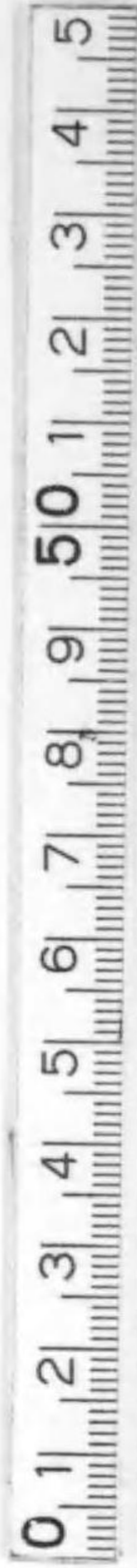


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No. 68

MINISTRY OF AGRICULTURE AND
FORESTRY, JAPAN.

DEPARTMENT OF AGRICULTURE.

Scientific Bulletin No. 3.

August, 1933.

- I. THE DIASPINE COCCIDAE OF JAPAN, VII.
- II. KEY TO GENERA OF DIASPINAE IN JAPAN.
- III. AN INDEX TO SPECIES OF COCCIDS RECORDED
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BY

INOKICHI KUWANA.

TOKYO, JAPAN.

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農務省
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142-717

PREFACE

The following treatise is the last and posthumous report of his studies concerning Japanese Diaspine Coccidae by the late Dr. Inokichi Kuwana, and completes his studies of Diaspinae.

August 31, 1933.

Department of Agriculture,
Ministry of Agriculture and Forestry.



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I. THE DIASPINE COCCIDAE OF JAPAN, VII.*

Genus *Aspidiotus* BOUCHÉ.

Naturg. Schadl. Gart. Ins., p. 52, 1833.

This genus includes species of Diaspinae in which the scale of the adult female is more or less circular, flat to convex or conical. Exuviae central or subcentral, invariably occupying the highest portion of the scale; with the first skin or exuvia superposed upon the second, and often coated with a thin secretory covering, which sometimes gives a nipple like effect to the scale. Ventral scale usually thin and delicate, often remaining on the host plant when the insect is removed. Scale of the male resembles that of the female to a great degree, but is usually smaller, rather more elongate, and usually more coriaceous. Adult female is oval; broadly rounded in front, narrowing behind, segmentation distinct. Anal aperture situated nearer the extremity than the genital aperture. Pygidium has lobes and generally branched plates, but no elongate paraphyses such as those found in *Chrysomphalus*. Circumgenital gland orifices usually in four groups, others without.

Type *A. hederæ* (Vallot).

Fifteen species belonging to this genus that are known in Japan, and described below may be differentiated with the following key:

Key to species.

- A. Female pygidium with three pairs of lobes.
- B. Third pair of lobes much reduced.
- C. Median lobes long, apex angular. *mithcanthii*.

* Parts I-III. of this work were published in 1925, Part IV. in 1926, Part V. in 1928, Part VI. in 1931, and Part VII. bears the date of 1933, which is the last part of the series.

- CC. Median lobes rather short, apex round. *pseudomeyeri*.
- BB. Third lobes well developed.
- C. Circumgenital gland orifices in five groups. *cryptomeriae*.
- CC. Circumgenital gland orifices in four groups.
- D. Median lobes shorter than the second. *destructor*.
- DD. Median lobes longer than the second.
- E. Median lobes much larger than the second and third lobes. *cyanophylli*.
- EE. Median lobes not much larger than the second.
- F. Female scale burrowing beneath the epidermal layer of the leaf. *jordani*.
- FF. Not so.
- G. Female scale thin, transparent. *transparentis*.
- GG. Female scale thick, white. *hederæ*.
- GGG. Female scale firm, pale yellow. *degeneratus*.
- AA. Female pygidium with less than three pairs of lobes.
- B. Third pair of lobes wanting.
- C. Circumgenital gland orifices present. *tsugæ*.
- CC. Circumgenital gland orifices wanting.
- D. Median lobes contiguous in the median line. *cryptoxanthus*.
- DD. Median lobes not contiguous in the median line. *pernicius*.
- BB. Second and third pairs of lobes wanting or rudimentary.
- C. Circumgenital gland orifices present. *lataniæ*.
- CC. Circumgenital gland orifices wanting.
- D. Apex of median lobes converging and rounded, anal opening very large. *camelliae*.
- DD. Median lobes not converging, inner margins straight, anal opening moderately large. *makii*.

Aspidiotus camelliae SIGNORET.

(Plate I, fig. a.)

1869 *Aspidiotus camelliae* Signoret; Ann. Soc. Ent. Fr., (7), ix, p. 117.1881 *Aspidiotus rapax* Comstock; Rep. U. S. Dep. Agr. (1880), p. 285.1991 *Aspidiotus rapax* Comstock; Kuwana, Nippon Kaig. Dusetu, pt. i, p. 80.

Scale of female: Very convex, gray, almost white, transparent; exuviae subcentral, marked by a brown or black dot and a concentric ring. Ventral scale snow white and usually entire. Diameter 1.5 mm.

Scale of male: Similar to that of the female; scarcely so convex, with exuvia sublateral.

Body of female: Bright yellow, broadly oval, slightly tapering and pointed behind. Rudimental antennae with a long curved hair. No parastigmatic gland orifices.

Pygidium of female: Only median lobes well developed and prominent, sharply notched on either side, the mesal notch near apex. Second and third lobes are represented by a small, pointed projection on the margin. A deep incision laterad of the median and second lobes, bounded by subequal chitinous processes. Two irregular toothed or branched plates caudad of each incision, with a simple one between them and two or three simple or branched ones laterad of the third lobe. Spines large and prominent as shown in the figure. Groups of circumgenital gland orifices absent. Dorsal gland pores in two or three irregular rows; the second of about six; the third of about few. Anal orifice very large, placed near apex of the pygidial margin.

Habitat: On olive and other plants.

Aspidiotus cryptomeriae KUWANA.

(Plate I, Fig. b.)

1902 *Aspidiotus cryptomeriae* KUWANA; Pr. Cal. Acad. Sci., 3, iii, p. 69.1911 *Aspidiotus cryptomeriae* KUWANA; Nippon Kaig. Dusetu, pt. i, p. 86.

Scale of female: Subcircular or elliptical, flatly convex; grayish in color, subtransparent. Exuviae a little to one side, straw in color; the first exuvia usually shows the segmentation distinctly; the second more or less covered with secretion. Ventral scale mere film applied to the bark of host plant. Length 1.1-2 mm., width about 1mm.

Scale of male: Elongate, grayish in color, same as female in texture; exuvia subcentral. Length about 1 mm., width 6 mm.

Body of female: Oval in form, not heavily chitinized, flatly convex; pale yellow in color with pygidial portion deep yellow. Rudimental antennae with a curved hair. Mouth parts rather large; rostral loop rather short. Stigmata with no parastigmatic gland orifices.

Pygidium of female: Three pairs of well developed lobes; the first and second lobes of the lateral side are abruptly narrowed towards their posterior extremities from about one half their length; the third pair is much smaller than the first two pairs, and the lateral sides are sloping and very minutely serrulate. Plates are well developed, but they are not much longer than the lobes, and are fringed; two small ones between median lobes; two between median and second lobes; three between second and third lobes; usually seven laterad of the third lobe. Spines as usual, not prominent. Anal opening placed nearer to the margin than to the base of the pygidium. Circumgenital gland orifices in four or five groups (two cases out of five examined with anterior group divided into two groups to form six groups); number of orifices in each group as in the following examples:

5	3	0	2:3	2:2
9-8	9-7	8-8	7-8	10-11
7-6	9-8	6-6	8-8	9-10

Habitat: Commonly found on *Cryptomeria japonica* (sugi), and sometime the scale is collected on *Pinus thunbergii* (kuromatsu), *Abies firma* (momi), *Chamaecyparis obtusa brevifolia* (chabohiba), *C. pisifera* (shinobushiba), and *C. obtusa* (hinoki).

Aspidiotus cryptoxanthus COCKERELL.

(Plate I, Fig. c.)

1900 *Aspidiotus* (*Laspidiotus*) *cryptoxanthus* COCKERELL; Psyche, ix, p. 71.

Scale of female: On bark of twigs, almost invisible, its color being that of the host; circular to suboval, often massed, very slightly convex. Exuviae deep orange in color, very conspicuous when exposed by rubbing. Scale removed from the bark leaves a whitish patch. Diameter about 1.3 mm.

Scale of male: Not observed.

Body of female: Circular, not heavily chitinized, segmentation distinct; margin of free abdominal segments with rather strong spines. Rudimental antennae with a curved hair. Mouth parts large, heavily chitinized; rostral loop very long. Stigmata with no parastigmatic gland orifices.

Pygidium of female: Triangular in outline. Two pairs of lobes are well shown; median lobes contiguous in the middle line, very large, produced, broadly rounded at ends, with long outer slope, crenulate or notched once; second lobes similarly formed but much smaller, separated by an appreciable interval from the first; third lobes obscure or represented by a small nodule. Plates short, pointed or branched; one between the median and second lobes which is short and bluntly pointed; one laterad of second lobe which is rather long and branched. Spines large and prominent as shown in the figure. Interlobular incisions with short chitinous thickening, the inner of the first incision nearly straight and swollen. Anal orifice small, round and very near to the pygidial margin. Dorsal pores arranged as shown in the figure. Circumgenital gland orifices in four groups; anterior laterals 14-16; posterior laterals 10-11.

Habitat: On *Quercus serrata* (konara) in Japan and Kantoshu.

Notes: The writer has noticed on the pygidium of the adult female only four groups of circumgenital gland orifices while in the original description as there are five.

Aspidiotus cyanophylli SIGNORET.

(Plate II, Fig. a.)

1896 *Aspidiotus cyanophylli* SIGNORET; Ann. Soc. Ent. Fr., (4), ix, p. 119.1911 *Aspidiotus cyanophylli* SIGNORET; Kuwana, Nippon Kaig. Datasets, Pt. i, p. 82.

Scale of female: Circular, often elongate, and brownish yellow; exuviae central, bright yellow. The exuviae are, however, normally covered with a nipple like mass of white secretion. Length about 2 mm.

Scale of male: Similar to that of the female, elliptical in outline; exuvia subcentral, yellow.

Body of female: Oval, narrowing towards posterior end; segmentation distinct; lemon yellow.

Pygidium of female: Median lobes very large, as broad as long, notched on each side near apex, appearing to project into the segment; second lobes long, narrow about one third the width of the median lobes, slightly notched on each side near the apex; third lobe similar but smaller. Plates long, extending beyond lobes, deeply branched; two between median lobes; two between the median and second lobes; three between the second and third lobes; outside of third lobe five or more simple or branched plates. Spines long and slender, not exceeding the plates in length. Anal opening large, remote from margin of the pygidial margin. Circumgenital gland orifices in four groups; anterior laterals 4-5; posterior laterals 3-5.

Habitat: In Japan on leaves of palm, in green house. This scale was originally described by Signoret at Paris from *Cyanophyllum magnificum*. Comstock has met with the species in the United

States on various species of *Ficus*. Green has recorded it from Ceylon on tea, cinchona, and palm plants.

***Aspidiotus degeneratus* LEONARDI.**

(Plate II, Fig. c.)

1896 *Chrysomphalus degeneratus* LEONARDI; Riv. Pat. Veg., p. 345.

1903 *Aspidiotus degeneratus* (LEONARDI); Fernald, Cata. Cocc. World, p. 257.

Scale of female: Circular, slightly convex; pale brownish yellow. Exuviae central, nipple like, pale yellow, shiny; The second exuvia covered with secretion. Diameter 1-1.2 mm.

Scale of male: Similar to that of the female, but smaller.

Body of female: Obpyriform with anterior margin rounded, narrowing towards posterior end, almost to acute. Rudimentary antennae conical in form with a curved hair. Mouth parts large, well chitinized; rostral loop long. Stigmata with no parastigmatic gland orifices.

Pygidium of female: Rather large, margin round, not heavily chitinized. Three pairs of lobes well developed; the median pair of lobes largest, round apex with a slight notch on both sides; the second pair of lobes smaller, notched on the outer margin; the third pair of lobes smallest and conical or notched on the outer margin. Plates fringed, not much longer than the lobes; two between the median lobes, two between the median and second; three, one small and two large ones between second and third lobes; three or more beyond the third lobe. Spines as usual. Paraphysis six on each side, very short but stout. Dorsal pores few, arranged in three rows. Anal opening round, placed near the apex of the pygidium. Circumgenital gland orifices in four groups, anterior laterals 1-4; posterior laterals 2-4.

Habitat: On under side of leaves of *Eurya japonica* (hisakaki),

Eurya ochracea (sakaki), *Ilex integra* (mochinoki), *Osmanthus fragrans* (mokusei), and *Thea japonica* (tsubaki). Collected by the writer and others in Tokyo city, Kanagawa, Miye, Shizuoka, and Hyogo-ken. Beside Japan, this scale insect is known from Italy.

***Aspidiotus destructor* SIGNORET.**

(Plate II, Fig. b.)

1869 *Aspidiotus destructor* SIGNORET; Ann. Soc. Ent. Fr., (4), ix, p. 120.

1911 *Aspidiotus lataniae* (Not SIGNORET) KUWANA; Nippon Kaig. Datasets, Pt. 4, p. 85.

Scale of female: Form circular; flat; smooth; very pale yellowish, almost colorless; transparent, showing the form of the sublying insect and eggs. Exuviae very pale clear yellow. Diameter about 1.75 mm.

Scale of male: Similar to that of the female, but smaller and somewhat elongated. Length about 0.75 mm.

Body of female: Rounded in front, tapering and pointed behind, flattish, pale yellow. Rudimental antennae with a curved hair. Stigmata with no parastigmatic gland orifices.

Pygidium of female: Three pairs of lobes, well developed; the median pair shortest and somewhat dark colored; all lobes rather narrow, notched on the outer edge; two lateral lobes constricted at the base and situated on the marginal prominences. Plates larger than lobes, branched or fimbriate; two between median lobes; two between median and second lobes; three between second and third lobes; about seven laterad of the third lobe on each side, these last rather broad, sloping and branched on their outer edge. Spines as usual. Dorsal pores numerous and conspicuous, but filiform and trumpet-shaped. Anal opening near the margin of the pygidium. Circumgenital gland orifices in four groups; anterior laterals 6-14; posterior laterals 3-9.

Habitat: In Japan on tea and other plants in the field and on palm, banana and other ornamental plants in the green house. The scale insect is a well known pest on the cocconut palm in the Southsea Islands.

***Aspidiotus hederæ* (VALLOT).**

(Plate III, Fig. c.)

- 1829 *Chermes hederæ* VALLOT; Mem. Acad. Dijon; p. 30.
 1823 *Aspidiotus nerii* BOUCHE; Schädli. Gart. Ins., p. 52.
 1903 *Aspidiotus hederæ* VALLOT; Fernald, Cata. Cocc. World, p. 260.

Scale of female: Subcircular, varying to ovate, often irregular flat or slightly convex; color very dull pale yellow often whitish in well-protected specimens; thin, somewhat transparent. Exuviae, yellow covered in newly molted adult female, but usually bare in older specimens. Diameter 1-2 mm.

Scale of male: Form variable, usually ovate; white; exuvia apparently central, usually naked and some shade of orange yellow.

Body of female: Nearly circular, with abdominal segments forming a pointed projection; light yellow in color. Rudimental antennae with a single curved hair. Mouth parts rather large; rostral loop long. Stigmata without parastigmatic gland orifices.

Pygidium of female: Three pairs of lobes well developed, the median the longest; the second pairs somewhat smaller, the third small and slender; the median notched on both inner and outer sides, the inner notch nearer to the apex; second lobes indistinctly notched on the outer sides, as are also the third, which are almost pointed at the top. No incisions or chitinous thickenings present. Plates prominent, branched; two between median lobes; two between median and second lobes; three between second and third lobes; four to six laterad of third lobes, all these both apically and laterally branched. Anal opening circular, distinct about three times its diameter from the apex

of the pygidium. Circumgenital gland orifices in four groups; anterior laterals 7-10; posterior laterals 5-10. Marginal gland orifices rather large, giving the margin a rather crenulated appearance and arranged as follows; one between median lobes; one between median and second lobes, two between second and third lobes, the inner one ento-caudad to the outer, two beyond the third lobes. Dorsal pores arranged in three or four indistinct rows.

Habitat: On an ornamental plant in a green house, Tokyo. Collected by Mr. Y. Ōuchi, February 1924. This scale insect was found on oranges and lemons from Europe and America, at quarantine work in Yokohama and other ports of the Empire.

***Aspidiotus jordani* KUWANA.**

(Plate III, Fig. a.)

- 1902 *Aspidiotus jordani* KUWANA; Pro. Cal. Acad. Sci., (3), iii, p. 69.
 1911 *Aspidiotus jordani* KUWANA; Nippon Kaig. Dusetu, Pt. i, p. 88.

Scale of female: Circular and flat; general color of the scale dingy brown, conforming usually to the color of the under side of the leaves to which it is attached. Exuviae central, covered with secretion; first exuvia pale straw; the second orange yellow. Diameter 1.5-2.5 mm.

Scale of male: Circular, flat, and the same color as that of the female; about 1 mm.

Body of female: Subcircular, brown in color. Mouth parts not heavily chitinized; rostral loop rather short. Antennae rudimentary, with a long hair.

Pygidium of female: Three pairs of lobes well developed; the median pair usually notched on the inner side, sloping on the outer side, and very minutely serratulate; the second pair smaller, and still smaller; the lateral side of the second and third pairs sloping, and very minutely serratulate. The margin of the ventral side deeply

incised between the lobes. The parts of the body wall forming the margin of these incisions are very much thickened. Plates distinct, not longer than the lobes, branched; two small ones between median lobes; two between median and second lobes; three between second and third lobes; five or six laterad of the third lobe. Spines as usual. Anal opening placed about the middle of the pygidium. Circumgenital gland orifices in four groups; anterior laterals 11-14; posterior laterals 7-9.

Habitat: on *Passania cuspidata* (shii). The scale is inconspicuous as it lines beneath the epidermis on the under side of the leaf.

Aspidiotus lataniae SIGNORET.

(Plate III, Fig. b.)

- 1869 *Aspidiotus lataniae* SIGNORET; Ann. Soc. Ent. Fr., 4, ix, p. 124.
 1881 *Aspidiotus cydoniae* COMSTOCK; Rep. U. S. Dep. Agr. (1880), 295.
 1911 *Aspidiotus cydoniae* COMSTOCK; Kuwana, Nippon Kaig. Datasets, Pt. i, p. 83.

Scale of female: Approximately circular, but somewhat irregular when clustered, strongly convex, rather dense, except the margins, which are semitransparent; central portion brown, the rest dirty white; exuviae central or subcentral, covered by a little secretion, pale brown. Diameter 1.5-2 mm.

Scale of male: Similar to that of the female in color, smaller and elongated.

Body of female: Oval, narrow behind; convex above; bright yellow. Rudimentary antennae with a long curved hair.

Pygidium of female: Median lobes only present, large, prominent, nearly as broad as long, notched on both margins; the inner notch much the smaller and nearer the apex. Two large interlobular incisions bounded by chitinous processes, the inner the larger, and one very small one, bounded by small chitinous processes, laterad of second incision. Usually a small chitinous process at inner base of

median lobes. Two simple plates between median lobes; two branched or incised plates caudad of first and second incision and one or more between them. Outside of the small third incision. The margin of the segment is produced to appear almost like two or three simple plates. On both dorsal and ventral surfaces, spines are located as follows: at outer base of median lobes, between first and second incision, just outside of second incision, and one about one-half the distance to the penultimate segment. Circumgenital gland orifices in four groups; anterior laterals 4-7; posterior laterals 3-4. Second and third rows of dorsal pores of 8-12 each, rather straight and distinct although interrupted. Anal opening large, rather remote from the margin.

Habitat: On palm, in a green house, Tokyo.

Aspidiotus makii KUWANA.

(Plate IV, Fig. c.)

- 1932 *Aspidiotus makii* KUWANA; Phil. J. Sci., 48, no. i, pp. 51-52.

Scale of female: Elongate oval, convex; white or dirty white. Exuviae subcentral, orange yellow; usually covered with a white waxy substance. Ventral scale very thin; when removed the insect leaves a white patch on the host. Length about 1.5 mm.; width about 1 mm.

Scale of male: Similar to that of the female, elongate, white, subtransparent. Exuvia a little to one side, orange yellow. Length about 1.3 mm., width 0.7 mm.

Body of female: Nearly circular, narrowing towards posterior end. Mouth parts large, well chitinized, rostral loop very long. Antennae rudimentary, conical, with a long spine. Spiracles rather large, with no parastigmatic gland orifice.

Pygidium of female: Rather large, margin round. One pair of lobes, prominent, broader than long to a greater or lesser extent

notched on each side; no indication of second and third lobes. Two distinct lateral incisions on each side of the margin, bounded by conspicuous thickenings, the inner the larger. Plates small, rather inconspicuous, two between the median lobes, which are much shorter than the lobes and fimbriated at the extremity; four or five along the margin, laterad of the median lobe, they are rather long and usually laterally fimbriated. Spines strongly developed, as shown in the figure. Paragenital gland orifice wanting. Dorsal gland orifices fewer, slender, more or less regularly arranged in three series. Transverse basal thickening fairly developed, laterals separated from the central line and robust. Apical ventral chitinization weakly developed. Anal opening large and nearer to the margin than the base of the pygidium.

Habitat: On *Pinus luchuensis* (ryukiu matsu). Found by Mr. Yoshitada Maki, of the Kagoshima Sugar Experiment Station, in Wada-mura, Amamiōshima, December 27, 1930.

This new scale insect is allied to *Aspidiotus uvae* Comstock and *A. ulmi* Johnson in the pygidial structures in general, but differs from them in the shape of median lobes, and is readily distinguishable from these two species. The species is named for Mr. Maki, the collector of the type specimens.

Aspidiotus mithcanthii KUWANA.

(Plate V, Fig. a.)

1931 *Aspidiotus mithcanthii* KUWANA; Dobutsugaku Zasshi Vol. xliii, Nos. 508-510, p. 169.

Scale of female: Nearly circular, more or less convex; grayish dark in color. Exuviae subcentral, first exuvia yellow, the second covered with white secretion. Ventral scale very thin and white. Diameter about 1.5 mm.

Scale of male: Similar to that of the female, but much smaller

and more or less elongate; exuvia central. Length about 1.2 mm., width 0.4 mm.

Body of female: Mounted on slide, subcircular; mouth parts rather large; rostral loop long. Antennae reduced to a minute tubercle bearing a long, curved bristle and a short spine. No parastigmatic gland orifices. Length 1.2 mm., breadth 1.05 mm.

Pygidium of female: Rather small, triangular in outline. The median pair of lobes much the largest, nearly parallel and of the shape of incisor teeth; second pair of lobes much smaller, conical; the third pair reduced to a small triangular projection or obsolete, plates well developed, deeply fringed, slightly exceeding the lobes in length, and are situated as follows: two between median lobes, two between the median and second, two to four between the second and third. Spines are rather large and placed as shown in the figure. Anal opening rather large and placed near the margin of the pygidium. Circumgenital gland orifices wanting.

Habitat: On the leaves of *Miscanthus* sp.; collected by Mr. Y. Maki, Amamiōshima, November 2, 1930.

Aspidiotus perniciosus COMSTOCK.

(Plate IV, Fig. a.)

1881 *Aspidiotus perniciosus* COMSTOCK; Rep. U. S. Dep. Agr., (1880), p. 304.

1896 *Aspidiotus albopunctatus* COCKERELL; Psyche, vii, Suppl., i, p. 20.

1897 *Aspidiotus (Diaspidiotus) andromelas* COCKERELL; Bull. 6, T. S., Dep. Agr., pp. 14, 20.

1911 *Aspidiotus perniciosus* COMSTOCK; Kuwana, Nippon Kaig. Datasets, i, p. 72.

Scale of female: Circular and flat, with the exuviae central or nearly so. Gray in color, excepting the central part, that which covers the exuviae, which varies from a pale yellow to a reddish yellow; sometimes the central part is black, resembling the scale of the

male, and in some specimens the outer part of the scale is marked by radiating ridges. Diameter 2 mm.

Scale of male: Black, and elongated when fully formed. The larval skin is covered with secretion; its position is marked by a nipple like prominence, which is between the center and the anterior margin of the scale.

Body of female: Yellowish in color, and almost circular in outline.

Pygidium of female: Only two pairs of lobes visible; first pair converge at the tip, notched about midway the length of the lateral margin, and often bearing a slight notch on the mesal margin near the tip; the second pair notched on the lateral margin. Margin of the ventral surface of the segment is deeply incised twice on each side of the meson; once between the bases of the first and second lobes, and again laterad of the second lobe. On each side of each of these incisions is a club-shaped thickening of the body wall. Two inconspicuous simple plates between the median lobes, and on each side two similar plates extending caudad of the first incision, three small plates serrate on their lateral margins caudad of the second incision, and the club shaped thickening of the body wall bounding it, and three wide prolongations of the margin between the third and fourth spines. These prolongations are usually fringed on their distal margins. There are also, in some, irregular prolongations of the margin between the fourth spines and the penultimate segment. The first and second spines are situated laterad of the first and second lobes, respectively; the third laterad of the second incision; and the fourth spine about half the distance from the first lobe to the penultimate segment. Circumgenital gland orifices wanting.

Habitat: Found on pear, apple and other fruit and ornamental trees in Japan, and often causing a great damage to the trees.

Aspidiotus pseudomeyeri KUWANA.

(Plate IV, Fig. b.)

1932. *Aspidiotus pseudomeyeri* KUWANA; Phil. Jl. Sci., 48. no. i, pp. 52-53.

Scale and body of female: Scale of females elongate oval or irregularly circular, convex. Dull greenish yellow; older specimens dirty pale yellow with posterior margin brown. Body round, pale yellowish in color. Mouth parts large, rostral loop short. Spiracles with no parastigmatic gland orifice. Antennae conical with a spine.

Pygidium of female: Broadly round, not heavily chitinized. Two pairs of lobes prominent, well chitinized; median pair largest, apices round with no notch on either side; second pair much smaller but the same general shape as the median; third pair is present, conical, often very small and obscure. Incisions moderate, very distinct. Paraphysis practically wanting. Plates broad, branched, extending but slightly beyond the lobes, two between the median lobes, two between the median and second lobes, and the three between the second and third lobes. Spines as usual, as shown in the figure. Anal opening large, circular, placed nearer to the margin than the base of the pygidium. Dorsal pores rather large, not regularly arranged. Paragenital gland orifices in four groups, each group with few pores as shown in the following examples:

4 - 4	4 - 3	3 - 2
2 - 2	2 - 2	2 - 1

Basal thickenings represented by two median transverse rods and the widely separated oblique lateral thickenings; ventral thickenings normal, but slightly chitinized.

Habitat: On *Juniperus chinensis* (ibuki or biyakushin). Collected by Mr. T. Maeda, in Yokohama, March 25, 1930. Previously collected by the writer in the same place.

This new scale insect is very closely allied to *Aspidiotus meyeri*

Marlatt, but diverges from the latter in the following structural features:

<i>A. meyeri</i>	<i>A. pseudomeyeri</i>
With a distinct notch on either side of the median and second lobes.	None.
With four or five branched plates following the third lobe.	None.

Aspidiotus transparens GREEN.

(Plate V, Fig. c.)

1896 *Aspidiotus transparens* GREEN; Ind. Mus. Notes, iv, p. 4.

1900 *Aspidiotus transparens* GREEN; Bomb. N. H. Soc., xiii, p. 69.

Scale of female: More or less circular to somewhat elongate; dense white, occasionally slightly transparent, so that the deep orange female may be indicated below. Scale usually with distinct radial striae. Occasionally the female scales are faintly tinged with yellow, but as a rule they are pure white with orange yellow exuviae. Diameter about 1.5 mm.

Body of female: Elongate, bright orange yellow, with pygidial margin somewhat darker. Antennae with a long hair.

Pygidium of female: Long, roundly tapering. Three pairs of lobes well developed; median pair dense, deeply colored, notched on both margins; second and third lobes smaller, delicate, notched on outer margins. Plate prominent, much longer than the lobes, branched; two between median lobes; two between median and second lobes; three between second and third lobes; seven or more laterad of the third lobe. Anal opening placed nearer the margin of the pygidium. Spines as usual. Circumgenital gland orifices in four groups; anterior laterals 5-12; posterior laterals 6-18.

Adult female similar to *A. destructor*, but readily distinguished by the following characters:

A. destructor

Lobe one shorter than lobe two and appearing slightly recessed, narrow, with the inner margin somewhat concave, outer margin notched near apex.

A. transparens

Lobe one larger and broader than lobe two, not appearing recessed, deeply colored, with thickened chitin extending into pygidium, notched on inner as well as outer margin.

Habitat: On banana and other plants in green houses, Japan.

Aspidiotus tsugae MARLATT.

(Plate, V, Fig. b.)

1911 *Aspidiotus (Diaspidiotus) tsugae* MARLATT; Ent. News, xxii, pp. 385-387.

Scale of female: Circular, convex, dark brown, rather pointed or nipped at center; central area usually covered by secretion, when rubbed a light resinous yellow. Diameter 1-3 mm.

Scale of male: Much smaller than that of the female, oval in form, grayish in color, exuvia central.

Body of female: Oval in shape, pale yellow in color.

Pygidium of female: Broadly triangular. Two pairs of short and rounded lobes, beyond the second lateral incision a prominent serrated projection having three or more distinct minute teeth; edge of pygidium beyond this projection unbroken; incision median and lateral scarcely below the general level of the edge of the pygidium; thickening of body wall very prominent and robust, pear-shaped, two prominent ones at the base of each lobe, most of them fully lobe length, and another below the second lateral incision; also a few small thickenings in the lobular area. Plate broad, branched, equaling the lobes in length; two median, two in first lateral incision and three in second lateral incision. Spines short, inconspicuous.

Anal opening large, oval, nearer the apex than the base of the pygidium. Dorsal pores large, narrow. Circumgenital gland orifices in five groups; anterior 2-5, anterior laterals 5-9, posterior laterals 4-8.

Habitat: On *Tsuga sieboldi* (tsuga), and *Abies firma* (momi). Common in Japan.

N. B.—The following species, although known from Japan, are not generally recognized here now;

Aspidiotus corticis-pini Lindg., *A. perscarum* Ckll., *A. ulmi* John.

Genus *Pseudaonidia* COCKERELL.

U. S. D. A. Bur. Ent., Bull. T. S. 6, p. 14, 1897.

This genus includes species of Diaspinae in which the scale of the adult female is circular or subcircular, moderately convex, dark blackish brown; exuviae nearly central, orange in color. Pygidium of the adult female with large median lobes, and three other pairs of lobes; plates branched and scale like. Circumgenital gland orifices numerous, grouped in two or four groups. On the dorsal surface with a lattice work pattern.

The scale of the male resembles that of the female, but smaller and more elongate.

Type *P. duplex* (COCKERELL).

Three species belonging to the genus are found in Japan, which may be differentiated with the following key:

Key to species.

- A. Median lobes large, strongly chitinized; second, third, and sometimes fourth lateral lobes slender, and elongate, hyaline.
- B. Median lobes projecting beyond laterals, lateral lobes very slender, less than one fourth the width of median lobes. *duplex*.

- BB. Median lobes not projecting and usually distinctly lower than laterals, lateral lobes about one half width of median lobes. *trilobitiformis*.
- AA. Median and lateral lobes of the same general character, laterals merely decreasing in size. *paconiac*.

Pseudaonidia duplex COCKERELL.

(Plate VI, Figs. a-d.)

1896 *Aspidiotus duplex* COCKERELL; Psyche, vii, Suppl., i, p. 20.

1896 *Aspidiotus (Pseudaonidia) duplex* COCKERELL; Bull. 6, T. S., Dep. Agr., p. 52.

1911 *Aspidiotus duplex* COCKERELL; Kuwana, Nippon Kaig. Datasets, i, p. 68.

Scale of female: Circular or subcircular in form, thick, moderately convex; dark brown in color, with the large round exuviae nearly to one side and orange in color. When removed the scale leaves a white patch on the host plant. Diameter 2-3 mm.

Scale of male: Similar to the scale of female in texture and color but much smaller and elongate; exuvia nearly central. Length about 1 mm.

Body of female: Pale in color, with the pygidium yellowish brown, turning to pale purple, before laying eggs; broadly oval or subcircular with the large cephalic portion separated from the rest of the body by a deep suture; dorsal skin strongly, transversely grooved. Mouth parts large, well chitinized; rostral loop rather long. Rudimental antennae with a long, curved hair. Anterior pair of spiracles with a group of stigmatic gland orifices, the number of orifices in a group are 17 to 22.

Pygidium of female: Large and broadly rounded. Four pairs of well developed lobes; median lobes very large, parallel sided, and rounded at the apex with a notch on each side so as to be trilobed; second lobes very narrow and only about one fourth the width of

the median lobe, inconspicuously notched on either side near the apex; the other two pairs of lobes are similar to the second, but somewhat shorter; the median lobes are rather close together. Plates well developed but rather delicate, usually forked and not projecting beyond the apex of the lobes; two between median lobes, two between median and second lobes, three or four between second and third lobes, and four between third and fourth lobes; margin beyond the fourth lobe distinctly serrated with no plates. Dorsal surface with a very distinct lattice work. Dorsal pores rather fewer, but large and oval in form, more or less distinctly arranged as shown in the figure. Anal opening much nearer to the apex of the pygidial margin than the base. Micropores and ventral thickenings as shown in the figure. Spines well developed and rather large. Circumgenital gland orifices in four groups; the anterior laterals 28-30, and the posterior laterals 40-41.

Male: Pale purple in color with dark purple eyes; legs and antennae paler; wings pale hyaline. Body stout with the abdomen in spindle shaped; style rather long. Antennae 10 jointed, thickly set with long hairs. Legs ordinary; tibiae and tarsi with long hairs; digitules and claw ordinary. Length of body about 1 mm., style 0.3 mm.

Egg: Broadly oval, pale purple in color. Length about 0.2 mm.

Newly hatched larva: Broadly oval, flat; pale purple with abdominal margin yellowish in color; eyes purple. Antennae and legs pale. Legs well developed. Caudal end with two long hairs. Length of body about 0.25 mm.

Male pupa: Elongate in form; pale purple in general color with dark purple eyes; antennae, legs, and style pale. Antennae long, and reaching to about the middle part of the wing pads; style short with round extremity. Length of body about 1 mm.

Life history and habit: One generation per year, passes the winter in the adult female stage. The female begins laying eggs in

the early part of May, and larvae hatch in the latter part of June. The adult male appears about the middle part of August, copulates with female and soon dies.

Habitat: This species is one of the commonest scale insect in Japan. The writer has collected it on *Cinnamomum camphora** (kusu), *Citrus* spp. (kankitsu), *Eurya ochracea* (sakaki), *Myrica rubra* (yamamomo), *Osmanthus fragrans* (mokusei), *Rhododendron* spp. (tsutsuji and satsuki), *Rhus succedanea* (hazenoki), *Thea chinensis* (cha), *Thea japonica* (tsubaki), *Thea sasanqua* (sazanka), and many other woody plants.

This scale insect was originally described by Professor T. D. A. Cockerell in 1896, from material obtained by the late Alex. Craw, plant inspector of San Francisco, who collected it on plants from Japan, at his quarantine work. Beside Japan, it is known in the Hawaiian Islands, California, Louisiana, and Washington, D. C.

Pseudaonidia paeoniae COCKERELL.

(Plate VI, Figs. e-h.)

- 1899 *Aspidiotus duplex* var. *paeoniae* COCKERELL; Can. Ent., xxxi, p. 105.
 1902 *Pseudaonidia paeoniae* (COCKERELL); in litt.
 1911 *Aspidiotus paeoniae* COCKERELL; Kuwana, Nippon Kaig. Datasets, i, p. 70.

Scale of female: Similar to that of *Pseudaonidia duplex* in form and color in general, but usually grayish brown. The scale is often covered by the thin epidermal layer of the host.

Scale of male: Similar to that of the female, small and oval in outline.

**Cinnamomum camphora* as the host of this coccid has become known to the writer only recently and he has obtained the scale on branches of this host in the Atsuta jingu grounds of Nagoya city and other Southern parts of the Empire, in the summer of 1924.

Pygidium of female: Broadly round with heavily chitinized lobes. Four pairs of lobes of the same general character, laterals merely decreasing in size; the medians are largest, distinctly notched on both sides, apex round with a distinct notch on either side; second and third lobes subequal in size, with a notch on either side; fourth lobes are somewhat smaller than the third, with a notch on either side which are not very prominent. Plates are simple and shorter than the lobes; two between median lobes; one between median and second lobes; two or three between second and third lobes, two between third and fourth lobes; no plate beyond the last lobe. - Spines prominent, rather long. Dorsal surface with distinct lattice work. Arrangement of dorsal pores as in *P. duplex*, but more numerous and somewhat smaller. Ventral thickenings as shown in the figure. Circumgenital gland orifices in two groups; each contains 75 to 80.

Habitat: As with one previous species, this species of scale is common in Japan, attacking *Thea sinensis*, *Thea japonica* and other woody plants.

It was described by Professor Cockerell in 1899, at the first time, and beside Japan, it is known from California.

Pseudaonidia trilobitiformis (GREEN).

(Plate VII, Figs. a-c.)

1896 *Aspidiotus trilobitiformis* GREEN; Indian Mus. Notes, iv, p. 4.

1896 *Aspidiotus trilobitiformis* GREEN; Cocc. Ceylon, pt. i, p. 31.

1911 *Aspidiotus trilobitiformis* GREEN; Kuwana, Nippon Kaig. Datasets, i, p. 67.

Scale of female: Almost flat or slightly convex; usually semicircular or deltoid from arrest of growth by prominent veins of the leaf, seldom circular. Pale reddish brown in color. Exuviae subcentral; first exuvia yellowish; the second reddish yellow, somewhat depressed. Diameter 3-4.5 mm.

Scale of male: Similar to that of the female, but much smaller

and elongate; exuvia central, pale yellow. Length about 1 mm.

Body of female: Yellowish brown, semitransparent; surface hard and horny, polished, with numerous delicate transverse striated lines. Form oblong, rounded in front, tapering to a point behind; dorsal surface flattened; ventral surface slightly tumid; segmentation distinct; a deep transverse groove on the dorsal surface between the prothoracic and mesothoracic segments; a large depressed space on each side of rostrum, covered with waxy secretion, marking the position of the parastigmatic gland orifices of which there is a group consisting of from 12-20 orifices in front of each of the anterior stigma. Mouth parts rather large, well chitinized; rostral loop long. Conical antennae with a long, curved hair.

Pygidium of female: Triangular in outline, rather small. Four pairs of prominent obscurely tricuspid lobes; median pair stoutest, but scarcely as long as second, or rather shorter than the second; others rather slender. Plates shorter than lobes, deeply fringed; two between median lobes, two between median and second lobes, three between second and third lobes, and three between third and fourth lobes. Lateral margin of pygidium beyond fourth lobe irregularly serratulate with two deep notches. On the dorsal surface is an extensive reticulated tract completely occupying the median area of the pygidium between the base and the anal opening, the boundaries well defined and constant, the spaces of irregular size and shape, crowded together, and forming a pattern not unlike that of crocodile leather. Circumgenital gland orifices in four groups; orifices numerous, anterior laterals 21-25, posterior laterals 16-27. Dorsal pores large and conspicuous, arranged in definite linear series as shown in the figure. Similar pores on the margin of free abdominal segments. Anal opening much nearer to the margin than the base of pygidium.

Habitat: This species has been taken in green houses in Tokyo and Osaka by the writer and his assistants on *Ficus wightiana* var. *japonica* (akou) and "mimitsubai".

Genus *Chrysomphalus* ASHMEAD.

Am. Ent., iii, p. 268, 1880.

This genus includes species of Diaspinae in which the scale of the female is similar to that of *Aspidiotus*, usually darker, or more compact, circular, with central exuviae. Scale of the male similar to *Aspidiotus*. Body of the adult female similar to *Aspidiotus*, but pygidium retracted into the body and not projecting as in *Chrysomphalus aurantii*, color orange or yellow. Pygidium similar to *Aspidiotus* except that the paraphysis running anteriorly from the margin of the pygidium are much more elongate and more slender; with at last three pairs of lobes. Circumgenital gland orifices present or absent.

Type: *C. ficus* Ashm.

There are five species belonging to this genus found in Japan, which may be differentiated by use of the following key:

Key to species.

- A. Circumgenital gland orifices wanting. *aurantii*.
- AA. Circumgenital gland orifices present.
 - B. Two outer rows of dorsal pores numerous and each arranged in a double row. *aonidum*.
 - BB. Two outer rows of dorsal pores few in number and each arranged in a single row.
 - C. A pair of very long and conspicuous marginal plates beyond the third lobes. *dictyospermi*.
 - CC. Without a conspicuous pair of long plates beyond the third lobes.
 - D. Scale of female deep, dull brown, almost black, nipple yellowish. *rossi*.
 - DD. Scale of female deep, dull brown, almost black, nipple shiny black. *setiger*.

Chrysomphalus aonidum (LINNAEUS.)

(Plate VIII, Figs. a,b.)

- 1758 *Coccus aonidum* LINNAEUS; Syst. Nat., Ed. x, i, p. 455.
- 1880 *Chrysomphalus ficus* ASHMEAD; Am. Ent., iii, p. 267.
- 1881 *Aspidiotus ficus* COMSTOCK; Rep. U. S. D. A. 1880, p. 267.
- 1899 *Chrysomphalus aonidum* LINN.; Cockerell, Biol. Centr. Amer., ii, pt. 2, p. 25.
- 1911 *Aspidiotus ficus* ASHMEAD; Kawana, Nippon Kaig. Datasets, pt. i, p. 93.

Scale of female: Circular, moderately convex; smooth. Dark olivaceous brown, or reddish brown, paler towards the margin. Exuviae central, reddish yellow, always partially obscured by a layer of secretion, which is reddish brown above the first, and pale olivaceous above the second exuvia. The center of the circular raised disk is usually exposed, the secretory covering being here worn out. In the young specimens the center is covered by a raised patch of opaque white secretion. The first exuvia convex above; the second often slightly convex; the form may last be observed inside of the scale, when the exuviae are more fully exposed. Ventral scale hardly evident. Diameter 1-2 mm.

Scale of male: Scale of the male is similar and has a long posterior flap, light gray in color; otherwise it is like that of the female. Length 0.8 mm.

Body of female: Broadly rounded in front, tapering suddenly to a point behind. Yellow, or white mottled with yellow. On the margin of the mesothorax is a small thickened patch bearing a stout thorn like spine. Mouth parts well chitinized, rostral loop rather long. Antennae with a stout hair.

Pygidium of female: Medium in size, strongly projecting. Three pairs of lobes well developed; the median largest, strongly projecting from the pygidial margin, widely separated, inner margin sometimes faintly notched, converging, then rounded into each apex, outer margins

deeply notched about the middle; second lobes closely resembling the median in shape, slightly smaller and not so prominent; third lobes similar to others, smaller, less prominent, not distinctly notched on outer margin. With long and slender chitinous thickenings or paraphyses extending cephalad from the inner and outer margin of each median lobe, one extending cephalad from the inner margin of the second lobe, another from a point beyond the outer margin of the second lobe, the middle three the largest. Branched plates present as follows: two between the median lobes, two between the median and second lobes, three between second and third lobes, all these deeply and conspicuously fringed on the apical margin and a little longer than the lobes; outside of the third lobes, three large compound branched plates, the last the most conspicuously branched; rest of margin more or less conspicuously serrate. Anal opening about three times its own diameter from the median lobes, oval. Circumgenital gland orifices in four groups; anterior laterals 3-8; posterior laterals 2-5. Dorsal pores in three rows, the first usually three in number, between the chitinous thickening of the outer margin of the median lobes and the inner margin of the second lobes; the second group composed of a double row extending cephalad from between the next pair of thickenings and consisting of 13-25; the third row of about 20 or less, running cephalad from the three compound plates laterad of the third lobe. With transverse thickening on each side cephalad of the circumgenital gland orifices and near the base of the pygidium. Micropores so far as observed shown in the figure.

Habitat: Common in Japan. Found on *Citrus* spp. (kankitsu), *Euonymus japonica* (masaki), *Ficus elastica* (indogomu), *Ficus foecolata* (itabikazura), *Ficus retusa* (gazyumaru), *Osmanthus fragrans* (mokusei), palm and other plants.

Chrysomphalus aurantii (MASKELL).

(Plate VII, Figs. d-g)

1878 *Aspidiotus aurantii* MASKELL; N. Z. Trans., xi, p. 199.

1911 *Aspidiotus aurantii* MASKELL; Kuwana, Nippon Kaig. Datasets, pt. i, p. 89.

Scale of female: Circular, margins broadly flat, median area low convex; pale yellowish gray, or pale ochreous in color; semi-transparent; revealing the form and color of the insect beneath it. Exuviae central; dull orange yellow; first secretory covering nipple shaped, its color varying from white to pale ochreous; the second, flat and pyriform, varying from pale ochreous to orange brown. Ventral scale thin at the center, but stout towards the margin; it is firmly attached to the dorsal scale. Diameter 1-2 mm.

Scale of male: Oblong, somewhat narrowed at the caudal extremity. Exuvia subcentral. Color and structure as that of the female. Diameter 0.5-1 mm.

Body of female: Adult female at period of gestation subcircular; pygidium partly contracted within the body; the abdominal segments forming two convergent lobes. At this stage the body becomes chitinized and retains its form. Pale dull orange in color. The early adult is broadly pyriform, with the pygidium produced. Mouth parts rather small, placed near the central of the body; rostral loop not very long. Antennae with a short hair.

Pygidium of female: Small, parabolic in form; the whole pygidium sunk into a depression in the caudal end of the almost circular body of the female. Three pairs of well-developed lobes; the median notched on both inner and outer margins, the mesal notch near the apex; second and third pairs smaller and less prominent, notched and sometimes crenulate on outer margin, sometimes also notched on inner margin. Chitinous thickenings or paraphyses slender, not clubshaped, not very long, a small one

running cephalad from the inner margin of each median lobe, a long pair, one from the outer margin of the median lobe, the other from the inner margin of the second lobe, a very small one from the outer margin of the second lobes and another pair the outer one smaller, from the inner and outer margins of the third lobes; with strongly branched plates as follows: two between the median lobes, two between the median and second lobes, three between second and third lobes, all about as prominent as the lobes, three large strongly branched compound plates laterad of the third lobe. Anal opening nearly circular, about five times its diameter from the median lobe. Circumgenital gland orifices absent. Dorsal gland orifices arranged in three double rows, the first cephalad from between the median and second lobe, composed of about 5; the second from between the second and third lobe, of about 15; the third from just outside of the third lobe, of about 15; some outside of the third row. Micropores as far as observed indicated in the figure.

Habitat: On palm collected by the writer, in a green house of the Park of Osaka city, in April 1924.

***Chrysomphalus aurantii* var. *citrinus* (COQUILLET).**

1891 *Aspidiotus citrinus* COQUILLET; Bull. 23, D. E. D. A., p. 29.

1894 *Aspidiotus aurantii* var. *citrinus* COQ.; Howard, Ins. Life, vi, p. 228.

1911 *Aspidiotus aurantii* COQ.; Kuwana, Nippon Kaig. Datasets pt. i, p. 92.

This variety differs but slightly from *Chrysomphalus aurantii*, but in its habits and color there is a very marked difference. The female scale is circular, with the exuviae slightly to one side; the scale is not as convex; the margins are wider and light gray. The body is pale yellow; the ventral scale is light colored and remains attached to the upper one, making it difficult to remove the insect from the scale.

A curious fact about this insect is that it seldom attacks the

wood, even when the foliage and fruit are covered with them. On this account one can readily determine between it and *aurantii*, as the latter infests the young shoots and even the larger branches.

Habitat: On *Citrus* spp. and many other plants. Common in Japan, especially southwards from Tokyo.

N. B. The writer is now under taking a comparative study of this variety and *C. aurantii*, and the result will be reported on another occasion.

***Chrysomphalus dictyospermi* (MORGAN).**

(Plate IX, Fig. b.)

1889 *Aspidiotus dictyospermi* MORGAN; Ent. Mon. Mag., xxv, p. 352.

1899 *Chrysomphalus dictyospermi* LEONARDI; Riv. Pat. Veg., vii, p. 218.

Scale of female: Flat, thin; very light brown or grayish in color. Exuviae central, nipple like; covered by a secretion, nearly the same color as the rest of the scale. Ventral scale thin, whitish, not well developed. Diameter about 1.5 mm.

Scale of male: Similar to that of the female, but more elongated and smaller.

Body of female: Circular to pyriform in shape; pale yellow in color; not heavily chitinized. Mouth parts rather small. Antennae with a fine hair.

Pygidium of female: Small, strongly projecting. Three pairs of lobes well developed; the outer margins of each distinctly and deeply notched. With long, club shaped chitinized thickenings or paraphyses running cephalad from the posterior margin of the pygidium as follows: one from both the inner and outer margin of each median lobes, one large one from the inner margin of the second lobe, one from laterad of the outer margin of the second lobe, and one from the inner margin of the third lobe, the largest of these being the second and third as located above. With fairly strongly

branched plates, somewhat less prominent than the lobes, as follows: two between the median lobes, one between the first and second lobes, typically three, sometimes two between the second and third lobes and three, basally broad, apically slender plates, with serrate margins, laterad of the third lobe. Anal opening distant about three times its diameter from the median lobes. Circumgenital gland orifices in four groups; the anterior laterals 3-4, posterior laterals 2-3. Dorsal pores in three rows, the first between the median and second lobes, of 2; second between the second and third lobes, of 4-7; third outside of the lobes, of 4-6.

Habitat: This species has been recorded in Japan, on "serojine" and "denshin-so" in a green house, collected by Mr. Y. Ouchi, February 1924. It was also found by the writer on palm in a green house, Osaka city, February 13, 1924.

Chrysomphalus rossi (MASKELL).

(Plate VIII, Figs. c-d.)

1891 *Aspidiotus rossi* MASKELL; N. Z. Trans., xxiv, p. II.

Scale of female: Circular, or irregularly oblong, flattish, opaque, reddish brown to dark brown; inner surface darker, almost black. Exuviae blackish, frequently obscured by a layer of brownish secretion, with central boss and concentric ring; sometimes depressed, sometimes slightly elevated. Ventral scale obsolete. Diameter 2-3 mm.

Scale of male: Similar to that of the female, but smaller.

Body of female: Broadly pyriform, terminal segment tapering suddenly to a point; median area tumescent, margin flattened. Color of living insect at first milky white or ochreous, tinged with purplish. Stigmata conspicuous, with no parastigmatic gland orifices.

Pygidium of female: With six prominent, obscurely tricuspid

lobes, all well developed and subequal in size; margin beyond the lobes, with seven projecting tooth like processes, forming a bold and regular serration; margin between the lobes, squarely but not deeply incised. Plates deeply fringed, two between the median lobes, two between first and second, three between second and third, and one or two in the space between the third lobes and the first marginal prominence. Circumgenital gland orifices usually in four groups; anterior laterals 4-12 orifices, posterior laterals with 6-9. Dorsal pores small and rather inconspicuous, arranged in definite linear series running upwards from the margin. Anal opening slightly caudad of the lower spinneret groups.

Habitat: On palm in a green house, Yokohama. This scale insect was originally described by the late Maskell, and besides Japan it is known from Australia, New Zealand, Phillipine Islands, South Africa, Ceylon, California, and China.

Chrysomphalus setiger (MASKELL).

(Plate IX, Fig. a.)

1897 *Aspidiotus setiger* MASKELL; N. Z. Trans., xxix, p. 298.

1902 *Aspidiotus (Chrysomphalus) kelloggi* KUWANA; Cal. Acad. Sci., 3, iii, p. 71.

1911 *Aspidiotus rossi* (Not MASKELL); Kuwana, Nippon Kaig. Datasets, pt. i, p. 96.

Scale of female: Very dark brown in color; circular; convex; thick and solid in texture. Exuviae subcentral; first exuvia small, shiny black; second exuvia covered by secretion. Diameter about 2 mm.

Scale of male: Light brown, subelliptical, flatish, exuvia yellow. Length about 1 mm.

Body of female: Subcircular, narrowing posteriorly. Antennae with a single hair. Mouth parts rather large; rostral loop long.

Stigmata conspicuous, without parastigmatic gland orifices.

Pygidium of female: Rather large, margin round. Three pairs of lobes well developed; median lobes largest, outer margins sloping and minutely serrulate; second and third pairs of lobes are similar, but smaller; laterad of the lobes with number of projecting tooth like processes, forming a bold and regular serration. Plates branched, less prominent than the lobes; two between median lobes, two between median and second lobes; three between second and third lobes; one beyond the third lobe. Long, club shaped chitinized thickenings or paraphyses running cephalad from the posterior margin of the pygidium as follows; one from both the inner and outer margin of each median lobes, the outer one much longer; one from both the inner and outer margin of each second lobe, the outer one much larger; one from both the inner and outer margin of the third lobe, which are small and short. Spines small and rather inconspicuous. Circumgenital gland orifices in four groups; anterior laterals 9-16; posterior laterals 10-14. Dorsal pores arranged in three rows, the arrangement of each row as shown in the figure. Anal opening large, placed about the middle of the pygidium.

Habitat: on *Quercus myrsinaefolia* (shiragashi), *Pasania sieboldii* (shii) and other plants. Collected by the writer and others in Kiushu and Honshu of the Japanese Empire.

The writer's *Aspidotus rossi* in his Nippon Kaig. Dusetu, part 1, p. 96, 1911, is this species instead.

Genus *Odonaspis* LEONARDI.

Riv. Veg., v, p. 284, 1897.

Species included in this genus have the scale of the adult female circular or subcircular in outline with the exuviae placed to one side of the center. The scale of the male is more elongate and convex, exuvia at anterior extremity. Body of female is broad-

ly oval, rather flat, with integument of caudal end strongly chitinized. Pygidium broad and triangular, terminating in a large and apparently single, fairly prominent median lobe; other lobes more or less indistinctly formed, merely indicated by lesser or slighter prominences; no plates whatsoever but a few marginal spines present. Circumgenital gland orifices present, also distinct paraphyses, and the pygidial area dotted with small pores.

Type *O. secreta* (Cockerell).

Two species belonging to this genus are found in Japan, which may be differentiated with the following key:

Key to species.

- A. Extremity of median lobe peaked. *secreta*.
- AA. Extremity of median lobe flatly round. *oshimaensis*.

Odonaspis oshimaensis KUWANA sp. nov.

(Plate X, Fig. a-c.)

1931 *Odonaspis secreta* COCKERELL; *Dobutsugaku Zasshi*, vol. ijiii, p. 166.

This new insect is closely allied to *O. secreta* Cockerell, but differs in the following characters:

The pygidium of the adult female with continuation of two large groups of circumgenital gland orifices in two rows of orifices to form a horseshoe shape, instead of a single row as in the case of *O. secreta*.

The extremity of the median lobe broadly round instead of bluntly pointed. The group of stigmatic gland orifices of the anterior spiracle very numerous, consisting of about thirty six, while in the case of *O. secreta* about ten.

Habitat: On "kankaya" and *Panicum sanguinale* (mehishiba). Collected by the writer in Amami-oshima, June 1931.



Odonaspis secreta (COCKERELL).

(Plate x, Figs. d-f.)

1896 *Aspidiotus secreta* COCKERELL; Psyche, vii, Suppl., i, p. 20.1898 *Aspidiotus secreta* var. *lobulatus* MASKELL; Ent. Mon. Mag., xxxiii, p. 241.1911 *Aspidiotus secreta* COCKERELL; Kuw., Nippon Kaig. Datasetsu, i, p. 65.

Scale of female: Usually concealed between the layers of the dry sheathing petioles of species of bamboo. When the sheath is removed from the stem, the insects are detached with it, this position indicated by small blister like swellings upon its inner surface, this view necessarily presenting the ventral surface of the scale. Exuviae yellow, usually the second exuvia only is present, the first becoming detached or the exuviae are more or less separated. Diameter 1.5-2.5 mm.

Scale of male: Oblong, strongly convex; white in color. Exuvia yellowish, shiny, close to anterior extremity. Length 1 mm.

Body of female: Pale yellow with dark brown abdominal extremity. Integument rather hard with distinct segmentation. Mouth parts well chitinized; rostral loop very long. Rudimental antennae with a strong hair. A small group of parastigmatic gland orifices around the opening of the anterior spiracles.

Pygidium of female: Broad and triangular, terminating in a large and single prominent median lobe, indented on each side; other lobes obsolete or represented only by marginal points. Margin irregularly serrulate. With four deep indentations on each side from which thickening of the body wall or paraphyses extends upwards. Plates wanting. A small spine on each side of median lobe, and one or two laterad of each marginal indentation. Circumgenital gland orifices in two groups which are often almost connected above by a line of single orifices; each group with eighty to ninety orifices.

Dorsal surface with numerous minute pores. Anal opening small, and placed at some distance from extremity.

Habitat: Beneath the sheathing petioles and bracts of *Arundinaria* (*Pseudosasa*) *japonica* (yadake), and other species of bamboo. Common in Japan.

Besides Japan, this scale insect is known from Ceylon, and Hawaiian Islands, on bamboo.

Genus Anoplaspis LEONARDI.

Riv. Pat. Veg. viii, p. 344, 1900.

Scale of the adult female is rather elongate, very convex; firm in texture and dark to dark brown in color; exuviae orange in color, placed at one side. Ventral scale well formed, brown in color. Scale of the male similar to that of the female, but smaller; exuvia subcentral. Pygidium of the adult female with no lobe or plate; circumgenital gland orifices wanting or present.

Type *A. bambusarum* (Cockerell).

Two species belonging to this genus are found in Japan, which may be differentiated with following key:

Key to species.

- A. Pygidium of the adult female with circumgenital gland orifices. *bambusarum*.
- AA. Pygidium of the adult female without circumgenital gland orifices. *penicillata*.

Anoplaspis bambusarum (COCKERELL).

(Plate XI, Figs. b-e)

1898 *Aspidiotus* (*Odonaspis*) *bambusarum* COCKERELL; Psyche, viii, p. 191.1900 *Anoplaspis bambusarum* LEONARDI; Gen. Spec. Dispiti, Asp., p. 228.1911 *Aspidiotus bambusarum* CKII.; Kuw., Nippon Kaig. Datasetsu, pt. i, p. 98.

Scale of female: Subcircular, very horny, strongly convex; dark sepia brown, almost black. Exuviae between the center and the side; first exuvia exposed, light orange; the second large, brown, covered. Ventral scale dark, well formed. Diameter about 2 mm.

Scale of male: Similar to that of the female, but much smaller.

Body of female: Oblong oval in outline, narrowing posteriorly, with pygidial end strongly chitinized; yellowish brown, pygidium brown. Mouth parts well chitinized; rostral loop very long. Antennae conical with a long, curved hair. Both anterior and posterior pairs of spiracles with a group of parastigmatic gland orifices, these anterior groups consist of about 24 orifices, with the posterior of about 14 orifices. Margin of the body with numerous small round pores on the dorsal surface.

Pygidium of female: Large, triangular with deep lateral notches on each side, with the anterior side more projecting, no lobes nor plates. Two long and prominent club shaped paraphyses on each side, numerous minute circular pores in the denser chitinous area. Anal opening small and far from the caudal margin. Three groups of circumgenital gland orifices; median of about 50 orifices, laterals about 150. The suture between the segments are curiously striated.

Habitat: On stalks of bamboo. Common in Japan. It was described by Prof. Cockerell in 1898, from the material obtained by the late Mr. Alex. Craw, San Francisco, in his quarantine work.

Besides Japan, this scale insect is recorded from California.

Anoplaspis penicillata (GREEN).

1905 *Odonaspis penicillata* GREEN; Jour. Bomb. N. H. Soc., xvi, p. 346.

Unfortunately the writer has not able to obtain this species of the Diaspine Coccid since the great disaster in the fall of 1923, but Prof. G. F. Ferris of Stanford University, California has stated in his

paper (Bull. of Entomological Research vol. xii, pt. 3, p. 219, 1921) that *Odonaspis inusitatus* of Kuwana (Proc. Cal. Acad. Sci. (3), iii, p. 65, 1902) was misidentified by him. Specimens recorded from Japan as *O. inusitata* by Kuwana are this species instead. The writer lost his cotype by the last disaster, so he has written to Prof. Ferris and asked him to loan type specimens of Stanford University, however, the writer has not had response. The following is Prof. Green's original description.

"Female puparium very pale fulvous: pellicles orange, usually concealed beneath the whitish secretion, situate at anterior extremity. Very firm and compact, the ventral scale as dense as the dorsal; the two scales so firmly adherent that it is difficult to extract the insect uninjured. Elongate: broadest immediately behind the pellicles: tapering posteriorly: flattened beneath: strongly convex in front, depressed towards hinder extremity. Length 1.50 to 2 mm. Greatest breadth 1 to 1.10 mm.

"Male puparium similar; but smaller, narrower and paler. Length 1mm.

"Adult female clear pale purplish: oval. Pygidium bluntly pointed: somewhat resembling that of *O. inusitatus*, but with a strongly cristate margin, three of the points on each side being larger and more prominent (possibly representing lobes). There is a moderately broad and deep excision at the extremity from which springs a dense brush of tapering hairs, the tips meeting in a point like a small paint-brush. No circumgenital glands. Numerous minute circular pores in the denser chitinous area. Six stout and moderately long paraphyses. Anal aperture near base of pygidium. Length 0.75 to 1.10 mm."

Genus *Aonidia* TARGIONI TOZZETTI.

Targ., Cat., p. 42, 1869.

This genus includes species of Diaspinae in which the scale of

the adult female is entirely enclosed within the large, hardened skin of the second stage. The first exuvia is placed in the center. Adult female is generally viviporous and without circumgenital gland orifices, margin of pygidium possesses lobes and plates. Scale of the male is similar to that of the female and exuvia placed near the center.

Type *A. purpurca* Targ.

There are two species belonging to this genus in Japan which may be differentiated with following key:

Key to species.

- A. Pygidium of adult female terminating in a single median lobe, with no plates. *elaegna*.
 AA. Pygidium of adult female terminating in a pair of median lobes, with plates. *yabunikkei*.

***Aonidia elaeagna* MASKELL.**

- 1897 *Aonidia elaeagnus* MASKELL; Ent. Mon. Mag., xxxiii, p. 241
 1898 *Aonidia elaeagnus* MASKELL; N. Z. Trans., xxx, p. 227.

This species of the scale insect is not known to the writer. The following is the description of the late Mr. W. M. Maskell.

"Female puparium circular, rather solid, yellowish-brown or reddish-yellow, in color; diameter about 1/30 in.; almost entirely occupied by the second pellicle; the first pellicle is small, yellow, and usually placed in a circular depression.

"Male puparium elliptical, rather lighter-coloured than that of the female, the pellicle yellow, terminal; length about 1/25 in.

"The larval pellicle is oval, and exhibits at the posterior extremity, indicates of terminal lobes.

"The second female pellicle, which occupies almost the whole

puparium, is elliptical, tapering posteriorly, and ends in six slender cylindrical emarginate lobes, all sloping inwards.

"Adult female yellow, or brownish; length about 1/50 in. The cephalic and thoracic regions largely overlap the abdominal. Abdomen triangular, with nearly straight emarginate sides, terminating in a single median lobe; this lobe is slightly notched on each side, and has a deep indentation on the terminal edge, so that it looks as if it were double. Separated from it by a short interval along the margin is another very small lobe, and still further along another still smaller (or, indeed, rather an indication of a lobe). There are no hairs or spines except one or two, very short and fine, on the anterior abdomen. No groups of spinnerets, but there are a few minute circular pores near the posterior margin.

"Male unknown.

"*Hab.* In Japan on *Elaeagnus macrophylla*. My specimens were sent by Mr. Koebele (No number attached to them)."

***Aonidia yabunikkei* KUWANA n. sp.**

(Plate XI, Fig. a.)

Scale of female: Circular or subcircular; reddish brown. First exuvia exposed, black, slightly convex, subcentral; second exuvia completely enclosing the adult insect, more or less convex. The extremity of second exuvia with six distinct chitinous lobes; two to three stout spiniform plates or spuames in each interlobular space, and beyond the third lobe with several fringed plates. Diameter, about 0.7 mm.

Scale of male: Similar in size and form to that of the female, but smaller.

Body of female: Subcircular, sharply tapering towards abdominal extremity. Antennae conical, with a stout, curved hair. Mouth parts large, well chitinized; rostral loop rather long. Anterior pair of

spiracles without parastigmatic gland orifices.

Pygidium of female: Small, triangular in form, not strongly chitinized. Margin of the pygidium with three pairs of lobes; median pair of lobes the largest, slender, sides parallel, with notch on each side near the tip which is round; second much shorter but similar to median lobe in general shape, with no distinct notch on the side; the third much smaller than the second and conical in shape, with indistinct teeth on the outer margin. Plates well developed; two between median lobes, which are spiniform; two between the median and second lobes which are spiny or branched; two between second and third lobes which are simple or branched; beyond the third lobe with several simple plates. Spines are rather sharp and strong as shown in the figure. Anal opening large, placed about the middle of the pygidium.

Habitat: On the leaf of *Cinnamomum pedunculatum* (yabunikkei). Collected by the writer and others in Mutsure-jima near Moji city in April 1924, and also collected by the writer in Amami-ōshima, on the same host in June 1930.

Notes: This new scale insect is allied to *Aonidia rhusae* Brain, but differs from the latter in the structure of the pygidium of the adult female.

(February 27, 1933,
Tokyo, Japan.)

I. KUWANA :

THE DIASPINE COCCIDAE OF JAPAN, VII.

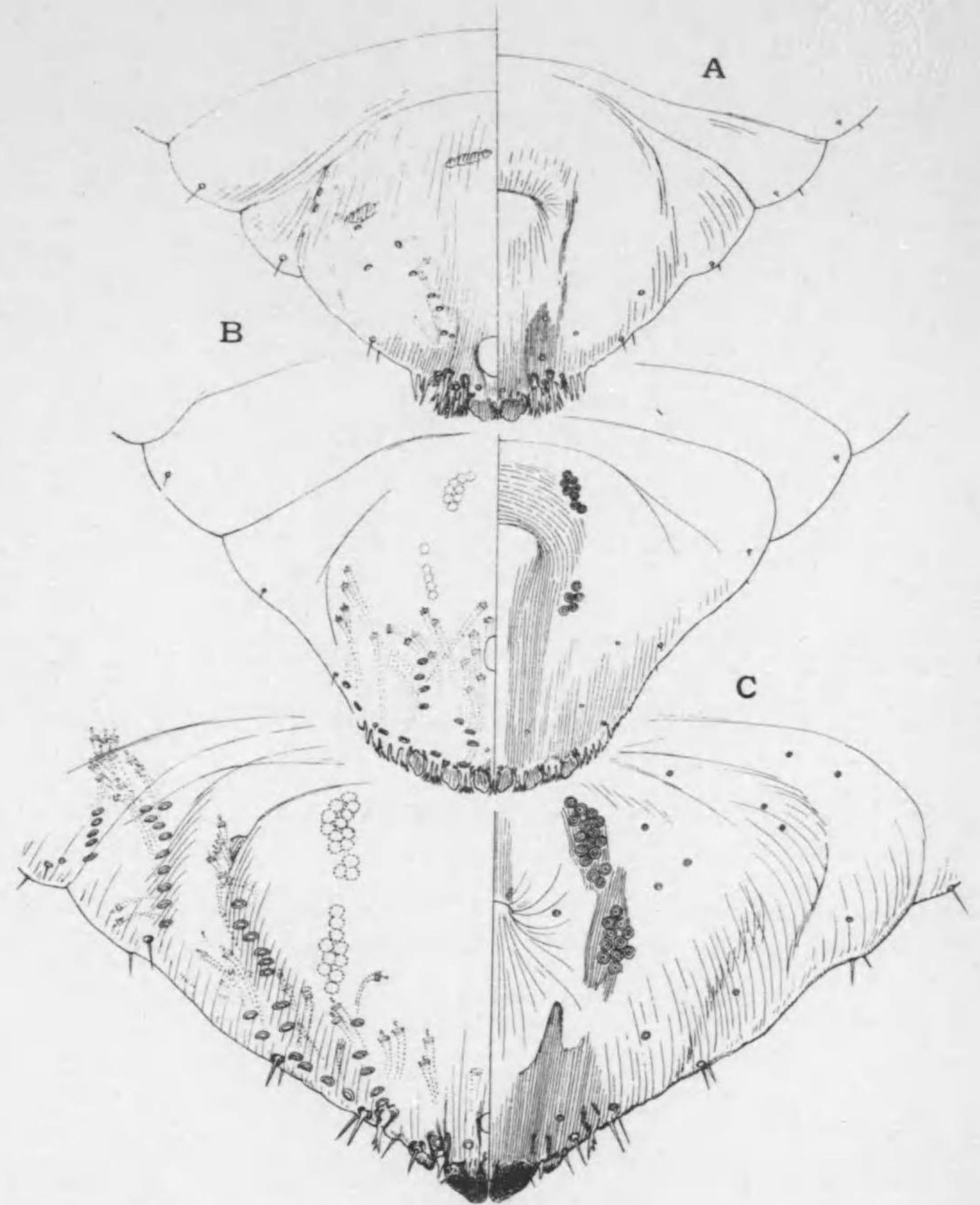
PLATE I.

Explanation of Plate I.

Pygidium of adult female.

- a. *Aspidiotus camelliae* Sign.
- b. *A. cryptomeriae* Kuw.
- c. *A. cryptoxanthus* Ckll.

(All figures, more or less enlarged.)



I. KUWANA :

THE DIASPINE COCCIDAE OF JAPAN, VII.

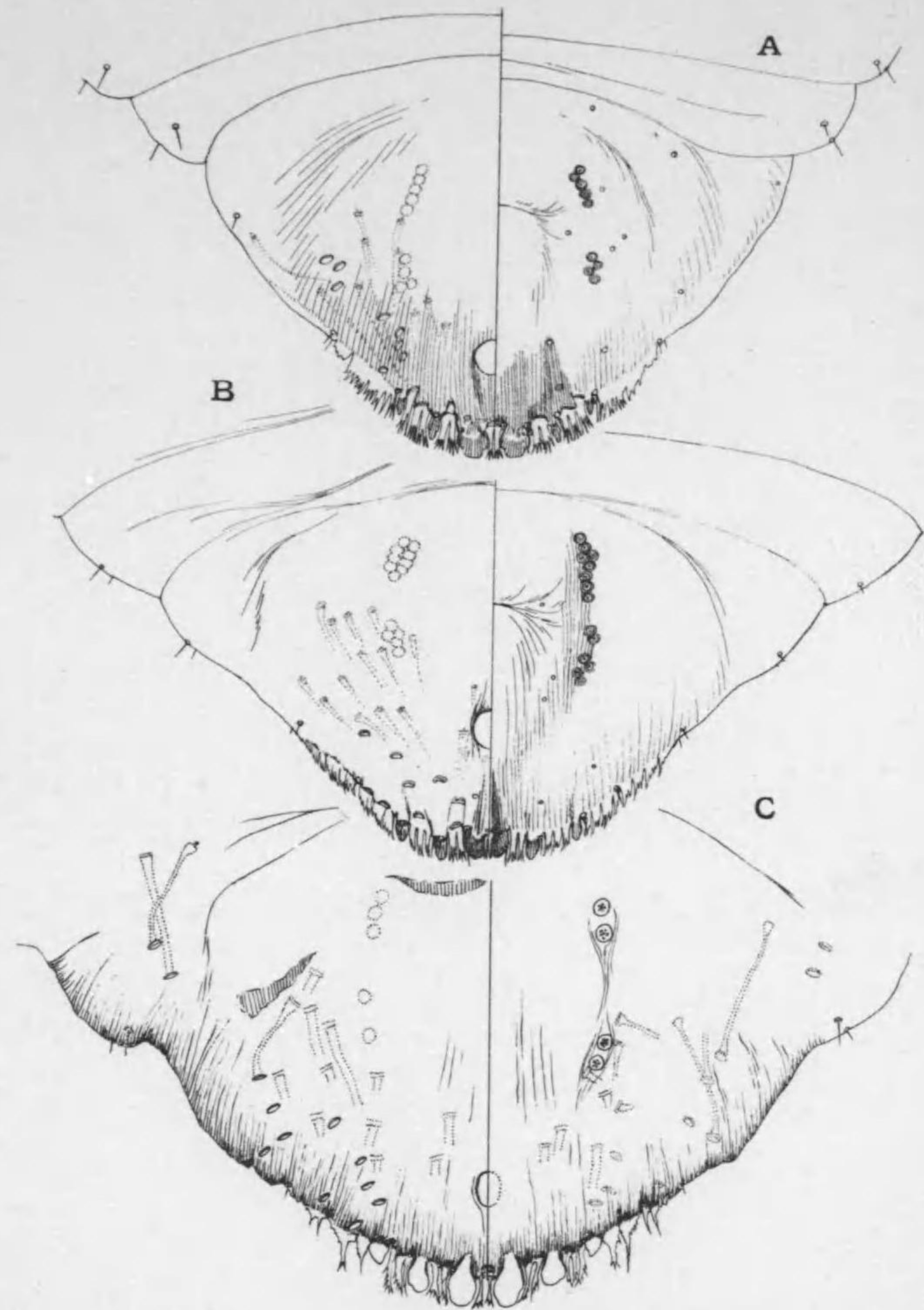
PLATE II.

Explanation of Plate II.

Pygidium of adult female.

- a. *Aspidiotus cyanophylli* Sign.
- b. *A. destructor* Sign.
- c. *A. degeneratus* (Leon.).

(All figures, more or less enlarged.)



I. KUWANA :

THE DIASPINE COCCIDAE OF JAPAN, VII.

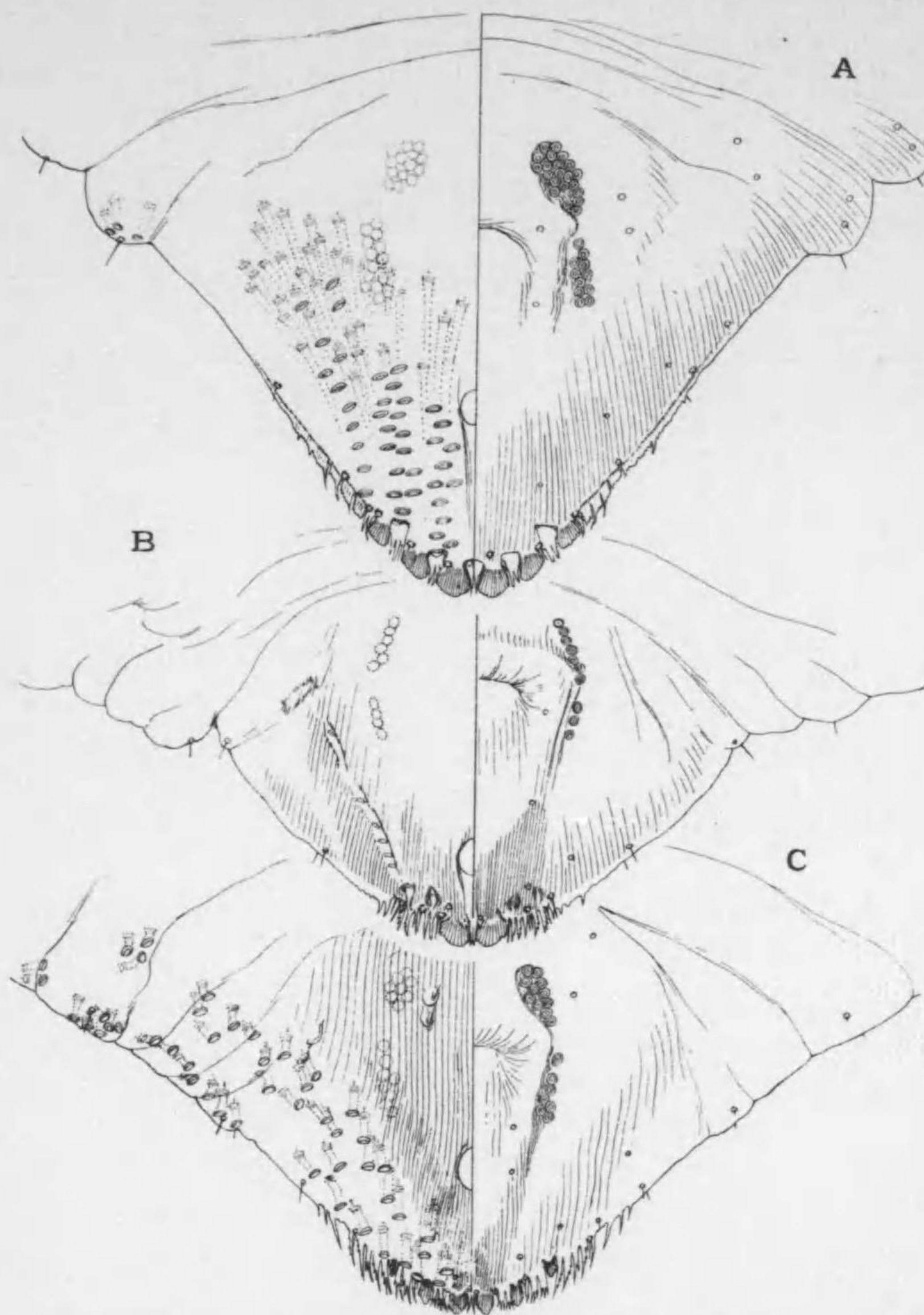
PLATE III.

Explanation of Plate III.

Pygidium of adult female.

- a. *Aspidiotus jordani* Kuw.
- b. *A. lataniae* Sign.
- c. *A. hedrae* (Vall.).

(All figures, more or less enlarged.)



I. KUWANA :

THE DIASPINE COCCIDAE OF JAPAN, VII.

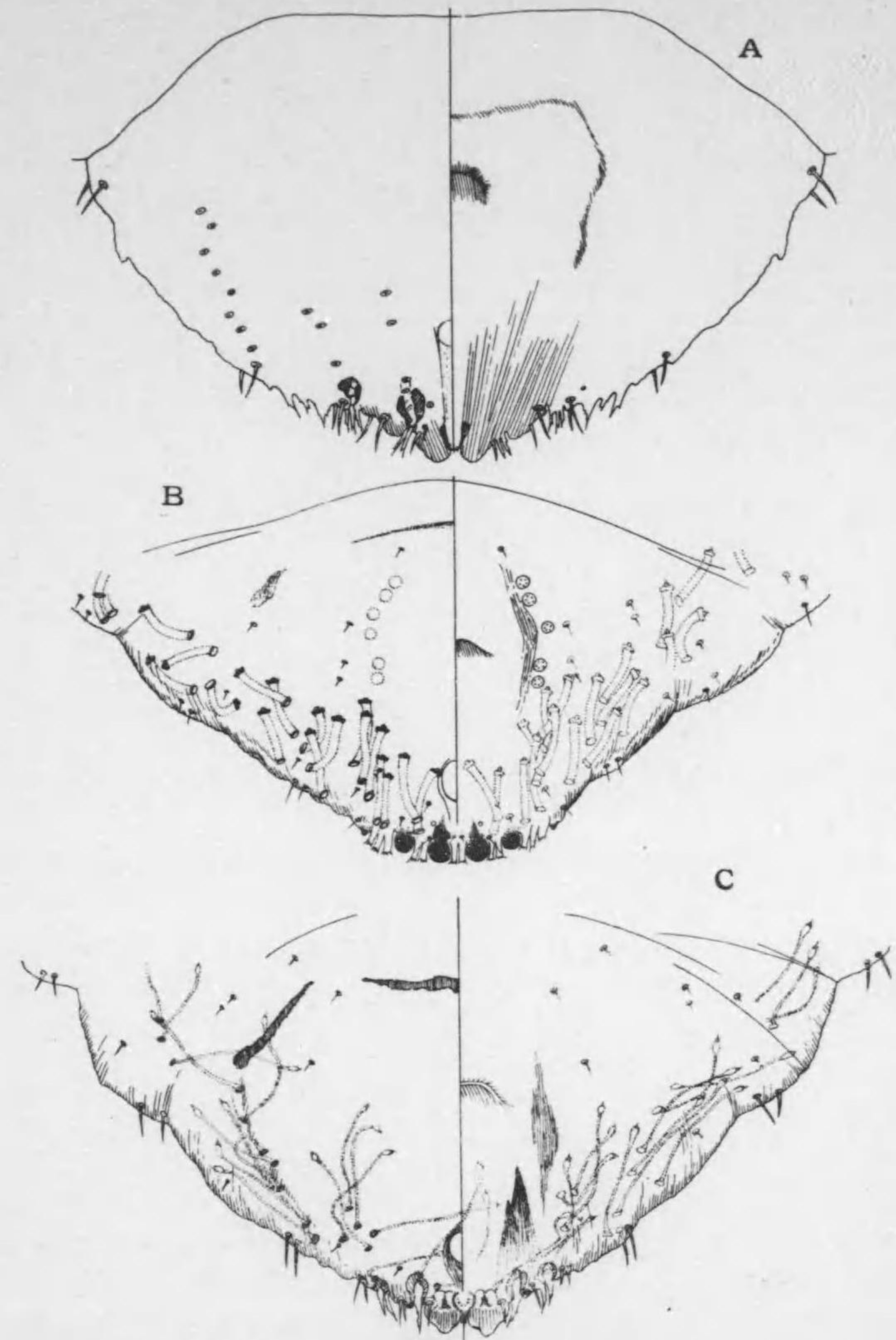
PLATE IV.

Explanation of Plate IV.

Pygidium of adult female.

- a. *Aspidiotus perniciosus* Comst.
- b. *A. pseudomyceri* Kuw.
- c. *A. makii* Kuw.

(All figures, more or less enlarged.)



I. KUWANA :

THE DIASPINE COCCIDAE OF JAPAN, VII.

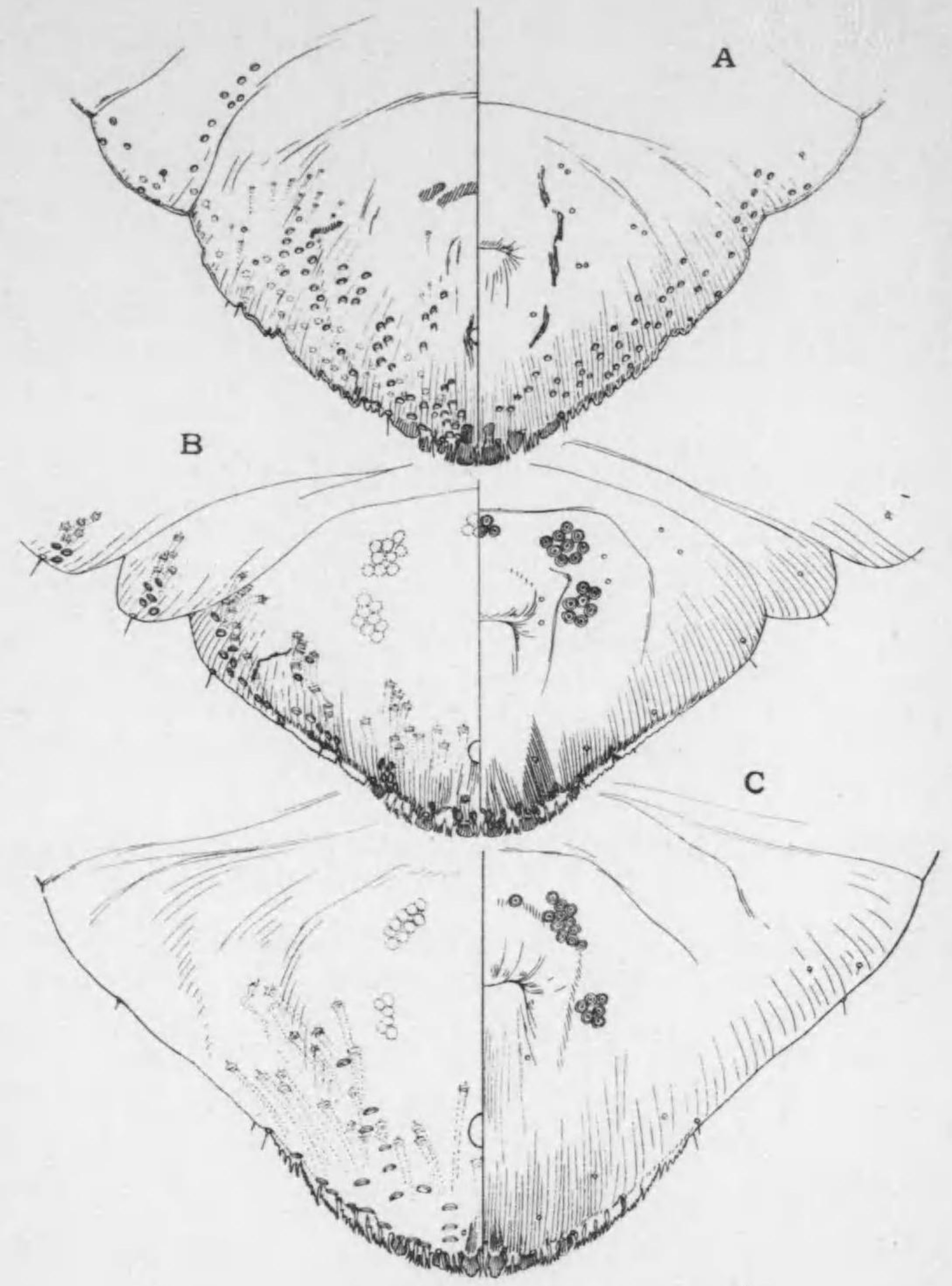
PLATE V.

Explanation of Plate V.

Pygidium of adult female.

- a. *Aspidiotus miscanthii* Kuw.
- b. *A. tsugae* Marl.
- c. *A. transparens* Green.

(All figures, more or less enlarged.)



I. KUWANA :

THE DIASPINE COCCIDAE OF JAPAN, VII.

PLATE VI.

Explanation of Plate VI.

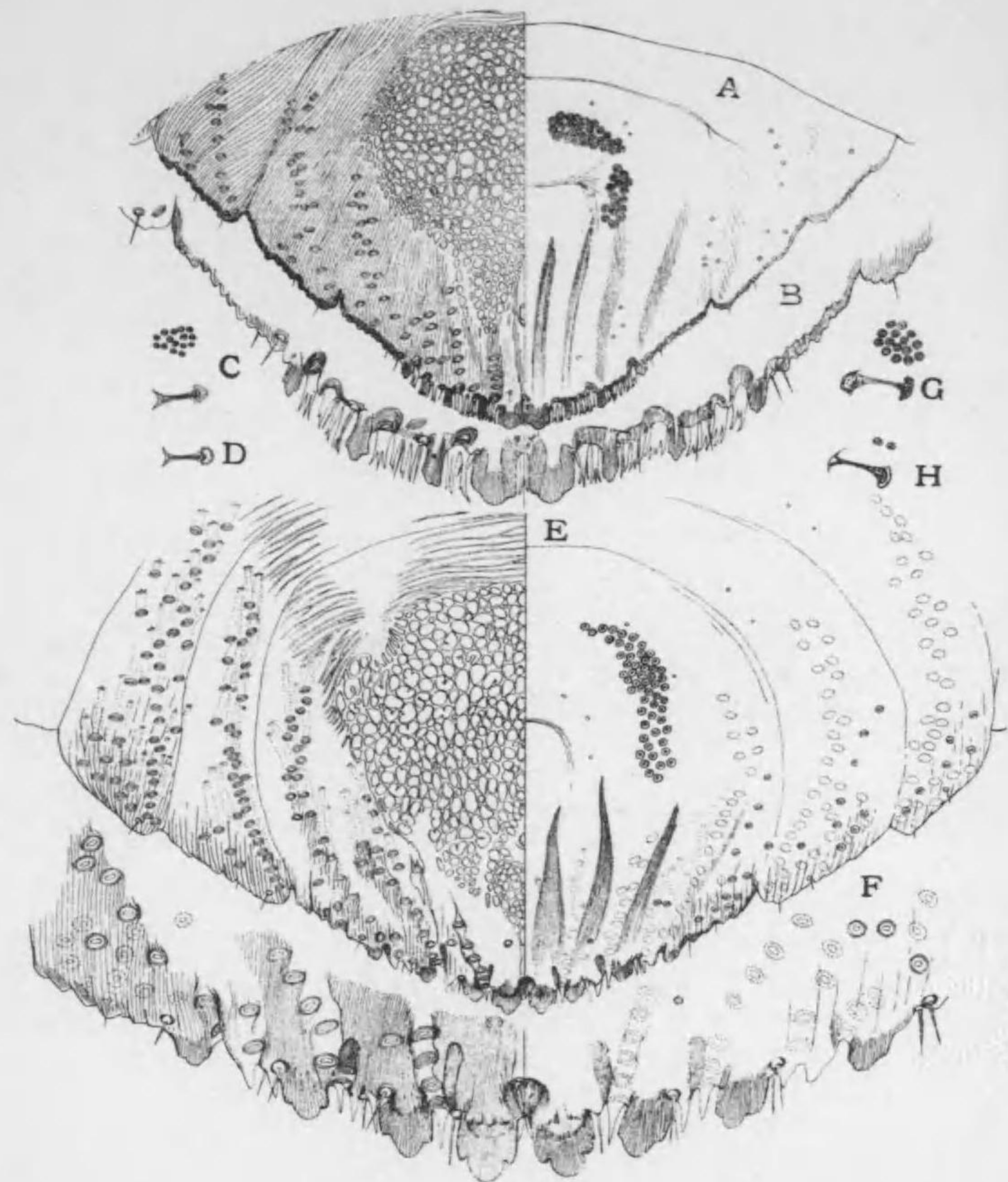
Pseudaoidia duplex (Ckll.).

- a. Pygidium of adult female.
- b. Margin of same.
- c. Anterior spiracle of same.
- d. Posterior spiracle of same.

P. paeoniae (Ckll.).

- e. Pygidium of adult female.
- f. Margin of same.
- g. Anterior spiracle of same.
- h. Posterior spiracle of same.

(All figures, more or less enlarged.)



I. KUWANA :

THE DIASPINE COCCIDAE OF JAPAN, VII.

PLATE VII.

Explanation of Plate VII.

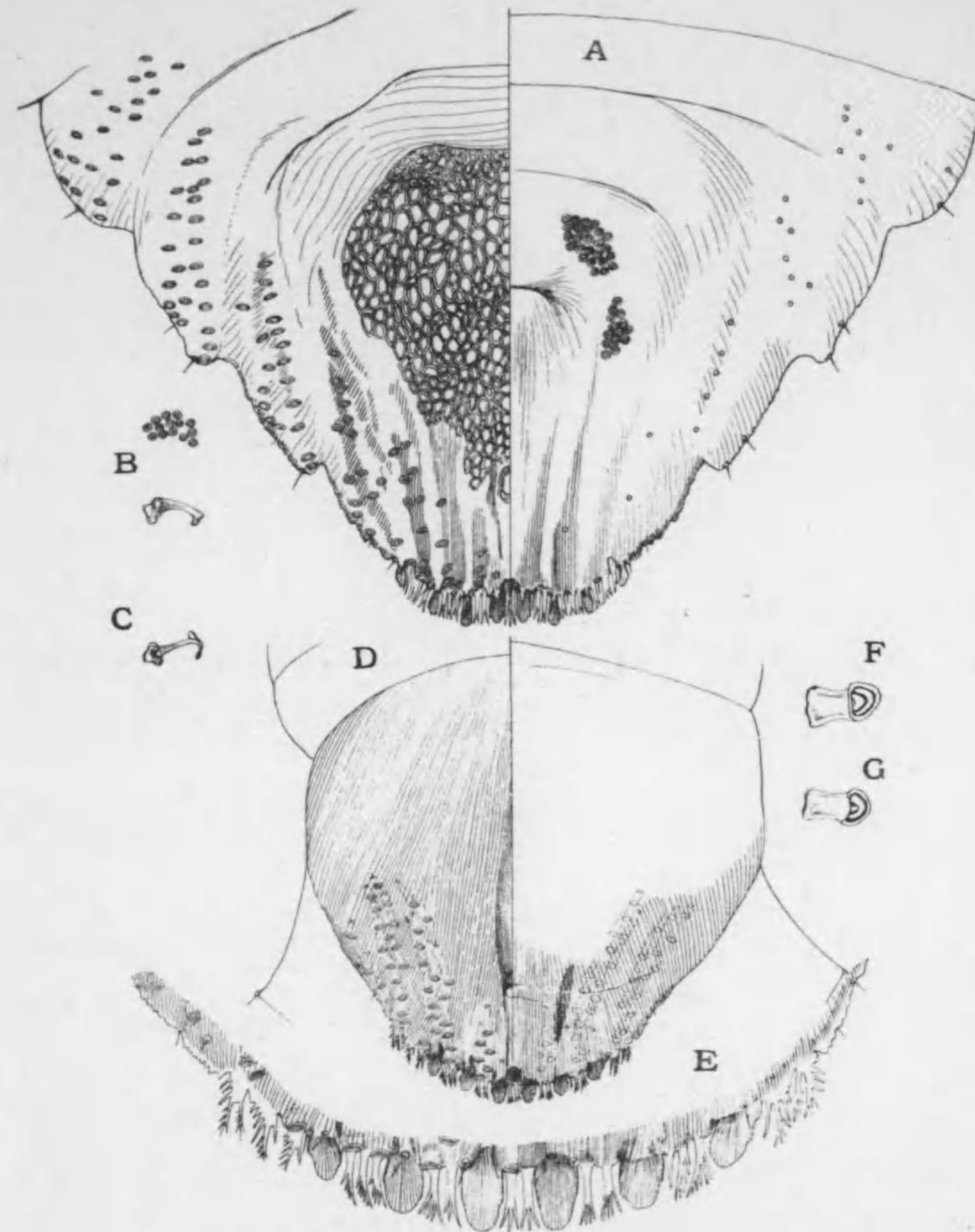
Pseudaomidia trilobitiformis (Green.).

- a. Pygidium of adult female.
- b. Anterior spiracle of same.
- c. Posterior spiracle of same.

Chrysomphalus anrantii (Mask.).

- d. Pygidium of adult female.
- e. Margin of same.
- f. Anterior spiracle of same.
- g. Posterior spiracle of same.

(All figures, more or less enlarged.)



I. KUWANA :

THE DIASPINE COCCIDAE OF JAPAN, VII.

PLATE VIII.

Explanation of Plate VIII.

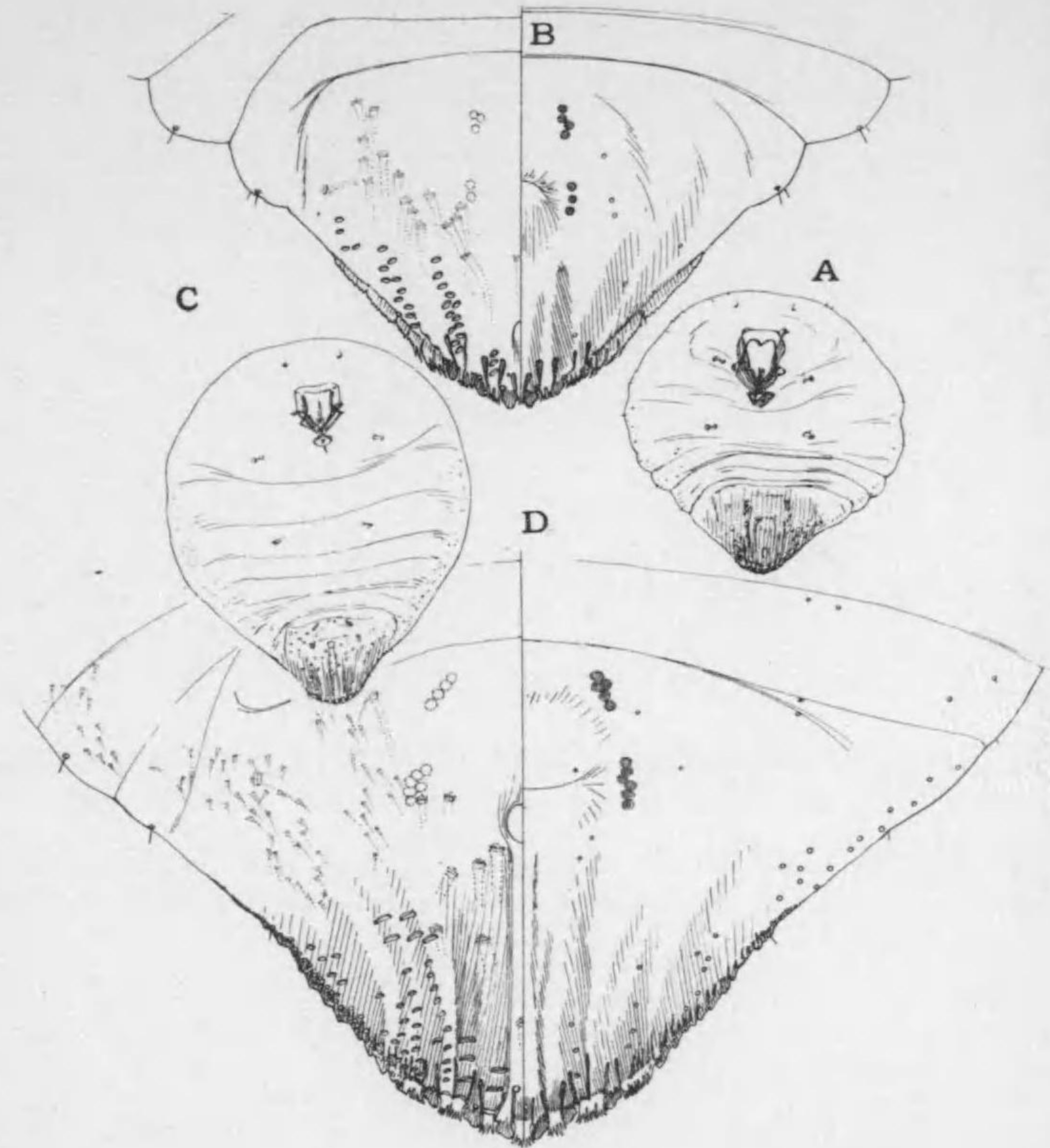
Chrysomphalus aonidum (Linn.).

- a. Adult female (ventral view).
- b. Pygidium of same.

C. rossi (Mask.).

- c. Adult female (ventral view).
- d. Pygidium of same.

(All figures, more or less enlarged.)



I. KUWANA :

THE DIASPINE COCCIDAE OF JAPAN, VII.

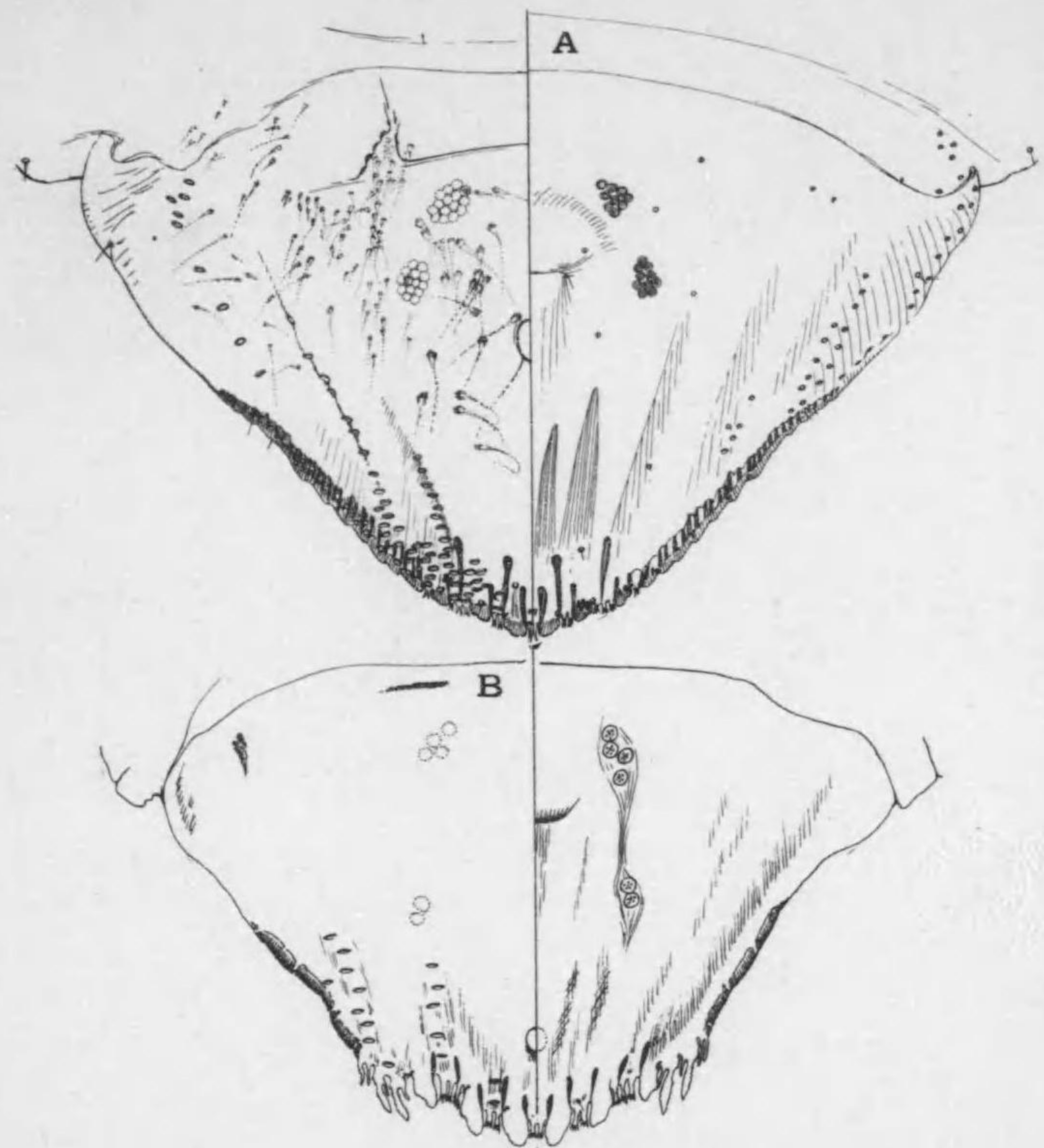
PLATE IX.

Explanation of Plate IX.

Pygidium of adult female.

- a. *Chrysomphalus setiger* (Mask.).
- b. *C. dictyospermi* (Morg.).

(All figures, more or less enlarged.)



I. KUWANA :

THE DIASPINE COCCIDAE OF JAPAN, VII.

PLATE X.

Explanation of Plate X.

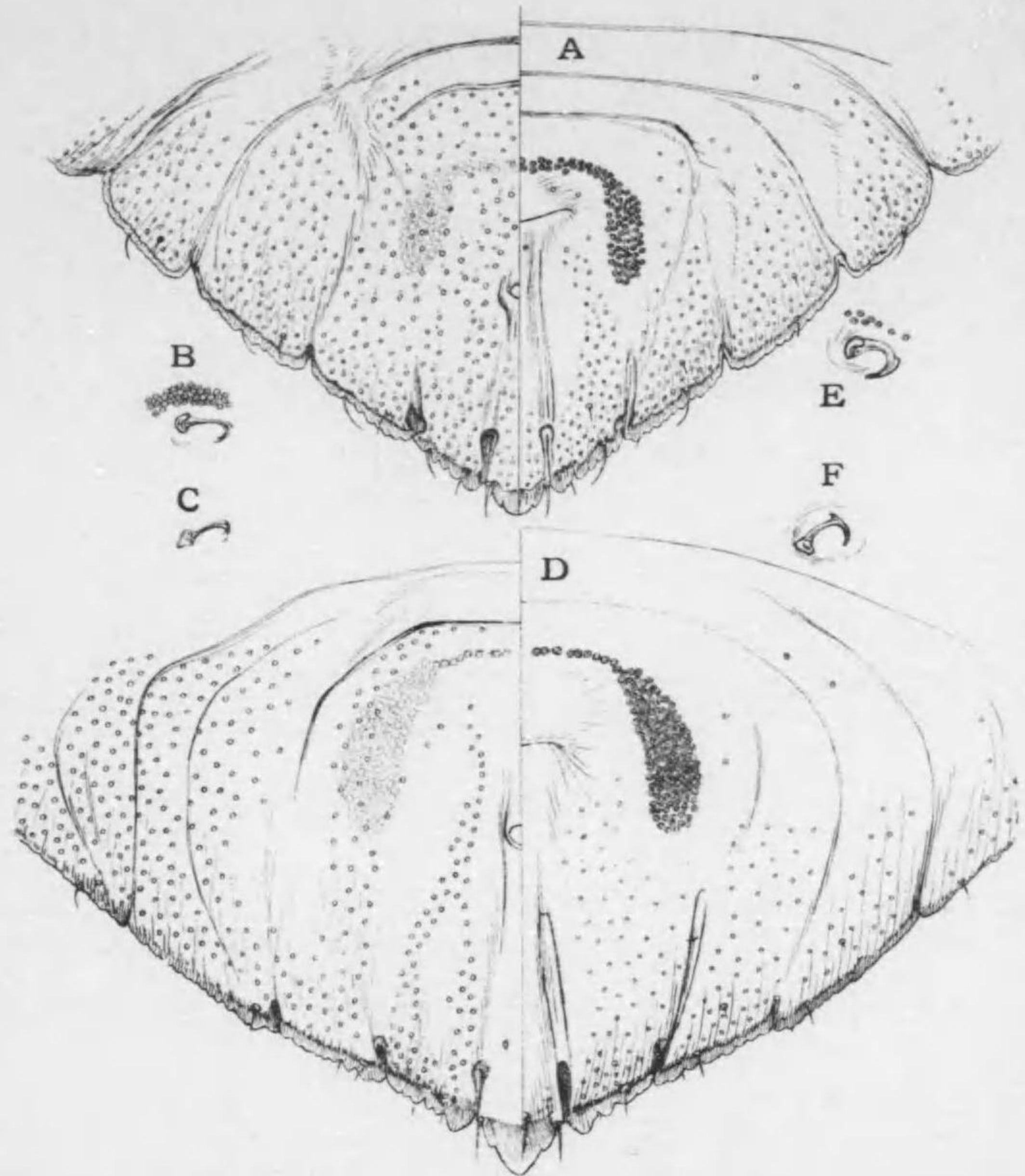
Odonaspis oshimaensis Kuw.

- a. Pygidium of adult female.
- b. Anterior spiracle of same.
- c. Posterior spiracle of same.

O. secreta (Ckll.).

- d. Pygidium of adult female.
- e. Anterior spiracle of same.
- f. Posterior spiracle of same.

(All figures, more or less enlarged.)



I. KUWANA :

THE DIASPINE COCCIDAE OF JAPAN, VII.

PLATE XI.

Explanation of Plate XI.

Aonidia yabunikkei Kuw.

a. Pygidium of adult female.

Anoplaspis bambusarum (Ckll.).

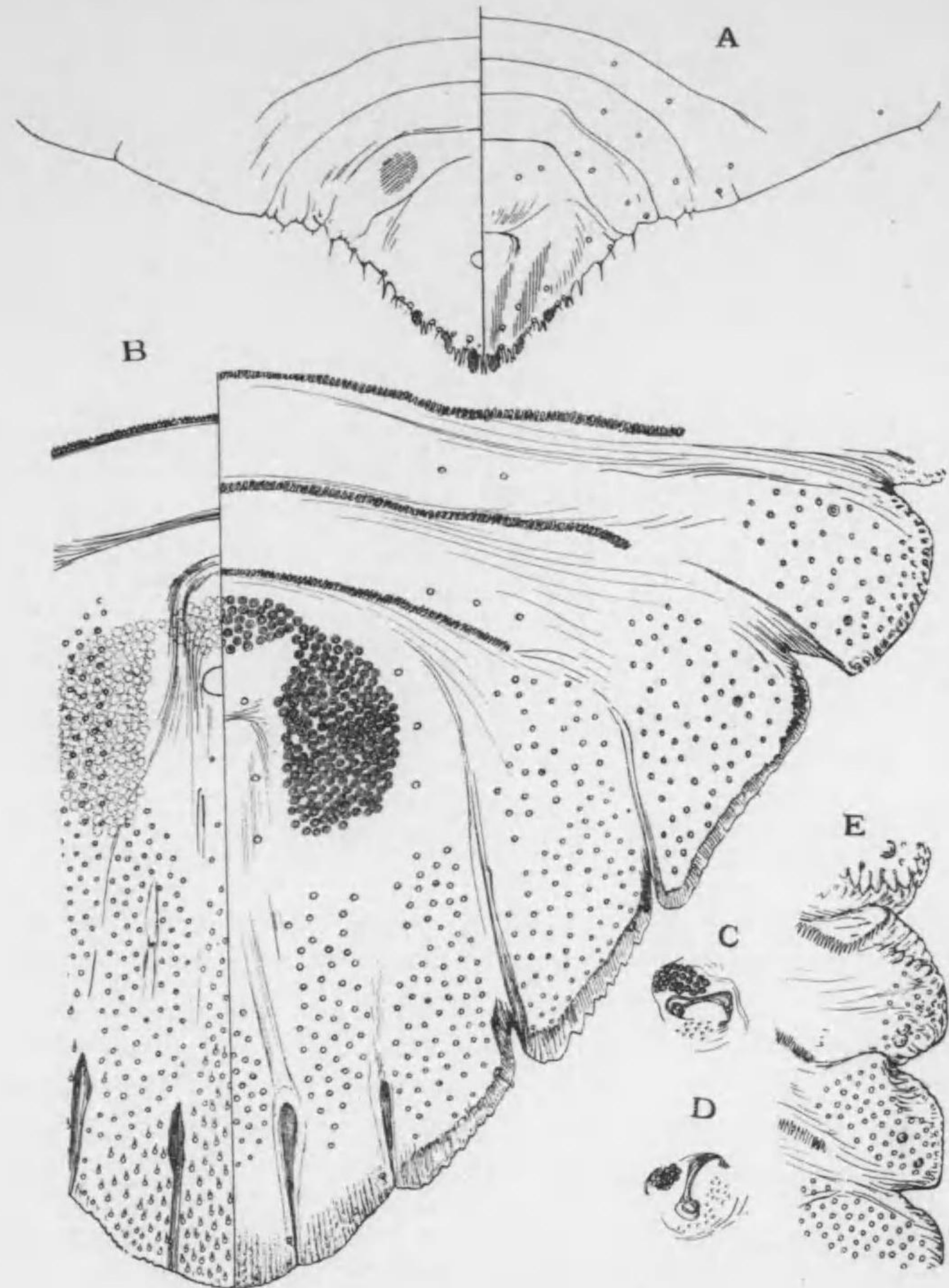
b. Pygidium of adult female.

c. Anterior spiracle of same.

d. Posterior spiracle of same.

e. Margin of free abdominal segments of same.

(All figures, more or less enlarged.)



II. KEY TO GENERA OF JAPANESE DIASPINAE.

The following key to the genera is largely based on morphological characters which can only be made out in carefully prepared specimens with the aid of the compound microscope.

- A. Scale of female circular to oval, with central, subcentral or submarginal exuviae.
 - a) Scale of female usually mining under epidermis of host; scale of male doubtful. *Howardia*.
 - aa) Not mining; scale of male usually resembling that of female in color and texture, being smaller and exuvia central.
 - b) Female enclosed in large nymphal exuvia. *Aonidia*.
 - bb) Female not enclosed in nymphal exuvia.
 - c) Much elongated chitinous processes (paraphyses) extending from bases of lobes or margin of pygidium.
 - d) With six well developed lobes. *Chrysomphalus*.
 - dd) With but single median lobe. *Odonaspis*.
 - ddd) Lobe wanting. *Anoplaspis*.
 - cc) Chitinous processes smaller and short or wanting.
 - d) Dorsum of pygidium with embossed design. *Pseudaonidia*.
 - dd) Dorsum of pygidium without embossed design. *Aspidiotus*.
 - aaa) Scale of male elongate, white and carinated, larval exuvia at cephalic extremity.
 - b) Female with dorsal pores in distinct rows.
 - c) Median lobes sunken into apex of pygidium. *Aulacaspis*.

- cc) Median lobes usually projecting from margin of pygidium. *Sasakiaspis*.
- bb) Female with dorsal pores irregular; median lobes widely separated. *Diaspis*.
- AA. Scale of female elongated with exuviae at one extremity.
 - a) Scale of male similar to that of female, smaller.
 - b) Scale of female very long and narrow; dorsum of pygidium with large embossed design. *Ischnaspis*.
 - bb) Scale of female plain, convex or flattened.
 - c) Scale of female occupied almost entirely by large nymphal exuvia which enclosed the body of female and is itself usually concealed by a covering of opaque white secretion. *Leucaspis*.
 - cc) Scale of female mytiliform.
 - d) Pygidium with not more than five groups of circumgenital gland orifices. *Lepidosaphes*.
 - dd) Pygidium with eight groups of circumgenital gland orifices in two concentric series. *Poliaspis*.
- aa) Scale of male elongate, white or gray in color, smooth.
 - b) Scale of male white. Female scale very convex, composed of almost entirely by nymphal exuvia which enclosed adult female. *Cryptoparlatoria*.
- bb) Scale of male grayish, rather depressed. Pygidium with a continuous marginal series of broad fimbriated squames and large semilunar pores. *Parlatoria*.
- aaa) Scale of male elongate, white, usually carinated.
 - b) Scale of female consisting chiefly of nymphal exuvia which completely enclosed adult

- female. *Fiorinia*.
- bb) Scale of female brown; median lobes together forming semicircular. *Pinnaspis*.
- bbb) Scale of female white; median lobes usually sunken into apex of pygidium. *Phenacaspis*.
- bbbb) Scale of female similar to *Phenacaspis*; median lobes not sunken into apex of Pygidium.
 - c) Median lobes together at the bases; circumgenital gland orifices in five groups. *Chionaspis*.
- cc) Median lobes not close together at the base; without fimbriated processes (squame in nature) between lobes; circumgenital gland orifices wanting. *Prontaspis*.
- ccc) Median lobes well parted; with fimbriated processes between lobes.
 - d) Lobes short, pointed, often divided; dorsal pores numerous. *Nikkoaspis*.
- dd) Lobes long, pointed; dorsal pores not numerous. *Tsukushiaspis*.

III. AN INDEX TO SPECIES OF COCCIDS DESCRIBED OR RECORDED IN THE DIASPINE COCCIDAE OF JAPAN, I-VII.

This index of Coccids includes all the Diaspine Coccids contained in the following papers:

- The Diaspine Coccidae of Japan, I.
Technical Bulletin No. 1.
Imperial Plant Quarantine Service of Japan, 1925.
- The Diaspine Coccidae of Japan, II.
Technical Bulletin No. 2.
Imperial Plant Quarantine Service of Japan, 1925.
- The Diaspine Coccidae of Japan, III.
Technical Bulletin No. 3.
Imperial Plant Quarantine Service of Japan, 1925.
- The Diaspine Coccidae of Japan, IV.
Technical Bulletin No. 4.
Imperial Plant Quarantine Service of Japan, 1926.
- The Diaspine Coccidae of Japan, V.
Scientific Bulletin No. 1.
Department of Agriculture, Ministry of Agriculture and Forestry, Japan, 1928.
- The Diaspine Coccidae of Japan, VI.
Scientific Bulletin No. 2.
Department of Agriculture, Ministry of Agriculture and Forestry, Japan, 1931.
- The Diaspine Coccidae of Japan, VII.
Scientific Bulletin No. 3.
Department of Agriculture, Ministry of Agriculture and Forestry, Japan, 1933.

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A Postscript

When he had finished the treatise Dr. I. Kuwana fell suddenly ill on July 7th, this year, and died on the 14th of the same month. His sudden death is greatly deplored by all those who know him and his work.

昭和八年八月二十五日印刷

昭和八年八月二十八日發行

農 林 省 農 務 局

印刷者 石 井 精 一 郎

東京市京橋區西八丁堀三丁目七番地

印刷所 安 信 舍 印 刷 所

東京市京橋區西八丁堀三丁目七番地

電話京橋(56)二四九四番

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