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DIASPIDIDAE OF TAIWAN
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(HOMOPTERA : COCCOIDEA)

PART II*

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Group B—*Diaspididae lepidosaphediformes*

Tribe *Lepidosaphedini*

XXIV. Genus *Lepidosaphes* Shimer

References. Shimer 1868: 372; Ferris 1937: 70; Balachowsky 1954e: 28.

Synonyms. *Mytilaspis* Targioni, 1869 [type-species: *Coccus conchiformis* Gmelin]; *Cornuaspis* MacGillivray, 1921 [type-species: *Mytilaspis ocellata* Green]; *Cephalaspis* MacGillivray, 1921 (nec Agassiz, 1835) [type-species: *Mytilaspis cocculi* Green]; *Insulaspis* Mamet, 1950 [type-species: *Lepidosaphes vermiculus* Mamet]; *Paralepidosaphes* Borchsenius, 1962 [type-species: *Paralepidosaphes coreana* Borchsenius]; *Parainsulaspis* Borchsenius, 1963 [type-species: *Lepidosaphes laterochitinos*a Green]; *Pistaciaspis* Borchsenius, 1963 [type-species: *Lepidosaphes pistaciae* Archangel-skaya]; *Cornimytilus* Borchsenius, 1963 [type-species: *Lepidosaphes afganensis* Borchsenius]; *Eucornuaspis* Borchsenius, 1963 [type-species: *Mytilaspis machili* Maskell]; *Pinomytilus* Borchsenius, 1963 [type-species: *Lepidosaphes pseudotsugae* Takahashi]. *Mytilococcus* Ameling, 1858, is proposed by some authors as valid to replace *Lepidosaphes*.

Type-species. *Coccus conchiformis*: Shimer (nec Gmelin) = *Coccus ulmi* L.

Diagnosis. Body elongate, fusiform or nearly so, with the free segments more or less lobed laterally. Derm well sclerotized on the pygidium; prepigidial region remaining membranous, or in some species (*gloverii*; *laterochitinos*a; etc.) sclerotized in particular specific patterns. Pygidium with two pairs of lobes well developed; third and fourth lobes represented by sclerotized marginal serrations or obsolete. Median lobes robust, symmetric or nearly so, separated from each other by a distinct space. Second lobes bilobulate. Basal scleroses present or absent on the lobes, if present slender, occurring at the basal angles of the lobes. Gland spines well developed, always present between the median lobes and also between the median and second. Marginal macroducts of the pygidium enlarged, with the orifice longitudinally elliptical and surrounded by a thickly sclerotized rim; are always absent between the median lobes and usually six in number on each side of the pygidium, being arranged as

* Part I: *Insecta Matsumurana*, Vol. 32, Part 1 (pp. 1-110), July, 1969.

[*Insecta Matsumurana*, Vol. 33 (pp. 1-146), November, 1970]

follows: one between the median and second lobes (between the seventh and eighth abdominal segments), two between the sixth and seventh abdominal segments (or on the sixth), two on the fifth, and one towards the base of the pygidium, probably belonging to the fourth (in *tritubulata* Borchsenius the marginal macroducts are seven or eight in number on each side of the pygidium, being triple on the fifth or sixth abdominal segment, or at times on both of these segments; in *micronesiensis* Takahashi the marginal macroducts are, after the original description, four in number on each side). Dorsal ducts basically arranged segmentally, varying in size from the macroduct type to the microduct type. In some species (*serrifrons* Leonardi; *coreana* Borchsenius; *piniphila* Borchsenius; etc.) the head is strewn with small conical processes or sclerotized granules. In some species (*kuwacola* Kuwana; *machili*; *pseudotsugae* Takahashi; etc.) the head is equipped with a pair of sclerotized, sharp, horn-like lateral processes ("modified eyes"). In many species the abdomen is provided with lateral processes, and in some species these processes are strongly sclerotized. Submarginal dorsal bosses sclerotized or membraneous. Antennal setae various in number, but usually two or more. Anal opening in the base of the pygidium. Perivulvar pores in five groups (in *pini* and *pineti* Borchsenius three supplementary groups of disc pores are present anteriorly to the usual five groups).

Composition and distribution. In the sense adopted here the genus *Lepidosaphes* is native to the Old World and is distributed through the tropics, subtropics and temperate region. It is composed of over 90 known species, of which most are native to Asiatic Continent, Japan and Taiwan and others to Europe, Africa, the Philippines, Micronesia, etc.

Remarks. The recent splitting of the genus into 10 smaller genera, made by Borchsenius in 1962 and 1963, is here not accepted. The members of the genus are indeed diverse in some characters. The most striking diversity is found in the size of the dorsal ducts, and in this regard the members of the genus may be divided into three groups, although the limits of these groups are not distinct owing to the presence of intermediate forms. Because the size of the dorsal ducts corresponds in some degree with other characters, the splitting based on it seems to be on secure ground, apart from the point whether the groups thus founded can be soundly treated as distinct genera or not. I can not agree, however, with Borchsenius in his further splitting on the basis of the outline of the pygidium, the relative size of the median lobes to the second lobes, the presence or absence of basal scleroses on these lobes, and the presence or absence of the horn-like lateral processes on the head. It seems, in the problem of relationship, to be not always appropriate to attach such extreme significance to these characters, which are, at least in some cases, not more than specific.

So far as I am aware 22 species were described or recorded from Taiwan in the genus *Lepidosaphes* as given below. In the present collection are found 13 species belonging to the genus, of which four are described as new species.

- 1) *beckii* Newman.
- 2) *bladhae* Takahashi. A synonym of *laterochitinsa*.
- 3) *cinnamomi* Takahashi. A synonym of *machili*.
- 4) *crawii* Cockerell. A species of *Andaspis*.
- 5) *cycadicola* Kuwana.
- 6) *cymbidicola* Kuwana. A synonym of *machili*.

- 7) *ficicola* Takahashi. Possibly a species of *Ungulaspis*. Not collected.
- 8) *garambiensis* Takahashi. Not collected.
- 9) *glaucae* Takahashi. Not collected.
- 10) *gloverii* Packard.
- 11) *hawaiiensis* Maskell. The type-species of *Andaspis*. Not collected.
- 12) *imperatae* Kuwana. A species of *Acanthomytilus*. Not collected.
- 13) *kamakurensis* Kuwana. Misidentification of *bladhaie* (= *laterochitinos*).
- 14) *lithocarpi* Takahashi. Not collected.
- 15) *machili* Maskell.
- 16) *pallida* Green. Not collected.
- 17) *pini* Maskell. Not collected.
- 18) *sacchari* Hall. A species of *Acanthomytilus*. Not collected.
- 19) *takaoensis* Takahashi. Not collected.
- 20) *tokionis* Kuwana.
- 21) *tubulorum* Ferris. Not collected.
- 22) *yamahoi* Takahashi. Not collected.

50. ***Lepidosaphes japonica*** (Kuwana)

References. Kuwana 1902: 80 [*Mytilaspis pomorum* var.]; Ferris 1921 a: 217; Kuwana 1925 a: 11.

Diagnosis. Body with the metathorax and basal four abdominal segments moderately lobed out laterally, and with the pygidium of the shape of a trapezoid. Median lobes as wide as or a little wider than long, flatly roundish apically, separated from each other by a space a little narrower than one of them. Second lobes with the inner lobule as large as the median lobe, and with the outer lobule much smaller than the inner, yet well developed, both lobules with the apical margin slanting outwards. Median lobes and both lobules of the second lobes with basal scleroses. Gland spines occurring in pairs anteriorly as far as the third abdominal segment; second abdominal segment with two or three gland spines on the lateral lobe, these gland spines are shortened and more or less conical; four gland cones on the metathorax halfway between the lateral margin and the posterior spiracle, and 10 or 11 on the lateral lobe of the first abdominal segment. Dorsal ducts not reduced in size, few in number; submedian ducts present on the second to sixth abdominal segments: three or four on the second, three to six on the third, four or five on the fourth, and two on the fifth and sixth each; submarginal ducts present on the first to fifth abdominal segments, the fifth segment with one submarginal duct in the single specimen available. Third and fourth abdominal segments each with a slight marginal pore prominence towards the base. Meso- and metathorax with submarginal ventral macroducts scattered. Antennal tubercle quite reduced, with two setae; microducts scattered between the antennae. Anterior spiracle with two disc pores. Perivulvar pores: two in the median group, six to eight in the anterolateral, and three or four in the posterolateral.

Specimens examined. Tung-pu, on *Tsuga chinensis* var. *formosana* [one adult female].

Distribution and host plants. This species occurs in Japan on *Abies firma*, *A. sachalinensis*, *Picea jezoensis* var. *hondoensis*, *Tsuga diversifolia*, *T. sieboldii*, and other conifers. It was recorded in Korea on *Chamaecyparis* and *Pinus densiflora*. Borch-

senius gives the mainland of China as a locality of this species, adding *Keteleeria* and *Taxus* to the host list, in his Catalogue of the Armoured Scale Insects (1966).

Remarks. This species is here recorded for the first time from Taiwan. It was collected in a natural forest of *Tsuga chinensis* var. *formosana* on an altitude of 2,650 meters above the sea level.

This species is close to *maskelli*, from which it is distinguishable by the median lobes flatly roundish on the apical margin, by the second lobes with a wider inner lobule, and by having microducts between the antennae. Furthermore, so far as compared on the basis of Japanese material, this species differs from *maskelli* by having one to three, usually two or three, submarginal macroducts on the fifth abdominal segment, whereas *maskelli* has always one in this position.

51. *Lepidosaphes nivalis*, n. sp. [Fig. 38]

Diagnosis. Body with the metathorax and basal four abdominal segments moderately lobed laterally, and with the pygidium of the shape of a trapezoid. Median lobes a little wider than long, with the apex obtuse-angulated; are separated from each other by a little less than the width of one of them. Second lobes with the inner lobule as large as the median lobe, and with the outer lobule much smaller, yet well developed, both lobules with the apical margin slanting outwards. Third and fourth lobes reduced to marginal serrations. Median lobes and both lobules of the second lobes with basal scleroses. Marginal gland spines short, occurring in pairs anteriorly as far as the fifth abdominal segment, two or three on the third and fourth each; two to four gland spines on the lateral lobe of the second abdominal segment; eight to 12 gland cones on the metathorax laterally to the posterior spiracle, and seven to nine on the lateral lobe of the first abdominal segment. Dorsal ducts not reduced in size, rather abundant; submedian ducts present on the metathorax and the first to sixth abdominal segments, often confounded with the submarginal ducts on the basal two abdominal segments, two to five on the metathorax, six to 12 on the first abdominal segment, eight to 13 on the second, seven to 10 on the third, five to nine on the fourth, two to five on the fifth, and two to four on the sixth; submarginal ducts on the metathorax and the first to fifth abdominal segments, two or three in number on the fifth. Third and fourth abdominal segments each with a marginal pore prominence towards the base. Ventral macroducts strewn within the lateral margin on the meso- and metathorax and in the anterolateral corner of the first abdominal segment. Antennal tubercle rudimentary, with two thickened setae and a tiny seta; microducts scattered between the antennae. Anterior spiracle with one to three disc pores. Perivulvar disc pores: two to six in the median group, six to nine in the anterolateral, and six to eight in the posterolateral. Scale white.

Specimens examined. Tung-pu, on *Tsuga chinensis* var. *formosana*; A-li Shan, on *Abies kawakamii*. Collected on the leaves of the host plants.

Remarks. This species comes closest to *japonica*, but is easily distinguishable from the latter by having numerous macroducts on the thorax and abdomen. Moreover, among the species of *Lepidosaphes* it is unique by the white scale.

52. *Lepidosaphes maskelli* (Cockerell)

References. Cockerell 1897 q: 704 [*Mytilaspis pallida* var.]; Kuwana 1925 a: 9 [*pallida*]; Ferris 1938 a: 146 [*newsteadi*]; Balachowsky 1954 e: 87.

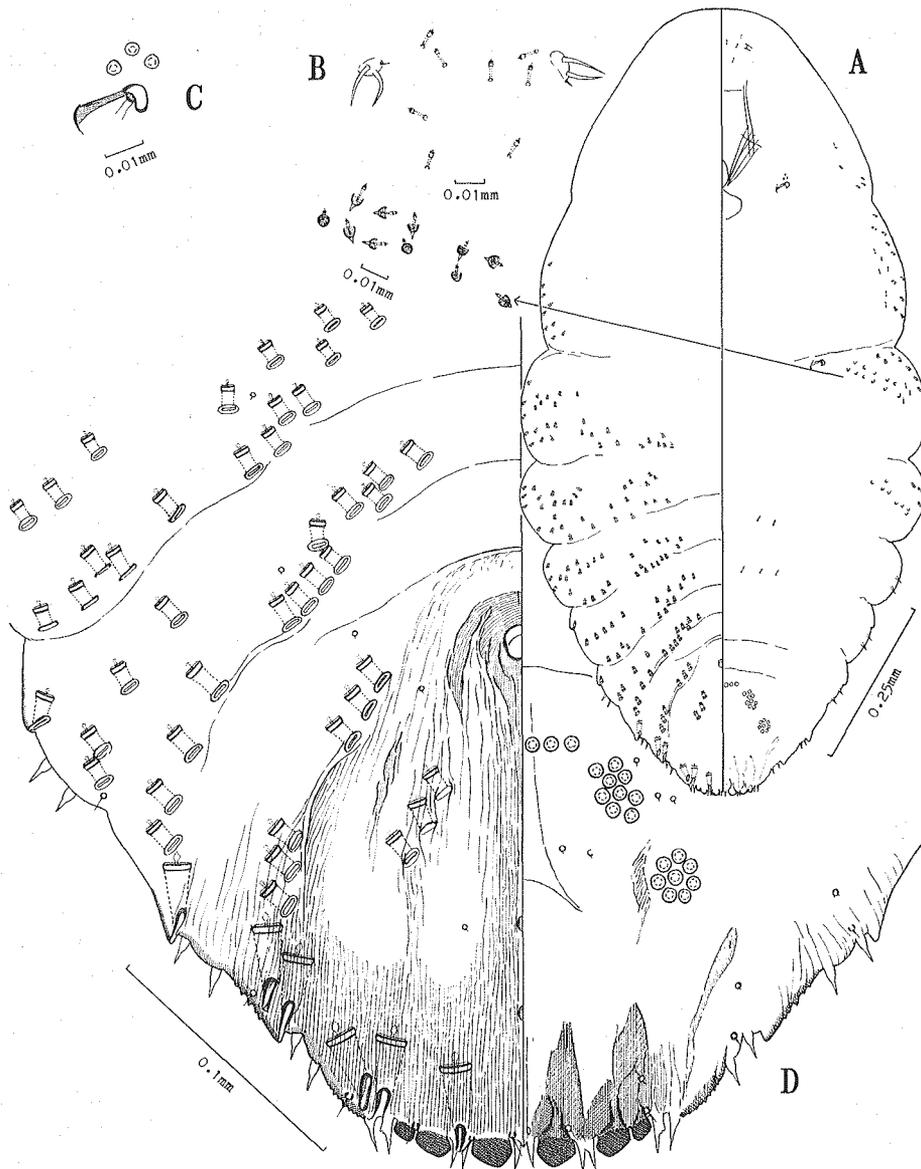


Fig. 38. *Lepidosaphes nivalis*, n. sp. Adult female (A, body; B, antennae with microducts; C, anterior spiracle; D, pygidium).

Diagnosis. Body slender, with the metathorax and basal four abdominal segments gently lobed laterally, and with the pygidium rather of the shape of a trapezoid. Median lobes as long as wide, with the apical margin well convex, and with a slight notch on each side; are separated from each other by a space as wide as one of them. Second lobes with the inner lobule somewhat smaller than the median lobe, a little longer than wide, and entire; and with the outer lobule smaller than the inner, yet well developed. Median lobes with basal scleroses; second lobes with basal scleroses on the inner lobule, the basal scleroses on the outer lobule being rudimentary. Gland spines occurring in pairs anteriorly as far as the fifth abdominal segment, two or three on the preceding two segments (third and fourth abdominal segments); second abdominal segment with three or four short, rather conical gland spines within the lateral margin; metathorax with four to seven gland cones posterolaterally to the posterior spiracle, and the first abdominal segment with seven to 12 in a submarginal cluster. Dorsal macroducts not reduced in size; submedian ducts absent in the first abdominal segment, one to three present or absent on the second, two to eight on the third, four to six on the fourth, two to four on the fifth, and two or three on the sixth; submarginal ducts few on the first to fifth abdominal segments, the fifth segment always with one submarginal duct. Metathorax with a transverse row of ventral macroducts on each side just posteriorly to the posterior spiracle, this row confounded with the lateral macroducts, mesally extending a little beyond the spiracle; mesothorax with some ventral macroducts in the posterolateral corner, and with several others scattered along the lateral margin. Third and fourth abdominal segments each with a marginal pore prominence towards the base. Antenna usually with two setae. Anterior spiracle with one to five disc pores. Perivulvar pores: two to five in the median group, four to seven in the anterolateral, and three to five in the posterolateral.

Specimens examined. Tai-pei, on *Podocarpus* sp.; Chiao-shi, on *Juniperus* sp.; Kao-hsuing, on *Juniperus* sp.

Distribution and host plants. This species was originally described from specimens collected in Hawaii on *Podocarpus* imported from Japan. It occurs commonly in Japan on various conifers such as *Cephalotaxus harringtonia*, *Cryptomeria japonica*, *Juniperus chinensis*, *J. sargentii*, *Podocarpus macrophyllus*, *Sciadopitys verticillata*, *Torreya nucifera*, etc. It was introduced into California, and was recorded from U.S.S.R.

Remarks. So far as I am aware, there has been published no authentic record of the occurrence of this species in Taiwan. The scale recorded by Takahashi under the name *pallida* is certainly not this species, since it feeds on non-coniferous plants.

This species has marginal pore prominences on the third and fourth abdominal segments, but these prominences are easily overlooked when specimens are not properly prepared, and in consequence are not or imperfectly described by previous authors.

53. *Lepidosaphes tokionis* (Kuwana)

References. Kuwana 1902: 81 [*Mytilaspis newsteadi* var.]; Ferris 1938 a: 145 [*lasianthi*]; ibid. 1942: 398.

Synonyms. *Mytilaspis auriculata* Green, 1907.

Diagnosis. Body slender, with the lateral sides almost parallel; head with a more or less pronounced lobe on each side; basal four abdominal segments moderately lobed

laterally; pygidium broad, rather of the shape of a trapezoid. Median lobes prominent, slightly divergent, separated from each other by a little less than the width of one of them, each lobe as long as wide, well convex apically, serrate on the inner side, once-notched on the outer side, with the inner apical margin longer than the outer. Second lobes with the inner lobule smaller than the median lobe and slanting outwards on the rounded apical margin; outer lobule similar in shape to the inner, but smaller. Median lobes with basal scleroses well developed; second lobes with basal scleroses well developed only on the inner lobule. Marginal gland spines rather short, occurring in pairs on the pygidium; four on the second abdominal segment, and three on the third and fourth each; metathorax with six submarginal gland cones laterally to the posterior spiracle, and the first abdominal segment with 10 to 12. Dorsal macroducts not reduced in size; submedian ducts absent on the first abdominal segment, four on the second, eight on the third, seven or eight on the fourth, and three or four on the fifth, the sixth abdominal segment with four to six ducts in a submedio-submarginal row; submarginal ducts on the first to fifth abdominal segments, the fifth segment with two or three submarginal ducts. Meso- and metathorax with macroducts scattered within the lateral margin and on the metathorax extending mesally towards the posterior spiracle in front of the gland cones. Fourth abdominal segment with a marginal pore prominence. Antenna with two long setae. Anterior spiracle with two or three disc pores. Perivulvar pores: four in the median group, six in the anterolateral, and four in the posterolateral.

Specimens examined. Ken-ting, on *Codiaeum variegatum* [one adult female].

Distribution and host plants. This species was originally described from specimens collected under glass in Tokyo on croton, and later recorded as a croton-feeder from various localities of the world. Green described it, under the name *auriculata*, from the Seychelles and later recorded from Ceylon, India, Hawaii, Singapore, Barbados and Australia. It was recorded under the name *crotonis* or *lasianthi* from Hawaii, the Philippines and North America. Other records of this species include Taiwan, Cuba, Mexico, Micronesia, Madagascar, Reunion Island, etc.

54. *Lepidosaphes gloverii* (Packard)

References. Packard 1869, Guide to Study of Ins.: 527 [*Coccus*]; Ferris 1937: 74; Balachowsky 1954e: 51.

Synonyms. *Mytilella sexspina* Hoke, 1922.

Diagnosis. Body slender, with the lateral sides almost parallel; thorax little and the free abdominal segments moderately lobed laterally; pygidium rather trapezoidal in outline. Derm of the thorax sclerotized at maturity. Median lobes separated from each other by a little less than the width of one of them, each lobe as long as wide, rounded apically, notched once or twice on the inner side and once on the outer side. Second lobes with the inner lobule similar in shape to the median but distinctly smaller, and with the outer lobule smaller than the inner, about twice as long as wide and rounded apically. Median lobes with basal scleroses; second lobes with basal scleroses well represented on the inner lobule but rudimentary on the outer lobule. Third and fourth lobes in coarse, rather prominent serrations. Marginal gland spines well developed, occurring in pairs on the pygidium, two or three on the third and fourth abdominal segments each; second abdominal segment with two or three much

shorter gland spines; metathorax with five to eight gland cones in a transverse row posteriorly to the posterior spiracle, and the first abdominal segment with 14 to 16 in a submarginal row. Dorsal macroducts somewhat reduced in size, but four submedian ducts on the sixth abdominal segment and two to four submarginal ducts on the fifth segment, together with an occasional intrasegmental submarginal one on the latter segment, are more or less larger; fifth abdominal segment with eight to 10 submedian macroducts; third and fourth segments each with a continuous, transverse row of macroducts across the segment; second segment with macroducts extending mesally but not into the median region; a small duct in front of the second lobe. Ventral macroducts scattered within the lateral margin on the meso- and metathorax and the first abdominal segment, on the metathorax extending mesally beyond the posterior spiracle. A sharp, sclerotized marginal process on the base of the second to fourth abdominal segments each. Antenna with two setae. Anterior spiracle with one to four disc pores. Perivulvar pores: two to four in the median group, five to eight in the anterolateral, and four or five in the posterolateral.

Specimens examined. Yang-ming Shan; southeastern Tai-pei Hsien; and Chia-i. On *Citrus*.

Distribution and host plants. This species is a well-known pest of *Citrus*, occurring widely in the tropics and other warm parts of the world. Takahashi recorded it, besides on *Citrus* spp., on *Carissa carandas* in Taiwan.

55. *Lepidosaphes beckii* (Newman)

References. Newman 1869 [*Coccus*]; Ferris 1937: 71; Balachowsky 1954e: 61.

Synonyms. *Aspidiotus citricola* Packard, 1869; *Coccus anguinus* Boisduval, 1870; *Mytilaspis fulva* Targioni, 1872; *Mytilaspis flavescens* Targioni, 1876; *Mytilaspis citricola* var. *tasmaniae* Maskell, 1897.

Diagnosis. Body robust, with the free abdominal segments well lobed laterally, and with the pygidium broad and a little invaginated between the median lobes. Pygidial lobes comparatively small. Median lobes separated from each other by a space about one-third as wide as one of them, each lobe more or less wider than long, and serrate on both sides. Second lobes much smaller, but either lobule well represented, with the apical margin slanting outwards. Median lobes with transverse basal scleroses. Marginal gland spines occurring in pairs on the pygidium; four on the third abdominal segment and three or four on the fourth well developed, but four or five on the second much shortened; metathorax with three to nine gland cones just posteriorly to the posterior spiracle, and the first abdominal segment with 16 to 20 in a submarginal transverse row. Dorsal ducts much reduced in size, but distinctly larger than the microducts of the gland spines, numerous; sixth abdominal segment with 22 to 27 ducts in a continuous submedio-submarginal band; second to fifth segments with ducts in both submedian and submarginal regions, but the first without them in the submedian region; one duct in front of the second lobe. Similar ventral ducts numerous within the lateral margin on the meso- and metathorax and the first abdominal segment, on the metathorax extending mesally to form a continuous transverse row across the segment. A small, sclerotized process is at times discernible on a slight marginal prominence on the base of the fourth abdominal segment. A submarginal dorsal boss on the first, second and fourth abdominal segments each, another boss not always distinct between the fifth and sixth abdominal segments; a pair of bosses tightly

appressed together on the prothorax. Antenna with two or three setae; microducts scattered on the head anteriorly to the antennae. Anterior spiracle with disc pores in two, inner and outer, loose clusters, the inner cluster with three or four disc pores and the outer with four or five. Perivulvar pores: six to eight in the median group, 12 to 16 in the anterolateral, and eight to 11 in the posterolateral, the disc pores in the median group usually forming a single transverse row.

Specimens examined. Kuan-tzu-ling, on *Citrus* spp.

Distribution and host plants. This species occurs widely in the tropics and other warm parts of the world, feeding on *Citrus*. It was also recorded from other plants, but it is assumed by authors that many of these records are in error. Balachowsky, however, found this species on *Elaeagnus*, *Ilex europea* and rose-tree. Takahashi recorded it on *Murraya paniculata* (= *exotica*) and *Codiaeum variegatum* as well as on *Citrus* spp. in Taiwan.

Remarks. This species is usually devoid of sclerotized marginal processes on the prepygidial abdominal segments, but is at times provided with a small one on the base of the fourth segment.

56. *Lepidosaphes cycadicola* Kuwana [Fig. 39]

References. Kuwana and Muramatsu 1931a: 651; Takahashi 1940: 26.

Diagnosis. Body robust, with the free abdominal segments well lobed laterally, and with the pygidium broad. Median lobes robust, more or less wider than long, with two to four incisions on each side, and with the apex flatly roundish; are separated from each other by a space about one-third as wide as one of them. Second lobes much smaller than the median, yet well represented; inner lobule with the apical margin slanting outwards; outer lobule much smaller than the inner. Both lobes without distinct basal scleroses. Marginal gland spines occurring in pairs on the pygidium, three to five on the third abdominal segment, and three or four on the fourth; second abdominal segment with three to six shorter gland spines within the lateral margin; metathorax with two or three gland cones just posteriorly to the posterior spiracle, and the first abdominal segment with six to 12 in a transverse submarginal row. Dorsal ducts much reduced in size, but distinctly larger than the microducts of the gland spines, numerous; 16 to 30 ducts on the sixth abdominal segment in a continuous submedio-submarginal row, with a small cluster of two or three ducts in front of the second lobe; submedian ducts numerous on the third to fifth abdominal segments, present or absent and if present few on the second; submarginal ducts numerous on the second to fifth abdominal segments, less numerous on the first. Similar ventral ducts numerous on the meso- and metathorax and the first abdominal segment, on the metathorax extending mesally to form a transverse row across the segment. A marginal prominence between the third and fourth abdominal segments, bearing a sclerotized process. A submarginal dorsal boss on the first, second and fourth abdominal segments each, and also between the fifth and sixth segments; two small bosses osculating on the prothorax. Ventral microducts scattered on the head. Antenna with two setae. Anterior spiracle with disc pores in two, inner and outer, loose clusters, the inner cluster with one to three disc pores and the outer with two to four. Perivulvar pores: six to nine in the median group, forming a single transverse row, 10 to 17 in the anterolateral, and eight to 13 in the posterolateral.



Fig. 39. *Lepidosaphes cycadicola* Kuw. Adult female (A, body; B, antenna; C, anterior spiracle; D, pygidium).

Specimens examined. Heng-chun, on *Vitex negundo* [one adult female]; Ken-ting, on *Cycas* sp.

Distribution and host plants. This species was originally described from specimens collected on *Cycas revoluta* imported from Taiwan. Takahashi found it on the same plant species in Taiwan.

Remarks. The original description of this species is so brief that the positive identification is not possible. The figures accompanying the original description may be in a partial failure to show the specific characters, lacking two or three ducts in front of the second lobe; in other pygidial characters of taxonomic importance the specimens at hand fairly agree with those figures. There are also disagreements between the original description and the specimens at hand in the numbers of the antennal setae and spiracular disc pores, but these disagreements may be less important. On the other hand, the present specimens agree well with the supplementary description given by Takahashi.

This species is evidently close to *beckii* Newman and *cupressi* Borchsenius (= *foliicola* Borchsenius). It is distinguishable from *beckii* by having less numerous gland cones and by having a cluster of two or three ducts in front of the second lobe, and from *cupressi* by having a lateral process only between the third and fourth abdominal segments and by the cluster of ducts in front of the second lobe.

57. *Lepidosaphes yoshimotoi*, n. sp. [Fig. 40]

Diagnosis. Body robust, with the free abdominal segments moderately lobed laterally, and with the pygidium broad. Median lobes comparatively small, a little wider than or as wide as long, rounded apically; are separated from each other by the width of one of them. Second lobes with the inner lobule a little smaller than the median lobe, similar in shape to the latter; outer lobule much smaller than the inner, and more or less elongate. Median lobes with basal scleroses; second lobes with basal scleroses on the inner lobule. Marginal gland spines rather short, single between the median and second lobes and also laterally to the second lobe, paired in the other segmental positions of the pygidium, four or five on the third abdominal segment, and three to five on the fourth; second abdominal segment with five to seven gland spines within the lateral margin, these gland spines are much shortened and mostly tubercular rather than conical. Gland cones rather tubercular; usually absent on the mesothorax, if present one in number; seven to 10 laterally to the posterior spiracle in a transverse row; nine to 13 on the first abdominal segment, forming a submarginal cluster. Dorsal ducts much reduced in size, but distinctly larger than the microducts of the gland spines; 13 to 21 in a submedio-submarginal row on the sixth abdominal segment; one in front of the second lobe; third to fifth abdominal segments with numerous ducts in both submedian and submarginal regions, the second with much fewer ducts, sometimes lacking ducts in the submedian region. Similar ventral ducts numerous on a broad lateral area on the meso- and metathorax, on the metathorax not extending mesally beyond the posterior spiracle. A somewhat sclerotized, robust tubercle in the posterolateral corner of the first abdominal segment, bearing one or two sclerotized processes; a similar, smaller tubercle between the second and third segments and also between the third and fourth, produced into a sclerotized process. A submarginal dorsal boss on the first to fifth abdominal segments each, and also

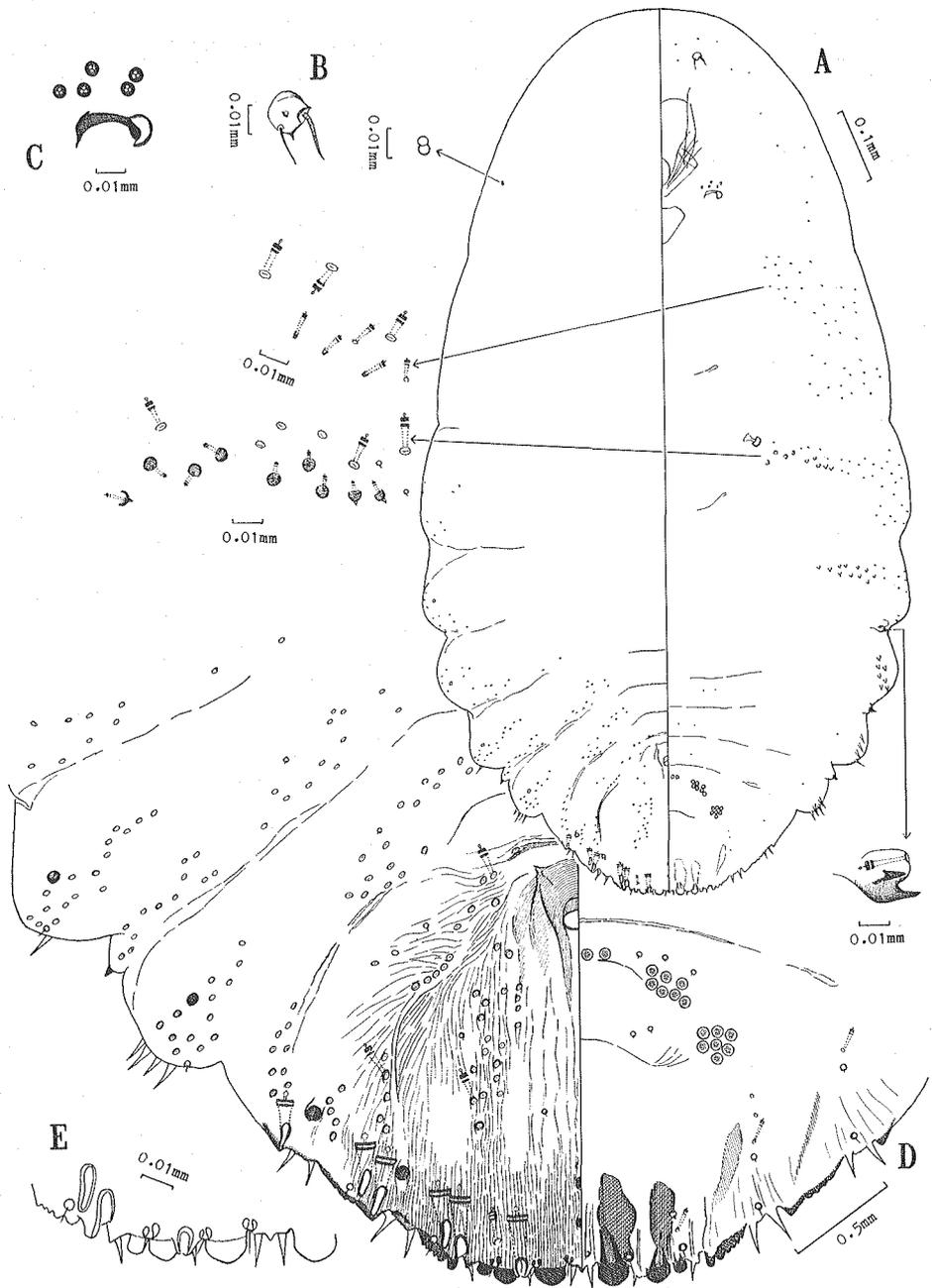


Fig. 40. *Lepidosaphes yoshimotoi*, n. sp. Adult female (A, body; B, antenna; C, anterior spiracle; D, pygidium).

between the fifth and sixth; two small bosses osculating or tightly appressed together on the prothorax; two small median bosses towards the apex of the pygidium, arranged along the median line. Antenna with two setae. Anterior spiracle with five or six disc pores in a loose cluster. Perivulvar pores: three or four in the median group, seven to 10 in the anterolateral, and six to nine in the posterolateral.

Specimens examined. A-li Shan, on the leaves of *Chamaecyparis formosensis*.

Remarks. This species is close to *beckii* Newman, *chinensis* Chamberlin, *cycadicola* Kuwana and *cupressi* Borchsenius (= *foliicola* Borchsenius) by the dorsal bosses and other characters, but is immediately distinguishable from the latter four by the median lobes smaller and widely separated from each other. All these five species form a close group, which is presumably native to eastern Asia.

58. *Lepidosaphes machili* (Maskell)

References. Maskell 1898: 230 [*Mytilaspis*]; Ferris 1942: 397; Balachowsky 1954 e: 47.

Synonyms. *Lepidosaphes tuberculata* Malenotti, 1917; *Lepidosaphes cymbidicola* Kuwana, 1925; *Lepidosaphes ezokihadae* Kuwana, 1932; *Lepidosaphes cinnamomi* Takahashi, 1933.

Diagnosis. Body robust, with the free abdominal segments moderately lobed laterally, and with the pygidium broad and little rounded. Median lobes about as wide as or a little wider than long, rounded apically, notched or serrate on each side, separated from each other by about a half width of one of them. Second lobes with either lobule much smaller than the median lobe, yet well developed; inner lobule about as long as wide, a little dilated apically, with the apical margin rounded and slanting outwards; outer lobule smaller than the inner. Median lobes with basal scleroses; second lobes with basal scleroses on the inner lobule. Marginal gland spines well developed, occurring in pairs on the pygidium except two or three on the fifth abdominal segment; three to five on the fourth; and four to seven on the third, with a submarginal group of one to six much shorter gland spines. Second abdominal segment with five to 13 short gland spines within the lateral margin. Mesothorax with one to seven gland cones far internally from the lateral margin; metathorax with five to 11 laterally to the posterior spiracle; and the first abdominal segment with 11 to 19 in a rather broad oblique submarginal row. Dorsal ducts much reduced in size, a little or hardly larger than the microducts of the gland spines; 15 to 33 on the sixth abdominal segment over a broad submedio-submarginal area; numerous in the submedian and submarginal regions on the second to fifth segments, and in the submarginal region on the first. Meso- and metathorax with similar ducts numerous within the lateral margin. A more or less sclerotized, blunt marginal process on the base of the second to fourth abdominal segments each. Head with a small, sharp, sclerotized, horn-like process on each side. Antenna with four setae. Anterior spiracle with seven to 13 disc pores. Perivulvar pores: 10 to 18 in the median group, 17 to 33 in the anterolateral, and 14 to 27 in the posterolateral.

Specimens examined. Yang-ming Shan, on *Lindera oldhamii*; Fen-chi-hu, on *Lindera communis*; A-li Shan, on an undetermined Lauraceous plant, *Daphniphyllum membranaceum* and *Stauntonia keitaoensis*; Ken-ting, on *Machilus kusanoi*.

Distribution and host plants. This species is widely distributed in eastern Asia as north as Japan, feeding on various kinds of plants, and was introduced to Europe and North America. It was originally described from specimens collected in Japan on

Machilus thunbergii and later recorded there from *Neolitsea sericea*, *Cinnamomum japonicum*, *Phellodendron amurense*, *Illicium religiosum* and other plants. In southern Japan this species is found in abundance on Lauraceous plants belonging to *Machilus* and *Cinnamomum*. Takahashi recorded it in Taiwan on *Cinnamomum camphora*, *C. kanehirai*, *Cycas revoluta* and orchids.

59. ***Lepidosaphes* sp.**

Specimens examined. Kuan-tzu-ling, on *Saurauia tristyla* var. *oldhamii* [one adult female in poor condition].

Remarks. This species is close to *machili*, but differs from the latter by having only two setae on each antenna, by having a broad row of ventral ducts across the whole segment of the metathorax, and by lacking gland cones on the meso- and metathorax (in the available specimen a single gland cone is discernible on one side of the metathorax). Since the available specimen is not in good condition I will keep from describing this species on the basis of it.

60. ***Lepidosaphes laterochitinosa* Green** [Fig. 41]

References. Green 1925: 41; Takahashi 1931b: 379 [*bladhia*]; ibid. 1935: 22 [*bladhia*]; Balachowsky 1954c: 54; Takagi 1960a: 77 [*bladhia*]; Beardsley 1966, Ins. Micronesia 6 (7); 536 [*bladhia*].

Synonyms. *Lepidosaphes bladhia* Takahashi, 1931. After Beardsley *Lepidosaphes mcgregori* Banks, 1906, may be identical with *bladhia*.

Diagnosis. Body slender, with the free abdominal segments well lobed laterally, and with the pygidium rounded. Derm at full maturity sclerotized on the mesothorax in a broad lateral area and on the metathorax less extensively (however, in many of the examined specimens including those perhaps fully grown the thoracic derm shows no trace of sclerotization). Pygidial lobes rather small. Median lobes more or less wider than long, with the apical margin well convex, and with a notch on each side not always distinct; are separated from each other by the width of one of them. Second lobes with both lobules well represented; inner lobule about as long as wide, with the apical margin slanting outwards; outer lobule smaller than the inner. Median lobes with basal scleroses; second lobes with basal scleroses well represented on the inner lobule, but much reduced on the outer lobule. Marginal gland spines well developed, occurring in pairs on the pygidium, five to eight on the second abdominal segment, four or five on the third and two to four on the fourth. Gland cones absent on the thorax; 17 to 30 on the first abdominal segment, forming a submarginal cluster. Dorsal ducts much reduced in size, practically as large as the microducts of the gland spines, but the second to fourth abdominal segments with more or less enlarged ducts strewn across the median and submedian regions and the fifth segment with some such ducts in the submedian row; sixth abdominal segment with five to 13 dorsal ducts in a longitudinal row, the seventh with two to six in a shorter row; one or rarely two ducts between the median lobes and one at the base of the second lobe more or less enlarged, with the orifice rounded and sclerotized on the rim; submarginal dorsal ducts few on the first to fifth abdominal segments. Ventral microducts numerous on the pro- and mesothorax within the lateral margin, and on the metathorax across the whole segment in a broad transverse row. A marginal tubercle on the base of the second to fourth abdominal segments each, produced into a thickly sclerotized,



Fig. 41. *Lepidosaphes laterochitinoso* Gr. Adult female (A, body; B, cephalothorax, showing the pattern of sclerotization; C, antenna; D, pygidium), figured from specimens collected on *Epipremnum mirabile*.

conical process. Head thickly strewn with minute granules. Antenna with two to four setae. Anterior spiracle with one to five disc pores loosely clustered. Perivulvar pores: two to seven in the median group, six to 11 in the anterolateral, and four to 10 in the posterolateral.

Specimens examined. Yang-ming Shan, on *Eurya japonica*; southeastern Tai-pei Hsien, on *Ardisia sieboldii*, *Camellia sinensis*, *Eurya* sp. and *Smilax* sp.; northern I-lan Hsien, on *Smilax* sp.; Kuan-tzu-ling, on *Ardisia sieboldii* and *Schefflera octophylla*; Fen-chi-hu, on *Epipremnum mirabile*; Ken-ting, on *Cycas* sp., *Machilus kusanoi*, *Ravenala madagascariensis* and an undetermined Lauraceous tree.

Distribution and host plants. This species was originally described from specimens collected under glass in England. It was described and recorded by Takahashi under the name *bladhaie* on the basis of specimens collected in Taiwan on *Agalma lutchuense*, *Ardisia* (= *Bladha*) spp., *Illicium philippinense*, *Maesa* sp., *Mangifera indica*, *Smilax china* and *Vitis* sp. Later, he recorded it, under the name *cocculi*, in Ponape, Palau and Malaya on *Cycas circinalis seemanii*, *Hevea*, *Hyophorbe verschaffeltii*, *Plumeria acuminata*, etc. Takagi recorded it under the name *bladhaie* on *Cocos nucifera* imported from the Philippines into Japan. Beardsley examined a number of specimens of this species collected in Micronesia on various plants such as *Alstonia scholaris*, *Areca catechu*, *Artocarpus communis*, asparagus, *Barringtonia asiatica*, *Bruguiera hexangula*, *Casuarina*, *Cestrum*, *Citrus*, guava, mango, manihot, *Rhizophora mucronata*, etc. This species is evidently of a wide distribution, occurring in southeastern Asia including oceanic islands. This species is one of the commonest scale insects in Taiwan.

Remarks. In my previous revision of *bladhaie* I overlooked Takahashi's supplementary description with further records of the species. Reading it I have no doubt that the present specimens as well as my previous ones are rightly identified with *bladhaie*. On the other hand, after examining a good number of specimens now available, I am very much inclined to the opinion that *laterochitinos* and *bladhaie* should be united. In many specimens including those perhaps fully grown the thoracic derm shows no trace of sclerotization, whereas in others the particular pattern of sclerotization specific to *laterochitinos* is well displayed. I have not found any other difference sufficient to allocate these two forms into distinct species. Moreover, these two forms are sometimes found mixed together in the same colonies.

61. *Lepidosaphes pitysophila*, n. sp. [Fig. 42]

Diagnosis. Body slender, with the free abdominal segments strongly lobed laterally. At maturity the derm sclerotized on the pygidium and also on the preceding segment. Pygidial lobes small. Median lobes rounded, about twice as wide as long, and separated from each other by a space about 1.5 times as wide as one of them. Second lobes with the inner lobule similar in shape to but smaller than the median lobe, and with the outer lobule smaller than the inner. Median lobes with basal scleroses well developed; second lobes with basal scleroses well developed on the inner lobule, but much shortened on the outer lobule. Marginal gland spines short, occurring in pairs on the pygidium except one on the sixth abdominal segment and one or rarely two on the fifth; four or five gland spines on the third abdominal segment, and three or four on the fourth; second abdominal segment with six to eight gland spines on the

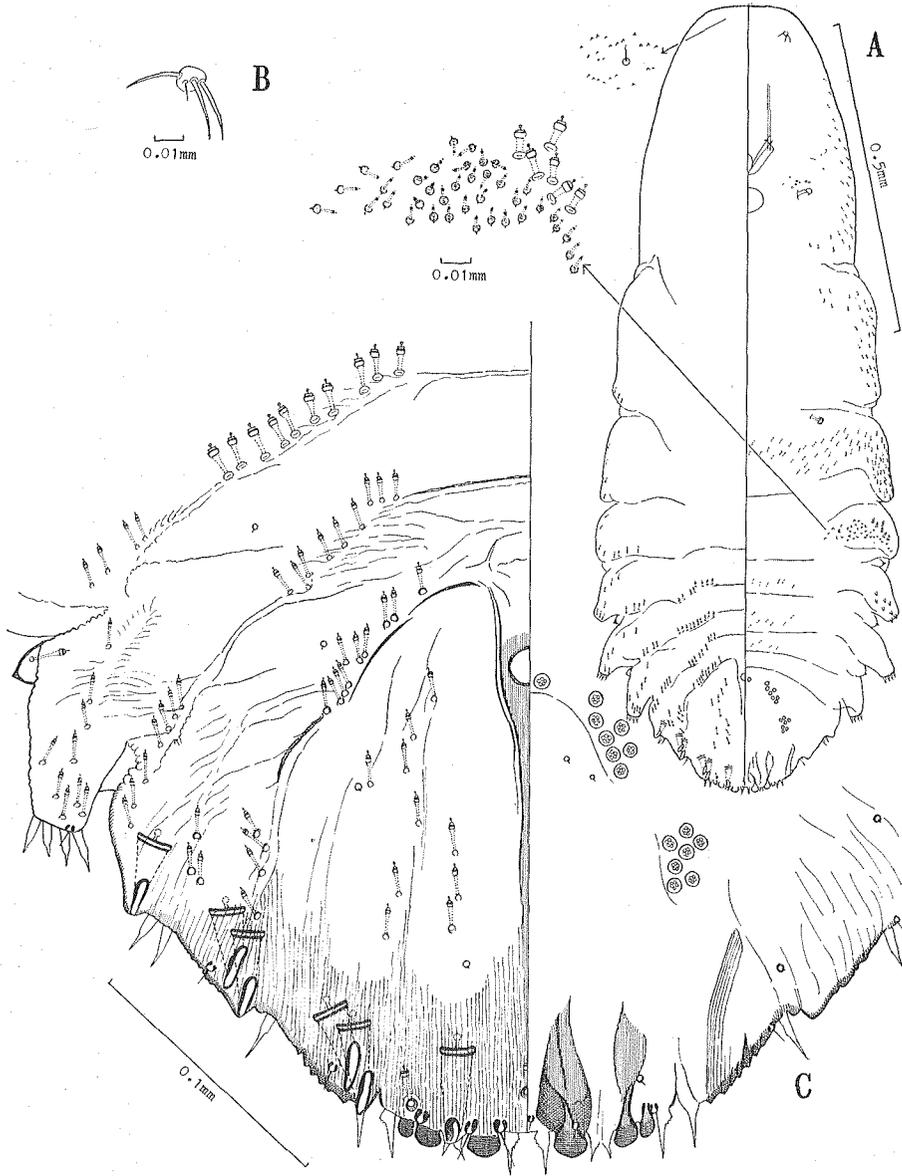


Fig. 42. *Lepidosaphes pitysophila*, n. sp. Adult female (A, body; B, antenna; C, pygidium).

lateral lobe. Gland cones absent on the thorax; 32 to 40 on the first abdominal segment, forming a thick submarginal cluster. Dorsal ducts extremely reduced in size, practically as large as the microducts of the gland spines except seven to 14 submedian ducts on the second abdominal segment and nine to 12 on the third somewhat enlarged; fourth abdominal segment with eight to 12 submedian ducts, and the fifth with five to 10; sixth abdominal segment with four to seven ducts in a long submedio-submarginal row, and the seventh with two to four in a shorter row; one duct on the base of the second lobe, at times enlarged and with the rim of the orifice sclerotized, a similar duct at times discernible between the median lobes; submarginal ducts few on the first to fifth abdominal segments. First abdominal segment with seven to nine ventral ducts in the anterolateral corner, these ducts are as large as or even larger than the submedian dorsal ducts of the second and third abdominal segments. Ventral microducts numerous on the pro- and mesothorax within the lateral margin, and on the metathorax in the lateral lobe and across the segment; are scattered across the median and submedian regions on the second to fourth abdominal segments. A marginal tubercle between the first and second abdominal segments, between the second and third, and also between the third and fourth, produced into a small sclerotized process. Head with granulations sparse within the vertical margin on the dorsal side. Antenna with three well-developed setae. Anterior spiracle with five to eight disc pores scattered anteriorly. Perivulvar pores: one to four in the median group, six to 11 in the anterolateral, and five to eight in the posterolateral.

Specimens examined. Chiao-shi, on the needles of *Pinus* sp.

Remarks. This species is very close to *laterochitinos*, from which it is distinguishable mainly by the following characters: the granulations or minute conical processes of the head are less thick than in *laterochitinos* and almost confined to the dorsal side; one or rarely two gland spines occur on the fifth abdominal segment and always one on the sixth (in *laterochitinos* a pair of gland spines occur on each of these segments); the dorsal ducts are absent in the median region of the prepygidial abdominal segments, and the submedian ducts of the second and third segments are distinctly larger than those of the fourth and fifth segments (in *laterochitinos* the dorsal ducts are strewn across the median and submedian regions of the second to fourth segments; although these ducts as well as the submedian ducts of the fifth segment are more or less enlarged, their enlargement is not always remarkable); and the dorsal ducts are usually absent between the bases of the median lobes (in *laterochitinos* one or two dorsal ducts are always present between the median lobes). This species is quite distinct from *piniphila* Borchsenius by the granulations of the head, the marginal gland spines of the pygidium, the numerous gland cones on the first abdominal segment, the presence of the submedian dorsal ducts on the second abdominal segment, the distinct enlargement of the submedian ducts on the second and third abdominal segments, etc.

62. *Lepidosaphes leei*, n. sp. [Fig. 43]

Diagnosis. Body slender, with the free abdominal segments moderately lobed laterally, and with the pygidium broadly rounded. Pygidial lobes rather small. Median lobes a little wider than long, with the apical margin well convex, and with a notch on each side; are separated from each other by the width of one of them. Second

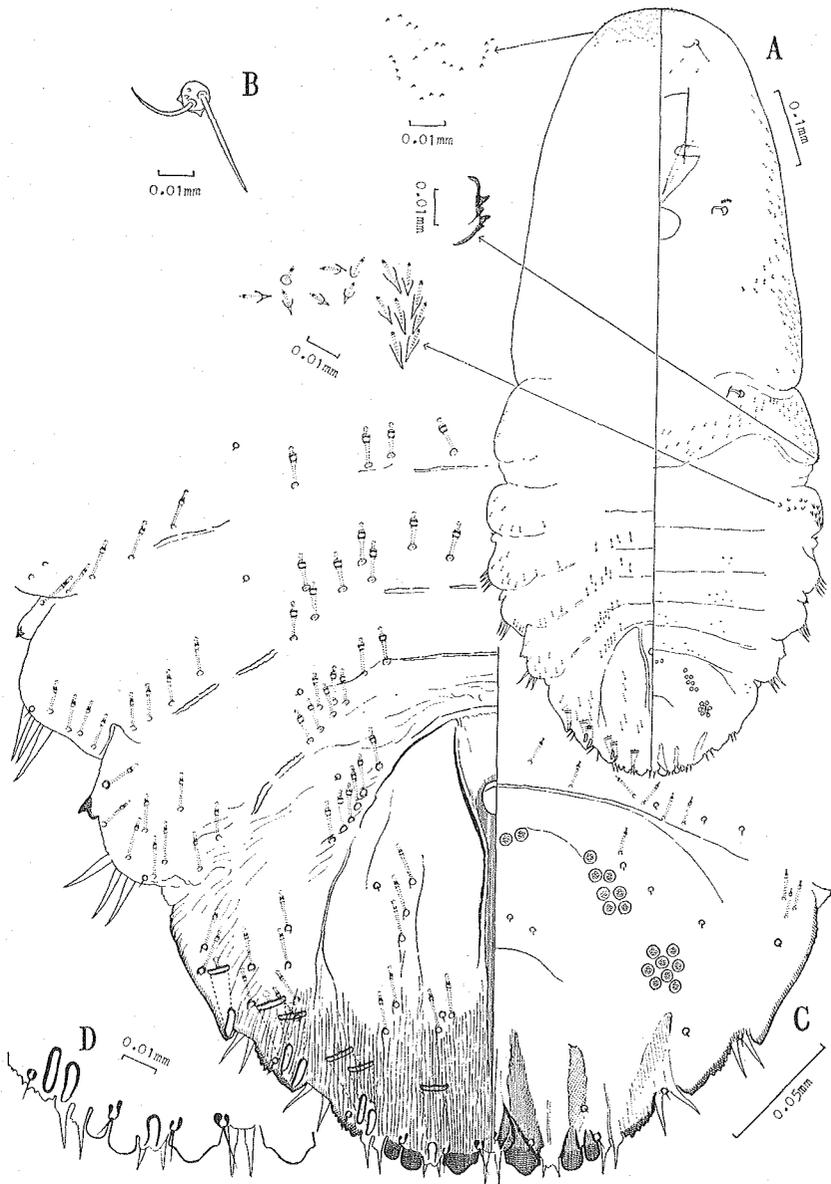


Fig. 43. *Lepidosaphes leei*, n. sp. Adult female (A, body; B, antenna; C, pygidium; D, pygidial margin).

lobes with both lobules well represented; inner lobule about as long as wide, rounded apically; outer lobule similar, but a little smaller. Median lobes with well-developed basal scleroses; second lobes with much shorter basal scleroses on either lobule. Marginal gland spines of the pygidium rather small, occurring in pairs. Prepygidial gland spines well developed on the second to fourth abdominal segments: three to eight on the second segment, three to five on the third, and two to four on the fourth; first abdominal segment with 15 to 22 gland spines, these gland spines are elongate on the margin but more or less conical or tubercular on the submarginal area. Dorsal ducts much reduced in size, practically as large as the microducts of the gland spines except the submedian ducts of the second and third abdominal segments obviously enlarged; four to seven on the sixth abdominal segment, forming a long row; two in the supposed region of seventh abdominal segment; submarginal dorsal ducts few on the first to fifth abdominal segments. Ventral microducts numerous on the pro- and mesothorax within the lateral margin, and on the metathorax in a rather broad band across the segment. A more or less sclerotized marginal tubercle between the first and second abdominal segments and also on the base of the third and fourth each, produced into a sclerotized process; another tubercle broad and low in the posterolateral corner of the metathorax, bearing some small sclerotized processes. Head rather sparsely strewn with minute conical processes within the vertical margin. Antenna with two long setae. Anterior spiracle with four or five disc pores. Perivulvar pores: two to four in the median group, four to 10 in the anterolateral, and six to eight in the posterolateral.

Specimens examined. Southeastern Tai-pei Hsien, on *Ilex formosana*; Fen-chi-hu, on *Viburnum arboricolum*; A-li Shan, on *Symplocos eriobotryaefolia*. Collected on the leaves of the host plants.

Remarks. This species is very close to *laterochitinoso*, from which it differs by the lateral tubercles of the metathorax and some other details, that is, the absence of dorsal ducts between the median lobes and in front of the second lobes, the sparse granulations of the head, the longer antennal setae, etc. By having lateral tubercles on the metathorax and some other respects this species is also related to *coreana* Borchsenius, *ussuriensis* Borchsenius and *spinulata* Borchsenius, but may be distinguishable from the latter three by having basal scleroses on the pygidial lobes.

XXV. Genus *Andaspis* MacGillivray

References. MacGillivray 1921: 275; Rao and Ferris 1952: 17; Williams 1963, Brit. Mus. (Nat. Hist.) Ent. Bul. 15: 13.

Synonyms. *Raoaspis* Borchsenius, 1967 [type-species: *Andaspis mori* Ferris]; *Pararaoaspis* Borchsenius, 1967 [type-species: *Lepidosaphes meliae* Green]; *Roonwalaspis* Borchsenius, 1967 [type-species: *Roonwalaspis quercicola* Borchsenius].

Type-species. *Mytilaspis flava* var. *hawaiiensis* Maskell.

Diagnosis. Body elongate, fusiform or nearly so, with the pygidium little rounded, of the shape of a triangle (in *kazimiae* Williams rather trapezoidal). Derm membranous in the prepygidial region (in a few species the head becomes sclerotized). Median lobes prominent, set close, strongly convergent, with the outer margin quite long, slanting and notched or serrate; basal scleroses various. Second lobes present or absent, if present various, but quite smaller than the median. Marginal gland spines

short, a pair between the median lobes quite small. Marginal macroducts of the pygidium enlarged, with the orifice thickly sclerotized on the rim, and with axis of the orifice practically perpendicular to the pygidial margin; marginal macroducts none between the median lobes, four to six laterally to the median lobe. Dorsal ducts in segmental rows, varying in size from the macroduct type to the microduct type. Prepygidial abdominal segments with or without marginal processes. Submarginal dorsal bosses present or absent. Antennal setae various in number, but usually two or more. Anal opening in the base of the pygidium. Perivulvar pores few in five groups.

Composition and distribution. In his revision of the genus Williams assigned to it a total of 22 species. Later, eight species were described in *Andaspis*, *Raoaspis* and *Roonwalaspis*. *Chionaspis ambigua* Brain and *Mytilaspis hymenantherae* Green were transferred to the present genus, and *Insulaspis madagascariensis* Mamet may be also referable to the genus. The type-species is widely distributed in the tropics, but the other species are mostly known from southeastern Asia as north as Japan. The Australian and Ethiopian regions may be included in the natural range of distribution of the genus, having some known species.

Remarks. This genus is, as a whole, very close to *Lepidosaphes*, but is distinguishable from the latter by the prominent, strongly convergent median lobes, the general tendency towards the reduction of the second lobes and marginal gland spines, and the remarkable basal scleroses of the median lobes in some species including *hawaiiensis*. Like *Lepidosaphes* this genus is diverse in the size of the dorsal ducts, but this diversity seems, in this genus, to be not always correlated with other characters and so may be of comparatively little significance in specific relationship. Borchsenius (1967, Ent. Obozr. 46: 724-734) erected *Raoaspis*, *Pararaoaspis* and *Roonwalaspis* as separations from *Andaspis*. This splitting is here not adopted, although his genera may be valid in some degree as species-groups.

63. *Andaspis crawii* (Cockerell)

References. Cockerell 1896 h: 21 [*Mytilaspis*]; Kuwana 1925 a: 15 [*Lepidosaphes*]; Rao and Ferris 1952: 18.

Synonyms. *Mytilaspis crawii* var. *canaliculatus* Maskell, 1897.

Diagnosis. Body slender, with the metathorax and free abdominal segments gently lobed laterally, and with the pygidium rather narrow. Median lobes as long as wide, serrate, separated from each other by about a half width of one of them; each lobe with a pair of quite slender, strongly convergent scleroses originated at the basal angles, and with a transverse sclerotized bar on the dorsum just in front of the base. Second lobes well developed for a member of the genus; inner lobule with the apex truncated and serrate; outer lobule quite small, conical. No trace of the third lobes. Marginal gland spines single on the pygidium except a small pair between the median lobes and one or two towards the base of the pygidium (on the fifth abdominal segment); three to five on the first abdominal segment, three or four on the second and third each, and one to three on the fourth. Five marginal macroducts on each side of the pygidium, single except a pair on the sixth abdominal segment. Dorsal ducts not reduced in size, not numerous; one present or absent just laterally to the anal opening; submedian ducts present or absent on the second and third abdominal

segments, always present on the fourth and fifth; submarginal ducts on the metathorax and the first to fourth abdominal segments. Some microducts scattered laterally to the posterior spiracle and within the vertical margin of the head; basal two abdominal segments scattered with ventral microducts across the medio-submedian region. Antenna with one or two setae; where two are present one of them is quite slender. Anterior spiracle with one or two disc pores. Perivulvar pores: three or four in the median group, six to 11 in the anterolateral, and four to nine in the posterolateral.

Specimens examined. Fen-chi-hu, on *Castanopsis kusanoi*; A-li Shan, on *Castanopsis* sp.

Distribution and host plants. This species occurs commonly in Japan on *Castanopsis cuspidata*. It was recorded by Takahashi on *Pasania uraiana* (= *Lithocarpus uraiana*) and *Castanopsis* sp. in Taiwan.

Remarks. The specimens at hand from Taiwan include two forms in regards to the number of the dorsal macroducts, especially of the submedian rows: one of these forms, which was collected on A-li Shan, has quite few submedian ducts, whereas the other, which comes from Fen-chi-hu, is distinguished by having more numerous submedian ducts (Table 3). In other respects, however, the two forms are quite identical and so are tentatively included within the same species. The form from A-li Shan agrees with the Japanese form.

TABLE 3. Number of submedian macroducts in *Andaspis crawii*.

Locality	Number of submedian macroducts					Total on one side
	Abd. II	Abd. III	Abd. IV	Abd. V	Anal	
A-li Shan	0	0-3	1-4	1-2	0	4-9
Fen-chi-hu	0-3	4-7	6-8	4-5	0-1	16-20

64. *Andaspis viticis*, n. sp. [Fig. 44]

Diagnosis. Body rather robust, with the metathorax and free abdominal segments moderately lobed laterally, and with the pygidium rather broad. Median lobes rather coarsely serrate, with the apex rounded and a little protruding; each lobe with a prominent, robust sclerosis at the outer basal angle, and with a similar, yet much smaller sclerosis at the inner basal angle, these scleroses are associated with the alveoli of the setae situated on the basal angles of the median lobe. Second lobes with the inner lobule well developed and slanting on the outer margin, and with the outer lobule much smaller than the inner, but definitely present, and conical; a robust sclerosis associated with the alveolus of the dorsal seta situated on the base of the second lobe, smaller than the outer sclerosis of the median lobe. Third and fourth lobes reduced into sclerotized marginal serrations. Marginal gland spines of the pygidium occurring in pairs, well developed except those between the median lobes and also between the median and second lobes; three to five gland spines on the second abdominal segment and three or four on each of the third and fourth segments are also well developed; first abdominal segment with 10 to 18 rather large gland cones in a submarginal cluster. Six marginal macroducts on each side of the pygidium. Dorsal ducts much reduced in size, practically as large as the microducts of the gland



Fig. 44. *Andaspis viticis*, n. sp. Adult female (A, body; B, antenna, with derm granulations; C, anterior spiracle; D, pygidium; E, pygidial lobes).

spines, scattered within the lateral margin on the meso- and metathorax and first to fifth abdominal segments, extending mesally on the second to fifth segments, on the third and fourth segments often extending into the median region to form a continuous transverse row across each of these segments; sixth abdominal segment with a longitudinal row of three to eight ducts, and the seventh with a shorter row of one to four ducts; two ducts between the bases of the median lobes and one in front of the second lobe are somewhat enlarged. Ventral microducts scattered within the lateral margin on the meso- and metathorax and the first abdominal segment, on the metathorax extending mesally beyond the posterior spiracle. A sclerotized marginal process between the first and second abdominal segments, and also on the base of the third and fourth each. Head rather sparsely strewn with granulations or minute conical processes. Antenna with two or three setae. Anterior spiracle with three to five disc pores. Perivulvar pores: four to 11 in the median group, six to 13 in the anterolateral, and five to nine in the posterolateral.

Specimens examined. Heng-chun, on the branches of *Vitex negundo*.

Remarks. This species is very close to *mori* Ferris described from China. Through the kindness of Prof. McKenzie I have had the opportunity to examine some specimens from the type material of *mori*. In my comparison the two species are distinguishable by the following features: in *viticis* the head is strewn with granulations or small conical processes, whereas in *mori* not (my phase-contrast microscopy reveals that in *mori* the head is strewn with quite minute black points, but these points are not so prominent as the granulations in *viticis*); in *mori* the prothorax is strewn with ventral microducts within the lateral margin, although these ducts are variable in number and may at times be obsolete, whereas in *viticis* the prothorax is always devoid of microducts; in *viticis* the gland cones and gland spines are less numerous on the prepygidial abdominal segments than in *mori* (in *mori* the first abdominal segment is provided with 25 to 28 gland cones on each side; the second segment with 11 to 24 gland spines; the third with eight to 12; and the fourth with six to nine); in *viticis* the basal scleroses of the median and second lobes are much more developed than in *mori*.

XXVI. Genus *Acanthomytilus* Borchsenius

References. Borchsenius 1947 a: 344; Balachowsky 1954 e: 104.

Synonyms. *Takahashiella* Borchsenius, 1964 [type-species: *Chionaspis vermiformis* Takahashi].

Type-species. *Lepidosaphes intermittens* Hall.

Diagnosis. Body elongate, fusiform (in *vermiformis* quite slender, with the lateral sides parallel). Derm membraneous except for the pygidium. Pygidial lobes in two pairs. Median lobes practically symmetrical, well separated from and parallel to each other. Second lobes smaller, with the outer lobule present or absent. Marginal gland spines of the pygidium comparatively much elongate, slender, occurring in pairs between the median lobes, between the median and second lobes, and laterally to the second lobe, otherwise if present much shortened. Marginal macroducts of the pygidium enlarged, with the orifice thickly sclerotized on the rim, and with the axis of the orifice practically perpendicular to the pygidial margin; are five in number on each side of the pygidium, single except a pair on the sixth abdominal segment, the basal-

most opened in a prominent marginal process; no marginal macroduct between the median lobes. Dorsal macroducts in segmental rows. Antennal setae various in number. Anterior spiracles with disc pores. Anal opening in the base of the pygidium. Perivulvar pores in five groups.

Composition and distribution. As here understood the genus *Acanthomytilus* is composed of some Old World species feeding on grasses of the Gramineae or Cyperaceae. The type-species was originally described from Egypt and later found at various localities in North Africa, Central Asia, etc. Another species, *sacchari* Hall, was also described from Egypt. Some other species (*arii* Kuwana; *imperatae* Kuwana; *vermiciformis* Takahashi; *graminicola* Takahashi = *Chionaspis graminicola*; *longissima* Rao = *Kuwanaspis longissima*; *miscanthi* Takahashi; *cypericola* Borchsenius) are known to occur in eastern Asia including Japan, Ryukyu, Taiwan, China and India. Also, *spinus* Borchsenius, from Central Asia, may be rightly referred to the genus, though is rather aberrant.

Remarks. Some species other than given above were also referred to *Acanthomytilus*; they are *bicuspis* Hall, *cedricola* Balachowsky and Alkan, *farsianus* Balachowsky and Kaussari, and *kurdicus* Bodenheimer. All these species may have nothing to do with the real members of the genus. *Cedricola* and *farsianus* are similar to *Pallulaspis ephedrae* Ferris; *bicuspis* is a member of *Nilotaspis* Ferris; and *kurdicus* is rather similar to *Lepidosaphes*-species.

65. *Acanthomytilus chui*, n. sp. [Fig. 45]

Diagnosis. Body rather robust, with the metathorax and free abdominal segments moderately lobed laterally, and with the pygidium broad and rather roundish. Median lobes a little wider than long, broadly rounded apically, often notched once or twice on either side, separated from each other by a space as wide as or wider than one of them, with a low, broad marginal protuberance between them; each lobe with basal scleroses rather obscure. Second lobes with the inner lobule similar in shape to the median lobe but much smaller; and with the outer lobule somewhat smaller than the inner, but obviously present, narrowing towards the apex. Third lobes reduced to mere marginal serrations. Median pair of marginal gland spines much exceeding the median lobes in length; lateral pairs each with the inner spine well elongate, and with the outer much shorter; short, basally broadened gland spines on the second to sixth abdominal segments on or just within the lateral margin, five or six on the second segment, four or five on the third, three to five on the fourth, three or four on the fifth, and two on the sixth; first abdominal segment with three to five gland cones in the lateral lobe. Submedian dorsal macroducts in distinct segmental rows, absent or one present on the second abdominal segment, three to six on the third, and five to nine on the fourth and fifth each; sixth abdominal segment with six to nine macroducts in a single submedio-submarginal row and one or two in the submarginal region laterally to the row; seventh abdominal segment with one to three macroducts in the submarginal region; submarginal macroducts occurring anteriorly as far as the first abdominal segment rather few, forming short segmental and intrasegmental rows, and on the prepygidial segments confounded with macroducts scattered within the lateral margin of those segments; metathorax also with dorsal macroducts scattered on the lateral lobe. Ventral macroducts scattered within the lateral margin on the meso-

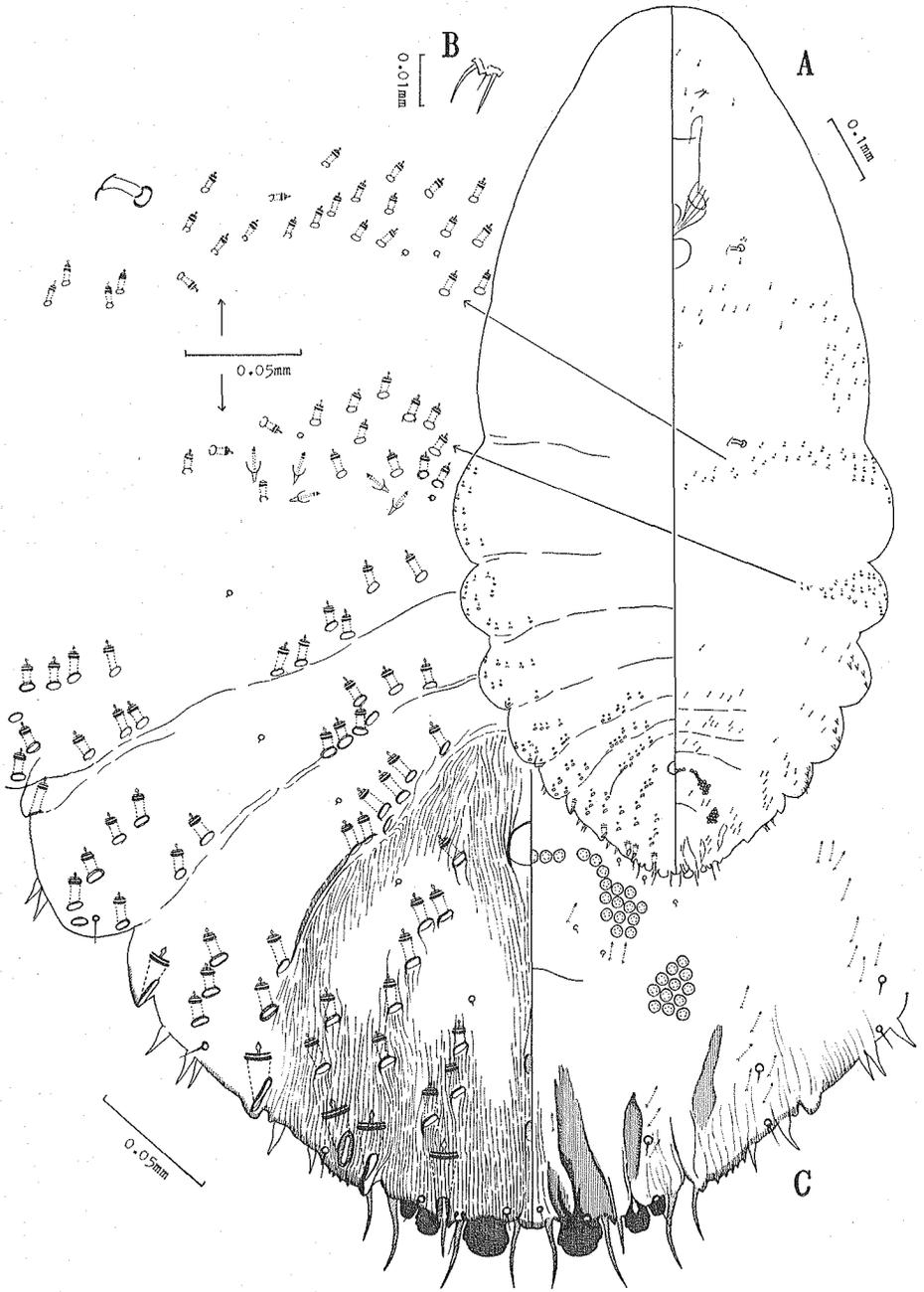


Fig. 45. *Acanthomytilus chui*, n. sp. Adult female (A, body; B, antenna; C, pygidium).

and metathorax and first abdominal segment, on the metathorax extending mesally to form a continuous transverse row across the segment. A membraneous marginal process between the second and third abdominal segments, and also between the third and fourth, with a macroduct. Antenna with two short setae. Anterior spiracle with two to four disc pores. Perivulvar pores: two to seven in the median group, 11 to 18 in the anterolateral, and nine to 13 in the posterolateral.

Specimens examined. Pei-tou and Ken-ting, on *Miscanthus*.

Remarks. This species is very close to *imperatae* Kuwana from Ryukyu, but is distinguished from the latter by the median lobes wider than long, and by the submedian dorsal macroducts distinctly separated from the submarginal ones on the prepygidial segments. In *imperatae* the median lobes are a little longer than wide, and the submedian and submarginal macroducts are confounded on the second to fourth abdominal segments.

66. *Acanthomytilus vermiformis* Takahashi [Fig. 46]

References. Takahashi 1930: 12 [*Chionaspis*].

Diagnosis. Body quite slender owing to the mesothoracic region much elongated, with the lateral sides parallel. Median lobes about as long as wide, rounded apically, notched once on each side, set parallel or slightly divergent, and separated from each other by a space about as wide as one of them. Second lobes with the inner lobule similar in shape to the median lobe, much smaller, yet well developed; outer lobule in a small, narrow process, at times obsolete. Median lobes with a pair of long basal scleroses converging anteriorly; second lobes with similar basal scleroses on the inner lobule. Pygidium with a short marginal gland spine at the base of the pygidium (on the fifth abdominal segment), and with a similar one just posteriorly to the anteriormost marginal macroduct (on the sixth abdominal segment), in addition to the long, paired gland spines towards the apex. First abdominal segment with six to nine gland cones in the submarginal region, the second and third each with three or four in the anterolateral corner, and the fourth with one to three on the lateral margin. Dorsal macroducts somewhat elongate and slender, scattered across the second to fifth abdominal segments, the sixth segment with four or five macroducts. Metathorax and the first abdominal segment with macroducts mostly on the ventral side, on the metathorax these macroducts extending mesally beyond the posterior spiracle. A robust marginal process between the fourth and fifth abdominal segments, with a macroduct opened at its blunt apex; a similar, somewhat smaller process between the third and fourth. Antenna with a long seta. Anterior spiracle with one or two disc pores. Perivulvar pores: one or two, or at times absent, in the median group, one to three in the anterolateral, and three or four in the posterolateral.

Specimens examined. Yang-ming Shan and Chia-i, on bamboo.

Distribution and host plants. This species was originally described from specimens collected in Taiwan on bamboo, and later recorded by Takahashi from Hongkong.

Remarks. This species is peculiar by the extremely elongate body and by the elongate dorsal macroducts. In other respects, however, it shows an unmistakable resemblance to the authentic species of *Acanthomytilus*. Borchsenius erected *Takahashiella* to accept this species, but I try to place it in *Acanthomytilus*.

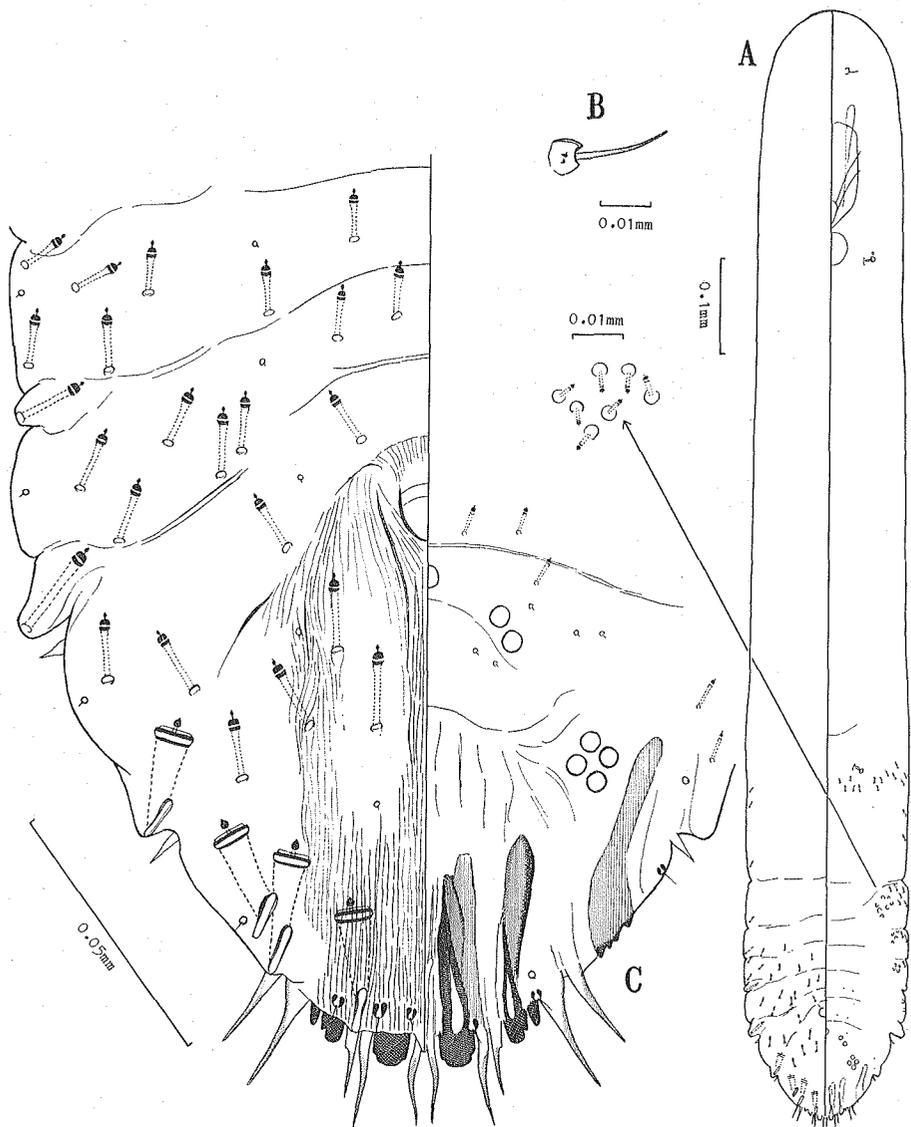


Fig. 46. *Acanthomytilus vermiformis* (Takah.).
 Adult female (A, body; B, antenna;
 C, pygidium).

XXVII. Genus *Neopinnaspis* McKenzie

References. McKenzie 1949.

Type-species. *Neopinnaspis harperi* McKenzie.

Diagnosis. Body elongate, fusiform, with the free abdominal segments lobed laterally, and with the pygidium triangular. Median lobes quite set close together, prominent, notched laterally, with the apices approached together. Second lobes set quite close to the median. Third lobes reduced. Marginal gland spines of the pygidium well developed except between the median lobes and between the median and second lobes (in the type-species the marginal gland spines are not discernible in these interlobar positions except for occasional suggestions of the presence of one or two between the median and second lobes, whereas in *travancorensis* a pair of gland spines are present in either interlobar position). Marginal macroducts of the pygidium enlarged, with the orifice thickly sclerotized on the rim, and with the axis of the orifice practically perpendicular to the pygidial margin; are six in number on each side: one on the base of the second lobe, two associated with the third lobe, two in the expected position of the fourth lobe, and one towards the base of the pygidium. Dorsal ducts small and slender, but larger than the microducts of the gland spines, tending to be arranged segmentally, the pygidium with submedian ducts laterally to the anal opening (on the sixth abdominal segment). Antenna with two setae. Anterior spiracle with disc pores few. Anal opening in the base of the pygidium. Perivulvar pores in five (or four ? in *travancorensis*) groups.

Composition and distribution. The type-species was originally described from California, but later recorded from Japan and is now found in Taiwan. Two other forms of the genus, *travancorensis* Lindinger and *miduensis* Borchsenius, are known to occur in India and China, respectively. This genus may be Asiatic in origin.

Remarks. This genus somewhat resembles *Dactylaspis* Ferris on account of the crowded median and second lobes. It is quite distinct from the latter by the arrangement of the dorsal ducts on the pygidium and by lacking lateral processes on the prepygidial abdominal segments.

67. *Neopinnaspis harperi* McKenzie [Fig. 47]

References. McKenzie 1949.

Diagnosis. Body slender, with the free abdominal segments gently lobed laterally, and with the pygidium pointed apically. Median lobes appressed together mesally, leaving a quite slender space between them, deeply notched twice on the steep outer margin. Second lobes immediately neighbouring the median; inner lobule similar in shape to but much smaller than the median, yet well developed, with a deep notch on the outer margin; outer lobule much smaller than the inner, conical. Third lobes well sclerotized, broad and coarsely dentate, with a long sclerotized bar extending to the posterolateral group of perivulvar pores. Marginal gland spines not discernible between the median lobes, but one or two short spines may at times be found between the median and second lobes; well-developed gland spines occurring laterally to the second lobe as far as the third abdominal segment. First abdominal segment with eight or nine sclerotized gland cones in the submarginal region, and the second with three or four within the lateral margin. Dorsal ducts scattered across the third to

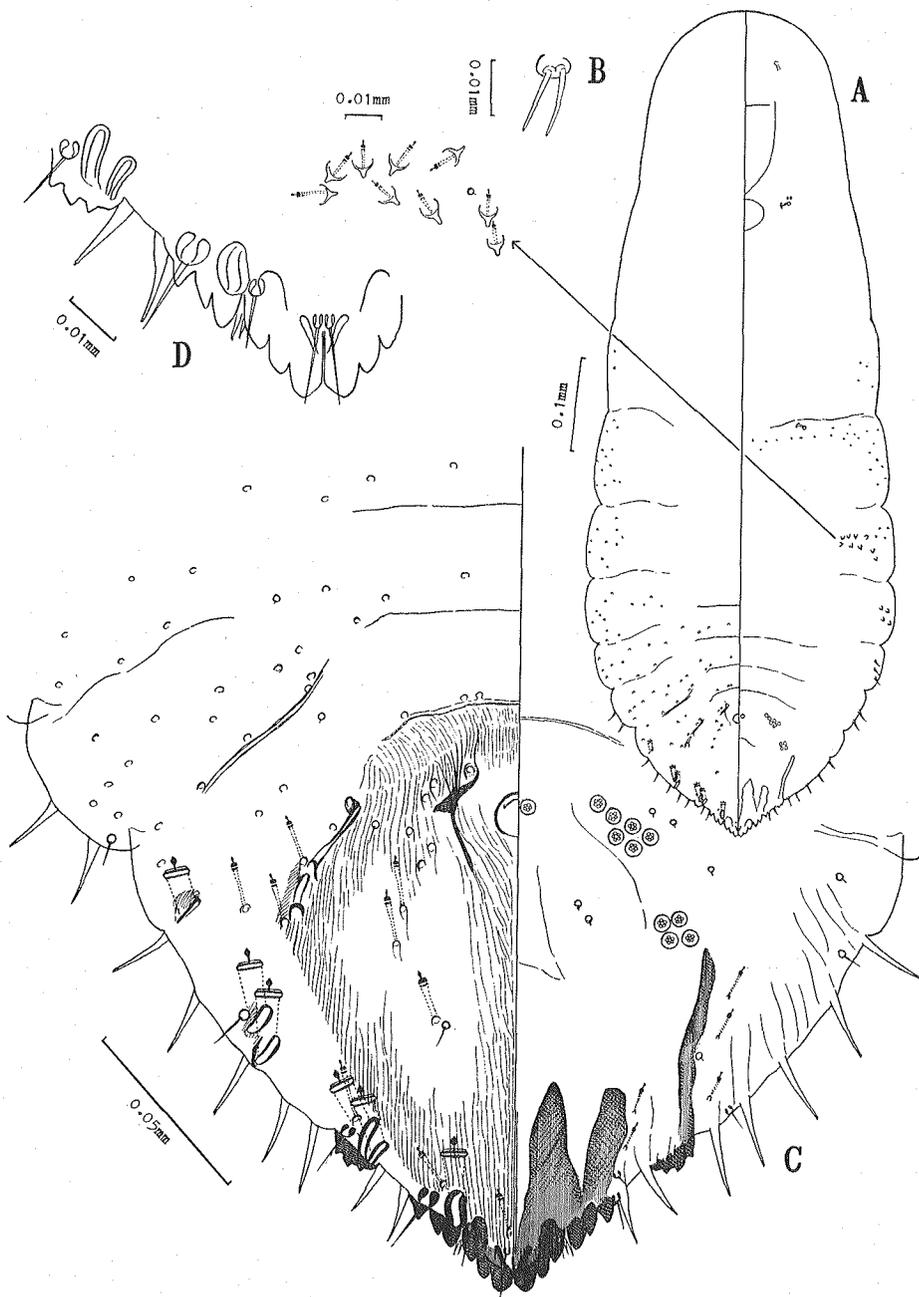


Fig. 47. *Neopinnaspis harperi* McK. Adult female (A, body; B, antenna; C, pygidium; D, pygidial lobes).

fifth abdominal segments, also scattered within the lateral margin on the preceding segments as far as the mesothorax, the sixth segment with seven or eight ducts flanking the anal opening and also with an isolated duct in the submarginal region. Similar ventral ducts scattered across the whole metathorax. Antenna with two short, thickened setae. Anterior spiracle with two disc pores. Perivulvar pores: two in the median group, six in the anterolateral, and four in the posterolateral.

Specimens examined. Chia-i, on *Hibiscus rosae-sinensis* [one adult female].

Distribution and host plants. This species was originally described from specimens collected in California on many various plants. Later, it was recorded from Japan.

Remarks. This species is here recorded from Taiwan for the first time. I have compared the available specimens collected in California, Japan and Taiwan, and have convinced that all these specimens belong to the same species.

XXVIII. Genus *Howardia* Berlese and Leonardi

References. Berlese and Leonardi 1896 : 347; Ferris 1937 : 64; Balachowsky 1954 e : 250.

Synonyms. *Megalodiaspis* Paoli, 1916 [type-species: *Chionaspis biclavis* Comstock].

Type-species. *Chionaspis biclavis* Comstock.

Diagnosis. Body robust, with the free abdominal segments strongly lobed laterally, and with the pygidium triangular (in the type-species the body is broad and turbinate, but in *stricklandi* Williams narrower and fusiform). Derm well sclerotized in the pygidium; in the type-species the cephalothorax and basal two abdominal segments also sclerotized at maturity. Median lobes prominent, set close, appearing to be strongly convergent, with the outer margin long, slanting and serrate; each lobe with a slender transverse sclerosis arising at either basal corner, and also with a quite prominent sclerosis at the inner basal corner, this sclerosis extending anteriorly and ended in a remarkable knob. Second lobes reduced or even obsolete. Third and fourth lobes in prominent marginal serrations, the fifth also more or less developed. Marginal gland spines in a short pair between the median lobes and also between the median and second, well developed and multiple laterally to the second lobe as far as the second abdominal segment. Marginal macroducts not differentiated on the pygidium, all the ducts on the dorsum belonging to a single type and quite reduced in size, yet somewhat larger than the microducts of the gland spines, with the orifice rounded and sclerotized on the rim; in the type-species the dorsal ducts tend to be arranged in segmental rows, but in *stricklandi* are mostly restricted within the margin. A sclerotized marginal process towards the base of the second to fourth abdominal segments each. Antenna with many setae. Both pairs of spiracles with disc pores. Anal opening in the base of the pygidium. Perivulvar pores absent.

Composition and distribution. The type-species is widely distributed in the tropics and subtropics. Another species, *stricklandi* Williams, was described from eastern Africa. We have no other species authentically referable to the genus.

Remarks. Admitting its similarity to lepidosaphedines, Balachowsky still referred this genus to his group of the Diaspidina on account of the broad body of the type-species. The discovery of *stricklandi* with a narrower, fusiform body threw light to the position of the genus. This genus may, as stated by Williams (1960 c : 391), be rightly allocated to the Lepidosaphedini, having some relationship with the Groupe II

of the *Lepidosaphedina* of Balachowsky. The median lobes of the pygidium of this genus are quite similar in shape to those of *Andaspis*, and the first instar larvae of these genera are also much alike by having a pair of enlarged lobes on the posterior end of the body. The difference between the two genera is nevertheless great in the marginal ducts of the pygidium, so that it is doubtful that the two are really closely related.

68. *Howardia biclavis* (Comstock)

References. Comstock 1883: 98 [*Chionaspis*]; Ferris 1937: 65; Balachowsky 1954c: 250.

Diagnosis. Body turbinate, broadest across the mesothoracic region, with the free abdominal segments strongly lobed laterally, and with the pygidium broad. Derm sclerotized at maturity in the cephalothorax and basal two abdominal segments. Median lobes as in the description of the genus. Second lobes present, but reduced each into a small conical process. Marginal gland spines well developed laterally to the second lobe as far as the second abdominal segment: six to 10 on the second and third abdominal segments each, seven to nine on the fourth, four to seven on the base of the pygidium between the fourth and fifth lobes, three to five between the third and fourth lobes, and three or four between the second and third. Metathorax with four to seven gland cones scattered laterally to the posterior spiracle, and the first abdominal segment with five to 12 in a submarginal row. Dorsal ducts numerous within the pygidial margin and in a broad laterobasal region of the pygidium (on the supposed fifth and sixth abdominal segments), on the supposed mesal margin of the sixth abdominal segment forming a long submedio-submarginal row; second to fourth abdominal segments with dorsal ducts on the lateral lobes, and with some extending mesally to form submarginal rows; third to fifth abdominal segments with ducts in the submedian region. Similar ventral ducts within the lateral margin on the meso- and metathorax and the first abdominal segment; ventral microducts (which are obviously distinguished in size from the lateral ventral ducts) on the pro-, meso- and metathorax and the first abdominal segment, forming a submarginal cluster on each of these segments. Antenna with six setae. Anterior spiracle with nine to 12 disc pores, and the posterior with three to seven.

Specimens examined. Chia-i, on *Lacuma nervosa*.

Distribution and host plants. This species is widely distributed in the tropics and subtropics and also found in greenhouses in the temperate region, feeding on various kinds of plants.

Tribe **Diaspidini***

XXIX. Genus *Diaspis* Costa

References. Costa 1835: 19; Ferris 1937: 31; Balachowsky 1954c: 173.

Synonyms. *Umbaspis* MacGillivray, 1921 [type-species: *Diaspis regularis* Newstead]; *Ferisidiaspis* Bodenheimer, 1951 [type-species: *Diaspis syriaca* Lindinger]. Balachowsky treats *Umbaspis* as a distinct genus, which is African in origin.

* This tribe appears at first glance quite heterogenous in its generic composition, but the bulk of the genera form a continuous series passing through evolutionary stages. So far as the genera studied in this paper are concerned there may be recognized three main infratribial groups:

(Continued to next page)

Type-species. *Diaspis calyptroides* Costa = *Aspidiotus echinocacti* Bouché.

Diagnosis. Body in most species subcircular or rather pyriform, slightly swollen in the prosoma, with the free abdominal segments moderately lobed laterally, and with the pygidium broad, little roundish except apically. Derm membraneous except for the pygidium. Pygidial lobes well developed in three pairs. Median lobes non-zygotic, separated from each other by a distinct space, divergent or parallel, with a pair of marginal setae between them. Second lobes bilobulate, with both lobules well represented (in certain species with the outer lobule reduced). Third lobes usually similar to the second in shape and size. Fourth lobes more or less reduced and modified, yet sclerotized. Marginal gland spines well developed on the pygidium and also on the preceding two segments, absent between the median lobes, single just laterally to each of the median to third lobes. Marginal macroducts with the orifice longitudinally narrow, one between the median lobes and also between the median and second, two associated with the third and fourth lobes each (on the sixth and fifth abdominal segments), and one on the fourth abdominal segment associated with a sclerotized, conical process; additional marginal macroducts may occur laterally to the conical process. Similar dorsal macroducts in the submarginal region of the pygidium. Smaller dorsal macroducts scattered or practically so submarginally; similar submedian dorsal macroducts present or absent. Antenna with a seta. Anterior spiracle with disc pores. Anal opening situated more or less posteriorly to the centre of the pygidium. Perivulvar pores in five groups.

Composition and distribution. As restricted in the recent sense the genus *Diaspis* is primarily of the New World (Ferris l. c.), whereas certain species appear to be native to the Old World. Many species are mainly tropical and subtropical in distribution, and some occur also under glass widely in the world.

Remarks. None of the genuine species of the genus is native to the fauna of Taiwan, only two introduced species, *boisduvalii* and *bromeliae*, having been known to occur in the island. Takahashi described or recorded the following species from Taiwan as members of *Diaspis*.

1) *boisduvalii* Signoret. Not collected.

1. *Diaspis*-group. This group is composed of *Diaspis* and some other genera, in which the median lobes are distinctly separated from each other, with a marginal macroduct or a pair of gland spines (or with both) between them. This group may be not native to the fauna of Taiwan. *Unaspis*, *Thysanoflorinia* and *Epiflorinia* are rather close to this group in their evolutionary stages. *Kuwanaspis* and *Megacanthaspis* are also similar to this group in their evolutionary stages, though are quite peculiar.

2. *Fiorinia*-group. This group includes *Fiorinia*, *Pseudaulacaspis* and *Achionaspis*, in all of which the median lobes are zygotic, with a pair of distinct marginal setae between their bases. The former two genera have a good number of native species in Taiwan.

3. *Chionaspis*-group. This group comprises *Chionaspis*, *Greenaspis*, *Aulacaspis*, *Pinnaspis*, *Afiorinia* and *Ichthyaspis*, in all of which the median lobes are zygotic, without distinct marginal setae between them. In the general trend of the family towards the reduction of the ninth abdominal segment this group is quite advanced; in some species belonging to the group the median lobes are entirely fused together. *Aulacaspis* and *Pinnaspis* are richly represented in the fauna of Taiwan. The genus *Duplachionaspis* has some resemblance to the genera of this group, but may be not rightly included here; it may be intermediate between the *Diaspis*-group and the other two groups.

- 2) *bromeliae* Kerner.
- 3) *cinnamomicola* Takahashi, *machilicola* var. A species of *Chionaspis*. Not collected.
- 4) *gordoniae* Takahashi. Later united with *manii* Green by Takahashi.
- 5) *machili* Takahashi. Referred to *Chionaspis*.
- 6) *machilicola* Takahashi. A species of *Chionaspis*. Not collected.
- 7) *major* Cockerell. A species of *Pseudaulacaspis*. Not collected.
- 8) *manii* Green. Not a species of *Diaspis*. Not collected.
- 9) *pentagona* Targioni. Type-species of *Pseudaulacaspis*.

69. ***Diaspis bromeliae*** (Kerner)

References. Kerner 1778 [*Coccus*]; Ferris 1937: 33; Balachowsky 1954 e: 182.

Diagnosis. Median lobes divergent, longer than wide, with the inner margin serrate, and with the apex flatly roundish. Second lobes with both lobules more or less elongate and slightly dilated apically, the outer lobule a little shorter than the inner. Third lobes similar to the second in both shape and size. Fourth lobe in a broad sclerotized process, serrate on the slanting outer margin. Median lobes and the lobules of the second and third lobes each with a pair of slender basal scleroses. Second abdominal segment with two or three marginal gland spines, the third and fourth each with four or five, and the fifth (between the fourth lobe and the marginal conical process) with two. Gland cones scattered submarginally: one to four on the mesothorax, and four to six on each of the metathorax and the first abdominal segment. Two or three additional marginal macroducts laterally to the conical process. Large submarginal macroducts, which are identical with the marginal macroducts in size, are scattered along the whole pygidial margin, six to eight in number on one side; 15 to 24 smaller macroducts scattered on the second abdominal segment to the base of the pygidium in a broad band within the margin. First and third abdominal segments each with a submarginal dorsal boss towards the posterolateral corner: a pair of smaller bosses tightly appressed together on the prothorax. Prosomatic tubercles absent. Anterior spiracle with 11 to 23 disc pores in a compact cluster; posterior spiracle with some microducts scattered just posteriorly. Perivulvar pores: eight or nine in the median goup, 15 to 21 in the anterolateral, and 14 to 17 in the posterolateral.

Specimens examined. Chu-chi, on pine-apple.

Distribution and host plants. This species is widely distributed in the tropics and subtropics and is also commonly found under glass in the temperate region. Although many plants belonging to various families were recorded as its hosts in the past, it is now generally accepted that this species feeds mainly on Bromeliaceous plants.

XXX. Genus ***Unaspis*** MacGillivray

References. MacGillivray 1921: 308; Rao 1949; Balachowsky 1954 e: 288.

Synonyms. *Graphaspis* MacGillivray, 1921 [type-species: *Chionaspis permutans* Green]; *Ametrochaspis* MacGillivray, 1921 [type-species: *Chionaspis flava* Green]; *Prontaspis* MacGillivray, 1921 [type-species: *Chionaspis citri* Comstock].

Type-species. *Chionaspis acuminata* Green.

Diagnosis. Body elongate, fusiform or nearly so, with the free abdominal segments

distinctly lobed, and with the pygidium more or less rounded along the margin. Prepygidial derm membranous, or sclerotized throughout on the cephalothorax and the first abdominal segment. Pygidial lobes in three pairs. Median lobes non-zygotic, in some species parallel and separated from each other by a good space, but in others set close basally and divergent. Second lobes bilobulate, with both lobules well developed. Third lobes similar to the second in both size and shape. Marginal gland spines developed, absent between the median lobes. Marginal macroducts of the pygidium practically as large as the dorsal macroducts, one between the median and second lobes (on the seventh abdominal segment), paired on the fourth to sixth abdominal segments each. Dorsal macroducts numerous and scattered on the whole pygidium; prepygidial macroducts also scattered or tending to be distributed segmentally. Antenna with two or more setae. Anterior spiracle with disc pores, the posterior with or without them. Anal opening situated more or less anteriorly to the centre of the pygidium. Perivulvar pores present or absent.

Composition and distribution. In his revision of the genus Rao referred to it a total of eight species, which are definitely centred in eastern Asia from India to Japan. Later two species, *rousseti* Balachowsky and *aesculi* Takahashi were described from Thailand and Japan, respectively. *Chionaspis assimilis* Maskell from Australia and *Coccomytilus kanoi* Takahashi from Lan Yu (Botel Tobago) were also referred to the genus by Borchsenius in his Catalogue of the Armoured Scale Insects (1966).

Remarks. So far as I am aware, only one species, *turpiniae* Takahashi, has been known to occur in Taiwan. In the present collection is found the following species.

70. *Unaspis aei*, n. sp. [Fig. 48]

Diagnosis. Body rather robust, with the free abdominal segments moderately lobed laterally, and with the pygidium rounded along the margin. Derm membranous except for the pygidium. Median lobes comparatively small, subparallel or slightly divergent, longer than wide, rounded apically, separated from each other by a little less than the width of one of them. Second and third lobes each with both lobules rather similar to the median lobes, and with the outer lobule a little shorter than the inner. Fourth and fifth lobes reduced to marginal serrations. Median lobes each with a pair of slender basal scleroses converging anteriorly; second and third lobes with similar basal scleroses on the inner lobule. Marginal gland spines occurring in pairs on the pygidium except two or three towards the base of the pygidium. Metathorax with three to seven gland cones laterally to the posterior spiracle, and first abdominal segment with 12 to 19 in the lateral lobe; somewhat larger, elongate-conical gland spines on the succeeding two segments just within the lateral margin: six to 10 on the second abdominal segment, and four to eight on the third. Dorsal macroducts rather numerous on the pygidium, scattered within the lateral margin to the submarginal region on the prepygidial abdominal segments; submedian ducts occurring as far as the first abdominal segment, remarkably reducing in size towards the anterior; median ducts on the second to fifth abdominal segments, often confounded with the submedian ducts, forming together a practically continuous transverse rows across the segments, those on the second and third segments quite reduced in size and sometimes few or even obsolete. Ventral macroducts scattered on the mesothorax within the lateral margin, with some microducts just mesally to

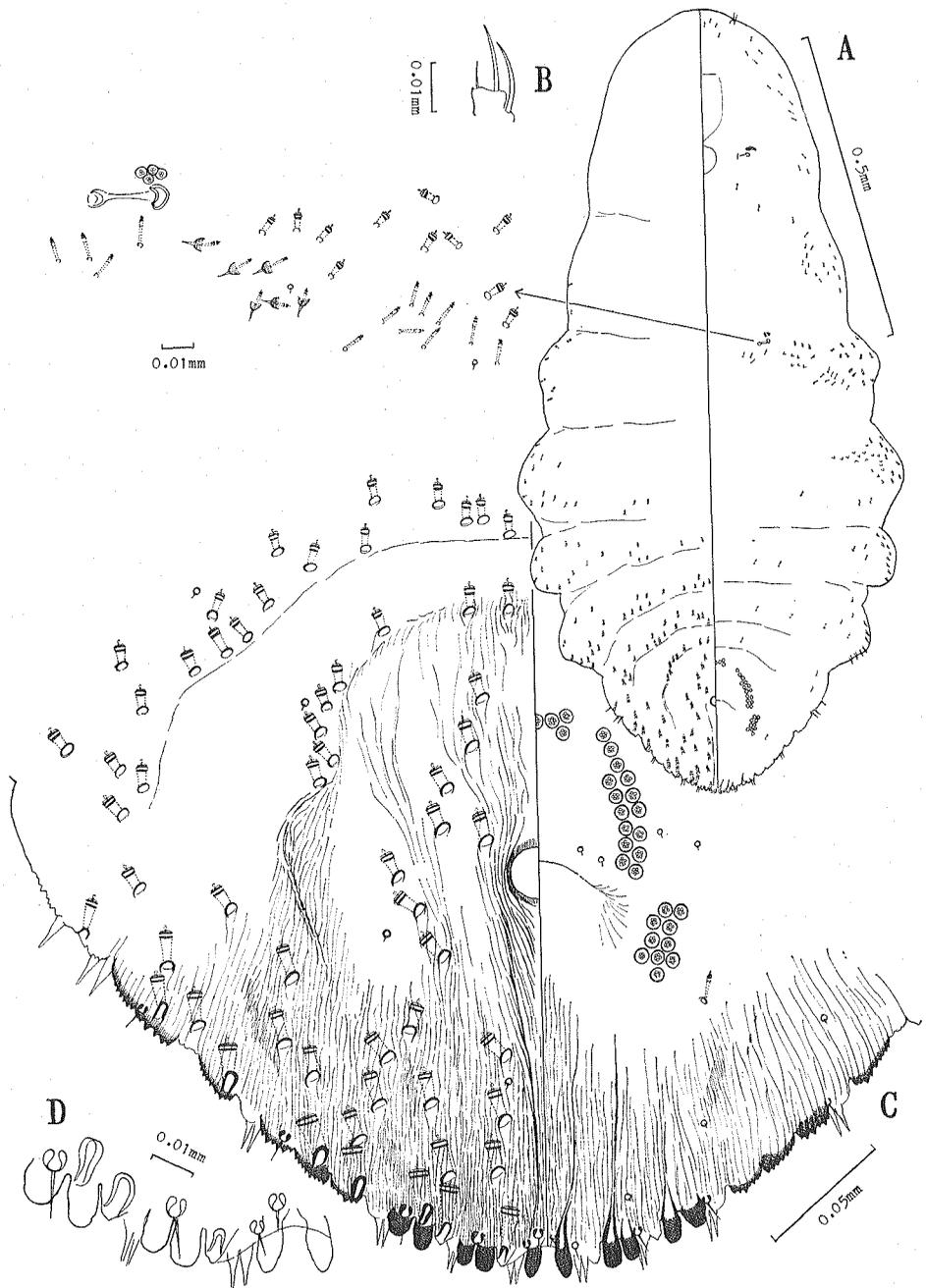


Fig. 48. *Unaspis aei*, n. sp. Adult female (A, body; B, antenna; C, pygidium; D, pygidial lobes).

them; scattered on the metathorax between the spiracle and the lateral margin, with microducts just posteromesally to them; and scattered also on the first abdominal segment on the lateral lobe. Antenna with three setae, of which one or two are thickened. Anterior spiracle with eight to 12 disc pores in a compact cluster; posterior spiracle with a smaller cluster of three to six disc pores. Perivulvar pores present, five to 12 in the median group, 11 to 15 in the anterolateral, and nine to 12 in the posterolateral. Scale brown, broadened posteriorly, well convex dorsally, with a slight median ridge.

Specimens examined. A-li Shan, on the leaves of *Euonymus echinatus*.

Remarks. This species comes closest to *euonymi* Comstock, from which it is distinguished by the median lobes narrower and by having median dorsal ducts on the second to fifth abdominal segments.

XXXI. Genus *Thysanoflorinia* Balachowsky

References. Balachowsky 1954e: 312.

Type-species. *Fiorinia nephelii* Maskell.

Diagnosis. Pupillarial. Body oval, with the free segments little lobed laterally, and with the pygidium triangular in outline. Derm membranous except for the pygidium. Median lobes prominent, sunken in a broad apical recess of the pygidium, distinctly non-zygotic, being separated from each other by a good space, with a pair of marginal setae between them. Second lobes quite reduced. Marginal gland spines small and few, absent between the median lobes. Dorsal ducts quite reduced in size and scattered within the pygidial margin; differentiated marginal macroducts absent. Antenna with one or two setae. Anterior spiracle with a few disc pores. Anal opening situated about the centre of the pygidium. Perivulvar pores absent.

Second instar female similar to the adult female in the general outline of the pygidium, but with the second lobes well represented and bilobulate, marginal gland spines well developed, and marginal macroducts differentiated. First instar larva with a marginal series of prominent setae around the whole body; antennae 6-segmented.

Composition and distribution. This genus was established to include only the type-species, which is widely distributed in the world but may be native to south-eastern Asia.

Remarks. This genus has nothing to do with *Fiorinia* on account of the median lobes which are distinctly non-zygotic in both of the adult and second instar females. It is particularly characterized in the first instar by having prominent marginal setae. *Greenaspis* MacGillivray is the only other genus known to me, which has such setae around the body in the first instar. A close relation between *Thysanoflorinia* and *Greenaspis* is, however, doubtful, since the two differ in the median lobes of the adult and second instar females. *Tulefiorinia* Mamet has also such enlarged marginal setae in the first instar, which are, however, confined to the abdomen.

71. *Thysanoflorinia nephelii* (Maskell)

References. Maskell 1897a: 242 [*Fiorinia*]; Ferris 1936: 5 [*Fiorinia*]; Balachowsky 1954e: 314.

Synonyms. *Fiorinia hirsuta* Marchal, 1906.

Diagnosis. Median lobes produced out of the apical recess of the pygidium,

separated from each other by about the width of one of them, divergent, serrate on the inner margin, which is much longer than the outer margin, the apex rounded. Second lobe reduced into a point. One marginal gland spine between the median and second lobes, scarcely extending beyond the apex of the median lobe; one on the supposed third to fifth abdominal segments each, broadened basally and somewhat conical. Dorsal ducts slightly larger than the microducts of the gland spines; a pair of ducts usually present between the bases of the median lobes; about seven to nine scattered on each side of the pygidium laterally to the median lobe. Antenna with one or two short, thickened setae. Anterior spiracle with one or two disc pores.

Second instar female with the second lobes small, yet distinct; inner lobule well represented, with a pair of slender basal scleroses; outer lobule in a point. Third and fourth lobes in slight marginal serrations. Marginal gland spines well developed, one laterally to the median to third lobes each, paired on the preceding five segments (first to fifth abdominal segments). Four single marginal macroducts on each side of the pygidium.

Specimens examined. Northern I-lan Hsien; Chia-i; and Kenting, all on *Euphoria longana*.

Distribution and host plants. This species was originally described from Hong-kong as a feeder of *Euphoria longana* (= *Nephelium longana*) and later recorded on the same plant species in Taiwan, Australia, Brazil, and Algeria. Takahashi recorded it in Taiwan on *Litchi chinensis* too.

XXXII. Genus *Duplachionaspis* MacGillivray

References. MacGillivray 1921: 307; Balachowsky 1954 e: 374.

Synonyms. Balachowsky suppressed *Nelaspis* Hall, 1946 [type-species: *Chionaspis exalbida* Cockerell] as a synonym of *Duplachionaspis*, but this synonymy is here not accepted.

Type-species. *Chionaspis graminis* Green.

Diagnosis. Body elongate, fusiform, with the free abdominal segments gently lobed laterally, and with the pygidium triangular or a little roundish. Derm membraneous except for the pygidium. Pygidial lobes well developed in two pairs. Median lobes more or less divergent, their bases set close, sometimes almost in contact, but never united by a distinct connecting sclerosis (zygosis). Second lobes bilobulate. Marginal gland spines well developed, absent between the median lobes. One marginal macroduct between the median and second lobes, two laterally to the second lobe (on the sixth abdominal segment), two on the fifth abdominal segment, and one or two on the fourth. Dorsal macroducts as large as the marginal macroducts, arranged in distinct segmental submedian and submarginal rows, the sixth abdominal segment with submedian macroducts only, the succeeding segments lacking dorsal macroducts. In many species dorsal microducts are scattered anteriorly to the macroducts in both submedian and submarginal regions, sometimes replacing part of the macroducts. Antenna with a seta. Anterior spiracle with disc pores, the posterior with or without them. Anal opening situated about the centre of the pygidium. Perivulvar pores in five groups.

Composition and distribution. This genus is composed of 27 or so known species mostly from the Old World. The type-species was described from Ceylon, whereas many other species are known from Africa, Madagascar, the Mediterranean Region

and Central Asia. Five North American species were referred to the genus, but four of them are members of *Haliaspis* Takagi.

Remarks. As here understood this genus is primarily of the Old World in distribution, belonging probably to the Old World stock of *Dentachionaspis* MacGillivray, *Getulaspis* Balachowsky and other genera, in all of which the median lobes are set close basally but not connected through a distinct zygotis. As a whole this genus is a group of grass-feeding species occurring on Gramineae or other Monocotyledons, although certain species feed on Chenopodiaceae. In Taiwan two species of the genus, *divergens* and *stanotophri*, were recorded, but the latter species is not available for the present study.

72. *Duplachionaspis divergens* Green [Fig. 49]

References. Green 1899 a: 123 [*Chionaspis graminis* var.]; Kuwana 1928: 10 [*Chionaspis miscantheae*]; Takagi 1961: 24 [*miscantheae*].

Synonyms. *Chionaspis miscantheae* Kuwana, 1928.

Diagnosis. Median lobes well divergent, almost in contact at their extreme bases, rounded apically. Second lobes with both lobules well represented; inner lobule about as long as wide, rounded apically, with a pair of short basal scleroses; outer lobule somewhat smaller. Third lobes merged into the pygidial margin. Marginal gland spines occurring in a pair between the median and second lobes, between the second and third, and also laterally to the third, always single on the preceding segment (fifth abdominal segment), two to four on the base of the pygidium (fourth abdominal segment.) Second abdominal segment with four to nine short gland spines on the lateral lobe, and the third with five to seven within the lateral margin. Submedian dorsal macroducts on the third to sixth abdominal segments: about two to four on the third to fifth segments each, and one or two on the sixth; submarginal macroducts on the third to fifth abdominal segments, forming single rows: six to 11 on the third segment, four to seven on the fourth and one to four on the fifth. Somewhat smaller macroducts scattered within the lateral margin on the second and third abdominal segments. Dorsal microducts few in the submedian region on the basal two or three segments of the abdomen, and in the submarginal region on the basal two segments. Anterior spiracle with about eight to 10 disc pores in a compact cluster, the posterior with four to nine. Perivulvar pores: six to 16 in the median group, 17 to 28 in the anterolateral, and 13 to 17 in the posterolateral.

Specimens examined. Yeh-liu, on *Arundo formosana*.

Distribution and host plants. This species was originally described from Ceylon as a feeder of *Andropogon nardus*, and later recorded from India and northern Australia. Takahashi recorded it, under the name *Chionaspis graminis* var. *divergens*, in Taiwan on *Spinifex littoreus*, and in Thailand. He also recorded "*Chionaspis graminis*" in Taiwan on *Zoisia matrella*: this record may in reality refer to the present form *divergens*, since no authentic record of *graminis* has been made outside Ceylon. It is the opinion here adopted that *Chionaspis miscantheae* Kuwana, originally described from Japan as a feeder of *Miscanthus sinensis*, is identical with *divergens*. As here understood the present species is widely distributed in Asia, feeding on various Gramineae.

Remarks. The identification of the present form with *divergens* is not easy since Green's description is brief, and moreover, the specimens at hand from both Taiwan

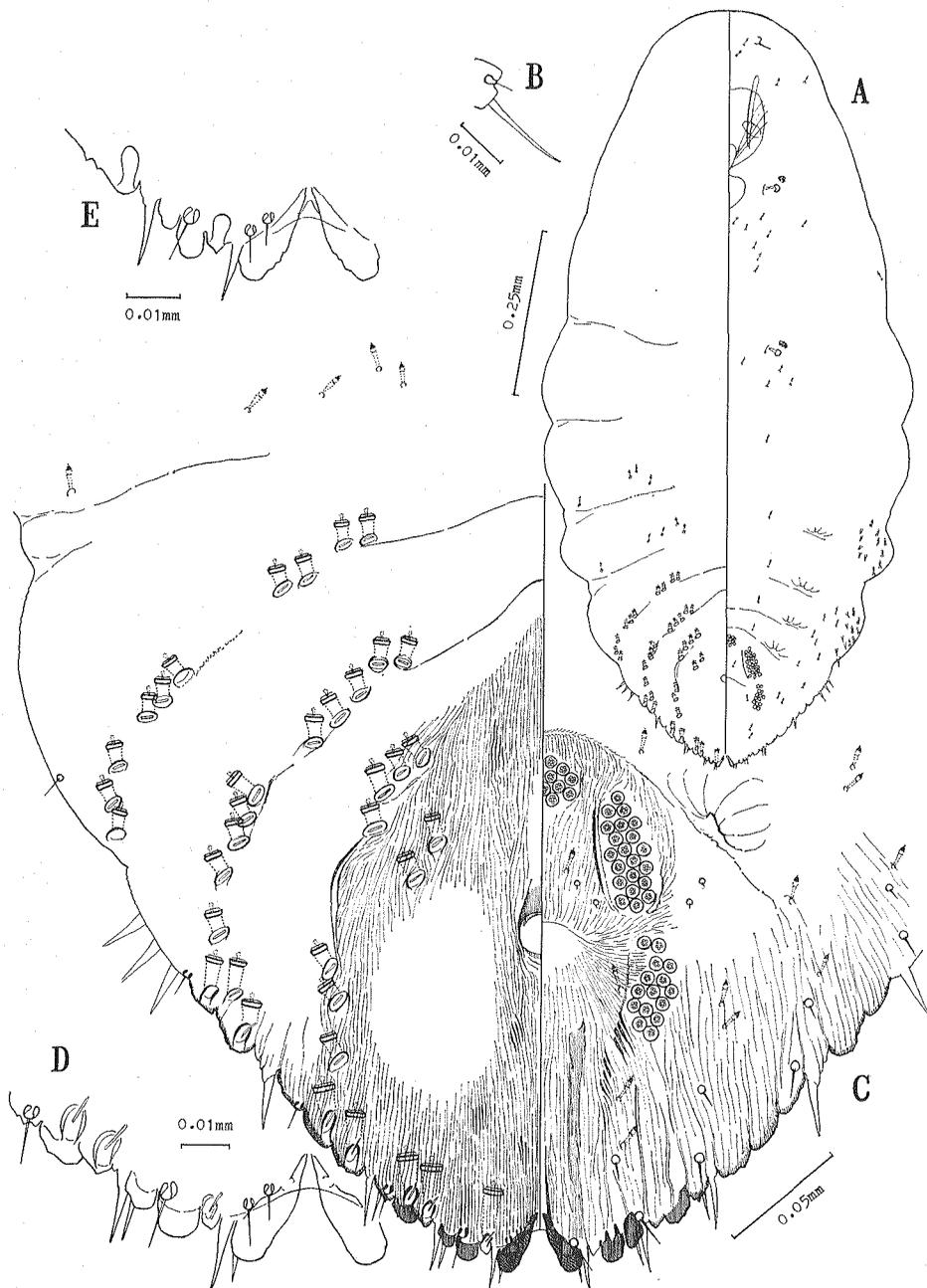


Fig. 49. *Duplachionaspis divergens* (Gr.) A-D, adult female (A, body; B, antenna; C, pygidium; D, pygidial lobes); E, pygidial lobes of the exuvium of the second instar female.

and Japan disagree with his illustration in that the submarginal row of macroducts is not double but single on the third abdominal segment. I am very much inclined, however, to the opinion that these specimens may be rightly referred to *divergens* on account of the agreement in the numbers of the perivulvar pores and marginal gland spines, and in the well-divergent median lobes. This species is very close to *graminis* Green, but seems to be distinct from the latter by the characters given just above.

XXXIII. Genus *Pseudaulacaspis* MacGillivray

References. MacGillivray 1921: 305; Ferris 1937: 108; Balachowsky 1954e: 235; Takagi and Kawai 1967, *Insecta Matsumurana* 30: 39.

Synonyms. *Sasakiaspis* Kuwana, 1926 [type-species: *Diaspis pentagona* Targioni]; *Euvoraspis* Mamet, 1951 [type-species: *Chionaspis cordiae* Mamet].

Type-species. *Diaspis pentagona* Targioni.

Diagnosis. Body broad and turbinate in the type-species and a few other species, but in many other species elongate and more or less fusiform (in a certain species the body is variable from a slender form to a broad form); free abdominal segments more or less lobed laterally. Derm membranous except for the pygidium. Pygidial lobes in two or three pairs. Median lobes well developed, zygotic basally, with a pair of distinct marginal setae between them. Second lobes usually developed, much smaller than the median lobes, bilobulate, with the outer lobule sometimes much reduced or even obsolete. Third lobes more or less reduced, or practically obsolete. Some species have bark- and leaf-feeding forms, which are quite dissimilar in the median and, in some degree, lateral lobes: in the bark-feeding form the median lobes are prominent, whereas in the leaf-feeding form the median lobes are sunken into the pygidium, forming a distinct notch on the apex of the pygidium, and the second lobes are comparatively more developed. Gland spines developed. Marginal macroducts of the pygidium: one between the median and second lobes, two associated with the third lobe (on the sixth abdominal segment), two on the fifth abdominal segment, and one or two on the fourth. Dorsal macroducts practically as large as the marginal macroducts, arranged segmentally in submedian and submarginal rows. Antenna with a seta. Anterior spiracle with disc pores; posterior spiracle with or without disc pores. Anal opening more or less close to the base of the pygidium. Perivulvar pores in five groups.

Composition and distribution. The type-species is widely distributed over the world apparently through the agency of man, but may be native to eastern Asia, having there closely related forms. This genus was previously restricted to a narrow limit, but this limit was recently removed to receive many species mostly from *Phenacaspis*. In the sense adopted here this genus is a large group and mainly Oriental in distribution, expanding its range along the eastern side of Asia as north as Japan and eastern Siberia.

Remarks. This genus is here understood after Takagi and Kawai (1967, l. c.). In this sense five species found in the present collection should be members of the genus. The other Taiwanese species referable to the genus are: *brideliae* Takahashi (= *Chionaspis brideliae*), *kuwanai* Takahashi (= *Chionaspis kuwanai*; = *Phenacaspis kuwanai*), *major* Cockerell, *manii* Green (= *Chionaspis manii*; = *Diaspis gordoniae* Takahashi) and

taiwana Takahashi (= *Phenacaspis taiwana*). In some species of the genus is known dimorphism associated with feeding-sites as stated in the above diagnosis.

73. *Pseudaulacaspis pentagona* (Targioni)

References. Targioni 1886 [*Diaspis*]; Ferris 1937: 109; Balachowsky 1954e: 236.

Synonyms. *Diaspis amygdali* Tryon, 1889; *Diaspis lanatus* Morgan and Cockerell, 1892; *Diaspis patelliformis* Sasaki, 1894; *Chionaspis prunicola* Maskell, 1894; *Diaspis amygdali* var. *rubra* Maskell, 1898; *Diaspis auranticolor* Cockerell, 1899.

Diagnosis. Body broad, turbinate, with the meso- and metathorax and free abdominal segments well lobed laterally, and with the pygidium broad and rather triangular in outline. Median lobes prominent, set parallel, each lobe approximately triangular, deeply notched several times on each side, with the apex rounded. Second lobes with the inner lobule well represented, more or less longer than wide, and with the outer lobule much reduced or practically obsolete. Marginal gland spines well developed on the pygidium, one between the median and second lobes, one or two just laterally to the second lobe (on the seventh abdominal segment), two or rarely three on the sixth abdominal segment, three or rarely two on the fifth, and four to six on the fourth (the base of the pygidium); second and third abdominal segments with five to nine and six to 10 gland spines, respectively, on and just within the lateral margin, those occurring within the margin being more or less shortened; five to nine short submarginal gland spines on the metathorax, and four to nine on the first abdominal segment; prosoma with some gland cones on the lateral lobe of the mesothorax. Submedian dorsal macroducts: three to 12 on the second abdominal segment, four to 13 on the third, four to 10 on the fourth, and two to six on the fifth; submarginal macroducts: eight to 16 on the second abdominal segment, seven to 17 (including one in a pore prominence on the margin) on the third, five to nine on the fourth, and three to nine on the fifth. Much smaller macroducts scattered on the lateral lobes of the metathorax and basal three abdominal segments. Microducts scattered in the prothoracic region and in the submarginal region of the mesothorax. Antennae set close together. Anterior spiracle with a large number of disc pores in a compact cluster; posterior spiracle lacking disc pores. Anal opening situated about the centre of the pygidium. A pair of slender preanal scleroses in the base of the pygidium. Perivulvar pores numerous in five groups. Second instar female with five single marginal macroducts on the third to seventh abdominal segments, one or two submarginal macroducts on the third abdominal segment, and at times also one submarginal macroduct on the fourth.

Specimens examined. Yang-ming Shan, on *Mallotus japonicus*; Kuan-tzu-ling, on *Morus* sp.; Tung-pu, on *Stranvaesia nitakayamensis*.

Distribution and host plants. This species is a well-known cosmopolitan, occurring widely in the world and feeding on various kinds of plants. Takahashi recorded it in Taiwan on *Hibiscus mutabilis*, *Morus alba*, *Prunus communis*, *P. persica*, *P. pognostyla*, etc.

Remarks. In the Japanese specimens at hand the marginal gland spines of the pygidium often divide apically, whereas in the Taiwanese specimens these spines are simple. As here understood this species may be distinguishable from closely allied species by the combination of the following characters: the much reduced outer lobule

of the second lobe; the constant absence of submedian and submarginal macroducts on the sixth abdominal segment; the absence of accompanying disc pores at the posterior spiracles; and, in the second instar female, the presence of submarginal macroducts on the third (and at times also fourth) abdominal segment. This species is represented only by the bark-feeding form.

74. ***Pseudaulacaspis cockerelli*** (Cooley)

References. Cooley 1897: 278 [*Chionaspis*]; Kuwana 1931 a: 3 and 5 [*Phenacaspis aucubae*; *P. dilatata*]; Ferris 1955 d: 46 [*Phenacaspis*].

Synonyms. *Chionaspis aucubae* Cooley, 1897; *Chionaspis dilatata* Green, 1898; *Phenacaspis natalensis* Cockerell, 1902; *Chionaspis miyakoensis* Kuwana, 1931; *Chionaspis syringae* Borchsenius, 1938; *Chionaspis Hattorii* Kanda, 1941; *Phenacaspis eugeniae* var. *sandwicensis* Fullaway, 1932; *Chionaspis akebiae* Takahashi, 1952; *Pseudaulacaspis biformis* Takagi, 1956; *Phenacaspis ferrisi* Mamet, 1959.

Diagnosis. As here understood this species is quite variable in the body shape, the number of dorsal macroducts, etc. Body varying from a slender form to a much broader form. The median lobes of the typical bark-feeding form are prominent and robust, with several notches on each side; those of the typical leaf-feeding form are entirely sunken into the apex of the pygidium, rather narrow, and serrate on the inner margin of the apical half; intermediate forms are also found between these typical dimorphic forms. Second lobes with both lobules well represented in the leaf-feeding form; outer lobule reduced in the bark-feeding form; a pair of basal scleroses on the inner lobule well elongate in the leaf-feeding form. Third lobe reduced, represented at most by a low prominence. Gland spines present as far as the metathorax, a few gland spines at times present on the mesothorax, the prepygidial gland spines are more or less shortened and conical. Submedian dorsal macroducts present on the second to sixth abdominal segments, but at times lacking on the sixth; submarginal macroducts present on the second to fifth abdominal segments, the sixth normally lacking submarginal macroducts (a few submarginal macroducts are rarely found in the supposed region of the sixth abdominal segment, but these macroducts are irregular in position, not forming a distinct segmental row). Antennae usually set close together. Anterior spiracle with disc pores in a compact cluster; posterior spiracle without disc pores. A submarginal dorsal boss not sclerotized on the first abdominal segment; another boss often discernible on the third abdominal segment just anteriorly to the submarginal macroducts, smaller and sclerotized. Anal opening situated somewhat basally to the centre of the pygidium, with a pair of preanal scleroses at times distinct. Perivulvar pores in five groups. Second instar female with five single marginal macroducts on the third to seventh abdominal segments; submarginal macroducts absent, or present on the fourth and fifth abdominal segments.

Specimens examined. Tai-pei, on *Nerium indicum*; southeastern Tai-pei Hsien, on *Eurya japonica* and *Nerium indicum*; Chia-i, on *Liquidambar formosana*; A-li Shan, on *Eurya acuminata*, *E. crenatifolia*, *E. strigillosa*, *Rhododendron* spp. (true rhododendrons), *Trochodendron aralioides* and *Viburnum arboricolum*; Ken-ting, on *Viburnum odoratissimum*.

Distribution and host plants. This species was originally described from specimens collected at quarantine on palm imported from China to North America. Later, some forms described from Hawaii, Japan, Ceylon and Natal were united with it. As here

TABLE 4. Number of dorsal macroducts in *Pseudaulacaspis cockerelli*.

Form	Locality & host	Submedian macroducts					Submarginal macroducts				
		Abd. II	Abd. III	Abd. IV	Abd. V	Abd. VI	Abd. II	Abd. III*	Abd. IV	Abd. V	Abd. VI
1	Southeastern Tai-pei Hsien, ex <i>Eurya japonica</i>	2 — 4	3 — 4	1 — 3	2	0 — 1	5 — 7	5 — 7	2 — 3	2 — 4	0
2	Tai-pei, ex <i>Nerium indicum</i>	4 — 6	4 — 7	4 — 5	3 — 5	1 — 3	9 — 13	8 — 10	4 — 7	3 — 7	0
3	A Southeastern Tai-pei Hsien, ex <i>Nerium indicum</i>	4 — 7	5 — 6	3 — 6	3 — 4	1 — 2	8 — 14	8 — 11	5 — 7	5 — 6	0 — 2
	B A-li Shan, ex <i>Rhododendron</i>	2**	3 — 6	3 — 5	2 — 5	0 — 2	6 — 12	8 — 10	5 — 9	6 — 9	0
4	A-li Shan, ex <i>Eurya acuminata</i> , <i>E. crenatifolia</i> & <i>Trochodendron</i>	1 — 5	2 — 7	3 — 5	2 — 6	1 — 3	5 — 14	6 — 14	5 — 9	3 — 9	0 — 2
5	A Ken-ting, ex <i>Viburnum odoratissimum</i>	6 — 9	7 — 10	5 — 8	4 — 7	2 — 4	11 — 18	9 — 13	7 — 9	6 — 8	0
	B A-li Shan, ex <i>Rhododendron</i>	5 — 11	7 — 10	6 — 8	4 — 6	2 — 4	10 — 17	8 — 13	6 — 9	5 — 9	0 — 3
	C A-li Shan, ex <i>Viburnum arboricolum</i>	7 — 9	7 — 8	6 — 8	4 — 8	2 — 5	16 — 23	12 — 17	9 — 13	8 — 11	0
6	A-li Shan, ex <i>Eurya strigillosa</i>	8 — 16	8 — 12	7 — 8	5 — 8	3 — 5	21 — 25	15 — 21	11 — 16	8 — 13	0 — 1
7	Chia-i, ex <i>Liquidambar formosana</i>	4 — 9	5 — 8	5 — 6	3 — 5	0 — 3	9 — 18	9 — 11	6 — 9	5 — 7	0

* The number of the submarginal macroducts of the third abdominal segment includes one or more macroducts opened in the marginal prominence.

** At times replaced by microducts.

TABLE 5. Number of disc pores and gland spines in
Pseudaulacaspis cockerelli.

Form	Perivulvar disc pores			Gland spines									
	medians	antero- laterals	postero- laterals	Meta- thorax	Abd. I	Abd. II	Abd. III	Abd. IV	Abd. V	Abd. VI	Abd. VII	Abd. VIII	
1	4 — 5	9 — 13	12 — 20	1 — 4	1 — 3	4 — 6	3 — 5	2	1	1	1	1	
2	7 — 9	14 — 20	19 — 29	2 — 3	3 — 4	4 — 7	5 — 7	2 — 4	1 — 2	1	1	1	
3	A	6 — 8	13 — 15	18 — 23	2 — 4	3 — 4	4 — 6	4 — 7	2 — 4	1 — 2	1	1	1
	B	11 — 16	22 — 29	29 — 39	3 — 6	2 — 6	4 — 7	4 — 8	2 — 6	2 — 4	1 — 2	1	1
4	10 — 21	16 — 36	20 — 39	1 — 6	1 — 7	5 — 10	3 — 9	2 — 6	2 — 3	1 — 2	1	1	
5	A	8 — 12	20 — 26	25 — 32	2 — 5	3 — 7	6 — 10	7 — 10	3 — 5	2	1	1	1
	B	7 — 11	24 — 29	33 — 40	3 — 8	6 — 11	5 — 11	5 — 8	4 — 5	3 — 4	2 — 3	1	1
	C	15 — 21	35 — 47	40 — 50	4 — 7	6 — 9	7 — 10	7 — 10	5 — 7	3 — 5	2 — 4	1	1
6	14 — 31	46 — 61	44 — 69	3 — 8	9 — 13	8 — 11	9 — 12	6 — 9	4 — 6	2 — 5	1	1	
7	9 — 18	13 — 34	20 — 31	2 — 4	5 — 7	6 — 9	5 — 8	3 — 5	2 — 3	2 — 3	1 — 2	1	

understood this species also includes other forms described from Japan, Korea, Vladivostok, and even Madagascar as given in the synonymic list, and is widely distributed in Asia, feeding on quite various kinds of plants. It is assumed by authors that this species is an immigrant in Hawaii and Africa. Takahashi recorded it in Taiwan, under the name *Phenacaspis eugeniae* or *P. dilatata*, on *Bischofia javanica*, *Camellia* sp., *Excoecaria orientalis*, *Michelia alba*, *M. fuscata*, etc.

Remarks. As stated in the diagnosis this species is variable in the body shape, the number and arrangement of the dorsal macroducts, the number of the disc pores and gland spines and other characters. A trial is here made to divide the specimens at hand from Taiwan into the following seven forms, although these forms are not distinct morphological units divided by obvious gaps (Table 4 and 5).

Form 1. Body slender, with the dorsal macroducts, disc pores and gland spines all comparatively few; prepygidial gland spines all shortened; antennae set well apart from each other; anterior spiracle with four to six disc pores.

Form 2. Body rather slender and the antennae set rather apart from each other; otherwise this form is similar to Form 3.

Form 3. Body moderate in width, fusiform, with the macroducts, disc pores and gland spines generally moderate in number.

Form 4. Adult female not distinguishable from that of Form 3. Second instar female often with one submarginal macroduct on the fourth or fifth abdominal segment, or at times on either of these segments.

Form 5. Body somewhat variable in shape, broader in some specimens; with the submarginal dorsal macroducts on the second or either of the second and third abdominal segments numerous and tending to be arranged in a double or triple row; perivulvar pores quite numerous in a certain colony.

Form 6. Close to Form 5, having double or triple rows of submarginal macroducts, but the body much broadened.

Form 7. Body quite broadened, with the submarginal macroducts moderately numerous and arranged in single rows.

The body shape varies in a practically continuous series from one extreme (Form 1) to the other (Form 7). The most slender form (Form 1) is particular by the antennae set apart from each other, but is connected with the nominate form (Form 3) through an intermediate form (Form 2). Form 1 is also characterized by the glandular organs fewer in number, but can not always be sharply distinguished from the other forms by this character. The broadest form (Form 7) is hardly separable from *Pseudaulacaspis biformis* Takagi, which may be tentatively united with *cockerelli*. A form from A-li Shan (Form 4) is particular by having submarginal macroducts in the second instar female; however, their presence is not constant and the adult female is very similar to that of Form 3. Form 5 and Form 6 are characterized by the dorsal macroducts tending to be numerous in double or triple rows on the second and third abdominal segments, but this character is not stable in the examined specimens. It is not easy to draw any definite conclusion on all these forms, but after all struggles it seems to me to be unavoidable to throw them into a single species—*cockerelli*.

I have little doubt that *Chionaspis syringae* and *C. Hattorii*, which were originally described from Vladivostok and Korea, respectively, are identical with the bark-feeding form of *cockerelli*. *Phenacaspis ferrisi* from Madagascar is, so far as judged from the original description, not distinguishable from the leaf-feeding form of *cockerelli*.



Fig. 50. *Pseudaulacaspis sasakawai*, n. sp. Adult female (A, body; B, antennae; C, pygidium; D-G, pygidial lobes) (A-D & G, bark-feeding form; E & F, leaf-feeding form), figured from specimens collected on *Symplocos arisanensis*.

75. *Pseudaulacaspis sasakawai*, n. sp. [Fig. 50]

Diagnosis. Body fusiform, with the meso- and metathorax and basal three abdominal segments well lobed laterally, and with the pygidium rather narrow; at full growth there is a slight indication of the swelling of the thoracic region. Median lobes of the leaf-feeding form entirely sunken into the apex of the pygidium, narrow, and serrate; those of the bark-feeding form broader, with the apex produced. Second lobes with both lobules well developed, the outer lobule smaller than the inner, either lobule with a pair of short basal scleroses. Third lobes much reduced, yet the inner lobule more or less produced out of the pygidial margin. Marginal gland spines well developed on the pygidium, one between the median and second lobes, one between the second and third lobes, one to three just laterally to the third lobe (on the sixth abdominal segment), two to four on the fifth abdominal segment, and three to nine on the fourth segment. Short gland spines on the lateral lobes of the metathorax and basal three abdominal segments: three to seven on the metathorax, five to seven on the first abdominal segment, four to nine on the second, and six to 10 on the third; a few small gland spines at times present also on the mesothorax in the submarginal region. Dorsal macroducts forming single or partly irregularly double rows; submedian macroducts: four to 11 on the second abdominal segment, three to nine on the third, four to seven on the fourth, two to six on the fifth, and two to four on the sixth; submarginal macroducts: seven to 15 on the second abdominal segment, six to 13 (including one in a marginal prominence) on the third, six to 12 on the fourth, five to 11 on the fifth, and one to four (usually two) on the sixth. Much smaller macroducts scattered on the lateral lobes of the meso- and metathorax and basal three abdominal segments. A submarginal dorsal boss not sclerotized and not always discernible on the first abdominal segment. Antennae set quite close together. Anterior spiracle with many disc pores in a compact cluster; posterior spiracle without disc pores. Anal opening situated about the centre of the pygidium. Perivulvar pores: nine to 19 in the median group, 12 to 35 in the anterolateral, and 20 to 46 in the posterolateral.

Specimens examined. A-li Shan, on the leaves of *Stauntonia keitaoensis* and on the leaves and twigs of *Symplocos arisanensis*.

Remarks. This species is very close to *cockerelli*, but is here regarded as distinct from the latter on account of the constant presence of submarginal macroducts on the sixth abdominal segment. In *cockerelli* a few macroducts are rarely found in the submarginal region of the sixth abdominal segment, but these macroducts are irregular in position, occurring at times close to the marginal macroducts and at times rather close to the submedian macroducts. In the new species the submarginal macroducts of the sixth abdominal segment always form a stable row.

76. *Pseudaulacaspis megacauda*, n. sp. [Fig. 51]

Diagnosis. Body elongate-oval or fusiform, with the free abdominal segments rather weakly lobed laterally. Median lobes quite large, in the leaf-feeding form (which is alone represented in the material at hand) practically entirely sunken into the pygidium, divergent, robust, rather roughly serrate, and more or less narrowing towards the apex. Second lobes much smaller than the median, yet well developed; inner lobule longer than wide, broadly rounded apically, with a pair of distinct basal scleroses; outer lobule

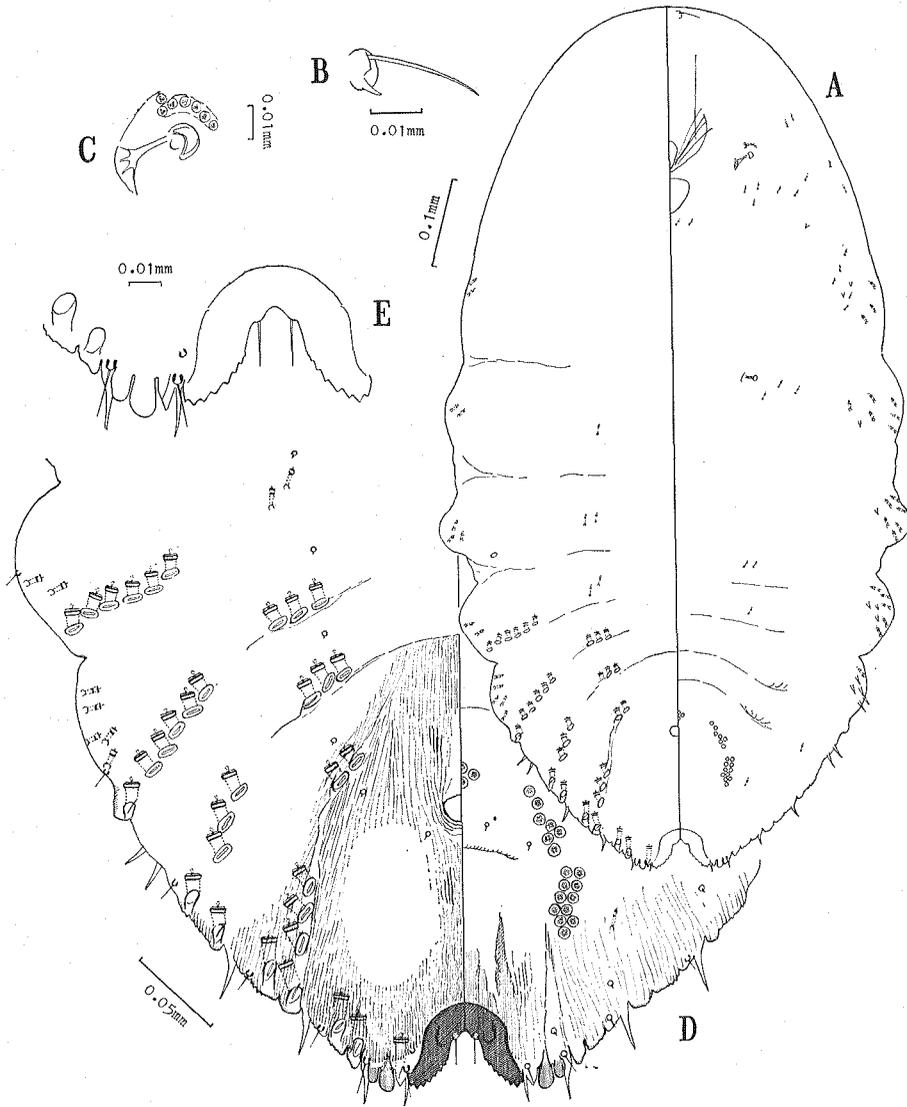


Fig. 51. *Pseudaulacaspis megacauda*, n. sp. Adult female (A, body; B, antenna; C, anterior spiracle; D, pygidium; E, pygidial lobes).

smaller, with the basal scleroses much reduced. Third lobes little developed. Marginal gland spines of the pygidium rather short, two or three on the fourth abdominal segment, one or rarely two on the fifth, otherwise single; third abdominal segment with three to five shorter gland spines on and just within the lateral margin, the preceding three segments with a few gland cones on the lateral lobe, the mesothorax at times with a few quite small gland cones in the submarginal region. Dorsal macroducts forming single rows; submedian macroducts: one to three on the third abdominal segment, and two or three on the fourth and fifth each; submarginal macroducts: three to six on the second abdominal segment, three to seven (including one in the marginal pore prominence) on the third, three to five on the fourth, and three or four on the fifth, the sixth segment at times with one or two submarginal macroducts. Metathorax and basal two abdominal segments each with one or two submedian dorsal microducts. Small macroducts scattered on the lateral lobes of the meso- and metathorax and basal three abdominal segments. A submarginal dorsal boss not sclerotized on the first abdominal segment. Antennae set quite close together. Anterior spiracle with about three to eight disc pores; posterior spiracle without disc pores. Anal opening situated about the centre of the pygidium. Perivulvar pores: four or five in the median group, seven to 14 in the anterolateral and posterolateral each.

Specimens examined. A-li Shan, on *Eurya acuminata*.

Remarks. This species agrees in most characters with *poloosta* Ferris (= *Phenacaspis poloosta*), which was described from specimens collected in Yunnan, China, on *Eurya nitida* and *Pittosporum yunnanensis*. However, it can not be positively identified with the latter owing to its much fewer spiracular disc pores. It is possibly a mere local variation of *poloosta*, but may be tentatively distinguished until a detailed comparison has been made between the two.

77. *Pseudaulacaspis takahashii* (Ferris) [Fig. 52]

References. Ferris 1955 d: 52 [*Phenacaspis*].

Diagnosis. Body robust, the meso- and metathorax and basal three abdominal segments well lobed laterally; prothoracic region also tending to be lobed, giving a more or less quadrate appearance to the cephaloprothoracic region; pygidium broad and roundish. Median lobes robust, rounded, and minutely serrate. Second lobes small, the outer lobule smaller than the inner, yet distinctly present, either lobule with much reduced basal scleroses. Marginal gland spines of the pygidium well developed, five or six on the fourth abdominal segment, two or three on the fifth abdominal segment, otherwise single; eight to 10 gland spines on the third abdominal segment on and just within the lateral margin, those situated within the margin being shortened; metathorax and basal two abdominal segments with gland cones on the lateral lobe: metathorax with five to 12, the first abdominal segment with five to nine, and the second with seven to 10. Dorsal macroducts numerous; submedian macroducts forming single rows: eight to 11 on the second abdominal segment, eight to 13 on the third, nine to 12 on the fourth, seven to nine on the fifth, and two or three on the sixth; submarginal macroducts: three to five scattered in the posterolateral corner of the metathorax, 20 to 28 and 25 to 28 on the first and second abdominal segments, respectively, forming a thick cluster or a broad multiple row on each of these segments, 19 to 23 on the third in a multiple row, 10 to 15 on the fourth in a single or partly double

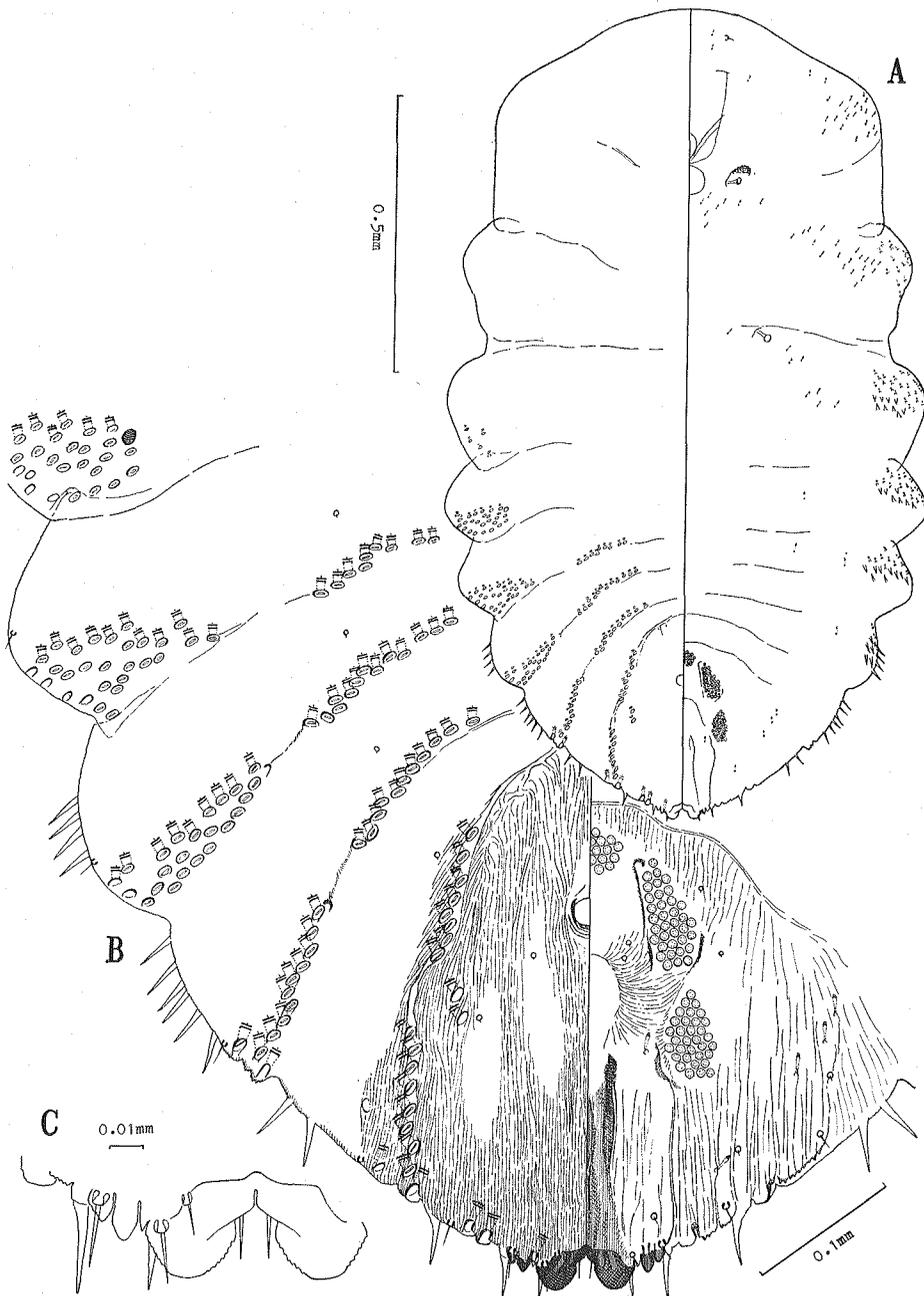


Fig. 52. *Pseudaulacaspis takahashii* (Ferr.). Adult female (A, body; B, pygidium; C, pygidial lobes).

row, and seven to 11 on the fifth in a single row. Much smaller macroducts strewn on the lateral lobes of the meso- and metathorax and basal three abdominal segments, numerous except on the third abdominal segment. Many ventral microducts strewn on the lateral lobe of the prothorax, and also on the mesothorax mesally to the lateral macroducts. A submarginal dorsal boss on the first abdominal segment. Antennae set apart from each other. Anterior spiracle with many disc pores in a compact cluster; posterior spiracle without disc pores. Anal opening situated somewhat basally to the centre of the pygidium. Perivulvar pores: 21 to 32 in the median group, 33 to 44 in the anterolateral, and 30 to 41 in the posterolateral.

Specimens examined. Ken-ting, on the twigs of *Diospyros discolor*.

Distribution and host plants. This species was originally described from specimens collected in Taiwan on an undetermined tree. There has been no further record of it.

Remarks. By lacking disc pores associated with the posterior spiracles the specimens at hand disagree with the original description, in which is also found no account of the numerous lateral ducts of the thoracic and prepygidial abdominal segments. However, they agree well with the original description in the dorsal macroducts which are quite characteristic of the species. The specimens at hand belong all to the bark-feeding form, being collected on the twigs of the host plant, whereas Ferris described and illustrated this species possibly on the basis of the leaf-feeding form. In the pygidial lobes this species is similar to *grandilobis* Green (= *Chionaspis grandilobis*), which was described from Ceylon as a feeder of *Diospyros thwaitesii*, but a further comparison is not possible owing to the brief description of *grandilobis*.

XXXIV. Genus *Epiflorinia*, n. g.

Type-species. *Epiflorinia tsugae*, n. sp.

Diagnosis. Pupillarial. Body elongate, with the lateral sides subparallel, and with the pygidium narrow and apically obtuse. Derm membranous except for the pygidium, which is weakly sclerotized. Pygidial lobes well developed in two pairs. Median lobes situated in a deep apical recess of the pygidium, divergent, with the bases approaching together but not in contact, and with a pair of marginal setae between them. Second lobes bilobulate. Marginal gland spines few on the pygidium, absent between the median lobes; prepygidial region with gland spines and gland cones just within the margin. Marginal macroducts well represented on the pygidium, absent between the median lobes; submedian and submarginal dorsal macroducts absent except small submedian ducts around the base of the pygidium. Antenna with a seta. Anterior spiracle with disc pores. Anal opening situated towards the base of the pygidium. Perivulvar pores in five groups. Second instar female similar to the adult female in the body shape and pygidial margin.

Remarks. This genus quite resembles *Fiorinia* in most details, but differs from the latter by the median lobes which are distinctly non-zygotic in both of the adult and second instar females. It is not easy to determine whether it is a distinct genus or a mere aberrant form of *Fiorinia*. However, giving prime importance to the absence of the basal zygotis of the median lobes, I will tentatively distinguish this genus from *Fiorinia*. In all the authentic members of *Fiorinia* the basal zygotis of the median lobes is primarily well developed; in certain species this zygotis is ill developed

or practically absent in the adult female, but this condition is apparently the result of a reductive modification in the imprisoned adult female, because even in such species the basal zygotis is well developed in the second instar female.

78. *Epiforinia tsugae*, n. sp. [Fig. 53]

Diagnosis. Median lobes slender, sunken in the pygidium for their most length, roughly serrate on the apical half of the inner margin, with the apex pointed. Second lobes well developed; inner lobule robust, about as long as wide, rounded apically, with a pair of short, slender basal scleroses; outer lobule smaller than the inner, yet well represented. A slender marginal gland spine just laterally to each of the median and second lobes, another gland spine shorter and basally broadened on the base of the pygidium, two or three similar gland spines on the preceding two segments each; meso- and metathorax and first abdominal segment with a few gland cones just within the lateral margin. One marginal macroduct between the median and second lobes, two laterally to the second lobe (on the sixth abdominal segment), two on the fifth abdominal segment, and three towards the base of the pygidium widely separated from each other. One or two small submedian dorsal ducts on the base of the pygidium, and two to four on the preceding segment. Antennae set rather close together, each with a rather short seta. Anterior spiracle with three to eight disc pores; both pairs of spiracles with microducts scattered posteriorly. Perivulvar pores: one to nine in the median group, 16 to 29 in the anterolateral, and 23 to 39 in the posterolateral. Second instar female with the pygidial margin similar to that of the adult female; six single marginal gland spines on each side of the abdomen, occurring anteriorly as far as the second abdominal segment, none on the sixth; five single marginal macroducts on each side of the abdomen, occurring on the third to seventh abdominal segments. Exuvium dark brown, the posterior half blackish, with a pair of large yellowish patches on the lateral sides.

Specimens examined. Tung-pu on the leaves of *Tsuga chinensis* var. *formosana*.

XXXV. Genus *Fiorinia* Targioni

References. Targioni 1868: 42; Ferris 1937: 54; Balachowsky 1954e: 302.

Synonyms. *Uhleria* Comstock, 1883 [type-species: *Diaspis fioriniae* Targioni].

Type-species. *Fiorinia pellucida* Targioni = *Diaspis fioriniae* Targioni.

Diagnosis. Pupillarial, the adult female being enclosed within the sclerotized exuvium of the second instar. Body elongate, with the segmentation much reduced in the prepygidial region, and with the pygidium rather narrow and triangular or roundish. Derm more or less sclerotized on the pygidium, otherwise membranous. Median lobes well developed, zygotic, with the basal zygotis well developed (in certain species the basal zygotis is much reduced into a mere sclerotized patch), and with a pair of distinct marginal setae between them. Second lobes well developed in many species, but reduced or even obsolete in others. Third lobes absent, or at most represented by marginal serrations. Marginal gland spines present or absent on the pygidium, if present all single and in many species restricted to the seventh and eighth abdominal segments; prepygidial gland spines becoming smaller and more or less conical towards the anterior, occurring on or just within the lateral margin as far as the thoracic region. Marginal macroducts of the pygidium various in number, in some species

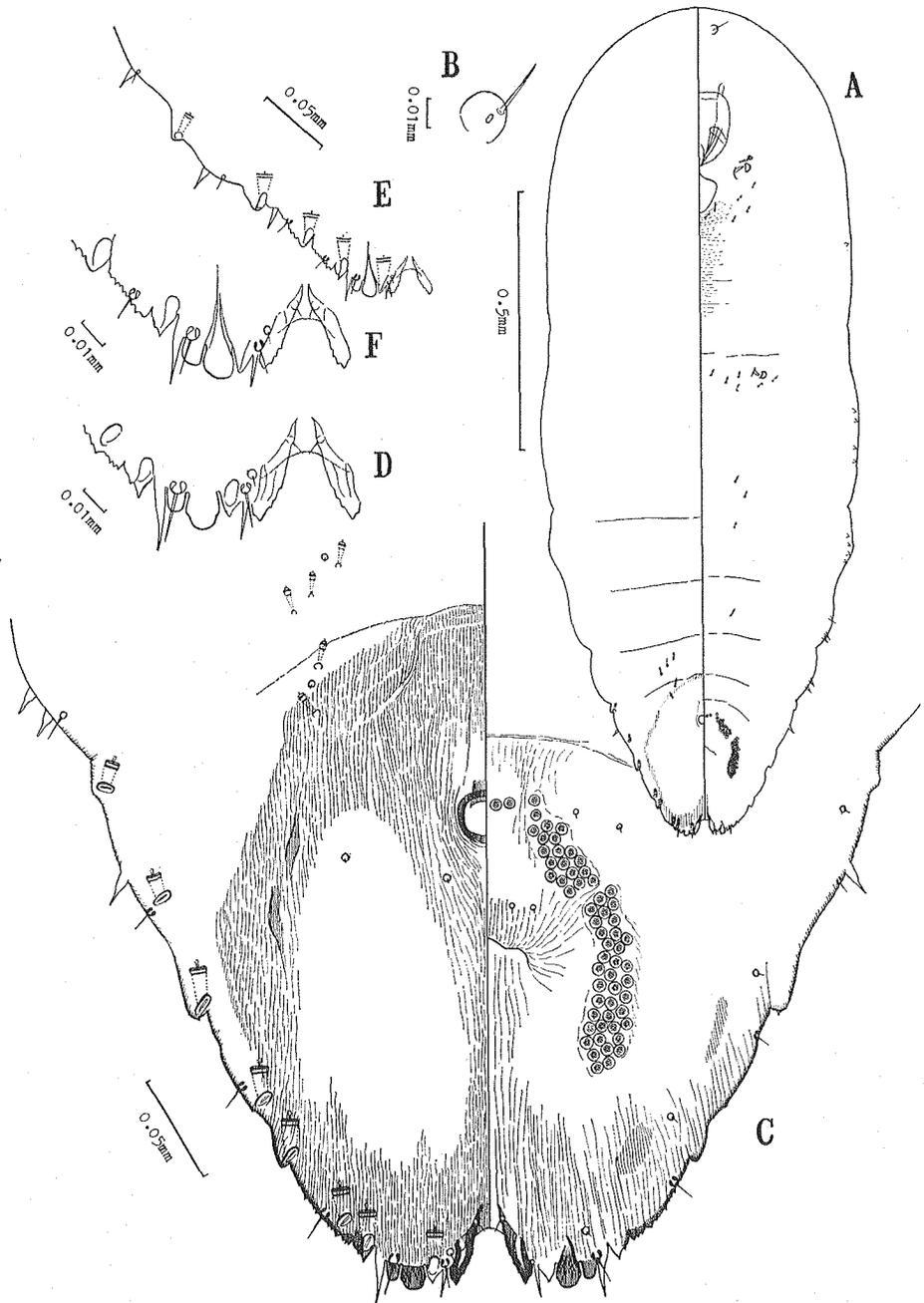


Fig. 53. *Epifiorinia tsugae*, n. sp. A-D, adult female (A, body; B, antenna; C, pygidium; D, pygidial lobes); E & F, exuvium of the second instar female (E, pygidial margin; F, pygidial lobes).

partly or wholly replaced by quite small ducts. Submarginal dorsal macroducts absent, or if present few within the base of the pygidium and on the preceding segment; submedian dorsal macroducts absent, at most represented by quite small ducts on the base of the pygidium and on some preceding segments. Antennae set more or less close together, each with a seta; a membraneous process (interantennal process) often present between the antennae, various in shape, in some species quite prominent. Anterior spiracles with disc pores, the posterior without them. Anal opening close to the base of the pygidium. Perivulvar pores in five groups. Second instar female with the median lobes always distinctly zygotic; second lobes usually well developed, with a pair of slender basal scleroses on the inner lobule; marginal macroducts single; marginal gland spines usually present, single; exuvium elongate, fusiform or with the lateral margins practically parallel.

Composition and distribution. Many species were described in *Fiorinia*, not all of them, however, being authentic members of the genus. In the sense adopted by recent authors at least more than 30 described species are to be rightly referred to the genus. So far as represented by a good number of species recently described or revised this genus is evidently centred in eastern Asia, most of those species occurring in India through China to Japan. None of the genuine members of the genus is native to the New World and the Ethiopian region. A certain species (*externa* Ferris), which is undoubtedly a member of the genus, was originally described from North America, but it was later found that it is a native of Japan.

Remarks. The species of the genus are variable in the adult females in regard to the pygidial lobes, the basal zygosis of the median lobes, the marginal gland spines and the marginal ducts, but are fairly uniform in the second instar females. It should be emphasized here that all the second instar females have a solid basal zygosis on the median lobes, although this zygosis may be quite reduced in the adult females.

In the present collection I have found 10 species of the genus, of which one is described as a new species. So far as I am aware the following species were described or recorded from Taiwan as members of the genus.

- 1) *arengae* Takahashi, *taiwana* var.
- 2) *chinensis* Ferris. A synonym of *minor*.
- 3) *fiorinae* Targioni.
- 4) *formosensis* Takahashi.
- 5) *hisakakii* Takahashi, *vaccini* var. Not collected.
- 6) *horii* Kuwana. Not collected.
- 7) *japonica* Kuwana.
- 8) *juniperi* Leonardi. A synonym of *japonica*; or misidentification of *pinicola*.
- 9) *minor* Maskell.
- 10) *nephelii* Maskell. Type-species of *Thysanofiorinia*.
- 11) *pinicola* Maskell.
- 12) *proboscitaria* Green.
- 13) *randiae* Takahashi, *proboscitaria* var. Not collected.
- 14) *rhododendri* Takahashi. Not collected.
- 15) *saprosmae* Green. Misidentification of *taiwana*.
- 16) *smilaceti* Takahashi. Not collected.
- 17) *taiwana* Takahashi.

18) *theae* Green.

19) *turpiniae* Takahashi, *theae* var. Not collected.

79. ***Fiorinia pinicola*** Maskell

References. Maskell 1897 a: 242; Kuwana 1925 b: 8 [*juniperi*]; Ferris 1936: 2; Balachowsky 1954 e: 309.

Diagnosis. Median lobes in a distinct apical notch of the pygidium for their most length, divergent, slender, roughly serrate on the inner margin of the apical half, and pointed apically. Second lobes well developed; inner lobule elongate, rounded apically, with a pair of basal scleroses; outer lobule smaller, yet well represented. Third lobes represented by marginal serrations. One marginal gland spine between the median and second lobes and also laterally to the second lobe; one to three gland spines on the second abdominal segment, one or two on the third, and one on the fourth all well developed; one to three gland cones on the meso- and metathorax each, and two to six on the first abdominal segment. Eight or so marginal macroducts on each side of the abdomen. One or two small submedian dorsal ducts just in front of the dorsal sclerotization of the pygidium (on the fourth abdominal segment), one on each of the preceding abdominal segments, these ducts gradually removing mesally towards the anterior. Antenna produced into an elongate process; interantennal process absent. Anterior spiracle with five to 11 disc pores; posterior spiracles with microducts scattered between them. Perivulvar pores: four to eight in the median group, nine to 22 in the anterolateral, and 19 to 27 in the posterolateral. Second instar female with five marginal macroducts (on the third to seventh abdominal segments) and five marginal gland spines (on the third, fourth, fifth, seventh and eighth abdominal segments) on each side.

Specimens examined. Southeastern Tai-pei Hsien, on *Podocarpus* sp.

Distribution and host plants. This species was originally described from specimens collected in Hongkong on *Pinus sinensis* and in Taiwan on *Cupressus juniperinus*. It is common in Japan, feeding on *Podocarpus macrophyllus*, *Pittosporum tobira* and other plants. It was recorded from Portugal as a feeder of *Podocarpus neriifolius*.

80. ***Fiorinia japonica*** Kuwana

References. Kuwana 1902: 79 [*foriniae* var.]; *ibid.* 1925 b: 5; Ferris 1942: 394.

Synonyms. *Fiorinia juniperi* Leonardi, 1906.

Diagnosis. Pygidium rather broad. Median lobes somewhat variable in shape, but more or less sunken into the apex of the pygidium and divergent, with the inner side notched several times, and with the apex pointed. Second lobes well developed; inner lobule usually with a slight subapical notch on the outer side, and with a pair of short basal scleroses; outer lobule smaller. One marginal gland spine between the median and second lobes and also laterally to the second lobe; two gland spines on the second abdominal segment, two or three on the third, and one on the fourth; two to four gland cones on the meso- and metathorax each, and five to seven on the first abdominal segment. Three or four marginal macroducts on each side of the pygidium, belonging to the fifth to seventh abdominal segments, with two small marginal ducts in the basal corner of the pygidium. Small submarginal dorsal ducts in the basal corner of the pygidium and on the preceding segment, seven to nine in

total on one side; two or three small submedian ducts on the base of the pygidium, two to four just in front of the pygidium, and one or two on the preceding segment. Antenna at times produced into a prominent process; interantennal process absent. Anterior spiracle with eight to 15 disc pores; posterior spiracles with microducts scattered between them. Perivulvar pores: four to nine in the median group, 10 to 19 in the anterolateral, and 15 to 23 in the posterolateral. Second instar female with five marginal macroducts (on the third to seventh abdominal segments) and five marginal gland spines (on the third, fourth, fifth, seventh and eighth abdominal segments) on each side.

Specimens examined. Tai-pei, on *Taxus mairei*.

Distribution and host plants. This species was originally described from specimens collected in Japan on *Podocarpus chinensis* and *Pinus*, and later recorded there on various kinds of conifers belonging to *Abies*, *Picea*, *Tsuga*, *Pinus*, *Podocarpus*, etc. It was recorded in Taiwan on *Pinus thunbergii*, *Podocarpus macrophyllus* and *Keteleeria davidiana*. It was introduced into North America and recorded there on *Abies*, *Cedrus atlantica*, *Podocarpus* and *Tsuga*. Lindinger recorded it from the Philippines as a feeder of *Abies veitchii*.

81. ***Fiorinia taiwana*** Takahashi [Fig. 54]

References. Takahashi 1934: 24.

Diagnosis. Median lobes sunken in a distinct apical notch of the pygidium, divergent, and serrate. Second lobes usually well represented; inner lobule wider than long, serrate on the oblique outer margin, with the basal scleroses rudimentary or obsolete; outer lobule smaller, at times fused with the inner lobule, forming together a broad serrate process. Marginal gland spines absent on the pygidium; one or two gland spines on the second abdominal segment and one on the third rather short; one or two gland cones on the mesothorax, two or three on the metathorax, and three to six on the first abdominal segment. Dorsal marginal setae of the pygidium elongate. Three marginal macroducts on each side of the pygidium, belonging to the fifth to seventh abdominal segments, all single, that of the sixth segment opened at the base of a rather slender, pointed marginal prominence; laterally to the marginal macroducts there are small dorsal ducts scattered just within the margin as far as the third abdominal segment; submedian dorsal ducts absent. Antennae truncated apically, situated at the lateral bases of a conical, apically spinous interantennal process. Anterior spiracle with one to three disc pores; posterior spiracles with microducts between them quite few. Perivulvar pores: three to six in the median group, eight to 13 in the anterolateral, and nine to 13 in the posterolateral. Second instar female with five marginal macroducts on the third to seventh abdominal segments; with two gland spines on the first abdominal segment, and one on each of the second to fifth and seventh and eighth.

Specimens examined. Ken-ting, on *Chrysalidocarpus lutescens*.

Distribution and host plants. This species was described from specimens collected in Taiwan on *Myrica rubra* and *Quercus glauca*. After Takahashi, the species recorded by him in Taiwan under the name *saprosmae*, on *Arenga engleri* and *Quercus glauca*, is identical with *taiwana*.

Remarks. It is stated in the original description that the marginal macroducts

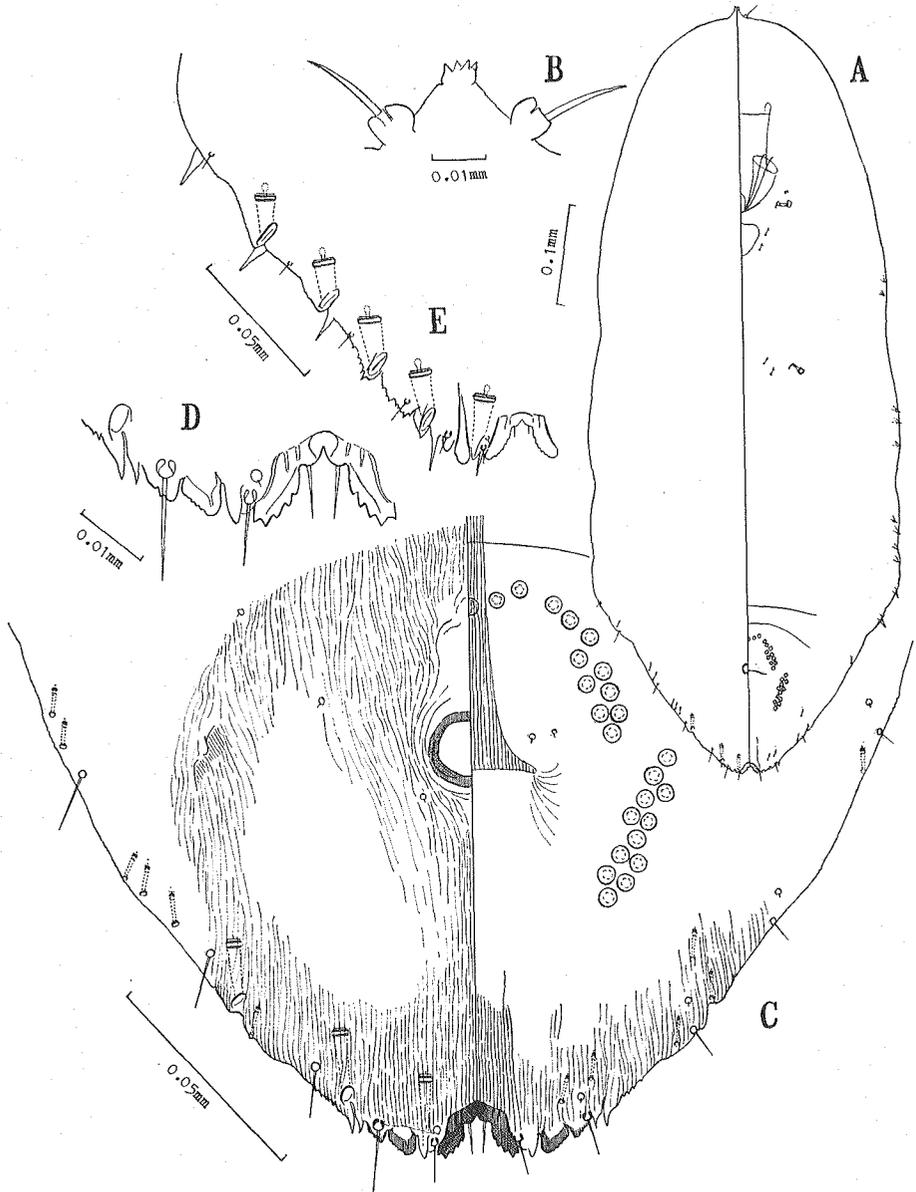


Fig. 54. *Fiorinia taiwana* Takah. A-D, adult female (A, body; B, antennae & interantennal process; C, pygidium; D, pygidial lobes); E, pygidial margin of the exuvium of the second instar female.

of the pygidium are variable in number, but the specimens at hand are uniform in having three macroducts on each side. In most other details these specimens agree well with the original description. The conical, spinous interantennal process, the single marginal macroducts and the broad second lobes are characteristic features of this species.

82. *Fiorinia arengae* Takahashi [Fig. 55]

References. Takahashi 1934: 26 [*taiwana* var.].

Diagnosis. Median lobes sunken in the pygidium for their basal half, rather robust, roughly serrate, with the apex pointed. Second lobes usually well developed; inner lobule pointed apically, with the basal scleroses rudimentary or obsolete; outer lobule smaller. Marginal gland spines of the pygidium absent or if present quite rudimentary; two to four gland spines on the second abdominal segment, one on the third; one to four gland cones on the mesothorax, 27 to 33 in an interrupted row through the metathorax and first abdominal segment. Marginal dorsal setae of the pygidium elongate. Three marginal macroducts on each side of the pygidium, all single, belonging to the fifth to seventh abdominal segments; laterally to the macroducts there are quite small dorsal ducts scattered just within the margin as far as the third abdominal segment; submedian dorsal ducts absent. Antenna produced into an elongate process, with a thickened seta; interantennal process well developed, more or less clavate, minute-spinous. Anterior spiracle with two or three disc pores; posterior spiracles with microducts scattered between them. Perivulvar pores: four or five in the median group, 13 to 19 in the anterolateral, and 20 to 25 in the posterolateral. Second instar female with five marginal macroducts on the third to seventh abdominal segments; with three gland spines on the first abdominal segment, and one on the second, third, fourth, seventh and eighth abdominal segments, the fifth and sixth abdominal segments lacking gland spines.

Specimens examined. Ken-ting, on *Arenga engleri*.

Distribution and host plants. This species was originally described from specimens collected in Taiwan on *Arenga engleri*.

Remarks. This species is very close to *taiwana* and was originally described as a variety of the latter. It may be, however, distinct from *taiwana*, having many gland spines on the metathorax and first abdominal segment.

83. *Fiorinia fioriniae* (Targioni)

References. Targioni 1867: 14 [*Diaspis*]; Ferris 1937: 55; Balachowsky 1954 e: 303.

Synonyms. *Fiorinia pellucida* Targioni, 1869; *Fiorinia camelliae* Comstock, 1881; *Fiorinia palmae* Green, 1896.

Diagnosis. Median lobes sunken in a distinct apical notch of the pygidium, divergent, elongate, roughly serrate on the inner margin, and pointed apically. Second lobes well developed; inner lobule about as long as wide, broadly rounded apically, at times with a slight outer notch, and with the basal scleroses short or obsolete; outer lobule a little smaller. One marginal gland spine between the median and second lobes and also just laterally to the second lobe; two or three gland spines on the second abdominal segment, two on the third, and one on the fourth and fifth each, all these gland spines well developed and broadened basally; one to seven gland

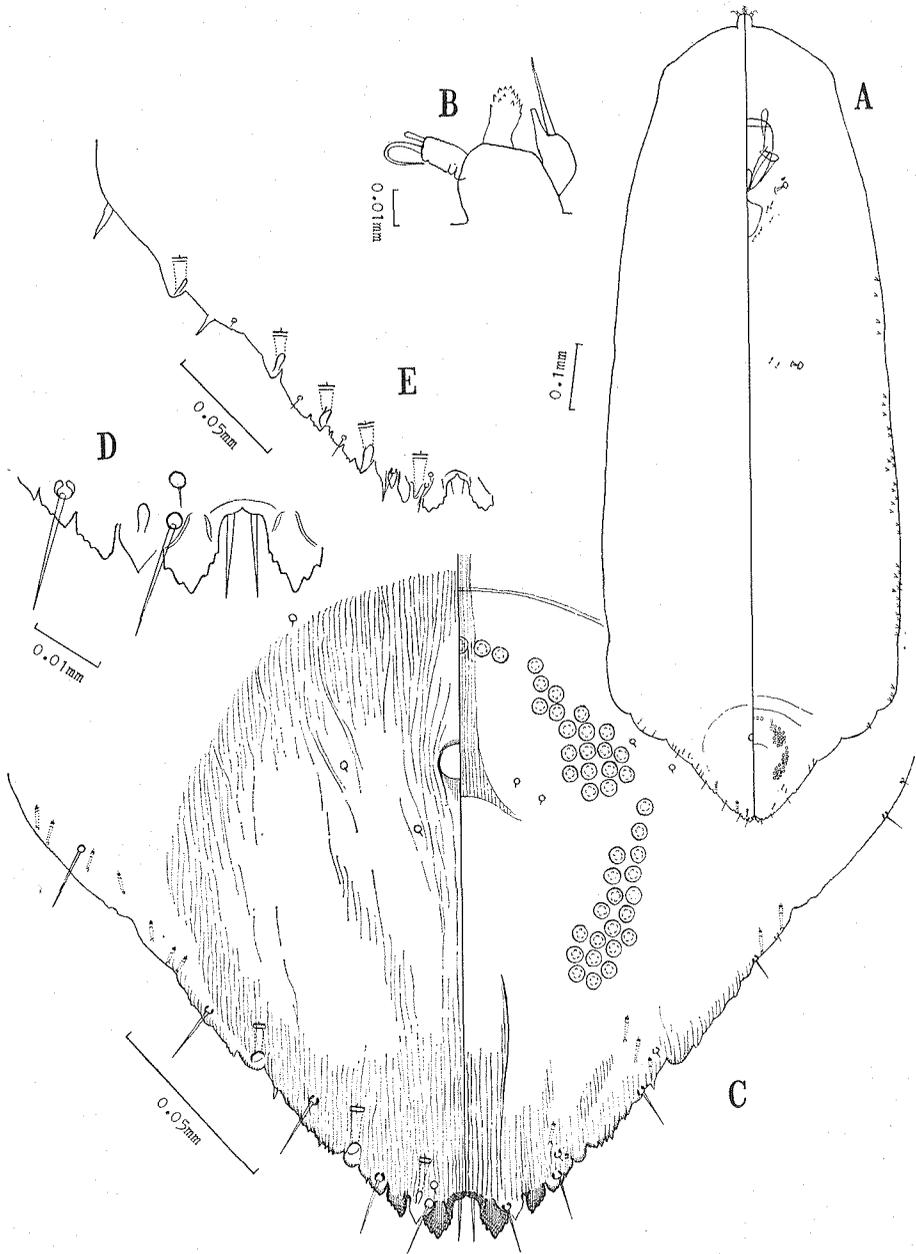


Fig. 55. *Fiorinia arengae* Takah. A-D, adult female (A, body; B, antennae & interantennal process; C, pygidium; D, pygidial lobes); E, pygidial margin of the exuvium of the second instar female.

cones on the mesothorax, two to eight on the metathorax, and four to seven on the first abdominal segment. Three or four marginal macroducts on each side of the pygidium, all single; a few small submedian dorsal ducts on the base of the pygidium and also on the preceding segment, the supposed basal three abdominal segments each with a few small dorsal ducts in the median region. Antenna produced into a slender, long process; interantennal process absent. Anterior spiracle with three to six disc pores; posterior spiracles with microducts scattered between them. Perivulvar pores: five to seven in the median group, 11 to 19 in the anterolateral, and 15 to 24 in the posterolateral. Second instar female with five marginal macroducts on the third to seventh abdominal segments, and with six marginal gland spines on the second to fifth and seventh and eighth abdominal segments.

Specimens examined. Southeastern Tai-pei Hsien, on *Eugenia javanica*; Chu-chi, on *Ficus nervosa* and *Machilus* sp.

Distribution and host plants. This species is a well-known cosmopolitan, occurring afield in the tropics and subtropics and under glass in the temperate region. It feeds on various kinds of plants. Takahashi recorded it in Taiwan on *Buchanania arborescens*, *Camellia japonica*, *Cinnamomum* sp., *Decaspermum fruticosum*, *Eucalyptus* sp., *Machilus kusanoi*, *Mangifera indica* and *Myristica heterophylla*.

84. *Fiorinia formosensis* Takahashi [Fig. 56]

References. Takahashi 1933: 50.

Diagnosis. Median lobes sunken in an apical notch of the pygidium for their most length, more or less elongate, and roughly serrate. Second lobes with the inner lobule about as long as wide, and notched on each side, and with the outer lobule much smaller or obsolete. One marginal gland spine between the median and second lobes, and also just laterally to the second lobe; two to four gland spines on the second abdominal segment, one or two on the third, and one on the fourth, all well developed and broadened basally; one gland cone on the mesothorax, one or two on the metathorax, and one to three on the first abdominal segment. Three to five marginal macroducts on each side of the pygidium, all single. A small submedian dorsal duct just in front of the dorsal sclerotization of the pygidium. Antennae small and rounded, with a short, spinous interantennal process. Anterior spiracle with two to four disc pores; posterior spiracles with microducts quite few between them. Perivulvar disc pores: three to six in the median group, seven to 12 in the anterolateral, and 13 to 16 in the posterolateral. Second instar female with five marginal macroducts on the third to seventh abdominal segments, and with five marginal gland spines on the second to fourth and seventh and eighth abdominal segments; pygidial margin prominently toothed on the fifth and sixth abdominal segments.

Specimens examined. Yang-ming Shan, on a creeping species of *Ficus*.

Distribution and host plants. This species was originally described from specimens collected in Taiwan on *Ficus* sp. Later, *Ficus foveolata*, a creeping species, was recorded as its host.

Remarks. Since the examined specimens agree well with the original description in main characters, I have no doubt that they are rightly identified with the present species. The interantennal process, however, is somewhat different from Takahashi's diagnosis and figures, being rounded and bearing small spinous processes, which are

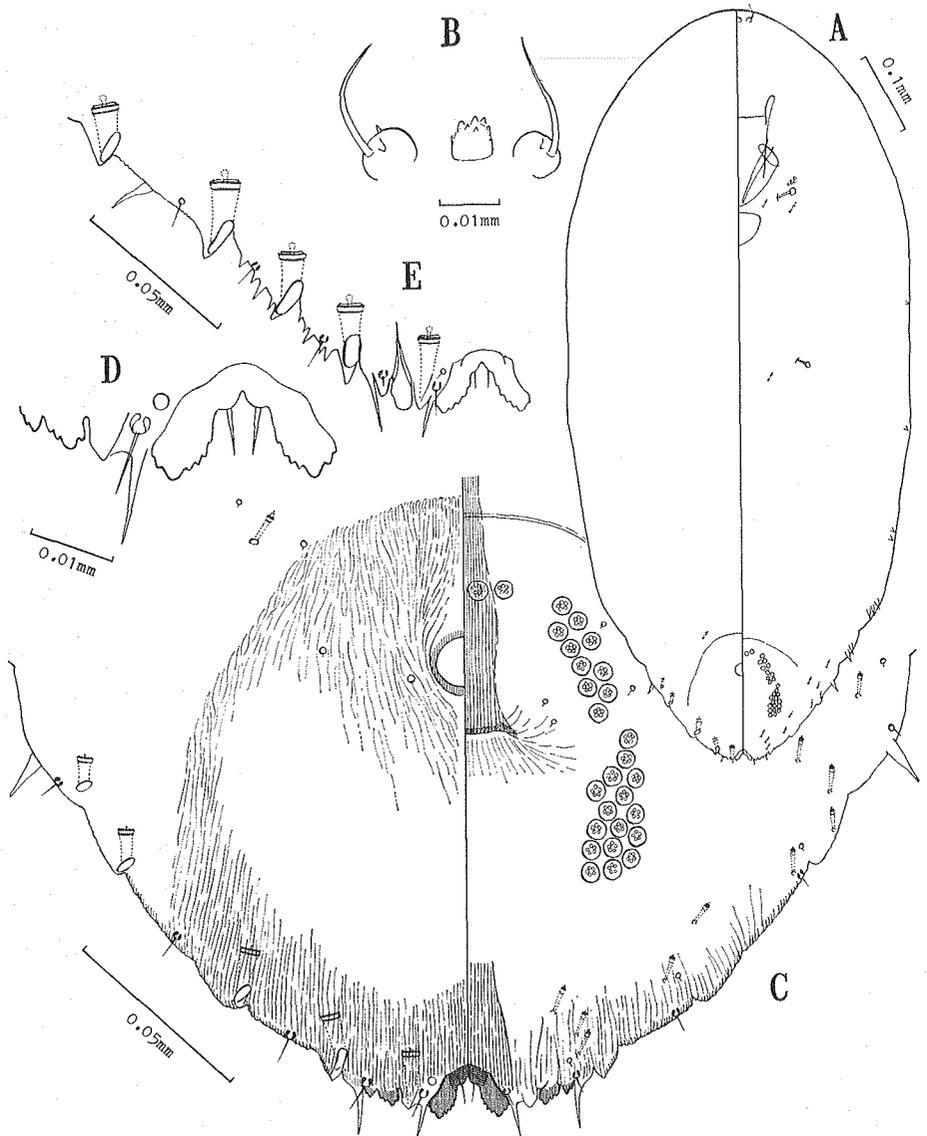


Fig. 56. *Fiorinia formosensis* Takah. A-D, adult female (A, body; B, antennae & interantennal process; C, pygidium; D, pygidial lobes); E, pygidial margin of the exuvium of the second instar female.

variable in number. This species is apparently close to *foriniae*, from which it is easily distinguished by the presence of the interantennal process, the rounded antennae, and other features.

85. *Fiorinia linderiae*, n. sp. [Fig. 57]

Diagnosis. Body more or less elongate-oval in outline, with the pygidium broad. Median lobes comparatively large, sunken in a distinct apical notch of the pygidium for their most length, well divergent, rather roughly serrate, and pointed apically. Second lobes somewhat variable in shape, but usually either lobule represented by a low, broad, serrate process. Gland spines absent on the pygidium, one or two present on the second abdominal segment; one to three gland cones on the metathorax, and three or four on the first abdominal segment. Four or five marginal macroducts on each side of the pygidium, all single. Submedian dorsal ducts absent. Antennae short; interantennal process present or absent, if present small and conical. Anterior spiracle with two or three disc pores; posterior spiracles with microducts between them. Perivulvar pores: four to six in the median group, eight to 14 in the anterolateral, and 13 to 17 in the posterolateral. Second instar female with the median lobes unusually large; second lobes with both lobules elongate; five marginal macroducts on each side of the pygidium, belonging to the third to seventh abdominal segments; five marginal gland spines on each side of the abdomen, belonging to the third, fourth, fifth, seventh and eighth abdominal segments.

Specimens examined. Southeastern Tai-pei Hsien, on the leaves of *Lindera communis*.

Remarks. This species comes close to *quercifolii* Ferris, which was described from Yunnan, China, as a feeder of *Quercus*, but may be distinguishable from the latter mainly by the second lobes distinctly divided into two lobules.

86. *Fiorinia minor* Maskell

References. Maskell 1897: 307 [*camelliae* var.]; Ferris 1921 a: 216 [*chinensis*]; *ibid.* 1936: 4. Synonyms. *Fiorinia chinensis* Ferris, 1921.

Diagnosis. Body rather elongate-oval. Median lobes slightly sunken into the pygidium, about as long as wide, the apical margin broadly rounded and rather roughly serrate; basal zygotis of the median lobes reduced into a sclerotized patch of derm or practically obsolete. Second lobe much reduced, at most represented by a slight prominence, or practically obsolete. Marginal gland spines absent on the pygidium except a minute one on the base of the pygidium (on the fourth abdominal segment); second and third abdominal segments each with one short gland spine; two to five gland cones on the metathorax, and one to five on the first abdominal segment. Dorsal marginal setae of the pygidium elongate. Marginal macroducts reduced in size, three or four in number on each side of the pygidium, all single. One small submedian dorsal duct just in front of the dorsal sclerotization of the pygidium. Antennae truncated apically; interantennal process absent. Anterior spiracle with one to three disc pores; posterior spiracles with microducts few between them. Perivulvar pores: three to five in the median group, seven to 11 in the anterolateral, and 11 to 15 in the posterolateral. Second instar female with the median lobes quite large and sunken in the pygidium; second lobes well developed, the inner lobule elongate, with a pair

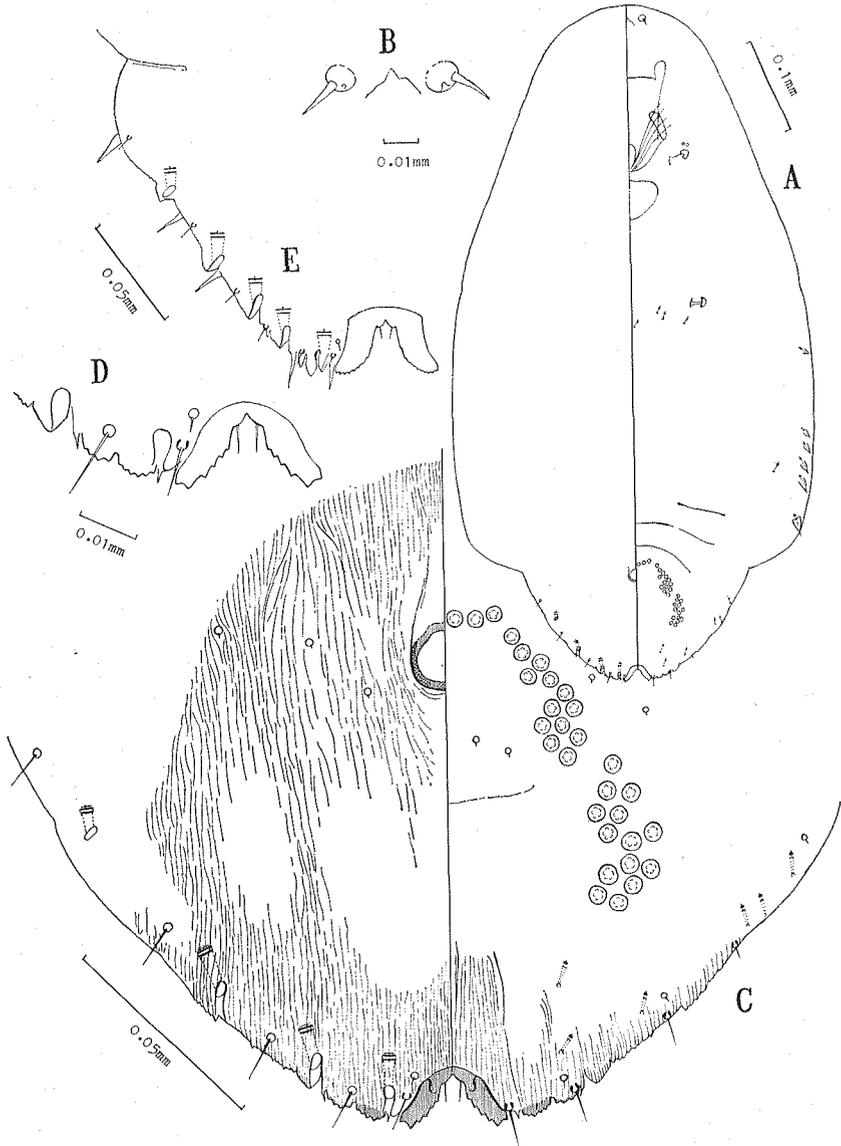


Fig. 57. *Fiorinia linderac*, n. sp. A-D, adult female (A, body; B, antennae & interantennal process; C, pygidium; D, pygidial lobes); E, pygidial margin of the exuvium of the second instar female.

of short basal scleroses, the outer lobule smaller, pointed apically; five marginal macroducts on each side of the pygidium, belonging to the third to seventh abdominal segments; six gland spines on each side of the abdomen, belonging to the third to eighth abdominal segments.

Specimens examined. Yang-ming Shan and Tai-pei, on creeping plants of *Ficus*.

Distribution and host plants. This species was recorded by Maskell from Amoy, Hongkong, Taiwan and Australia, being collected on *Camellia*, *Ficus* and other plants. Ferris described it under the name *chinensis* on the basis of specimens collected at quarantine at San Francisco on an undetermined plant from China. Takahashi recorded it, under the name *chinensis*, in Taiwan on *Celtis sinensis* and *Ficus pumila*.

87. *Fiorinia theae* Green

References. Green 1900 c: 3; Kuwana 1925 b: 10; Ferris 1942: 395.

Diagnosis. Pygidium rather of an angulated appearance. Median lobes slightly sunken into the pygidium, robust, low, about as long as wide, and serrate. Second lobes in low, broad, serrate processes. Marginal gland spines all short and basally broadened, five in number on each side of the pygidium, single, belonging to the fourth to eighth abdominal segments; prepygidial region with as many as 20 gland cones arranged just within the margin in an interrupted row as far as the mesothoracic region. Marginal macroducts replaced by about nine slender ducts on each side of the pygidium. A few small dorsal ducts scattered around the base of the pygidium. Interantennal process prominent, dilated apically. Anterior spiracle with two to four disc pores; posterior spiracles with microducts few between them. Perivulvar pores: five or six in the median group, 11 to 18 in the anterolateral, and 13 to 18 in the posterolateral. Second instar female with the median lobes elongate and entirely sunken into the pygidium; second lobes well developed, the inner lobule elongate, with a pair of basal scleroses, the outer lobule smaller; seven marginal gland spines on each side of the pygidium, belonging to the second to eighth abdominal segments, the anterior three of them are enlarged, increasing in size towards the anterior.

Specimens examined. Yang-ming Shan, on *Eurya japonica* [a few specimens in poor condition].

Distribution and host plants. This species was originally described from specimens collected in India on tea-plant, and later recorded in India on *Citrus* and *Olea glandulifera*. It was recorded in Ceylon on *Ostodes zeylanicus*, in the Philippines on *Caryola*, in Taiwan on *Citrus*, *Eurya* and *Thysanospermum diffusum*, and in Japan on *Eurya japonica*. This species was introduced into North America, where it was recorded on *Camellia*.

88. *Fiorinia proboscidiaria* Green [Fig. 58]

References. Green 1900 a: 256; Kuwana 1931, Yengei no Kenkyu 26: 3.

Diagnosis. Body fusiform, narrowing towards both ends; head conical, terminating in a prominent interantennal process, with a low prominence on each side. Median lobes a little sunken into the pygidium, broad and serrate. Second lobes in low, serrate processes. Marginal gland spines quite reduced in size, one on the third to eighth abdominal segments each; gland cones numerous, 31 to 38 in number on one side of the body, arranged in an interrupted row on the prothorax to the second

abdominal segment. Marginal setae of the pygidium elongate. Marginal macroducts replaced by quite slender ducts, four in number on each side of the pygidium, single, belonging to the fourth to seventh abdominal segments. A few small dorsal ducts in the median region on the base of the pygidium and the preceding two segments. Anterior spiracle at times with a single disc pore; posterior spiracles with microducts few between them. Perivulvar pores; three to seven in the median group, 11 to 16

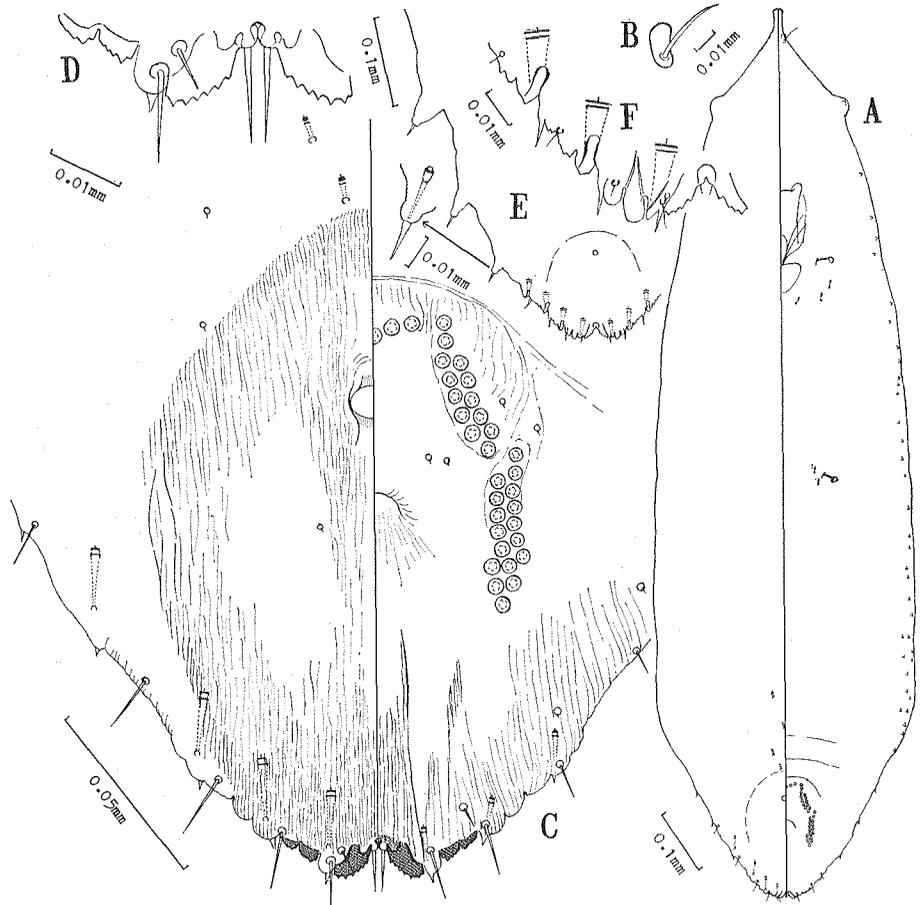


Fig. 58. *Fiorinia proboscidea* Gr. A-D, adult female (A, body; B, antenna; C, pygidium; D, pygidial lobes); E & F, exuvium of the second instar female (E, abdomen; F, pygidial margin).

in the anterolateral, and 12 to 17 in the posterolateral. Second instar female with the median lobes elongate and entirely sunken into the pygidium; second lobes well developed, the inner lobule elongate, with a pair of basal scleroses, the outer lobule somewhat smaller; four marginal macroducts on each side of the pygidium, belonging to the fourth to seventh abdominal segments; seven marginal gland spines on each side of the abdomen, belonging to the second to eighth abdominal segments, the anterior

three of them are enlarged, increasing in size towards the anterior.

Specimens examined. Chia-i and Kuan-tzu-ling, on *Eugenia jambos*.

Distribution and host plants. This species was originally described from Ceylon as a feeder of *Gelonium lanceolatum*. It was recorded in Taiwan on *Citrus* and *Eugenia jambos* and in Ryukyu on *Citrus*.

Remarks. This species is very close to *thaeae*, but may be distinct. It is distinguishable from the latter mainly by the head narrowing towards the interantennal process and having a pair of lateral prominences; by the anterior spiracles lacking disc pores except for the occasional presence of a single disc pore; by the marginal gland spines less prominent; and by the marginal ducts of the pygidium fewer.

XXXVI. Genus *Achionaspis*, n. g.

Type-species. *Achionaspis kanoi*, n. sp.

Diagnosis. Body fusiform, with the free segments well lobed laterally. Derm membraneous except for the pygidium. Median lobes well developed, zygotic basally, with a pair of setae between them. Second and third lobes well represented, bilobulate. Marginal gland spines well developed on the pygidium. Marginal macroducts of the pygidium somewhat larger than the dorsal macroducts, one between the median and second lobes, two associated with the third lobe (on the sixth abdominal segment), two on the fifth abdominal segment, and one or two on the fourth. Dorsal macroducts rather small in size, tending to be arranged in segmental rows, but appearing rather scattered, occurring posteriorly as far as the supposed seventh abdominal segment in both of the submedian and submarginal regions. Antenna with a seta. Anterior spiracles with disc pores. Anal opening situated a little basally to the centre of the pygidium. Perivulvar pores in five groups.

Remarks. This genus is very close to *Pseudaulacaspis*, but is distinguished from the latter on account of the distribution and arrangement of the dorsal macroducts.

89. *Achionaspis kanoi*, n. sp. [Fig. 59]

Diagnosis. Median lobes comparatively very large, almost entirely sunken into the pygidium, forming a distinct notch on the apex of the latter, elongate, divergent, with the margin rather roughly serrate. Second lobes much smaller than the median lobes, yet well developed, with both lobules elongate, the outer lobule a little smaller than the inner. Third lobes also well developed, but less sclerotized than the median and second lobes, both lobules broader than those of the second lobe, notched on the outer or either side. Pygidial margin serrate laterally to the third lobe as far as the apex of the lateral lobe of the third abdominal segment. Marginal gland spines of the pygidium single except three on the base of the pygidium (on the fourth abdominal segment), the preceding two segments (second and third abdominal segments) each with four to six gland spines as large as the pygidial ones; metathorax with two or three gland cones laterally to the posterior spiracle, and the first abdominal segment with four to six in the submarginal region. Dorsal macroducts more or less smaller than the marginal macroducts of the pygidium, the submarginal macroducts appearing rather scattered as far as the thoracic region, the submedian macroducts tending to be arranged in segmental rows, one or two on the basal three abdominal segments each,

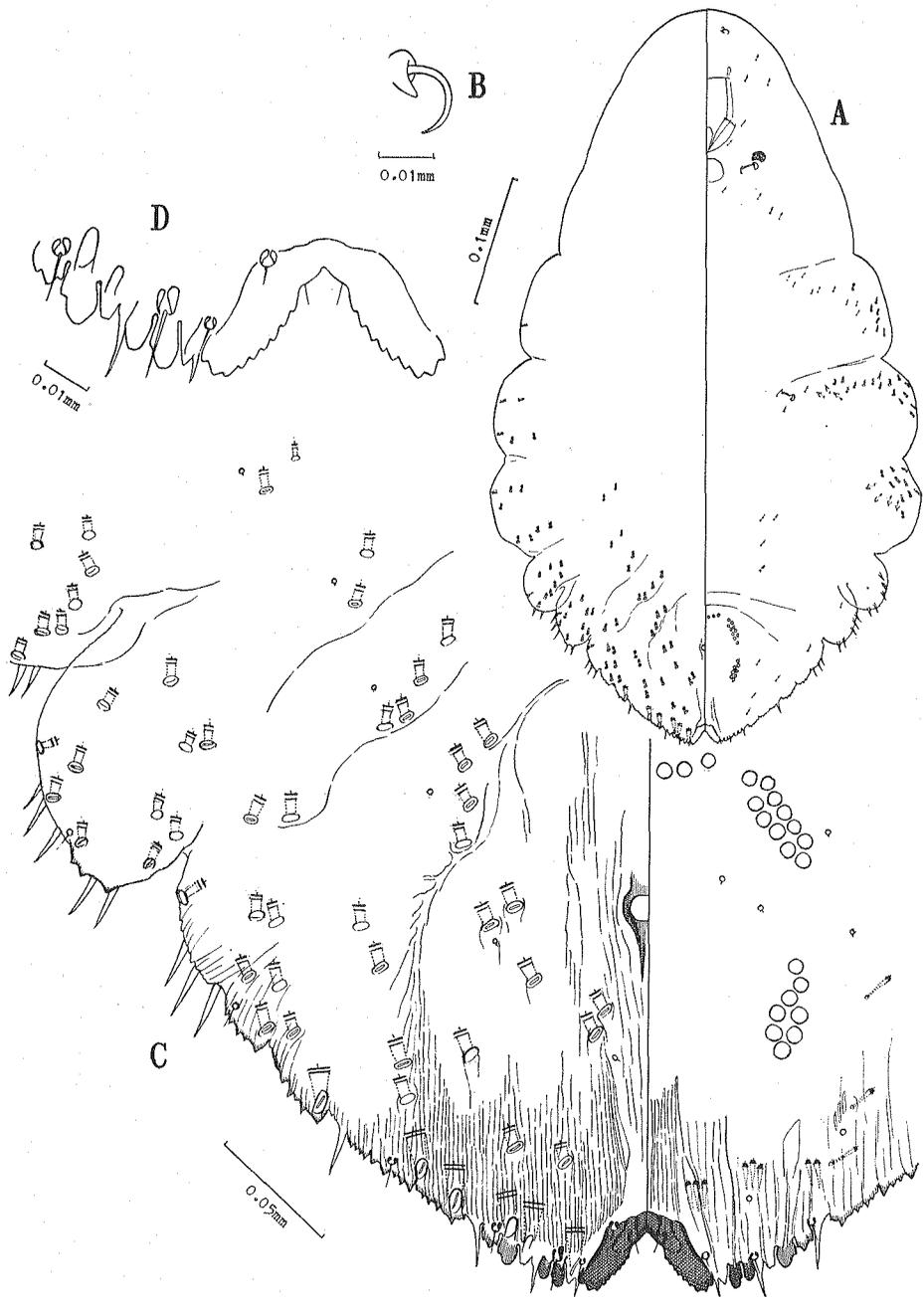


Fig. 59. *Achionaspis kanoi*, n. sp. Adult female (A, body; B, antenna; C, pygidium; D, pygidial lobes).

three or four on the fourth abdominal segment, four on the fifth, three on the supposed sixth, and one or two on the supposed seventh, becoming smaller towards the anterior. Meso- and metathorax and first abdominal segment scattered with ventral macroducts on the lateral lobe. Anterior spiracle with many disc pores in a compact cluster. Perivulvar pores: four to six in the median group, nine to 12 in the anterolateral, and seven to nine in the posterolateral. Scale white.

Specimens examined. Southeastern Tai-pei Hsien, on the leaves of *Eurya japonica* [two adult females].

XXXVII. Genus *Chionaspis* Signoret

References. Signoret 1869 a: 442; Ferris 1937: 13 and 91 [*Chionaspis*; *Phenacaspis*]; Balachowsky 1954 e: 317; Takagi and Kawai, 1967, *Insecta Matsumurana* 30: 31.

Synonyms. *Phenacaspis* Cooley and Cockerell, 1899 [type-species: *Chionaspis nyssae* Comstock]; *Fundaspsis* MacGillivray, 1921 [type-species: *Chionaspis americana* Johnson]; *Marchaliella* Bodenheimer, 1951 [type-species: *Chionaspis lepineyi* Balachowsky].

Type-species. *Coccus salicis* L.

Diagnosis. Body elongate-fusiform in the authentic members of the genus, with the free segments more or less lobed laterally, and with the pygidium rounded or rather triangular. Derm usually remaining membraneous except for the pygidium. Median lobes well developed, zygotic basally, without distinct marginal setae between their bases. Second lobes bilobulate. Some species have bark- and leaf-feeding forms, which are different mainly in the median lobes and at times also in the dorsal macroducts of the pygidium; in the bark-feeding form the median lobes are prominent and more or less set close together, whereas in the leaf-feeding form these lobes are sunken into a distinct apical notch of the pygidium. Gland spines well developed on the abdomen. One marginal macroduct between the median and second lobes, two laterally to the second lobe (on the sixth abdominal segment), two on the fifth abdominal segment, and one or two on the fourth. Dorsal macroducts practically as large as the marginal macroducts, arranged segmentally in well-defined submedian and submarginal rows. Dorsal microducts generally present, often replacing part of the macroducts. Antenna with a seta. Anterior and often also posterior spiracles with disc pores. Anal opening situated about the centre of the pygidium in the type-species, but in other species various in position. Perivulvar pores in five groups.

Composition and distribution. In the sense adopted here this genus is mainly Holarctic in distribution, having there at least more than 30 known species. Some species occurring in the Oriental region are also definitely referable to the genus.

Remarks. It is the opinion proposed by Takagi and Kawai (1967, l. c.) that *Phenacaspis* is a synonym of *Chionaspis*, all the North American and part of the Asiatic species of *Phenacaspis* forming in reality an aggregate of dimorphic forms of *Chionaspis*. Of the Taiwanese species, *Chionaspis sozanica* should be undoubtedly retained in the genus, and *Phenacaspis formosana* may be also a real member of the genus. Certain other Taiwanese species may be referred to *Chionaspis*, but they are more or less deviate from the genuine members of the genus in the body shape or pygidial lobes; such species are: *Chionaspis vitis*, *Diaspis machili*, *D. machilicola*, *D. machilicola* var. *cinnamomicola*, *Phenacaspis rotunda* and *P. trochodendri*. Further, three new species are described here tentatively as members of the genus.

So far as I am aware, the following species were described or recorded from Taiwan in *Chionaspis* (No. 1-11) or *Phenacaspis* (No. 12-20).

- 1) *annandalei* Green. Possibly a species of *Kuwanaspis*. Not collected.
- 2) *atalantiae* Takahashi. Belongs to the *Fiorinia*-group. Not collected.
- 3) *bambusifoliae* Takahashi. Referable to *Greenaspis*. Not collected.
- 4) *brideliae* Takahashi. Referable to *Pseudaulacaspis*. Not collected.
- 5) *divergens* Takahashi, *graminis* var. A species of *Duplachionaspis*.
- 6) *elongata* Green. Type-species of *Greenaspis*.
- 7) *graminicola* Takahashi. Referable to *Acanthomytilus*. Not collected.
- 8) *sozanica* Takahashi. Retained in *Chionaspis*.
- 9) *stanotophri* Cooley. A species of *Duplachionaspis*. Not collected.
- 10) *vermiformis* Takahashi. Type-species of *Takahashiella* (= *Acanthomytilus*).
- 11) *vitis* Green. Not collected.
- 12) *dilatata* Green. A synonym of *Pseudaulacaspis cockerelli*.
- 13) *eugeniae* Maskell. Misidentification of *dilatata* (= *cockerelli*).
- 14) *formosana* Takahashi. Referable to *Chionaspis*. Not collected.
- 15) *kuwanai* Takahashi. A species of *Pseudaulacaspis*. Not collected.
- 16) *manii* Green. Identical with *Diaspis manii* Green and *Diaspis gordoniae* Takahashi; referable to *Pseudaulacaspis*. Not collected.
- 17) *rotunda* Takahashi. Referable to *Chionaspis*. Not collected.
- 18) *taiwana* Takahashi. Referable to *Pseudaulacaspis*. Not collected.
- 19) *takahashii* Ferris. Referable to *Pseudaulacaspis*.
- 20) *trochodendri* Takahashi. Tentatively referred to *Chionaspis*.

90. *Chionaspis sozanica* Takahashi [Fig. 60]

References. Takahashi 1933: 41.

Diagnosis. Pygidium triangular in outline, with the median lobes more or less divergent and minutely serrate. Second lobes with both lobules well represented, the outer lobule smaller than the inner. Third lobes with the inner lobule in a slight prominence, and with the outer lobule almost reduced to marginal serrations. Marginal gland spines well developed, single except for two or three on the fourth abdominal segment; prepygidial gland spines becoming shorter towards the anterior, occurring on the lateral lobes of the basal three abdominal segments: two to four on the first abdominal segment, four to seven on the second, and five to seven on the third. Submedian dorsal macroducts: three to six on the third abdominal segment, three to five on the fourth, three or four on the fifth and one or two (or at times lacking) on the sixth; submarginal macroducts: six to 11 (including one or two opened in a marginal prominence) on the third abdominal segment, four to six on the fourth, and three or four on the fifth; smaller macroducts on the lateral lobes of the basal three abdominal segments. Anterior spiracle with 10 to 16 disc pores; posterior spiracle with four to eight. Anal opening situated towards the base of the pygidium. Perivulvar pores: 12 to 23 in the median group, 22 to 30 in the anterolateral, and 18 to 24 in the posterolateral.

Specimens examined. Yang-ming Shan, on *Acer* sp.

Distribution and host plants. This species was originally described from specimens collected in Taiwan on *Acer*. Specimens collected in Okinawa on *Acer oblongum*

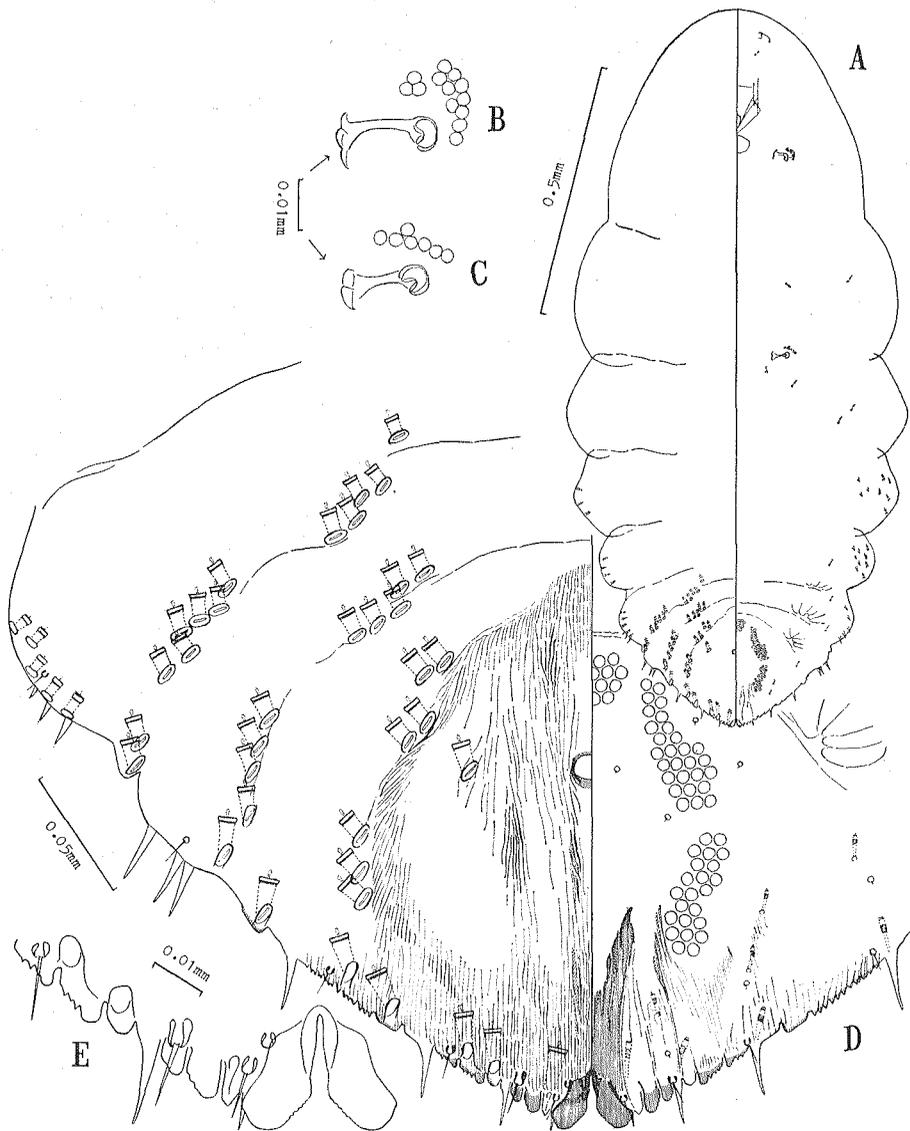


Fig. 60. *Chionaspis sozanica* Takah. Adult female (A, body; B, anterior spiracle; C, posterior spiracle; D, pygidium; E, pygidial lobes).

var. *itoanum* are also at hand.

Remarks. The type specimens of this species were collected at Yang-ming Shan ("Sozan") on the leaves of the host plant. It is evident that Takahashi described and figured this species on the basis of the leaf-feeding form. The specimens at hand from Taiwan were all collected on the twigs and branches of the host plant and differ from the original description by the median lobes broader and almost wholly produced beyond the apex of the pygidium and by the perivulvar pores much more numerous. On account of the agreement in the locality and host plant I am very much inclined to the opinion that the specimens at hand may rightly be identified with the present species, representing the bark-feeding form of the species.

The specimens at hand from Okinawa belong to the leaf-feeding form, their pygidial lobes agreeing well with the figures given in the original description. In these specimens, however, the perivulvar pores are numerous as in the present specimens from Taiwan.

Chionaspis acer (Takagi and Kawai) (= *Phenacaspis acer*) from Japan is very close to *sozanica*, but the former may be distinguished from the latter by the constant lacking of submedian dorsal macroducts on the sixth abdominal segment and by the median lobes which are different in shape from those of *sozanica* in both of the bark- and leaf-feeding forms.

91. *Chionaspis machili* (Takahashi) [Fig. 61]

References. Takahashi 1931: 1 [*Diaspis*]; Takagi and Kawai 1966, Insecta Matsumurana 28: 112 [*Phenacaspis obovata*].

Synonyms. *Phenacaspis obovata* Takagi and Kawai, 1966.

Diagnosis. Body robust, more or less swollen in the cephalothorax, usually broadest across the mesothoracic region, with the pygidium broad and triangular. In the bark-feeding form the median lobes are robust, parallel or slightly divergent, more or less produced beyond the pygidial margin, and serrate; in the leaf-feeding form these lobes are almost wholly retracted into the pygidium, forming a distinct notch at the apex of the pygidium, divergent, narrow, and minutely serrate. Second lobes much smaller than the median lobes, yet well represented, the outer lobule smaller than the inner. Third lobes with the inner lobule more or less distinct. Marginal gland spines of the pygidium well developed, single except two to four on the base of the pygidium (on the fourth abdominal segment); second and third abdominal segments with five to nine and six to 10 gland spines, respectively, these gland spines well developed and situated just within the margin. About four to seven submedian dorsal macroducts on the third to fifth abdominal segments each, and two to four on the sixth; six to 13 submarginal macroducts on the third abdominal segment, five to seven on the fourth, and four to six on the fifth. Smaller macroducts few on the second and third abdominal segments just within the lateral margin. A submarginal dorsal boss between the third and fourth abdominal segments; another boss larger but little sclerotized on the first abdominal segment. Anterior spiracle with about 30 to 50 disc pores in a compact cluster, the posterior with six to 25. Anal opening situated at the centre of the pygidium. Perivulvar pores: 15 to 27 in the median group, 22 to 50 in the anterolateral, and 16 to 36 in the posterolateral.

Specimens examined. Yang-ming Shan, on *Machilus japonica*; Kuan-tzu-ling, on

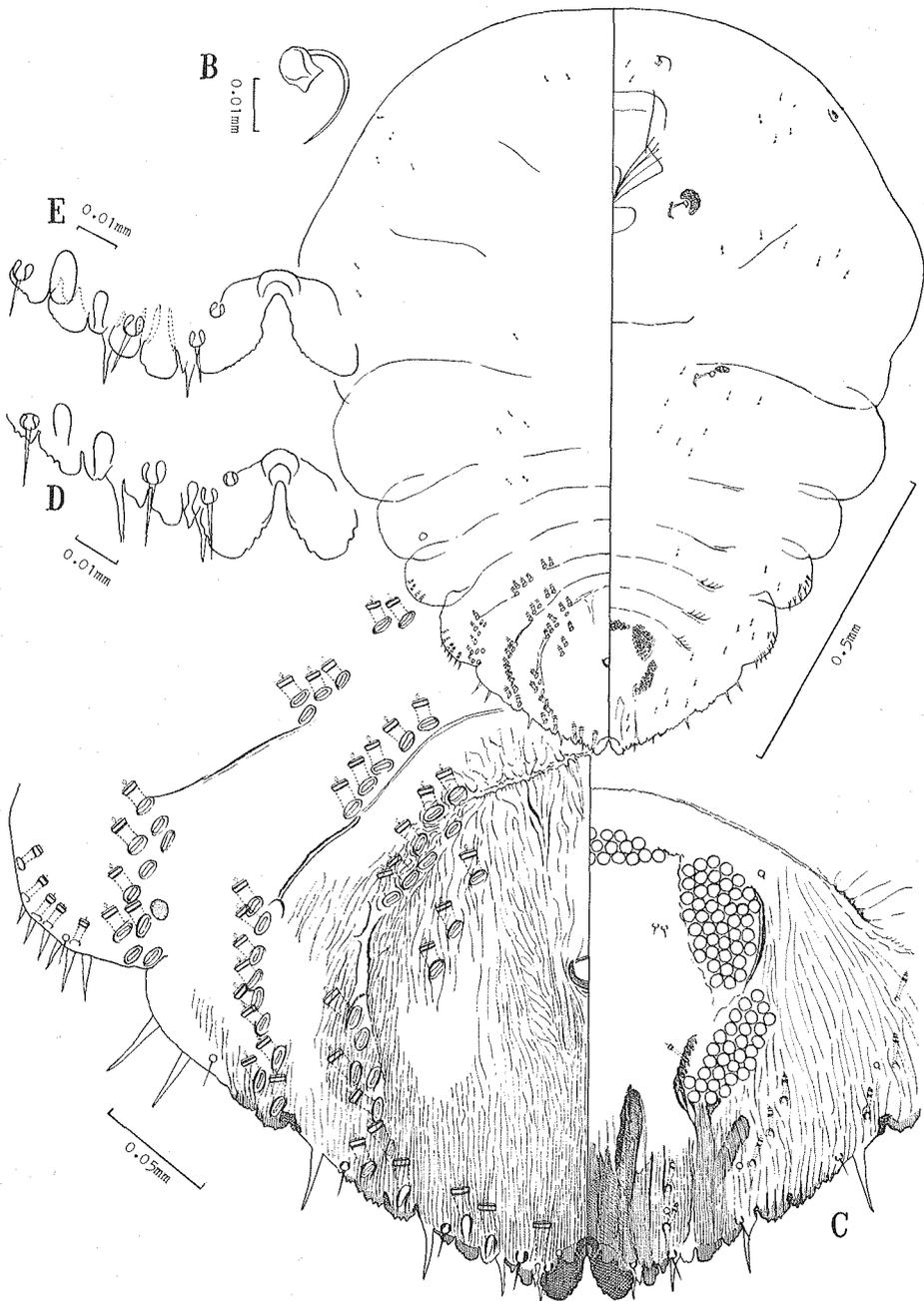


Fig. 61. *Chionaspis machili* (Takah.). Adult female (A, body; B, antenna; C, pygidium; D & E, pygidial lobes) (A-D, bark-feeding form; E, leaf-feeding form).

Machilus kusanoi; Fen-chi-hu, on *Machilus* sp.; Ken-ting, on *Machilus kusanoi*.

Distribution and host plants. This species was originally described from specimens collected in Taiwan on *Machilus kusanoi*. *Phenacaspis obovata*, which was described from Japan as a feeder of *Machilus japonica*, is here regarded as identical with the present species.

Remarks. This species is not a typical form of *Chionaspis* on account of its broad body shape. The body shape is, however, variable in the specimens at hand: at one extreme the body is quite broad and rather pyriform as described by Takahashi, resembling that of *Diaspis*, whereas at the other extreme it is much less robust and similar to that of *Aulacaspis*, although does not agree with the typical body shape of that genus. *Phenacaspis obovata* nearly agrees with the narrower form of the present species, so that it may be united with the latter.

92. *Chionaspis uenoi*, n. sp. [Fig. 62]

Diagnosis. Body robust, with the thoracic region, especially the mesothorax, more or less broadened. Median lobes comparatively very large, deeply sunken into the pygidium, divergent, elongate and serrate. Second lobes much smaller than the median, but well represented; inner lobule a little longer than wide, rounded apically, with a pair of short basal scleroses; outer lobule smaller. Third lobes with the inner lobule well represented, and with the outer lobule in a low process. Marginal gland spines of the pygidium single except three or four on the base of the pygidium; prepygidial gland spines well developed on the second and third abdominal segments, occurring just within the lateral margin, two to seven on the second segment, and four to nine on the third. Submedian dorsal macroducts: three or four on the third abdominal segment, two to four on the fourth, and one or two on the fifth; submarginal macroducts: five to eight (including one situated on the margin) on the third abdominal segment, three or four on the fourth, and two to four on the fifth. Smaller macroducts few on the second and third abdominal segments, occurring just within the lateral margin. A submarginal dorsal boss quite small between the third and fourth abdominal segments; another boss larger on the first abdominal segment; five points forming a small circle on the prothorax just within the margin. Anterior spiracle with many disc pores in a compact cluster; posterior spiracle with one to four. Anal opening situated about the centre of the pygidium. Perivulvar pores: 14 to 22 in the median group, 23 to 32 in the anterolateral, and 20 to 26 in the posterolateral.

Specimens examined. Fen-chi-hu, on *Lindera communis*.

Remarks. This species comes very close to *machili*, from which it is distinguished mainly by the head not particularly broadened, by the median lobes comparatively very large, and by the submedian macroducts always lacking on the sixth abdominal segment. The above diagnosis is based on several specimens which were all collected on the leaves of the host and may represent the leaf-feeding form of this species.

93. *Chionaspis trochodendri* (Takahashi) [Fig. 63]

References. Takahashi 1936 d: 4 [*Phenacaspis*].

Diagnosis. Body fusiform, with the pygidium rather broad and slightly roundish. Median lobes comparatively small, sunken in the pygidium, divergent, rather narrow; basal zygotis in a pair of small sclerotized pieces, which are confluent only in a point.

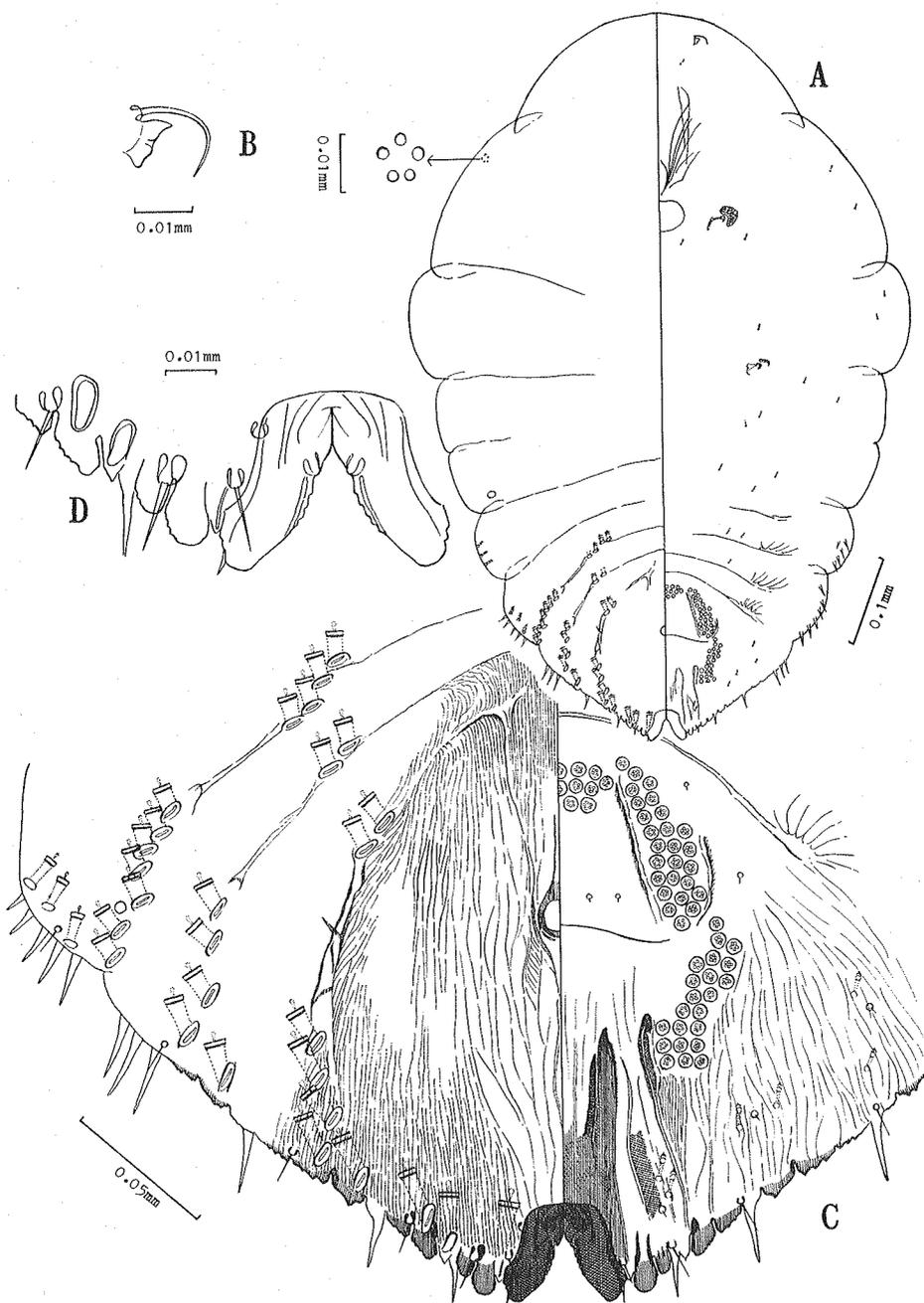


Fig. 62. *Chionaspis uenoi*, n. sp. Adult female (A, body; B, antenna; C, pygidium; D, pygidial lobes).

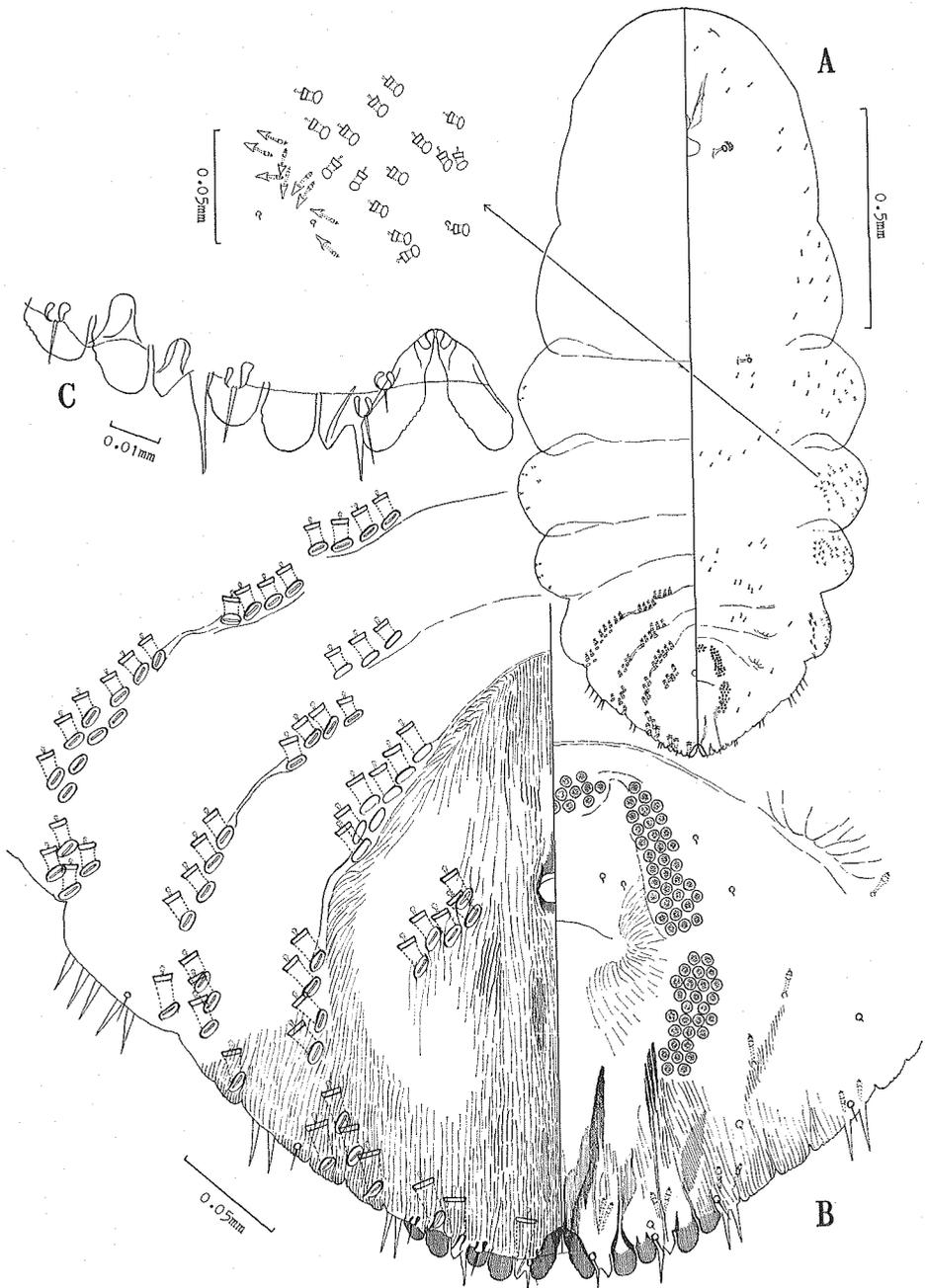


Fig. 63. *Chionaspis trochodendri* (Takah.). Adult female (A, body; B, pygidium; C, pygidial lobes).

Second lobes well developed; inner lobule only slightly longer than wide, rounded apically, with a pair of long basal scleroses; outer lobule a little smaller, with a pair of short basal scleroses. Third lobes similar to the second. Marginal gland spines of the pygidium rather short; five to eight on the fourth abdominal segment (on the base of the pygidium), two or three on the fifth; and perhaps paired but often appearing to be single on the sixth to eighth each (just laterally to the third lobe; between the second and third lobes; between the median and second); gland cones numerous on the lateral lobes of the basal three abdominal segments: five to 10 on the first abdominal segment, nine to 14 on the second, and eight to 10 on the third. Submedian dorsal macroducts: seven to nine on the third and fourth abdominal segments each, five to eight on the fifth, and three to five on the sixth; submarginal macroducts: 10 to 18 (including one situated on the margin) on the third abdominal segment, often forming a double or triple row; seven to 11 on the fourth; and five to seven on the fifth. Smaller macroducts scattered on the lateral lobes of the metathorax and basal three abdominal segments, few on the metathorax, but rather numerous on the abdominal segments. Anterior spiracle with about seven to 12 disc pores in an arch; posterior spiracle with two to seven. Anal opening situated towards the base of the pygidium. Perivulvar pores: 17 to 20 in the median group, 31 to 41 in the anterolateral, and 24 to 30 in the posterolateral.

Specimens examined. A-li Shan, on *Trochodendron aralioides*.

Distribution and host plants. This species was originally described from specimens collected in Taiwan on *Trochodendron aralioides*. There has been made no further record.

Remarks. This species differs from the authentic members of *Chionaspis* by the reduced basal zygotis of the median lobes, but there is no positive evidence sufficient to exclude it from the genus.

Both the original description and the above diagnosis are based on specimens collected on the leaves of the host plant.

94. *Chionaspis schizosoma*, n. sp. [Fig. 64]

Diagnosis. Body becoming robust at maturity, with the mesothorax eminently swollen laterally and the metathorax in a less degree, and with the free abdominal segments also strongly lobed out laterally. Head produced into a small ear-like prominence on each lateroposterior corner. Pygidium broad, and rather triangular in outline, with three pairs of lobes all well represented. Median lobes comparatively small, but larger than the second, sunken in an apical notch of the pygidium, elongate, with their inner margins parallel in the basal half and then divergent to the rounded apices and minutely serrate: basal zygotis in a pair of small sclerotized pieces confluent only in a point. Second lobes with either lobule slightly longer than wide; inner lobule with a pair of long basal scleroses, the outer with short ones. Third lobes similar to the second, but with the lobules more or less broader than those of the second. Marginal gland spines of the pygidium rather small, single except two or three on the base of the pygidium; prepygidial gland spines short, occurring along the lateral margin, about 10 in number on the second and third abdominal segments each. Submedian dorsal macroducts: four to seven on the third abdominal segment, two to five on the fourth, two to four on the fifth, and one or two, or at times absent,

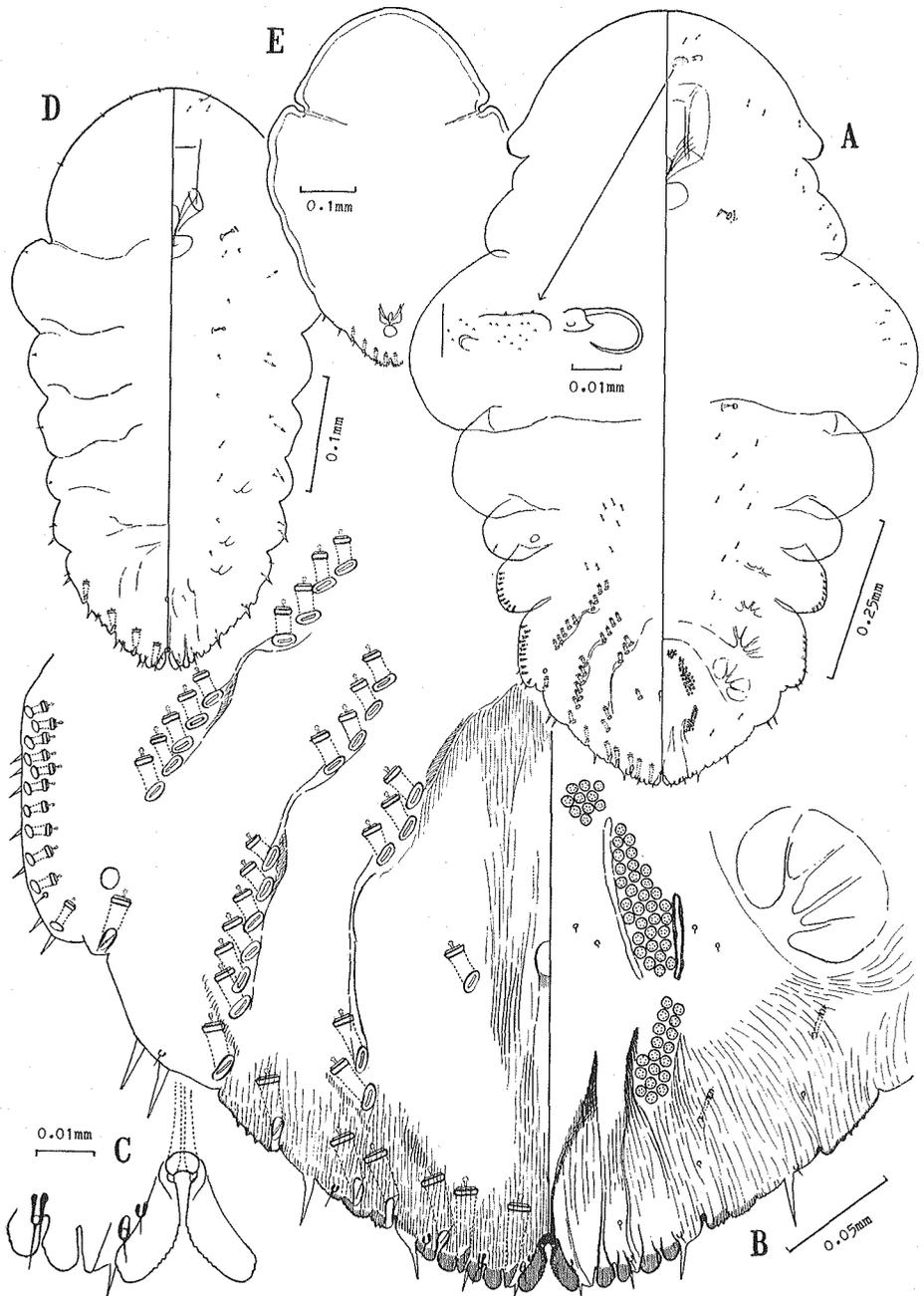


Fig. 64. *Chionaspis schizosoma*, n. sp. A-C, adult female (A, body; B, pygidium; C, pygidial lobes); D, second instar female; E, exuvium of the second instar female.

on the sixth; submarginal macroducts: five to eight (including one situated on the margin and distinctly separated from the submarginal row) on the third abdominal segment, four to seven on the fourth, and two or three on the fifth. Second and third abdominal segments each with about 10 smaller macroducts arranged along the lateral margin. A few dorsal microducts scattered anteriorly to the submedian macroducts of the third abdominal segment. A submarginal dorsal boss between the third and fourth abdominal segments; another boss larger on the first abdominal segment. Between the antennae the derm is swollen into a slight tubercle, which is strewn with minute granules. Anterior spiracle with five to 10 disc pores; posterior spiracle without disc pores. Anal opening situated about the centre of the pygidium. Perivulvar pores: eight to 22 in the median group, 24 to 39 in the anterolateral, and 16 to 22 in the posterolateral, the median group often divided medianly. Exuvium of the second instar female with a distinct notch between the pro- and mesothoracic regions.

Specimens examined. Yang-ming Shan, on *Machilus japonica*; Chia-i, on *Machilus* sp.; Chu-chi, on *Machilus* sp.; Ken-ting, on *Machilus kusanoi*.

Remarks. This species is peculiar by the body shape of the adult female and by the thoracic notch of the second instar exuvium of the female (a corresponding thoracic notch is seen in the full-grown second instar female and also in the immature adult female enclosed within the second instar exuvium). In the pygidial characters it much resembles *trochodendri*. It should be here noted that the present species has five-segmented antennae in the first instar, whereas all the preceding species referred to *Chionaspis* have six-segmented antennae as in the type-species and other genuine members of the genus.

All the specimens at hand were collected on the leaves of the host plants, representing probably the leaf-feeding form of this species.

I have found in the present collection another form which is very close to the above species. This form was collected at Ken-ting on *Machilus kusanoi*. It differs from the above species by the mesothorax much less broadened and by lacking the thoracic notch in the second instar. It is not easy to guess whether this form is a distinct species or a mere variant of *schizosoma*. However, it should be noted here that this form is found in a distinct colony and not mingled with *schizosoma*.

95. *Chionaspis* sp.

Diagnosis. Body rather robust, with the cephalothorax a little swollen, and with the pygidium rather roundish. Derm sclerotized on the cephalothorax and the first abdominal segment in a broad marginal area. Median lobes comparatively small, somewhat larger than the second, sunken in an apical notch of the pygidium, divergent, elongate, with the basal zygois reduced in size. Second lobes with both lobules practically as long as wide, rounded apically, the inner lobule with a pair of long basal scleroses. Third lobes with both lobules well developed and wider than those of the second. Marginal gland spines of the pygidium rather well developed, single except four to six on the base of the pygidium; second abdominal segment with nine and the third with 11 to 14 gland spines just within the lateral margin. Submedian dorsal macroducts: one or two on the first abdominal segment, nine or ten on the second, seven or eight on the third, five or six on the fourth, three to five on the fifth, and two on the sixth; submarginal macroducts: about 10 on the second to fourth abdominal

segments each, and four to six on the fifth. Many smaller macroducts scattered on the second and third abdominal segments just within the lateral margin. A small sub-marginal dorsal boss between the third and fourth abdominal segments. Anterior spiracle with a compact cluster of many disc pores; posterior spiracle with a smaller cluster. Anal opening situated at the centre of the pygidium. Perivulvar pores: 14 in the median group, 27 in the anterolateral, and 30 in the posterolateral.

Specimens examined. Fen-chi-hu, on *Beilschmiedia erythrophloia* (on the leaf) [one adult female in poor condition].

Remarks. This species is close to *trochodendri* and *schizosoma*, but is easily distinguishable from the latter two by having dorsal macroducts on the basal two abdominal segments. It is possible that this species is identical with *Diaspis machilicola* var. *cinnamomicola* Takahashi, which was originally described from specimens collected in Taiwan on *Beilschmiedia erythrophloia* (= *Cinnamomum erythrophloia*), but the description of the latter is too brief to ascertain this identity.

XXXVIII. Genus *Greenaspis* MacGillivray

References. MacGillivray 1921: 307; Ferris 1952 a: 6.

Synonyms. *Canaspis* MacGillivray, 1921 [type-species: *Chionaspis arundinariae* Green].

Type-species. *Mytilaspis elongata* Green.

Diagnosis. Body much elongate, with the pygidium narrow. Derm membraneous except for the pygidium. Pygidium with two pairs of lobes crowded at its apex and comparatively small. Median lobes zygotic basally, slightly sunken into the pygidium, forming a shallow notch at the apex of the latter, divergent, and emarginate on the inner side. Second lobes much smaller than the median, bilobulate. Third lobes obsolete. Marginal gland spines well developed, and comparatively robust. Marginal macroducts paired on the fourth to sixth abdominal segments each, and single on the seventh (between the median and second lobes). Dorsal macroducts as large as the marginal macroducts, few in well-defined segmental rows. Antenna with a seta. Anterior spiracle with disc pores few in number, the posterior without them. Anal opening situated towards the base of the pygidium. Perivulvar pores in five groups. First instar larva with prominent marginal setae around the body; antennae five-segmented, with the terminal segment much elongate and annulate.

Composition and distribution. This genus is a small group of bamboo-feeding species occurring in southeastern Asia. The type-species has a wide range of distribution from India and Ceylon through China and Taiwan to Japan. *Chionaspis arundinariae* Green from Ceylon and *Chionaspis bambusifoliae* Takahashi from Taiwan are undoubtedly referable to the genus.

Remarks. This genus is very similar to *Chionaspis* in the general characters of the adult female, but the elongate body shape, the small pygidial lobes and the peculiar shape of the median lobes may allow of accepting the genus as distinct. This view is supported by the first instar, in which this genus is quite distinct from *Chionaspis* by having eminent marginal setae around the body and by the much elongate, annulate terminal segment of the antennae. On account of these characters this genus can not be placed close to any other. *Thysanofiorinia*, another genus in which the marginal setae of the first instar larva are enlarged, has nothing to do with *Greenaspis* so far

as the adult females are concerned. Hall (1946 a: 519) points out the resemblance between *Greenaspis* and *Albataaspis* MacGillivray, but this resemblance is confined only to the shape of the median lobes.

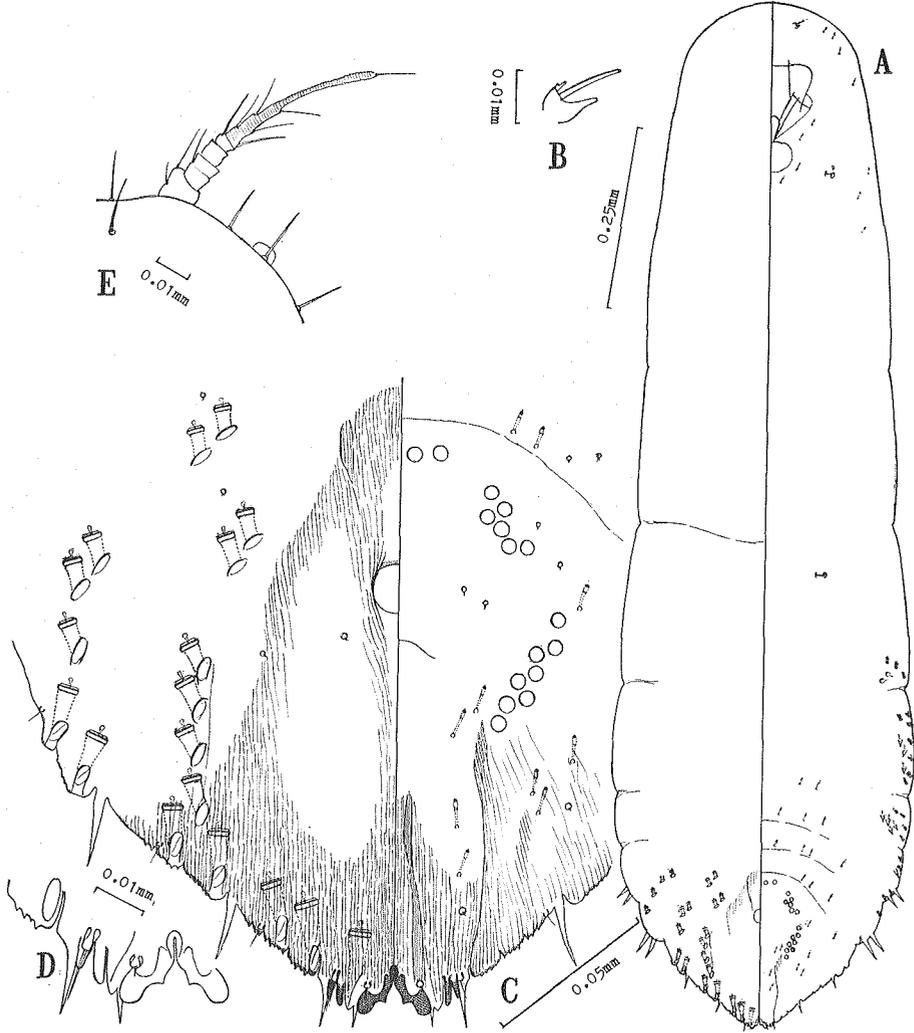


Fig. 65. *Greenaspis elongata* (Gr.). A-D, adult female (A, body; B, antenna; C, pygidium; D, pygidial lobes); E, head of the exuvium of the first instar larva.

96. *Greenaspis elongata* (Green) [Fig. 65]

References. Green 1896: 4 [*Mytilaspis*]; *ibid.* 1899 a: 125 [*Chionaspis*]; Ferris 1952 a: 7 [*yunnanensis*]; Takagi 1961: 18 [*yunnanensis*].

Synonyms. *Greenaspis yunnanensis* Ferris, 1952.

Diagnosis. Body quite long and narrow at full growth owing to the prolongation of the thoracic region. Median lobes broadly emarginate on the apical half of

the inner margin, rounded apically. Second lobes with both lobules quite narrow; inner lobule with a pair of slender, inconspicuous basal scleroses; outer lobule obviously smaller than the inner. Pygidial margin more or less serrate on the fifth and sixth abdominal segments. Marginal gland spines paired on the fourth abdominal segment, single on the succeeding segments; third abdominal segment with two or three gland spines just within the margin; two or three gland cones in the posterolateral corner of the metathorax, the first and second abdominal segments with four to nine and three or four gland cones, respectively, within the lateral margin. One or two submedian dorsal macroducts on the fourth abdominal segment, and one to three on the fifth; two to five submarginal macroducts on the third and fourth abdominal segments each, and one to four on the fifth. Smaller macroducts scattered on the metathorax in the posterolateral corner, and also on the first and second abdominal segments within the lateral margin. Anterior spiracle with one or at times two disc pores. Perivulvar pores: four or five in the median group, four to eight in the anterolateral, and seven to nine in the posterolateral.

Specimens examined. Southeastern Tai-pei Hsien; Yang-ming Shan; and Ken-ting. On bamboos.

Distribution and host plants. This species was originally described from Ceylon as a feeder of bamboo and later recorded from India, Thailand, Malaya and Taiwan. In Taiwan it was recorded on bamboos and *Phragmites*. *Greenaspis yunnanensis*, which was described from Yunnan, China, and later recorded from Japan, is here regarded as identical with *elongata*.

Remarks. Ferris distinguished *yunnanensis* from *elongata* by the serrate margin of the pygidium at the position of the third lobe. The marginal serrations, however, are variable in the examined specimens from Taiwan. Comparing the present specimens with those from Yunnan (prepared from type material of *yunnanensis*) and Japan, I am very much inclined to the opinion that all these specimens belong to a single species and that *yunnanensis* is a mere variant of *elongata*.

XXXIX. Genus *Aulacaspis* Cockerell

References. Cockerell 1893 c; Ferris 1937: 9; Scott 1952; Balachowsky 1954 e: 240.

Synonyms. *Miscanthaspis* Takagi, 1961 [type-species: *Aulacaspis kuzunoi* Kuwana and Muramatsu] is tentatively included within *Aulacaspis*.

Type-species. *Aspidiotus rosae* Bouché.

Diagnosis. Body elongate, typically with the prosoma swollen into an eminent mass and demarcated from the metathorax by a distinct constriction; prosomatic tubercles often pronounced, giving a more or less quadrate appearance to the prosoma. In some species the derm is heavily sclerotized at maturity in the prosoma or throughout the body. Pygidium with three (or rarely two or four) pairs of lobes. Median lobes well developed, zygotic basally, in certain species the basal zygotism is represented by a pair of small pieces; in many species these lobes are sunken into the pygidium, forming a distinct notch at the apex of the latter, and divergent, whereas in others are produced, set close together and parallel. Second lobes well developed, usually smaller than the median, bilobulate, the inner lobule with a pair of slender basal scleroses. Third lobes similar to the second or more or less reduced. Fourth lobe if

present represented by a single process. Marginal gland spines well developed on the pygidium as far as the fourth abdominal segment, usually the preceding two segments with gland spines on the lateral lobe. Marginal macroducts paired on the fourth to sixth abdominal segments, and single on the seventh (between the median and second lobes). Dorsal macroducts practically as large as the marginal macroducts, arranged in well-defined submedian and submarginal rows on the fifth and some preceding segments of the abdomen or even as far as the metathorax, on the sixth abdominal segment confined to the submedian row if present; in certain species (*murrayae* and others) the prosoma is scattered with dorsal ducts. Second and third abdominal segments usually with small macroducts on the lateral lobe. Antenna with a seta. Anterior spiracles with numerous disc pores; posterior spiracles with disc pores in most species. Anal opening situated about the centre of the pygidium. Perivulvar pores numerous in five groups.

Composition and distribution. This genus is composed of over 40 known species, most of which are centred in southeastern Asia including India, Ceylon, Java, the Philippines, China, Taiwan, Japan, etc. None is native to the New World.

Remarks. So far as the adult females are concerned, this genus is very close to *Chionaspis*, the only remarkable difference between the two lying in the body shape: in *Chionaspis* the body is fusiform, whereas in *Aulacaspis* swollen in the prosoma, which is an eminent mass at latest at full growth. This difference is quite striking between the typical forms of these genera, but it is not easy to make a complete separation between the two genera owing to the presence of some puzzling forms in southeastern Asia. In the present work such forms are tentatively thrown into *Chionaspis*.

The genus *Miscanthaspis* was erected to accept the aberrant grass-feeding species *Aulacaspis kuzunoi*, which is peculiar by the enlarged basal antennal segment of the first instar larva. The Taiwanese species *Aulacaspis divergens*, another grass-feeding species, is undoubtedly very close to *kuzunoi* so far as based on the characters of the adult females, yet differs from the latter by the basal antennal segment of the first instar larva not particularly enlarged. I will tentatively place both *kuzunoi* and *divergens* in *Aulacaspis*.

In Taiwan the following species were described or recorded in *Aulacaspis*. In the present collection are found 13 species of the genus, of which four are described as new species and one (*difficilis*) is newly recorded from Taiwan.

- 1) *aceris* Takahashi, *mangiferae* var. Not collected.
- 2) *cinnamomi* Newstead. A synonym of *tubercularis*; Takahashi's records of *cinnamomi* refer in reality to *greeni*, and Ferris' record is a misidentification of *yabunikkei*.
- 3) *crawii* Cockerell. Not collected.
- 4) *divergens* Takahashi, *kuzunoi* var.
- 5) *greeni* Takahashi.
- 6) *madiunensis* Zehntner. Not collected.
- 7) *mangiferae* Newstead. A synonym of *tubercularis*.
- 8) *murrayae* Takahashi.
- 9) *phoebicola* Takahashi. Not collected.
- 10) *robusta* Takahashi.
- 11) *rosae* Bouché. Not collected.

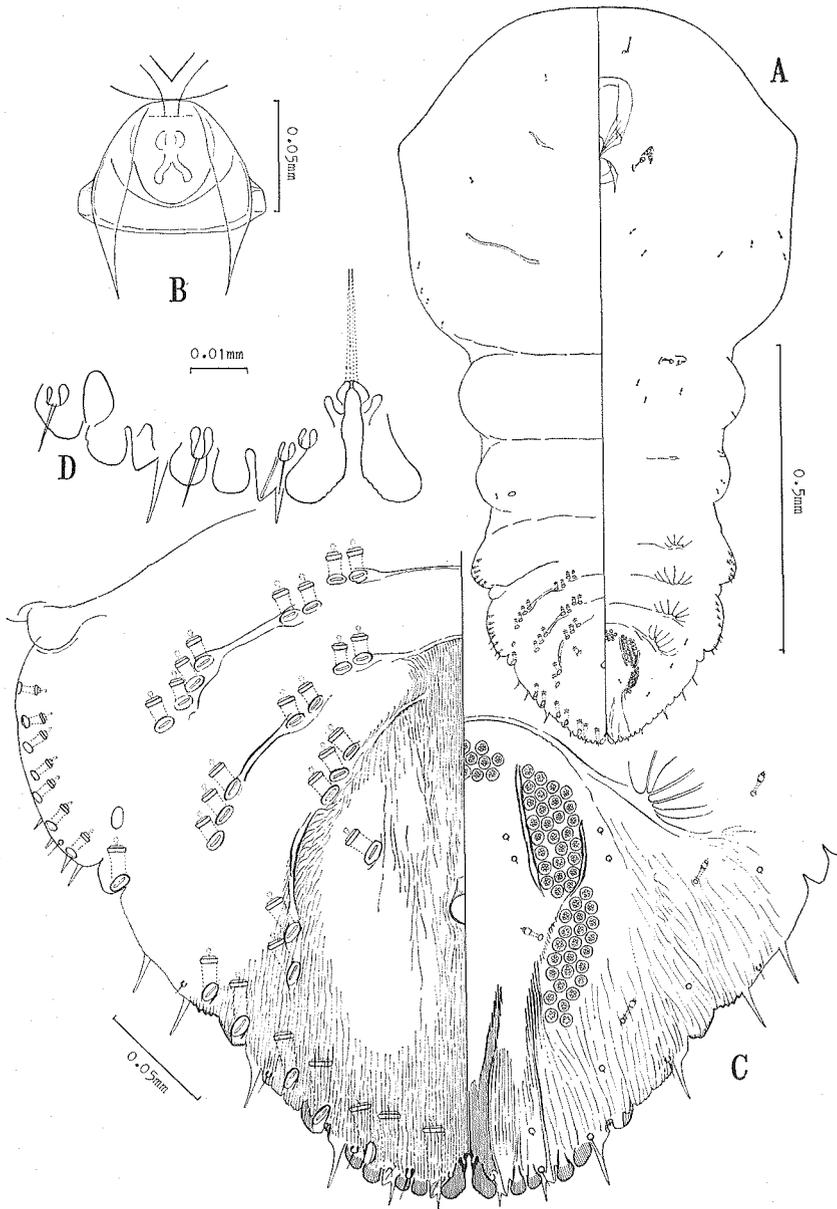


Fig. 66. *Aulacaspis tubercularis* Newst. Adult female (A, body; B, lateral scleroses of the beak; C, pygidium; D, pygidial lobes).

- 12) *spinosa* Maskell.
- 13) *tegalensis* Zehntner. Not collected.
- 14) *wakayamaensis* Kuwana. A misidentification of *divergens* or *madiunensis*.
- 15) *yabunikkei* Kuwana.

97. ***Aulacaspis tubercularis*** Newstead [Fig. 66]

References. Newstead 1906 a; Balachowsky 1954 c: 246 [*mangiferae*]; Williams 1961 a.

Synonyms. *Aulacaspis cinnamomi* Newstead, 1908; *Diaspis (Aulacaspis) cinnamomi* var. *mangiferae* Newstead, 1911.

Diagnosis. Prosoma at maturity much wider than the whole postsoma, quadrate, the prosomatic tubercles robust, blunt apically; pygidium slightly roundish. Median lobes more or less sunken into the apex of the pygidium, rather small, more or less elongate, broadly rounded apically, quite obscurely serrate or entire on the inner margin; basal zygotis in a pair of small pieces which are scarcely confluent with each other, a slender sclerosis extending anteriorly from each of these pieces. Second lobes with the inner lobule somewhat smaller than the median, about as long as wide, with the apex flatly rounded; outer lobule a little smaller than the inner. Third lobes well developed, with both lobules wider than the lobules of the second. Marginal gland spines rather short, single except two or three towards the base of the pygidium (on the fourth abdominal segment); prepygidial gland spines shortened, three to eight on the second abdominal segment, and eight to 15 on the third. Three to seven submedian dorsal macroducts on the third abdominal segment, inner macroducts a little replaced anteriorly, two to five on the fourth, two or three on the fifth, and one (at times absent) on the sixth; four to seven (including one opened in a marginal prominence) submarginal dorsal macroducts on the third abdominal segment, two to four on the fourth, and one to four (usually two) on the fifth. Second and third abdominal segments each with six to nine macroducts on the lateral lobe. A small submarginal dorsal boss on the posterior border of the third abdominal segment, another boss larger on the first. Mouth-parts with a pair of elongate scleroses laterally to the beak. Anterior spiracle with a close cluster of seven to 12 disc pores; posterior spiracle with disc pores much fewer. Perivulvar pores: 10 to 16 in the median group, 18 to 32 in the anterolateral, 17 to 28 in the posterolateral.

Specimens examined. Chia-i and Chu-chi, on *Mangifera indica*.

Distribution and host plants. This species was originally described from Java as a feeder of "*Cinnamomum zeylanicum*". Williams examined material of this species collected in Java, India, Iraq, Mauritius and Africa on *Cinnamomum zeylanicum*, *Laurus nobilis*, *Litsea sebifera*, *L. polyantha* and *Mangifera indica*. This species was recorded under the name *mangiferae* from various localities as a feeder of *Mangifera indica*.

Remarks. Through the kindness of Dr. Williams I have examined one type specimen of *Aulacaspis tubercularis* and two specimens mounted from the type material of *Diaspis cinnamomi* var. *mangiferae*, and have been convinced that *tubercularis* and *mangiferae* are identical and also that the present specimens collected on *Mangifera indica* should rightly belong to *tubercularis*.*

* *Tubercularis* and *cinnamomi* were described from *Cinnamomum zeylanicum* (Lauraceae), whereas *mangiferae* from *Mangifera indica* (Anacardiaceae). This difference in host plants

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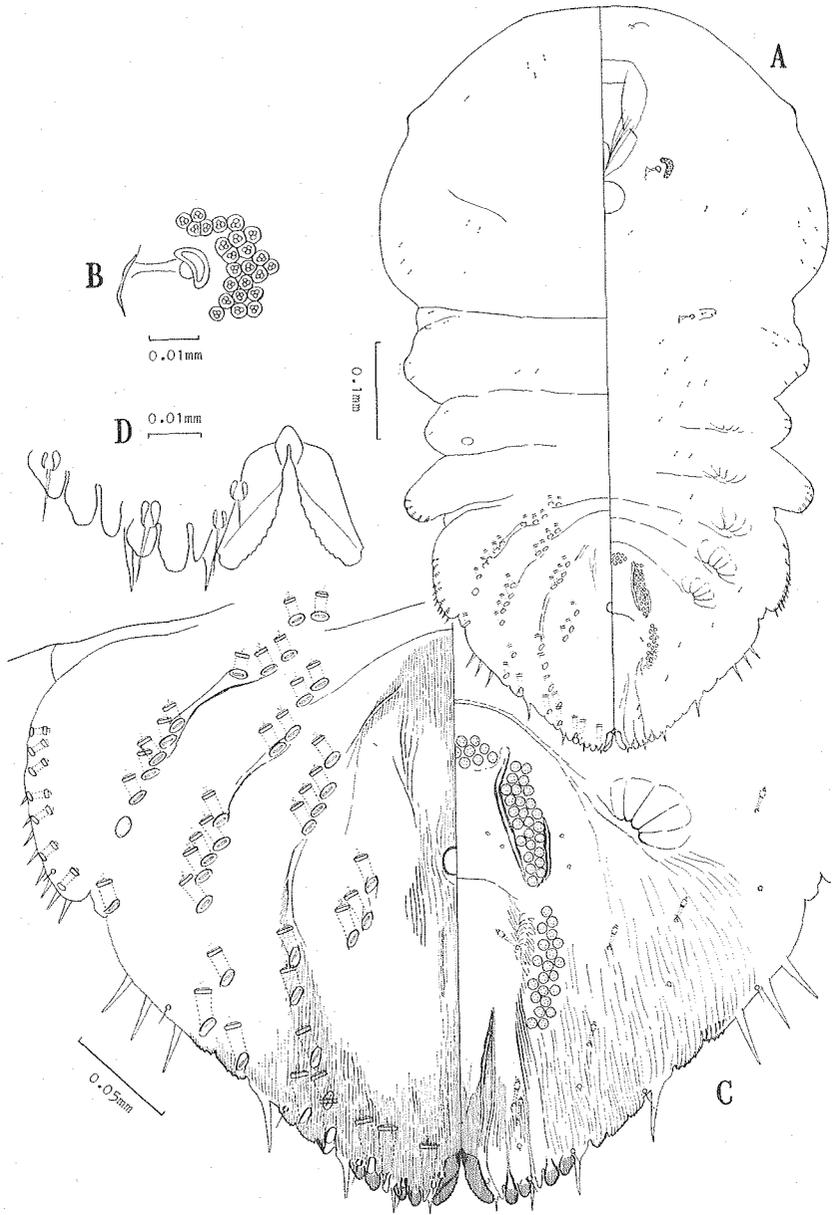


Fig. 67. *Aulacaspis yabunikkei* Kuw. Adult female (A, body; B, anterior spiracle; C, pygidium; D, pygidial lobes).

is so striking that I have grave doubt about Newstead's records. In reality, Newstead's material of "*tubercularis*" includes *yabunikkei*, too. My inference is that Newstead may have confounded two distinct species, *tubercularis* and *yabunikkei*, putting down only the host plant of the latter (see also under *A. yabunikkei*).

This species is characterized by having a pair of elongate scleroses on the beak as described by Balachowsky ("Présence d'un repli péribuccal autour du mentum"). These peribuccal scleroses have been found in all the specimens available for the present study, and are quite well developed in the examined type specimen of *tubercularis*.

98. *Aulacaspis yabunikkei* Kuwana [Fig. 67]

References. Ferris 1921a: 212 [*cinnamomi*]; Kuwana 1926: 32; Scott 1952: 41.

Diagnosis. Prosoma more or less wider than the metathorax, the prosomatic tubercles more or less prominent and rather angulate (at times not discernible); post-soma comparatively robust, with the second abdominal segment strongly lobed out laterally, and with the pygidium rather broad and triangular in outline. Median lobes in a distinct apical notch of the pygidium, comparatively large, elongate, minutely serrate on the inner margin; basal zygotis distinct though small, somewhat produced anteriorly beyond the bases of the median lobes. Second lobes with the inner lobule longer than wide; outer lobule a little shorter than the inner. Third lobes well developed, with both lobules wider than those of the second. Marginal gland spines single except two to four towards the base of the pygidium (on the fourth abdominal segment); prepygidial gland spines shortened, three to eight on the second abdominal segment, and seven to 12 on the third. Submedian dorsal macroducts: three to eight on the third abdominal segment, inner macroducts distinctly replaced anteriorly; two to six on the fourth, inner macroducts usually with some replacement; one to five on the fifth; and one to four (usually two) on the sixth. Submarginal dorsal macroducts: four to 11 (including one opened in a marginal prominence) on the third abdominal segment, two to seven on the fourth, and two to eight on the fifth. Second and third abdominal segments each with about five to 10 macroducts on the lateral lobe. A submarginal dorsal boss on the posterior border of the third abdominal segment, another boss larger but little sclerotized on the first. Anterior spiracle with a compact cluster of nine to 24 disc pores; posterior spiracle with disc pores few and scattered. Perivulvar pores: 10 to 19 in the median group, 19 to 33 in the anterolateral, and 14 to 26 in the posterolateral.

Specimens examined. Pei-tou on *Cinnamomum* sp.; Ken-ting, on an undetermined Lauraceous tree.

Distribution and host plants. This species was originally described from specimens collected in Japan on *Cinnamomum japonicum* (= *C. pedunculatum*) and in Taiwan on *C. camphora*. It occurs commonly on various Lauraceous plants in southern Japan. Takahashi recorded it in Taiwan on *Actinodaphne*, *Cinnamomum*, *Lindera* and *Neolitsea*, in Hongkong on an undetermined Lauraceous plant, and in Ryukyu on *Cinnamomum*. Scott recorded it from Canton, China. I have found in Newstead's material of "*tubercularis*" one specimen of *yabunikkei* collected in Java ("1788./Java, Casuarian Region").

Remarks. At a glance this species is so similar to *tubercularis* (= *cinnamomi*; = *mangiferae*) that there have been made some confusions between these two species. Accordingly, the records of *tubercularis* or *cinnamomi* on Lauraceous plants may be all open to criticism. Ferris' record of *cinnamomi* from Taiwan should in reality refer to *yabunikkei* as pointed out by Scott, in his illustration the body agreeing with that of *yabunikkei* in shape.

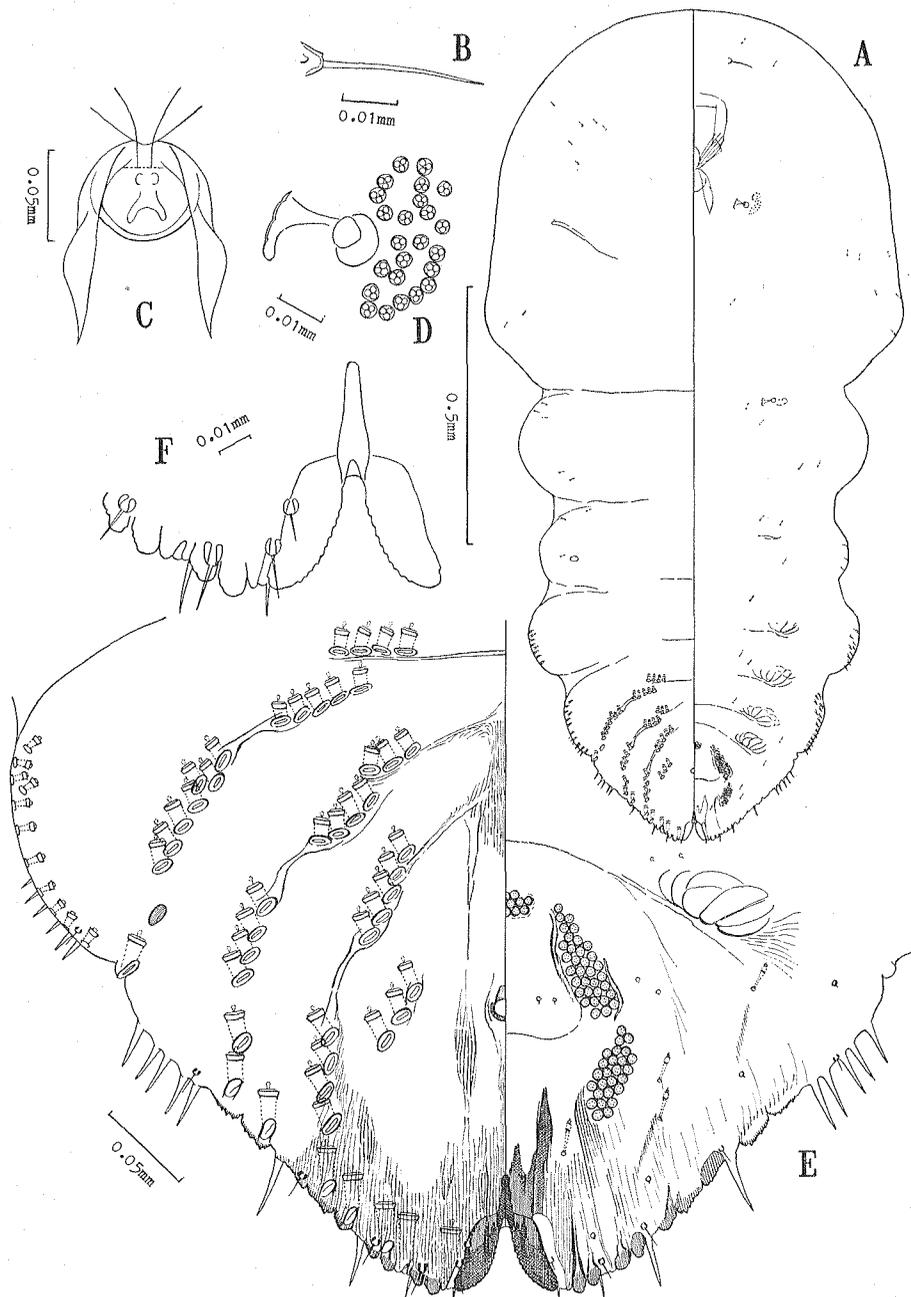


Fig. 68. *Aulacaspis actinodaphnes*, n. sp. Adult female (A, body; B, antenna; C, lateral scleroses of the beak; D, anterior spiracle; E, pygidium; F, pygidial lobes).

This species is easily distinguishable from *tubercularis* by lacking elongate scleroses on the beak. It differs from the latter also by the prosomatic tubercles much less robust, by the postsoma comparatively robust, and by the basal zygois of the median lobes lacking slender scleroses.

99. *Aulacaspis actinodaphnes*, n. sp. [Fig. 68]

Diagnosis. Prosoma distinctly wider than the metathorax, the prosomatic tubercles not discernible; postsoma with the second abdominal segment more or less lobed out laterally, and with the pygidium broadly triangular. Median lobes comparatively very large, forming a large notch at the apex of the pygidium, elongate, serrate on the inner margin; basal zygois prominent, much produced anteriorly beyond the bases of the lobes. Second lobes with the inner lobule slightly longer than wide, rounded apically; outer lobule a little shorter than the inner. Third lobes well developed, with the lobules oblique on the outer margin. Marginal gland spines well developed, single except three to six towards the base of the pygidium (on the fourth abdominal segment); prepygidial gland spines more or less shortened, four to 11 on the second abdominal segment, and 11 to 17 on the third. Submedian dorsal macroducts: four to 11 on the third abdominal segment, inner macroducts displaced anteriorly; four to eight on the fourth, inner macroducts slightly displaced anteriorly; two to seven on the fifth; and one to four on the sixth. Submarginal dorsal macroducts: four to 10 (including one in a slight marginal prominence) on the third abdominal segment, four to eight on the fourth, and four to six on the fifth. Second abdominal segment with nine to 18, and the third with five to 14 macroducts on the lateral lobe. A submarginal dorsal boss oval on the posterior border of the third abdominal segment (or between the third and fourth segments), another boss little sclerotized on the first. A pair of peribuccal scleroses well developed. Anterior spiracle with a loose cluster of 12 to 24 disc pores; posterior spiracle with disc pores few and scattered. Perivulvar pores: 10 to 22 in the median group, 19 to 42 in the anterolateral, and 16 to 32 in the posterolateral.

Specimens examined. A-li Shan, on the leaves of *Actinodaphne mushaensis*.

Remarks. This species is close to *yabunikkei*, from which it is distinguished mainly by having well-developed peribuccal scleroses and by the basal zygois of the median lobes strongly produced anteriorly. Its resemblance to *pallida* Robinson from the Philippines is also quite close, but the separation of the two may be easy by the character of the basal zygois of the median lobes.

100. *Aulacaspis alisiana*, n. sp. [Fig. 69]

Diagnosis. Prosoma quite wider than the whole postsoma, the prosomatic tubercles prominent, broadly rounded; postsoma slender, with the pygidium rather narrow. Median lobes sunken into the apex of the pygidium, comparatively large, elongate, minutely serrate on the inner margin. Second and third lobes well developed, the third lobes with the lobules oblique on the outer margin. Marginal gland spines well developed, single except two to four towards the base of the pygidium (on the fourth abdominal segment); prepygidial gland spines small, four to eight on the second abdominal segment, and five to 10 on the third. Dorsal macroducts few; one to four submedian macroducts on the third abdominal segment, one to three on the fourth,

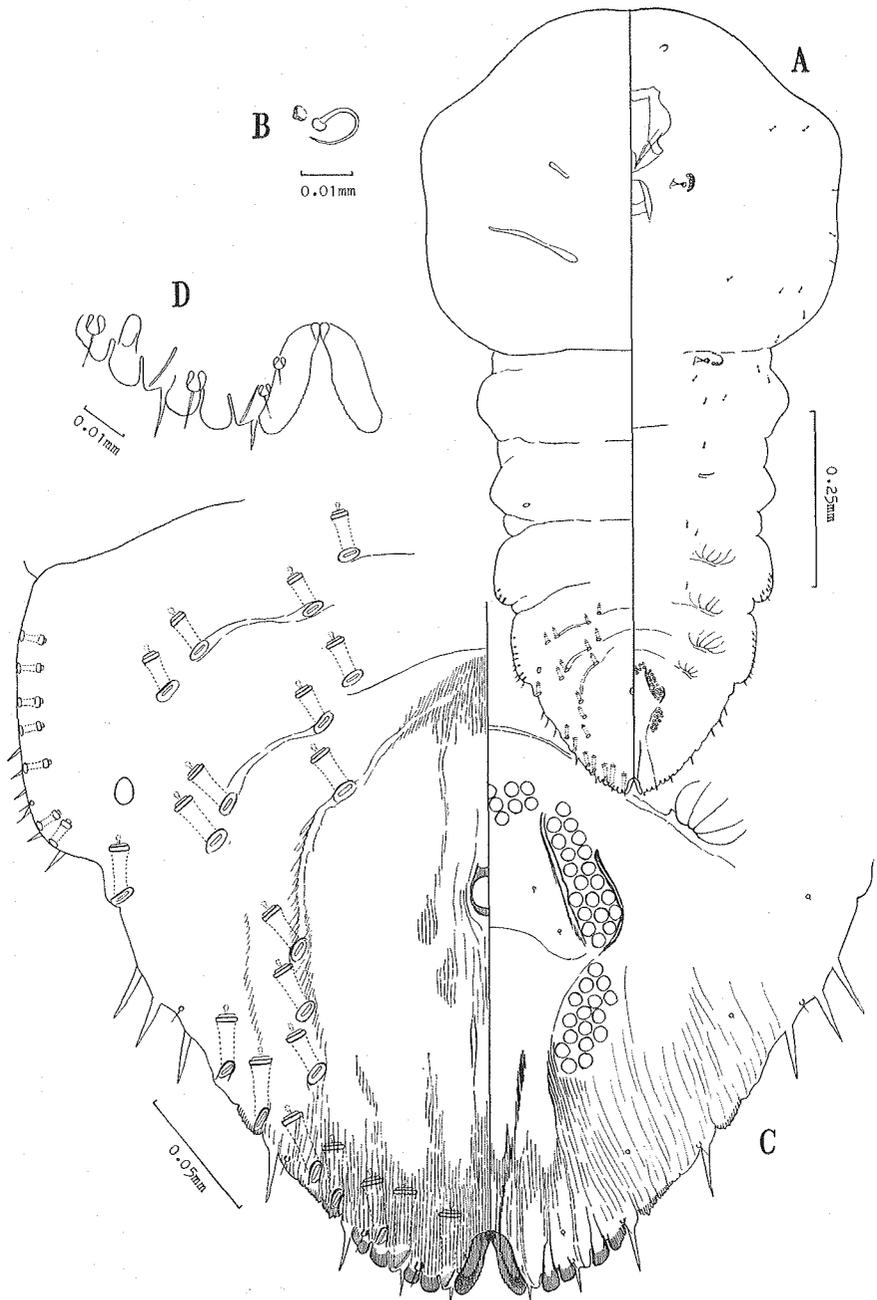


Fig. 69. *Aulacaspis alisiana*, n. sp. Adult female (A, body; B, antenna; C, pygidium; D, pygidial lobes).

one or rarely two on the fifth, and one (or absent) on the sixth; two to four (including one in a slight marginal prominence) submarginal macroducts on the third abdominal segment, one or two on the fourth, and two or three on the fifth. Second and third abdominal segments each with four to eight macroducts on the lateral lobe. A submarginal dorsal boss on the posterior border of the third abdominal segment, another boss less sclerotized on the first. Anterior spiracle with seven to 12 disc pores; posterior spiracle with a few disc pores. Perivulvar pores: eight to 15 in the median group, 17 to 25 in the anterolateral, and 14 to 19 in the posterolateral.

Specimens examined. A-li Shan, on the leaves of *Neolitsea acuminatissima*.

Remarks. By having quite robust prosomatic tubercles and a slender postsoma this species is similar to *mischocarp*i Robinson and Cockerell and *thoracica* Robinson, but differs from the latter two mainly by the dorsal macroducts much fewer and lacking on the second abdominal segment.

101. *Aulacaspis saigusai*, n. sp. [Fig. 70]

Diagnosis. Body widest across the prosoma, gradually narrowing posteriorly in the prepygidial segments, thus presenting a rather cuneate shape; prosoma rounded, the prosomatic tubercles lacking; postsoma with the free segments gently lobed laterally, and with the pygidium triangular in outline. Median lobes sunken into the apex of the pygidium, comparatively large, elongate, the inner margin gently convex and serrate; basal zygotis small, yet distinct. Second and third lobes well developed, the third with the lobules oblique on the outer margin. Marginal gland spines rather shortened, single except five to eight towards the base of the pygidium (on the fourth abdominal segment); prepygidial gland spines shortened, 11 to 14 on the second abdominal segment, and nine to 14 on the third. Submedian dorsal macroducts: 13 to 19 on the third abdominal segment, nine to 16 on the fourth, six to 11 on the fifth, and three to seven on the sixth, the rows on the third to fifth segments being irregularly double or triple. Submarginal dorsal macroducts: 16 to 22 (including one or two opened in a marginal prominence) on the third abdominal segment, 11 to 13 on the fourth, and five to 10 on the fifth, the submarginal rows being irregularly double or triple towards the interior end. Second abdominal segment with 12 to 16 and the third with eight to 13 smaller macroducts on the lateral lobe. A submarginal dorsal boss small between the third and fourth abdominal segments, another boss larger, but little sclerotized (at times indiscernible) on the first. Anterior spiracle with a loose cluster of about 30 to 40 disc pores; posterior spiracle with somewhat fewer disc pores. Perivulvar pores: 15 to 35 in the median group, 50 to 62 in the anterolateral, and 40 to 59 in the posterolateral.

Specimens examined. A-li Shan, on the branches of *Rubus floribundopaniculatus*.

Remarks. I can not place this species close to any other species known to me. In the pygidial margin it somewhat resembles *tubercularis* Newstead, *yabunikkei* Kuwana, *latissima* Cockerell, *ferrisi* Scott, *pallida* Robinson, etc., but differs from all those species by having numerous dorsal macroducts arranged in double or triple rows. It may be not particularly close to *rosae* Bouché, which occurs on *Rosa* and *Rubus*.

102. *Aulacaspis murrayae* Takahashi

References. Takahashi 1931a: 212; Scott 1952: 39.



Fig. 70. *Aulacaspis saigusai*, n. sp. Adult female (A, body; B, anterior spiracle; C, posterior spiracle; D, pygidium; E, pygidial lobes).

Diagnosis. Prosoma broad and rather quadrate in outline, the prosomatic tubercles low and broad; postsoma robust, the free segments well lobed out, gradually broadened posteriorly towards the second abdominal segment, the pygidium broad and roundish. Derm thickly sclerotized throughout at full growth. Median lobes sunken into the apex of the pygidium, comparatively very large, their inner margins are serrate, parallel for some basal length, leaving a narrow space between, then divergent to the rounded apices; basal zygotis comparatively small but distinct. Second lobes with the lobules elongate and practically same in size. Third lobes well developed, similar to the second, but the outer lobule broadened, with the oblique outer margin. Marginal gland spines slender, single except five to nine towards the base of the pygidium (on the fourth abdominal segment); prepygidial gland spines slender, 10 to 17 on the second abdominal segment, and 12 to 17 on the third. Submedian dorsal macroducts: 11 to 44 on the first abdominal segment, 15 to 41 on the second, 13 to 25 on the third, and nine to 18 on the fourth, these macroducts are all or mostly arranged in two (segmental and intrasegmental) rows on each segment; eight to 12 on the fifth, inner macroducts slightly displaced anteriorly; and seven to 15 on the sixth in an irregularly double or triple row. Submarginal dorsal macroducts: five to 24 on the first abdominal segment, 16 to 36 on the second, and 14 to 27 on the third, these macroducts are arranged in a broad, irregularly double or multiple row on each segment; 12 to 19 on the fourth, and eight to 15 on the fifth; the row of each of these segments is double or multiple at least towards the interior end. Small dorsal macroducts scattered on the prosoma, 24 to 48 in number on one side; metathorax usually lacking dorsal ducts, but at times with two or three small submedian macroducts. Second and third abdominal segments with numerous macroducts on the lateral lobe, these macroducts are quite small, being smaller than the prosomatic dorsal macroducts. Anterior spiracle with a loose cluster of many disc pores; posterior spiracle with a smaller cluster. Perivulvar pores: 10 to 20 in the median group, 33 to 45 in the anterolateral, and 23 to 31 in the posterolateral.

Specimens examined. Tai-pei; southeastern Tai-pei Hsien; northern I-lan Hsien; Kuan-tzu-ling; and Ken-ting. On *Murraya paniculata*.

Distribution and host plants. This species was originally described from Taiwan as a feeder of *Murraya paniculata* (= *M. exotica*). It is common throughout the island on that plant species.

103. *Aulacaspis greeni* Takahashi [Fig. 71]

References. Takahashi 1934: 4.

Diagnosis. Prosoma broad and rather quadrate in outline, the prosomatic tubercles produced in a broad deltoid, scattered with ventral microducts, apically spinous; postsoma robust, the pygidium rather broad, triangular in outline. Median lobes sunken into the apex of the pygidium, comparatively small, somewhat elongate, slightly serrate on the inner margin. Second and third lobes well developed, the third with the lobules oblique on the outer margin. Marginal gland spines well developed, single except three to six towards the base of the pygidium (on the fourth abdominal segment); prepygidial gland spines shortened, nine to 14 on the second abdominal segment, and eight to 14 on the third. Submedian dorsal macroducts: eight to 17 on the first abdominal segment, eight to 16 on the second, seven to 13 on the third, four to nine

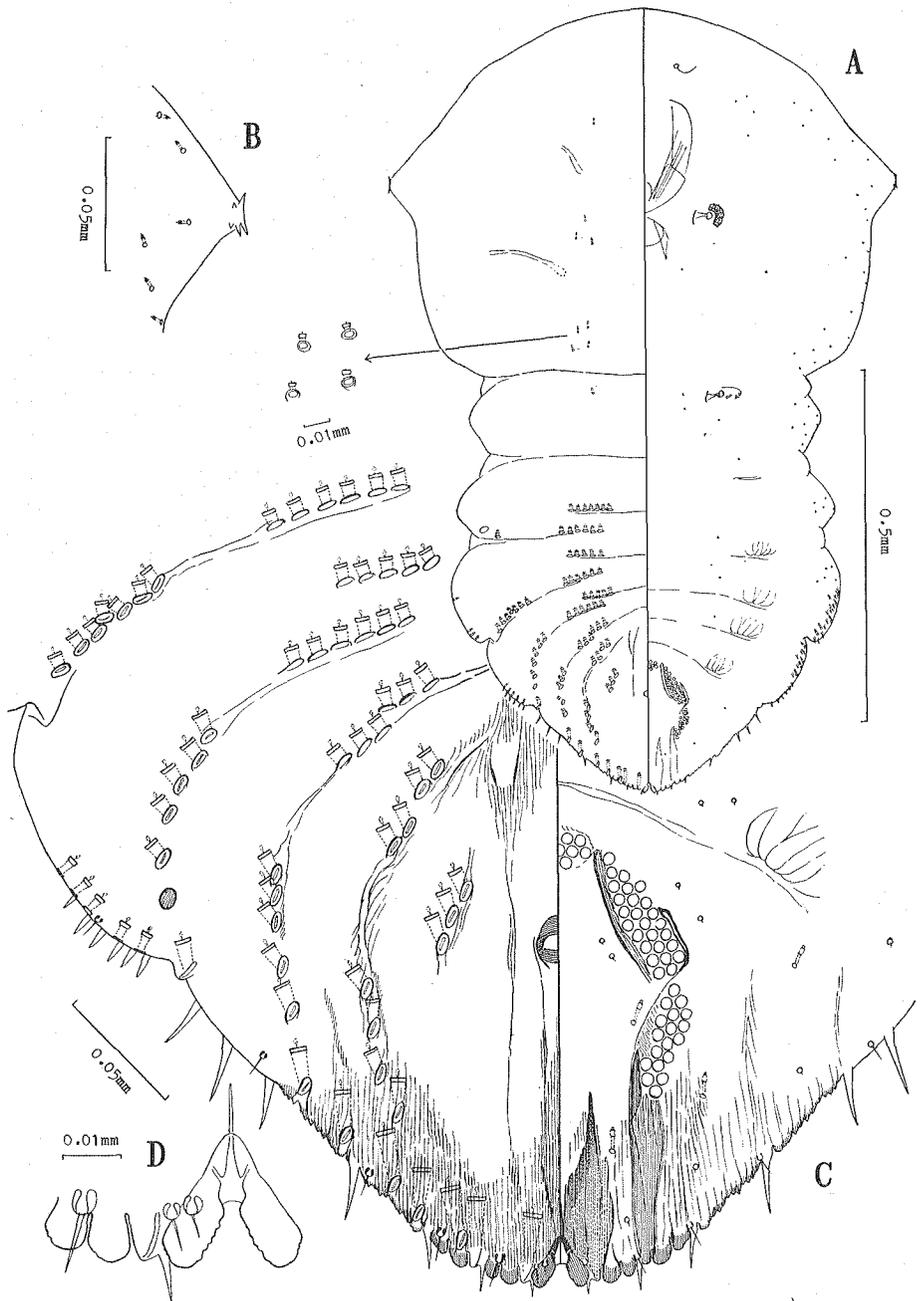


Fig. 71. *Aulacaspis greeni* Takah. Adult female (A, body; B, prosomatic tubercle; C, pygidium; D, pygidial lobes).

on the fourth, four to six on the fifth, and three or four on the sixth, the submedian macroducts on the basal three abdominal segments are arranged in two (segmental and intrasegmental) rows on each segment, the intrasegmental row being somewhat displaced mesally. Submarginal dorsal macroducts absent or if present few (one to three in number) on the first abdominal segment, three to eight on the second, five to seven (including one in a marginal pore prominence) on the third, two to six on the fourth, and three to five on the fifth. Much smaller dorsal macroducts present in the submedian region of the prosoma as follows: one to four (or absent) on the head, two to five on the prothorax (superimposed on the anterior spiracle), and four to six on the mesothorax (near the posterior border of the prosoma); several similar submedian dorsal macroducts rarely present on the metathorax. Second abdominal segment with 12 to 15 and the third with 10 to 12 macroducts along the margin of the lateral lobe, these macroducts are small in size, being practically as large as the prosomatic macroducts. A submarginal dorsal boss on the first abdominal segment, and also between the third and fourth. Anterior spiracle with eight to 21 disc pores; posterior spiracle with one to four. Perivulvar pores: eight to 13 in the median group, 17 to 27 in the anterolateral, and 16 to 25 in the posterolateral.

Specimens examined. Ken-ting, on *Cinnamomum* sp.; O-luan-pi, on an undetermined Lauraceous plant.

Distribution and host plants. This species was originally described from specimens collected in Taiwan on *Cinnamomum reticulatum*. After Takahashi this species is restricted to the southern extreme of Taiwan in distribution.

Remarks. This species is quite peculiar by having spinous prosomatic tubercles, but I have little doubt that it is rightly referred to *Aulacaspis*. In some respects it is similar to *murrayae*.

104. *Aulacaspis maesae*, n. sp. [Fig. 72]

Diagnosis. Prosoma rather weakly swollen, slightly surpassing the metathorax in width, rounded, the prosomatic tubercles at most only slightly pronounced; post-soma robust, the metathorax and basal three abdominal segments approximately equal in width, the second abdominal segment only moderately lobed out; pygidium broad, triangular in outline. Median lobes only slightly sunken into the pygidium, somewhat divergent, comparatively large, robust, roughly serrate on the inner margin, notched once or twice on the outer margin; basal zygotis well developed. Second lobes with the outer lobule somewhat reduced. Third lobes present, though reduced. Marginal gland spines well developed, single except five or six towards the base of the pygidium (on the fourth abdominal segment); prepygidial gland spines well developed, practically as large as the marginal gland spines of the pygidium, seven to 11 on the second abdominal segment, and nine to 15 on the third. Submedian dorsal macroducts: two to six on the second abdominal segment, five to eight on the third, four to eight on the fourth, three to seven on the fifth, and three to five on the sixth. Submarginal dorsal macroducts: three to eight on the second abdominal segment, seven to nine (including one on the margin) on the third, five to eight on the fourth, and four to eight on the fifth. Second and third abdominal segments each with about five or six macroducts on the lateral lobe. A submarginal dorsal boss between the third and fourth abdominal segments, another boss larger on the first. Anterior spiracle with

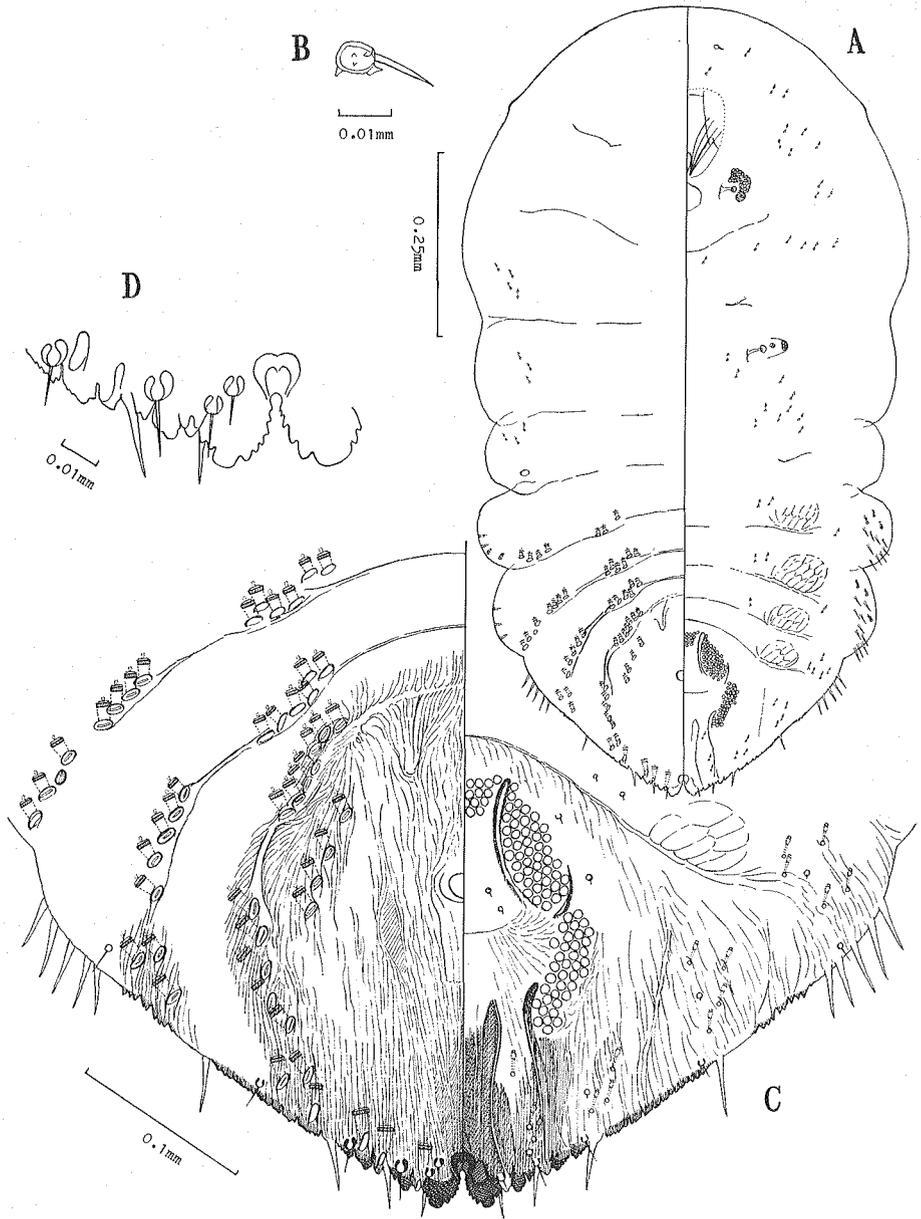


Fig. 72. *Aulacaspis maesae*, n. sp. Adult female (A, body; B, antenna; C, pygidium; D, pygidial lobes).

a compact cluster of quite numerous disc pores; posterior spiracle with a much smaller cluster. Perivulvar pores: 16 to 30 in the median group, 32 to 55 in the anterolateral, and 23 to 44 in the posterolateral.

Specimens examined. Yang-ming Shan, on the roots of *Maesa tenera*.

Remarks. We have now four root-feeding species in *Aulacaspis* all agreeing in the prosomatic swelling ill-developed and, in consequence, much resembling in the body shape. The new species differs from the other three root-feeding species as follows:

From *isobeae* Takagi, which was described from Ryukyu, it is distinguishable by the median lobes more robust, by the marginal gland spines more numerous on the fourth abdominal segment, and by the second and third abdominal segments having macroducts on their lateral lobes (in *isobeae* the prepygidial lateral macroducts are reduced into microducts).

From *trifolium* Takagi, which occurs on the roots of *Trifolium pratense* in Japan, it differs mainly by the presence of the prepygidial lateral macroducts and by the absence of a dorsal boss between the fifth and sixth abdominal segments.

From *discorum* Williams, which feeds on the roots of *Panicum psilopodium* in Pakistan, it is quite distinct by having submedian and submarginal macroducts on the second abdominal segment, by lacking pygidial bosses and by other features.

105. *Aulacaspis spinosa* (Maskell)

References. Maskell 1897 a: 241 [*Diaspis rosae* var.]; Kuwana 1926: 24; Scott 1952: 40.

Diagnosis. Prosoma at maturity distinctly wider than the metathorax and more or less wider than long, the prosomatic tubercles more or less produced, blunt apically (at times not discernible); postsoma robust, the pygidium triangular. Derm sclerotized at maturity except for the free abdominal segments. Median lobes forming a rather shallow notch at the apex of the pygidium, divergent, rather small in size, with the apex rounded. Second and third lobes well developed, the outer lobule of the third reduced into a small process. Marginal gland spines well developed, single except four to eight on the fourth abdominal segment (on the base of the pygidium) and one or two on the fifth; prepygidial gland spines also well developed, two to 11 on the second abdominal segment, and five to 13 on the third. Submedian dorsal macroducts: absent or if present one to seven in number on the first abdominal segment, four to 13 on the second, four to 11 on the third, four to eight on the fourth, four to seven on the fifth, and two to five on the sixth, on the basal three segments some inner macroducts are usually displaced anteriorly. Submarginal dorsal macroducts: one to 10 on the second abdominal segment, five to 12 (including one on the margin) on the third, five to 10 on the fourth, and four to seven on the fifth. Second abdominal segment with three to 13 and the third with two to eight macroducts on the lateral lobe, these macroducts being quite small in size. A small submarginal dorsal boss on the first abdominal segment, and also between the third and fourth. Anterior spiracle with a compact cluster of many disc pores, the posterior with a smaller cluster. Perivulvar pores: 10 to 19 in the median group, 16 to 34 in the anterolateral, and 21 to 37 in the posterolateral. Several microducts present in front of the vulvar opening.

Specimens examined. Southeastern Tai-pei Hsien; Kuan-tzu-ling; and Fen-chi-hu. On *Smilax*.

Distribution and host plants. This species was originally described from Japan and later recorded from Taiwan and China, all the records being made on *Smilax*.

Remarks. In the Japanese form of this species the prosomatic tubercles are completely lacking, whereas in the Taiwanese form these tubercles are usually more or less pronounced, agreeing with the form described by Scott. Since there is no other distinct difference between the two forms, the Taiwanese form may be included within *spinosa*.

106. *Aulacaspis difficilis* (Cockerell)

References. Cockerell 1896 h: 21 [*Chionaspis*]; Kuwana 1926: 11 [*Sasakiaspis*]; Takagi 1961 a: 81.

Diagnosis. Prosoma at maturity distinctly wider than the postsoma, rounded and sclerotized, the prosomatic tubercles practically absent; postsoma robust, with the basal three segments equal in width and weakly lobed out; pygidium broad and triangular. Median lobes slightly sunken into the apex of the pygidium, comparatively large, robust, approximately triangular, and finely serrate; basal zygotis robust. Second lobes with the inner lobule slightly longer than wide, dilated, with the basal scleroses indistinct; outer lobule quite small, yet distinct. Third lobes with the lobules broad and low. Marginal gland spines well developed, four to 11 on the fourth abdominal segment (on the base of the pygidium), three or four on the fifth, two to four on the sixth, two or three on the seventh (between the second and third lobes), and one (or two ?) on the eighth (between the median and second lobes); prepygidial gland spines also well developed, nine to 14 on the second abdominal segment, and seven to 19 on the third. Submedian dorsal macroducts: six to 18 on the second abdominal segment, eight to 19 on the third, seven to 17 on the fourth, five to 12 on the fifth, and seven to 11 on the sixth, on each of the second to fourth segments inner macroducts are displaced anteriorly, forming a distinct intrasegmental row. Submarginal dorsal macroducts: four to 20 on the second abdominal segment, eight to 20 on the third (including one or more opened on the margin), nine to 14 on the fourth, and nine or 10 on the fifth, on each of the second and third segments these macroducts are arranged in an irregularly double or multiple row. Second abdominal segment with two to six macroducts on the lateral lobe, these macroducts are much smaller than the submedian and submarginal macroducts; third abdominal segment lacking macroducts on the lateral lobe except for the rare presence of a single such macroduct. Submarginal dorsal bosses hardly discernible, at most a small, weakly sclerotized patch of derm is seen on the first abdominal segment and also between the third and fourth. Anterior spiracle with a compact cluster of many disc pores, the posterior with a smaller cluster. Perivulvar pores: 11 to 25 in the median group, 20 to 40 in the anterolateral, and 17 to 35 in the posterolateral. Microducts absent in front of the vulvar opening.

Specimens examined. Yeh-liu, on *Elaeagnus* sp.

Distribution and host plants. This species was originally described from specimens collected on *Elaeagnus* imported from Japan into California. It commonly occurs in Japan on various species of *Elaeagnus*.

Remarks. This species may be here newly recorded from Taiwan. It is very close to *spinosa*, differing from the latter by some details. Constant differences between the two are found in the numbers of the marginal gland spines and the presence or

absence of microducts in front of the vulvar opening. In general, the dorsal macroducts are more numerous and the lateral macroducts are less so in *difficilis* than in *spinosa*. The median lobes are also somewhat different in shape between the two, though in either species these lobes are somewhat variable.

107. *Aulacaspis robusta* Takahashi [Fig. 73]

References. Takahashi 1931 a: 212.

Diagnosis. Prosoma broad, rather quadrate in outline, distinctly wider than whole postsoma, the prosomatic tubercles low and broad; postsoma robust, with the basal three segments about equal in width, weakly lobed laterally; pygidium rather roundish. Derm at maturity sclerotized on the prosoma or even throughout the body. Median lobes produced, set close, parallel, rather large in size, about as long as wide, rounded, and minutely serrate. Second lobes with the inner lobule about as long as wide, its apical margin rounded and oblique outwards; outer lobule somewhat smaller than the inner, similar in shape to the inner lobule or rather conical. Third lobes well developed, with the lobules more or less broad. Marginal gland spines rather short, four to eight towards the base of the pygidium (on the fourth abdominal segment), one or rarely two on the fifth abdominal segment, double or often appearing single on the sixth and seventh, and single (?) and quite small on the eighth (between the median and second lobes); one to three on the second abdominal segment, and 10 to 14 on the third. Submedian dorsal macroducts: two to 10 on the third abdominal segment, inner macroducts being displaced anteriorly; two to seven on the fourth and fifth each; and one or two (or at times absent) on the sixth. Submarginal dorsal macroducts: two to eight on the third abdominal segment in a row well removed from the margin, on which another macroduct is opened; three to seven on the fourth; and five to eight on the fifth. Second abdominal segment with two to five and the third with two to seven macroducts along the margin of the lateral lobe, these macroducts are somewhat smaller than the dorsal macroducts. A submarginal dorsal boss between the third and fourth abdominal segments, and another boss on the first; a pair of small bosses tightly appressed together in the anterolateral corner of the prosoma. Anterior spiracle with a compact cluster of many disc pores, the posterior with disc pores irregularly scattered. Perivulvar pores: 30 to 42 in the median group, 52 to 74 in the anterolateral, and 32 to 48 in the posterolateral.

Specimens examined. Kuan-tzu-ling, on *Ardisia sieboldii*.

Distribution and host plants. This species was originally described from Taiwan as a feeder of *Ardisia sieboldii* (= *Bladhia sieboldii*). There has been made no further record.

Remarks. This species is very close to *kadsurae* Takagi and Kawai, which feeds on *Kadsura* and *Schisandra* (both belonging to the family Magnoliaceae) in Japan, but may be distinguishable from the latter by having more numerous gland spines on the third and fourth abdominal segments; the dorsal macroducts are also generally more numerous in *robusta* than in *kadsurae*. Since the two species are quite distinct in their host plants they should be separated as good species.

108. *Aulacaspis actinidiae*, n. sp. [Fig. 74]

Diagnosis. Prosoma well swollen at maturity, rather quadrate in outline, the

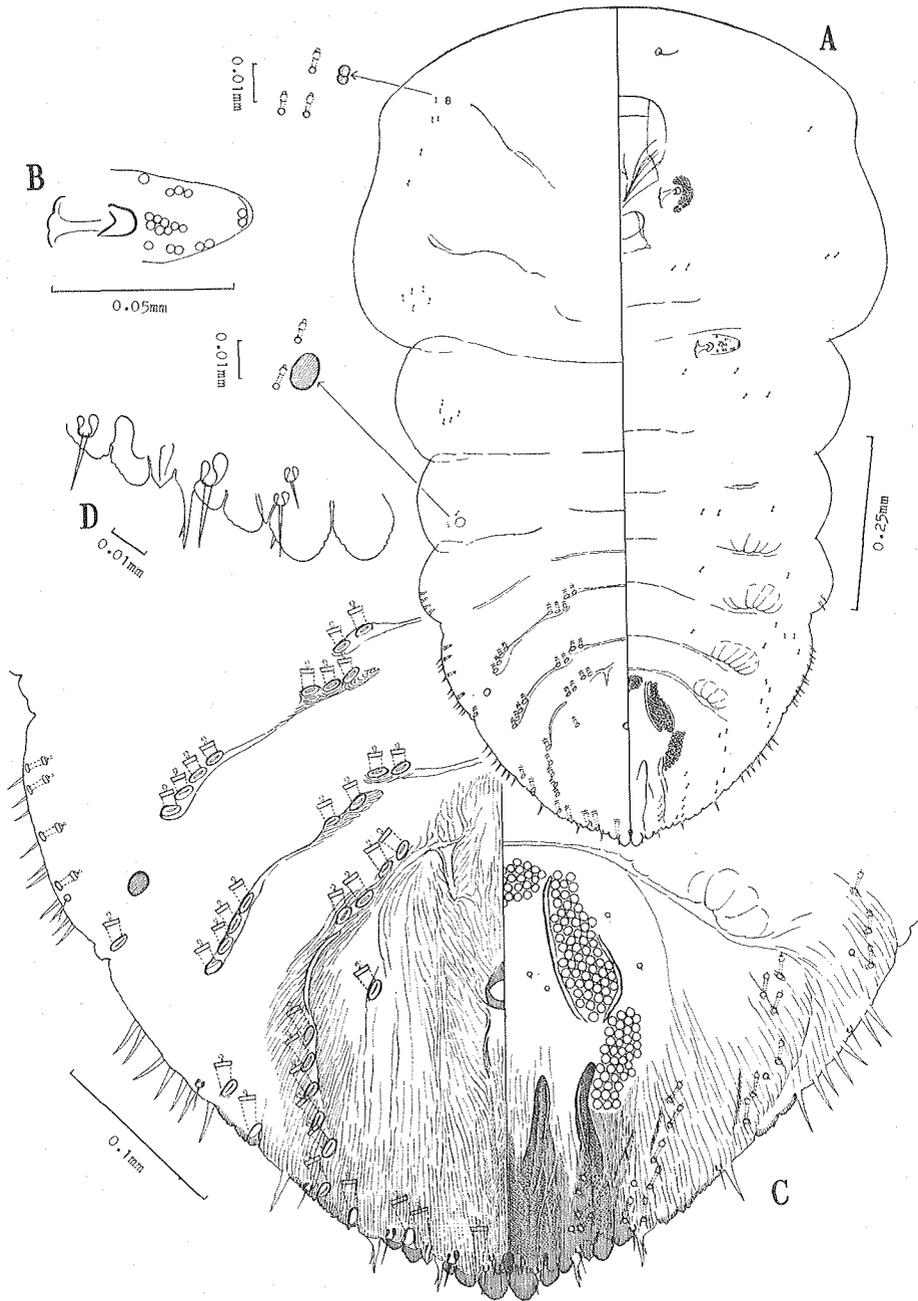


Fig. 73. *Aulacaspis robusta* Takah. Adult female (A, body; B, posterior spiracle; C, pygidium, D, pygidial lobes).

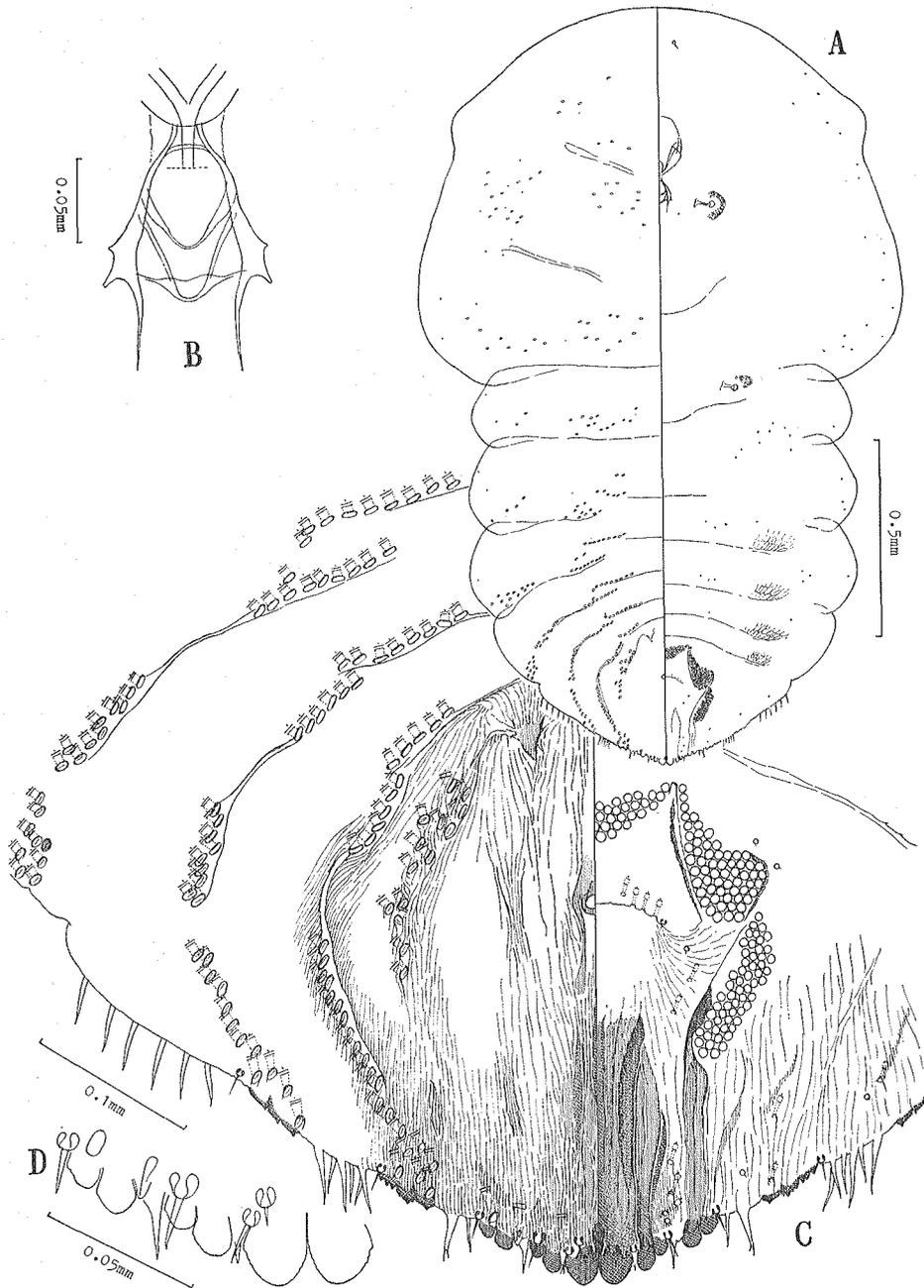


Fig. 74. *Aulacaspis actinidiae*, n. sp. Adult female (A, body; B, lateral scleroses of the beak; C, pygidium; D, pygidial lobes).

prosomatic tubercles more or less prominent and rounded; postsoma robust, the basal three segments practically equal in width; pygidium quite broad and triangular. Derm at maturity sclerotized throughout. Median lobes produced, set close together, parallel, about as long as wide, rounded; basal zygotis produced anteriorly. Second lobes with the inner lobule slightly dilated, and rounded; outer lobule smaller, with the outer margin more or less oblique. Third lobes similar to the second. Marginal gland spines slender, comparatively small, five to eight on the fourth abdominal segment (towards the base of the pygidium), four to seven on the fifth, two to four on the sixth, one or two on the seventh (between the second and third lobes), and one on the eighth (between the median and second lobes); prepygidial gland spines absent except for the occasional presence of a single gland spine on the third abdominal segment just within the margin. Dorsal macroducts comparatively small in size, distributed from the head to the sixth abdominal segment. Dorsal macroducts of the cephalothorax practically as large as those of the abdomen, irregularly scattered in submedian and submarginal clusters as follows: three to five submedian macroducts and one to four submarginal on the supposed region of the head (the submarginal cluster is at times absent); eight to 17 submedian and seven to 14 submarginal on the prothorax, the submedian macroducts superimposed on the anterior spiracle; nine to 20 submedian and one to seven submarginal on the mesothorax in front of the posterior border of the prosoma; nine to 17 submedian and one to four submarginal on the metathorax, the submarginal cluster is at times absent, and the submedian clusters of both sides are at times confluent. Submedian dorsal macroducts of the abdomen: 11 to 20 on the first abdominal segment in segmental and intrasegmental clusters, usually with some other macroducts scattered in front of the intrasegmental cluster; 16 to 22 on the second, and 15 to 20 on the third, arranged in distinct segmental and intrasegmental rows on each segment; 11 to 15 on the fourth, eight to 13 on the fifth, and 11 to 21 on the sixth. Submarginal dorsal macroducts of the abdomen: one to nine in the posterolateral corner of the first abdominal segment, at times absent; 12 to 22 on the second in a multiple row; 16 to 25 on the third, 15 to 31 on the fourth, and 15 to 20 on the fifth, arranged in a well-defined single to multiple row on each segment. A submarginal dorsal boss on the first abdominal segment; another boss small in the submarginal row of macroducts on the third. Beak with a pair of distinct elongate scleroses laterally. Anterior spiracle with a large, compact, semi-circular cluster of disc pores; posterior spiracle with a smaller cluster of an irregular shape. Anal opening comparatively very small. Perivulvar pores: 43 to 51 in the median group, 44 to 60 in the anterolateral, and 49 to 58 in the posterolateral.

Specimens examined. Fen-chi-hu, on the twigs of *Actinidia arisanensis*.

Remarks. This species belongs to the species group composed of *robusta* Takahashi, *projecta* Takagi, and *kadsurae* Takagi and Kawai, and its resemblance to *projecta* is especially close. It is easily distinguishable from all the latter three by having many dorsal macroducts on the cephalothorax.

109. *Aulacaspis divergens* Takahashi [Fig. 75]

References. Takahashi 1935: 10 [*kuzunoi* var.].

Diagnosis. Body rather slender, constricted across the metathorax; prosoma more or less elongate, oval in outline, the prosomatic tubercles slightly pronounced; second

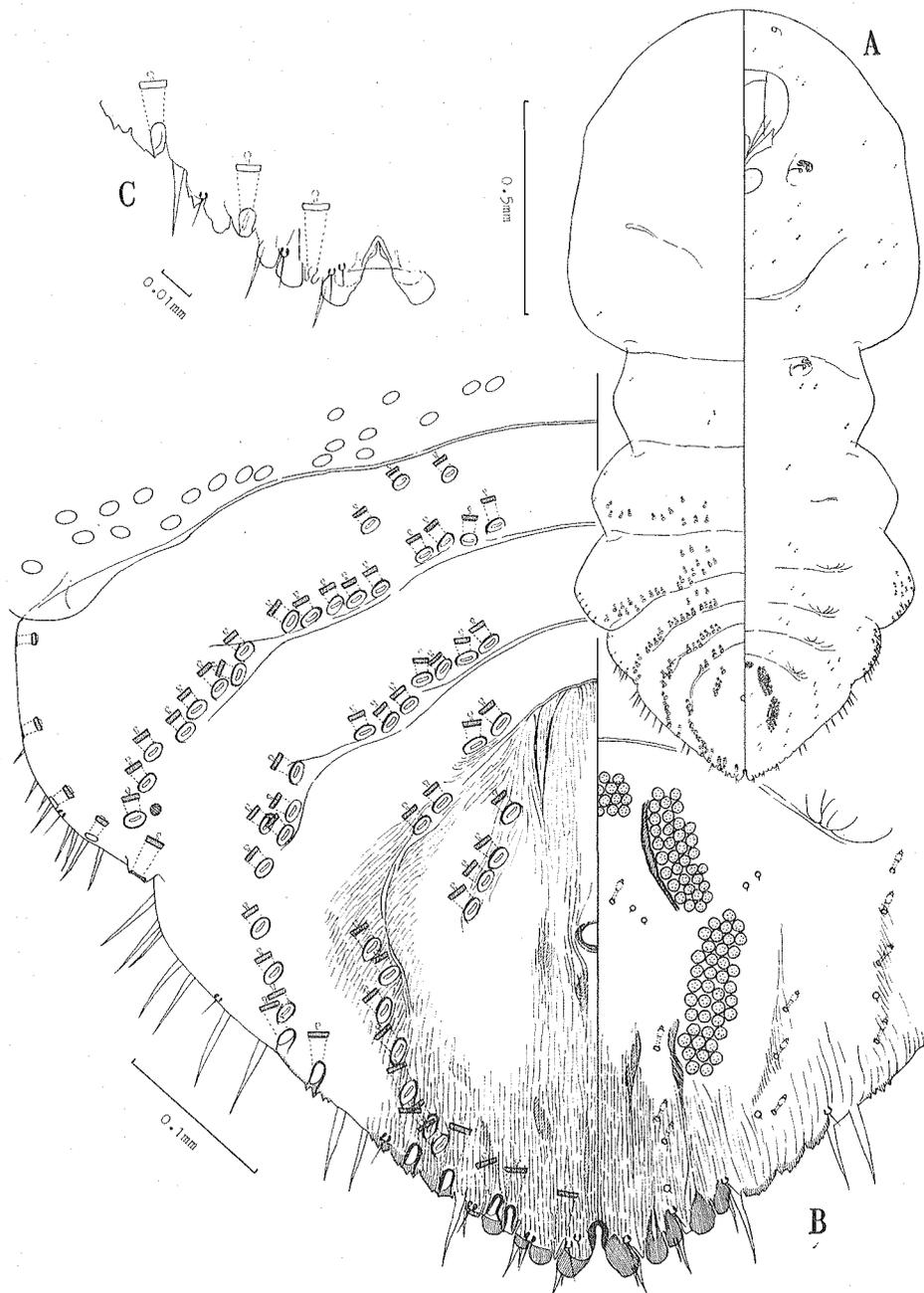


Fig. 75. *Aulacaspis divergens* Takah. A & B, adult female (A, body; B, pygidium); C, pygidial margin of the exuvium of the second instar female.

abdominal segment lobed out laterally, about as wide as the prosoma; pygidium rather narrow, slightly roundish or triangular. Median lobes almost wholly produced, but the basal zygotis is deeply invaginated into the pygidium, forming a narrow arch; these lobes are distinctly divergent, about as long as or a little longer than wide, and flatly roundish apically. Second lobes with the inner lobule somewhat smaller than the median, about as long as wide, flatly roundish apically; outer lobule a little smaller than the inner. Third lobes also well developed. Marginal gland spines well developed, five to 11 on the fourth abdominal segment (on the base of the pygidium), two to five on the fifth, and paired on each of the succeeding segments; prepygidial gland spines also well developed, one to three on the second abdominal segment, and nine to 14 on the third. Submedian dorsal macroducts: seven to 18 on the first abdominal segment and 12 to 21 on the second are strewn, at times almost joined with the submarginal macroducts; seven to 18 on the third mostly in a single segmental row, but some are scattered in front of the row; five to 14 on the fourth in a single row, inner macroducts being slightly displaced anteriorly; three to nine on the fifth, and two to seven on the sixth, arranged in a single row on each segment. Submarginal macroducts: one to nine strewn in the posterolateral corner of the first abdominal segment, rarely absent; six to 15 on the second in a cluster along the posterior margin of the segment; seven to 20 on the third, six to 15 on the fourth, and five to 10 on the fifth, arranged in a distinct segmental row on each segment. Second abdominal segment with 12 to 25 and the third with eight to 15 macroducts on the lateral lobe, these macroducts are somewhat smaller than the submedian and submarginal macroducts. A submarginal dorsal boss quite small and often indiscernible on the first abdominal segment, another between the third and fourth. Anterior spiracle with a compact cluster of numerous disc pores; posterior spiracle with fewer, yet still numerous disc pores. Perivulvar pores: 12 to 31 in the median group, 27 to 53 in the anterolateral, and 27 to 61 in the posterolateral.

Specimens examined. Yeh-liu; Chu-chi; Kuan-tzu-ling; and Fen-chi-hu. On *Miscanthus*.

Distribution and host plants. This species was originally described from specimens collected in Taiwan and Botel Tobago on *Miscanthus*. Specimens collected in Hongkong on *Miscanthus* are also at hand.

Remarks. This species is close to the Japanese species *kuzunoi* Kuwana and Muramatsu and was described as a variant of the latter. It is a good species, differing from *kuzunoi* mainly by the dorsal macroducts present as far as the basal segment of the abdomen and by the median lobes well divergent. It differs from *kuzunoi* also in the first instar larva: in *kuzunoi* the basal antennal segment of this instar is eminently enlarged in a conical shape, whereas in *divergens* not. This species may be close to *Chionaspis herbae* Green from Ceylon.

XL. Genus *Pinnaspis* Cockerell

References. Cockerell 1892 d: 136; Ferris 1937: 96; Ferris and Rao 1947; Balachowsky 1954 e: 275.

Synonyms. *Hemichionaspis* Cockerell, 1897 [type-species: *Chionaspis aspidistrae* Signoret]; *Jaapia* Lindinger, 1914 [type-species: *Mytilaspis uniloba* Kuwana]; *Lepidaspidis* MacGillivray, 1921 [type-species: *Mytilaspis uniloba* Kuwana].

Type-species. *Mytilaspis pandani* Comstock = *Aspidiotus buxi* Bouché.

Diagnosis. Body elongate, more or less slender and fusiform, with the free abdominal segments and metathorax well or little lobed out laterally, and with the pygidium triangular or roundish. Derm more or less sclerotized on the pygidium. Median lobes of the pygidium well developed, zygotic basally, closely appressed together mesally, in certain species (*uniloba*; *shirozui*, n. sp.) even wholly fused together. Second lobes in many species developed and bilobulate, but in some others much reduced or completely obsolete. Third lobes much reduced or obsolete. Marginal gland spines well developed on the pygidium, in most species single on the fifth to eighth abdominal segments. Marginal macroducts usually paired on the fourth to sixth abdominal segments, single on the seventh (on the fourth segment the outer of the paired macroducts may be more or less removed interiorly). Dorsal macroducts practically as large as the marginal macroducts, basically arranged in submedian and submarginal segmental rows, but the submedian macroducts are often completely obsolete or replaced partly or wholly by microducts. Some prepygidial segments with macroducts scattered on the lateral lobe. Antenna with a single seta. Anterior spiracle with a cluster of disc pores; posterior spiracle also often with disc pores. Anal opening situated about the centre of the pygidium or towards the base of the pygidium. In many species a pair of slender dorsal scleroses (preanal scleroses or scars) are present towards the base of the pygidium. Perivulvar pores in five groups.

Composition and distribution. In their revision of the genus Ferris and Rao recognized 12 species mostly from India and Ceylon. The discoveries of further species show that this genus is also rich on the eastern side of Asia as north as Japan. The natural range of distribution of the genus probably covers the whole Oriental region, whereas more than 20 described species found mostly in the Indo-Ceylonese and Japanese areas may form a small part of the genus.

Remarks. In the definition given by Ferris and Rao the genus *Pinnaspis* constitutes a fairly homogeneous group. So far as I am aware the following species were described or recorded from Taiwan, but one of them, *lithocarpi*, should be removed from the genus. In the present collection are found nine species of the genus, of which four are described as new species.

- 1) *aspidistrae* Signoret.
- 2) *lithocarpi* Takahashi. Not a member of *Pinnaspis*. Not collected.
- 3) *minor* Maskell. Presumably refers to *strachani*.
- 4) *muntingi* Takagi.
- 5) *strachani* Cooley.
- 6) *theae* Maskell. Not collected.
- 7) *uniloba* Kuwana.

110. *Pinnaspis buxi* (Bouché)

References. Bouché 1851: 111 [*Aspidiotus*]; Ferris 1937: 98; Ferris and Rao, 1947: 32; Balachowsky 1954 e: 277.

Synonyms. The following species are united by authors with the present species: *Mytilaspis pandani* Comstock, 1881; *Pinnaspis bambusae* Cockerell, 1893; *Pinnaspis siphonodontis* Cockerell and Robinson, 1915; *Hemichionaspis pseudaspidistrae* Green, 1916.

Diagnosis. Pygidium triangular. Median lobes comparatively small, rather loosely

appressed together mesally, leaving a slender space between them, notched once or twice on the lateral side; basal zygotis represented by a slender arch. Second lobes well developed; inner lobule expanded towards the apex, with a pair of distinct slender basal scleroses; outer lobule a little shorter, less constricted basally and less sclerotized. Marginal gland spines single except two on the base of the pygidium (on the fourth abdominal segment). Second abdominal segment with one or two and the third with one to three gland spines on the lateral lobe; first abdominal segment lacking gland spines except for the occasional presence of a single gland spine. Submedian dorsal ducts reduced to microducts on the second to fourth abdominal segments, few. Submarginal macroducts if present quite few: third abdominal segment with one macroduct on the margin and with one or two macroducts present or absent in the posterolateral corner; fourth abdominal segment with one or two submarginal macroducts present or absent. Basal two abdominal segments each with two to four and the third with one or two (usually two) macroducts on the lateral lobe, these macroducts being slightly smaller than the submarginal macroducts. Anterior spiracle with three to six disc pores, the posterior with none. Anal opening situated about the centre of the pygidium. Preanal scleroses absent. Perivulvar pores: four to eight in the median group, eight to 16 in the anterolateral, and eight to 17 in the posterolateral. Scale brown.

Specimens examined. Kuan-tzu-ling, on *Pothos seemanni*.

Distribution and host plants. This species is widely distributed in the world, occurring afield in the tropics and subtropics and under glass in the temperate region, and feeds on various kinds of plants. So far as I am aware, however, it has hitherto been not recorded from Taiwan.

111. *Pinnaspis aspidistrae* (Signoret)

References. Signoret 1869 a: 443 [*Chionaspis*]; Ferris 1937: 97; Ferris and Rao 1947: 30; Balachowsky 1954 e: 281.

Synonyms. *Chionaspis brasiliensis* Signoret, 1869, and *Chionaspis latus* Cockerell, 1896, are generally accepted as synonyms of *aspidistrae*; *Pinnaspis ophiopogonis* Takahashi, 1952, is synonymized by Balachowsky with *aspidistrae*.

Diagnosis. pygidium rather narrow and triangular. Median lobes comparatively small, notched once or several times on the lateral side; basal zygotis apparently produced anteriorly beyond the bases of the lobes. Second lobes well developed; inner lobule more or less expanded towards the apex, with a pair of slender basal scleroses; outer lobule a little shorter, little constricted basally, somewhat variable in width. Third lobes reduced, the inner lobule in a low, broad process, with basal scleroses. Marginal gland spines single except two or rarely three on the base of the pygidium (on the fourth abdominal segment). Second and third abdominal segments each with two or three gland spines, and the first with one small gland spine, on the lateral lobe. Submedian dorsal ducts wholly represented by microducts on the second to fifth abdominal segments. Submarginal dorsal macroducts: two to four (including one on the margin) on the third abdominal segment, one to four on the fourth, and one on the fifth. Metathorax and basal three abdominal segments with slightly smaller macroducts on the lateral lobe: one on the metathorax, one to three on the first abdominal segment, three or four on the second, and two on the third. Anterior spiracle with five to eight disc pores, the posterior with one or two. Preanal scleroses indiscernible on the pygidium. Anal opening situated towards the base of the pygidium. Perivulvar

pores: eight or nine in the median group, 12 to 17 in the anterolateral, and 13 to 17 in the posterolateral. Scale brown.

Specimens examined. Southeastern Tai-pei Hsien, on *Camellia sinensis* and *Eurya japonica*.

Distribution and host plants. This species is widely distributed in the world, feeding on various kinds of plants. In Taiwan it was recorded by Takahashi on a long list of plants, but some of his records may be open to criticism.

Remarks. This species is a well-known cosmopolitan, having been revised and recorded by many authors. However, the recent discoveries of certain forms (*boehmeriae* Takahashi; *muntingi* Takagi; *musae* Takagi; *piperis* Takagi) closely related to *aspidistrae* create a necessity for criticism on the published records. It is possible that the records of *aspidistrae* made by Takahashi in Taiwan may include other forms.

I have little doubt that the present specimens are rightly identified with *aspidistrae*. This identification is based on the combination of the following characters: the comparatively small median lobes; the well-developed second lobes with basal scleroses on the inner lobule; the absence of preanal scleroses; the absence of submedian macroducts; the few submarginal macroducts; and the presence of disc pores at the posterior spiracles. Ferris and Rao state that the third lobes are never more than the faintest possible suggestion in *aspidistrae*, but in the present specimens these lobes are rather developed, having even basal scleroses more or less distinct.

Takahashi described *ophiopogonis* as distinct from *aspidistrae* on the basis of some characters, but these characters are mostly subject to some variation in *aspidistrae*. *Ophiopogonis* may be better included within *aspidistrae* as stated by Balachowsky.

I have found in the present collection another form of *Pinnaspis* very close to *aspidistrae*. This form was collected at Fen-chi-hu on *Cunninghamia lanceolata* (Coniferae: Taxodiaceae). It deviates by lacking submedian dorsal ducts of any size, by the macroducts tending to be comparatively more numerous (Table 6), and by lacking enlarged ducts on the head in the first instar larva. Moreover, the Coniferae are not usual for *aspidistrae* as host plants. Although there seems to be no sufficient morphological basis to distinguish this form as distinct from *aspidistrae*, I will tentatively keep from throwing it into the latter.

TABLE 6. Number of macroducts in *Pinnaspis aspidistrae* and the *Cunninghamia*-feeding form.

Locality	Host plant	Submarginal macroducts			Lateral macroducts			
		Abd. III	Abd. IV	Abd. V	Metathorax	Abd. I	Abd. II	Abd. III
Tai-pei Hs.	<i>Camellia</i>	2 - 4	1 - 2	1	1	1 - 3	3 - 4	2
Tai-pei Hs.	<i>Eurya</i>	3 - 4	2 - 4	1	1	3	3	2
Fen-chi-hu	<i>Cunninghamia</i>	3 - 7	1 - 4	1 - 3	2 - 5	4 - 5	3 - 5	1 - 3

112. *Pinnaspis muntingi* Takagi

References. Takagi 1965, Kontyû 33: 446.

Diagnosis. Pygidium triangular in outline. Median lobes rather small to mod-

erate in size, notched several times on the lateral side; basal zygotis produced anteriorly beyond the bases of the median lobes. Second lobes well developed; inner lobule apparently expanded towards the apex, with a pair of basal scleroses; outer lobule smaller, yet well represented, less constricted basally. Third lobes quite reduced. Marginal gland spines single except two or three on the base of the pygidium (on the fourth abdominal segment). Basal three abdominal segments with gland spines on the lateral lobe: first abdominal segment with one or two gland spines rarely absent, the second and third each with two to four; prothorax with one or two minute gland cones within the margin. Submedian dorsal ducts represented by microducts mostly scattered on the second to fourth abdominal segments. Submarginal dorsal macroducts: three to eight (including one on the margin) on the third abdominal segment, at times in an irregularly double row; two to four on the fourth; and one or two present or absent on the fifth. Metathorax and basal three abdominal segments with macroducts on the lateral lobe, these macroducts being more or less smaller than the submarginal macroducts: one present or absent on the metathorax, two to four on the first and second abdominal segments each, and one or two on the third. Anterior spiracle with three to six disc pores, the posterior with none. Preanal scleroses absent, or at most only weakly developed. Anal opening situated about the centre of the pygidium. Perivulvar pores: four to 10 in the median group, nine to 13 in the anterolateral, and 12 to 16 in the posterolateral. Scale dark brown.

Specimens examined. O-luan-pi, on *Ficus swinhoei*.

Distribution and host plants. This species was originally described from specimens collected in Natal, South Africa on *Abutilon*, in Ceylon on *Anthurium*, and in Taiwan on banana.

Remarks. This species was separated from *aspidistrae* exclusively by the absence of disc pores at the posterior spiracles, but in other characters is practically identical with the latter. I have some doubt that it is a good species. So far as examined, however, the presence and absence of disc pores at the posterior spiracles are constant and stable characters in *aspidistrae* and *muntingi* and these two have been not found mixed in the same colonies. It may, therefore, be better to separate the two until further detailed informations have been at hand.

113. ***Pinnaspis strachani*** (Cooley) [Fig. 76]

References. Cooley 1899: 54 [*Hemichionaspis minor* var.]; Ferris and Rao 1947: 39; Balachowsky 1954 e: 284; Schmutterer 1959: 218.

Synonyms. The following synonymy is generally accepted by authors: *Hemichionaspis marchali* Cockerell, 1902; *Hemichionaspis townsendi* Cockerell, 1905; *Hemichionaspis aspidistrae* var. *gossypii* Newstead, 1908; *Hemichionaspis proxima* Leonardi, 1914; *Pinnaspis temporaria* Ferris, 1942.

Diagnosis. Pygidium triangular in outline. Median lobes comparatively large, notched two or three times on the lateral side; basal zygotis produced anteriorly beyond the bases of the lobes. Second lobes well developed; inner lobule expanded towards the apex, with the apical margin fairly rounded, and with a pair of basal scleroses; outer lobule smaller, yet well represented. Third lobes quite reduced. Marginal gland spines single except two or three on the base of the pygidium (on the fourth abdominal segment). First abdominal segment with one to three, the second with three to five, and the third with four to seven gland spines on the lateral lobe;

mesothorax with one, and metathorax with one or two gland cones on the lateral lobe. Submedian dorsal ducts represented by microducts scattered on the second and third, and at times also fourth, abdominal segments. Submarginal dorsal macroducts: five to 11 (including one on the margin) on the third abdominal segment, at times forming an irregularly double row; three to six on the fourth; and one to three on the fifth. Meso- and metathorax and basal three abdominal segments with macroducts on the lateral lobe, these macroducts being more or less smaller than the submarginal macro-

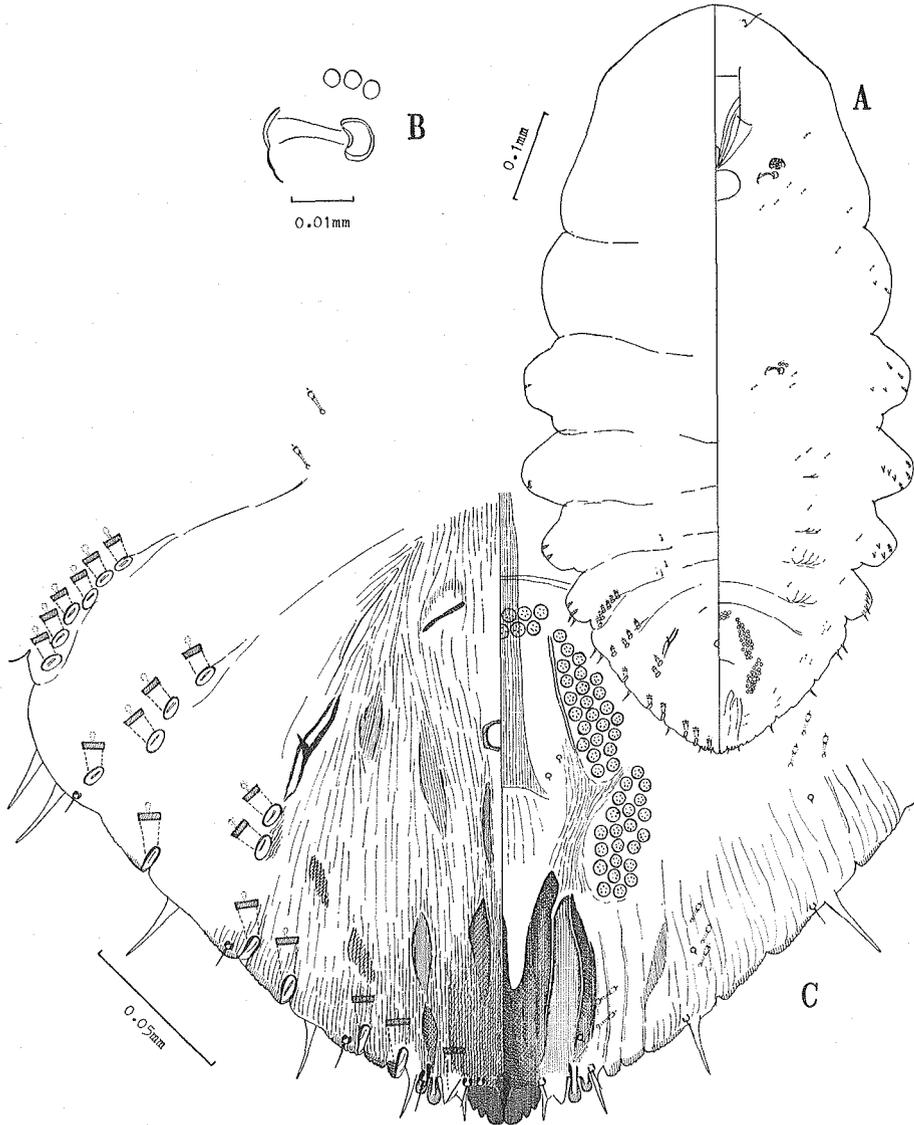


Fig. 76. *Pinna sp. strachani* (Cool.). Adult female (A, body; B, posterior spiracle; C, pygidium).

ducts: mesothorax with one, metathorax with three to five, first abdominal segment with four or five, the second with three to five, and the third with one or two. Anterior spiracle with 10 to 14 disc pores, the posterior with one to four. Preanal scleroses present and normally well developed. Anal opening situated rather towards the base of the pygidium. Perivulvar pores: eight to 16 in the median group, 21 to 25 in the anterolateral, and 16 to 25 in the posterolateral. Scale grayish white to pale brown.

Specimens examined. Ken-ting, on *Sansevieria* sp.

Distribution and host plants. This species is widely distributed in the tropics and subtropics and also under glass in the temperate region, feeding on various kinds of plants. The records of *Pinnaspis minor* in Taiwan, made by Ferris and Takahashi on *Sideroxyron ferrugineum* and undetermined plants, may as many other records of *minor* refer to *strachani*.

Remarks. It is not easy to identify the present form with *strachani* owing to the presence of disc pores associated with the posterior spiracles. By this character the present form agree with Schmutterer's *strachani* (see Schmutterer 1959). Another difficulty is found in the colour of the scale which is variable from grayish white to pale brown. The case is similar to that with *aspidistrae* and *muntingi*, and there may be a technical ground for the separation of the present form from *strachani*. By reason that not all of various forms of *strachani*, which are expected to be present from the study by Ferris and Rao (1947), are known to me I prefer keeping the present form in *strachani*. The present form is not to be referred to *aspidistrae* on account of the comparatively large median lobes, the well-developed preanal scleroses, and the grayish white to pale brown scale.

114. *Pinnaspis liui*, n. sp. [Fig. 77]

Diagnosis. Body slender, with the free abdominal segments only gently lobed laterally, and with the pygidium rather narrow and slightly roundish along the margin. Median lobes small, loosely appressed together, with several notches on the lateral side, their inner basal margins are usually separated by a narrow space; basal zygotis comparatively well developed, almost wholly produced anteriorly beyond the bases of the lobes. Second lobes well developed; inner lobule a little expanded towards the apex, with a pair of slender basal scleroses; outer lobule normally also well represented. Third lobes reduced, with either lobule represented by a low, often serrate, sclerotized process. Marginal gland spines single except two or three on the base of the pygidium (on the fourth abdominal segment). First abdominal segment with one or two, and the second and third each with one to three short gland spines on the lateral lobe; a few small gland spines often discernible in the submarginal region of each thoracic segment. Submedian dorsal ducts represented by a few microducts on each of the second to fourth and at times also fifth abdominal segments. Submarginal dorsal macroducts: two to five (including one near the margin) on the third abdominal segment, one to three on the fourth, one to four on the fifth, and one or two on the sixth. First abdominal segment with two to five, the second with two to four, and the third with two or three macroducts on the lateral lobe, these macroducts being more or less smaller than the submarginal macroducts; meso- and metathorax with several macroducts within the lateral margin, these macroducts being only slightly

larger than the neighbouring microducts. Anterior spiracle with two to six disc pores, the posterior with one to three. Preanal scleroses absent. Anal opening comparatively large, situated towards the base of the pygidium. Perivulvar pores: four to eight in the median group, eight to 16 in the anterolateral, and eight to 17 in the posterolateral. Scale brown.

Specimens examined. A-li Shan, on the leaves of *Adinandra lasiostyla*, *Eurya acuminata* and *E. strigillosa*.

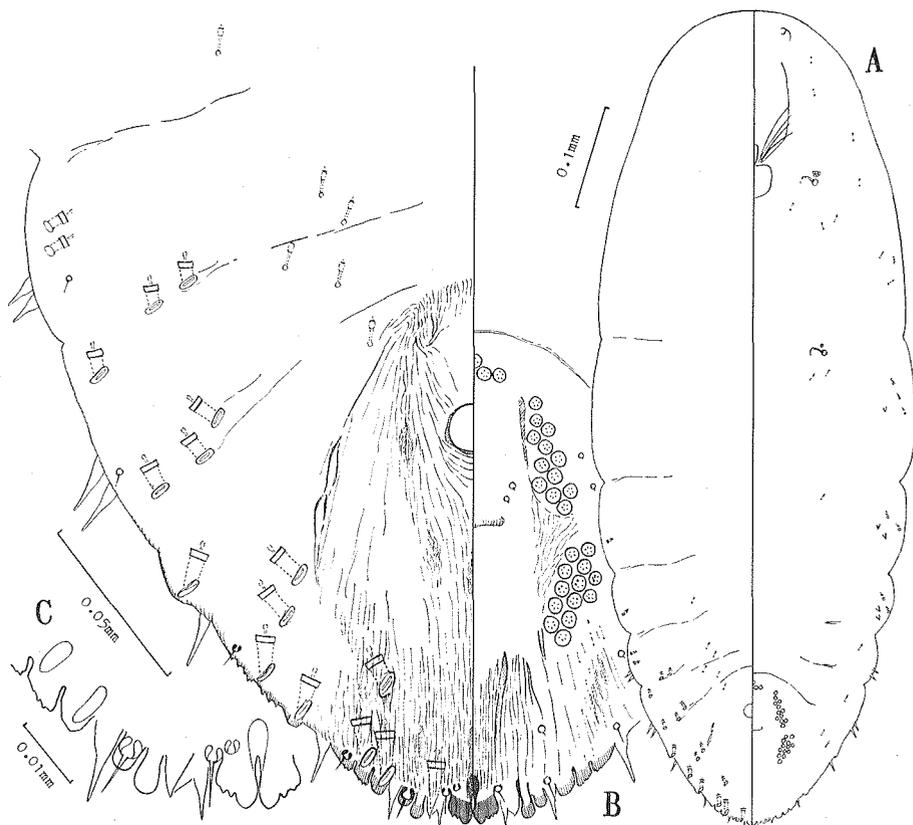


Fig. 77. *Pinnaspis liui*, n. sp. Adult female (A, body; B, pygidium; C, pygidial lobes).

Remarks. This species is unique by having one or two submarginal macroducts on the sixth abdominal segment. Although this character is quite unusual in *Pinnaspis*, I have no doubt that this species is an authentic member of the genus. The host plants of this species belong to the Theaceae.

115. *Pinnaspis shirozui*, n. sp. [Fig. 78]

Diagnosis. Body with the free segments strongly lobed out, and with the pygidium rather broad and triangular in outline. Median lobes comparatively large, strongly appressed together mesally and seemingly fused together, with their apices separated by a deep median notch, and with the lateral margin deeply notched twice; basal

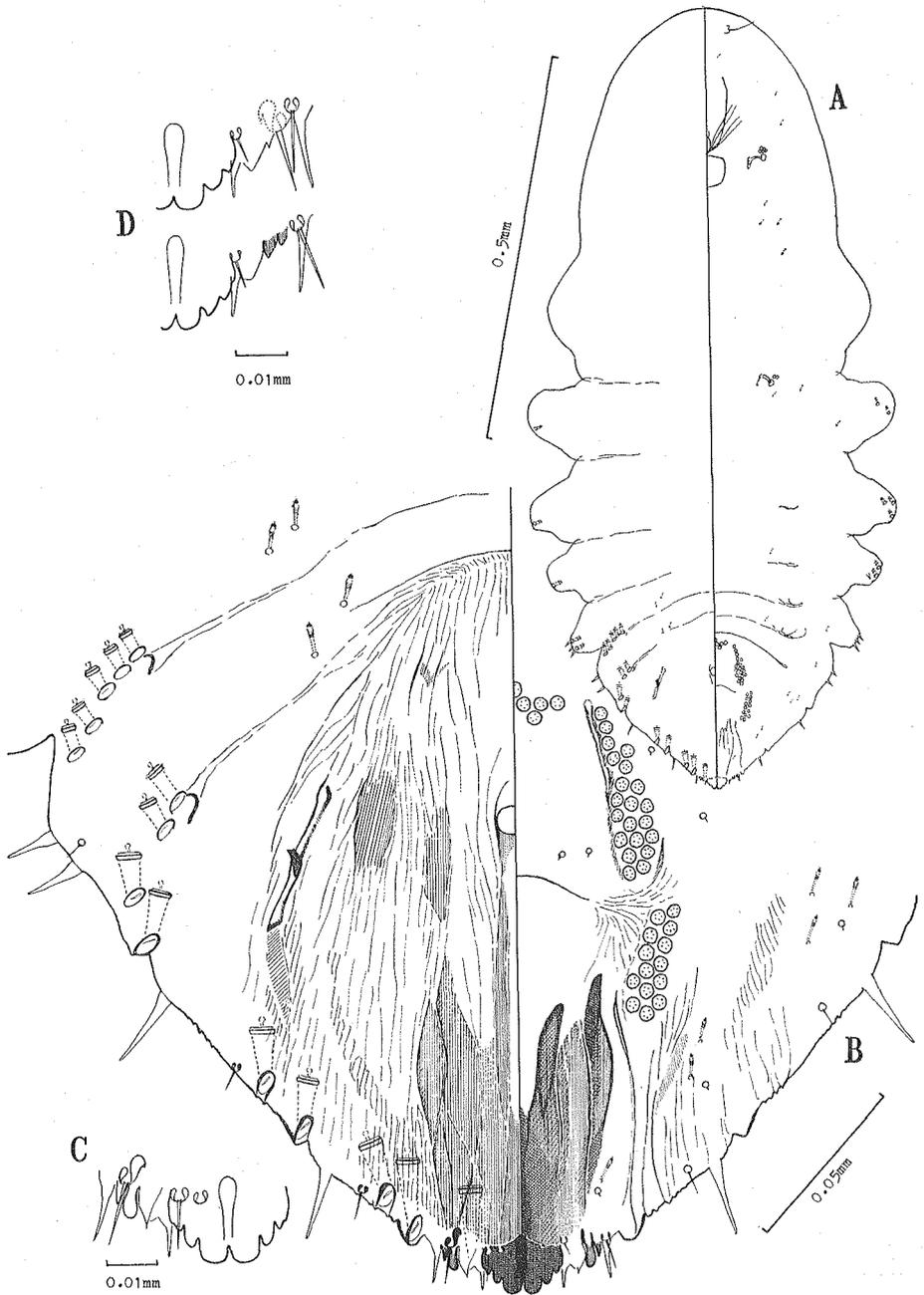


Fig. 78. *Pinnaspis shirozui*, n. sp. - Adult female (A, body; B, pygidium; C & D, pygidial lobes).

zygosis slightly produced anteriorly beyond the bases of the lobes. Second lobes various in development, but even if both lobules are present quite small in size: in one extreme the inner lobule is rather well developed, with the apex rounded, and with the basal scleroses distinct, and the outer lobule is a smaller, pointed process, whereas in the other extreme there is discernible only a quite small, pointed, unsclerotized process where the second lobe is expected; intermediate forms are also found between these extremes. Marginal gland spines single except two on the base of the pygidium (on the fourth abdominal segment). Second abdominal segment with one to three (usually one), and the third with one to three (usually three) gland spines on the lateral lobe. Submedian dorsal ducts represented by a few microducts at times present on the third and fourth abdominal segments. Submarginal dorsal macroducts: three to five (including one on the margin) on the third abdominal segment, one or two on the fourth, and one at times present on the fifth. Metathorax and basal three abdominal segments with macroducts on the lateral lobe: one to four on the metathorax, three to five on the first abdominal segment, three or four on the second, and two on the third. Anterior spiracle with three to eight disc pores, the posterior with one or two. Preanal scleroses absent or vestigial. Anal opening situated towards the base of the pygidium. Perivulvar pores: eight to 11 in the median group, 14 to 22 in the anterolateral, and 10 to 17 in the posterolateral. Scale brown.

Specimens examined. Heng-chun, on the leaves and twigs of *Ficus cuspidatocaudata*.

Remarks. This species may be close to *strachani*, but in some respects is rather similar to *mussaendae* Green and its allies. This species may be recognized by the combination of the following characters: the seemingly fused median lobes, which are, however, separated apically by a distinct notch; the absence of distinct preanal scleroses; and the submarginal macroducts usually lacking on the fifth abdominal segment.

116. *Pinnaspis hibisci*, n. sp. [Fig. 79]

Diagnosis. Body rather robust, with the pygidium broad and triangular in outline. Median lobes large, tightly appressed together mesally but not fused, deeply notched twice or thrice on the lateral margin; basal zygosis produced anteriorly beyond the bases of the lobes. Second lobes quite reduced yet rather variable in size, with the outer lobule at times obsolete; basal scleroses obsolete on the inner lobule. Third lobes practically obsolete. Marginal gland spines single except two to four (usually three) on the base of the pygidium (on the fourth abdominal segment). First and second abdominal segments each with two to four, and the third with three to five gland spines on the lateral lobe. Meso- and metathorax usually, and prothorax occasionally, with small gland spines few in the submarginal region. Submedian dorsal ducts wholly represented by microducts: one to three on the first abdominal segment at times absent, one to five on the second, one to four on the third, and one at times present on the fourth. Submarginal dorsal macroducts: four to 10 (including one or two on the margin) on the third abdominal segment, at times forming an irregularly double row; two to eight on the fourth, and one to seven on the fifth. Metathorax and basal three abdominal segments with macroducts on the lateral lobe: metathorax with six to 13 macroducts, first abdominal segment with seven to 11, the second with five to eight, and the third with two to four. Anterior spiracle with a cluster of five to 23 disc pores, the posterior with two to six disc pores. Preanal scleroses usually

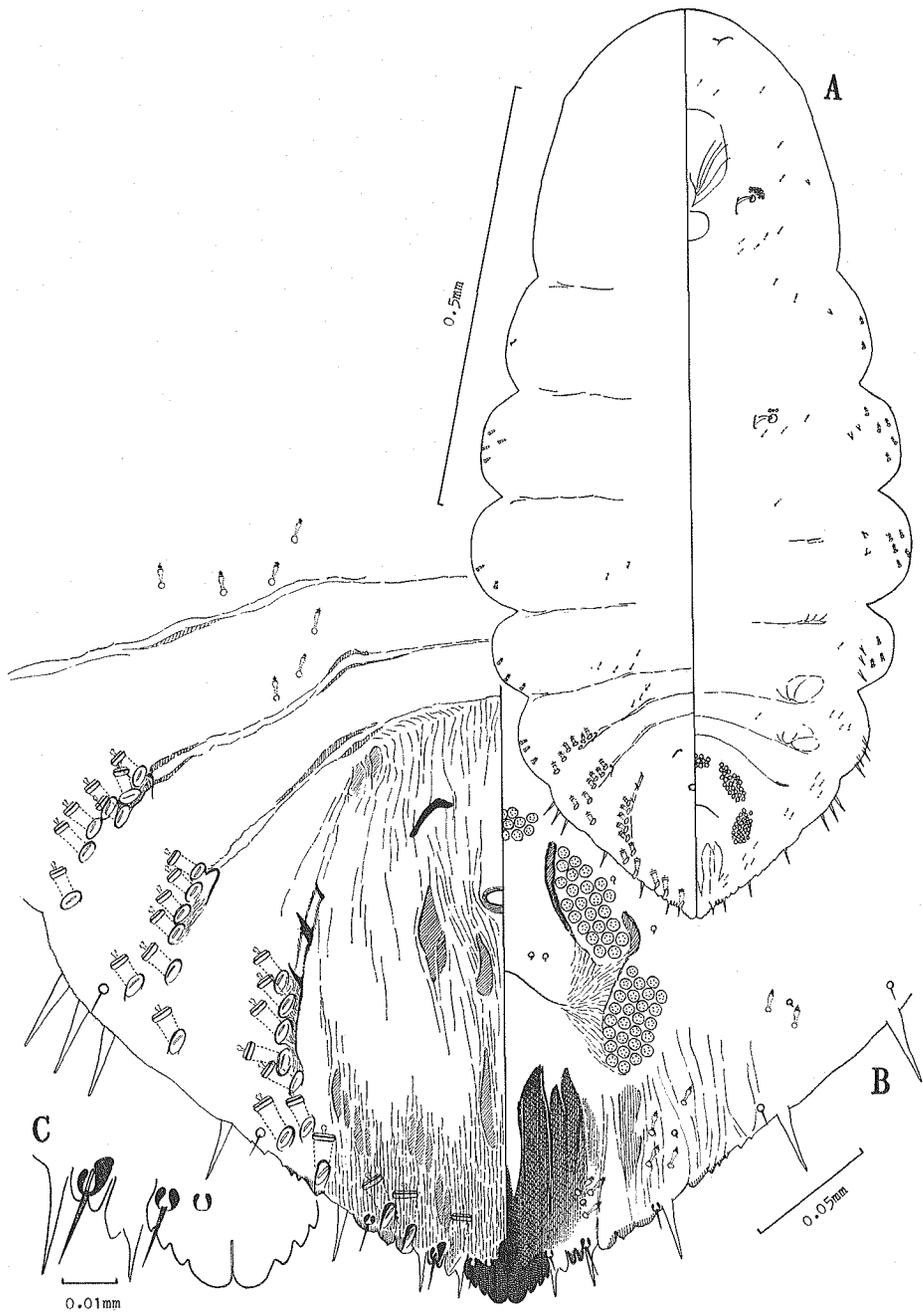


Fig. 79. *Pinnaepis hibisci*, n. sp. Adult female (A, body; B, pygidium; C, pygidial lobes), figured from specimens collected at Kuan-tzu-ling on *Hibiscus taiwanensis*.

more or less developed. Anal opening situated towards the base of the pygidium. Perivulvar pores: eight to 20 in the median group, 16 to 30 in the anterolateral, and 17 to 37 in the posterolateral. Scale white.

Specimens examined. Chia-i, on *Hibiscus rosae-sinensis*; Kuan-tzu-ling, on *Hibiscus taiwanensis* and *Boehmeria densiflora*; Heng-chun, on *Hibiscus rosae-sinensis*. Collected on the twigs and branches of the host plants.

Remarks. This species comes close to *yamamotoi* Takagi, from which it may be distinguishable by having gland spines as anteriorly as the mesothorax, by having more numerous lateral macroducts, and by the white scale. It differs from *shirozui* mainly by the following characters: the unfused median lobes; the well-developed preanal scleroses; the presence of the submarginal macroducts on the fifth abdominal segment; the more numerous submarginal macroducts on the third and fourth abdominal segments; the more numerous lateral macroducts; the presence of gland spines in the thoracic region; and white scale. It has a close resemblance to *strachani*, but so far as based on the present material of both species it is easily distinguishable from the latter by the much less developed second lobes, of which the inner lobule is devoid of distinct basal scleroses. Its resemblance to the *townsendi*-type of *strachani*, which was revised by Ferris and Rao (1947), is especially close, but it may differ at least from the nominate form of the *townsendi*-type by lacking submedian dorsal macroducts. By having the large median lobes and much reduced second lobes this species are also very similar to the Ceylonese *mussaendae* Green, *rhododendri* Green and *scrobicularum* Green, but differs from the latter three by the second lobes, preanal scleroses or dorsal macroducts.

The present specimens are variable in the number of spiracular disc pores and also in that of the submarginal macroducts, and these variations seem to be associated with their localities. In other characters, however, they are so close that there seems to be no good reason to separate them. Furthermore, the specimens collected at Kuan-tzu-ling on both *Hibiscus taiwanensis* and *Boehmeria densiflora* are quite identical, showing no discernible difference associated with the host plants.

117. *Pinnaspis frontalis*, n. sp. [Fig. 80]

Diagnosis. Body slender, with the free segments little lobed out laterally, and with the pygidium narrow and only slightly roundish. Median lobes rather small, tightly appressed together mesally, notched twice on the lateral side; basal zygotis somewhat produced anteriorly beyond the bases of the lobes. Second lobes well developed, either lobule much elongate, constricted basally, often with a subapical notch on each side, and without basal scleroses. Third lobes reduced to mere marginal serrations. Marginal gland spines slender and single except two short gland spines on the base of the pygidium (on the fourth abdominal segment); third abdominal segment with one small gland spine within the lateral margin. Marginal macroducts: usually four in two pairs around the supposed region of the fourth abdominal segment, three on the fifth, two on the sixth, and one on the seventh. Submedian dorsal ducts of any size absent. One submarginal dorsal macroduct on the fourth and fifth abdominal segments each, as large as or even tending to be larger than the marginal macroducts. Metathorax and basal three abdominal segments with macroducts within the margin, these macroducts being more or less smaller than the marginal macroducts: meta-

thorax with four to six, the first abdominal segment with four or five, the second with three, and the third with two; mesothorax usually with several ducts within the margin a little larger than microducts. Frons with an interantennal tubercle sessile, fairly large and spinous. Anterior spiracle with two to five disc pores, the posterior with one or two. Preanal scleroses absent or if present vestigial. Anal opening situated towards the base of the pygidium. Perivulvar pores: two to eight in the

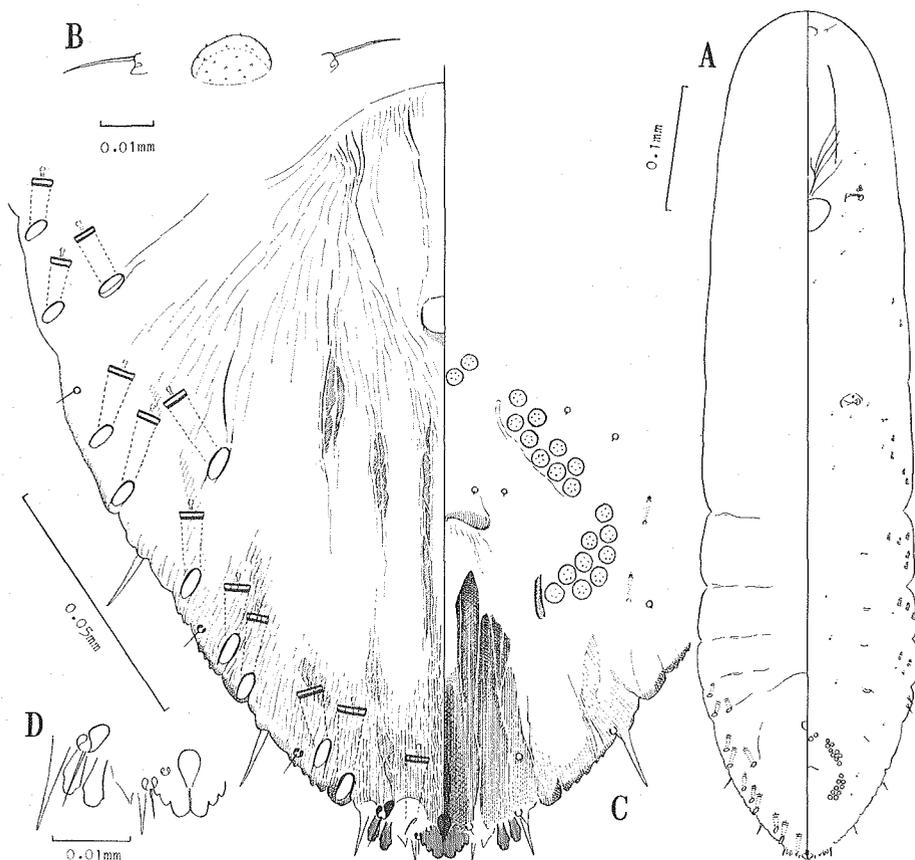


Fig. 80. *Pinnaspis frontalis*, n. sp. Adult female (A, body; B, antennae and interantennal process; C, pygidium; D, pygidial lobes).

median group, six to ten in the anterolateral, and six to twelve in the posterolateral. Scale quite slender, highly convex dorsally, and dark brown.

Specimens examined. Chu-chi, on the leaves of *Eurya japonica*.

Remarks. This species is distinguishable from any other known species of the genus by the presence of the interantennal tubercle.

118. *Pinnaspis uniloba* (Kuwana) [Fig. 81]

References. Kuwana 1909: 156 [*Mytilaspis* (*Lepidosaphes*)]; *ibid.* 1925 a: 37 [*Lepidosaphes*]; Ferris and Rao 1947: 42.

Synonyms. *Pinnaspis simplex* Ferris, 1921.

Diagnosis. Body slender, almost parallel on the lateral margins through the thorax and prepygidial abdominal region, with the free segments not much lobed out laterally, and with the pygidium triangular. Median lobes wholly fused together, notched twice or thrice on the lateral margin; an eminent, fusiform, median sclerosis occurring at the base of the fused median lobes. Second lobes completely obsolete. Marginal gland spines single except two towards the base of the pygidium (on the fourth abdominal segment), those on the fourth and fifth abdominal segments being

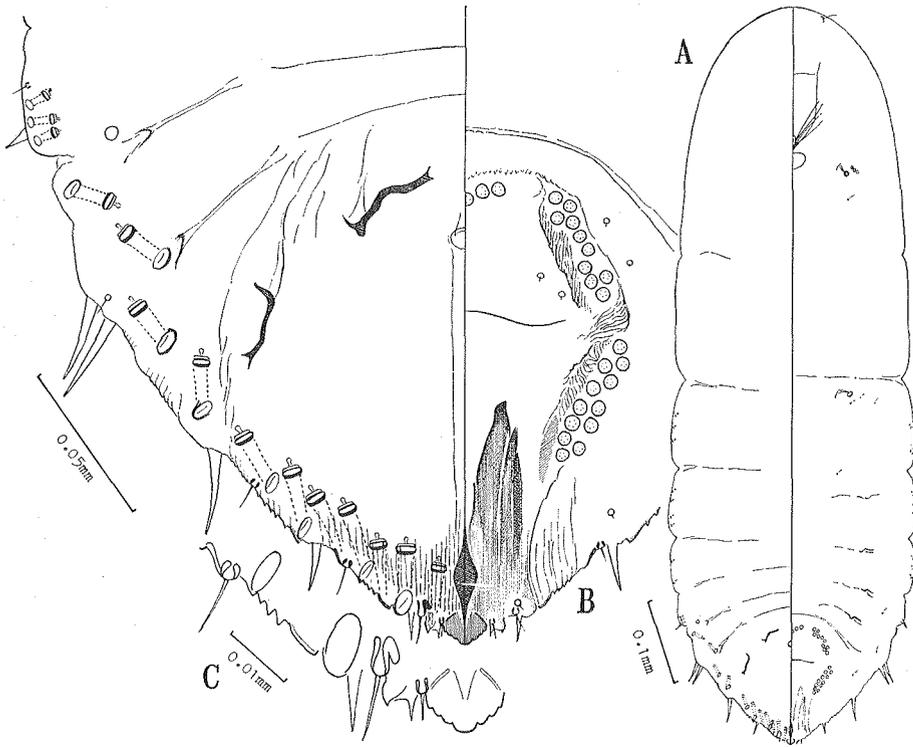


Fig. 81. *Pinnaspis uniloba* (Kuw.). Adult female (A, body; B, pygidium; C, pygidial margin).

quite developed. Third abdominal segment with a short gland spine at the apex of the lateral lobe. Marginal macroducts: three in the supposed region of the fourth abdominal segment, one of them is situated in the anterolateral corner of the segment; two on the fifth; four on the sixth; and one on the seventh. Submedian dorsal ducts of any size absent. One submarginal dorsal macroduct on the fourth abdominal segment. Metathorax and basal three abdominal segments with smaller macroducts within the lateral margin: metathorax with three to seven, first abdominal segment with four to eight, the second with three to six, and the third with two or three. A small submarginal dorsal boss between the third and fourth abdominal segments often

indiscernible. Anterior spiracle with two to four disc pores, the posterior with or without one disc pore. Preanal scleroses quite strongly developed, much elongate; a similar sclerosis in the anterolateral corner of the pygidium. Anal opening towards the base of the pygidium. Perivulvar pores: four or five in the median group, five to 12 in the anterolateral, and nine to 14 in the posterolateral. Scale slender, dark brown.

Specimens examined. Yang-ming Shan, on *Cleyera japonica*; southeastern Taipei Hsien, on *Adinandra milletti* and *Cleyera japonica*.

Distribution and host plants. This species was originally described from Japan, where it feeds on *Cleyera japonica* (= "*Eurya ochracea*"), *Osmanthus fortunei* and *O. fragrans*. Takahashi recorded it in Taiwan on *Adinandra*, *Camellia japonica*, *Cleyera japonica*, *Eurya japonica* and *Osmanthus fragrans*. Ferris described it as *simplex* from China. Ferris and Rao recorded it in India on *Aegle marmelos* and *Bauhinia racemosa*. It was introduced into Hawaii, where it was recorded on *Alyxia olivaeformis*.

Remarks. This species is variable in the number of the marginal macroducts, but the present specimens are all uniform in having 10 marginal macroducts on each side of the pygidium.

XLI. Genus *Afiorinia*, n. g.

Type-species. *Afiorinia hirashimai*, n. sp.

Diagnosis. Pupillarial, the adult female being enclosed within the sclerotized second exuvium. Body elongate, with the free segments little lobed out laterally, and with the pygidium triangular in outline. Median lobes zygotic, comparatively very large, lacking distinct marginal setae between them. Second lobes bilobulate, much reduced. Gland spines ill-developed. Dorsal marginal setae of the pygidium elongate. Macroducts present only on the pygidial margin. Antenna with a seta. Anterior spiracle with disc pores. Anal opening situated rather towards the base of the pygidium. Perivulvar pores in five groups. Second instar female with marginal gland spines comparatively well developed, otherwise similar to the adult female.

Remarks. In the present state of our knowledge it is not easy to determine whether the present form is a mere variant of *Fiorinia* or a distinct unit. However, the present form differs from all the authentic species of *Fiorinia* by lacking marginal setae between the median lobes, so that a trial is here made to establish a new genus for it. In this respect this genus may be better placed in the *Chionaspis*-group than in the *Fiorinia*-group.

119. *Afiorinia hirashimai*, n. sp. [Fig. 82]

Diagnosis. Median lobes sunken into a distinct apical notch of the pygidium, somewhat divergent, robust, rounded and minutely serrate on the free margin, connected basally through a strong band. Second lobes with either lobule in a minute, membranous process, or at times hardly discernible. A small marginal gland spine just laterally to the median and second lobes each. Marginal macroducts variable in number and arrangement, one to five on each side of the pygidium; a sharp pore prominence is always present on each of the sixth and seventh abdominal segments, even if the associated macroduct is lacking. Anterior spiracle with two to five disc pores, the posterior with or without one. Perivulvar pores: six to nine in the median

group, nine to 13 in the anterolateral, and eight to 14 in the posterolateral, the median group is often divided medially into two clusters. Second instar female with three marginal macroducts and four marginal gland spines all single on each side of the pygidium.

Specimens examined. Fen-chi-hu, on the leaves of *Castanopsis kusanoi*.

Remarks. As described above this species is variable in the number and arrangement of the marginal macroducts. The variations found in the present specimens are given in Table 7.

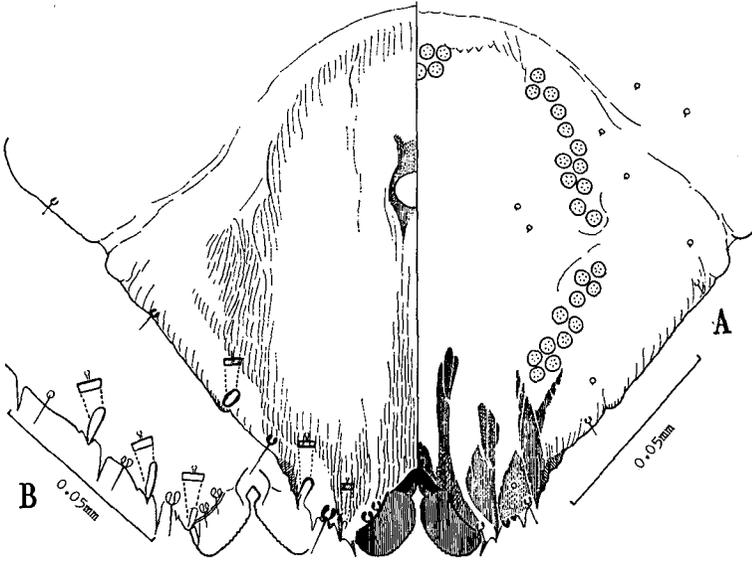


Fig. 82. *Aforinia hirashimai*, n. sp. A, pygidium of the adult female; B, pygidial margin of the exuvium of the second instar female.

TABLE 7. Number of the marginal macroducts in *Aforinia hirashimai*.

Variant	Marginal macroducts				Total on one side
	Abd. IV	Abd. V	Abd. VI	Abd. VII	
1	1	0	0	0	1
2	0	1	0	0	1
3	0	0	1	0	1
4	1	0	1	0	2
5	0	1	1	0	2
6	1	1	1	0	3
7	0	1	1	1	3
8	0	1	2	0	3
9	1	1	1	1	4
10	1	1	2	1	5

XLII. Genus *Ichthyaspis*, n. g.

Type-species. *Adiscofiorinia ficicola* Takahashi.

Diagnosis. Pupillarial. Body oval in outline, membraneous except for the weakly sclerotized pygidium. Pygidium produced apically into a short, broad stalk, ending in large median lobes, which are fused together basally. No trace of lateral lobes. Marginal gland spines absent on the pygidium. Marginal setae of the pygidium much elongate on both dorsal and ventral sides. Marginal macroducts single on the pygidium; submedian and submarginal macroducts absent. Antenna with a seta. Spiracles without disc pores. Anal opening closer to the base of the pygidium. Perivulvar pores in five groups. Second exuvium elongate, fusiform; pygidium narrow, rounded along the free margin, divided into dorsal and ventral valves along the whole free margin; median lobes comparatively large, confluent basally; lateral lobes absent; marginal gland spines single, well developed; marginal macroducts single, rather large in size.

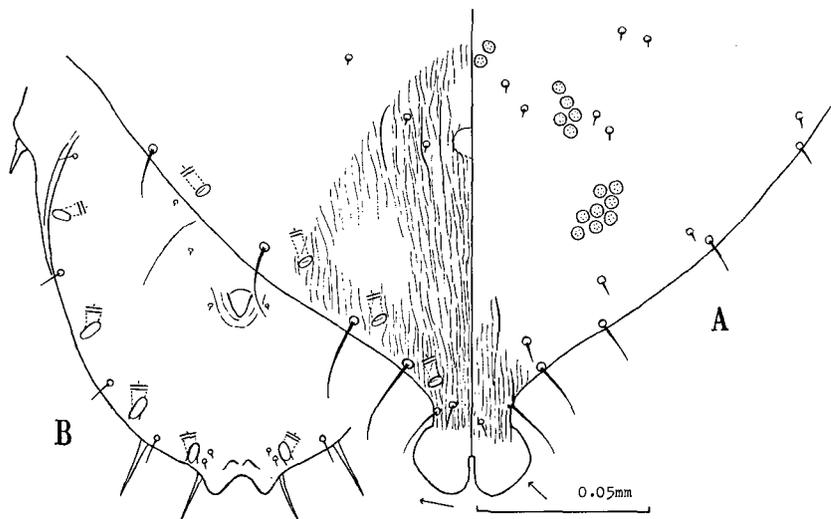


Fig. 83. *Ichthyaspis ficicola* (Takah.). A, pygidium of the adult female; B, pygidium of the exuvium of the second instar female.

Remarks. The genus *Adiscofiorinia* Leonardi was erected for the gall-making pupillarial species *Fiorinia secreta* Green from Ceylon. The new genus *Ichthyaspis*, a separation from *Adiscofiorinia*, differs from the latter by the eminent marginal setae of the pygidium and by having marginal macroducts; its type-species is not a gall-maker.

120. *Ichthyaspis ficicola* (Takahashi) [Fig. 83]

References. Takahashi 1931b: 380 [*Adiscofiorinia*].

Diagnosis. Pygidium nearly triangular in outline, a little roundish on the free margin. Median lobes rounded, entire, separated from each other for their apical two-thirds by a narrow but distinct space. Marginal macroducts are four in number on each side of the pygidium, all single. Basal three abdominal segments each with

several minute gland cones just within the margin. Perivulvar pores: two to four in the median group, five to seven in the anterolateral, and eight in the posterolateral. Second instar female with the median lobes conical; four marginal macroducts on each side of the pygidium; two pairs of slender, elongate marginal gland spines towards the apex of the pygidium, a shorter marginal gland spine on the base of the pygidium and also on some preceding segments each.

Specimens examined. Yang-ming Shan, on a creeping species of *Ficus*.

Distribution and host plants. This species was originally described in Taiwan on *Ficus foveolata*. There has been made no further record.

Genera incertae sedis

XLIII. Genus *Kuwanaspis* MacGillivray

References. MacGillivray 1921: 311; Kuwana 1928: 30 [*Tsukushiaspis*]; Ferris 1941 d: 287; Balachowsky 1954 e: 264.

Synonyms. *Tsukushiaspis* Kuwana, 1928 [type-species: *Chionaspis pseudoleucaspis* Kuwana]; *Lepidosaphoides* Lindinger, 1930 [type-species: *Leucaspis bambusae* Kuwana=*Chionaspis pseudoleucaspis*].

Type-species. *Chionaspis hikosani* Kuwana.

Diagnosis. Body elongate, in some species moderately so and fusiform, but in others extremely so, with the lateral sides parallel; free abdominal segments slightly or little lobed laterally; pygidium rounded. Derm membraneous except for the pygidium, which is sclerotized dorsally in a median area. Pygidial lobes in two pairs, the median lobes uni- or bilobulate and the second bi- to quadrilobulate, all these lobules of both pairs are similar, practically symmetrical, and comparatively small; median lobes separated from each other by a good space. Marginal gland spines well developed, usually single, absent between the median lobes; prepigidial region with gland cones. Pygidial margin fringed with a series of apically toothed, broad processes (in certain species these processes are reduced to mere tubercular processes). Dorsal macroducts tending to be arranged segmentally, with the orifice elliptical and more or less sclerotized on the rim; marginal macroducts not differentiated on the pygidium. Antennal setae various in number. Anterior spiracles with disc pores. Anal opening situated in the base of the pygidium. Perivulvar pores present or absent, if present clustered in five groups.

Composition and distribution. Takahashi described nine species in *Tsukushiaspis* or *Kuwanaspis* from Taiwan: *arundinariae*, *bambusifoliae*, *elongata*, *formosana*, *hichiseisana*, *neolinearis*, *phragmitis*, *suishana*, and *vermiformis*. Of these species *hichiseisana* is apparently referable to *Nikkoaspis*, which is, in my opinion, a distinct genus. *Suishana* was later recorded from Thailand, *neolinearis* from Singapore, and *vermiformis* from Madagascar. Four species of the genus were originally described from Japan: *hikosani* Kuwana, *pseudoleucaspis* Kuwana, *takahashii* Takagi, and *tanzawensis* Takagi and Kawai. Two species described from India or Ceylon, *annandalei* Green and *linearis* Green, may be also true members of the genus. Another species, *sasae* Takahashi, was described from China as a member of *Tsukushiaspis*, but is referable to *Nikkoaspis*. Three species of the genus are widely distributed in the world. One of them, *pseudoleucaspis*, was originally described from Japan and recorded from

Taiwan, China, Europe, North America, etc. The other two species *howardi* Cooley and *bambusicola* Cockerell were originally described from East India and Brazil, respectively, but their origins are unknown; *howardi* was recently found in Japan, but it is not possible from the information at hand to assume whether it is a native or introduced species in Japan. All these evidences point to the eastern extreme of Asia (Taiwan; Japan) as the centre of the genus.

Remarks. This genus is a predominantly eastern-Asiatic group of graminivorous species occurring mainly on bamboos. It is close to *Nikkoaspis* Kuwana and, in some degree, also to *Unachionaspis* MacGillivray, northeastern-Asiatic genera of bamboo-feeders, presumably forming together with the latter two a peculiar phylogenetic stock. *Kuwanaspis* and *Nikkoaspis* are so close that Takahashi united them into a single genus. It is not easy to come to a definite conclusion concerning the distinctness of *Nikkoaspis* until various forms of the two genera have been compared in detail. However, *Nikkoaspis* seems to be boreo-montane in distribution, whereas *Kuwanaspis* occurs in a wide range from tropical lowlands to the temperate region. This trait in distribution, together with the peculiar body shape and numerous dorsal macroducts, may afford a basis to accept *Nikkoaspis* as valid.

The genus *Kuwanaspis* may possibly belong to the Diaspidini, but deviates from the main stock of the tribe by having plate-like processes on the pygidial margin and by lacking differentiated marginal macroducts. These characters may belong to the "parlatorine pattern", but there is no further positive evidence that the genus has really a particular relation with the Diaspididae parlatoriformes. The first instar larva offers no solution as to the taxonomic position of the genus, having the marginal processes almost wholly obsolete.

So far as I am aware 10 species were described or recorded by Takahashi in *Tsukushiaspis* or *Kuwanaspis* from Taiwan. Ferris recorded *Chionaspis annandalei* Green, which may very possibly be a member of *Kuwanaspis*, from Taiwan.

- 1) *annandalei* Green. Not collected.
- 2) *arundinariae* Takahashi. Not collected.
- 3) *bambusifoliae* Takahashi. Not collected.
- 4) *elongata* Takahashi. Not collected.
- 5) *formosana* Takahashi. Not collected.
- 6) *hichiseisana* Takahashi. A species of *Nikkoaspis*. Not collected.
- 7) *neolinaris* Takahashi.
- 8) *phramitis* Takahashi. Not collected.
- 9) *pseudoleucaspis* Kuwana.
- 10) *suishana* Takahashi.
- 11) *vermiformis* Takahashi.

121. ***Kuwanaspis pseudoleucaspis*** (Kuwana)

References. Kuwana 1902: 74 [*Leucaspis bambusae*]; Kuwana 1923 c: 323 [*Chionaspis*]; ibid. 1928: 31 [*Tsukushiaspis*]; Ferris 1941 d: 288; Balachowsky 1954 e: 269.

Synonyms. *Leucaspis bambusae* Kuwana, 1902 (nec *Chionaspis bambusae* Cockerell, 1896).

Diagnosis. Body narrow on the head, gradually broader posteriorly towards the second abdominal segment, the pygidium broadly rounded along the free margin. Median lobes unilobed, about as long as wide, notched on each side, separated from

each other by a space about as wide as one of them. Second lobes bilobulate, the inner lobule as large as the median lobe, but the outer somewhat smaller. Four single marginal gland spines on each side of the pygidium, the fourth abdominal segment with some conical gland spines within the lateral margin; basal three abdominal segments with submarginal gland cones as follows: first abdominal segment with two or three gland cones, the second with seven or eight, and the third with eight or nine. Plate-like marginal processes well developed, a pair between the median lobes, one between the median and second lobes, many on the whole remaining margin of the pygidium. Submedian dorsal macroducts: one or two present or absent on the second abdominal segment, three or four on the third, three to six on the fourth, three to five on the fifth, and two or three on the sixth (laterally to the anal opening). Segmental and intrasegmental rows of submarginal dorsal macroducts on the fourth to sixth abdominal segments, the second and third abdominal segments with submarginal macroducts in the posterolateral corner; three to five macroducts scattered in the supposed region of the seventh abdominal segment; one macroduct near margin between the median lobes. Ventral macroducts scattered submarginally on the metathorax and basal two abdominal segments. Antenna with two setae. Anterior spiracle with seven or eight disc pores. Perivulvar pores: five to seven in the median group, six to 11 in the anterolateral, and eight to 12 in the posterolateral.

Specimens examined. Yang-ming Shan, on an undetermined bamboo.

Distribution and host plants. This species was originally described from Japan and is commonly found there on *Phyllostachys*, *Pleioblastus*, *Sasa* and other bamboos. It was recorded in Taiwan and China on various bamboos ("*Bambusa*" sp., *Phyllostachys*, and an undetermined bamboo). It was introduced to Europe, North America and other parts of the world.

Remarks. This species is very close to *howardi* Cooley. Balachowsky gives a detailed comparison between the two, but some characters used by him are variable. A decided difference between the two is found in that *howardi* has a transverse row of ventral macroducts on the basal segment of the abdomen, whereas *pseudoleucaspis* has not. Other differences are as follows: in *howardi* a loose cluster of microducts is present just posteriorly to the anterior spiracle but in *pseudoleucaspis* absent; in *pseudoleucaspis* ventral microducts are scattered across the metathorax and basal three abdominal segments, but in *howardi* the second and third segments of the abdomen lack ventral ducts of any size in a broad median region.

122. *Kuwanaspis suishana* (Takahashi) [Fig. 84]

References. Takahashi 1930: 16 [*Tsukushiaspis*].

Diagnosis. Body much elongate, quite slender, with the lateral margins practically parallel, and with the pygidium narrow. Median lobes uni- or bilobulate, the second tri- or quadrilobulate (rarely bilobulate), all the lobules being small, acute apically, and often once-notched subbasally on each side. Four single marginal gland spines strongly developed on each side of the pygidium. Gland cones numerous on the base of the abdomen in two large clusters on each side as follows: 12 to 21 in a submedian cluster, and nine to 16 in a submarginal cluster just posterolaterally to the submedian cluster. Plate-like marginal processes developed on the pygidium, a pair between the median lobes at times fused into a broad process, one between the

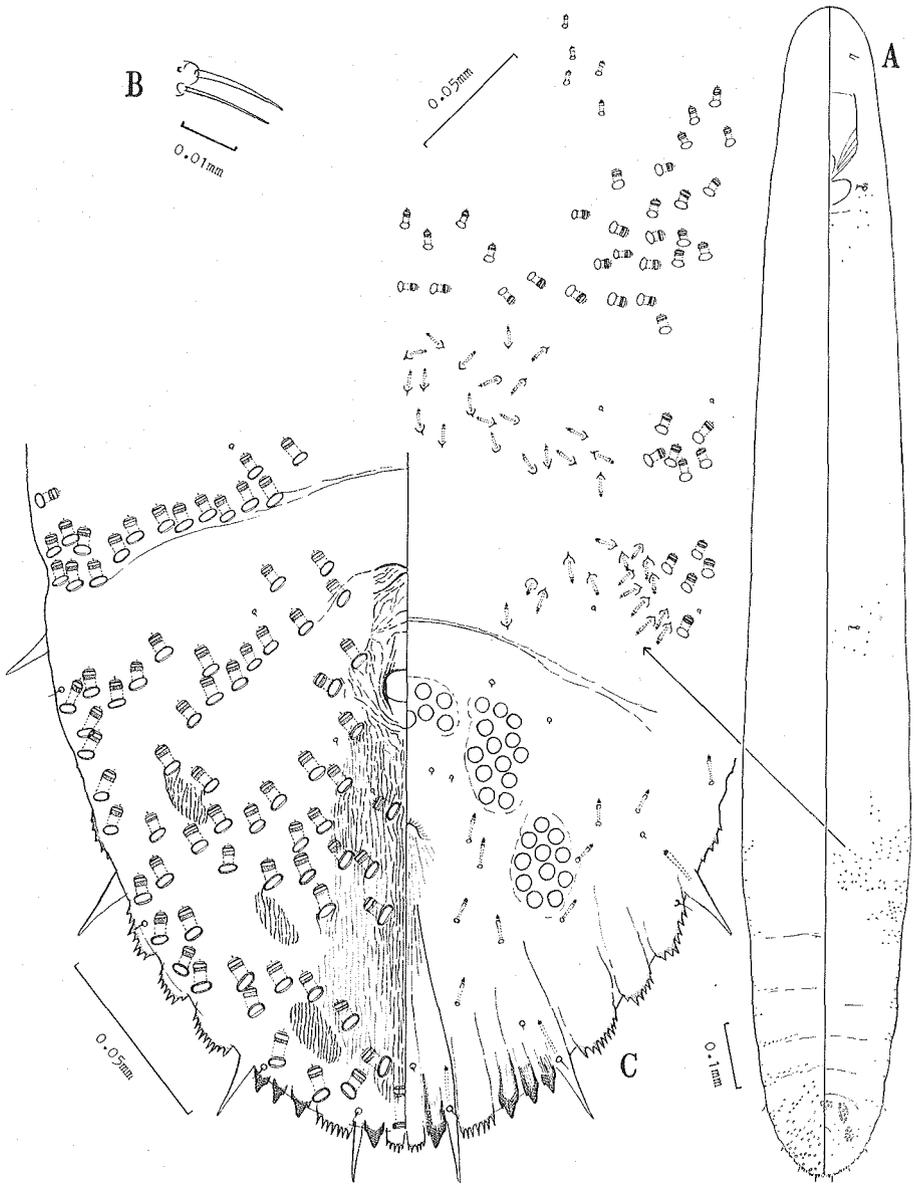


Fig. 84. *Kurvanaspis suishana* (Takah.). Adult female (A, body; B, antenna; C, pygidium).

median and second lobes, three to five laterally to the second lobe. Dorsal macroducts of the pygidium numerous and rather scattered except in the segmental row of the fifth abdominal segment; on the preceding two segments (third and fourth abdominal segments) arranged in a long segmental row on each side, and scattered within the lateral margin; less numerous on the basal two abdominal segments. Ventral macroducts numerous on the base of the abdomen in a transverse row across the body just anteriorly to the submedian clusters of gland cones. Microducts scattered posteriorly to both pairs of spiracles. Antenna with two long setae. Anterior spiracle with three or four disc pores. Perivulvar pores: four to 10 in the median group, 11 to 14 in the anterolateral, and nine to 19 in the posterolateral.

Specimens examined. Yang-ming Shan, on an undetermined bamboo; southeastern Tai-pei Hsien, on *Phyllostachys edulis*.

Distribution and host plants. This species was originally described from Taiwan as a feeder of bamboo, and later recorded from Thailand.

123. *Kuwanaspis vermiformis* (Takahashi) [Fig. 85]

References. Takahashi 1931 a: 215 [*Tsukushiaspis*].

Diagnosis. Body quite elongate, with the lateral margins practically parallel, and with the pygidium narrow. Median lobes unilobed, the second bilobulate, all practically same in shape and size, small, acutely pointed apically, usually deeply once-notched subbasally on each side. Four single marginal gland spines comparatively well developed on each side of the pygidium. Gland cones on the base of the abdomen in two clusters on each side as follows: four to seven in a submedian cluster, and three to five in a submarginal cluster lateroposteriorly to the submedian cluster. Plate-like marginal processes absent towards the base of the pygidium, a pair between the median lobes, one between the median and second lobes broad, two or three laterally to the second lobe broad, tending to be much reduced. Dorsal macroducts rather scattered on the pygidium except in a more or less definite segmental row on the fifth abdominal segment, the preceding three segments each with a segmental row of macroducts on each side. Third and fourth abdominal segments with macroducts scattered within the lateral margin on both surfaces. Ventral macroducts scattered laterally to the submarginal gland cones, and also in a medially interrupted or continuous transverse row across the body anteriorly to the submedian gland cones. Microducts scattered posteriorly to the anterior spiracle. Antenna with two long setae. Anterior spiracle with one or two disc pores. Perivulvar pores: one or two in the median group, two to four in the anterolateral, and three or four in the posterolateral.

Specimens examined. Southeastern Tai-pei Hsien, on an undetermined bamboo; Chia-i, on an undetermined bamboo; Chu-chi, on *Sinocalamus oldhami*.

Distribution and host plants. This species was originally described from specimens collected in Taiwan on *Bambusa stenostachya*, *Sinocalamus latiflorus* (= *Dendrocalamus latiflorus*), etc. Mamet recorded it in Madagascar on a "climbing bamboo said to be indigenous" to that island.

124. *Kuwanaspis neolinearis* (Takahashi) [Fig. 86]

References. Takahashi 1930: 21 [*Tsukushiaspis*].

Diagnosis. Body quite elongate, slender, with the lateral margins practically

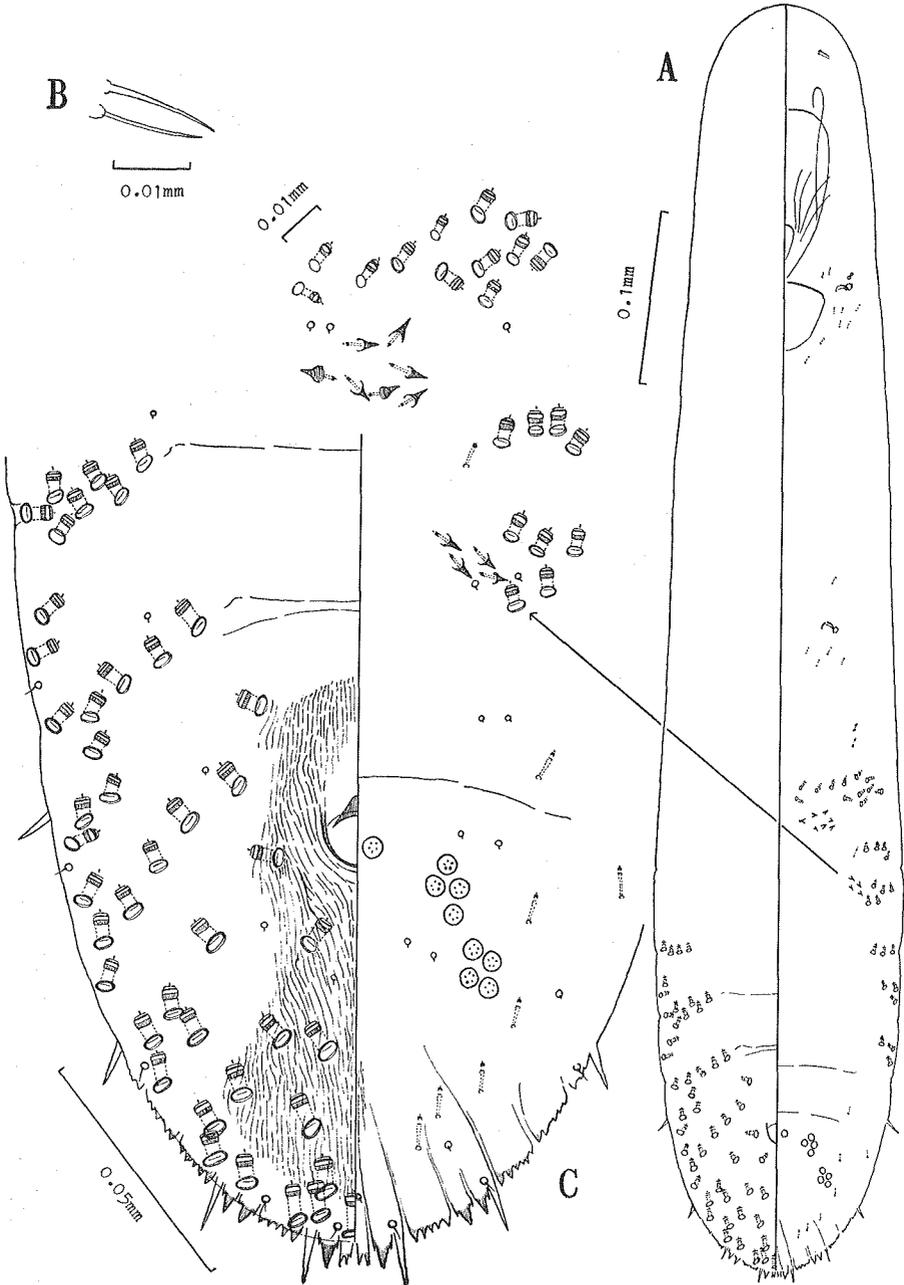


Fig. 85. *Kuwanaspis vermiformis* (Takah.). Adult female (A, body; B, antenna; C, pygidium).

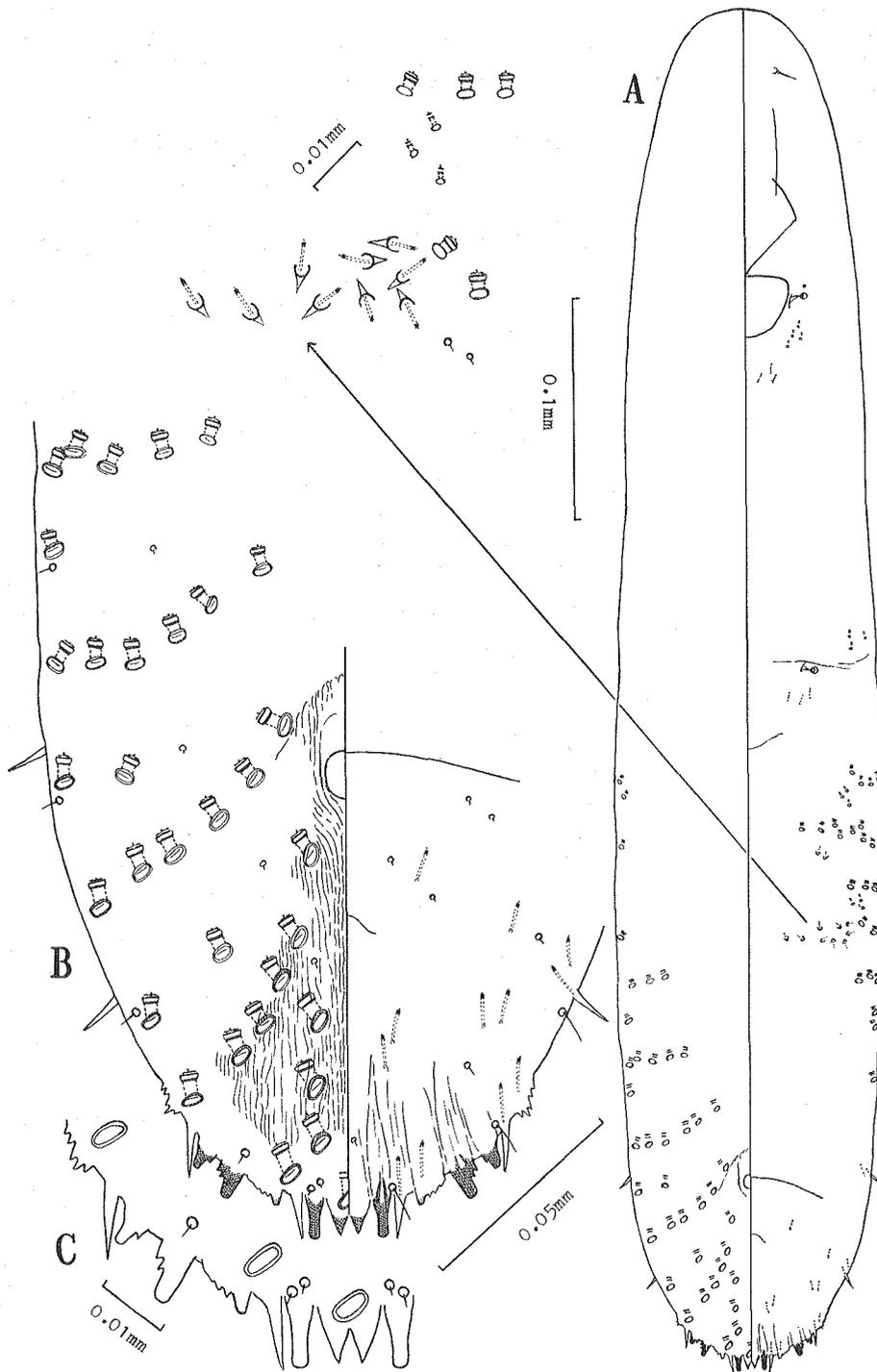


Fig. 86. *Kuwanaspis neolinearis* (Takah.). Adult female (A, body; B, pygidium; C, pygidial margin).

parallel, and with the pygidium narrow. Median lobes unilobed, the second bilobulate, all narrow, little or slightly narrowing towards the truncated or obtuse apex, at times notched subbasally on one or either side; second lobes with the outer lobule somewhat reduced in size. Four single marginal gland spines on each side of the pygidium. Gland cones in two clusters on each side towards the base of the abdomen as follows: two or three in one cluster, and seven to nine in the other cluster situated posteriorly. Plate-like marginal processes reduced, a pair between the median lobes conial and sclerotized, one between the median and second lobes more or less tubercular and irregularly toothed, and one much reduced or even obsolete laterally to the second lobe. Dorsal macroducts comparatively large; on the pygidium rather few and mostly in the segmental rows of the fifth to seventh abdominal segments; on the preceding three segments mostly arranged segmentally. Ventral macroducts scattered within the lateral margin towards the base of the abdomen and in the posterolateral corner of the metathorax. Antenna with a rather thickened seta. Anterior spiracle with a disc pore, both pairs of spiracles with microducts scattered posteriorly. Perivulvar pores absent.

Specimens examined. Yang-ming Shan, on an undetermined bamboo.

Distribution and host plants. This species was originally described from Taiwan as a feeder of bamboo, and later recorded by Takahashi from Singapore.

XLIV. Genus *Megacanthaspis* Takagi

References. Takagi 1961a: 97.

Type-species. *Megacanthaspis actinodaphnes* Takagi.

Diagnosis. Body elongate, with the lateral margins subparallel; segmentation indistinct. Derm membraneous except for the pygidium, which is more or less sclerotized dorsally in a narrow median band. Pygidium small, rounded along the free margin. Pygidial lobes absent. Short, broad, fimbriate, plate-like processes along the apical margin of the pygidium. Pygidial and some prepygidial segments each with a gland spine basically marginal in position; in the type-species this gland spine is a much thickened and conical process, through which two or more ducts are opened. Small gland cones on the thorax and the base of the abdomen. Dorsal macroducts rather scattered, or in the type-species tending to be arranged in segmental rows; marginal macroducts not particularly differentiated on the pygidium. Antenna with a seta. Anterior spiracle with disc pores, the posterior with none. Anal opening situated towards the base of the pygidium. Perivulvar pores in an almost continuous arch.

Composition and distribution. This genus was erected for the Japanese *actinodaphnes*. Another species collected in Japan is at hand. A new species is here described from Taiwan.

Remarks. In some characters this genus much resembles *Kuwanaspis*. The characters possessed in common by the two genera are: the concurrence of the marginal gland spines and the plate-like marginal processes on the pygidium; and the absence of differentiated marginal macroducts. The two are also identical in the first instar larvae by lacking sclerotized processes at the apex of the abdomen.

It is, however, not easy to put *Megacanthaspis* down for a close relative of *Kuwanaspis* on account of the absence of pygidial lobes in both of the adult and second instar females of the former. Another difficulty is found in that *Kuwanaspis* and its

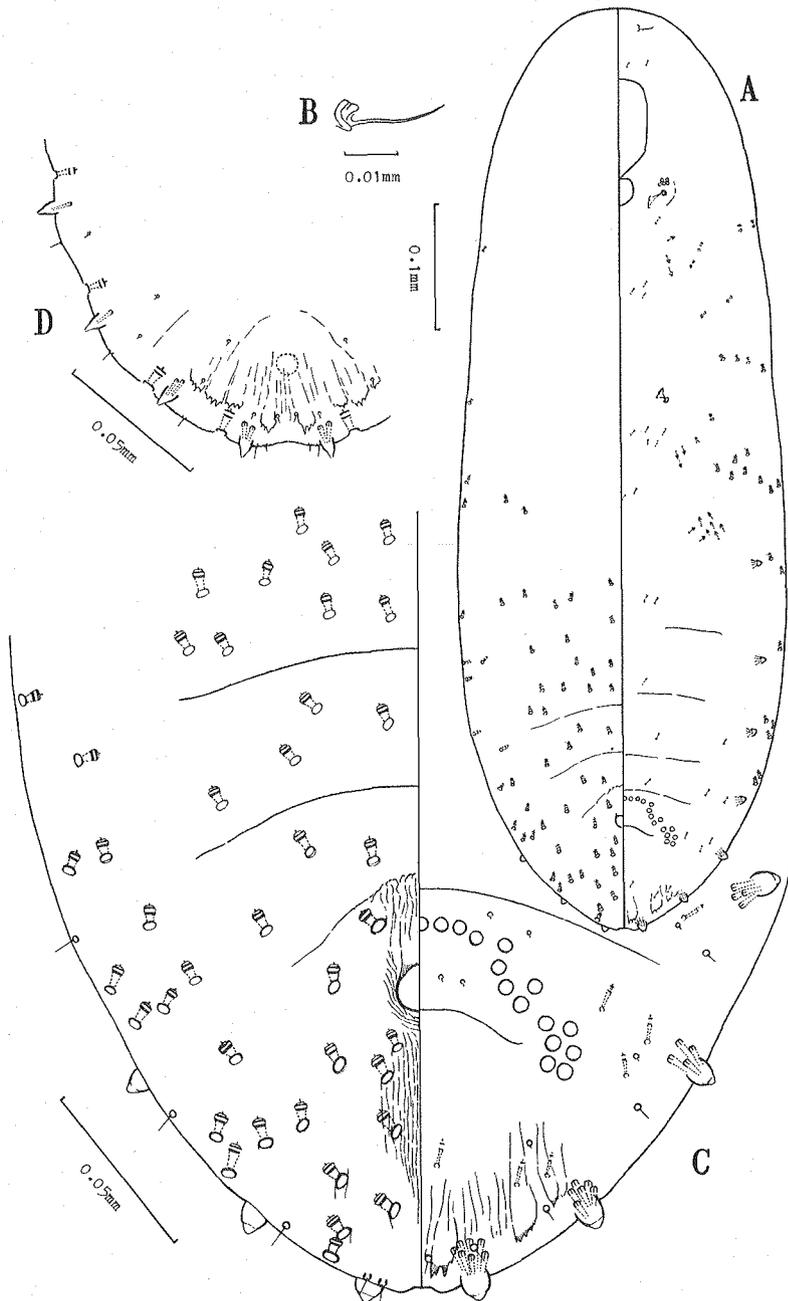


Fig. 87. *Megacanthaspis litseae*, n. sp. A-C, adult female (A, body; B, antenna; C, pygidium); D, pygidium of the exuvium of the second instar female.

supposed relatives (*Nikkoaspis*; *Unachionaspis*) are bamboo- or grass-feeders, whereas *Megacanthaspis* is associated with Lauraceous plants. It is expected that further discoveries of related forms will throw light on the taxonomic positions of these genera.

125. *Megacanthaspis litseae*, n. sp. [Fig. 87]

Diagnosis. Pygidium with three to five pairs of plate-like processes around the apical margin. Abdomen with seven pairs of thickened conical gland spines, the posteriormost gland spines are separated from each other by a space about twice as wide as one of them. Small gland cones: two to four and three to five posteriorly to the anterior and posterior spiracle, respectively, and seven to 10 in the submarginal region of the first abdominal segment. Dorsal macroducts rather numerous and almost scattered on the pygidium, and also on the prepygidial segments of the abdomen. Thoracic segments with some macroducts within the lateral margin. Anterior spiracle with two to 10 disc pores. Perivulvar pores: 27 to 36 in total. Scale narrow, quite highly convex dorsally, dark brown, and felted in appearance.

Specimens examined. Fen-chi-hu, on the leaves of *Litsea akoensis*.

Remarks. This species is close to *actinodaphnes*, from which it is distinguished mainly by having seven pairs of thickened conical marginal gland spines, of which the posteriormost are not appressed together.

Species not collected

As far as I have been able to notice, there remain at least 79 species of the Diaspididae described or recorded from Taiwan which have been not found in the collection. A list of these species follows in alphabetical order.

1. *Acanthomytilus imperatae* (Kuwana)

References. Kuwana 1931 b: 170 [*Lepidosaphes*]; Takagi 1960: 98.

Distribution and host plants. This species was originally described from specimens collected in Ryukyu (Amami-Ōshima) on *Imperata arundenacea*, and later recorded there on *Miscanthus*. It was recorded in Taiwan on *Imperata*.

2. *Acanthomytilus sacchari* (Hall)

References. Hall 1923: 23 [*Lepidosaphes*]; Balachowsky 1954 e: 108.

Distribution and host plants. This species was originally described from specimens collected in Egypt on sugar-cane, and later recorded from other localities of Africa on gramineous plants. Takahashi recorded it in Taiwan on *Miscanthus* and an undetermined grass.

Remarks. Judging from a brief note given by Takahashi (1931: 2), it seems that the form examined by him was rightly identified with the present species.

3. *Andaspis hawaiiensis* (Maskell)

References. Maskell 1895 b: 47 [*Mytilaspis flava* var.]; Ferris 1937: 4; Rao and Ferris 1952: 19; Balachowsky 1954 e: 132.

Synonyms. *Lepidosaphes moorsi* Doane and Ferris, 1916.

Distribution and host plants. This species is widely distributed in the tropics on various kinds of plants. It was recorded in Taiwan on *Pirus serotina*.

4. *Andaspis mori* Ferris

References. Rao and Ferris 1952: 21; Williams 1963 Brit. Mus. (Nat. Hist.) Ent. Bul. 15: 20.

Distribution and host plants. This species was originally described from China as a feeder

of *Morus australis*, and later recorded by Ferris at the type locality on *Broussonetia papyrifera*. Williams recorded it in Taiwan on *Sapindus* sp.

Remarks. This species is very close to *viticis*, which is proposed as a new species in this paper, and from which it is distinguished by rather trifling differences.

5. *Aonidia tentaculata* var. *formosana* Takahashi

References. Takahashi 1935: 35.

Distribution and host plants. This scale insect was originally described from specimens collected in Taiwan on *Cinnamomum* sp.

Remarks. It is not possible to determine the proper taxonomic position of this form on the basis of Takahashi's description.

6. *Aonidia (Greeniella) lahoarei* Takahashi

References. 1931 a: 219.

Distribution and host plants. This species was originally described from specimens collected in Taiwan on *Eugenia* sp.

Remarks. This species may be close to the species of *Greeniella* Cockerell (= *Decoraspis* Ferris), which is accepted by recent authors as a parlatorine genus.

7. *Aonidia rarasana* Takahashi

References. Takahashi 1934: 31.

Distribution and host plants. This species was originally described from specimens collected in Taiwan on an undetermined plant.

Remarks. This species is apparently not referable to *Aonidia*. It was erroneously referred to *Gymnaspis* by Borchsenius in his Catalogue of the Armoured Scale Insects (1966).

8. *Aonidiella comperei* McKenzie

References. McKenzie 1937: 327; *ibid.* 1938: 8; Balachowsky 1958 b: 223.

Distribution and host plants. This species was originally described from India as an orange-feeder, and later redescribed by Balachowsky from specimens collected in Tanganyika, the Antilles and Puerto Rico on *Anona muricata*, *Citrus* and coco palm. It was found on banana imported from Taiwan to Japan.

9. *Aonidiella messengeri* McKenzie

References. McKenzie 1953.

Distribution and host plants. This species was originally described from specimens collected in the Miyako Islands, Ryukyu, on *Calophyllum inophyllum* and in Taiwan on *Bladhia sieboldii*, and later recorded in Japan on *Daphniphyllum glaucescens* and *Phoenix roebelenii*.

10. *Aonidiella taxus* Leonardi

References. Leonardi 1906: 1; McKenzie 1938: 15; Ferris 1942: 425; Balachowsky 1948 b: 370.

Distribution and host plants. This species is known to occur at various localities of the world, feeding on coniferous plants such as *Taxus* and *Podocarpus*. Takahashi recorded it in Taiwan on *Podocarpus macrophyllus*.

11. *Aspidiotus chipponsanensis* Takahashi

References. Takahashi 1935: 33.

Distribution and host plants. This species was described from Taiwan as a feeder of *Rhododendron* sp.

Remarks. This species is not referable to *Aspidiotus*. It resembles some species of *Hemiberlesia*, but is quite peculiar by having prominent marginal setae on the pygidium.

12. *Aspidiotus phragmitis* Takahashi

References. Takahashi 1931 (Feb.): 4; Kuwana 1931 b (Apr.): 169 [*miscanthii*]; *ibid.* 1933: 14 [*mithcanthii* (sic)]; Takahashi 1933: 54; Takagi 1958: 121 [*Aspidiella*].

Synonyms. *Aspidiotus miscanthii* Kuwana, 1931, was synonymized with *phragmitis* by Takahashi (1933). Ferris (1955 c: 32) suggested *miscanthii* as a possible synonym of *Aspidiotus bilobis* Maskell, 1898 (= *Chortinaspis bilobis*).

Distribution and host plants. This species was originally described from specimens collected in Taiwan on *Phragmites* sp., and later recorded on *Thysanolaena maxima*. *Aspidiotus miscanthii*, which was synonymized with *phragmitis*, was described from Amami-Ōsima as a feeder of *Miscanthus* sp.

Remarks. I agree with Takahashi in his opinion that *miscanthii* is a synonym of *phragmitis*, but I have some doubt about Ferris' opinion that *miscanthii* is identical with *bilobis*, which is now a species of *Chortinaspis*. So far as my study goes on the basis of specimens collected in Amami-Ōsima, *phragmitis* may be better placed in *Aspidiella* rather than in *Chortinaspis*.

13. *Aulacaspis mangiferae* var. *aceris* Takahashi

References. Takahashi 1935: 12.

Distribution and host plants. This "variety" was described from specimens collected in Taiwan on *Acer insulare* (= *A. kawakamii*).

Remarks. This scale insect may have nothing to do with *mangiferae* (= *tubercularis*), since the latter occurs primarily on *Mangifera indica* and, so far as the literature goes, also on certain Lauraceous plants.

14. *Aulacaspis crawii* (Cockerell)

References. Cockerell 1898 b: 190 [*Diaspis*]; Kuwana 1926: 25; Scott 1952: 36.

Distribution and host plants. This species was originally described from specimens collected in California on *Elaeagnus umbellata* imported from China, and later recorded in China, Taiwan, Hawaii and Japan on diverse kinds of plants. In Taiwan it was recorded on *Hibiscus tiliaceus* and *Melia azedarach*.

15. *Aulacaspis madiunensis* (Zehntner)

References. Zehntner 1898 [*Chionaspis*]; Scott 1952: 38.

Distribution and host plants. This species was originally described from Java as a feeder of sugar-cane, and later recorded in Uganda, Taiwan, Australia and China on sugar-cane or other grasses. In Taiwan Takahashi recorded it on sugar-cane, *Oplismenus* and other grasses.

16. *Aulacaspis phoebicola* Takahashi

References. Takahashi 1936: 81.

Distribution and host plants. This species was originally described from specimens collected in Taiwan on *Phoebe formosana*.

17. *Aulacaspis rosae* (Bouché)

References. Bouché 1834 [*Aspidiotus*]; Balachowsky 1954 e: 242.

Distribution and host plants. This species is a well-known cosmopolitan, having been revised by many authors. It occurs mainly on *Rosa* and *Rubus*. There have been made records of the occurrence of this species on other plants, but some of them are quite in doubt.

18. *Aulacaspis tegalensis* (Zehntner)

References. Zehntner 1898 [*Chionaspis*]; Scott 1952: 40.

Distribution and host plants. This species was originally described from Java as a feeder of sugar-cane, and later recorded on the same host species from Taiwan, the Philippines, Mauritius and Reunion Island.

19. *Chionaspis annandalei*
References. Green 1919 c: 434.
Distribution and host plants. This species was originally described from specimens collected in India on *Dendrocalamus strictus*. Ferris recorded it in Taiwan on *Bambusa stenostachya*.
Remarks. Judging from Green's description, this species is not a true *Chionaspis*-species, but certainly referable to *Kuwanaspis*.
20. *Chionaspis atalantiae* Takahashi
References. Takahashi 1933: 44.
Distribution and host plants. This species was described from specimens collected in Taiwan on *Severinia buxifolia* (= *Atalantia bilocularis*).
Remarks. This species is not a member of *Chionaspis*. It may be referable to the *Fiorinia*-group composed of *Fiorinia*, *Pseudaulacaspis*, etc.
21. *Chionaspis bambusifoliae* Takahashi
References. Takahashi 1930: 14.
Distribution and host plants. This species was originally described from Taiwan as a bamboo-feeder.
Remarks. This species is referable to *Greenaspis*.
22. *Chionaspis brideliae* Takahashi
References. Takahashi 1933: 43.
Distribution and host plants. This species was described from specimens collected in Taiwan on *Bridelia*.
Remarks. This species may be a member of *Pseudaulacaspis*.
23. *Chionaspis graminicola* Takahashi
References. Takahashi 1934: 9.
Distribution and host plants. This species was originally described from specimens collected in Taiwan on a Gramineous plant.
Remarks. This species is undoubtedly referable to *Acanthomytilus*.
24. *Chionaspis vitis* Green
References. Green 1896: 3; Ferris 1955 d: 53 [*Phenacaspis*].
Distribution and host plants. This species is known to occur in Ceylon on *Vitis lanceolaria* and allied species of plants, and occasionally also on *Elaeagnus latifolia* and *Loranthus* sp. Further records include India, Java, Sumatra, Taiwan, Botel Tobago, and Japan. Takahashi recorded it in Taiwan and Botel Tobago on *Acalypha kotoensis*, *Elaeagnus glabra*, *E. macrophylla* (= *kotensis*), *E. thunbergii*, *Kandelia candel* (= *rheedii*) and *Mallotus philippinensis*.
25. *Chortinaspis bilobis* (Maskell)
References. Maskell 1898: 225 [*Aspidiotus*]; Ferris 1936: 9 [*Aspidiotus*]; *ibid.* 1946: 38.
Synonyms. Ferris (1955 c: 32) suggested *Aspidiotus miscanthii* Kuwana (= *phragmitis* Takahashi) as a possible synonym of *Chortinaspis bilobis*.
Distribution and host plants. This species was originally described from Hongkong as a feeder of undetermined grass and later recorded by Ferris from Continental China and Taiwan.
Remarks. I have some doubt about Ferris' opinion that *Chortinaspis bilobis* and *Aspidiotus miscanthii* are identical (see *Aspidiotus phragmitis*).
26. *Chrysomphalus dictyospermi* (Morgan)
References. Morgan 1889 a: 352 [*Aspidiotus*]; Ferris 1938 a: 200; McKenzie 1939: 57; Balachowsky 1948 b: 351; *ibid.* 1956: 86.

Synonyms. The followings were synonymized with the present species by authors: *Aspidiotus mangiferae* Cockerell, 1893; *Aspidiotus dictyospermi* var. *jamaicensis* Cockerell, 1894; *Chrysomphalus minor* Berlese and Leonardi, 1896; *Aspidiotus agrumicola* Gregorio, 1915; and *Chrysomphalus castigatus* Mamet, 1936.

Distribution and host plants. This species occurs afield widely in the tropics and other warm parts of the world and indoors in the cooler parts, feeding on palms and many other diverse plants. In Taiwan it was recorded by Takahashi on *Citrus* spp., *Cycas revoluta*, *Mangifera indica* and *Pinus thumbergii*.

27. *Chrysomphalus tabayanus* (Cockerell)

References. Cockerell 1905 f: 133 [*Aspidiotus*]; Takahashi 1933: 56.

Distribution and host plants. This species was originally described from specimens collected in the Philippines on *Gardenia* or *Jasminum*. Takahashi recorded it from Taiwan as a feeder of *Pyracantha koidzumii*.

Remarks. Robinson (1917: 32) states that this species is by no means a typical *Aspidiotus*. Takahashi referred it to *Chrysomphalus*, giving illustration. On the basis of his illustration it was assumed by Takagi and Kawai (1966, *Insecta Matsumurana* 28: 115) as belonging possibly to their genus *Clavaspidiotus*.

28. *Coccomytilus dispar* (Vayssière)

References. Vayssière 1913 a: 124 [*Mytilaspis* (*Coccomytilus*)].

Distribution and host plants. This species was originally described from Madagascar as a feeder of Manihot, and later recorded in Taiwan and Hongkong on the same plant species. This species is synonymized with *Aonidomytilus albus* (Cockerell) by recent authors.

29. *Diaspis boisduvalii* Signoret

References. Signoret 1896 a: 432; Ferris 1937: 32; Balachowsky 1954 e: 178.

Distribution and host plants. This species is widely distributed in the tropics and subtropics and is a common pest in greenhouses in the temperate region, feeding on various kinds of plants. Takahashi recorded it in Taiwan on *Rhynchosstylis retusa*.

30. *Diaspis machilicola* var. *cinnamomicola* Takahashi

References. Takahashi 1935: 15.

Distribution and host plants. This "variety" was originally described from specimens collected in Taiwan on *Beilschmiedia erythrophloia* (= *Cinnamomum erythrophloia*).

Remarks. It is not possible to make a definite identification of this form on the basis of the original description (see: p. 80).

31. *Diaspis machilicola* Takahashi

References. Takahashi 1935: 13.

Distribution and host plants. This species was described from specimens collected in Taiwan on *Machilus* sp.

Remarks. This species is not a member of *Diaspis*. It may be tentatively referred to *Chionaspis*.

32. *Diaspis manii* (Green)

References. Green 1907, Pusa Mem. Dept. Agr. Ent. Ser. 1: 344 [*Chionaspis*]; Takahashi 1931 a: 211 [*Diaspis gordoniae*].

Synonyms. *Diaspis gordoniae* Takahashi, 1931 (after Takahashi 1934: 6).

Distribution and host plants. This species was originally described from specimens collected in India on tea plant and *Solanum melongena*. Takahashi recorded it ("*Phenacaspis manii*") in Taiwan on *Diospyros discolor*. After him *Diaspis gordoniae*, which was originally described from

Taiwan as a feeder of *Gordonia axillaris*, is identical with *manii*, and *Lithocarpus* sp. is a further host plant of this species.

Remarks. Judging from the description of *gordoniae*, this species seems to be a member of *Pseudaulacaspis*.

33. *Dinaspis taiwana* Takahashi

References. Takahashi 1936 b: 427.

Distribution and host plants. This species was described from Taiwan as a gall-maker of *Actinodaphne pedicellata*.

Remarks. This species may be not a true member of *Dinaspis*, which is originally of the New World.

34. *Duptylacionaspis stanotophri* (Cooley)

References. Cooley 1899: 35 [*Chionaspis*]; Balachowsky 1954 e: 395.

Synonyms. *Chionaspis graminis* var. *aegyptiaca* Hall, 1923.

Distribution and host plants. This species was originally described from specimens collected in South Africa on *Stanotophrum glabrum*. Further records were made in Africa, Iran and Madagascar on Gramineous plants. Takahashi recorded it in Taiwan on *Phragmites* and an undetermined Gramineous plant.

35. *Fiorinia vaccini* var. *hisakakii* Takahashi

References. Takahashi 1936 d: 7.

Distribution and host plants. This "variety" was described from Taiwan as a feeder of *Eurya* sp.

36. *Fiorinia horii* Kuwana

References. Kuwana 1927 b.

Distribution and host plants. This species was originally described from specimens collected in Japan on *Rhododendron*. Takahashi recorded it in Taiwan on *Rhododendron lasiostylum* (= *sasakii*).

37. *Fiorinia proboscilaria* var. *randiae* Takahashi

References. Takahashi 1934: 20.

Distribution and host plants. This "variety" was originally described from specimens collected in Taiwan on *Randia canthioides*.

38. *Fiorinia rhododendri* Takahashi

References. Takahashi 1935: 27.

Distribution and host plants. This species was described from Taiwan as a feeder of *Rhododendron*.

39. *Fiorinia smilaceti* Takahashi

References. Takahashi 1931 a: 218.

Distribution and host plants. This species was originally described from specimens collected in Taiwan on *Smilax* sp., and later recorded also on *Lindera communis*.

40. *Fiorinia turpiniae* Takahashi

References. Takahashi 1934: 21 [*theae* var.]; Ferris 1950 a: 78.

Distribution and host plants. This species was originally described from Taiwan as a feeder of *Turpinia formosana*. Ferris redescribed it on the basis of specimens collected in China on *Citrus*.

41. *Formosaspis formosana* (Takahashi)

References. Takahashi 1931: 2 [*Leucaspis*].

Distribution and host plants. This species was originally described from Taiwan as a bamboo-feeder, and later recorded from Hongkong.

42. ***Formosaspis takahashii*** (Lindinger)

References. Takahashi 1930: 25 [*Protodiaspis nigra*]; Ferris 1952 a: 7 [*nigra*].

Synonyms. *Protodiaspis nigra* Takahashi, 1930.

Distribution and host plants. This species was originally described from Taiwan as a bamboo-feeder, and later recorded by Ferris in China on *Arundinaria*.

Remarks. Lindinger (1932 f: 186) transferred *Protodiaspis nigra* Takahashi (nec *Crypthemichionaspis nigra* Lindinger) to *Crypthemichionaspis* Lindinger and gave it the new name *takahashii*. Acting upon the International Code of Zoological Nomenclature, Article 59 (c), the name *takahashii* should be used.

43. ***Kuwanaspis arundinariae*** Takahashi

References. Takahashi 1938: 42.

Distribution and host plants. This species was collected on *Arundinaria* sp. in the mountainous region of Taiwan.

Remarks. This species may possibly be a member of *Nikkoaspis*.

44. ***Kuwanaspis bambusifoliae*** (Takahashi)

References. Takahashi 1934: 11 [*Tsukushiaspis*].

Distribution and host plants. This species was originally described from specimens collected in Taiwan on "*Bambusa*" sp.

45. ***Kuwanaspis elongata*** (Takahashi)

References. Takahashi 1930: 18 [*Tsukushiaspis*].

Distribution and host plants. This species was originally described from specimens collected in Taiwan on "*Bambusa*" sp.

46. ***Kuwanaspis formosana*** (Takahashi)

References. Takahashi 1930: 23 [*Tsukushiaspis*].

Distribution and host plants. This species was originally described from specimens collected in Taiwan on "*Bambusa*" sp.

47. ***Kuwanaspis hichiseisana*** (Takahashi)

References. Takahashi 1934: 12 [*Tsukushiaspis*].

Distribution and host plants. This species was originally described from specimens collected in Taiwan, on a level of 1,100 meters, on "*Bambusa*" sp.

Remarks. This species is a member of *Nikkoaspis*.

48. ***Kuwanaspis phragmitis*** (Takahashi)

References. Takahashi 1931: 216 [*Tsukushiaspis*].

Distribution and host plants. This species was originally described from specimens collected in Taiwan on *Phragmites* sp., and later recorded on *Arundo formosana*.

49. ***Lepidosaphes ficicola*** Takahashi

References. Takahashi 1931 b: 378.

Distribution and host plants. This species was originally described from Taiwan as a feeder of *Ficus nervosa*.

Remarks. This species is not a member of *Lepidosaphes*, but referable to *Ungulaspis* MacGillivray, of which the type-species is the Javanese *Lepidosaphes ungulata* Green.

50. *Lepidosaphes garambiensis* Takahashi
References. Takahashi 1933: 47.
Distribution and host plants. This species was originally described from specimens collected in Taiwan on an undetermined plant.
51. *Lepidosaphes glaucae* Takahashi
References. Takahashi 1932: 47; Takagi 1960: 88.
Distribution and host plants. This species was originally described from specimens collected on *Quercus glauca* in Taiwan, and later redescribed from specimens collected on the same plant species in Japan.
52. *Lepidosaphes lithocarp*i Takahashi
References. Takahashi 1934: 18.
Distribution and host plants. This species was originally described from specimens collected on *Lithocarpus* spp. in Taiwan.
53. *Lepidosaphes pallida* (Green)
References. Green 1896: 5 [*Mytilaspis*]; ibid. 1896 e: 85 [*Mytilaspis gloverii* var.]; Williams 1960 c: 395 [comparison with *L. tapleyi* Williams].
Distribution and host plants. This species was originally described from specimens collected in Ceylon on undetermined plants. Later, it was recorded from various localities of eastern Asia, but these records are mostly open to doubt. Takahashi recorded it in Taiwan on *Kandelia candel* (= *rheedii*) and *Scolopia oldhamii*.
54. *Lepidosaphes pini* (Maskell)
References. Maskell 1897 a: 242 [*Poliaspis*]; Kuwana 1925: 1 [*Poliaspis*].
Distribution and host plants. This species occurs commonly in Japan on the needles of *Pinus*. It was recorded also from Korea. Takahashi recorded it in Taiwan on *Pinus thunbergii*.
55. *Lepidosaphes takaoensis* Takahashi
References. Takahashi 1935: 23.
Distribution and host plants. This species was originally described from specimens collected in Taiwan on *Celtis sinensis*, and later recorded on *Codiaeum variegatum*.
56. *Lepidosaphes tubulorum* Ferris
References. Ferris 1921 a: 216; ibid. 1953: 61.
Distribution and host plants. This species was originally described from specimens collected in Taiwan on *Sapium sebiferum* and *Salix glandulosa* var. *warburgi* and in Japan on *Ilex crenata*, willow and currant. Ferris recorded it in China on *Salix* sp. and *Hedwigia japonica*. It was recorded in Japan on a long list of plants, but these records may partly be open to criticism. In Taiwan, *Erythrina* sp., *Melia azedarach*, etc. were also recorded as its hosts.
57. *Lepidosaphes yamahoi* Takahashi
References. Takahashi 1935: 26 [*cycadicola* var.].
Distribution and host plants. This species was originally described from specimens collected in Taiwan on an undetermined plant.
58. *Leucaspis hydrangeae* (Takahashi)
References. Takahashi 1934: 15 [*Leucodiaspis*].
Distribution and host plants. This species was originally described from specimens collected in Taiwan on *Hydrangea integrifolia* (= *integra*) and *H.* sp. Later, Takahashi recorded it in Taiwan on *Liquidambar formosana* and Bodenheimer in Turkey on *Citrus aurantium*.
Remarks. This species is referable to *Lopholeucaspis*. Balachowsky (1953 g: 881) assumed

that it is identical with *Lopholeucaspis japonica*. Judging from the original description and illustrations, however, it should be not united with *japonica* on account of the fewer dorsal ducts on the pygidium and the presence of gland tubercles on the base of the pygidium. The record of this species in Turkey made by Bodenheimer may, as stated by Balachowsky (l. c.), be erroneous, since Bodenheimer's illustration seemingly agrees with *japonica*.

59. *Leucaspis vitis* (Takahashi)

References. Takahashi 1935: 19 [*Leucodiaspis*].

Distribution and host plants. This species was described from Taiwan as a feeder of *Vitis* sp.

Remarks. This species is not a true member of *Leucaspis*.

60. *Lindingaspis rossi* (Maskell)

References. Maskell 1891: 3 [*Aspidiotus*]; Ferris 1938 a: 246; McKenzie 1950: 104; Balachowsky 1951: 590; *ibid.* 1958 b: 180.

Synonyms. Williams suppressed *Aonidiella subrossi* Laing, 1929, as a synonym of the present species.

Distribution and host plants. This species occurs widely in the tropics and subtropics, feeding on various kinds of plants. In Taiwan it was recorded by Takahashi from the following plants: *Bryophyllum calycinum*, *Calophyllum inophyllum*, *Cocos nucifera*, *Diospyros eriantha*, *Ficus pumila*, *Kandelia candel* (= *rheedii*), *Mangifera indica*, *Pyracantha koidzumii*, *Scolopia oldhamii* and *Vitis* sp.

61. *Melanaspis smilacis* (Comstock)

References. Comstock 1883: 69 [*Aspidiotus*]; Ferris 1941 d: 336; Balachowsky 1958 b: 202.

Synonyms. *Aspidiotus* (*Targionia*) *marlatti* Parrot, 1899; *Aonidiella bromiliae* Leonardi, 1899; *Pseudischnaspis anassarum* Lindinger, 1932; *Aspidiotus* (*Aonidiella*) *multiclavatus* Green and Laing, 1923.

Distribution and host plants. This species has been recorded widely in the tropics and subtropics on diverse kinds of plants including even grasses and bamboos. It was recorded by Takahashi, under the name *Pseudischnaspis anassarum*, in Taiwan on *Ananas comosus*.

62. *Neoparlatoria formosana* Takahashi

References. Takahashi 1931 b: 382.

Distribution and host plants. This species was described from Taiwan as a feeder of *Quercus glauca*, and later recorded on *Lithocarpus* spp. It was recorded in Japan on *Quercus acuta* and other oaks.

63. *Neoparlatoria lithocarpi* Takahashi

References. Takahashi 1934: 28.

Distribution and host plants. This species was described from Taiwan as a feeder of *Pasania uraiana* (= *Lithocarpus uraiana*).

64. *Neoparlatoria lithocarpicola* Takahashi

References. Takahashi 1934: 30.

Distribution and host plants. This species was originally described from specimens collected in Taiwan on *Pasania uraiana* (= *Lithocarpus uraiana*) and *Castanopsis* sp.

65. *Odonaspis secreta* (Cockerell)

References. Cockerell 1896 h: 20 [*Aspidiotus*]; Ferris 1938 a: 166; Balachowsky 1953 g: 733.

Synonyms. Balachowsky suppressed *Odonaspis secreta* var. *Greeni* Cockerell, 1902, which was once raised to specific rank, as a synonym.

Distribution and host plants. This species was originally described from Japan as a bamboo-feeder, and later recorded from various localities of the world including Ceylon, Samoa, North America, France, Algeria, etc. Takahashi recorded it in Taiwan on *Bambusa stenostachya* and *Miscanthus* sp.

66. *Parlatoria crotonis* Douglas

References. Douglas 1887: 242 [*proteus* var.]; Morrison 1939 a: 12; Ferris 1942: 401; McKenzie 1945: 61; Balachowsky 1953 g: 800; ibid. 1958 b: 326.

Synonyms. *Parlatoria greeni* Banks, 1906.

Distribution and host plants. This species is widely distributed in the tropics and is also found in greenhouses in the temperate region, feeding on *Croton* and *Codiaeum* and sometimes also on other various plants. Takahashi recorded it in Taiwan on *Dendrobium moschatum*, *Illium philippinense* (= *randaiense*), etc.

67. *Parlatoria lithocarpus* Takahashi

References. Takahashi 1935: 29.

Distribution and host plants. This species was originally described from Taiwan as a feeder of *Lithocarpus* sp.

Remarks. It is open to doubt that this species is a real member of *Parlatoria* on account of the peculiar shape of the second instar exuvium of the female and some characters of the pygidium of the adult female.

68. *Parlatoria mytilaspiiformis* Green

References. Green 1899 a: 164; McKenzie 1945: 69.

Distribution and host plants. This species was originally described from Ceylon as a feeder of *Psychotria thwaitesii*. Later, Green recorded tea plant as a host of this species in Ceylon. After McKenzie it was also recorded in Hawaii on *Codiaeum* sp. Takahashi recorded it in Taiwan on *Camellia*.

69. *Parlatoria pergandii* Comstock

References. Comstock 1881 a: 327; Ferris 1937: 88 [*pergandei*]; Morrison 1939 a: 18; McKenzie 1945: 70; Balachowsky 1953 g: 816; ibid. 1958 b: 330.

Synonyms. *Parlatoria sinensis* Maskell, 1897.

Distribution and host plants. This species is widely distributed in the tropics and subtropics, feeding on *Citrus* and many other plants. Takahashi recorded it in Taiwan on the following plants: *Citrus* spp., *Cymbidium sinense*, *Eurya* sp., *Ficus foveolata*, *F. retusa*, *Osmanthus fragrans*, *Pandanus tectorius*, *Scolopia oldhamii*, and *Camellia japonica*.

70. *Parlatoria virescens* Maskell

References. Maskell 1897: 300 [*proteus* var.]; McKenzie 1945: 75.

Distribution and host plants. This species was recorded in China (Amoy; Macao; Hongkong) on *Myrtus*, *Camellia* and *Pyrus sinensis*, in Japan on rose, and in Taiwan on a liliaceous plant.

Remarks. After McKenzie (1960 b) Maskell's collection of *virescens* includes in reality two distinct species: one of them is nothing else than *camelliae* Comstock, which Maskell mentions in his original description of *virescens*, and the other is identical with authors' *virescens*, for which a new species, *desolator* McKenzie, is proposed. The authentic records of *desolator* includes New Zealand, Amoy and Hongkong. It is not possible for me to know whether Maskell's record of "*virescens*" from Taiwan refers to *camelliae* or *desolator*.

71. *Phenacaspis formosana* Takahashi

References. Takahashi 1934: 7.

Distribution and host plants. This species was described from Taiwan as a feeder of *Wik-*

stroemia sp.

Remarks. This species may be a member of *Chionaspis*.

72. *Phenacaspis rotunda* Takahashi

References. Takahashi 1935: 16.

Distribution and host plants. This species was described from Taiwan as a feeder of *Quercus pseudomyrsinaefolia*.

Remarks. This species appears to be close to *Chionaspis schizosoma* and *C. trochodendri*.

73. *Phenacaspis taiwana* Takahashi

References. Takahashi 1935: 17.

Distribution and host plants. This species was described from Taiwan as an oak-feeder.

Remarks. This species may be referable to *Pseudaulacaspis*.

74. *Pinnaspis lithocarpi* Takahashi

References. Takahashi 1931a: 214.

Distribution and host plants. This species was originally described from Taiwan as a feeder of *Lithocarpus* sp.

Remarks. This species is not a genuine member of *Pinnaspis*.

75. *Pinnaspis theae* (Maskell)

References. Maskell 1891a: 60 [*Chionaspis*]; Ferris and Rao 1947: 41.

Synonyms. *Chionaspis separata* Green, 1900.

Distribution and host plants. This species occurs in India on tea plant, *Symplocos theaefolia* and *Cylogena elata*. Takahashi recorded it in Taiwan on tea plant and camellia.

76. *Pseudaonidia duplex* (Cockerell)

References. Cockerell 1896h: 20 [*Aspidiotus*]; Ferris 1938a: 253; Balachowsky 1951: 681.

Synonyms. *Aspidiotus theae* Maskell, 1891 (nec Green, 1890); *Aspidiotus theae* var. *rhododendri* Green, 1900; *Pseudaonidia rhododendri thearum* Cockerell, 1902.

Distribution and host plants. This species was originally described from Japan and later recorded in many countries on various kinds of plants. Takahashi recorded it in Taiwan on *Cinnamomum camphor*, *Michelia fuscata* and *Camellia sinensis*.

77. *Pseudaulacaspis kuwanai* (Takahashi)

References. Kuwana 1931a: 6 [*Phenacaspis quercus*]; Ferris 1955d: 50 and 51 [*Phenacaspis kuwanai*; *Phenacaspis saitamaensis*]; Takagi 1961: 29 [*Phenacaspis*].

Synonyms. *Phenacaspis quercus* Kuwana, 1931 (nec *Chionaspis quercus* Comstock, 1881).

Distribution and host plants. This species was originally described from Japan as a feeder of *Quercus myrsinaefolia* and later recorded also on *Castanea crenata*, *Quercus serrata*, etc. Ferris recorded it in Taiwan on an undetermined tree.

Remarks. This species was once removed to *Chionaspis* and the new name *kuwanai* was proposed by Takahashi (1953: 50).

78. *Pseudaulacaspis major* (Cockerell)

References. Cockerell 1894a [*Chionaspis*]; Mamet 1941: 30; Zimmermann 1948: 381 [illustration].

Synonyms. *Diaspis euphoriae* de Charmoy, 1899, was synonymized with *major* by Mamet, and *Aulacaspis flacourti* Rutherford, 1914, by Morrison; *Pseudaulacaspis hwangyensis* Chen, 1937, may possibly be identical with *major*.

Distribution and host plants. This species was originally described from Antigua, West Indies, as a feeder of Heliotrope. Further records of this species include scattered localities in the

tropics and various kinds of host plants. Takahashi recorded this species in Taiwan on *Ficus beecheyana* and *Scolopia oldhamii* (= *crenata*).

79. *Unaspis turpiniae* Takahashi

References. Takahashi 1934: 10 [*acuminata* var.]; *ibid.* 1956 a: 58.

Distribution and host plants. This species was originally described from Taiwan as a feeder of *Turpinia formosana*. Later, it was recorded from Japan as a feeder of *Turpinia ternata*.

New nomenclatorial changes made in the present work

Part I

Maniaspis Borchsenius is included within *Leucaspis* Targioni (p. 25).

Parlatoareopsis octolobatus Takagi and Kawai and *Parlatoareopsis sexlobatus* Takagi and Kawai are members of *Parlatoria* Targioni (40).

Rugaspidiotus heimi Balachowsky is transferred to *Smilacicola* Takagi (55).

Aspidiotus shakunagi Takahashi is transferred to *Taiwanaspidiotus* Takagi (72).

Hemiberlesia Cockerell, *Diaspidiotus* Leonardi, *Quadraspidiotus* MacGillivray and *Abgrallaspis* Balachowsky, in the sense adopted by recent authors, are united into a single genus, for which the name *Hemiberlesia* is tentatively kept as valid (76).

Aspidiotus machili Takahashi is transferred to *Metaspidiotus* Takagi (92).

Part II

Lepidosaphes bladhaie Takahashi is synonymized with *Lepidosaphes laterochitina* Green (14).

Raoaspis Borchsenius, *Pararaoaspis* Borchsenius and *Roonwalaspis* Borchsenius are included within *Andaspis* MacGillivray (20).

Takahashiella Borchsenius is included within *Acanthomytilus* Borchsenius (24).

Duplachionaspis miscantheae Kuwana (= *Chionaspis miscantheae* Kuwana) is synonymized with *Duplachionaspis divergens* Green (= *Chionaspis graminis* var. *divergens* Green) (39).

Euvoraspis Mamet is included within *Pseudaulacaspis* MacGillivray (41).

Chionaspis syringae Borchsenius, *Chionaspis hattorii* Kanda, *Pseudaulacaspis biformis* Takagi and *Phenacaspis ferrisi* Mamet are synonymized with *Pseudaulacaspis cockerelli* Cooley (= *Chionaspis cockerelli* Cooley) (43).

Phenacaspis takahashii Ferris is a species of *Pseudaulacaspis* MacGillivray (50).

Diaspis machili Takahashi is tentatively referred to *Chionaspis* Signoret (72).

Phenacaspis obovata Takagi and Kawai is synonymized with *Chionaspis machili* Takahashi (= *Diaspis machili* Takahashi) (72).

Phenacaspis trochodendri Takahashi is referred to *Chionaspis* Signoret (74).

Greenaspis yunnanensis Ferris is synonymized with *Greenaspis elongata* Green (81).

Adiscofiorinia ficicola Takahashi is transferred to *Ichthyaspis* Takagi (120).

Deposition of the specimens

The mounted specimens studied in the present work are deposited in the National Science Museum, Tokyo or in the Entomological Institute, Hokkaido University, Sapporo.

Postscript

The fauna of Taiwan comprises now more than 200 species of the family Diaspididae recorded to occur. Some of them are assumed to have been introduced by human activities, whereas in my estimation at least three-fourths of them are definitely native to the island. This region was under tireless efforts of the late Dr. R. Takahashi until he removed to Malaya in 1941. It was therefore a considerable surprise to learn that about one third of the species found in the present collection are acceptable as new to science. The number of these new forms becomes more remarkable when one takes into the account the short time and limited localities available for collecting. This is sufficient to illustrate an inestimable richness of the Taiwanese fauna, necessarily striking one how enormous labours must be done until one can believe to have appreciated the whole composition of the Coccoidea of an island of 35,964 sq. km.

Such richness of the Coccoidea fauna may, however, be a common property of all the warm, well-wooded parts of Asia. There is undoubtedly much to be done in the eastern side of Asian Continent. As to the Indonesian islands, which largely remain *terrae incognitae*, it is beyond all imagination how large an amount of effort is needed before the Coccoidea fauna of this region can be regarded as even roughly explored.

So this work presents nothing more than a short step towards the unbounded horizon of the study of the Coccoidea in eastern Asia.

Corrigendum & errata in Part I

P. 26, line 9 from top. It is incorrectly stated that *Maniaspis* was erected for "two Indian species". The type-species, *Maniapis manii*, is surely an Indian insect, but the other species, *gigas*, was originally described from New Zealand and later recorded from Afganistan.

P. 5, line 17 from bottom, for "scond" read "second"; p. 6, line 4 from bottom, for "intar" read "instar"; p. 14, line 6 from bottom, for "ramarkable" read "remarkable"; p. 31, bottom, for "1968" read "1868"; p. 108, top, for "*Tysanaspis*" read "*Thysanaspis*".

P. 83, line 18 from bottom, remove parentheses from "(McKenzie)"; put the following author names between parentheses: p. 22, line 18 from top, "Comst."; p. 23 line 13 from top, "Cockll."; p. 24, line 18 from top, "Gr."; p. 24, line 8 from bottom, "Kuw."; p. 24, line 4 from bottom, "Takah."; p. 31, line 19 from top, "Cockerell"; p. 36, line 22 from bottom, "Lucas"; p. 78, line 4 from bottom, "Signoret".