4686, 4705, 4715, 4802. (Alabama)—4630.

1a. Afzelia pectinata peninsularis Pennell, var. nov.

Stem 4–6 dm. tall, finely glandular-pubescent to -puberulent in lines with ascending-incurved to -appressed hairs. Leaves glandular-pubescent to -puberulent, those of the stem 1–2 cm. long, 5–8 mm. wide. Pedicels in flower 5 mm. long, in fruit 7–10 mm. long. Calyx-lobes 4.5 mm. long. Corolla 8 mm. long, its tube 3–3.5 mm. long, its lobes 4.5 mm. long. Style 4–5 mm. long. Capsule minutely glandular-pubescent with hairs slightly dark-jointed, most or all with terminal knob-like glands. Seeds 1.2–1.4 mm. long.

Type, flat woods, Marco, Lee Co., Florida, collected in fruit July–August, 1900, A. S. Hitchcock 254, in United States National Herbarium.

Flat long-leaf pineland or hammocks, southern Florida.

Flowering June to August, probably flowering and fruiting throughout the year.

2. Afzelia cassioides (Walt.) J. F. Gmel.

Anonymos cassioides Walt., Fl. Carol. 171. 1788. Presumably from lower South Carolina. Description sufficiently distinctive.

Afzelia cassioides (Walt.) J. F. Gmel., Syst. 927. 1791.

Gerardia afzelia Michx., Fl. Bor. Amer. 2: 20. 1803. New name for *Afzelia cassioides* (Walt.) Gmel.

Seymeria tenuifolia Pursh, Fl. Amer. Sept. 737. 1814. New name for *Gerardia cassioides* (Walt.) Pers.

[10] Reported from lower North Carolina, collected by Croom [see M. A. Curtis, Bot. N. C. 39. 1867].

[11] Harper, Bull. Torr. Bot. Club 36: 587. 1909.

[12] Earle, Ala. Agric. Exp. Sta., Bull. 119: 104. 1902.

Moist or dry pineland, usually in sandy soil, in the Coastal Plain from North Carolina to Florida and Louisiana, in the Florida peninsula south to Manatee County; inland to the mountains of northern Georgia, northern Alabama and eastern Tennessee; also on the Bahamas.

Flowering from September to mid-October, and soon ripening fruit. Corolla pale-yellow, more or less marked with purple-red within throat and at the bases of the lobes.

Pennell (North Carolina)—4900, 4919. (South Carolina)—4866, 4872, 4878. (Georgia)—4725, 4743, 4762, 4809, 10173. (Florida)—4588, 4649, 4653, 4678, 4691, 4713, 4719, 9647. (Alabama)—4552, 4639. (Louisiana)—4217.

31. AUREOLARIA Rafinesque.

Aureolaria Raf., New Fl. Amer. 2: 58. 1837.

Type species, *Aureolaria villosa* Raf.

Annuals. Stem, leaves and calyx glandular. Leaves bipinnatifid, more or less pectinately cut. Calyx-lobes dentate to pectinate. Corolla externally glandular-pubescent, within pubescent below posterior sinus and over bases of posterior lobes; more or less marked or tinged with purple-red. Anther-sacs 2.5–4 mm. long. Capsule ellipsoid to broadly-ovoid in outline, glandular-puberulent to -pubescent. Seeds .8–1 mm. long, not winged. (*Panctenis* Raf.)

Leaves less sharply cut, with mostly rounded teeth, puberulent to somewhat glandular-pubescent. Pedicels 10–28 mm. long. Calyx-tube turbinate, glandular-puberulent externally. Capsule narrowly to broadly ellipsoid, 9–15 mm. long, one-half to two-thirds enclosed in the calyx-tube. Seeds .8 mm. long.

Stem closely pubescent above, not or slightly glandular. Leaves puberulent, not or slightly glandular. Calyx-lobes 8–10 mm. long. Capsule narrowly ellipsoid, 9–11 mm. long.

Leaves 3–6 cm. long, more strongly cut, incisions extending mostly about two-thirds distance to midrib, not or scarcely glandular. Pedicels permanently more or less glandular-pubescent. Calyx-tube 4–5 mm. long. Stem closely pubescent, not or scarcely glandular above. 1. *A. pedicularia.*

Leaves 2–3.5 cm. long, less cut, incisions extending mostly about one-half distance to midrib, slightly glandular. Pedicels tending to become nearly glabrous. Calyx-tube 5–7 mm. long. Stem from nearly glabrous to slightly glandular. 1a. *A. pedicularia carolinensis.*

Stem glandular-pubescent to hirsute above. Leaves glandular-puberulent to -pubescent. Calyx-lobes 10–16 mm. long,

relatively deeply lobed. Capsule broadly ellipsoid, 11–14 mm. long. 1b. *A. pedicularia austromontana.*

Leaves more sharply cut, with acute or acutish teeth, glandular-pubescent to -villose. Pedicels 4–20 mm. long. Calyx-tube hemispheric, glandular-hirsute to -lanose. Capsule broadly ovoid, 11–16 mm. long, only its base enclosed in the calyx-tube. Seeds 1 mm. long.

Stem stiffly branched. Leaves all spreading, the upper smaller but not excessively reduced, those of the stem 2–6 cm. long. Pedicels 4–20 mm. long, conspicuous when in flower. Calyx-tube glandular-hirsute to -lanose. Corolla 30–40 mm. long. Anther-sacs ovate. 2. *A. pectinata.*

Stem virgately branched. Leaves, at least the upper, appressed-ascending, uppermost leaves very much reduced, those of the stem 1.5–3 (–4) cm. long. Pedicels 4–9 mm. long, usually very short when in flower. Calyx-tube glandular-lanose. Corolla 38–45 mm. long. Anther-sacs lanceolate-ovate 2a. *A. pectinata floridana.*

Perennials. Not glandular. Leaves entire to somewhat coarsely bipinnatifid, not pectinately cut. Calyx-lobes entire to dentate. Corolla externally glabrous, within glabrous or diffused-pubescent; not marked nor tinged with purple-red. Anther-sacs 4–6 mm. long. Capsule ovate to globose-ovate in outline, not glandular. Seeds 1.3–2.7 mm. long, strongly winged. (*Aureolaria*, sensu strictu.)

Capsule densely rusty-pubescent. Pedicels 1.5–3 mm. long. Stem puberulent to pubescent, at least above.

Stem puberulent to pubescent throughout. Leaves permanently downy-pubescent. Capsule 12–15 mm. long. Seeds 1.5–1.8 mm. long 3. *A. virginica.*

Stem glabrous below, more or less puberulent above. Leaves puberulent becoming glabrous. Capsule 9–12 mm. long. Seeds 1.3–1.5 mm. long. 4. *A. microcarpa.*

Capsule glabrous. Pedicels 3–25 mm. long. Stem glabrous to minutely puberulent.

Bracts entire to finely crenate-serrate. Pedicels slender, 15–25 mm. long. 5. *A. patula.*

Bracts entire to coarsely dentate. Pedicels stouter, 3–15 mm. long.

Lower leaves ovate-lanceolate in general outline, widest about the middle, not long-acuminate. Petioles evident, mostly 10–30 mm. long. Pedicels 5–15 mm. long. Calyx densely pubescent within. Corolla 35–60 mm. long. Capsule 12–24 mm. long. Seeds 2–2.7 mm. long. Stem relatively stout, frequently purple.

Stem finely puberulent, not glaucous. Pedicels and calyx externally puberulent. Anther-sacs ovate. 6. *A. dispersa.*

Stem glabrous, glaucous. Pedicels and calyx externally glabrous. Anther-sacs ovate-lanceolate.

Stem slightly glaucous. Lower leaves from nearly entire to more or less dentate or cut, rarely $\frac{1}{2}$ distance to midrib. 7a. *A. flava reticulata.*

Stem quite glaucous. Lower leaves more or less pinnately cut, lowermost somewhat bipinnatifid, mostly over $\frac{1}{2}$ distance to midrib. 7. *A. flava.*

Lower leaves lanceolate to ovate-lanceolate, widest below the middle, long-acuminate. Petioles very short, less than 10 mm. long. Pedicels 3–8 mm. long. Calyx sparingly pubescent to glabrous within. Corolla 30–35 mm. long. Capsule 10–12 mm. long. Seeds 1.5–1.7 mm. long. Stem slender, rarely purplish, not puberulent nor glaucous. *8 A. laevigata.*

1. Aureolaria pedicularia (L.) Raf.

Gerardia pedicularia L., Sp. Pl. 611. 1753. "Habitat in Virginia, Canada." Type not verified, but description sufficiently distinctive.
Aureolaria pedicularia Raf., New Fl. Amer. 2: 61. 1837.

Dry oak-woods, sandy or rocky, perhaps in the Piedmont of North Carolina.[13] Ranges from Maine to Virginia (and Minnesota.

Flowering in August and September, fruiting September and October. Corolla yellow, externally more or less tinged with reddish, within at times with some purple-red spotting.

1a. Aureolaria pedicularia carolinensis Pennell.

Aureolaria pedicularia carolinensis Pennell, Bull. Torr. Bot. Club 40: 413. 1913. "Type, savannahs near Mill Pond, Wilmington, North Carolina, June 23, 1909, J. M. Macfarlane in Herb. University of Pennsylvania."

Dry sandy oak and mixed woods, pine-barrens of southeastern North Carolina.

Pennell (North Carolina)—4925.

1b. Aureolaria pedicularia austromontana Pennell, var. nov.

Stem glandular-pubescent to -hirsute above, with spreading short hairs, and among these, usually outnumbering them and exceeding them in length, gland-tipped hairs, so that stem is very glandular. Leaf-blades tending to lanceolate ovate, mostly deeply and sharply cut, finely puberulent with gland tipped hairs, more rarely evidently glandular-pubescent. Pedicels in flower 10–20 mm. long, in fruit (12–)18–25 mm. long. Calyx relatively sparingly pubescent with gland-tipped hairs, its lobes 10–16 mm. long, linear-lanceolate to lanceolate, relatively deeply lobed. Capsule 11–14 mm. long, broadly ellipsoid.

[13] *Aureolaria pedicularia caesariensis* Pennell, Bull. Torr. Bot. Club 40: 413, 1913, with leaves 1.2–5 cm. long, pedicels longer than bracts and stem not glandular hirsute below, has been found in woodland in Orange Co., N. C.

Type, Biltmore, North Carolina, collected in flower August 27, 1897, Biltmore Herbarium 481; in United States National Herbarium.

Dry oak or mixed woodland, on mountain-slopes, eastern and western Appalachians, from southwestern Virginia and southeastern Kentucky to northern Georgia.

This differs from *Aureolaria pedicularia ambigens* (Fernald) Farwell of the southern Lake region in its leaves narrower, more deeply and sharply cut, and its calyx-lobes longer and more deeply lobed.

Pennell (Tennessee)—5725.

2. Aureolaria pectinata (Nutt.) Pennell.

Gerardia pedicularia pectinata Nutt., Gen. Pl. N. Amer. 2: 46. 1818. "Hab. In the sandy pine forests of Carolina and Georgia." Specimen of Nuttall's collecting in the British Museum, labeled "*Gerardia millefolia* S. Carol.?" may represent the type. It is determined by Dr. S. Moore as the form now considered, agreeing with my number 5638 from Louisiana.

Aureolaria pectinata (Nutt.) Pennell, Bull. Torr. Bot. Club 40: 414. 1913.

Dry sandy pine and oak lands, especially hilly, through the Coastal Plain from South Carolina to northwestern Florida and Louisiana; extending inland on sandy soils (as the granite of central Georgia), to westernmost North Carolina and eastern Tennessee, and through the Mississippi Valley westward in our area. Ranges northwestward to Kentucky and southern Missouri. The inland forms have larger leaves and fruit, and probably represent several geographic varieties, an enumeration of which will be given in the writer's "Agalinis and Allies in North America."

Flowering from July to October, fruiting in September and October. Corolla yellow, externally more or less tinged with reddish, within not marked with purple-red.

Pennell (Georgia)—4066, 5694, 5695, 5700, 5708, 5713. (Alabama)—4532, 4625, 5689. (Tennessee)—5707, 5716.

2b. Aureolaria pectinata floridana Pennell.

Aureolaria pectinata floridana Pennell, Bull. Torr. Bot. Club 40: 414. 1913. "Type, Fort Gadsden, Franklin Co., Florida, Sept. 20, 1912, F. W. Pennell 4683, in Herb. University of Pennsylvania."

Dry sandy pineland, through the flatwoods of southern Georgia to central Florida.

Pennell (Georgia)—4724. (Florida)—4683.

3. Aureolaria virginica (L.) Pennell.

Rhinanthus virginicus L., Sp. Pl. 603. 1753. "Habitat in Virginia." Type, Clayton 488, is identified by Dr. S. F. Blake, in Rhodora 20: 66. 1918, as the plant here considered.

Aureolaria villosa Raf., New Fl. Amer. 2: 59. 1837. No type locality stated, nor type known to exist. Description sufficiently distinctive.

Dasystoma pubescens Benth., in DC. Prod. 10: 520. 1846. "In Americae sept. civitatibus orientalibus frequens." Type not verified, but description sufficiently distinctive.

Dasystoma brachycarpa Small, Bull. Torr. Bot. Club 28: 452. 1901. "The specimens on which this species is based were collected by the writer on the slopes of Stone Mountain, Georgia, Sept. 6–12, 1894." Type seen in Herb. New York Botanical Garden. Also collected by myself at Stone Mountain, Pennell 4050, 5692. The short capsules of this plant are quite within the normal range of variation of *Aureolaria virginica*.

Aureolaria virginica (L.) Pennell, Bull. Torr. Bot. Club 40: 409. 1913.

Dry open woods, usually sandy, frequent through the Piedmont and eastern Appalachians south to central Georgia, less common through the western Appalachians and Mississippi Valley of our area; occasional in the Coastal Plain south to northern Florida and west to Louisiana. Ranges from New Hampshire, south to Florida and Louisiana. This species has been long known as "*Gerardia flava.*"

Flowering from late May to July, fruiting from July to September. Corolla yellow, with no tinge of purple-red.

Pennell (Georgia)—4050, 4070, 4090, 5691, 5692, 5697, 5702. (Tennessee)—5724.

4. **Aureolaria microcarpa** Pennell, sp. nov.

Perennial. Stem 6–10 dm. tall, simple or with stiff ascending branches above, below glabrous, above less or more densely puberulent with recurved-spreading dark-jointed hairs. Petioles more or less defined from the narrowed base of the leaves. Lower leaves lanceolate-ovate, somewhat deeply and coarsely sinuate-lobed or merely shallowly dentate, 6–11 cm. long, 15–40 mm. wide; upper leaves gradually smaller and simpler, bracts ovate-lanceolate; leaves above scabrous-puberulent, beneath softly puberulent, becoming nearly or quite glabrous, above dull-green, beneath paler. Pedicels stout, closely pubescent, in flower 1–2 mm. long, in fruit 2–3 mm. long. Calyx externally closely puberulent, its tube 3–5 mm. long, turbinate, within puberulent, its lobes 3.5–7 mm. long, lanceolate to spatulate-ovate, acute to acutish. Corolla 30–40 mm. long, its tube inflated ventrally, its lobes 5–10 mm. long, ovate-orbicular, rounded; externally glabrous, within sparingly pubescent proximally, but glabrous below sinuses of lobes; yellow, with no tinge of purple-red. Filaments slender, flattened, posterior 13–17 mm. long, anterior 18–23 mm. long, all loosely lanose near base and again distally, especially close to the apex; anther-sacs 4–4.5 mm. long, ovate, broadly narrowed at apex into a rigid downcurved awn .8–.9 mm. long; sacs lanose-pubescent with retrorse white hairs. Style 25–30 mm. long. Capsule 9–12 mm. long, ovate to globose-ovate in out-

line, acute to acuminate, brownish, densely rusty-pubescent with reflexed-appressed brown hairs. Seeds 1.3–1.5 mm. long, broadly angular-lunate, flattened; testa gray, with reticulations dark, produced on outer side into several thin wings $\frac{1}{3}$–$\frac{1}{4}$ diameter of seed.

Type, Stevenson, Jackson Co., Alabama, collected in fruit October 17, 1913, F. W. Pennell 5720, in Herb. University of Pennsylvania.

Dry oak-woods, on siliceous soil, southeastern Tennessee to southern Alabama and northwestern Florida, especially in the southern Cumberland Mountains.

Flowering from early June to late August, fruiting August to October.

Pennell (Georgia)—5711. (Alabama)—5720, 9739, 9742. (Tennessee)—5703, 5706, 5715.

5. Aureolaria patula (Chapm.) Pennell, comb. nov.

Dasystoma patula Chapm. Bot. Gaz. 3: 10. 1878. "Valley of the Coosa River, near Rome, Georgia." Several collections of Chapman's seen, one labeled "Banks of Horse-leg Creek, a tributary of the Coosa River," in Herb. New York Botanical Garden, may stand as the type.

Wooded bluffs along rivers, central and eastern Tennessee, and northwestern Georgia.

Flowering from August to October. Corolla yellow, with no tinge of purple-red.

Pennell (Tennessee)—5722.

6. Aureolaria dispersa (Small) Pennell.

Dasystoma dispersa Small, Bull. Torr. Bot. Club 28: 452. 1901. "Louisiana: Feliciana, Carpenter; type in the herbarium of Columbia University." Type seen in Herb. Columbia University at the New York Botanical Garden.

Aureolaria dispersa (Small) Pennell, Bull. Torr. Bot. Club 40: 411. 1913.

Sandy thickets and oak-land, pineland from southern Alabama to Louisiana.

Flowering in August and September, fruiting in October.

Pennell (Alabama)—4504, 4521. (Mississippi)—4384. (Louisiana)—4117, 4245.

7. Aureolaria flava (L.) Farwell.

Gerardia flava L., Sp. Pl. 610. 1753. "Habitat in Virginia, Canada." Specimen in Linnean Herbarium identified by Bentham; see in Comp. Bot. Mag. 1: 198. 1836.

Gerardia quercifolia Pursh, Fl. Amer. Sept. 2: 423. pl. 19. 1814. "On the banks of rivers in rich shady places: Pensylvania to Carolina." Type not verified, but description sufficiently distinctive.

Aureolaria flava (L.) Farwell, Rep. Mich. Acad. Sci. 20: 188. 1918.

Oak woodland, usually on rocky hillsides, loam or sometimes sandy soil, nearly throughout above the Fall-Line, common in the

southern Appalachians; scarcely entering the southern Coastal Plain, where it passes into the following variety. In the southwestern Appalachians and westward, largely replaced by several ill-defined varieties, to be characterized in the writer's monograph of this group. This species has been known as "*Gerardia virginica*" and "*Dasystoma virginica.*"

Flowering from mid-July to mid-September, fruiting late August to October. Corolla yellow, with no tinge of purple-red.

Pennell (Georgia)—4109, 5693, 5712. (Alabama)—5688, 9728, 9750. (Tennessee)—5704, 5718.

7a. **Aureolaria flava reticulata** (Raf.) Pennell, comb. nov.

Aureolaria reticulata Raf., New Fl. Amer. 2: 59. 1837. "Florida and Alabama." No type known to exist.

Dasystoma bignoniiflora Small, Bull. N. Y. Bot. Gard. 1: 285. 1899. "Collected by Dr. Burrows, at Tampa Bay, Florida, in 1834." Type seen in Herb. Columbia University at the New York Botanical Garden.

Sandy ravines and moist woodland, in the Coastal Plain from Maryland to central Florida. Replaces the species in the southern Coastal Plain.

Flowering from late-August to mid-October, fruiting in September and October.

Pennell (South Carolina)—4875. (Georgia)—4723, 4765. (Florida)—4565, 4566, 4696, 4698, 4720, 9703.

8. **Aureolaria laevigata** (Raf.) Raf.

Gerardia levigata Raf., Ann. Nat. 13. 1820. "It grows on the knob hills of Kentucky, the Cumberland mountains and the Alleghany." Specimen in Herb. Columbia University at the New York Botanical Garden labeled in Rafinesque's handwriting "Gerardia—n. sp.—Kentucky," may be the type. Description sufficiently distinctive.

Aureolaria levigata (Raf.) Raf., New Fl. Amer. 2: 59. 1837.

Rocky oak-woods, along streams or on mountain-sides, frequent or common through the Appalachians south to northwestern South Carolina and eastern Tennessee. Ranges northward to Pennsylvania.

Flowering from late July to early September, fruiting in September and October. Corolla yellow, with no tinge of purple-red.

Pennell (Tennessee)—5721, 5726, 9791.

32. AGALINIS Rafinesque.

Agalinis Raf., New Fl. Amer. 2: 61. 1837.

Type species, *A. palustris* Raf.

Perennial, from a running rootstock. Pedicels erect. Corolla slightly fleshy, pink with darker spots, but with no yellow lines within throat. (*Linifoliæ.*) 1. *A. linifolia.*

Annuals, fibrous-rooted. Pedicels ascending or spreading. Corolla membranous, rose-pink, mostly with darker spots and two yellow lines within throat on the anterior side.

Corolla with lobes all spreading, pubescent within at base of posterior lobes, externally more or less pubescent.

Seeds dark-brown. Plants tending to blacken in drying. Calyx-tube not decidedly reticulate-venose. (*Purpureæ.*)

Leaves uniform, linear to filiform-linear.

Inflorescence of elongated normal racemes; pedicels less than 12 mm. long. Seed-coat with dark-brown ridges, between which mostly paler and minutely reticulate.

Leaves and calyx-lobes obtuse to acutish. Anther-sacs obtuse to acutish at distal apex. Plant fleshy, bushy-branched below with elongated racemes above. Pedicels 5–12 mm. long. 2. *A. spiciflora.*

Leaves and calyx-lobes acute to acuminate. Anther-sacs mucronate to caudate at distal apex. Plants not fleshy, more uniformly branched. Pedicels .5–5(–8) mm. long.

Corolla rose-pink to pink, two yellow lines and almost always darker spots within throat evident. Capsule 4–7 mm. long. Plants dull-green or purplish.

Stem smooth or minutely scabrellous. Axillary fascicles not or slightly developed, if present shorter than the leaves. Seeds .6–1.5 mm. long.

Corolla 20–38 mm. long, deeper rose-pink.

Axillary fascicles slightly developed. Pedicels 3–8 mm. long. Seeds .9–1.5 mm. long; areas between reticulations mostly paler, and intrareticular lines discernible.

Stem relatively stiffly branched, sparingly scabrellous. Calyx-lobes triangular-lanceolate to -subulate. Corolla 20–38 mm. long. 3. *A. purpurea.*

Stem slender, virgately branched, glabrous. Calyx-lobes triangular-subulate to subulate. Corolla 20–25 mm. long. 4. *A. virgata.*

Axillary fascicles scarcely or not developed. Pedicels 2–3 mm. long. Seeds .9–1 mm. long; areas between reticulations nearly black, and no intrareticular lines discernible. 5. *A. pinetorum.*

Corolla 15–18 mm. long, paler rose-pink. Flowers nearly sessile, on pedicels less than 2 mm. long. 6. *A. harperi.*

Stem more or less scabrous. Axillary fascicles usually abundantly developed, mostly equaling the leaves. Seeds .5–.8 mm. long. 7. *A. fasciculata.*

Corolla lavender-pink, no yellow lines nor darker spots evident within throat. Capsule 3.5–5 mm. long. Plant bright-green, little darkening in drying. Stem smooth or nearly so. Axillary fascicles abundantly developed.

8. *A. georgiana.*

Inflorescence usually of short or much broken racemes (if elongated and normal, pedicels over 10 mm. long), usually some flowers by slower or arrested growth of stem-apex appearing terminal. Pedicels 5–50 mm. long.

Stem scabrous. Corolla pubescent within in narrow line below sinus of posterior lobes. Anther-sacs strongly mucronate-caudate at distal apex, densely lanose with pink hairs on the sides. Seed-coat with dark-brown reticulations, areas between these more or less hexagonal, pale and not reticulated. Stem-leaves opposite, axillary fascicles abundantly developed. Pedicels 25–40 mm. long. Corolla 25–30 mm. long.

9. *A. pulchella.*

Stem glabrous or essentially so. Corolla pubescent within over entire width of basal portions of posterior lobes. Anther-sacs acute to minutely mucronate-caudate at distal apex, glabrous over much of dorsal surface. Seed-coat with dark-brown reticulations, areas between these elongated, scarcely paler, and scarcely or not reticulated.

Stem-leaves alternate, widening distally, slightly fleshy. Axillary fascicles abundantly developed. Stigma 3.5–5.5 mm. long. Pedicels 20–35 mm. long. Corolla 22–28 mm. long.

10. *A. filifolia.*

Stem-leaves all opposite, not widening distally, not fleshy. Axillary fascicles not or scarcely developed. Stigma 1–2 mm. long.

Branches very widely and laxly ascending. Pedicels 25–50 mm. long, very slender, four or five times as long as the bracts. Corolla 15–18 mm. long, paler rose-pink. Seeds .3–.5 mm. long.

11. *A. laxa.*

Branches more closely and stiffly ascending. Pedicels 4–40 mm. long, less than twice as long as the bracts. Corolla 15–30 mm. long, deeper rose-pink. Seeds .5–.9 mm. long.

Leaves 2–3.5 cm. long, equaling or exceeding the internodes, slightly scabrous to glabrous above.

Pedicels 15–40 mm. long, longer than the bracts. Calyx-tube $\frac{2}{3}$–$\frac{4}{5}$ the length of the capsule.

Corolla mostly 17–25 mm. long. Capsule 3–4 mm. long. Seeds .5–.6 mm. long. Leaves sparingly scabrous to glabrous above.

Leaves narrowly linear to filiform, .3–1.5 mm. wide. Racemes mostly somewhat developed, so flowers not conspicuously "terminal." Pedicels 15–40 mm. long. Calyx-lobes .2–.5 mm. long. Corolla 18–25 mm. long. Seeds rounded, turgid, with reticulations very fine, relatively close. 12. *A. holmiana.*

Leaves filiform-setaceous, .1–.3 mm. wide. Racemes scarcely developed, so flowers conspicuously "terminal." Pedicels 15–20 mm. long. Calyx-lobes .1–.3 mm. long. Corolla 17–20 mm. long. Seeds angled, with reticulations less fine and more remote. 13. *A. stenophylla.*

Pedicels 5–10 (–15) mm. long, shorter than or equaling the bracts. Calyx-tube $\frac{3}{5}$–$\frac{2}{3}$ the length of the capsule. Corolla mostly 25–30 mm. long. Capsule 4–5 mm. long. Seeds .6–.8 mm. long. Leaves slightly scabrous above. Flowers conspicuously "terminal." 14. *A. setacea.*

Leaves .5–1.2 cm. long, shorter than the internodes, scabrous above. Corolla 15–22 mm. long.

Stem slightly striate-four-angled, sparingly scabrellous to glabrous. Leaves filiform, .8–1.2 cm. long. Pedicels 4–6 mm. long, about equaling the bracts. Calyx-lobes not becoming callose. 15. *A. keyensis.*

Stem nearly terete, striate-ridged, minutely hispidulo-roughened on the ridges. Leaves linear-subulate, .5–1 cm. long. Pedicels 4–15 mm. long, three to six times the length of the bracts. Calyx-lobes becoming more or less callose. 16. *A. oligophylla.*

Leaves dimorphic, those near the base of the stem oval ovate, spreading, the cauline minute, scale-like, appressed. Pedicels 1.5–3 mm. long (many flowers appearing to terminate minute axillary branchlets). Calyx-lobes minute, subulate, callose. Corolla 15–20 mm. long. Stem striate-four-angled, ridged, minutely hispidulo-roughened on the ridges, often pubescent at base. 17. *A. aphylla.*

Seeds yellowish-brown. Plants not tending to blacken in drying. Calyx-tube evidently reticulate-venose. (*Erectæ.*)

Stem evidently striate-four-angled, simple to moderately branched. Leaves linear to nearly filiform, 1–2.5 cm. long. Racemes well-developed, so flowers not conspicuously "terminal." Stigma 1–2 mm. long.

Leaves linear to nearly filiform, not widening distally, acutish to acuminate. Corolla with two yellow lines and purple-red spots within throat strongly defined. Capsule globose to globose-ovoid, somewhat flattened at base.

Leaves 2–2.5 cm. long, filiform-linear, relatively scabrous above. Pedicels one to three times the length of the bracts. Corolla 13–15 mm. long. Seeds .6–.8 mm. long. 18. *A. decemloba.*

Leaves 1–1.5 (–2) cm. long, linear-filiform to nearly filiform, slightly scabrous above. Pedicels mostly three to eight times the length of the bracts. Corolla 15–20 mm. long. Seeds .9–1.1 mm. long. 19. *A. tenella.*

Leaves linear, widening distally, acutish to obtuse, 1–1.5 (–1.8) cm. long. Corolla with lines and spots within throat faint or obsolete. Capsule globose-ovoid to globose-elliptic, rounded at base. Corolla 12–16 mm. long. 20. *A. erecta.*

Stem nearly terete, much branched. Leaves narrowly linear, 2–3 cm. long. Racemes scarcely developed, so flowers scattered and conspicuously "terminal." Stigma 2–3 mm. long. Corolla 12–18 mm. long. 21. *A. gattingeri.*

Corolla with posterior lobes arched over stamens and style, glabrous within at their base. (*Tenuifoliæ.*)

Corolla pubescent externally, its posterior lobes about two-thirds the length of the anterior, minutely ciliate, concave-arched. Pedicels, if exceeding the bracts, less than twice their length. Corolla 10–23 mm. long, rose-pink. Leaves linear.

Corolla 15–23 mm. long. 22a. *A. tenuifolia leucanthera.*

Corolla 10–15 mm. long.

Leaves linear, 1–6 mm. wide, those of the stem obviously wider than those of the branches.

Calyx-lobes mostly 1–2 mm. long. Capsule mostly 5–7 mm. long. Seeds .7–1.3 mm. long, with reticulations more pronounced. Leaves 1–6 mm. wide. 22b. *A. tenuifolia macrophylla.*

Calyx-lobes mostly less than 1 mm. long. Capsule mostly 3–4 mm. long. Seeds .6–.9 mm. long, with reticulations very fine. Leaves 1–3.5 mm. wide. 22. *A. tenuifolia.*

Leaves linear-filiform to filiform, .3–1 mm. wide, those of the stem scarcely wider than those of the branches.
22c. *A. tenuifolia polyphylla.*

Corolla glabrous externally, its posterior lobes less than one-half the length of the anterior, conspicuously ciliate, flattened. Pedicels at least three times the length of the bracts.

Leaves filiform, those of the stem 1.5–2 cm. long. Racemes well-developed, so flowers not appearing "terminal." Pedicels 20–32 mm. long, three to twelve times the length of the bracts. Corolla 15–18 mm. long, rose-pink. Plant widely much branched.
23. *A. divaricata.*

Leaves minute, triangular-subulate, .1–.2 cm. long. Flowers scattered, mostly appearing "terminal." Pedicels 6–10 mm. long, many times the length of the bracts. Corolla 10–13 mm. long, lavender-pink. Plant sparingly very laxly branched. 24. *A. filicaulis.*

1. Agalinis linifolia (Nutt.) Britton.

Gerardia linifolia Nutt., Gen. Pl. N. Amer. 2: 47. 1818. "Hab. From Wilmington, North Carolina, to Florida." Type, labeled "Carolina," and collected by T. Nuttall, seen in Herb. Academy of Natural Sciences of Philadelphia.

Agalinis perennis Raf., New Fl. Amer. 2: 63. 1837. "My specimen is from Florida." Type not known to exist, but description quite distinctive.

Agalinis linifolia (Nutt.) Britton; Britton & Brown, Ill. Fl. ed. II. 3: 209. 1913.

Wet sandy pineland, usually about margins of ponds in long-leaf pineland, in the Coastal Plain from North Carolina to southern Florida and west to Louisiana. Northward occurs in southern Delaware.

Flowering from mid-August to October, fruiting September to November. Corolla pink, with no yellow lines but with diffused purple-red spots within throat anteriorly.

Pennell (Georgia)—4729, 4745, 4790, 4823. (Florida)—4600, 4648, 4654, 4666, 4690, 4714, 4794, 4807, 4813.

2. Agalinis spiciflora (Engelm.) Pennell, comb. nov.

Gerardia maritima grandiflora Benth., Comp. Bot. Mag. 1: 208. 1836. "Texas, Drummond, (1st Coll.)" Type in Kew Herbarium verified by Dr. N. E. Brown as agreeing with my number 4702 from Florida; isotype seen in Herb. Columbia University at the New York Botanical Garden.

Gerardia spiciflora Engelm., Bost. Journ. Nat. Hist. 5: 227. 1845. New name for *Gerardia maritima grandiflora* Benth.

Gerardia maritima major Chapm., Fl. S. Un. St. 300. 1860. "Brackish marshes, Apalachicola, Florida." Different collections of this, made by Dr. Chapman, seen.

Salt marshes, along the coast from North Carolina to Texas. Ranges through the West Indies and on the shore of Yucatan. Prob-

ably not specifically distinct from the northern smaller ally, *A. maritima* (Raf.) Raf.

Flowering from March to September, and soon ripening fruit; in subtropical Florida flowering and fruiting throughout the year. Corolla pink, with two yellow lines and many small purple-red spots within throat anteriorly.

Pennell (Florida)—4702, 9550, 9561.

3. Agalinis purpurea (L.) Pennell.

Gerardia purpurea L., Sp. Pl. 610. 1753. "Habitat in Virginia, Canada." Linnean diagnosis includes long- and short-pediceled plants, so could include any pink (= "purple") flowered species. The first citation accompanied by a figure, Plukenet's *Digitalis virginiana rubra, foliis & facie Antirrhini vulgaris*, evidently the prevalent plant of the Atlantic seaboard, is considered as the type.

Agatinis palustris Raf., New Fl. Amer. 2: 62. 1837. "Near marshes. . . . From New England to Carolina." Type not known to exist, but characterization evidently of the common species of the Atlantic seaboard.

? *Agalinis corymbosa* Raf., l. c. 63. 1837. "Carolina and Florida." Type not known to exist; either the species now considered or a near ally.

Agalinis purpurea (L.) Pennell, Bull. Torr. Bot. Club 40: 126. 1913.

Moist sandy soil, edges of salt-marsh, of ponds or of rivers, depressions in sand-dunes, or locally on barren soil, common and locally abundant through the Coastal Plain, especially near the coast, along rivers and sand-hills, locally absent or replaced by derivitive species in the longleaf pine belt; southward in a modified form to extreme southern Florida; inland much less frequent, although ascending river-valleys into the southern Appalachians. Ranges from Massachusetts to Florida, Minnesota, Nebraska and Texas.

Flowering from mid-July to mid-September, and soon ripening fruit. Corolla rose-pink, with two yellow lines and many small diffused purple-red spots within throat anteriorly.

Pennell (North Carolina)—4914, 4927, 4932, 4948. (South Carolina)—4850, 4854, 4869, 4876. (Georgia)—4735a, 4746, 4753, 4758, 4767, 4769, 4784, 4811. (Florida)—4703, 4799, 4806. (Mississippi)—4357.

4. Agalinis virgata Raf.

Agalinis virgata Raf., New Fl. Amer. 2: 62. 1837. "Glades of pine woods in South New Jersey near Mullica Hill, etc." Type not known to exist.

Moist sandy pine barrens, in the Coastal Plain south to South Carolina. Ranges northward to Long Island.

Flowering from September to mid-October, and soon ripening fruit. Corolla pink, with two yellow lines and diffused purple-red spots within throat anteriorly.

Pennell (North Carolina)—4902, 4921. (South Carolina)—4877.

5. Agalinis pinetorum Pennell.

Agalinis pinetorum Pennell, Bull. Torr. Bot. Club 40: 424. 1913. "Type, St. Marks, Wakulla Co., Florida, Sept. 26, 1912, F. W. Pennell 4708, in Herb. University of Pennsylvania."

Agalinis delicatula Pennell, l. c. 425. 1913. "Type, Ponce de Leon, Holmes Co., Florida, Sept. 17, 1912, F. W. Pennell 4661 in Herb. University of Pennsylvania." A distinct-seeming plant, with leaves more slender, filiform, curling in drying, and corolla within not spotted with purple-red. Until known from other stations not maintained as a species.

Moist soil in longleaf pineland, and on coastal prairie, southern Georgia and northern Florida to Louisiana.

Flowering in September and October, and soon ripening fruit. Corolla pink, with two yellow lines and purple red spots within throat anteriorly.

Pennell (Georgia)—4734, 4738, 4750, 4770, 4771, 4773, 4775, 4781, 4791. (Florida)—(4661 *delicatula*), 4688, 4708, 4795.

6. Agalinis harperi Pennell.

Agalinis harperi Pennell; Small, Fl. Miami 167, 200. 1913. "Type, St. Marks, Wakulla County, Florida, F. W. Pennell 4707." Type, collected September 25, 1912, seen in Herb. University of Pennsylvania.

Moist sandy pineland and borders of salt-marshes, longleaf pineland, from southern Georgia south to the Everglades of southern Florida. Also on the Bahamas.

Flowering northward from mid-September to October, and soon ripening fruit, southward flowering and fruiting throughout the year. Corolla pale rose-pink, with two yellow lines and small purple-red spots mostly along these lines within throat anteriorly. This has been confused with the northern "*Gerardia paupercula.*"

Pennell (Georgia)—4726, 4810. (Florida)—4701, 4707, 4711.

7. Agalinis fasciculata (Ell.) Raf.

Gerardia fasciculata Ell., Sketch Bot. S. C. and Ga. 2: 115. 1822. "Grows principally in lands subject to occasional inundation from the ocean . . . on Eding's Island near Beaufort very common." Type seen in the Elliott Herbarium at the Charleston Museum.

Agalinis fasciculata (Ell.) Raf., New Fl. Amer. 2: 63. 1837.

Moist to dry sandy loam or clay soil, in depressions among sand-dunes, edges of salt-marsh, or loam soil in limestone districts; the only species of cultivated fields; locally common through the Coastal Plain from South Carolina to southern Florida and westward near the Gulf Coast. Ranges westward to Texas and southern Missouri. In southern Florida represented by a variant with less scabrous stem.

Flowering from August to October and soon ripening fruit. Corolla pink, with two yellow lines and many diffused purple-red spots within throat anteriorly.

Pennell (North Carolina)—4949. (South Carolina)—4849, 4860, 4863, 4868. (Georgia)—4735, 4740, 4747, 4751, 4755, 4761, 4766, 4772, 4792, 4818. (Florida)—4669, 4675, 4680, 4695, 4697, 4706, 4717, 4718, 4793, 9544, 9562. (Mississippi)—4356, 4370. (Louisiana)—4267, 4276, 4303, 4304, 4330.

8. Agalinis georgiana (Boynton) Pennell.

Gerardia georgiana Boynton, Biltm. Bot. Stud. 1: 148. 1902. "In the pine barrens near Cordele, Dooly County, Georgia, in September, 1901. . . . In moist sandy soil in pine barrens. . . . The type specimens are deposited in the Biltmore Herbarium." Type, collected Sept. 18, 1901, seen in the Biltmore Herbarium.

Agalinis georgiana (Boynton) Pennell, Bull. Torr. Bot. Club 40: 427. 1913.

Dry sandy or clay soil, in longleaf pineland, southern Georgia, southern Alabama and northern Florida.

Flowering from mid- to late-September, and soon ripening fruit. Corolla lavender-pink, without yellow lines or purple-red spots within throat anteriorly.

Pennell (Georgia)—4728, 4739. (Florida)—4586, 4662, 4665, 4693. (Alabama)—4609, 4629, 4632.

9. Agalinis pulchella Pennell.

Agalinis pulchella Pennell, Bull. Torr. Bot. Club 40: 428. 1913. "Type, Ponce de Leon, Holmes Co., Florida, Sept. 17, 1912, F. W. Pennell 4658, in Herb. University of Pennsylvania."

Dry open sandy longleaf pineland, southern Georgia and northern Florida, westward to Louisiana.

Flowering in September, fruiting in October. Corolla rose-pink, with two yellow lines and relatively large longitudinal purple-red spots within throat anteriorly.

Pennell (Georgia)—4731, 4776, 4779. (Florida)—4587, 4650, 4658, 4663, 4692. (Alabama)—4427, 4452, 4454, 4455, 4493, 4515, 4642.

10. Agalinis filifolia (Nutt.) Raf.

Gerardia filifolia Nutt., Gen. Pl. N. Amer. 2: 48. 1818. "Hab. In West Florida. Dr. Baldwyn." No type in the herbarium of the Academy of Natural Sciences of Philadelphia, but the description is quite distinctive.

Agalinis filifolia (Nutt.) Raf., New Fl. Amer. 2: 65. 1837.

Rather dry sandy longleaf pineland, in the Coastal Plain from southern Georgia southward to southern Florida.

Flowering in September and early October, and soon ripening fruit. Corolla rose-pink, with two yellow lines and diffused purple-red spots within throat anteriorly.

Pennell (Georgia)—4741, 4752, 4785, 4821, 4828, 10174. (Florida)—4671, 4673, 4694, 4800, 4803.

11. Agalinis laxa Pennell.

Agalinis laxa Pennell, Bull. Torr. Bot. Club 40: 431. 1913. "Type, Brunswick, Glynn Co., Georgia, Oct. 10, 1912, F. W. Pennell 4824, in Herb. University of Pennsylvania."

Dry sandy longleaf pineland, or more especially on river-sandhills and old dunes, near the coast, South Carolina to central Florida.

Flowering in late September and October, and soon ripening fruit. Corolla pink, with two yellow lines and, especially along these, small purple-red spots within throat anteriorly.

Pennell (South Carolina)—4880. (Georgia)—4778, 4783, 4824. (Florida)—4801, 4805.

12. Agalinis holmiana (Greene) Pennell.

Gerardia holmiana Greene, Pittonia 4: 52. pl. 10. 1899. "Plentiful in open pine and oak groves along Michigan Avenue south of the Soldiers' Home grounds near Brookland, D. C., collected by Mr. Holm and the writer, 20 Oct., 1898." Probable type seen in the herbarium of the New York Botanical Garden, and I have myself collected the plant at the type station.

Agalinis holmiana (Greene) Pennell, Bull. Torr. Bot. Club 40: 429. 1913.

Dry sandy pineland, in the Coastal Plain; near the coast south to South Carolina, and apparently in the sand-hills near the Fall-Line southwestward into Georgia. Ranges northward to Long Island, New York.

Flowering from late August to mid-October, and soon ripening fruit. Corolla rose-pink, with two yellow lines, and, especially along these, small purple-red spots within throat anteriorly.

Pennell (North Carolina)—4904, 4923, 4929. (South Carolina)—4864.

13. Agalinis stenophylla Pennell, sp. nov.

Plant dull-green or purplish, tending to blacken in drying. Stem 6–7 dm. tall, slender, with many ascending branches, essentially glabrous. Leaves ascending-spreading, filiform-setaceous, entire, acuminate, those of the stem 2–3 cm. long, .1–.3 mm. wide; scabro-roughened to glabrous above. Axillary fascicles scarcely or not developed. Racemes scarcely elongate, often broken, usually but one flower of each pair developed, 1–6 flowered. Pedicels ascending, glabrous, in flower 8–12 mm. long, in fruit 15–20 mm. long, 2–2.5 times the length of the bracts, some on all the branches appearing "terminal." Calyx-tube 2.5 mm. long, hemispheric-campanulate, $\frac{2}{3}$–$\frac{4}{5}$ the length of the capsule, truncate, its lobes .1–.3 mm. long, triangular-subulate, not callose. Corolla 17–20 mm. long; its tube 11–17 mm. long, slightly upcurved, its lobes 6–7 mm. long, rounded to retuse, all spreading; externally minutely pubescent,

within pubescent below sinus and over entire width of basal portions of posterior lobes; probably rose-pink (not seen fresh). Anther-sacs 1.7–2 mm. long, lanceolate, acuminate at distal apex, lanate with white hairs on the valvular surface. Style glabrous. Stigma 1.5–2 mm. long. Capsule 3–4 mm. long, globose-ovoid, dark-brown. Seeds .5–.6 mm. long; testa dark-brown to nearly black, with reticulations heavy and relatively remote; intra-reticular lines not discernible.

Type, Tampa, Florida, collected in flower and young fruit October, 1877, A. P. Garber 281; in Herb. Academy of Natural Sciences of Philadelphia.

Known only from the original collection.

14. Agalinis setacea (Walt.) Raf.

Anonymos setacea Walt., Fl. Car. 170. 1788. Supposedly from lower South Carolina, but probably from much further west. Type in the British Museum identified by Dr. A. B. Rendle as agreeing with my number 4757 from Cobb, Sumter Co., Georgia.

Gerardia plukenetii Ell., Sketch Bot. S. C. and Ga. 2: 114. 1822. "Grows in wet spungy soils, very common between the Oakmulgee and Chatahouchie Rivers." Type seen in the Elliott Herbarium at the Charleston Museum. Statement of habitat probably due to confusion with *Agalinis pinetorum* Pennell.

Agalinis setacea (Walt.) Raf., New Fl. Amer. 2: 64. 1837.

Gerardia filifolia gatesii Benth., in DC. Prod. 10: 518. 1846. "In Alabama (Gates!)." Type in the Kew Herbarium, identified, frum a fragment sent me, as this species.

Dry open sandy pineland. In the Coastal Plain from western Georgia and northern Florida to eastern Mississippi, usually in long-leaf pineland; inland in pinewoods on mountain-slopes through northern Georgia and northern Alabama.

Flowering from mid-September to October, and soon ripening fruit. Corolla rose-pink, with two yellow lines and many small diffused purple-red spots within throat anteriorly.

Pennell (Georgia)—4757, 5710. (Florida)—4569, 4570, 4583, 4584, 4672. (Alabama)—4426, 4457, 4461, 4517, 4523, 4524, 4561, 4623, 5690. (Mississippi)—4382.

15. Agalinis keyensis Pennell, sp. nov.

Plant dull-green, tending to blacken in drying. Stem at least 7 dm. tall, slender, with many spreading-ascending branches, sparingly scabrellous or glabrous. Leaves spreading, filiform, entire, acuminate, those of the stem (lowest not seen) .8–1.2 cm. long, .2–.4 mm. wide; scabrous above. Axillary fascicles none. Racemes not elongate, much broken and but one flower of each pair developed, 1–4 flowered. Pedicels ascending, glabrous, in flower 3–4 mm. long, in fruit 4–6 mm. long, about equaling the bracts, some

on all the branches appearing "terminal." Calyx-tube 2.5–3 mm. long, hemispheric, $\frac{1}{2}$–$\frac{2}{3}$ the length of the capsule, truncate, its lobes .4–.6 mm. long, triangular-subulate, not becoming callose. Corolla 18–20 mm. long; its tube 14–15 mm. long, slightly upcurved, its lobes 4–5 mm. long, truncate to emarginate, all spreading; externally minutely pubescent, within pubescent below sinus and over entire width of basal portions of posterior lobes; probably pink (not seen fresh). Anther-sacs 2.5 mm. long, lanceolate, cuspidate at distal apex, lanate with white hairs on the valvular surface. Style glabrous. Capsule 3–3.5 mm. long, globose, brown. Seeds .7–.9 mm. long; testa dark-brown to nearly black, with reticulations rather fine; intrareticular lines not discernible.

Type: woods, Pine Key, Florida, collected in flower and fruit by Mr. Blodgett; in herb. Columbia University at the New York Botanical Garden.

Known only from the original station in the Florida Keys. Not re-collected; Dr. Small and myself have hunted in vain for this on Pine Key, but at the time of our joint visit the season had been unusually dry.

16. Agalinis oligophylla Pennell.

Gerardia aphylla grandiflora Benth., Comp. Bot. Mag. 1: 174. 1836. "Jacksonville [Drummond]." Type, labeled "Jacksonville," [certainly an error for Louisiana], seen in Kew Herbarium.

Gerardia plukenetii microphylla A. Gray, Syn. Fl. N. Amer. II. 1: 293. 1878. "Louisiana, Drummond, Hale." Type, an isotype of *Gerardia aphylla grandiflora* Benth., seen in Gray Herbarium.

Agalinis oligophylla Pennell, Bull. Torr. Bot. Club 40: 432. 1913. New name for *Gerardia plukenetii microphylla* A. Gray.

Moist longleaf pineland, in the Coastal Plain from southern Mississippi to southeastern Texas.

Flowering from late September to late October, and soon ripening fruit. Corolla rose-pink, with two yellow lines and, mostly along these, rather large purple-red spots within throat anteriorly.

17. Agalinis aphylla (Nutt.) Raf.

Gerardia aphylla Nutt., Gen. Pl. N. Amer. 2: 47. 1818. "Hab. From North Carolina to Florida, where it was first detected by Dr. Baldwyn." Type seen in herbarium of the Academy of Natural Sciences of Philadelphia.

Agalinis microphylla Raf., New Fl. Amer. 2: 65. 1837. "In Florida, collected by Le Conte (Collins herb.)." Type not known to exist.

Agalinis aphylla (Nutt.) Raf., l. c. 65. 1837.

Moist sandy longleaf pineland, near the coast, North Carolina to northern Florida and Louisiana.

Flowering from mid-September to early November, and soon ripening fruit. Corolla pale-pink, with two yellow lines but without purple-red spots within throat anteriorly.

Pennell (Georgia)—4748, 4789, 4808, 4819. (Florida)—4647, 4655, 4664, 4676, 4682, 4712, 4798, 4814.

18. Agalinis decemloba (Greene) Pennell.

Gerardia decemloba Greene, Pittonia 4: 51. pl. 9. 1899. "Plant not uncommon about Brookland, D. C., inhabiting grassy knolls and hillsides bordering on pine woods." Type probably seen in Herb. New York Botanical Garden, and I have collected the plant at the type station.

Agalinis decemloba (Greene) Pennell, Bull. Torr. Bot. Club 40: 434. 1913.

Dry open soil, sandy or clay, southward on mountain sides, locally frequent in the Piedmont and southern Appalachians. Ranges from southeastern Pennsylvania to northern Alabama, but with a very broken distribution and wholly east of the mountains.

Flowering from late August to mid-October, and soon ripening fruit. Corolla pink, with two yellow lines and fine purple-red spots within throat anteriorly.

Pennell (Alabama)—5687. (Tennessee)—5709.

19. Agalinis tenella Pennell.

Agalinis tenella Pennell, Bull. Torr. Bot. Club 40: 434. 1913. "Type Thomasville, Thomas Co., Georgia, Sept. 28, 1912, F. W. Pennell 4727 in Herb. University of Pennsylvania."

Dry sandy pineland, in the Coastal Plain from South Carolina to north-central Florida, west to Louisiana.

Flowering from mid-September to mid-October, and soon ripening fruit. Corolla pink, with two yellow lines and purple-red spots within throat anteriorly.

Pennell (South Carolina)—4853, 4871. (Georgia)—4727, 4744, 4756, 4764, 4768, 4774, 4777, 4782, 4786.

20. Agalinis erecta (Walt.) Pennell.

Anonymos erecta Walt., Fl. Car. 170. 1788. Presumably from lower South Carolina; no type in the Walter herbarium in the British Museum and only identified as possibly the plant here considered.

Gerardia setacea parvifolia Benth., Comp. Bot. Mag. 1: 174. 1836. "Jacksonville." Drummond. Type in Kew Herbarium verified by Dr. N. E. Brown as agreeing with my number 4659 from Ponce de Leon, Florida.

Agalinis obtusifolia Raf., New Fl. Amer. 2: 64. 1837. "West Tennessee, Alabama and Florida." Type not known to exist. Description, and certainly the name, belongs to the plant now considered, although the Tennessee specimen could hardly belong here.

Agalinis erecta (Walt.) Pennell; Small, Fl. Florida Keys 133. 1913.

Moist to dry sandy pineland, mostly longleaf, usually common, in the Coastal Plain, from North Carolina to southernmost Florida, and west to Louisiana. Occurs northward in southward Delaware.

Flowering from early September to mid-October, and soon ripening fruit. Corolla pink, with the two yellow lines and purple-red spots within throat anteriorly faint or absent.

This and related species have been known as "*Gerardia skinneriana.*"

Pennell (North Carolina)—4910, 4915, 4926, 4933. (South Carolina)—4870, 4879. (Georgia)—4733. (Florida)—4596, 4640, 4646, 4659, 4667, 4685, 4710, 4797, 4804, 4815. (Alabama)—4428, 4453, 4503, 4526, 4548, 4562, 4614, 4634. (Mississippi)—4363, 4399. (Louisiana)—4226, 4227, 4231.

21. Agalinis gattingeri (Small) Small.

Gerardia tenuifolia leptophylla Benth., Comp. Bot. Mag. 1: 174. 1836. "Jacksonville, Louisiana." Drummond. Type, doubtless from Louisiana, seen in Kew Herbarium.

Gerardia tenuifolia filiformis Benth., in DC. Prod. 10: 518. 1846. "Southern States." Type labeled "Amer. bor. Rafinesque. *Gerardia filiformis* Raf.," seen in Kew Herbarium.

Gerardia gattingeri Small, Fl. S. E. Un. St. 1078, 1338. 1903. "Type, Curtiss N. A. Pl. no. 1910* in Herb. C. U." Type, collected by A. Gattinger on hills around Nashville, Tennessee, seen in Herb. Columbia University at the New York Botanical Garden.

Agalinis gattingeri (Small) Small, in Britton & Brown, Ill. Fl. N. Un. St. and Can. ed. II. 3: 213. 1913.

Dry to moist, sandy or clayey soil, woodland, barrens or open bluffs, in central Tennessee and northern Alabama. Ranges from southwestern Ontario to Minnesota, south to Alabama and eastern Texas.

Flowering from late August to mid-October, and soon ripening fruit. Corolla pink, with two yellow lines and several to many rather large purple-red spots within throat anteriorly.

Pennell (Tennessee)—5705.

22. Agalinis tenuifolia (Vahl) Raf.

Gerardia tenuifolia Vahl, Symb. Bot. 3: 7. 1794. "Habitat in America septentrionali." Type in Herb. Universitetets Botaniske Museum, Copenhagen, Denmark, collected by Von Rohren, and said to be probably from Philadelphia, is identified by Dr. C. H. Ostenfeld as agreeing with my number 2681 from Pennsylvania.

Agalinis tenuifolia (Vahl) Raf., New Fl. Amer. 2: 64. 1837.

Loam or sandy soil, moist or dry, usually in open deciduous woodland, common throughout above the Fall-line, through the eastern Appalachians, southward smaller-leaved, passing into var. *polyphylla*, westward, mainly near river-banks, passing into var. *macrophylla;* descending into the Coastal Plain locally in heavier soils, as limestone, and in river-bottoms, there passing into var. *leucanthera*. Ranges from Maine to Michigan, south to Georgia and Louisiana.

Flowering from August to October, and soon ripening fruit. Corolla purplish-pink, with two yellow lines and small diffused purple-red spots within throat anteriorly.

Pennell (Georgia)—4091.

22a. Agalinis tenuifolia leucanthera (Raf.) Pennell, comb. nov.

Gerardia leucanthera Raf., Fl. Ludov. 50. 1817. Louisiana. C. C. Robin. Type not seen.

Stem 4–10 dm. tall, widely much branched. Pedicels .5–1.5 times the length of the bracts. Corolla 15–23 mm. long. Capsule 6–7 mm. long. Seeds apparently slightly longer and more evidently reticulate.

Usually in moist soil, loam or clay, more rarely in sand, woodland or meadow, especially near streams, in alluvial or limestone soils, in the Coastal Plain from southern Georgia and northern Florida to eastern Texas.

Pennell (Georgia)—4759. (Florida)—4601, 4670, 4699, 4721. (Alabama)—4522, 4597, 4606, 4619.

22b. Agalinis tenuifolia macrophylla (Benth.) Blake.

Gerardia tenuifolia macrophylla Benth., Comp. Bot. Mag. 1: 174. 1836. "St. Louis, Jacksonville." Drummond. Fragment of type, from Kew Herbarium, labeled "St. Louis," seen.

Gerardia besseyana Britton, Mem. Torr. Bot. Club 5: 295. 1894. New name for *Gerardia tenuifolia macrophylla* Benth., not *Gerardia macrophylla* (Nutt.) Benth.

Agalinis tenuifolia macrophylla (Benth.) Blake, Rhodora 20: 71. 1918.

In situations similar to that of the species, but more frequent along river-banks, from northern Alabama and Mississippi northward. Ranges from southern Ontario and Minnesota south to Alabama and Oklahoma.

Pennell (Alabama)—5719. (Mississippi)—5685. (Tennessee)—5714.

22c. Agalinis tenuifolia polyphylla (Small) Pennell, comb. nov.

Gerardia polyphylla Small, Bull. Torr. Bot. Club 25: 618. 1898. "The original specimens were collected by the writer on Little Stone Mountain, De Kalb County, Georgia, in September, 1895." Type seen in Herb. New York Botanical Garden.

Dry light soil over granite, locally in the granite region of central Georgia.

Pennell (Georgia)—4065, 5696, 5699.

23. Agalinis divaricata (Chapm.) Pennell.

Gerardia divaricata Chapm., Fl. S. Un. St. 299. Mar., 1860. "Low sandy pine barrens, West Florida." No type indicated, but numerous specimens collected and distributed by the describer seen.

Gerardia mettaueri Wood, Class-Book 530. Dec., 1860. "Wet sandy places, Middle Fla. (Dr. Mettauer.)" Type seen in herbarium of Columbia University at the New York Botanical Garden.

Gerardia mettaueri clausa Wood, l. c. 530. 1860. "With the others," that is, with the species and *G. mettaueri nuda*. No specimen so labeled seen.

Agalinis divaricata (Chapm.) Pennell, Bull. Torr. Bot. Club 40: 437. 1913.

Dry sandy longleaf pineland, western Florida and southeastern Alabama, mostly abundant.

Flowering in September and October, and soon ripening fruit. Corolla rose-pink, with no yellow lines but with faint purple-red spots within throat anteriorly.

Pennell (Florida)—4572, 4593, 4644, 4657, 4668, 4679, 4684, 4687, 4716. (Alabama)—4622, 4624, 4627, 4633.

24. Agalinis filicaulis (Benth.) Pennell.

Gerardia aphylla filicaulis Benth., Comp. Bot. Mag. 1: 174. 1836. "Jacksonville." Drummond. Type in Kew Herbarium, verified by Dr. N. E. Brown, as agreeing with my number 4660 from Florida.
Gerardia mettaueri nuda Wood, Class-Book 530. 1860. "Middle Fl. (Dr. Mettauer, 1855.)" No type seen.
Agalinis filicaulis (Benth.) Pennell, Bull. Torr. Bot. Club 40: 438. 1913.

Moist grassy sandy longleaf pineland, in the Coastal Plain from southern Georgia and northern Florida to eastern Louisiana.

Flowering from mid September to early November, and soon ripening fruit. Corolla lavender pink, without yellow lines or purple-red spots within throat anteriorly.

Pennell (Georgia)—4749, 4788. (Florida)—4594, 4643, 4660, 4677, 4689, 4709, 4796. (Alabama)—4608, 4626.

33. OTOPHYLLA Bentham.

Otophylla Benth., in DC. Prod. 10: 512. 1846.

Type species, *Gerardia auriculata* Michx.

1. Otophylla auriculata (Michx.) Small.

Gerardia auriculata Michx., Fl. Bor. Amer. 2: 20. 1803. "In pratis regionis Illinoensis [A. Michaux]." Description sufficiently distinctive.
Otophylla michauxii Benth., in DC. Prod. 10: 512. 1846.
Otophylla auriculata (Michx.) Small, Fl. S. E. Un. St. 1075, 1338. 1903.

Moist to dry prairies, old fields and waysides, known only from Jackson, Madison Co., western Tennessee, where probably introduced. Native of the prairies of the central Mississippi Valley from Michigan to Minnesota and Arkansas.

Flowering from late August to mid-September, fruiting in September and October.

34. BUCHNERA Linné.

Buchnera L., Sp. Pl. 630. 1753.

Type species, *B. americana* L.

Leaves 3–9 cm. long, lanceolate to ovate-lanceolate, relatively coarsely dentate. Corolla-lobes 6–9 mm. long, the tube 2–2½ times the length of the calyx. Capsule 8–9 mm. long, oblong. Stem hirsute-pubescent. 1. *B. americana.*

Leaves 2–7 cm. long, lanceolate-elliptic to linear, entire or the lower slightly dentate. Corolla-tube mostly 1–1½ times the length

of the calyx. Capsule ovate, 5–6.5 mm. long. Seeds. Stem less pubescent or even glabrate.

Leaves prevailingly lanceolate-elliptic, mostly obtuse, only the uppermost at times linear and then reduced. Corolla-lobes usually 4–6 mm. long. 2a. *B. elongata obtusa.*

Leaves linear or nearly so, mostly acute to acuminate, only the lowermost if any lanceolate-elliptic. Corolla-lobes usually 6–8 mm. long. 2. *B. elongata.*

1. Buchnera americana L.

Buchnera americana L., l. c. 630. 1753. "Habitat in Virginia, Canada." Based upon Gron., Fl. Virg. 74. 1743, typified by Clayton 142 from Virginia. Description sufficiently distinctive.

Sandy or sterile loam soil, throughout the area except in the Appalachians, probably more frequent in the Coastal Plain where it may intergrade with *B. elongata obtusa.*

Flowering from June to September, and soon ripening fruit. Corolla purplish-blue throughout.

Pennell (Alabama)—4478, 4518, 4550, 4554.

2. Buchnera elongata Sw.

Buchnera elongata Sw., Prod. Veg. Ind. Occ. 92. 1788. "India occidentalis, Jamaica"; Fl. Ind. Occ. 1061. 1800, "Habitat in arenosis depressis Indiae occidentalis. Versus jugum montium paroeciae Clarendon Jamaicae."

Sandy soil, dunes and limestone pineland of southern Florida, passing into var. *obtusa.* Ranges through the West Indies, and in northern South America.

Pennell (Florida)—9541, 9543, 9546, 9547, 9552.

2a. Buchnera elongata obtusa Pennell, var. nov.

Buchnera angustifolia Raf., New Fl. Amer. 2: 32. 1837. "In Alabama." Described as with linear leaves, but these remote. Surely an attenuate state of our variety.

(?) *Buchnera levicaulis* Raf., l. c. 39. 1837. "Florida." Description of stem as angular and quite smooth suggests that this may belong to some other genus. However, while our plant is characteristically pubescent, it occasionally occurs nearly glabrous.

Leaves prevailingly lanceolate-elliptic, mostly obtuse, only the uppermost linear and then not elongate. Corolla usually smaller than in the species, its lobes usually 4–6 mm. long. Intergrades with the species in southern Florida and the Bahamas.

Type, open sandy pineland, 1–2 miles north of Abita Springs, St. Tammany Parish, Louisiana, collected in flower and fruit August 14, 1912, F. W. Pennell 4190, in herbarium New York Botanical Garden; isotype in herbarium University of Pennsylvania.

Sandy pineland, in the Coastal Plain from North Carolina to southern Florida, westward to southeastern Texas.

Flowering from March to October, and soon ripening fruit; southward throughout the year. Corolla purplish-blue throughout; occurring also frequently in an albino form.

Pennell (North Carolina)—4911. (South Carolina)—4874, 4882. (Georgia)—4730, 4787, 4812. (Florida)—4704, 4722, 9535, 9645, 9674. (Alabama)—4473. (Louisiana)—4190, 4296.

35. SCHWALBEA Linné.

Schwalbea L., Sp. Pl. 606. 1753.

Type species, *S. americana* L., of Virginia.

1. Schwalbea australis Pennell, sp. nov.

Stem 4–8 dm. tall, finely pubescent with short ascending or upcurved hairs. Leaves elliptic-oval, 3–4 cm. long, 12–18 mm. wide, acutish, obscurely reticulate, minutely strigose. Pedicels becoming 4–5 mm. long in fruit. Calyx 10-ridged, its lobes all acute, the posterior linear, 7–10 mm. long, postero-lateral lobes 19–20 mm. long, their free portion 6–7 mm. long, the anterior lobes 20–22 mm. long, united to within 1–2 mm. of their apices. Corolla about 30 mm. long, slender, the lips 10–11 mm. long, the posterior narrowly arched, strongly pubescent externally, the anterior densely lanose within over the bases of the three short lobes. Capsule at least 10 mm. long, not seen mature.

Type, damp pine barrens near Seville, Volusia Co., Florida, collected in flower May 10, 1900, A. H. Curtiss 6742; in herbarium of the New York Botanical Garden.

Distinguished from the northern *S. americana* by the following characters:

Pubescence of stem, pedicels and calyx consisting of recurved hairs. Leaves elliptic-lanceolate, rarely over 10 mm. wide, usually evidently veined. Anterior calyx-lobes obtuse. *S. americana.*

Pubescence of stem, pedicels and calyx consisting of upcurved, usually shorter hairs. Leaves elliptic-oval, usually about 15 mm. wide, usually more obscurely veined. Anterior calyx-lobes acute or acutish. *S. australis.*

Sandy soil, rather moist, oak-land and pine-land, in the Coastal Plain from South Carolina to central Florida and Louisiana; inland apparently occasional, seen only from "sandy humid places in the Cumberland Mountains between Montgomery and Jamestown," Tennessee, collected by Rugel in 1841.

Flowering from April to June. Not seen growing.

36. CASTILLEJA Mutis.

Castilleja Mutis; L. f. Suppl. 293. 1781.

Type species, *C. fissifolia* L. f., of Colombia.

1. Castilleja coccinea (L.) Spreng.

Bartsia coccinea L., Sp. Pl. 602. 1753. "Habitat in Virginia, Noveboraco . . . Hort. Cliff. 235." From L., Hort. Cliff. 325. 1737, "Crescit in Virginia, unde delatam communicavit DD. Gronovius". From Gron., Fl. Virg. 69. 1743: "Clayton n. 293." Certainly the plant here considered.

Castilleja coccinea (L.) Spreng., Syst. Veg. 2: 775. 1825.

Meadows or moist grassy slopes, loam or sandy loam, in the upland from North Carolina to Alabama.[14] Ranges from Maine to Manitoba, south to Georgia and Kansas.

Flowering from April to early June, and soon ripening fruit. Corolla yellowish-green throughout.

37. PEDICULARIS Linné.

Pedicularis L., Sp. Pl. 607. 1753.

Type species, *P. palustris* L., of Europe.

Stem 6–8 dm. tall, glabrous. Leaves shallowly lobed, the sinuses narrow, the lobes with minute regular crenations. Bracts auriculate near base. Rachis of inflorescence glabrous. Fused sepals of each side terminating in a slightly enlarged crenate foliar tip, glabrous or with a very few long hairs near base. Corolla with truncate apex of posterior lobes without tooth-like processes. Capsule brown, scarcely exceeding the calyx, slenderly beaked. Flowering in late summer. ..... 1. *P. lanceolata.*

Stem 1–3 dm. tall, hirsute, especially above. Leaves deeply lobed, the sinuses broad, the lobes with more prominent irregular crenations. Bracts entire near base. Rachis of inflorescence lanate. Fused sepals of each side broadly acute, entire, pubescent along the veins. Corolla with apex of posterior lobes each with a tooth-like process. Capsule straw-colored, twice as long as the calyx, scarcely beaked. Flowering in spring. 2. *P. canadensis.*

1. Pedicularis lanceolata Michx.

Pedicularis lanceolata Michx., Fl. Bor. Amer. 2: 18. 1803. "Hab. in regione Illinoensi" (A. Michaux). Type not verified, but description distinctive.

Swales and wet meadows, mountains of North Carolina. Ranges from Massachusetts to Manitoba, south to North Carolina and Nebraska.

Flowering from late July to September. Corolla yellow throughout.

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[14] Seen only south to Berkeley Co., lower South Carolina, but this very easily distinguished plant is recorded from upper Georgia by Elliott, Sketch Bot. S. C. and Ga. 2: 132. 1822; and from Etowah Co., Alabama, by Mohr, Contrib. Nat. Herb. 6: 728. 1901.

2. Pedicularis canadensis L.

Pedicularis canadensis L., Mant. 86. 1767. "Habitat in America septentrionali. Kalm."

Woodland or knolls in meadows, throughout above the Fall-line, probably more common northward; in the Coastal Plain descending locally to northern Florida. Ranges from Nova Scotia to Manitoba, south to Florida and Texas.

Pennell (Alabama)—9722. (Tennessee)—9789.

38. MELAMPYRUM Linné.

Melampyrum L., Sp. Pl. 605. 1753.

Type species, *M. cristatum* L.,.of Europe.

Main stem-leaves linear or lanceolate-linear. Bracts conspicuously fimbriate near base, with teeth frequently as long as the width of the blade. Capsules mostly 6–7 mm. long, curved and usually attenuate-beaked. Seeds 2–2.5 mm. long, brown to blackish.....1. *M. lineare.*

Main stem-leaves linear-lanceolate to nearly ovate. Bracts slightly or not fimbriate near base, the teeth shorter than the width of the blades. Capsules frequently larger, reaching 8–9 mm. long, slightly or not curved, and less or not attenuate-beaked. Seeds often larger, reaching 3 mm. long, usually black.

1a. *M. lineare latifolium.*

1. Melampyrum lineare Desr.

Melampyrum lineare Desr., Lam., Encyc. 4: 22. 1796. "Rapportee de la Caroline par M. Fraser . . . (v. s.)." Description made from a very young plant, but certainly of the form here considered. Characterization of the calyx as 5-toothed certainly erroneous.

Open woodland, thin acid soil, upland and probably midland districts of North Carolina. In the Appalachians mainly replaced by var. *latifolium.* Ranges northward to Long Island, and through its varieties much further northward and across the continent.

Flowering and fruiting through the summer. Corolla white, more or less pinkish externally, the palate yellow.

1a. Melampyrum lineare latifolium (Muhl.) Beauverd.

Melampyrum americanum Michx., Fl. Bor. Amer. 2: 16. 1803. "Hab. a sinu Hudsonis ad montosam Carolinam." (A. Michaux.) Description evidently of the prevalent inland broader-leaved plant.

Melampyrum latifolium Muhl. (Cat. 57. *nomen nudum*); Eaton, Bot. 316. 1818. From Muhlenberg's Catalog, the type station is in Delaware. Type not seen, but evidently is the prevalent inland plant.

Melampyrum lineare latifolium (Muhl.) Beauverd, Mem. Soc. Phys. Geneve 38: 474. 1916.

Moist open woodland, in the Appalachians south to northern Georgia. The prevalent inland plant, southward attaining its greatest distinctness from the species.

NOTES ON NEW JERSEY, PENNSYLVANIA, AND VIRGINIA FISHES

BY HENRY W. FOWLER

The notes and records given below are chiefly gathered from collections made for the Museum of the Academy during 1919. A few others, made previously and used in this connection, are included. An interesting addition to the fauna of New Jersey is recorded, besides notices of rare and little-known species. The records are condensed and exhibit only briefly the more important items in the great mass of material examined. Acknowledgment for assistance in procuring material is herewith given but as the names of most of the contributors have appeared elsewhere the names are not repeated.

New Jersey.

Material was collected and studied in the field with Dr. R. O. Van Deusen during the past season, in Salem County, as follows: basin of Alloway Creek in Deep Run with its enlarged artificial ponds "Lake Tranquility" and "House's Pond" (August 29); Alloway Creek tidal, "Diamond Pond," and mill-race at Alloway (August 30); "Maskell's Pond," in Stow Creek basin (August 31). In Cumberland County (on September 2): the fresh-waters of the mill-pond at Newport and the brackish and salt estuary of Nantuxent Creek were explored to Delaware Bay.

A few old specimens of New Jersey fishes in the University of Pennsylvania, from Avalon, Beach Haven, Ludlam Bay and Sea Isle City, were examined through the kindness of Dr. J. Percy Moore.

Notes from the excursions of the Philadelphia Aquarium Society to May's Landing, in May, 1919, were sent by Mr. W. T. Innes; others were received from Dr. R. J. Phillips, taken at Corson's Inlet during his summer residence there; and finally Dr. R. O. Van Deusen made a full list of the fishes captured in the nets at Atlantic City during the entire season until November.

Petromyzon marinus Linné. Few in the spring at Atlantic City.

Eulamia milberti (Müller and Henle). Large one at Atlantic City during June. Other abundant sharks were *Carcharias taurus*, *Mustelus mustelus*, and *Squalus acanthias*, the last only in the fall, when common.

Sphyrna zygaena (Linné). Small ones frequent at Atlantic City. Two, each two feet long, angled at Corson's Inlet during August.

Raja erinacea Mitchill. Corson's Inlet. Not at Atlantic City, where *R. ocellata*, *R. eglanteria*, two adult *R. laevis* and *Dasyatis say* were taken.

Rhinoptera bonasus (Mitchill). Large one at Atlantic City in August. One of about 60 pounds taken on the oyster-beds off the mouth of Nantuxent Creek on August 30.

Acipenser sturio Linné. Five at Atlantic City early in June.

Megalops atlanticus Valenciennes. Adult in June at Atlantic City. During the spring *Pomolobus mediocris* and *P. pseudoharengus* were common, and *P. aestivalis* irregular through the summer. School of *P. mediocris* at Corson's Inlet in mid-September.

Etrumeus sadina (Mitchill). Nineteen examples from Avalon on August 7, 1892, in the U. of Pa.

Pomolobus pseudoharengus (Wilson). Deep Run and Alloway Creek; common in spring. At Atlantic City few *Alosa sapidissima* in the spring, and *Brevoortia tyrannus* abundant all summer.

Dorosoma cepedianum (LeSueur). Four during September at Atlantic City. Taken at Alloway in October.

Anchovia brownii (Gmelin). Eight taken August 7, 1892, at Avalon. In the U. of Pa.

Salmo fario Linné. This and the next found in Deep Run above House's Pond, where introduced.

Salvelinus fontinalis (Mitchill).

Ameiurus catus (Linné). Alloway Creek: run five pounds in weight.

Ameiurus natalis (LeSueur). Deep Run, Lake Tranquility, Alloway Creek, and Maskell's Pond.

Ameiurus nebulosus (LeSueur). Same as above though more abundant.

Hybognathus nuchalis regius (Girard). Alloway Creek.

Abramis crysoleucas (Mitchill). May's Landing, Deep Run, Lake Tranquility, Alloway Creek, Diamond Pond, Maskell's Pond.

Notropis hudsonius amarus (Girard). Alloway Creek.

Cyprinus carpio Linné. Deep Run and Alloway Creek.

Erimyzon sucetta oblongus (Mitchill). May's Landing, Deep Run, House's Pond, Alloway Creek.

Anguilla rostrata (LeSueur). May 20, 1900 at Ludlam Bay; several at Atlantic City during 1919; also Deep Run and House's Pond.

Esox americanus (Gmelin). May's Landing and Deep Run at Lake Tranquility.

Esox tridecemlineatus Mitchill. Deep Run, Alloway Creek and Maskell's Pond.

Umbra pygmaea (DeKay). Deep Run at House's Pond.

Fundulus majalis (Walbaum). Atlantic City.

Fundulus heteroclitus macrolepidotus (Walbaum). Beach Haven and Nantuxent Creek.

Fundulus diaphanus (Le Sueur). Deep Run and Alloway Creek.

Fundulus luciae (Baird). Nantuxent Creek delta in salt ponds on the meadows.

Cyprinodon variegatus Lacépède. Ludlam Bay and Atlantic City.

Syngnathus fuscus Storer. Beach Haven and Ludlam Bay.

Hippocampus hudsonius DeKay. Two in September, 1919, at Atlantic City.

Apeltes quadracus (Mitchill). Ludlam Bay.

Strongylura marina (Walbaum). Manasquan. Small ones abundant at Corson's Inlet.

Strongylura acus (Lacépède). Five adults in August at Atlantic City.

Menidia menidia notata (Mitchill). Beach Haven, Nantuxent Creek, Atlantic City.

Mugil curema Valenciennes. Small ones in great schools, at Corson's Inlet. Atlantic City.

Scomber scombrus Linné. Fifty barrels reported at Ocean City, June 16, 1919.

Scomber colias Gmelin. Ludlam Bay. A few in the spring at Atlantic City.

Sarda sarda (Bloch). An interesting young example from Avalon, taken August 8, 1892. In the U. of Pa. It has 14 dark vertical bars on the back. An example of 35 pounds weight taken at Atlantic City during the past summer.

Scomberomorus maculatus (Mitchill). Few in spring at Atlantic City.

Trichiurus lepturus Linné. Two caught in June and one in September, at Atlantic City.

Seriola zonata (Mitchill). Atlantic City, abundant, mostly small.

Decapterus punctatus (Agassiz). One 85 mm. long from Avalon, August 7, 1892, in the U. of Pa. It shows: Head $3\frac{3}{4}$; depth

$4\frac{3}{4}$; D. VIII—I, 30; A. II, 23—I; scutes 46+38; snout $3\frac{1}{6}$ in head; eye $3\frac{2}{3}$; maxillary $2\frac{2}{5}$; interorbital $3\frac{1}{8}$; lanceolate rakers 14+30?

Caranx hippos (Linné). Atlantic City. Abundant in August and September, mostly small and but few large ones. Adult taken June 16.

Caranx crysos (Mitchill). Atlantic City. Occasional; at least six captured.

Selene vomer (Linné). Ludlam Bay, on July 26, 1892; Atlantic City; three caught in September, 1919.

Trachinotus carolinus (Linné). Atlantic City. Young very abundant, and 15 to 20 adults during the season, one on June 16.

Pomatomus saltatrix (Linné). Atlantic City and Corson's Inlet; small ones very abundant.

Poronotus triacanthus (Peck). Sea Isle City and Atlantic City.

Aphredoderus sayanus (Gilliams). May's Landing, Deep Run, House's Pond, and Maskell's Pond.

Pomoxis sparoides (Lacépède). Deep Run, Alloway Creek, and Alloway.

Acantharchus pomotis (Baird). Diamond Pond at Alloway; also New Lisbon in Burlington County, and Franklinville in Gloucester County, and said to be abundant at the last locality. Eight taken in September, 1917 at Willow Grove, in Gloucester County.

Ambloplites rupestris (Rafinesque). Daretown, Salem County (introduced).

Enneacanthus gloriosus (Holbrook). May's Landing, Deep Run, House's Pond, Maskell's Pond.

Mesogonistius chaetodon (Baird). May's Landing.

Pomotis gibbosus (Linné). May's Landing, Deep Run, Alloway Creek, Alloway, Maskell's Pond.

Micropterus salmoides (Lacépède). Deep Run and Alloway Creek.

Perca flavescens (Mitchill). Deep Run, Lake Tranquility, Alloway Creek, Alloway, Maskell's Pond.

Boleosoma nigrum olmstedi (Storer). Alloway Creek.

Boleichthys fusiformis (Girard). May's Landing.

Roccus lineatus (Bloch). Atlantic City. Fairly common. Ten to 15 pounds, one of 35 pounds.

Morone americana (Gmelin). Deep Run, Alloway Creek and Atlantic City. *Centropristis striatus* abundant at last locality.

Orthopristis chrysopterus (Linné). Atlantic City, one in September, also same for *Lagodon rhomboides*. *Stenotomus chrysops* also taken, besides young, at Corson's Inlet.

Cynoscion regalis (Schneider). Atlantic City and Corson's Inlet. At latter, largest eight pounds, in September, and examples of five pounds not scarce.

Cynoscion nebulosus (Cuvier). Atlantic City, one, and Corson's Inlet, two of three pounds and one of little less than two pounds. All captured in September.

Bairdiella chrysura (Lacépède). Nantuxent Creek and Atlantic City.

Sciaenops ocellatus (Linné). Atlantic City and Corson's Inlet. Examples 20 to 35 pounds.

Micropogon undulatus (Linné). Three at Ocean City on June 16, 1919. Atlantic City, June 15, common. Adults taken inside at Corson's Inlet.

Leiostomus xanthurus Lacépède. Atlantic City and Corson's Inlet. Common. Many large and wounded taken at latter place.

Menticirrhus americanus (Linné). Corson's Inlet. Spawners arrive little later than in next species.

Menticirrhus saxatilis (Schneider). Atlantic City and Corson's Inlet, where spawners arrive in mid-May. Two examples caught in middle of October.

Pogonias cromis (Linné). Common at Atlantic City, though fewer than red drum. Also Corson's Inlet and Ocean City.

Upeneus phillipsi Fowler. One example in the U. of Pa. 80 mm. long, from Ludlam Bay, July 26, 1892. It shows: Head $3\frac{1}{4}$; depth $3\frac{1}{5}$; D. VIII—I, 8; A. ?, 6; scales in l. l. 34 to caudal base and 4 more on latter; 3 scales above l. l., 6 below; snout $2\frac{1}{2}$ in head; eye $3\frac{2}{3}$; maxillary 3; interorbital $3\frac{2}{5}$; rakers 6+15, lanceolate. Single row of teeth in upper jaw, and lower teeth biserial. Spinous dorsal shows distinctly two dark longitudinal bands and soft dorsal three. Each caudal lobe with four transverse dark bars. At present body brown on back; belly and under surface brassy. According to a note on the original label "Caudal and dorsals with dark bands, other fins pale. The anal spines torn loose."

Tautogolabrus adspersus (Walbaum). Atlantic City and Corson's Inlet. Also *Tautoga onitis*.

Chaetodipterus faber (Broussonet). Atlantic City, four on June 15, and three in September.

Balistes carolinensis Gmelin. One at Atlantic City during the summer.

Stephanolepis hispidus (Linné). This and the next, same locality as last, though only a few.

Alutera schoepfii (Walbaum).

Lagocephalus laevigatus (Linné). One at Fortesque by H. E. Dimmick 19½ inches long. Another adult angled in Great Bay, September 28, 1919. It was feeding largely on small amphipods, living in the tubes of various marine worms. Several adults reported from Maurice River Cove during the summer. *Spheroides maculatus* was abundant at Atlantic City.

Chilomycterus atinga (Linné). A fine adult example of this tropical fish was sent to the U. of Pa. shortly after its capture August 1, 1900, at Ocean City, by H. Adams. As the species was previously unknown north of Florida, its occurrence in New Jersey is of considerable interest. The original label says, "Caught this afternoon a fish which seems to be very rare here, as no one knows the name of it."

Head $2\frac{3}{5}$; depth 3; D. 12; A. 11; snout $2\frac{1}{4}$ in head; eye $5\frac{3}{4}$; mouth width $2\frac{2}{3}$; interorbital $1\frac{3}{5}$. Spines short points covered with skin, wide set. Forehead broad, flat, and interorbital, slightly concave. Three low supraorbital spines, one above opercle and one over gill-opening. Head broad as long, flattened below. Body greatly depressed. Caudal peduncle small, its least depth equals eye. Eye ellipsoid, slightly advanced. Mouth broad, with thick papillose fleshy lips, gape half way to eye. Nostrils before middle of front eye edge. Gill-opening little longer than eye. Skin spongy, thick. Dorsal slightly before anal, and like all fins, rounded. Fully expanded pectoral twice broad as deep. Caudal slightly longer than pectoral.

Color in alcohol dull brownish, with lilac tints on back and upper surface, marked everywhere with jet-black round spots, variable in size, but none larger than pupil. On head above, spots more crowded. Dorsal, caudal and pectoral dull brownish, marked with very small black spots, few also on anal. All spots on fins not extending very near edges. Brown tint of back extends into pale lower color below eye, before gill-opening, behind pectoral base and below dorsal origin. Under surface of body, including mandible, creamy-white, with an occasional scattered black spot. Length 335 mm.

Chilomycterus schoepfi (Walbaum). Atlantic City.

Mola mola (Linné). One four feet long ashore near Barnegat Light on July 26, reported by E. P. McCormick. Another, about same size, at Ocean City, early in September, reported by Richard Erskine.

Myoxocephalus aeneus (Mitchill). Four at Atlantic City.

Cyclopterus lumpus Linné. Adult during August at Atlantic City.

Prionotus evolans strigatus (Cuvier). Ludlam Bay, very abundant at Ocean City in early June, common at Atlantic City and occasional at Corson's Inlet. *P. carolinus* common at Atlantic City.

Leptecheneis naucrates (Linné). Atlantic City.

Paralichthys dentatus (Linné). Three, each ten pounds weight, at Corson's Inlet. Abundant at Ocean City with *Lophopsetta maculata;* also at Sea Isle City and Atlantic City. At latter place both species, besides *Pseudopleuronectes americanus* and *Achirus fasciatus.*

Astroscopus guttatus Abbott. One July 23, at Sea Isle City and one at Ocean City, August 17.

Pollachius virens (Linné). One or two at Atlantic City, in May, besides *Microgadus tomcod, Gadus callarias, Phycis chuss, Merluccius bilinearis, Opsanus tau* and *Lophius piscatorius,* the last very abundant.

PENNSYLVANIA.

During the past spring the following streams in the Delaware River basin of Berks County were visited: headwaters of the Northkill Creek near Straussberg, tributary to the west, and headwaters of the Tulpehocken Creek south of Strausstown. Notes on Paupack Lake in Pike County were sent by Mr. L. Tromner.

Trips were also made into the Susquehanna River basin: in the Little Swatara of Berks County near Schubert (April 28); during early September in Cumberland County in Yellow Breeches Creek at Three Springs and Walnut Bottom, Conodoguinet Creek at Shippensburg, tributary near Carlisle Springs, one at Hogestown and another below; in Franklin County in the Tuscarora headwaters at Concord; in Perry County in Fishing Creek about Keystone.

Finally, the Potomac River basin of Franklin County was examined at Chambersburg in the Conococheague Creek and small tributary to the west of the town, Back Creek or a tributary between Chambersburg and Fort Loudon and its affluent near St. Thomas, and West Branch of the Conococheague at Fort Loudon and near Metal. These were all visited in early September.

Salmo fario Linné. Hogestown.

Salvelinus fontinalis (Mitchill). Paupack Lake and Fort Loudon.

Ameiurus nebulosus (LeSueur). Same as last.

Schilbeodes insignis (Richardson). Paupack Lake outlet.

Pimephales notatus (Rafinesque). Conococheague tributary west of Chambersburg, Back Creek and St. Thomas.

Semotilus bullaris (Rafinesque). Paupack Lake.

Semotilus atromaculatus (Mitchill). Straussberg, Paupack Lake, Walnut Bottom, Chambersburg, Back Creek, St. Thomas, Metal, Concord.

Abramis crysoleucas (Mitchill). Paupack Lake.

Notropis whipplii analostanus (Girard). Schubert.

Notropis cornutus (Mitchill). Northkill headwaters and Schubert; Chambersburg and Concord.

Notropis atherinoides Rafinesque. Back Creek and Fort Loudon.

Ericymba buccata Cope. Conococheague tributary west of Chambersburg and Back Creek.

Rhinichthys cataractae (Valenciennes). Three Springs.

Rhinichthys atronasus (Mitchill). Straussberg, Northkill headwaters, Schubert, Tulpehocken headwaters, Paupack Lake outlet, Three Springs, Walnut Bottom, Shippensburg, Chambersburg and brook to west, Back Creek, St. Thomas, Fort Loudon, Metal, Concord, Carlisle Springs, Hogestown.

Hybopsis kentuckiensis (Rafinesque). Schubert, Chambersburg, Fort Loudon, Metal, Concord.

Exoglossum maxillingua (LeSueur). Schubert, Chambersburg, Concord and Keystone.

Catostomus commersonnii (Lacépède). Schubert, Shippensburg, Back Creek, St. Thomas, Fort Loudon, Concord.

Catostomus nigricans LeSueur. Schubert, Back Creek, Fort Loudon, Keystone.

Anguilla rostrata (LeSueur). Paupack Lake. Fort Loudon.

Esox americanus (Gmelin). Northkill Creek headwaters and Three Springs.

Esox tridecemlineatus Mitchill. Paupack Lake.

Fundulus diaphanus (LeSueur). Northkill Creek headwaters.

Ambloplites rupestris (Rafinesque). Chambersburg.

Lepomis auritus (Linné). Paupack Lake, Three Springs, Chambersburg, Fort Loudon, Metal, Concord.

Micropterus dolomieu Lacépède. Paupack Lake.

Micropterus salmoides (Lacépède). Chambersburg.

Perca flavescens (Mitchill). Paupack Lake.

Boleosoma nigrum olmstedi (Storer). Northkill Creek headwaters, Schubert, Tulpehocken headwaters, Three Springs, Concord, Carlisle Springs.

Poecilichthys flabellaris (Rafinesque). Chambersburg and brook to west, Back Creek, St. Thomas and Fort Loudon.

Cottus gracilis Heckel. Chambersburg and tributary below Hogestown.

VIRGINIA.

A small collection in the University of Pennsylvania from the oyster-beds near Cape Charles, was obtained by Dr. J. Percy Moore, July 19, 1891. It contains: *Dasyatis say, Fundulus majalis, F. heteroclitus macrolepidotus, Syngnathus fuscus, Strongylura marina, Menidia beryllina, M. menidia notata, Scomberomorus maculatus, Seriola zonata, Poronotus triacanthus, Centropristis striatus, Orthopristis chrysopterus, Stenotomus chrysops, Leiostomus xanthurus, Micropogon undulatus, Gobiosoma bosc, Paralichthys dentatus, Hypsoblennius hentz* and *Gobiesox strumosus.* I received *Rhinichthys atronasus* from Deerfield, June 23, 1919.

The following reports were ordered to be printed:

REPORT OF THE RECORDING SECRETARY.

The Recording Secretary is again indebted to Dr. J. Percy Moore for acting in that office, and to Dr. Philip P. Calvert, who performed the duties of Recorder of the Council, at the meetings during the past year. The statistics of this report have been again prepared by the Assistant Librarian, William J. Fox.

Meetings have been held December 17, 1918; January 21, February 18, March 18, April 15, and November 18, 1919. Communications were made by Messrs. Henry A. Pilsbry, Edgar Fahs Smith, J. W. Harshberger, and Witmer Stone.

Papers for publication have been presented by David Starr Jordan, John W. Harshberger and Vincent G. Burns, Henry W. Fowler, James A. G. Rehn, Julia W. Gardner and T. H. Aldrich, David Starr Jordan and Masamitsu Oshima, Ezra T. Cresson, Jr., and S. Tillman Berry.

Three-hundred and fifty-nine pages and fourteen plates of the Proceedings were issued.

The Entomological Section (American Entomological Society) has published three-hundred and ninety-six pages and thirty-five plates of its Transactions, seventy-eight pages and twenty plates of

MEMOIRS, and three-hundred and four pages and eleven plates of the ENTOMOLOGICAL NEWS.

Of the MANUAL OF CONCHOLOGY, parts 98 and 99, of volume 25, second series, comprising one-hundred and eighty pages and eighteea colored plates, have been issued by Dr. Pilsbry, Curator of Mollusca.

Seven members have been elected during the year, and the deaths of eleven have been announced. Three members have resigned.

The Ludwick Institute Free Lecture Courses were delivered at the Academy, in the evening on Mondays, January 7, to April 22 incl., and in the mornings during the spring at the several High Schools, by Witmer Stone, Henry W. Fowler, James A. G. Rehn, Spencer Trotter, Henry A. Pilsbry, J. Percy Moore, and J. Fletcher Street. All lectures were illustrated by lantern slides.

The Delaware Valley Ornithological Club and the Philadelphia Botanical Club have continued their meetings in the Academy; and meetings of the Women Teachers' Association of Philadelphia, and The State Graduate Nurses' Association, were held in the Lecture Hall.

EDW. J. NOLAN, *Recording Secretary.*

REPORT OF THE CORRESPONDING SECRETARY.

Deaths of the following named correspondents were announced during the year. Raphael Blanchard, Frederick DuCane Godman, William J. Farlow, Gustav Retzius, and Ernst Haeckel. No correspondents were elected.

A slight increase in the volume of foreign correspondence reflects the renewal of scientific activities since the cessation of hostilities, but most of the antebellum agencies for effecting scientific cooperation remain disorganized.

There have been no international congresses to which the Academy was invited. An invitation from the Academy of Literature, Sciences, Arts and Agriculture of Metz to participate in the celebration of its reestablishment after forty-nine years of suppression by the German conquerers was received and answered by a congratulatory letter.

A copy of a resolution thanking the Academy for courtesies extended during its convention in Philadelphia was received from the American Association of Museums. In connection with the removal of the offices and exhibits of the Pennsylvania Department of Health a letter expressive of appreciation of favors rendered by the Academy was received from the new Commissioner of Health.

Inquiries for information were answered as usual.

Statistics of the correspondence follow:

Communications received:

Acknowledging the receipt of the Academy's publications	107
Transmitting publications to the Academy	35
Requesting exchanges or the supply of deficiencies	9
Invitations to learned gatherings, celebrations, etc	2
Notices of deaths of scientific men	4
Circulars concerning the administration of scientific and educational institutions, etc	9
Letters from correspondents Miscellaneous letters	48
Total received	214

Communications forwarded:

Acknowledging gifts to the Library	789
Requesting the supply of deficiencies	131
Acknowledging gifts to the Museum	95
Acknowledging photographs and biographies	2
Letters of sympathy or congratulation, addresses, etc	3
Diplomas and notices of election of correspondents and delegates' credentials	7
Miscellaneous letters	117
Annual reports and circulars sent to correspondents	280
Total forwarded	1424

Respectfully submitted,

J. Percy Moore, *Corresponding Secretary.*

REPORT OF THE LIBRARIAN.

Your Librarian has to again make acknowledgments to the Assistant Librarian, William J. Fox, for performing the duties of the office during the past year. The present report has been prepared entirely by Mr. Fox.

During the past year the additions to the library total 4,824, an increase over the previous year. These consisted of 4,245 pamphlets and parts of periodicals, 490 volumes, 88 maps, and one engraved portrait.

They were received from the following sources:

Exchange	2279
Isaiah V. Williamson Fund	1303
United States Department of Agriculture	452

James Aitken Meigs Fund	226
Authors	93
United States Department of the Interior	38
Pennsylvania State Library	34
Editors	31
American Entomological Society	23
Cornell University Agricultural Experiment Station	20
Tennessee State Board of Entomology	20
Wistar Institute of Anatomy and Biology	18
Imperial Department of Agriculture, British West Indies	18
United States Department of Commerce	14
Miss Alice J. Smith	14
Statens Skögforsökanstalt	13
Dr. Henry Skinner	14
Utah Agricultural College Experiment Station	13
Pan American Scientific Congress	11
Samuel G. Gordon	11
Colonel George W. Norris	11
California State Commission of Horticulture	10
North Carolina Geological and Economic Survey	7
State Geological Survey, Tennessee	7
Secretaria de Agricultura y Fomento, Mexico	6
Museum of the American Indian, Heye Foundation	6
Trustees of the British Museum	6
California Fish and Game Commission	5
New York Agricultural Experiment Station	5
Publication Committee of the Academy	5
Dr. Edward J. Nolan	5
Michigan Geological and Biological Survey	4
University of Wyoming	5
John Lawrence	4
Queensland Department of Mines	5
Roger Williams Park Museum	4
Thomas B. Wilson Fund	4
Princeton University Department of Geology	4
United States Treasury Department	4
Royal Scottish Museum, Edinburgh	3
Dr. W. L. Abbott	3
Cuerpo de Ingenieros de Minas del Peru	3
United States War Department	3
Ohara Institut für landwirthschaftliche Forschungen	2
Geological Survey of Georgia	2
Department of Trade and Customs, Australia	2
University of Tennessee	2
Argentine Government	2
San Diego Museum Association	2
Mississippi State Geological Survey	2
Iowa Geological Survey	2
Mrs. C. J. Pennock	2

New York State Archeological Association, Morgan Chapter	2
State Board of Charities, New York	1
Geological Survey of Great Britian	1
Philadelphia Museums	1
State Geological Survey of Kansas	1
Bristol Museum and Art Gallery	1
Delaware County Institute of Science	1
Observatorio de Madrid	1
Colorado Museum of Natural History	1
William J. Fox	1
Danish Government	1
Botanical Society of America	1
Lewis S. Ware	1
Deseret Museum	1
Louisiana State Museum	1
San Diego Society of Natural History	1
Westwood Astrophysical Observatory	1
Delaware Valley Ornithological Club	1
Museum of Comparative Oology	1
Bermuda Biological Station for Research	1
Entomological Society of Nova Scotia	1
Zoological Society of Philadelphia	1
Florida State Geological Survey	1
New South Wales State Fisheries	1
Commissioners on Fisheries and Game, Massachusetts	1
St. Louis Natural History Association	1
E. R. Squibb and Sons	1
United States Brewers' Association	1
East Indian Government	1
West Virginia Geological Survey	1
Escola Superior da Agricultura e Medicina Veterinaria, Nictheroy	1
Government of Formosa	1
Lithuanian National Council, U. S. A.	1
The Peruvian Corporation Ltd	1
Boston City Hospital	1
Geological Survey of Alabama	1
Mechanics' Institute, San Francisco	1
Natural Resources Intelligence Branch, Dep't of the Interior, Canada	1
Dr. Harry F. Keller	1
New Jersey Department of Conservation and Development	1
National Parks Association	1

They have been distributed to the various departments of the library as follows;

Journals	3248
Agriculture	647
Geology	317
Botany	117
Geography	106

General Natural History	87
Entomology	46
Anatomy and Physiology	40
Ornithology	36
Voyages and Travels	23
Anthropology	20
Medicine	18
Ichthyology	16
Mineralogy	17
Bibliography	11
Chemistry	11
Physical Science	10
Conchology	9
Helminthology	9
Mathematics	6
Herpetology	5
Mammalogy	4
Miscellaneous	21

The following journals were added to the library:

Academia de Ciencias exactas, fisica-quimicas y naturales de Zaragoza.
Anales Mexicanos de Ciencias, etc., 1 vol., 1860.
American Fisheries Society, Transactions.
Canadian Field Naturalist. Ottawa.
De Re Indica. Caracas.
Giornale per la Morfologia dell' Uomo e dei Primati. Pavia.
Mexico (El) Antigua. Mexico.
Mining Review (South Australia Department of Mines).
Musea. Revue de l'Association des Museums de Province. Havre.
Museum of Comparative Oology. Journal.
Ohara Institut für landwirthschaftliche Forschungen. Berichte.
Rivista di Biologia. Roma.
Science and Industry. Melbourne.
Svenska Vetenskaps Akademiens Protokoll, 1739 och 1741.
Treubia. 'sLands Plantentuin te Buitenzorg.

Among the more important works added to the library are:

Leonhard Fuchs, De Stirpium Historia . . . 1542. G. Thuret, Études Phycologiques. J. C. Sepp, Nederlandsche Insecten. 14 vols. 1762–1905. Sven Hedin, Southern Tibet. Hume and Marshall, Game Birds of India. 3 vols. 1879–1881.

Four hundred and ninety-eight volumes have been bound.

Four volumes and 124 parts of periodicals have been returned to the Superintendent of Public Documents at Washington, and 71 volumes and 144 pamphlets have been transferred to the Free Library of Philadelphia, these being non-essential to the Academy's interests.

Part of the book stack has been rearranged to allow for growth in certain departments.

Eight hundred and seventy-four volumes and parts of periodicals were used on the premises by the scientific staff, and 105 volumes were borrowed. No record was kept of books used in the reading room.

The cooperation of Miss H. N. Wardle in the library is thankfully acknowledged.

Edward J. Nolan, *Librarian.*

REPORT OF THE CURATORS.

The impossibility of obtaining metal cases and the greatly increased cost of everything connected with museum exhibits have seriously handicapped the Curators in any effort toward the instalment of new exhibits during the past year as well as in the better arrangement of the study collections.

It has nevertheless been possible to keep the collections and the buildings in excellent condition, to properly care for all accessions and to make some notable improvements in the quarters of several of the departments.

The removal of the offices of the State Department of Health to Harrisburg on July 1st, last, and the consequent vacating of the rooms which they had occupied for many years made these quarters in the east of the north wing available for museum purposes and the botanical department was immediately installed there. The increased light in these rooms makes them much better suited for the work of the botanical staff and greatly facilitates the consultation of the herbarium. One of the old rooms at the west end of the north wing has been retained as a botanical storage room where collections can be roughly sorted and prepared for mounting.

The other rooms at the west end of the north wing were alloted to the mineralogical and geological department which in turn vacated the room on the fourth floor of the south wing which it had temporarily occupied, and which now reverts to the department of marine invertebrates. A dark room was erected in the new mineralogical quarters and running water was supplied in the herbarium.

The alterations to the heating plant outlined in last years report were completed during the summer and a telephone exchange established on the fourth floor of the middle wing in charge of a stenographer, where the clerical work of the curators can be carried on.

The large plaster shades hung below the ceiling lights on the first floor of the museum were removed as they had proved unsatisfactory and were in danger of falling.

The Indian elephant "Bolivar," which had never been a suitable specimen for mounting, deteriorated to such an extent that it was removed and dismounted during the autumn.

Five storage cases for mollusks and five for birds' nests and eggs, with the necessary trays were secured with the balance of the State appropriation of 1917. The latter have been arranged in the hallway on the fourth floor forming a small room in which the entire oological collection will be arranged.

Special educational exhibits were installed during the spring. One, consisting of mounted wild flowers from the herbarium, was displayed inside the large cases containing the forestry exhibit and was added to from time to time as the season advanced, so that it illustrated at any time the wild flowers to be found in bloom in the vicinity of Philadelphia.

The other consisted of bird skins from the study collection, the winter species being installed first and the others on approximately the date at which they arrive from the South so that the series at all times showed the wild birds to be found about the City. These collections were an innovation and attracted much attention among students of local natural history and the classes of school children which visited the museum in large numbers.

While most of the time of the museum staff was fully occupied in the care of the collections, it was also possible to do considerable field work.

Dr. Stone was granted leave of absence for three months, May 15, to August 15, and visited the Chiricahua Mountains, southern Arizona, the expenses being largely born by the Redfield botanical fund. He obtained a large collection of plants from a region not heretofore represented in the Academy's herbarium, as well as several thousand insects, and many birds, mammals and reptiles. The success of this expedition was largely due to the generosity of Mr. J. Eugene Law of California, who had invited Dr. Stone to be his guest at his camp in the Chiricahuas and did everything in his power to further the interests of the Academy. In the same connection the Academy is under obligations to Mr. Frank H. Hands of Pinery Canyon in the same mountains.

Mr. Morgan Hebard conducted another expedition to the southwestern United States during July, August and September primarily for the collection of Orthoptera visiting such localities as the Death Valley, Mts. Whitney, San Gorgonio and Charleston. As on previous

trips he generously took Mr. Rehn of the Academy staff with him and shared his collections with the institution.

Local trips were taken by other members of the staff which resulted in the acquirement of much valuable material while collections belonging to other institutions or individuals were identified by our specialists in return for a series of the duplicates.

The details of work in the several departments of the museum follow:

Mammals.

As in previous years many valuable specimens were received from the Zoological Society of Philadelphia which have been prepared as skins, or skeletons. The taxidermist Mr. McCadden has been constantly engaged upon the preparation of such material and in the cleaning of skeletons obtained in previous years. A large number of such osteological material has thus been added to the study series, and an African Wart Hog and Kinhajou have been mounted during the year.

Specimens were loaned to E. W. Nelson.

Birds.

A number of valuable local nests and sets of eggs were added to the Delaware Valley Ornithological Club Collection, while to the study collection of skins the most notable accessions were a large series of Colombian birds obtained by purchase from M. A. Carriker; a number of skins from French Guiana and Senegambia presented by the Philadelphia Museums, a collection of local birds, mainly mounted, from Mr. E. W. Woolman and some 200 specimens from Arizona collected by Dr. Stone.

Considerable rearrangement of the study collection was accomplished during the year and much miscellaneous material mounted and unmounted made readily available.

Many specimens received from the Zoological Society were prepared either as skins or osteological specimens which were catalogued and added to the series.

Many ornithologists have studied the collections during the year and specimens were loaned to H. C. Oberholser, and C. B. Cory.

Reptiles and Fishes.

Mr. Henry W. Fowler who has continued in charge of this department reports that a large number of specimens have been received during the year, notable among which have been 30 specimens of

lizards from the Congo region presented by the American Museum of Natural History, a series of reptiles from the Death Valley and other localities in the western United States, collected by Messrs. Hebard and Rehn and 75 specimens of reptiles obtained in Arizona by Dr. Stone. A number of fishes from Pennsylvania and New Jersey were obtained by Mr. Fowler and other local collectors.

During the past year Mr. Fowler has catalogued, determined and labelled 738 specimens of fishes and has published three papers in the Academy's PROCEEDINGS involving the study and identification of many specimens in the collection.

He has also received for study from the U. S. National Museum the fishes obtained by the U. S. Exploring Expedition of 1839 to 1842, upon which he is preparing a report and of which the Academy will receive a duplicate series.

The collections have been consulted by several visiting specialists and material loaned to Alexander Ruthven and Thomas Barbour.

MOLLUSKS.

Dr. Henry A. Pilsbry in charge of the department of Mollusks reports that specimens were received during the year from 72 donors, among the more valuable gifts being 646 lots of North American fresh-water shells from Bryant Walker, selected by Dr. Pilsbry, and a series of Arizona shells and alcoholic specimens collected and presented by James H. Ferriss and A. A. Hinkley. Dr. V. Sterki supplied paratypes of numerous species of Sphaeriidæ and Mr. A. A. Hinkley a series of shells from Guatemala including types of new species. Mr. C. T. Simpson presented a large series of the handsome tree snails of Florida from newly explored localities in the Everglades and elsewhere; and substantial additions to the Pennsylvania and New Jersey collections have been made by E. G. Vanatta and Bayard Long.

Studies on the family Pupillidæ have been continued during the year and published in volume XXV of the MANUAL OF CONCHOLOGY which has been completed, the last part being now in press, Dr. C. Montague Cooke having collaborated in the description of the Hawaiian species. Work has also been done on a report on the mollusca of New York and many specimens have been determined for correspondents.

Mr. E. G. Vanatta has continued the arrangement of the collections, the preparation of material for the museum, and has published four short articles on new material received. Miss Ziegler has made good progress in cataloguing the tertiary fossils.

Specimens have been loaned for study to Dr. Paul Bartsch, Mr. J. B. Henderson and Dr. V. Sterki.

Insects.

Dr. Henry Skinner, head of the Entomological department, reports that as usual a large amount of material has been incorporated in the collections during the year but lack of cases has seriously retarded its arrangement. He has, however, completed the rearrangement of the large group of the exotic Hesperidæ.

Notable additions to the collection have been 75 diptera from the western United States and Alaska from F. M. Jones; some rare East Indian and South American lepidoptera from W. J. Coxey; 356 lepidoptera from Panama and Costa Rica, from D. E. Harrower; a gynandromorphic *Papilio turnus* from G. F. Pettinos, Jr.; a collection from the Chiricahua Mountains, Arizona, from Dr. W. Stone, consisting of about 4000 specimens; a large series of orthoptera and many coleoptera etc., from Morgan Hebard.

Mr. E. T. Cresson, Jr., has prepared a revision of the dipterous family, Sciomyzidæ, which is now in press, while the family Anthomyidæ has been studied by J. R. Malloch. Many new species of diptera have been received in return for identification of material sent by other institutions.

In orthoptera, Mr. J. A. G. Rehn has rearranged several groups so as to admit of the incorporation of newly received or determined material and has mounted and labelled many specimens. His studies during the year have covered the West Indian Blattidæ, African Blattidæ and a revision of the North American Trimerotropi.

Mr. Morgan Hebard, who has continued his researches at the Academy during the year, has completed a study of the Colombian dermaptera and orthoptera and also a monograph of the Blattidæ of Panama, and a report on Mantidæ from Malaysia, Papua and Australia.

Numerous entomologists have studied the collections and specimens were borrowed for study by Chas. Schaeffer and Edw. C. Van Dyke.

Plants.

The transfer of the herbarium to new quarters at the east end of the north wing, has already been mentioned. Mr. Stewardson Brown, in charge of this department, reports that the general series of plants has been arranged in the three lower rooms, the local collection in the middle room on the upper floor and the cryptogams in the south

room, the deSchweinitz and other historic collections being arranged in a fireproof vault which had been erected there. The north room has been fitted up for the mounting and preparation of specimens.

During the year, Miss Ada Allen, who has continued as an aid in the department, has mounted upwards of 3700 sheets of specimens comprising the remainder of the Joel Carter herbarium exclusive of the local material, 302 specimens from California, and 613 sheets of New England plants both of which were received by purchase. Most of these have been catalogued by Mr. Brown and distributed. Much additional time was spent in the general arrangement of the herbarium in its new quarters.

Mr. Bayard Long has spent much time in the critical study of various groups in the local herbarium and in its general supervision.

Much use has been made of the herbarium by visiting botanists and specimens have been loaned to C. A. Wetherby, M. L. Fernald, W. B. Maxon, C. Schneider, A. L. Grant and F. L. Stevens.

Minerals and Rocks.

The change of location in this department to rooms adjacent to the exhibition collections of minerals has been very advantageous as it brings all of the mineralogical and geological material into close association where it is readily available for consultation.

The collection of Pennsylvania minerals has been transferred to the gallery of the mineral hall formerly occupied by the State Department of Health exhibit, where there is abundant room for its expansion.

The Curators are again indebted to Mr. Frank J. Keeley, curator of the William S. Vaux Collections, and to Mr. Samuel G. Gordon, a student of the Jessup Fund, for all the attention that has been given to this department. Mr. Gordon has cared for the various accessions and has completed an examination of the old collections and duplicates stored in the building, preparing the latter for gift or exchange to other institutions. He has also made a number of field trips to various counties in Pennsylvania and obtained many specimens of great value to the State collection.

Archeology.

Miss H. N. Wardle, who has cared for the collections in this department, reports that considerable shifting of exhibits has been necessary to make room for accessions or the display of material not hitherto on exhibition, many specimens from the A. H. Gottschall collection of North American Indian material having been thus displayed.

She attended to the packing, transfer and exhibit of a large and very valuable series of shell heap material collected by Mr. Clarence B. Moore on his early explorations in Florida, which was originally presented to the Wagner Free Institute of Science, but which through a generous donation, the Academy was enabled to secure for arrangement with the rest of the Clarence B. Moore collection.

Owing to the coal regulations and other hindrances, Mr. Moore's usual autumn expedition in the southern states was prevented, while his spring exploration in Florida was not very productive, owing to the country visited having been so thoroughly covered by his previous investigations.

WITMER STONE, *Chairman.*

REPORT OF THE CURATOR OF THE WILLIAM S. VAUX COLLECTIONS, DECEMBER 1, 1919.

During the past year, the offices of the William S. Vaux Collections have been removed to the northwest corner of the building, where, with ample space, it is hoped to develop an adequate mineralogical laboratory.

All accessions to date, have been incorporated in the collection, after being catalogued and labelled by Mr. Samuel G. Gordon, who has presented the choice of the specimens, thirty-four in all, secured in connection with his collecting trips over the season, including an unrivalled suite of Nesquehonite and other interesting minerals from Pennsylvania localities.

Other gifts were received from the following donors:

Thomas Harvey. Almandite, Columbite, Tourmaline, Beryl, Corundum.—Delaware Co., Penna.

E. S. Moore. Calcite.—Montana.

Bently R. Morrison. Cacoxenite, Apophyllite, Byssolite.—Lancaster County and Chester County, Penna.

Frederick Pierce. Columbite and Monazite.—Boothwyn, Penna.

Washington A. Roebling. Epidsmine.—Moore Station, N. J.

Frederick Oldach. Epidesmine.—Robeson, Penna.

Twelve specimens were purchased, of which one of the most important was crystallized orpiment from Japan.

Respectfully submitted,

F. J. KEELEY, *Curator, Wm. S. Vaux Collections.*

REPORTS OF THE SECTIONS.

THE BIOLOGICAL AND MICROSCOPICAL SECTION.—The Biological and Microscopical Section held nine stated meetings during the year.

Weekly excursions were made, except during July and August and the winter months, to various localities, for collecting purposes.

At the suggestion of Mr. H. F. Munro, a class in miscroscopic technique has been formed and now meets once a month for the purpose of giving instruction to non-members of the Section. The membership now numbers about twenty and is open to all applicants.

Communications on various subjects have been made by the following members of the Section: Messrs. T. Chalkley Palmer, Hugo Bilgram, B. F. Ray, Dr. Thomas Stewart, J. W. Palmer, John G. Rothermel, Walter Palmer, F. J. Keeley, H. F. Munro, W. H. Van Sickel and Charles S. Boyer.

The following donations to the Sections are reported:

From Miss Elizabeth S. Brown, the miscroscopical collection of Dr. Amos P. Brown, including a Queen Acme microscope, a Leitz mineralogical microscope, a Beck petrographical microscope, twenty-four objectives, a series of accessories and an object cabinet containing about twelve hundred mounted objects.

From the Estate of Dr. Samuel G. Dixon, a mahogany object cabinet, with about two hundred and seventy-five slides of Bacteria.

The following have been elected officers for the year 1920:

Director.....J. Cheston Morris, M. D.
Vice-Director.....T. Chalkley Palmer
Recorder.....Charles S. Boyer
Corresponding Secretary.....Walter Palmer
Treasurer.....Thomas S. Stewart, M. D.
Conservator.....F. J. Keeley

CHARLES S. BOYER, *Recorder.*

ENTOMOLOGICAL SECTION.—The Section held the usual stated meetings during the year, with an average attendance of eleven persons. Wm. J. Coxey was elected a member and Robert L. Haines, a Contributor. Interesting communications were made by J. A. G. Rehn, Philip Laurent, J. H. West, J. C. Bradley, Henry Skinner, W. J. Chamberlain, P. P. Calvert, Morgan Hebard and J. J. Davis.

The following officers and committees were elected to serve for 1920:

Director.....Philip Laurent
Vice-Director.....R. C. Williams, Jr.
Treasurer.....E. T. Cresson

Conservator.....Henry Skinner, M. D., Sc. D.
Secretary.....J. A. G. Rehn
Recorder.....E. T. Cresson, Jr.
Publication Committee.....E. T. Cresson,
P. P. Calvert, Ph. D.,
E. T. Cresson, Jr.

E. T. Cresson, Jr., *Recorder*.

Botanical Section.—Officers to serve for the year 1920 were elected as follows:

Director.....Joseph Crawford
Vice-Director.....Alexander MacElwee
Recorder.....John W. Eckfeldt, M. D.
Treasurer.....Stewardson Brown
Conservator.....Stewardson Brown

John W. Eckfeldt, M. D., *Recorder*.

Mineralogical and Geological Section.—Owing to the serious illness of the Director, Mr. Benjamin Smith Lyman, no written report was received, but Mr. Frank J. Keeley, the Vice-Director, reported verbally that several meetings had been held, and in conjunction with the Biological and Miscroscopical Section, twenty-four field excursions had been given. The Officers of the Section are:

Director.....Benjamin Smith Lyman.
Vice-Director.....Frank J. Keeley
Recorder and Secretary.....William B. Davis
Treasurer.....Benjamin Smith Lyman
Conservator.....George Vaux, Jr.

Ornithological Section.—The Section has continued its function of encouraging ornithological activity at the Academy during the year. The Delaware Valley Ornithological Club has held regular meetings in the ornithological room and has been instrumental in bringing much material to the department and in interesting many persons in its development.

At the annual meeting of the Section the following officers were elected for the year 1920:

Director.....Spencer Trotter, M. D.
Vice-Director.....George Spencer Morris
Recorder.....Stewardson Brown
Secretary.....William A. Shryock
Treasurer and Conservator.....Witmer Stone

Witmer Stone, *Conservator*.

The annual election of Officers, Councillors and members of the Committe on Accounts was held December 16th, with the following result:

PRESIDENT	John Cadwalader, A. M., LL.D.
VICE-PRESIDENTS	Edwin G. Conklin, Ph.D., Sc.D.
	Henry Skinner, M. D., Sc.D
RECORDING SECRETARY	Edward J. Nolan, M. D., Sc.D.
CORRESPONDING SECRETARY	J. Percy Moore, Ph.D.
TREASURER	George Vaux, Jr.
LIBRARIAN	Edward J. Nolan, M. D., Sc.D.
CURATORS	Witmer Stone, A. M., Sc. D.
	Henry A. Pilsbry, Sc. D.
	Henry Tucker, M. D.
	Spencer Trotter, M. D.
COUNCILLORS TO SERVE THREE YEARS	Edwin S. Dixon.
	Robert G. LeConte, M. D.
	George Spencer Morris.
	George L. Harrison, Jr.
COMMITTEE ON ACCOUNTS	Charles Morris.
	Samuel N. Rhoads.
	John G. Rothermel.
	Thomas S. Stewart, M. D.
	Walter Horstmann.

COUNCIL FOR 1920.

Ex-Officio.—John Cadwalader, A. M., LL. D., Edwin G. Conklin, Ph. D., Sc. D., Henry Skinner, M. D., Sc. D., Edward J. Nolan, M. D., Sc. D., J. Percy Moore, Ph. D., George Vaux, Jr., Henry A. Pilsbry, Sc. D., Witmer Stone, A. M., Sc. D., Henry Tucker, M. D., Spencer Trotter, M. D.

To serve three years.—Edwin S. Dixon, Robert G. LeConte, M. D., George Spencer Morris, George L. Harrison, Jr.

To serve two years.—Philip P. Calvert, Ph. D., Frank J. Keeley, Walter Horstmann, T. Chalkley Palmer.

To serve one year.—Charles B. Penrose, M. D., LL. D., Ph. D., Charles Morris, William E. Hughes, M. D., Roswell C. Williams, Jr.

COUNCILLOR.....George Vaux, Jr.

LIBRARY STAFF.

Librarian.....Edward J. Nolan.
Assistant Librarian.....William J. Fox.

MUSEUM STAFF.

Department of Vertebrate Zoology

Witmer Stone, Special Curator.
Henry W. Fowler, Assistant Curator (Reptiles and Fishes).
James A. G. Rehn, Assistant Curator (Mammals).

Department of Invertebrate Zoology (exclusive of Insects)

Henry A. Pilsbry, Special Curator.
Edward G. Vanatta, Assistant Curator.

Department of Insects

Henry Skinner, Special Curator.
James A. G. Rehn, Assistant Curator.
Ezra T. Cresson, Jr., Assistant Curator.
Morgan Hebard, Research Associate.

Department of Botany

Stewardson Brown, Assistant Curator (in charge).
Bayard Long, Research Associate.
Ada Allen, Aid.

Department of Mineralogy and Geology

Frank J. Keeley, Curator of the William S. Vaux Collections.
Samuel G. Gordon, Aid (in charge of general collection).

Department of Archeology

Harriet Newell Wardle, Aid (in charge).

Artist

Helen Winchester.

Taxidermist

David McCadden.

STANDING COMMITTEES, 1920.

Finance.—Effingham B. Morris, John Cadwalader, A. M., LL. D., Edwin S. Dixon, Walter Horstmann, and the Treasurer.

Publication.—Henry Skinner, M. D., Sc. D., Witmer Stone, A. M., Sc. D., Henry A. Pilsbry, Sc. D., Edward J. Nolan, M. D., Sc. D., William J. Fox.

Library.—Henry Tucker, M. D., Frank J. Keeley, Witmer Stone, A. M., Sc. D., Spencer Trotter, M. D., T. Chalkley Palmer.

Instruction and Lectures.—Henry Skinner, M. D., Henry A. Pilsbry, Sc. D., Charles Morris, James A. G. Rehn, George S. Morris.

ELECTIONS IN 1919.

Members.

February 18.—W. Judson Coxey.

April 15.—Edgar Fahs Smith.

November 18.—William H. Van Sickel, Walter Palmer, Hampton L. Carson, Anne Hinchman, Arthur Cope Emlen.

ADDITIONS TO THE MUSEUM

1919.

Mammals.

Miss M. C. Booth. Mole (*Scalopus aquaticus*). Haverford, Penna.

Samuel W. Green. Skull of Black Bear (*Ursus americanus*). Moscow, Pa.

Richard C. Harlon. Woodland Jumping Mouse (*Napaeozapus insignis*). Huntingdon County, Pennsylvania.

Purchased. New York Weasel (*Putorius noveboracensis*). State College, Pa.

Dr. Witmer Stone. Fifty mammals. Chiricahua Mountains, Arizona.

Zoological Society of Philadelphia. Specimens prepared as follows: Mounted. Kinkajou (*Potos caudivolvulus*). Skin and Skeleton. Orang-utan (*Pongo pygmaeus*). Huanaco (*Lama glama*). Young male Sumatran Elephant (*Elephas maximus sumatranus*). Skin and skull, Warthog (*Phacochoerus africanus*). Pale Cebus (*Cebus flavescens*). Night Monkey (*Nyctipithecus trivirgatus*). Two Ocelots (*Felis pardalis*). Brazalian Ocelot (*Felis chibigouazou*). Jungle Cat (*Felis chaus*). Young Wild Horse (*Equus prejevalskii*). Two warthogs (*Phacochoerus africanus*), 2 male and female. Spring-bok (*Antidorcas euchore*). Red Kangaroo (*Macropus rufus*). Black-tailed Wallaby (*Macropus ualabatus*). Skeleton, Dromedary (*Camelus dromedarius*). Skull, Pigtailed Macaque (*Macaca nemestrina*). Raccoon-like Dog (*Canis procyonoides*).

Birds.

Mrs. Howard Gamble. Rose-breasted Cockatoo (*Cacatoes roseicapilla*).

Chas. G. Herman. Eighteen skins of birds. Nicaragua.

Mrs. Emma J. Lewis. Egg of Sulphur-crested Cockatoo.

W. W. McCall. Skin of Weaver Finch.

Purchased. 650 skins of Colombian birds.

Dr. Witmer Stone. Two hundred and two birds and six sets of birds' eggs. Chiricahua Mountains, Arizona.

Mrs. E. M. Swainson. Mounted Mourning Dove (*Zenaduˑa macroura*). New York State.

Miss B. Town. Several bird skins. New Zealand and New Guinea.

Dr. M. P. Warmuth. Two cases of mounted birds.

E. W. Woolman. Collection of mounted birds and bird skins.

Zoological Society of Philadelphia. Specimens prepared as follows: Skin and skeleton, Cassowary (*Casuarius* species). Skin and sternum, Horned Screamer (*Chauna chavaria*). Gray-lag Goose (*Anser anser*). Skin, Coscoroba Swan (*Coscoroba coscoroba*). Cereopsis Goose (*Cereopsis novae-hollandiae*). Ruddy Flamingo (*Phoenicopteris ruber*). Stanley's Crane (*Tetrapteryx paradisea*). King Vulture (*Gypaegus papa*). Skull and sternum, Anhinga (*Anhinga anhinga*). Skull, Orinoco Goose (*Alopochen jubata*). Scarlet Ibis (*Guara rubra*). Sarus Crane (*Antigone antigone*). Lilford's Crane (*Grus lilfordi*). Red-sided Electus (*Eleetus roratus*). Senegal Parrot (*Poioeephalus senegalensis*). Satin Bower Bird (*Ptilorhynehus violaeea*).

Reptiles and Amphibians.

American Museum of Natural History. Collection of reptiles. Belgian Congo.

G. W. Bassett. Shell of Box Tortoise. New Jersey.

Hebard-Academy Expedition of 1919. Collection of reptiles and amphibians. Arizona, Nevada and California.

Russell Rosenfeldt. Newt (*Diemietylus virideseens*). Massachusetts.

Dr. R. W. Shufeldt. Gila Monster (*Heloderma suspectum*). Arizona.

Dr. Witmer Stone. Seventy-five reptiles and amphibians. Chiricahua Mountains, Arizona.

Albert S. Thompson. Jar of reptiles and amphibians. Deerfield, Va.

University of Michigan Museum (in exchange). *Ranodon* and *Rana*.

Zoological Society of Philadelphia. Young American Crocodile (*Crocodilus amerieanus*).

Fishes.

William Duncan. Star Gazer (*Astrospeetus guttatus*).

H. W. Fowler. Five jars of fishes. Bucks, Cumberland and Franklin Counties, Pennsylvania.

Hebard-Academy Expedition of 1919. Small lot of fishes. Beatty, Nevada.

Morgan Hebard. *Rhomboehirus*. Florida. Three jars of fishes. Charlotte Harbor, Florida.

Hermano Apolinar Maria. Catfish. Colombia.

E. S. Mattern and H. W. Fowler. Two jars of fishes. Berks County, Pa.

T. L. Hankinson. Four jars of fishes. Palisades, New Jersey.

W. L. Paulin. Three *Pterophyllum scalare*.

University of Michigan Museum (in exchange). *Etheosoma iowae* and *Catostonus eatostomus*.

Dr. R. W. Van Deusen and H. W. Fowler. Three jars of fishes. Cumberland and Salem Counties, New Jersey.

Witmer Stone. Several specimens from the Chiricahua Mts., Arizona.

Insects

W. L. Abbott. One butterfly, San Domingo.

A. R. Allen. Seven insects, Texas.

William Beutenmuller. Twenty Cynipidæ.

Annette F. Braun. Twenty-four Microlepidoptera, Ohio. Two *Coleophora amaranthella* (paratypes), Ohio.

PHILIP P. CALVERT. *Psilophora maculata* (type), Costa Rica. Eighteen insects, Costa Rica.

JOSÉ CABRERA. Three specimens of Blattidae.

D. M. CASTLE. Twenty-five insects, New Jersey.

T. D. A. COCKERELL. Eighty Hymenoptera, South America.

W. J. COXEY. *Morpho rhetenor*, French Guiana. *Morpho eugenia*, French Guiana.

NINE EXOTIC LEPIDOPTERA. *Antheraea helena*, Australia. Three butterflies from Assam and Java. *Papilio coon*, Java.

W. J. CRESSON, Jr. One moth, Swarthmore, Penna.

W. T. DAVIS. *Cacama variegata* (cotype), Texas.

J. H. FERRIS. Four Coleoptera, New Mexico.

EXCHANGE. Sixty butterflies, Utah.

W. J. FOX. Two Coleoptera, Philadelphia.

GEORGE M. GREEN. Fifty-two Coleoptera, United States.

FRANK HAIMBACH. Eight *Catocala*, New Mexico. Two moths, New Jersey.

D. E. HARROWER. Three hundred and fifty-six Lepidoptera, Central America.

TWENTY INSECTS. Central America.

HAWAIIAN SUGAR PLANTER'S ASSOCIATION. Nine Orthoptera, Philippines.

MORGAN HEBARD. Four thousand five hundred Orthoptera, western United States. Twenty-three Orthoptera, Colombia. Two hundred and twenty-five Orthoptera, Mexico and Central America. Nineteen Orthoptera, Japan. Seven Orthoptera, United States. Sixteen Lepidoptera, Florida. One *Plusia*, Florida. Twenty-three insects, Florida. Twenty-two Lepidoptera, Florida. Fifteen Coleoptera, United States. Sixty-three insects, Florida.

HERMAN HORNIG. One hundred and fifty Diptera, Philadelphia.

A. R. ILLIFF. Nineteen Orthoptera, New Mexico.

FRANK M. JONES. Seventy-five Diptera, and 41 Orthoptera, Western United States.

J. N. KNULL. Two *Dicera tepida*, Pennsylvania.

A. W. LINDSEY. Five Hesperidæ, South America.

FRANK R. MASON. *Nothus luteus*, California.

LEVI W. MENGEL. One moth, Colombia. *Perisama sinerubra* (type), Bolivia.

R. OTTOLENGUI. Five moths, California.

GEORGE F. PETTINOS, Jr. Gynandromorphic *Papilio glaucus*, Merion, Pennsylvania.

PURCHASED. Four hundred and fifty-two Orthoptera, Pará, Brazil. Five hundred and ten Orthoptera, Argentina. Seventeen *Cicada*, sixty-six *Argynnis*, Neuroptera, Colorado.

HENRY SKINNER. Twenty-one insects, White Mountains, New Hampshire. Twenty-one butterfllies, Arizona.

STATE DEPARTMENT OF AGRICULTURE. Eight Diptera, Pennsylvania.

WITMER STONE. Four thousand insects from the Chiricahua Mountains, Arizona.

UNIVERSITY OF MICHIGAN. Two hundred and forty-two Diptera, Pennsylvania.

UNIVERSITY OF CALIFORNIA. Eleven Orthoptera, California.

E. C. VAN DYKE. Four Coleoptera, California.

L. H. WELD. Two *Charips leguminosa* (paratypes), Idaho.

JOHN H. WEST. Six *Catocala*, Utah.

RECENT MOLLUSCA.

DR. W. L. ABBOTT. Seventy-six trays of shells from Hayti.

W. O. ABBOTT. Twenty-eight trays of shells from Massachusetts and Pennsylvania.

JACOB AEBLY. *Ityanassa obsoleta* Say from a duck.

REGINALD ALLEN. Five species of marine shells.

A. BAILEY. *Sphaerium sulcatum* Lam. from Columbia, New York.

F. C. BAKER. Six species of freshwater shells from New York and Illinois.

DR. FRED BAKER. Four species of shells from Brazil.

MRS. W. L. BAKER. Twenty-five species of marine shells from Florida.

NATHAN BANKS. *Bulimulus liquabilis* Rve from near Brownsville, Texas.

S. S. BERRY. Nine trays of land shells from California.

DR. J. BEQUAERT. Six species of African land shells.

HUGO BILGRAM. *Polinices duplicata* Say from Atlantic City, New Jersey.

LOUIS H. BREGG. Twelve species of land and marine shells.

DR. W. T. BRIGHAM. Twelve trays of land shells from Hayti.

MRS. W. A. BRYAN. Twelve trays of shells from New York.

W. A. BRYAN. Cotypes of *Tapes philippinarum kupi* Bryan from Oahu.

MRS. H. H. BUCKMAN. *Pyramidula alternata* Say from Au Sable Gorge, New York.

H. C. BURNUP. Five trays of African land shells.

DR. P. P. CALVERT. Two species of shells from Costa Rica.

G. H. CLAPP. *Gastrocopta delicata* Pils from Cat Cay, Bahama Islands.

W. F. CLAPP. Twenty-five trays of land shells.

J. B. CLARK. Forty-eight trays of shells from Florida.

T. D. A. COCKERELL. Two species of land shells.

EMILY COLLINS COLLECTION. Twenty-eight species of shells.

PROF. FRANCO CONTRERAS. Four species of *Naiades* from Mexico.

DR. C. M. COOKE. Eighty-five trays of land shells from Vancouver Island and Hawaiian Islands.

W. J. CRESSON, JR. Two species of marine shells.

DR. FLORENTINO FELIPPONE. Twelve trays of shells from Uruguay.

J. H. FERRISS. Eighty-four trays of land shells from South Western United States.

J. H. FERRISS AND E. HAND. *Vertigo sterkii* Pils from near Kern River, California.

W. J. FOX. *Limax flavus* L. from Philadelphia. Pennsylvania.

FRIENDS' CENTRAL SCHOOL. Seven species of marine shells.

G. M. GREENE. Two species of marine shells.

J. M. HAWLEY. Two species of land shells from New York.

MISS HAYES. *Argonauta tuberculosa* Lam.

MORGAN HEBARD. Twenty-eight trays of shells from Florida.

J. B. HENDERSON. Ten trays of shells from Cuba and the United States.

A. A. HINKLEY. Seventy-four trays of shells from Guatemala and Mexico.

A. A. HINKLEY and J. H. FERRISS. Eighty-four trays of land shells from Arizona.

C. W. JOHNSON. *Oliva cærulea* Bolt. from New Guinea.

F. J. KEELEY. Two species of shells from Pennsylvania and Florida.

C. H. KENNEDY. *Zonitoides arborea* Say from Bay Shore, near Baltimore, Maryland.

Bayard Long. Ninety-three trays of shells from the Eastern United States.

W. G. Mazyck. *Polita rhoadsi* Pils. from Williamsburg County, South Carolina.

R. A. McConnell. Four species of Mexican land shells.

Rev. H. E. Meyer. Fourteen species of land shells.

J. B. Mockridge. Three marine shells from England and Florida.

Clarence B. Moore. For y two trays of land shells from Florida.

F. Oldach. *Elimia virginica* Gm. Tulpohocken Creek, near Reading, Pennsylvania.

J. M. Ostergard. Two species of marine shells from Oahu.

Dr. H. A. Pilsbry. One hundred and fifty-three trays of shells.

Purchased. One hundred and fifty-two trays of exotic shells.

Chas. T. Ramsden. *Vaginulus* from Cuba.

S. N. Rhoads. Seven trays of shells from Guatemala.

J. Rehn and M. Hebard. Fourteen trays of shells from Southern United States.

Dr. Emmet Rixford. *Epiphragmophora* from California.

C. T. Simpson. Seventy trays of *Liguus* from Florida.

Burnett Smith. Twenty-four trays of shells from New York.

Geo. C. Spence. Five species of exotic shells.

Dr. V. Sterki. Twenty-nine trays of North American shells.

Dr. Witmer Stone. Twenty-five trays of shells Chiricahau Mts., Arizona.

Mrs. E. M. Swainson. *Turritella duplicata* Lam.

E. G. Vanatta. One hundred and six trays of shells.

Gilbert Van Ingen. One hundred and sixty-eight trays of shells from New York.

Bryant Walker. Six hundred and forty-six trays of land and fresh water shells.

Miss Mary E. Walker. Three species of fresh water shells from New York.

Miss H. N. Wardle. Two species of land shells from Pennsylvania.

Joseph Willcox. Five marine shells.

George Willett. *Velutina rubra* W. from Forrester Island, Alaska.

W. P. Woodring. *Succinea grosvenori* Lea from Wolf Point, Montana.

B. B. Woodward. Ten trays of *Pisidium* from Europe.

James Zetek. Forty-nine trays of shells from Panama.

Other Invertebrates.

L. S. Adams. One starfish.

Mrs. W. L. Baker. *Balanus galeatus* L., upon gorgonians from Osprey, Florida.

J. B. Clark. One tray of *Lingula* from Florida.

R. E. Coker. *Balanus* from near Key West, Florida.

Dr. Florentino Felippone. Three trays of invertebrates from South America.

Jarvis B. Grubb. One starfish. Cape May, New Jersey.

Purchased. Nine trays of invertebrates.

Mrs. Mary Ludwig Suydam. Collection of corals.

United States National Museum. Four species of barnacles from California and Florida.

Fossil Invertebrates.

James B. Clark. Portion of scapula of fossil elephant (*Elcphas*). Near Dawson, Yukon, Alaska.

G. W. Bassett. *Belemnitella americana* Mort. from a well at Middletown, New Jersey.

J. B. Clark. Six species of fossil shells from Florida.

T. D. A. Cockerell. Fourteen fossil insects and two fossil spiders. Florrisant, Colorado.

David Dallam. One fossil.

Dr. H. A. Pilsbry. Three species of fossil from Wolcott Creek, New York.

Fossil Plants

Bro. G. Arsine. Two phials of fossil diatoms. Auvergne, France.

Herbarium.

Miss Alice A. Albertson. Ten specimens from Nantucket, Massachusetts.

George W. Bassett. Number of small collections from New Jersey.

Samuel N. Baxter. *Synoplocos paniculata*, cultivated.

Walter M. Benner. Four specimens from eastern Pennsylvania.

Rev. T. R. Brendle. Number of specimens from the Perkiomen Valley, Pennsylvania.

O. H. Brown. Two hundred and twenty-four specimens from Cape May County, New Jersey.

Elizabeth S. Brown. Collection of Myxomycetes of the late Dr. Amos P. Brown.

Stewardson Brown. *Callitriche anatini* from Germantown, Philadelphia.

Macy Carhart. *Gentiana saponaria* from Keyport, New Jersey.

M. Chapman. *Ilex opaca* from Purmont, New Jersey.

Mrs. Devereux. Three specimens from Maine, fifty specimens from North Carolina.

Mrs. Joseph Fox. *Firmiana platinifolia* in fruit, from McPhersonville, South Carolina.

C. D. Fretz, M. D. Eighteen specimens from Bucks County, Pennsylvania.

Mrs. Adele Lewis Grant. 9 species of *Mimulus* from California.

John W. Harshberger, Ph. D. 15 species from Hackensack Marshes, New Jersey.

Arthur N. Leeds. 2 species from eastern Pennsylvania.

Charles D. Lippincott. *Allium tricoccum* from Harrisonville, New Jersey.

S. Lloyd. *Lycopodium obscurum* from Cold Spring, Cape May County, New Jersey.

Bayard Long. 36 specimens from New Jersey, Pennsylvania and Delaware.

Joseph R. Mumbauer. *Viola canadensis* and *V. cucullata* from Berks County, Pennsylvania.

Alexander MacElwee. 14 plants from New Jersey.

Rev. J. P. Otis. *Rumex nuxicanus* and *Vernonia glauca* from New Castle County, Delaware.

T. Chalkley Palmer. *Centaurium pulchellum* from Chester County, Pennsylvania.

Harold W. Pretz. 242 specimens, chiefly from Lehigh County, Pennsylvania.

Miss Alice L. Smith. Herbarium of the late Benjamin H. Smith.

Witmer Stone. Collection of flowering plants and ferns from Cape May, New Jersey. 1002 sheets of plants collected in the Chiricahua Mts., Arizona.

Joseph Stakes. *Veronica tournefontii* from Moorestown, New Jersey.

H. W. Trudell. *Solidago rigida* from Berks County, Pennsylvania.

S. S. Van Pelt. 2 specimens of local plants

Morgan Hebard. 24 specimens from California.

New York Botanical Garden. 249 specimens. In exchange.

United States National Museum. 16 specimens. In exchange.

Purchased. 1215 plants from North America. Collected by Bayard Long.

Minerals.

Bro. G. Arsine. Lava with maize impressions. La Soledad, near Morelia, Michoacan, Mexico.

J. H. Drosser. Wulfenite crystals. Rodeo, New Mexico.

Samuel G. Gordon. Sixty-eight specimens of minerals from Pennsylvania.

Thomas Harvey. Collection of 3000 Pennsylvania minerals.

Bently R. Morrison. Collection of minerals, French Creek, Pennsylvania.

Frederick Pierce. Collection of minerals, Boothwyn, Pennsylvania.

W. L. Stevenson. Collection of minerals made by the late W. G. Stevenson.

Mrs. Mary Ludwig Suydam. Collection of minerals.

H. F. Zerger. Moss agate, Lancaster County, Pennsylvania.

Ethnology and Archeology.

Miss Virginia Hartshorne. Mummy head and mummy shawl. Egypt.

Clarence B. Moore. Type collection made by Mr. Moore in his early researches of artifacts from the shell-heaps of Florida.

Physical Apparatus.

Miss Elizabeth S. Brown. Three microscopes, objectives, accessories and miscropic slides, formerly the property of the late Dr. A. P. Brown.

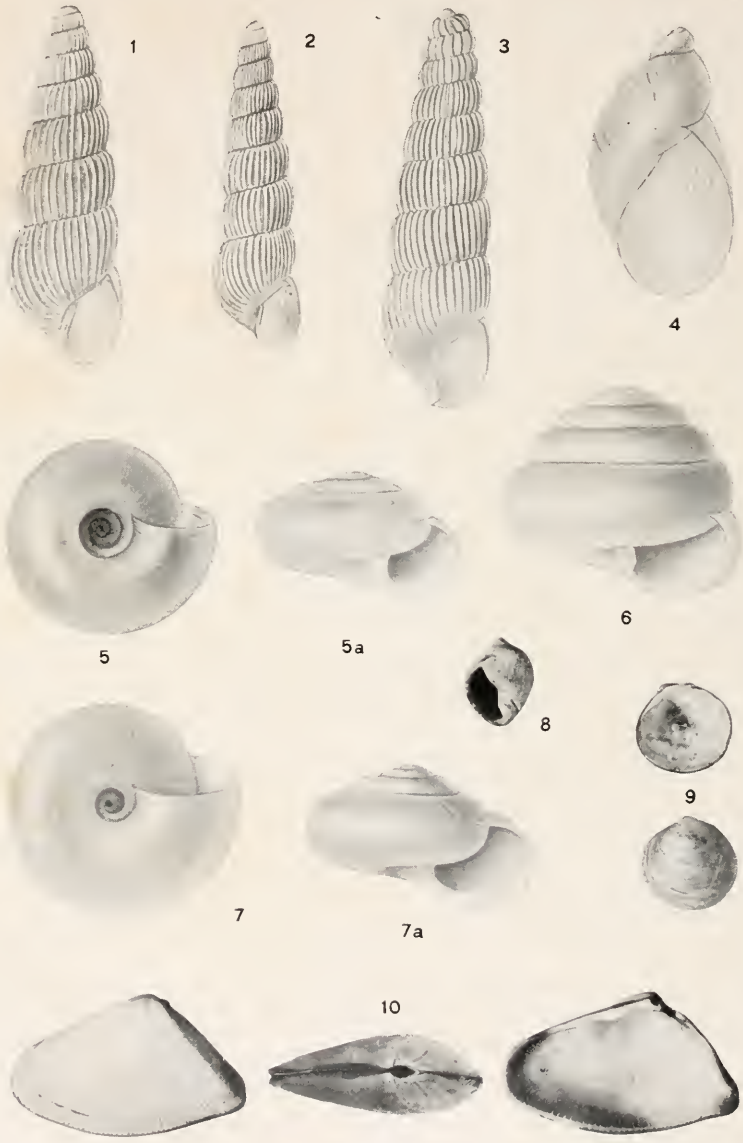
Dr. Herman Burgin. Contact goniometer.

INDEX TO GENERA, SPECIES, ETC., DESCRIBED AND REFERRED TO IN THE PROCEEDINGS FOR 1919.

Species described as new are indicated by heavy-faced, synonyms by italic numerals.

GENERAL INDEX.

1919



PILSBRY: MOLLUSCA FROM CENTRAL AMERICA AND MEXICO.