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A CONTRIBUTION TO THE KNOWLEDGE OF THE DIASPIDINI OF JAPAN (HOMOPTERA: COCCOIDEA)

Part I

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Since Dr. I. Kuwana wrote 'The Diaspine Coccidae of Japan,' our knowledge on this insect group has remarkably advanced. The main plan of the present paper is to arrange the members of the tribe Diaspidini occurring in Japan according to the recent taxonomic knowledge. The term 'Japan' is interpreted to include Hokkaido, Honsyu, Sikoku, and Kyusyu with their neighbouring islets and also the Amami Islands. Greenhouse species are excluded from the present work. It is hoped that this paper may prepare a ground for further studies.

The terminology adopted in this paper is substantially the same as that used by recent workers. The term 'prosoma' is used for the part of body which is composed of the fused head, prothorax, and mesothorax, and the term 'postsoma' for the metathorax and abdomen united. The references and synonymies mentioned are strictly selected and given under each genus or species; the dates in parentheses before 1956 refer to Morrison and Renk: A Selected Bibliography of the Coccoidea (United States Department of Agriculture, Agricultural Research Service, Miscellaneous Publication No. 734, 1957). The localities and host plants of the examined specimens are given under the heading L. & H.; unless otherwise stated the specimens were collected by me. Most of the type specimens designated in this work are deposited in the collection of the Entomological Institute of Hokkaido University at Sapporo.

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FAUNAL NOTES

So far as recognized in this work the tribe Diaspidini is represented in Japan by twenty-five genera, which, in the faunal view, may be divided into the following three groups.

1. Genera which are generally accepted as originally Oriental. In this group fall *Parlatoria*, *Andaspis*, *Unaspis*, *Greenaspis*, *Phenacaspis*, *Fiorinia*, *Pinnaspis*, and *Aulacaspis*. These genera have their members centred distinctly in the Oriental region. Also the following genera can be included in this group: *Neoparlatoria*, *Microparlatoria*, *Lopholeucaspis*, *Kuwanaspis*, *Nikkoaspis*, *Miscanthaspis* (gen. nov.), *Pseudaulacaspis*, and *Thysanaspis*. They are represented in Japan by one or a few species respectively and occur also in south-eastern Asia, but are unknown from any other part of the world unless introduced thereto. The genus *Cryptoparlatorea* is extremely close to *Neoparlatoria*, which is represented in Formosa and Japan; it is included here, although its real composition is unknown.

2. Genera of which the known species are widely scattered mainly in the Old World except for the Ethiopian region. In this group are included *Parlatoreopsis*, *Lepidosaphes*, *Acanthomytilus*, *Pallulaspis*, and *Duplachionaspis*. Of *Lepidosaphes* a few species are known only from North America, but numerous ones are originally of the Old World. One species of *Pallulaspis* occurs in California, but two others are now known from the Palaearctic region. Four American species have been referred to *Duplachionaspis*, but it is open to doubt that these species are real members of the genus.

3. Genera which are at present known only from Japan. In this group are placed *Unachionaspis*, *Takahashiaspis* (gen. nov.), and *Megacanthaspis* (gen. nov.). The first genus is, as at present understood, related to *Kuwanaspis* and *Nikkoaspis* and may belong to the Oriental stock. The genus *Takahashiaspis* resembles certain Palaearctic or Ethiopian genera, but is a very distinct one as well. *Megacanthaspis* is a peculiar genus of unknown affinities.

The diaspidine fauna of Japan is, unquestionably, closely related to that of south-eastern Asia, and there can be found no genus which suggests any particular relation to the New World or to the Ethiopian region. In conclusion, roughly speaking, the Japanese fauna is mainly composed of many Oriental genera mingled with a few ones which are of the Old World or may be said to be pre-eminently Palaearctic.

CLASSIFICATION

Tribus **Diaspidini** Ferris

The tribe Diaspidini of the family Diaspididae is here understood in the conception proposed by Prof. G. F. Ferris. It is represented in Japan by twenty-five genera, and the bulk of these can be divided into three groups.

Parlatoria group (Parlatorini Balachowsky). In this group are included *Parlatoria*, *Cryptoparlatores*, *Neoparlatoria*, *Microparlatoria*, *Parlatoreopsis*, and *Lopholeucaspis*.

Lepidosaphes group (Lepidosaphedina Balachowsky, 'Premier groupe'). In this group fall *Lepidosaphes*, *Andaspis*, *Acanthomytilus*, and *Pallulaspis*.

Phenacaspis group (Diaspidina Balachowsky). In this group are placed *Kurvanaspis*, *Nikkoaspis*, *Unachionaspis*, *Unaspis*, *Duplachionaspis*, *Greenaspis*, *Phenacaspis*, *Fiorinia*, *Miscanthaspis* (gen. nov.), *Pinnaspis*, *Aulacaspis*, *Pseudaulacaspis*, and *Takahashiaspis* (gen. nov.).

Isolated genera. *Thysanaspis* and *Megacanthaspis* (gen. nov.).

Parlatoria group

The most important characteristic of this group is that the pygidial lobes are all without any trace of division into two lobules. In this respect it resembles the Aspidiotini, from which it differs, however, by having two-barred ducts.

It has been possible to see the first stage larvae, mostly through the female exuvia, of the Japanese species except *Parlatoria piceae* and *Neoparlatoria formosana*. Through all the examined species the antennae are five-segmented, the terminal segment being elongate and distinctly annulate, and there are on the head no enlarged dorsal ducts. In the examined species of *Parlatoria* there is at the posterior extremity just laterad of the apical setae a pair of well-sclerotized lobes, which may be homologous with the median lobes of the adult female. These lobes are not divided into lobules, set widely apart, and nearly parallel or slightly divergent. Laterad of these there is a pair of similar, but smaller lobes—the second lobes.

There is no remarkable difference between *Parlatoria* and *Cryptoparlatores* in this stage. The genera *Microparlatoria*, *Parlatoreopsis*, and *Lopholeucaspis* are characterized by lacking any sclerotized processes representing the second lobes in the first stage. While in the characters of the head and antennae they have nothing distinct from *Parlatoria*, there is at the posterior extremity only a single pair of lobes, which are set apart and parallel in *Lopholeucaspis*, but are convergent slightly in *Microparlatoria* and very strongly in *Parlatoreopsis*, the apices being set closely in the last genus. The exuvium of the first stage female is rounded or oval in the examined genera except *Lopholeucaspis*, in which it is very elongate.

I. Genus *Parlatoria* Targioni

Parlatoria Targioni (1868, p. 735); Ferris (1937, SI-84); Morrison (1939 a); McKenzie (1945); Balachowsky (1953 g, p. 773).

Type: *Aspidiotus proteus* Curtis.

This genus is, after McKenzie, native to the Oriental region, a number of species being found therein. In Japan it is represented by five species, which belong to the *proteus* group.

1. *Parlatoria camelliae* Comstock

Parlatoria pergandii var. *camelliae* Comstock (1883, p. 114). *Parlatoria camelliae* Morrison (1939 a, p. 8); Ferris (1942, SIV-400); McKenzie (1945, p. 58); Balachowsky (1953 g, p. 797).

L. & H.: Ôsaka, Honsyu, on *Quercus glauca* (R. Takahashi leg.) and *Quercus phillyraeoides*; Miyazaki, Kyusyu, on *Distylium racemosum*; Kagosima, Kyusyu, on an undetermined non-coniferous plant; Amami-Ôsima, on *Ficus pumila*.

2. *Parlatoria piceae* Takagi

Parlatoria piceae Takagi (1956, Insecta Matsumurana, Vol. 20, Nos. 1-2, p. 45).

L. & H.: Sapporo, Hokkaido, on *Picea excelsa*.

3. *Parlatoria pergandii* Comstock

Parlatoria pergandii Comstock (1881 a, p. 327); Ferris (1937, SI-88); Morrison (1939 a, p. 18); McKenzie (1945, p. 70); Balachowsky (1935 g, p. 816).

L. & H.: Sizuoka, Honsyu, on *Citrus* (K. Kamiyo leg.).

As mentioned by Ferris the scale insect figured by Kuwana (1925) under the name *P. pergandii* is not this species, but, in reality, *P. camelliae*. This is apparently shown by the somewhat elongate body and the pygidial lobes which are but slightly graded in size.

4. *Parlatoria theae* Cockerell

Parlatoria theae Cockerell (1896 h, p. 21); Kuwana (1925, p. 12); Morrison (1939 a, p. 25); Ferris (1942, SIV-403); McKenzie (1945, p. 74); Balachowsky (1953 g, p. 813).

L. & H.: Kamidaki, Toyama-ken, Honsyu, on *Prunus* sp.; Ôsaka, Honsyu, on *Aucuba japonica*; Hukuoka, Kyusyu, on *Euonymus japonicus*.

5. *Parlatoria zizyphus* (Lucas)

Coccus zizyphus Lucas (1853). *Parlatoria zizyphus* Kuwana (1925, p. 6); Ferris (1937, SI-90); Morrison (1939 a, p. 27); McKenzie (1945, p. 76). *Parlatoria zizyphi* Balachowsky (1953 g, p. 779).

Although this species was recorded by Kuwana from southern Kyusyu, no material collected in Japan is now available. Some specimens from Formosa are at hand.

Key to the species

1. A remarkable ear-like marginal prominence present on each side of prosoma opposite anterior spiracle; derm pockets absent; three pairs of well-developed lobes present, all practically equal in size, rather slender; fourth lobes represented by a thickly sclerotized, pointed process; fifth lobes replaced by a fimbriate spine, which is similar in shape and size to the adjacent spines *P. zizyphus*.
- Membraneous, ear-like prominences absent on prosoma. 2.
2. Derm pockets absent laterad of posterior spiracles; three pairs of well-developed lobes present, grading in size from median to outer; fourth and fifth lobes each represented by a short, sclerotized, conical process *P. pergandii*.
- Derm pocket present laterad of each posterior spiracle. 3.
3. Three pairs of well-developed lobes present, distinctly grading in size from median to outer; fourth and fifth lobes each represented by a short, sclerotized, apically pointed process. *P. theae*.
- Three pairs of well-developed lobes present, all practically equal in size. 4.

4. Fourth lobes represented by a somewhat sclerotized, short, apically pointed process; fifth lobes similar, but less sclerotized. *P. camelliae*.
- Fourth and fifth lobes each replaced by a fimbriate spine, which is slightly smaller than the adjacent ones. *P. piceae*.

II. Genus *Cryptoparlatoarea* Lindinger

Cryptoparlatoarea Lindinger (1905 a, p. 132). *Cryptoparlatoria* MacGillivray (1921. p. 248); Kuwana (1926, p. 1).

Type: *Cryptoparlatoarea leucaspis* Lindinger.

In addition to the type, five species have been referred to the genus, but at present it is not possible to determine whether these are real members of this genus or not. So far as represented by the type species this genus is very similar to *Parlatoria* in the first stage. Also in the characters of the second stage female there is no serious difference between the two. In the present genus, however, the second exuvium of the female is somewhat elongate, entirely covering the adult female, and is provided with a distinct lateral constriction on each side. In the adult females the difference between the two genera is distinct, in *Cryptoparlatoarea* the pygidial lobes being represented by small, conical projections and the marginal spines of the pygidium distinctly exceeding the lobes in length.

This genus may be also closely related to *Neoparlatoria*, but is regarded as distinct (v. *Neoparlatoria*).

6. *Cryptoparlatores leucaspis* Lindinger

Cryptoparlatoarea leucaspis Lindinger (1905 a, p. 132); Ferris (1936 a, fig. 26). *Cryptoparlatoria leucaspis* Kuwana (1926, p. 2).

Adult female. Pupillarial. Body oval, membranous except for pygidium, which is broadly rounded and rather well sclerotized on dorsum. Antennae set apart, with a seta. Anterior spiracles with a few accompanying disc pores. Tubercular gland spines in an intermittent row along body margin on each side through cephalothorax and prepygidial region of abdomen. Anus circular, rather large in size, situated somewhat posteriorly than middle of pygidium. Perivulvar pores in four groups of not few pores. Pygidial lobes in three pairs, all similar in shape and size, small, conical, symmetrical; median lobes parallel, widely separated. Marginal spines of pygidium well developed, distinctly exceeding lobes in length, slender, simple or variously fimbriate, two between median lobes and also between median and second, three between second and third and also laterad of third. Macroducts rather large, with the orifice transverse and surrounded by a sclerotized rim, a marginal one in each interlobar space, a few ones laterad of third lobe along pygidial margin; submarginal macroducts present or absent, if present few in number.

Second exuvium of female. As mounted attaining 0.97 mm. in length and 0.63 mm. in width. Elongate; the posterior third forming a pygidium-like fused part, which is set off from the remaining part by a distinct lateral constriction on each side, flat and

rounded, and somewhat sclerotized along the margin; the constriction seemingly occurring between first and second abdominal segments, the anterior part of the exuvium is oval, convex dorsally, and strongly sclerotized throughout. Lobes in three pairs, all similar in shape and size, each with a pair of slender basal paraphyses. Marginal fimbriate spines slightly shorter than lobes, provided with a microduct, two between median lobes and also between median and second, three between second and third, three rather robust ones laterad of third, laterad of these the replaced spine of the fourth lobe is not distinguishable from the adjacent spines in shape but lacks a microduct, and three spines laterad of the replaced spine, giving way to a row of tubercular marginal spines which extend to the lateral constriction, number twelve on each side, and are divided into three series each composed of four, the anterior three spines of each series bearing a microduct.

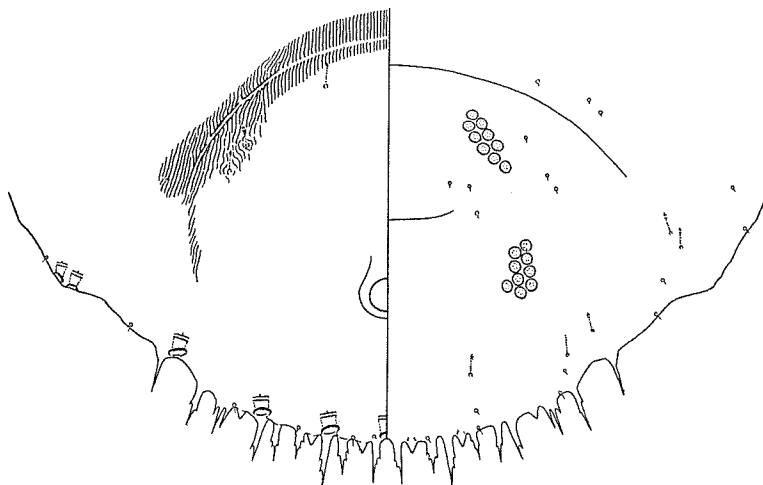


Fig. 1. *Cryptoparlatores leucaspis* Lindinger.
Adult female: pygidium.

Marginal macroducts with the orifice transverse and surrounded by a sclerotized rim, one in each lateral interlobar space, a similar one just mesad of replaced spine of fourth lobe, and laterad of the replaced spine there are two single ones, which become smaller.

L. & H.: Toyama, Honsyu, on *Cryptomeria japonica*; Wakasugi-yama, Hukuoka-ken, Kyusyu, on *Chamaecyparis obtusa*.

All the examined exuvia of the second stage female collected at Wakasugi-yama are yellowish throughout, while those from Toyama hold to the pattern hitherto known, being black with the margin reddish. There is, however, no other distinct difference between the two forms.

III. Genus *Neoparlatoria* Takahashi

Neoparlatoria Takahashi (1931 b, p. 381).

Type: *Neoparlatoria formosana* Takahashi.

This genus is apparently very close to *Cryptoparlatores*, but may certainly be valid as far as the types of these genera are concerned. In the type of the latter genus, *C. leucaspis*, the pygidial lobes are small and symmetrical, and a marginal macroduct is present between the median lobes. *Neoparlatoria formosana* differs from that species by the pygidial lobes rather prominent and asymmetrical, and by the median lobes set rather closely and lacking a marginal macroduct between them. It is impossible at present to determine whether these differences can be always employed in separating the two genera or not. However, two other species of *Neoparlatoria* from Formosa, *N. lithocarp* Takahashi and *N. lithocarpicola* Takahashi, agree so well with the type species in the characters mentioned above that the supposed generic differences seem to be actual. As *Cryptoparlatoria pini* Takahashi from India lacks a marginal macroduct between the median lobes it may very possibly be a member of *Neoparlatoria*.

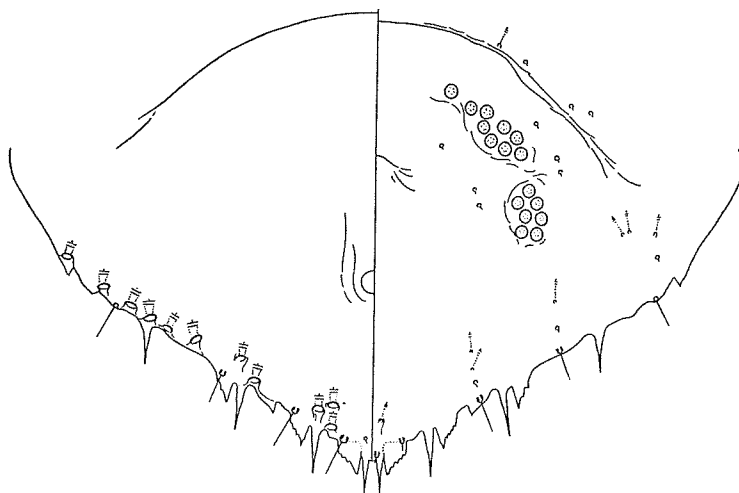


Fig. 2. *Neoparlatoria formosana* Takahashi.
Adult female: pygidium.

A single species of this small Oriental genus occurs in southern Japan.

7. *Neoparlatoria formosana* Takahashi

Neoparlatoria formosana Takahashi (1931 b, p. 382; 1957, Transactions of the Shikoku Entomological Society, Vol, 5, Pars 7, p. 104); Ferris (1937 d, fig. 88).

L. & H.: Kyusyu (Hukuoka, Miyazaki, and Kagosima), on *Quercus* spp.

In the original description and figures of this species it is shown that the marginal macroducts are arranged singly and three in number on each side of the pygidium. There is no available specimen which agrees in this point with the type form.

There has been examined a specimen which has three marginal macroducts on one side of the pygidium, but on this side two macroducts, instead of one, occur between the median and second lobes, a single one laterad of the third lobe, and none between the second and third lobes; on the other side of the pygidium there are seen five marginal

macroducts, of which one occurs between the median and second lobes, and two between the second and third lobes and also laterad of the third lobe. In the other examined specimens the macroducts occurring along the pygidial margin range from four to eleven on one side.

In the other characters, however, the present specimens agree very well with the original description.

IV. Genus *Microparlatoria* Takahashi

Microparlatoria Takahashi (1956, Insecta Matsumurana, Vol. 20, Nos. 1-2, p. 26).

Type: *Parlatoria itabicola* Kuwana.

This genus is represented by the type species from the Ryukyu Islands and *M. fici* (Takahashi) from Thailand.

8. *Microparlatoria itabicola* (Kuwana)

Parlatoria itabicola Kuwana (1931 b, p. 167). *Microparlatoria itabicola* Takahashi (1956, Insecta Matsumurana, Vol. 20, Nos. 1-2, p. 26).

L. & H.: Amami-Ôsima, on *Ficus pumila*.

V. Genus *Parlatoreopsis* Lindinger

Parlatoreopsis Lindinger (1912 b, 191); Ferris (1942, SIV-404); McKenzie (1945, p. 83); Balachowsky (1953 g, p. 827).

Type: *Chionaspis longispina* Newstead.

This genus is represented by three known species, which are considered to be originally Palearctic. The following species has been known to occur in Japan.

9. *Parlatoreopsis chinensis* (Marlatt)

Parlatoria chinensis Marlatt (1908 c, p. 30). *Parlatoreopsis chinensis* Ferris (1942, SIV-405); McKenzie (1945, p. 84); Balachowsky (1953 g, p. 831).

L. & H.: Hagi, Yamaguti-ken, Honsyu, on *Eriobotrya japonica* (R. Takahashi leg.).

VI. Genus *Lopholeucaspis* Balachowsky

Lopholeucaspis Balachowsky (1953 g, p. 875).

Type: *Leucaspis japonica* Cockerell.

The type species is a well-known cosmopolitan, but is generally accepted as originally Asiatic. The other known species, *L. cockerelli*, has been recorded from various parts of the tropics, but it is said that this insect is an invader in the New World. This genus may presumably be an Asiatic derivative of *Leucaspis*.

10. *Lopholeucaspis japonica* (Cockerell)

Leucaspis japonica Cockerell (1897 d, p. 53); Kuwana (1928, p. 36); Ferris (1938 a, SII-148). *Lopholeucaspis japonica* Balachowsky (1953 g, p. 877).

L. & H.: Toyama, Honsyu, on *Enkianthus* sp.; Hukuoka, Kyusyu, on an undeter-

mined Leguminous plant; Amami-Ôsima, on an undetermined plant.

Lepidosaphes group

This group is characterized by the marginal macroducts of the pygidium which are particularly enlarged and of which the orifices are set vertically or nearly so, and by having a pair of gland spines between the median lobes. The second lobes are primarily divided into two lobules, although the outer lobule sometimes becomes rudimentary or even obsolete.

I have examined the first stage larvae, mostly through the female exuvia, of the Japanese species of the genus *Lepidosaphes* except *L. beckii* and *L. camelliae*. The antennae are six-segmented in all the examined species, and the terminal segment is elongate and annulate or non-annulate. These species, except *L. piniphilus*, have a pair of enlarged dorsal ducts on the head. There is at the posterior extremity, just laterad of the apical setae, a pair of sclerotized processes, which are moderate in size except in *L. glaucae*, in which these processes are enlarged as in *Andaspis*. In most of the examined exuvia or larvae there is apparently seen just laterad of the sclerotized processes a pair of membranous, broad but very short, apically fimbriate or serrate processes, and a similar one is also discernible on each side in the position where the second lobe should be expected.

Acanthomytilus and *Lepidosaphes* are much alike in the first stage, so far as the former is represented by *A. imperatae*, in which, however, the female exuvium is very elongate, being two to three times as long as wide. There is a pair of dorsal ducts on the head. The antennae are slender, and six-segmented; the terminal segment is elongate, being about as long as the four preceding segments united, and is distinctly annulate. The posterior extremity is furnished with processes, which fairly resemble those seen in most examined species of *Lepidosaphes*.

The first exuvia of three species of *Andaspis* recognized in this work have been examined. They are particularly characterized by having at the posterior extremity a pair of enlarged processes, which are well sclerotized and similar in shape to the median lobes of the adult female. There is on the head a pair of dorsal ducts. The antennae are six-segmented, and the terminal segment is distinctly annulate.

It has been not yet seen the first stage of *Pallulaspis quercus*, a unique species of the genus in Japan.

VII. Genus *Lepidosaphes* Shimer

Lepidosaphes Shimer (1868, p. 373); Ferris (1937, SI-70); Balachowsky (1954 e, p. 28). *Mytilococcus** Amerling (1858 a, p. 99); Zahradnik (1952, p. 161). *Mytilaspis* Targioni (1868, p. 737) et auct.

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

* The nomenclatorial situation in regard to this name is not clear to me. The name *Lepidosaphes*, which has been used for long, is here adopted.

As concluded from our recent knowledge the genus *Lepidosaphes* is evidently native to Eurasia, its numerous members being known there. The Japanese members of this genus have been revised by Takahashi (1955 e), seventeen being enumerated. Later, in 1957, three species were proposed to the fauna by the same author, but it seems that *Lepidosaphes kashicola* is not a member of the present genus, but should be transferred to *Andaspis*. In the present study five other species including two new are found, and then are now known as occurring in Japan twenty-four species in total. However, as *L. buzenensis* still remains uncertain it is excluded from the accompanying key.

In these species the dorsal ducts are very various in structure, and the genus seems to be extremely heterogenous in this regard. Of the other characters, however, there is nothing particular sufficient to recognize any division, and the species seem to form a natural group, which is fairly uniform in the main characters of the pygidial margin. It should be mentioned here that in all the Japanese species the marginal macroducts of the pygidium are six in number on each side.

These species are much alike in the first stage. Exceptions, however, are made by *L. glaucae* and *L. piniphilus*; in *L. glaucae* there is at the posterior extremity a pair of enlarged processes, and in *L. piniphilus* there are on the head no dorsal ducts. Nevertheless, in any other respect, there seems to be no good reason to exclude the two species from *Lepidosaphes*.

11. *Lepidosaphes japonica* (Kuwana)

Mytilaspis pomorum var. *japonica* Kuwana (1902, p. 80). *Lepidosaphes japonica* Kuwana (1925 a, p. 11); Takahashi (1955 e, p. 72).

L. & H.: Abasiri, Hokkaido, on *Abies sachalinensis*; Sapporo, Hokkaido, on *Picea excelsa*; Toyama, Honsyu, on *Abies* sp. and *Picea* sp.; Yamanashi-ken, Honsyu, on *Abies* sp.; Amagi-san, Sizuoka-ken, Honsyu, on *Abies* sp.

12. *Lepidosaphes maskelli* Cockerell

Lepidosaphes pallida var. *maskelli* Cockerell (1897 q, p. 704). *Lepidosaphes pallida* Kuwana (1925 a, p. 9) (nec Green). *Lepidosaphes maskelli* Balachowsky (1954 e, p. 87); Takahashi (1955 e, p. 75). *Lepidosaphes newsteadi* Ferris (1938 a, SII-146) (nec Šulc).

L. & H.: Toyama, Honsyu, on *Juniperus Sargentii* and *Podocarpus macrophyllus* var. *Maki*; Kamidaki, Toyama-ken, Honsyu, on *Cryptomeria japonica*; Kanagawa-ken, Honsyu, on *Cephalotaxus Harringtonia*; Amagi-san, Sizuoka-ken Honsyu, on *Cephalotaxus Harringtonia*; Hukuoka, Kyusyu, on *Juniperus* sp.

13. *Lepidosaphes yanagicola* Kuwana

Lepidosaphes yanagicola Kuwana (1925 a, p. 19); Takahashi (1955 e, p. 78). *Lepidosaphes atunicola* Siraiwa (1939, p. 69), **syn. nov.**

Adult female. Body elongate, broadest across second or third abdominal segment, 1.29 mm. in length and 0.60 mm. in width at maximum; free abdominal segments each but weakly produced laterally; pygidium more or less rounded along its free margin. Antennae with two setae. Anterior spiracles with four to ten accompanying disc pores.

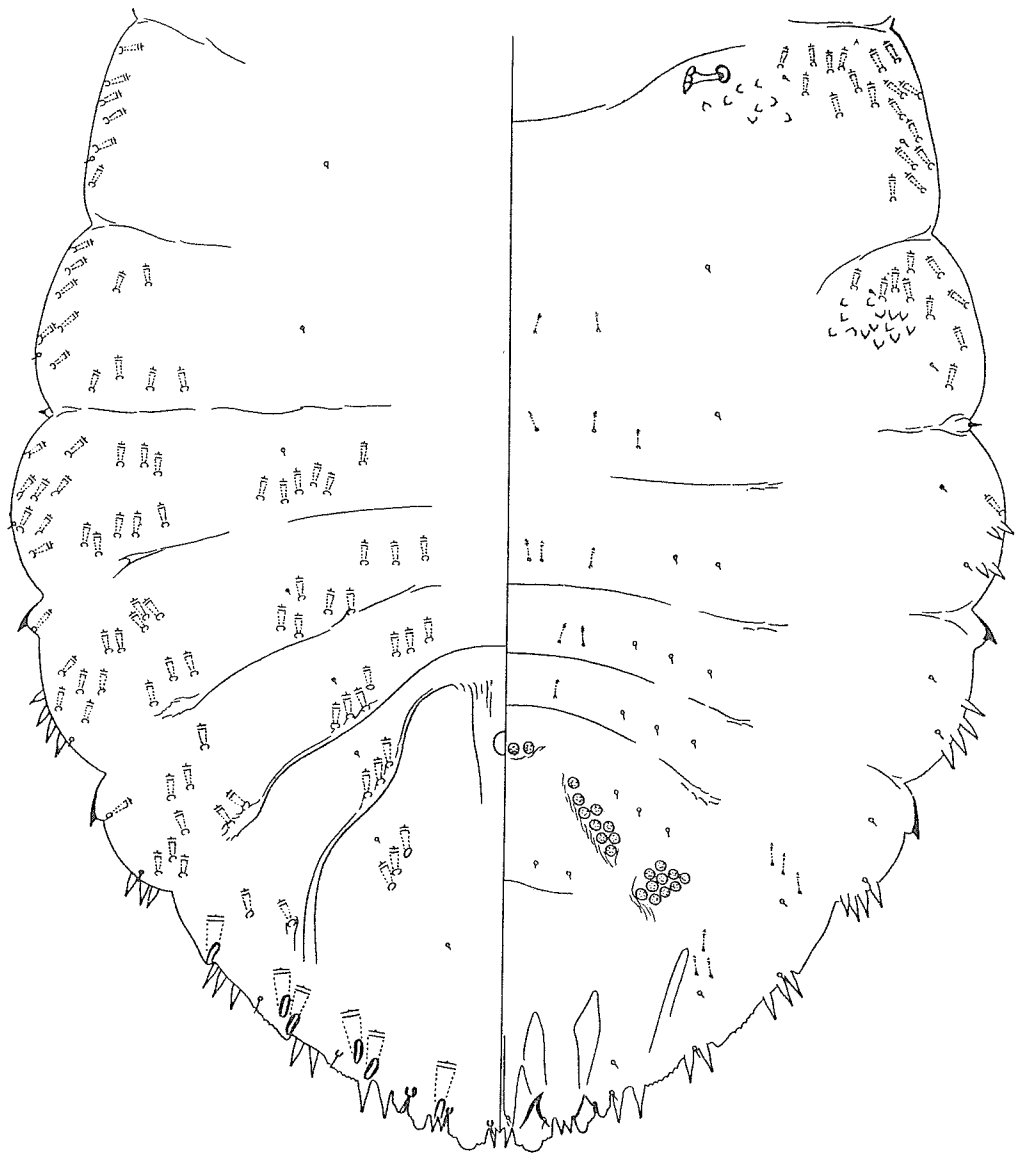


Fig. 3. *Lepidosaphes yanagicola* Kuwana.
Adult female: postsoma.

Macroducts occurring along lateral margins of mesothorax, absent between posterior spiracles, but rather abundant ones present laterad of them, submarginal dorsal ones occurring on second to sixth abdominal segments, two to four in number on the sixth segment on each side, a single slender one present or absent in front of second lobe, fifth abdominal segment with but a few submarginal macroducts. Gland spines occurring on metathorax and abdomen, several tubercular ones just laterocaudad of each posterior spiracle, similar more numerous submarginal ones on first abdominal segment, the succeeding free segments and pygidium with short and rather robust gland spines. Three lateral tubercles present on each side of abdomen, each produced into a heavily sclerotized spur, the posterior two with an accompanying macroduct opened at the posterior base. Perivulvar pores in five groups. Median lobes projecting, nearly as long as wide, notched on both sides, separated by a space as wide as or slightly narrower than one of them, each with a pair of basal paraphyses. Second lobes well developed, the inner lobule with a pair of basal paraphyses, the outer one smaller than the inner, but well represented.

L. & H.: Sapporo, Hokkaido, on *Tilia japonica*; Hukuoka, Kyusyu, on *Salix* sp. and *Albizzia Julibrissin*; Hiko-San, Kyusyu, on an undetermined non-coniferous plant.

This species is so extremely close to *L. corni* in most details that there can be justification for skepticism as to the distinctness of the two. I am inclined to the opinion that this species may be distinguishable from *L. corni* by the pygidium which is not trapezoidal like the latter but is rounded along its free margin. In *L. corni* there is always seen a submarginal dorsal duct in front of the second lobe. Among the specimens mentioned above, those collected on *Salix* at Hukuoka have this submarginal duct on one or either side of the pygidium, while the others present no duct in this position. It may be possible to refer the specimens collected on *Salix* to *L. corni*, but they represent probably a mere variant of *L. yanagicola*, the pygidium being rounded along its free margin.

Judging from the description, *L. atunicola* Siraiwa described from Saghalien as a feeder of *Ulmus laciniata* can not be distinguishable from *L. yanagicola*. As at present understood this species occurs over the Archipelago of Japan including Saghalien and feeds on several non-coniferous plants.

14. *Lepidosaphes corni* Takahashi

Lepidosaphes corni Takahashi (1957, Transactions of the Shikoku Entomological Society, Vol. 5, Pars 7, p. 111).

L. & H.: Miyazaki, Kyusyu, on *Euonymus japonicus*; Amami-Ôsima, on *Euonymus japonicus*, *Eurya emarginata* and *Quercus* sp.

This species was originally described from specimens collected on *Cornus controversa* at Tokyo. The present specimens agree so closely with the original description and figure that there can be little doubt of the correct identification. The scale insect recorded by Kuwana (1931 b, p. 167) under the name *L. pallida* from Amami-Ôsima as a feeder of *Euonymus japonicus* may possibly be this species.

This scale insect is extremely close to *L. yanagicola*, from which it may be

distinguishable by the shape of the pygidium (v. *L. yanagicola*). These two appear also to be closely related to *Lepidosaphes sciadopitysi* McKenzie, from which they may be distinguishable by having submedian dorsal ducts on the second abdominal segment.

15. *Lepidosaphes gloverii* (Packard)

Coccus gloverii Packard (1869, Guide to Study of Insects, Ed. I, p. 527). *Lepidosaphes gloverii* Kuwana (1925 a, p. 16); Ferris (1937, SI-74); Balachowsky (1954 e, p. 51); Takahashi (1955 e, p. 72).

L. & H.: Sizuoka-ken, Honsyu (K. Kamijo leg.); Matuyama, Ehime-ken, Sikoku (T. Tachikawa leg.); Miyazaki, Kyusyu. On *Citrus*.

16. *Lepidosaphes camelliae* Hoke

Lepidosaphes camelliae Hoke (1921, p. 339); Kuwana (1925 a, p. 7); Ferris (1937, SI-72); Takahashi (1955 e, p. 71).

L. & H.: Idu-Ôsima, on *Camellia*.

17. *Lepidosaphes pini* (Maskell)

Poliaspis pini Maskell (1898, p. 231); Kuwana (1925, p. 1). *Lepidosaphes pini* Takahashi (1955 e, p. 76).

L. & H.: Sado; Miyazaki, Kyusyu. On *Pinus Thunbergii*.

18. *Lepidosaphes conchiformioides* Borchsenius

Lepidosaphes conchiformioides Borchsenius (1958, Acta Entomologica Sinica, Vol. VIII, No. 2, p. 168). *Lepidosaphes conchiformis* Kuwana (1925 a, p. 5) (nec Gmelin); Takahashi (1955 e, p. 72) (nec Gmelin).

L. & H.: Okitu, Sizuoka-ken, Honsyu (R. Takahashi leg.); Okayama, Honsyu (R. Takahashi leg.). On *Pyrus*.

19. *Lepidosaphes machili* (Maskell)

Mytilaspis machili Maskell (1898, p. 230). *Lepidosaphes machili* Kuwana (1925 a, p. 35); Ferris (1942, SIV-397); Balachowsky (1954 e, p. 47); Takahashi (1955 e, p. 75). *Lepidosaphes cymbidicola* Kuwana (1925 a, p. 27). *Lepidosaphes cinnamomi* Takahashi (1933, p. 48). *Lepidosaphes ezokihadae* Kuwana (1932 c, p. 147).

L. & H.: Sapporo, Hokkaido, on *Phellodendron amurense*; Tokyo, on *Illicium religiosum*; Miyazaki, Kyusyu, on *Cinnamomum* sp.

I agree with Takahashi's opinion that *L. ezokihadae* Kuwana, which was described from specimens from *Phellodendron*, is a synonym of *L. machili*. There are at hand some specimens collected on *Phellodendron*; they hold to the pattern which is distinctive of the present species, and consequently there can be little doubt about the identity of the two.

20. *Lepidosaphes kuwacola* Kuwana

Lepidosaphes kuwacola Kuwana (1925 a, p. 23); Takahashi (1955 e, p. 74). *Lepidosaphes ume* Kuwana (1925 a, p. 25).

L. & H.: Zenibako, Hokkaido, on *Salix* sp.; Sapporo, Hokkaido, on *Fraxinus mandschurica* var. *japonica*, *Kalopanax septemlobus*, *Morus* sp., *Ulmus Davidiana* var. *japonica*, and *Taxus cuspidata*; Hayatuki, Toyama-ken, Honsyu, on a Leguminous plant; Tokyo, on an undetermined non-coniferous plant; Ôsaka, Honsyu, on *Ligustrum japonicum*.

This species has been known as a feeder of various non-coniferous plants including *Ginkgo biloba*. The specimens at hand collected on the conifer *Taxus cuspidata* agree very closely with the other examined specimens, and there is no distinct difference sufficient to distinguish them from the present species.

I follow the opinion proposed by Takahashi, who has examined Kuwana's type material, that *L. ume* is a synonym of *L. kurvacola*.

21. *Lepidosaphes pseudotsugae* Takahashi

Lepidosaphes pseudotsugae Takahashi (1957, Transactions of the Shikoku Entomological Society, Vol. 5, Pars 7, p. 108).

L. & H.: Hirayu, Hida, Honsyu, on *Tsuga* (R. Takahashi leg.); Ôdai-ga-Hara, Nara-ken, Honsyu, on *Pseudotsuga japonica* (R. Takahashi leg.).

22. *Lepidosaphes beckii* (Newman)

Coccus beckii Newman (1869, p. 217). *Lepidosaphes beckii* Kuwana (1925 a, p. 14); Ferris (1937, SI-71); Balachowsky (1954 e, p. 61); Takahashi (1955 e, p. 70).

Although it is said that this species occurs in southern Kyusyu on *Citrus*, there has been available no material collected in Japan. Through the kindness of Prof. R. Takahashi I have had the opportunity to see specimens from Los Angeles, U.S.A.; this species is included in the accompanying key on the basis of their characters.

23. *Lepidosaphes kamakurensis* Kuwana

Lepidosaphes kamakurensis Kuwana (1925 a, p. 18); Takahashi (1955 e, p. 73).

L. & H.: Sado; Hukuoka, Kyusyu; Miyazaki, Kyusyu. On *Camellia*.

24. *Lepidosaphes abdominalis* sp. nov.

Adult female. Body slender, 1.26 mm. in length and 0.50 mm. in width at maximum; prosoma elongate, slender, very flatly rounded along the anterior extremity; free abdominal segments strongly produced laterally each into a membraneous lobe; pygidium rather trapezoidal. Antennae with two long setae. Anterior spiracles with four to six accompanying disc pores. Very slender ducts scattered along lateral margins in thoracic region, a number of similar ventral ones in a transverse band across metathorax; similar ducts on abdomen, those occurring along lateral margins of the first to fifth segments with the orifice a little larger and surrounded by a slender, sclerotized ring; rather abundant dorsal ducts occurring on first abdominal segment, but lacking in median and submedian areas of the segment, numerous ones scattered in an almost continuous band across each of the succeeding free segments, several submedian ones on fifth abdominal segment, and ten to sixteen ones in a longitudinal row on sixth abdominal segment on each side; a submarginal dorsal duct present just cephalad of second lobe, variable in size. Gland spines occurring on metathorax and abdomen, one to three tubercular ones just latero-caudad of each posterior spiracle, twelve to fifteen similar submarginal ones on first abdominal segment, six to eight short, rather tubercular ones on second abdominal segment, slender ones on the succeeding free segments and pygidium, there are on the

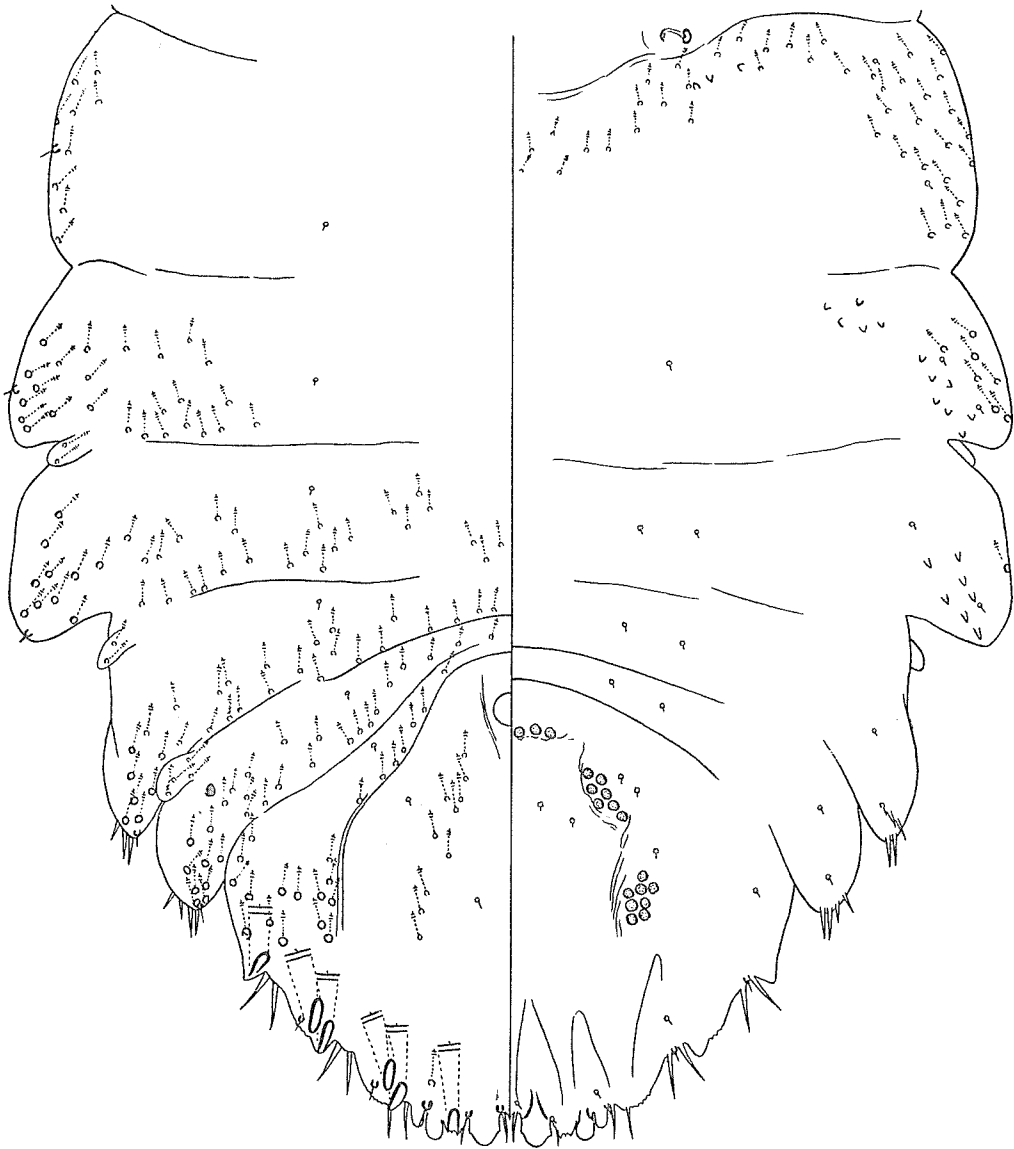


Fig. 4. *Lepidosaphes abdominalis* sp. nov.
Adult female: postsoma.

pygidium three pairs of marginal gland spines laterad of the second lobe. Three inter-segmental lateral tubercles on each side of abdomen, membranous, bearing a few ducts. A submarginal dorsal boss discernible on fourth abdominal segment. Perivulvar pores in five groups, three to five in the median group, seven to nine in the laterocephalics each, and seven or eight in the laterocaudals each. Median lobes rather small, nearly as wide as or wider than long, little or slightly dilated, rounded apically, separated by a space slightly narrower than one of them, each with a pair of basal paraphyses. Second lobes well developed, the inner lobule with a pair of basal paraphyses, the outer lobule well represented.

Second exuvium of female. Elongate, fusiform, flatly rounded along the anterior extremity; pygidium trapezoidal; attaining 0.94 mm. in length and 0.47 mm. in width. Four single marginal macroducts present on each side of abdomen, belonging probably to the fourth to seventh segments. Submedian and submarginal macroducts present, smaller than the marginal ones, a submedian one on each side of pygidium laterocaudad of anal opening and also on the two or three preceding segments each. Pygidial lobes similar to those of adult female.

Scale. Scales of both sexes of normal lepidosaphine form, rather slender, convex dorsally, and of a dark brown colour.

L. & H.: Sumiyô, Amami-Ôsima, on an undetermined non-coniferous tree (14. V, 1957).

There are at hand a few specimens of the adult female, which are not in good condition. It is hoped, however, that no serious errors have been made in preparing the present description and figure.

This species is apparently very close to *L. kamakurensis*, from which it is distinct by having ventral ducts between the posterior spiracles, by the free abdominal segments more strongly produced laterally, etc.

25. *Lepidosaphes ulmi* (L.)

Coccus ulmi Linné (1758, p. 455). *Lepidosaphes ulmi* Kuwana (1925 a, p. 21); Ferris (1937, SI-76); Balachowsky (1954 e, p. 37); Takahashi (1955 e, p. 77). *Mytilococcus ulmi* Zahradník (1952, p. 162).

L. & H.: Abasiri, Hokkaido, on *Sorbus* sp.; Sapporo, Hokkaido, on *Malus* sp., *Crataegus jozana*, an undetermined Rosaceous plant, and *Cornus controversa*.

As stated by Takahashi this species has been known mostly from specimens from Rosaceous plants including *Crataegus*, *Malus*, and *Prunus* but not from *Ulmus* in Japan; it is commonly found on certain Rosaceous plants at Sapporo, but not on *Ulmus*, on which *L. kurvacola* and *L. tubulorum* have been collected by me.

In the examined specimens there are always seen a few tubercular gland spines caudad of each of the posterior spiracles.

26. *Lepidosaphes celtis* Kuwana

Lepidosaphes celtis Kuwana (1925 a, p. 28); Takahashi (1955 e, p. 71).

L. & H.: Toyama-ken, Honsyu, on *Celtis*.

27. *Lepidosaphes salicina* Borchsenius

Lepidosaphes salicina Borchsenius (1958, Acta Entomologica Sinica, Vol. VIII, No. 2, p. 171).

Adult female. Body elongate, rather robust, fusiform, 1.76 mm. in length and 0.82 mm. in width at maximum; free abdominal segments each more or less produced laterally; pygidium broadly rounded along its free margin. Antennae with two setae normal in size, and also two minute setae are often seen. Anterior spiracles with twelve to sixteen accompanying disc pores loosely clustered. A number of slender ventral ducts scattered in submarginal area of mesothoracic region, laterad of posterior spiracles each, and rather sparsely in a narrow band between these spiracles; abundant similar dorsal ducts occurring on free abdominal segments in both submedian and submarginal areas, twenty-five to thirty-six ones in a narrow longitudinal band on sixth abdominal segment on each side, eight to twenty-two on seventh in a narrow band, which extends anteriorly to the position

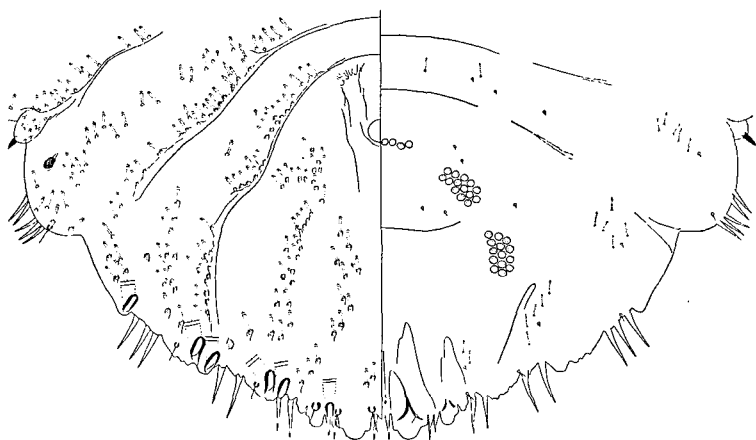


Fig. 5. *Lepidosaphes salicina* Borchsenius.
Adult female: pygidium.

opposite the vulvar opening and posteriorly to the base of the second lobe, and, finally, one or two ducts occurring cephalad of inner basal angle of median lobe. Gland spines occurring on metathorax and abdomen, one to four tubercular ones just laterocaudad of each posterior spiracle, fourteen to eighteen similar submarginal ones on first abdominal segment, six to nine short, rather tubercular submarginal ones on second, and slender ones on the succeeding free segments and pygidium. A membranous lateral tubercle present between third and fourth abdominal segments, with slender ducts opened on its dorsal surface and a sclerotized spur at its apex, a similar tubercle present in each of the preceding two intersegmental constrictions, with slender ducts and one or two sclerotized spurs. A submarginal dorsal boss seen on fourth to sixth abdominal segments each and at times also on second and third each. Perivulvar pores in five groups, five to ten pores in the median group, twelve to nineteen in the laterocephalics each, and ten to eighteen in the laterocaudals each. Median lobes prominent, distinctly notched once on either side, rounded apically, separated by about half the width of one of them,

each with a pair of basal paraphyses. Second lobes well developed, the inner lobule with a pair of basal paraphyses, the outer lobule smaller than the inner.

Second exuvium of female. Fusiform, rather robust, attaining 1.02 mm. in length and 0.61 mm. in width. Four single marginal macroducts present on each side of abdomen, belonging probably to the fourth to seventh segments. Submedian and submarginal macroducts present, smaller than the marginal ones, a submedian one occurring on each side of pygidium laterocaudad of anal opening and also on the preceding two segments each. Pygidial lobes similar to those of adult female.

Scale. In female of normal lepidosaphine form, and very dark in colour.

L. & H.: Sapporo, Hokkaido, on *Juglans ailanthifoliae*, *Betula platyphylla* var. *japonica*, and *Populus nigra* var. *italica*.

This species was originally described from Kilin, China, as a feeder of *Salix*. Prof. N. S. Borchsenius has kindly examined some specimens collected at Sapporo on *Populus* and informed me that they belong to the present species and also that this species occurs in Korea too.

28. *Lepidosaphes piniphilus* Borchsenius

Lepidosaphes piniphilus Borchsenius (1958, Acta Entomologica Sinica, Vol. VIII, No. 2, p. 171).

Adult female. Rather small, 0.84 mm. in length and 0.40 mm. in width; body elongate, broadened but weakly in abdominal region; free abdominal segments each slightly produced laterally; pygidium rather broadly rounded along its free margin. Numerous minute, sclerotized granules thickly strewn on head cephalad of mouth-parts. Antennae with three slender setae. Anterior spiracles with two to five accompanying disc pores. A number of minute ducts scattered along lateral margins of mesothoracic region, laterad of posterior spiracles, and in a transverse band between these spiracles; similar dorsal ducts occurring on abdomen, rather few, absent in median and submedian areas of basal two abdominal segments, five to ten in a longitudinal band on sixth abdominal segment on each side, two to five in a row on seventh on each side, and a single one occurring just cephalad of second lobe and also of inner basal angle of median lobe. Tubercular gland spines occurring on first abdominal segment, two to ten in number on each side; elongate spines on the succeeding free segments, and in nine pairs on pygidium, those occurring between median lobes distinctly surpassing the lobes. Three lateral tubercles present on each side of abdomen, becoming more or less sclerotized, each produced into a heavily sclerotized spur. Perivulvar pores in five groups, three to five in the median group, five to eight in the laterocephalics each, and four or five in the laterocaudals each. Pygidial lobes rather small; median lobes nearly as long as wide, rounded apically, separated by a space somewhat wider than one of them, each with a pair of basal paraphyses; second lobes well represented, the inner lobule with a pair of basal paraphyses.

Second exuvium of female. Elongate, fusiform, 0.77 mm. in length and 0.43 mm. in width. Four single macroducts present on each side of abdomen, belonging probably to the fourth to seventh segments. Submedian and submarginal dorsal ducts represented by very slender ones.

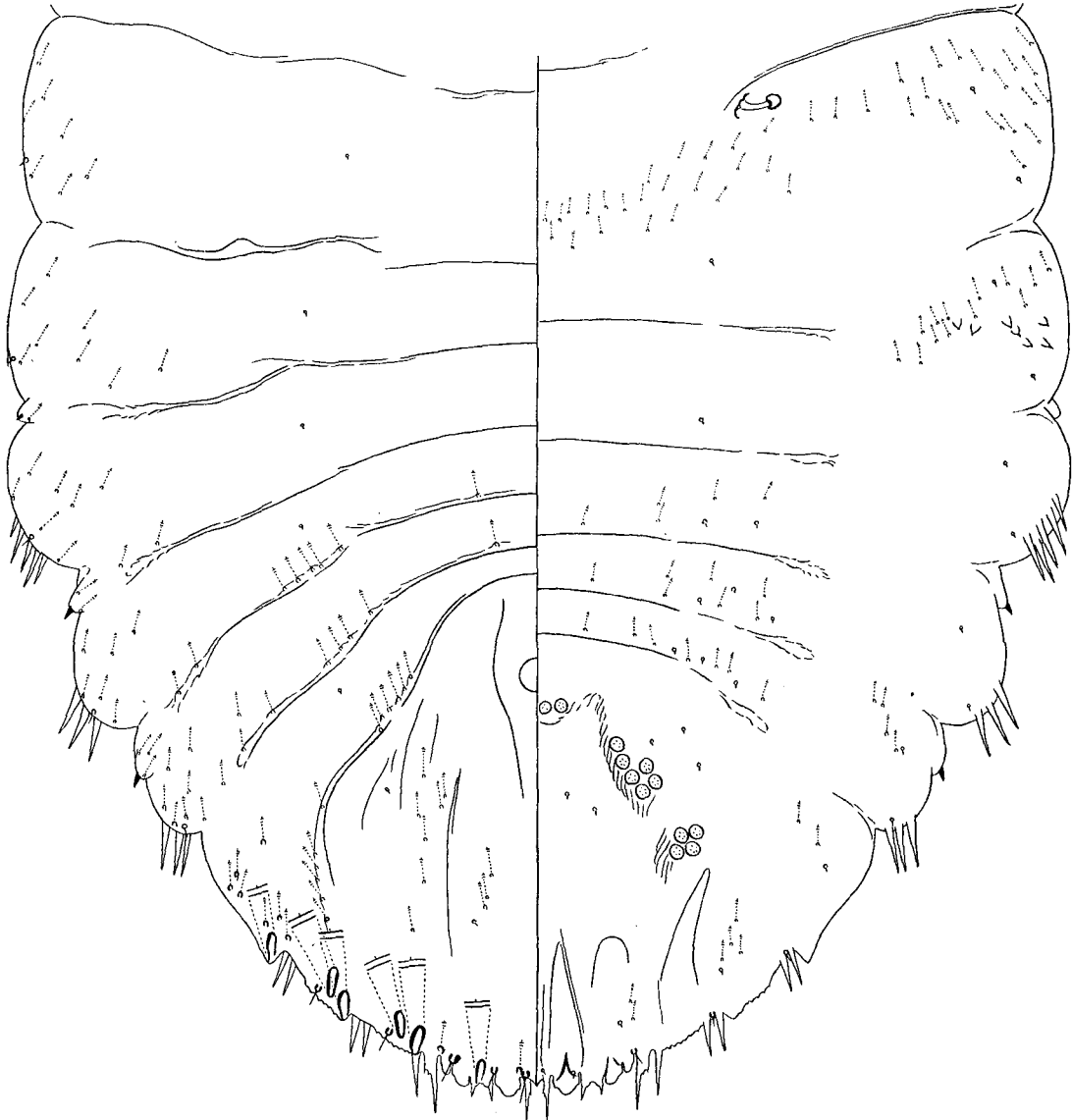


Fig. 6. *Lepidosaphes piniphilus* Borchsenius.
Adult female: postsoma.

Scale. In female slender, convex dorsally, with rather conspicuous ridges of growth, and dark in colour; in male similar, but much smaller.

L. & H.: Matuyama, Ehime-ken, Sikoku, on *Podocarpus* (T. Tachikawa leg.); Hukuoka, Kyusyu, on *Podocarpus macrophyllus* var. *Maki*. In addition to the material mentioned above there has been examined, through the kindness of Prof. R. Takahashi, a slide containing specimens of this species and bearing the label 'Nagasaki, Japan/Exp. Sta. Office Grounds/C. L. Marlatt/May 15. 1901/#58.'

This species was originally described from material collected in China on *Pinus*. Some specimens collected at Hukuoka have been sent to Prof. N. S. Borchsenius, who kindly determined them as belonging to this species.

29. *Lepidosaphes smilacis* sp. nov.

Adult female. Body slender, attaining 1.13 mm. in length and 0.48 mm. in width, little broadened in abdominal region; free abdominal segments each but slightly produced laterally. Antennae with a rather short seta and a very fine seta. Anterior spiracles with five to ten disc pores in a cluster and also often with two pores situated anteriorly to the cluster. A number of minute ducts scattered along lateral margins of mesothoracic region, laterad of posterior spiracles, and in a transverse band between these spiracles; similar dorsal ducts occurring on abdomen, ten to fourteen in a longitudinal band on sixth abdominal segment on each side, five to seven in a narrow longitudinal band on seventh on each side, and a single one occurring just cephalad of second lobe. Submarginal tubercular gland spines on first abdominal segment, one to six in number on each side; slender gland spines on the succeeding free segments, and in nine pairs on pygidium. A lateral tubercle occurring between first and second abdominal segments and also between second and third, bearing a minute duct and becoming somewhat sclerotized; a low lateral prominence on fourth abdominal segment, with an accompanying minute duct. Perivulvar pores in five groups, three to seven pores in the median group, eight to twelve in the laterocephalics each, and eight to ten in the laterocaudals each. Median lobes rather prominent, slightly wider than long, rounded apically, separated by a space a little narrower than one of them, each with a pair of basal paraphyses. Second lobes well developed, the inner lobule nearly as long as wide, slightly dilated apically, with a pair of basal paraphyses.

Second exuvium of female. Fusiform, 0.84 mm. in length and 0.48 mm. in width. Four single marginal macroducts present on each side of abdomen, belonging probably to the fourth to seventh segments. Submedian and submarginal ducts represented by very slender ones.

Scale. In both sexes slender, convex dorsally, and very dark in colour.

L. & H.: Koniya and Naze, Amami-Ōshima, on *Smilax* sp. (17. & 20. V, 1957).

This species occurs under the stipules of the host.

This species is apparently very close to *L. piniphilus* and *L. glaucae*. It is distinguishable from *L. piniphilus* by lacking minute granules on the head, by the lateral tubercles not produced into heavily sclerotized spurs, by the median lobes larger and

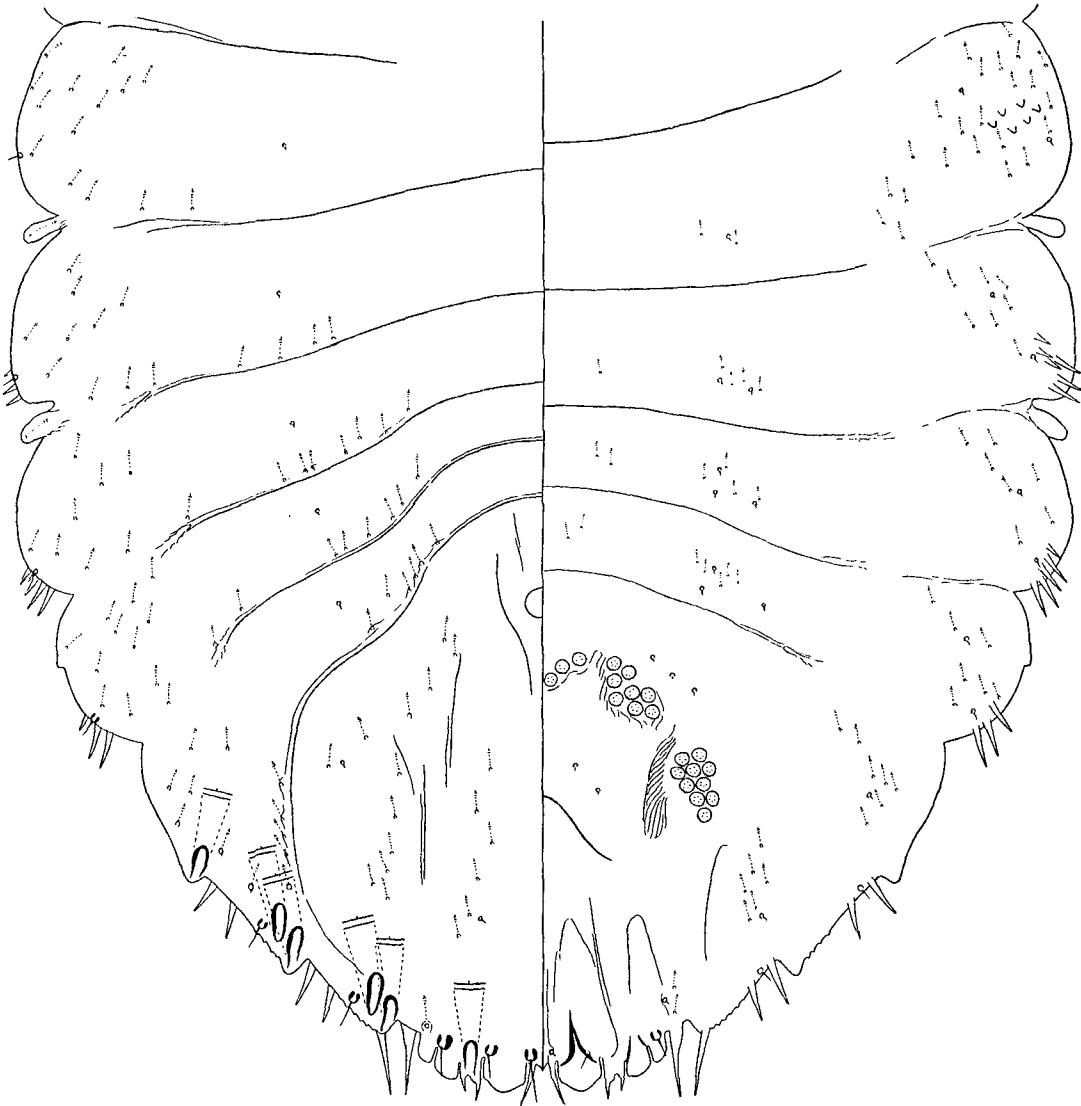


Fig. 7. *Lepidosaphes smilacis* sp. nov.
Adult female: abdomen.

set more closely, etc. It is distinct from *L. glaucae* by the lateral tubercles not produced into heavily sclerotized spurs, by the inner lobules of the second lobes nearly as long as wide, by the pygidial gland spines occurring in three pairs on each side laterad of the second lobe, etc.

30. *Lepidosaphes glaucae* Takahashi

Lepidosaphes glaucae Takahashi (1932, p. 47).

Adult female. Attaining 1.03 mm. in length and 0.42 mm. in width; body slender, only slightly broadened in abdominal region; free abdominal segments each but weakly produced laterally; pygidium rounded along its free margin. Cephalothorax membranous, abdominal region becoming sclerotized. Antennae with two setae. Anterior spiracles with two accompanying disc pores. A number of minute ducts scattered along lateral margins of mesothoracic region, laterad of posterior spiracles, and in a narrow transverse band between these spiracles; similar ducts occurring on dorsal surface of abdomen, few, absent in median and submedian areas of first abdominal segment, four to six on sixth on each side, two or three on seventh on each side, and a single one opened near base of second lobe. Submarginal tubercular gland spines occurring on first abdominal segment, seventeen to nineteen in number on each side; slender gland spines on the succeeding free segments, three single ones on each side of pygidium laterad of second lobe. Three lateral tubercles present on each side of abdomen, each bearing a minute duct and produced apically into a small, heavily sclerotized spur. Perivulvar pores in five groups, two or three pores in the median group, six to eight in the laterocephalics each, and four in the laterocaudals each. Median lobes prominent, much wider than long, broadly rounded apically, separated by about half the width of one of them, each with a pair of slender but distinct basal paraphyses. Second lobes well developed, the inner lobule similar in shape to median lobe, but smaller, with a pair of basal paraphyses, the outer lobule smaller than the inner one, but well developed, nearly as long as wide.

Second exuvium of female. Elongate, only weakly expanded in abdominal region, slightly narrowing anteriorly in cephalothoracic region, attaining 0.84 mm. in length and 0.38 mm. in width. Four single marginal macroducts present on each side of abdomen, belonging probably to the fourth to seventh segments. Submedian and submarginal dorsal ducts represented by very slender ones. Pygidial lobes similar to those of adult female, outer lobule of second lobe well represented, a little elongate. Basal paraphyses occurring on median lobes and inner lobules of second lobes.

L. & H.: Matuyama, Ehime-ken, Sikoku, on *Quercus glauca* (T. Tachikawa leg.).

This species was originally described from Formosa as a feeder of *Quercus glauca*. There are slight discrepancies between the present material and the original description, in which the antennae are provided with a single seta and many ducts are present in the lateral region of the prepygidial abdominal segments. In the examined specimens the antennae are provided with two setae and the dorsal ducts of the free abdominal segments are just as good as few. Furthermore, in the females at hand the median lobes are set somewhat more apart than those figured in the original description. As there is

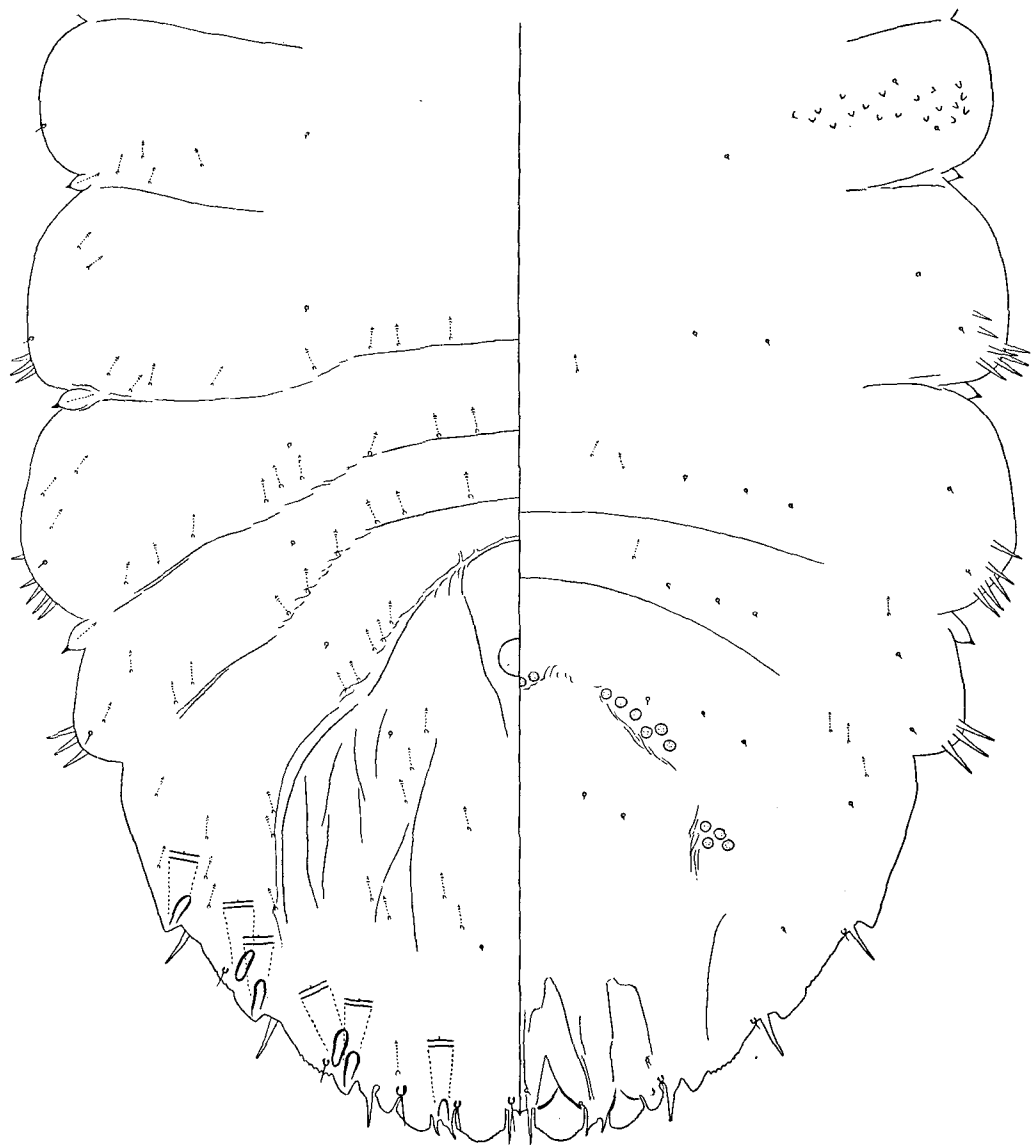


Fig. 8. *Lepidosaphes glaucae* Takahashi.
Adult female: abdomen.

in the other characters no serious difference I am inclined to believe that the present material may represent a mere variant of *L. glaucae*.

31. *Lepidosaphes euryae* (Kuwana)

Mytilaspis euryae Kuwana (1902, p. 80). *Lepidosaphes euryae* Ferris (1936, p. 7); Takahashi (1955 c, p. 72).

L. & H.: Hiko-San, Kyusyu, on *Eurya japonica*; Amami-Ôsima, on *Eurya emarginata*.

32. *Lepidosaphes okitsuensis* Kuwana

Lepidosaphes okitsuensis Kuwana (1925 a, p. 33); Takahashi (1955 c, p. 76).

L. & H.: Namerikawa, Toyama-ken, Honsyu, on *Abies* sp.; Hiko-San, Kyusyu, on *Torreya nucifera*.

In the shape of the body and the pygidial fringe this species resembles *L. euryae*, but it has small tubercular spines on the head and thickly sclerotized spurs on the abdomen like *L. tubulorum*.

33. *Lepidosaphes tubulorum* Ferris

Lepidosaphes tubulorum Ferris (1921 a, p. 216; 1953, p. 61); Kuwana (1925 a, p. 30); Takahashi (1955 e, p. 77).

L. & H.: Hokkaido (Horokanai; Abasiri; Bannaguro; Barato; Zenibako; Sapporo; Zyôzan-Kei; Yûbari; Tomakomai; Apoi), on *Betula* spp., *Cercidiphyllum japonicum*, *Fraxinus mandschurica* var. *japonica*, *Fraxinus Sieboldiana*, *Ligustrum Tschonoskii*, *Magnolia obovata*, *Populus Maximowiczii*, *Rosa rugosa*, *Sorbus* sp., *Syringa* sp., and *Vitis Coignetiae*; Awasuno, Toyama-ken, Honsyu, on *Camellia* sp.; Yamanasi-ken, Honsyu, on *Alnus* sp.; Kanagawa-ken, Honsyu, on *Hydrangea* sp.; Hiko-San, Kyusyu, on *Clethra barbinervis*, *Enkianthus* sp., *Helwingia japonica*, *Hydrangea* sp., and *Lindera* sp.; Amami-Ôsima, on *Quercus* sp.

There is at hand a single adult female collected at Yamanasi-ken, which belongs to the type form of this species, lacking small tubercular spines on the head. Another specimen is available from Amami-Ôsima; this agrees in every respect with the type form except for the fact that there are on the head numerous small tubercular spines.

There is through all the other examined specimens a remarkable feature—the presence of a thickly sclerotized submarginal projection on each side of the metathorax. This projection becomes at times rudimentary, being represented by a sclerotized patch of the derm, but is very usually a prominent, robust tubercle, which is mostly stump-like in shape and often bears minute pointed processes at the apex; it is rather rarely spur-like in shape like the metathoracic lateral spurs of *L. okitsuensis*. Whether this form is a distinct species or a mere variant of *L. tubulorum* can not be determined from the present information. However, there seems to be no very good reason for the positive separation of this form into a distinct species, there being nothing of the other characters particular to it, and for the present it may be best to consider that this form belongs to *L. tubulorum*. While in most of the specimens of this variant there are seen numerous small tubercular spines on the head, in a few ones these spines are entirely absent.

34. *Lepidosaphes buzenensis* (Kuwana)

Mytilaspis buzenensis Kuwana (1909, p. 155). *Lepidosaphes buzenensis* Kuwana (1931 b, p. 167).

This species was originally described from specimens collected at 'Buzen, Kiushiu, on vine,' and later recorded from Amami-Ôsima as a feeder of 'Ô-itabi'—*Ficus pumila*. There are at hand specimens collected in Amami-Ôsima on *Ficus pumila* by me and on '*Ficus foveolata*'(=*F. nipponica*) by Prof. R. Takahashi. They might be identified with the present species, but the original description is too brief to make possible the definite recognition. They also closely resemble *Lepidosaphes laterochitিনosa* Green, from which they differ by the median lobes much wider than long, separated by a space distinctly narrower than one of them, and lacking a marginal macroduct between them, and by the metathorax remaining entirely membraneous.

Key to the species

- 1. Submarginal tubercular gland spines present on metathorax, or if absent submarginal dorsal bosses present on abdomen or a thorn-like, thickly sclerotized projection (modified eye) present on each side of head. 2.
- Submarginal tubercular gland spines absent on metathorax; submarginal dorsal bosses absent on abdomen; eyes never modified into a thorn-like projection; dorsal ducts excessively small. . . . 18.
- 2. Dorsal ducts seven or less in number and arranged in a single submedian row on sixth abdominal segment on each side; submarginal dorsal bosses absent on abdomen; eyes never modified into a thorn-like projection. 3.
- Dorsal ducts slender, seven or more in number on sixth abdominal segment on each side; submarginal dorsal bosses present or absent on abdomen; a thorn-like, thickly sclerotized projection present or absent on each side of head. 10.
- 3. Three sharp, thickly sclerotized lateral spurs present on each side of abdomen, much broadened basally, the posterior two with an accompanying macroduct opened at the base. 4.
- Sharp, thickly sclerotized lateral spurs absent on abdomen; a slight marginal prominence present on fourth abdominal segment, but at times becoming indistinct; a similar prominence present or absent near anterior-lateral angle of third abdominal segment. 6.
- 4. Cephalothorax elongate, little narrowing anteriorly; thoracic region and first abdominal segment becoming heavily sclerotized dorsally at full maturity; dorsal macroducts arranged in an almost continuous, transverse band across third and fourth abdominal segments each, four to six macroducts in a longitudinal submedian row on sixth abdominal segment on each side, a small one just cephalad of second lobe; median lobes nearly as long as wide, separated by a space as wide as one of them. *L. gloverii*.
- Cephalothorax gradually narrowing anteriorly; thoracic region remaining membraneous, but abdominal segments becoming sclerotized at full maturity; submedian series of macroducts well defined on both sides, not extending mesad to make a continuous row on third and fourth abdominal segments each; two to four macroducts in a longitudinal submedian row on sixth abdominal segment on each side. 5.
- 5. Pygidium more or less rounded along its free margin; a submarginal duct occasionally seen just cephalad of second lobe but very often not discernible in this position. *L. yanagicola*.
- Pygidium trapezoidal, its apical margin being straight or even a little emarginate; a slender submarginal duct present just cephalad of second lobe. *L. corni*.
- 6. Pygidium rounded along its free margin; median lobes prominent, projecting, set close, being separated

- by a space much narrower than one of them; second lobes much reduced in size, the lobules each represented by a small, conical projection; basal paraphyses indiscernible on pygidial lobes; dorsal ducts slender, not occurring in median area on free abdominal segments, four to seven in a longitudinal row on sixth abdominal segment on each side, a single one present just cephalad of second lobe; a faint marginal prominence with an accompanying duct present on fourth abdominal segment, but at times becoming indistinct. *L. conchiformioides*.
- Pygidium more or less trapezoidal, its apical margin being straight or even a little emarginate; median lobes separated by a space as wide as or wider than one of them; second lobes well developed; basal paraphyses present on pygidial lobes. 7.
 - 7. Perivulvar pores in eight groups, three auxiliary groups being present cephalad of the usual five ones; median lobes rather small, separated by a space twice as wide as one of them; basal paraphyses present on median lobes and both lobules of second lobes; four to six dorsal macroducts in a longitudinal row on sixth abdominal segment on each side; a rather prominent, angular marginal process present on third and fourth abdominal segments each, with one or two accompanying macroducts. *L. pini*.
 - Perivulvar pores in five groups; median lobes separated by a space as wide as one of them. . . 8.
 - 8. Five to seven dorsal macroducts occurring in a longitudinal row on sixth abdominal segment on each side, a single one just cephalad of second lobe; basal paraphyses indiscernible on outer lobules of second lobes; a faint marginal prominence present on fourth abdominal segment, with one or two accompanying macroducts. *L. camelliae*.
 - Body slender, dorsal macroducts four or less in number on sixth abdominal segment on each side, absent cephalad of second lobes; basal paraphyses present on median lobes and both lobules of second lobes. 9.
 - 9. Median lobes moderately convex apically; second lobes with the inner lobule as wide as or very often a little wider than long, very flatly rounded apically, the outer lobule similar in shape to the inner one; submarginal macroducts mostly two or three, or very rarely one, on fifth abdominal segment on each side; a marginal prominence present on third and fourth abdominal segments each, with an accompanying macroduct, a very small lateral tubercle present between first and second. *L. japonica*.
 - Median lobes and both lobules of second lobes rather strongly convex apically, inner lobules of second lobes about as long as or very often longer than wide; submarginal macroducts one in number on fifth abdominal segment on each side; a marginal prominence present near anterior-lateral angle of third and fourth abdominal segments each, with an accompanying macroduct, but becoming often indistinct. *L. maskelli*.
 - 10. A erect, thickly sclerotized, thorn-like projection (modified eye) present on each side of head. . . 11.
 - Eyes never modified into a thorn-like projection. 13.
 - 11. Median lobes prominent, separated by a space distinctly narrower than one of them; second lobes small; basal paraphyses absent on pygidial lobes; nine to fifteen dorsal macroducts occurring in a longitudinal submedio-submarginal band on each side of pygidium, all these probably belonging to sixth abdominal segment, and a slightly larger one just cephalad of second lobe; three blunt lateral tubercles on each side of abdomen, becoming somewhat sclerotized, with an accompanying duct opened near the apex; tubercular gland spines numerous on metathorax and first abdominal segment. *L. kurwacola*.
 - Median lobes separated by a space as wide as or slightly wider than one of them; basal paraphyses present on pygidial lobes. 12.
 - 12. Body stout, expanded in abdominal region; eight to twenty-two dorsal macroducts occurring on each

- side of pygidium, all these probably belonging to sixth abdominal segment, a single one cephalad of second lobe; two to six tubercular gland spines present on mesothorax, four to thirteen on metathorax, nine to thirteen on first abdominal segment, and seven to nine on second; three lateral tubercles present on each side of abdomen, becoming somewhat sclerotized. *L. machili*.
- Body rather narrow, a little expanded in abdominal region, strongly constricted between metathorax and prosoma, the succeeding intersegmental notches also very distinct; sixteen to twenty dorsal macroducts present on each side of pygidium, these belonging probably to sixth and seventh abdominal segments; tubercular gland spines few in number; three lateral tubercles present on each side of abdomen, elongate, pointed apically, becoming somewhat sclerotized, with an accompanying duct opened at the base. *L. pseudotsugae*.
13. A faint marginal prominence present near anterior-lateral angle of fourth abdominal segment, but no other distinct lateral projections; ventral ducts in a narrow transverse band across metathorax; a number of dorsal ducts in a longitudinal submedio-submarginal band on sixth abdominal segment on each side; free abdominal segments each strongly produced laterally; a submarginal dorsal boss present on first, second, fourth, and sixth abdominal segments each, two similar dorsal bosses present on each side of cephalothorax, appressed together; median lobes separated by a space much narrower than one of them, second lobes well developed. *L. beckii*.
- Three intersegmental lateral projections present on each side of abdomen. 14.
14. Pygidium rather trapezoidal; median lobes rather small, nearly as long as wide, separated by a space more or less narrower than one of them. 15.
- Pygidium broad, not trapezoidal; median lobes prominent, broader than long, separated by a space distinctly narrower than one of them. 16.
15. Body slender, free abdominal segments each more or less strongly produced laterally; ventral ducts absent between posterior spiracles; seven to ten dorsal ducts occurring in a narrow longitudinal band on sixth abdominal segment on each side, a single one cephalad of second lobe; three lateral tubercles remaining membranous, each with a few accompanying ducts; a submarginal dorsal boss present on fourth abdominal segment. *L. kamakurensis*.
- Free abdominal segments strongly produced laterally each into a membranous lobe; ventral ducts present between posterior spiracles in a transverse band; ten to sixteen dorsal ducts occurring in a narrow longitudinal band on sixth abdominal segment on each side, a single one just cephalad of second lobe. *L. abdominalis* sp. nov.
16. A longitudinal band of eight to twenty-two dorsal ducts present on seventh abdominal segment on each side, extending anteriorly to the position opposite vulvar opening and posteriorly to base of second lobe. *L. salicina*.
- A longitudinal band of dorsal ducts absent on seventh abdominal segment on each side, but a few dorsal ducts present just cephalad of second lobe. 17.
17. A few submarginal gland spines present caudad of posterior spiracles each; ventral ducts present in a narrow transverse band between posterior spiracles; numerous dorsal ducts occurring in a longitudinal submedio-submarginal band on sixth abdominal segment on each side, a few ones just cephalad of second lobe and also of inner basal angle of median lobe; a submarginal dorsal boss often seen on third to sixth abdominal segments each; three intersegmental lateral tubercles present on each side of abdomen, each bearing a few ducts and produced into an elongate, sharp, sclerotized spur. *L. ulmi*.
- Tubercular gland spines absent on metathorax; ventral ducts sparsely scattered between posterior spiracles; numerous dorsal ducts occurring in a longitudinal submedio-submarginal band on sixth abdominal segment on each side, a few ones cephalad of second lobe; a submarginal dorsal boss

- present on first to sixth abdominal segments each; three intersegmental lateral tubercles present on each side of abdomen, each bearing a few ducts and produced into an elongate, sharp, sclerotized spur. *L. celtis*.
18. Body slender, only slightly broadened in abdominal region, free abdominal segments each but weakly produced laterally; two or three intersegmental lateral tubercles present on each side of abdomen, produced into small, thickly sclerotized spurs or remaining membranous. 19.
- Body stout, free abdominal segments each strongly or moderately produced laterally; three prominent, thick, sclerotized spurs present on each side of abdomen, or if absent a lateral tubercle bearing a minute duct occurring between first and second abdominal segments and also between second and third and a rather faint marginal prominence with an accompanying minute duct present on fourth. 21.
19. Median lobes prominent, much wider than long, separated by about half the width of one of them; inner lobules of second lobes distinctly wider than long; three single marginal gland spines on each side of pygidium laterad of second lobe. *L. glaucae*.
- Median lobes as wide as or slightly wider than long, separated by a space somewhat wider or a little narrower than one of them; marginal gland spines occurring in three pairs on each side of pygidium laterad of second lobe. 20.
20. Numerous minute, sclerotized granules thickly strewn on head cephalad of mouth-parts; three intersegmental lateral tubercles present on each side of abdomen, produced into heavily sclerotized spurs; median lobes nearly as long as wide, separated by a space somewhat wider than one of them. *L. piniphilus*.
- Minute granules lacking on head; an intersegmental lateral tubercle occurring between first and second abdominal segments and also between second and third, neither of these tubercles produced into a sclerotized spur, a low marginal prominence present on fourth abdominal segment, with an accompanying minute duct; median lobes slightly wider than long, separated by a space a little narrower than one of them. *L. smilacis* sp. nov.
21. Free abdominal segments each strongly produced laterally; thickly sclerotized lateral spurs absent on abdomen, a lateral tubercle bearing a minute duct occurring between first and second abdominal segments and also between second and third, and a rather faint marginal prominence with an accompanying minute duct present on fourth; a thickly sclerotized submarginal projection absent on metathorax; small tubercular spines absent on head; median lobes rather small, separated by a space nearly as wide as one of them; slender basal paraphyses present on median lobes and inner lobules of second lobes. *L. euryae*.
- Three thickly sclerotized lateral spurs present on each side of abdomen; a thickly sclerotized submarginal projection present or absent on metathorax, if present spur-like or stump-like in shape. 22.
22. Free abdominal segments each strongly produced laterally; many small tubercular spines present on head; three thickly sclerotized lateral spurs present on each side of abdomen, prominent, elongate, a similar but much smaller submarginal spur on metathorax; median lobes rather small, separated by a space somewhat narrower than one of them; slender basal paraphyses occurring on median lobes and inner lobules of second lobes. *L. okitsuensis*.
- Free abdominal segments each moderately convex laterally; many small tubercular spines very often occurring on head; three thickly sclerotized spurs present on each side of abdomen; a thickly sclerotized, robust submarginal projection present or absent on metathorax, if present mostly stump-like in shape; median lobes prominent, separated by a space much narrower than one of them; basal paraphyses not discernible on pygidial lobes. *L. tubulorum*.

VIII. Genus *Andaspis* MacGillivray

Andaspis MacGillivray (1921, p. 275); Rao et Ferris (1952); Balachowsky (1954 e, p. 130).

Type: *Mytilaspis flava* var. *hawaiiensis* Maskell.

After Rao and Ferris this genus is an Oriental one, its members being centred in south-eastern Asia. In Japan *A. crawii*, *Lepidosaphes kashicola* Takahashi, and *A. naracola* (sp. nov.) are recognized as members of the genus.

The first stage larva of this genus is characterized by having at the posterior apex a pair of enlarged lobes, which are similar in shape to those of the adult female.

35. *Andaspis crawii* (Cockerell)

Mytilaspis crawii Cockerell (1896 h, p. 21). *Lepidosaphes crawii* Kuwana (1925 a, p. 15). *Andaspis crawii* Rao et Ferris (1952, p. 18).

L. & H.: Idu-Ôsima; Amami-Ôsima. On *Castanopsis cuspidata*.

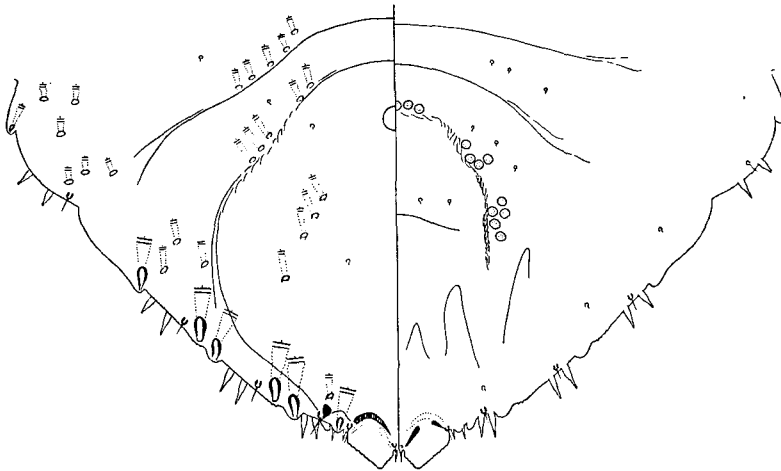


Fig. 9. *Andaspis kashicola* (Takahashi).

Adult female: pygidium, figured from fully matured specimens.

36. *Andaspis kashicola* (Takahashi) comb. nov.

Lepidosaphes kashicola Takahashi (1957, Transactions of the Shikoku Entomological Society, Vol. 5, Pars 7, p. 109).

Adult female. Body elongate, about three times as long as wide at full maturity, attaining 1.54 mm. in length. Antennae with two setae. Several ventral microducts scattered along head margin. Anterior spiracles with one or two accompanying disc pores. Several macroducts occurring in each posterior-lateral angle of mesothorax, rather numerous ones on metathorax laterad of posterior spiracles, rather few ones along lateral margins of free abdominal segments, a few submarginal ones on fifth abdominal segment, and a single submarginal one just cephalad of second lobe; submedian macroducts on third to sixth abdominal segments, two to four in number on the sixth segment on each side. Marginal macroducts of pygidium six in number on each side. Two to four tubercular

gland spines occurring laterocaudad of posterior spiracles each, six to ten similar submarginal ones on first abdominal segment, four or five slightly elongate ones on second, a few rather short and robust marginal ones on the succeeding free segments each, similar ones on pygidium in three pairs on each side laterad of second lobe and in a pair between median lobes and also between median and second. A blunt lateral tubercle near anterior-lateral angle of third and fourth abdominal segments each, bearing a macroduct. Anus close to base of pygidium. Perivulvar pores in five groups. Median lobes robust, set close, each with a pair of slender paraphyses occurring from the basal angles and a curved, sclerotized bar laid transversely on the base. Second lobes present, unilobed, the outer lobule being obsolete.

L. & H. : Toyama, Honsyu, on *Castanea crenata* ; Yamanasi-ken, Honsyu, on *Alnus* sp. ; Ôsaka, Honsyu, on *Quercus glauca* (R. Takahashi leg.).

There have been examined many immature adult females collected on *Quercus* at Ôsaka and determined by Prof. R. Takahashi as belonging to *Lepidosaphes kashicola*. In some of them the median lobes are nearly of the form described in the original description and are similar to those in *Lepidosaphes*; in some others, however, these lobes more or less develop into the shape characteristic of *Andaspis*. There have been also available some fully matured adult females taken at Toyama on *Castanea*. In these specimens there is nothing distinct from the material from Ôsaka except that the median lobes are of the particular shape of *Andaspis*. The first stage female is, as in the other two Japanese species of the genus, provided at the posterior extremity with a pair of enlarged lobes.

This species is here referred to *Andaspis*. It resembles *Andaspis antidesmae* Rao and *Lepidosaphes* (?) *mackieana* McKenzie, but may be distinguishable from the two by the second lobes unilobed, by having lateral tubercles on the third and fourth abdominal segments, etc.

37. *Andaspis naracola* sp. nov.

Adult female. Body elongate, attaining 1.02 mm. in length and 0.48 mm. in width. Many minute conical spines scattered on head. Some microducts scattered around and between antennae. Antennae set apart, with a rather prominent seta and two very fine setae. Anterior spiracles with one or two accompanying disc pores. Excessively minute ducts scattered along lateral margins of mesothorax, laterad of posterior spiracles, and along lateral margins of free abdominal segments, a few submarginal ones on fifth abdominal segment; similar submedian dorsal ducts on second to fifth abdominal segments and pygidium, the pygidial ones few, six to ten in number on each side, belonging to sixth and seventh abdominal segments. Marginal macroducts of pygidium six in number on each side. Gland spines absent on metathorax, numerous tubercular submarginal ones present on first abdominal segment, several elongate marginal ones on the succeeding free segments each, similar ones in three pairs on each side of pygidium laterad of second lobe, a pair of very small gland spines between median lobes and also between median and second. Three small, sharp, thickly sclerotized spurs on each side of abdomen: one

between first and second segments and one near anterior-lateral angle of third and fourth each. Anus close to base of pygidium. Perivulvar pores in five groups, three pores in the median group, six to nine in the laterocephalics each, and three or four in the laterocaudals each. Median lobes prominent, rounded apically, each with a robust, elongate, longitudinal paraphysis extending into pygidium from the middle basal part. Second lobes present, the inner lobule well developed, the outer lobule represented by a slight prominence or practically obsolete.

Second exuvium of female. Attaining 0.69 mm. in length and 0.47 mm. in width. Elongate, fusiform, very flatly rounded along the anterior extremity. Four single marginal macroducts present on each side of abdomen, belonging probably to the fourth to seventh segments. Dorsal ducts represented by very minute ones.

Scale. In female elongate, moderately convex dorsally, and dark brown.

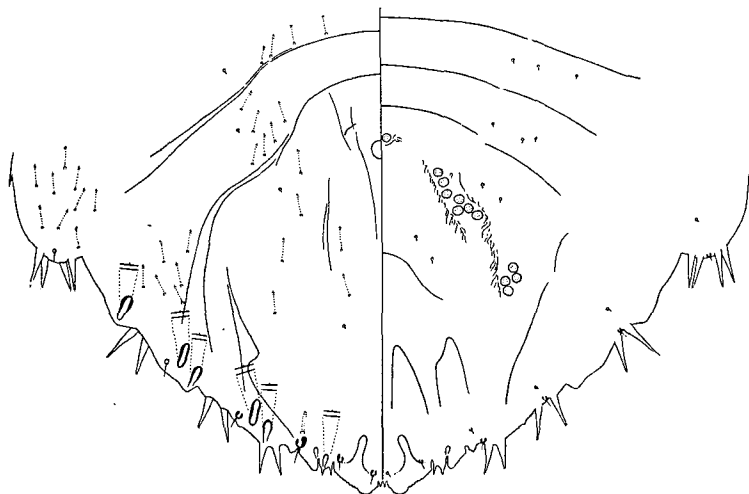


Fig. 10. *Andaspis naracola* sp. nov.
Adult female: pygidium.

L. & H.: Hukuoka, Kyusyu, on *Quercus serrata* (30. V, 1957).

This species is similar to *Andaspis micropori* Borchsenius from China, the dorsal ducts being represented by very minute ones, but may be distinguishable from the latter by lacking ventral ducts between the posterior spiracles, by having lateral spurs on the abdomen, by the second lobes well represented, etc.

Key to the species

1. Marginal macroducts of pygidium five in number on each side; pygidium without dorsal ducts, or with one or two small submedian dorsal macroducts in the bottom on each side; marginal gland spines occurring singly on pygidium laterad of second lobes; median lobes each with a pair of slender paraphyses occurring from the basal angles and a curved, sclerotized bar laid transversely on the base; second lobes with the outer lobule small but apparently seen. *A. crawii*.
- Marginal macroducts of pygidium six in number on each side. 2.
2. Two to four submedian dorsal macroducts on each side of pygidium, belonging to sixth abdominal

- segment; a submarginal macroduct just cephalad of second lobe. *A. kashicola*.
 - Six to ten excessively minute ducts present on each side of pygidium, belonging to sixth and seventh abdominal segments. *A. naracola* sp. nov.

IX. Genus *Acanthomytilus* Borchsenius

Acanthomytilus Borchsenius (1947 a, p. 344); Balachowsky (1954 e, p. 104).

Type: *Lepidosaphes intermittens* Hall.

This genus is composed of several species occurring on Gramineous plants in the Old World, and is represented in Japan by the following two species.

38. *Acanthomytilus imperatae* (Kuwana)

Lepidosaphes imperatae Kuwana (1931 b, p. 170); Takahashi (1933, p. 47).

Adult female. Body elongate, fusiform, attaining 1.50 mm. in length and 0.48 mm. in width; prosoma elongate, occupying about half the length of total body at full maturity; free abdominal segments each little produced laterally; pygidium approximately triangular and well sclerotized. Antennae set apart, with two slender setae. Anterior spiracles with three to five accompanying disc pores. About twenty small macroducts occurring along each lateral margin of mesothorax, many laterad of posterior spiracles and in a transverse band across metathorax; abundant similar dorsal ducts on abdomen, sixth abdominal segment with eight ducts arranged in a longitudinal submedio-submarginal row and one or two submarginal ducts just laterad of the row on each side, seventh with one to five on each side. Marginal macroducts of pygidium thickly sclerotized around the orifice, five on each side. Gland spines absent in thoracic region, several tubercular submarginal ones on first abdominal segment, slightly elongate ones on the succeeding free segments, and a few similar marginal ones on fifth and sixth abdominal segments each; a pair of very slender, elongate marginal gland spines present between median lobes, between median and second, and laterad of second. Two lateral tubercles present on each side of abdomen, bearing a duct: one between second and third segments and one between third and fourth. Anus close to base of pygidium, rounded. Perivulvar pores in five groups. Median lobes separated by a space a little wider than one of them, parallel, approximately as long as wide, rounded apically, with a small marginal protuberance between them, each with a pair of slender basal paraphyses, the inner paraphysis bearing a branch extending mesad. Second lobes projecting, bilobulate, the inner lobule similar to, but smaller than, median lobe, the outer lobule much smaller and more or less conical. Third lobes practically obsolete.

L. & H.: Amami-Ôsima, on *Miscanthus* sp.

This species was originally described from Amami-Ôsima as a feeder of *Imperata*. Takahashi recorded it from Formosa.

39. *Acanthomytilus miscanthi* Takahashi

Acanthomytilus miscanthi Takahashi (1956, Annotationes Zoologicae Japonenses, Vol. 29, No. 1, p. 58).

L. & H.: Types, Tukumi, Ôita-ken, Kyusyu, on *Miscanthus sinensis* (T. Tachikawa leg.).

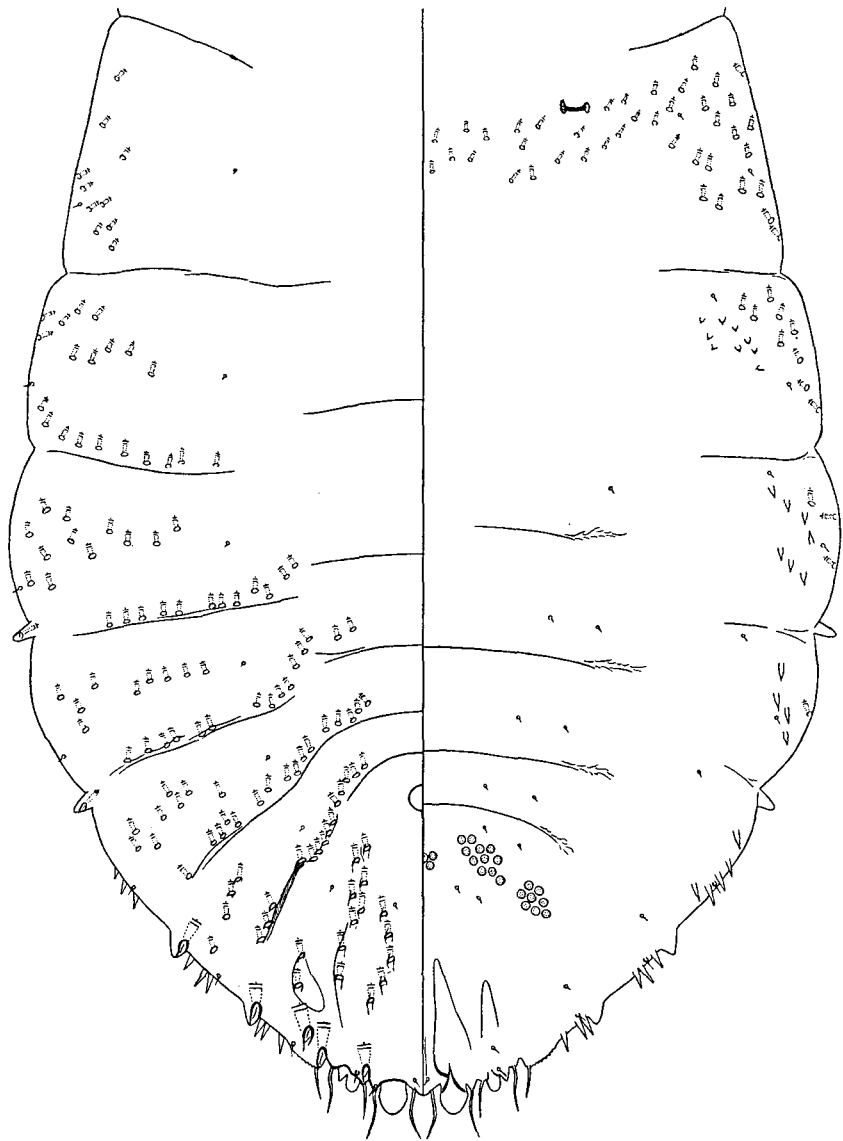


Fig. 11. *Acanthomytilus imperatae* (Kuwana).
Adult female: postsoma.

Key to the species

1. A few marginal gland spines present on fifth and sixth abdominal segments each; a small marginal protuberance present between median lobes; second lobes distinctly projecting beyond pygidial margin; dorsal macroducts abundant, those of first abdominal segment extending mesad into the submarginal region. *A. imperatae*.
- Marginal gland spines absent on fifth and sixth abdominal segments; a marginal protuberance absent between median lobes; inner lobule of second lobe scarcely projecting beyond the marginal prominence which is associated with the marginal macroduct of the seventh abdominal segment; dorsal macroducts not numerous in each series, those of first abdominal segment occurring only along the lateral margins. *A. miscanthi*.

X. Genus *Pallulaspis* Ferris

Pallulaspis Ferris (1937, SI-82); Balachowsky (1954 e, p. 114).

Type: *Pallulaspis ephedrae* Ferris.

This peculiar genus is represented at present by the type species occurring in California and two others in the Old World.

40. *Pallulaspis quercus* Takahashi

Pallulaspis quercus Takahashi (1957, Transactions of the Shikoku Entomological Society, Vol. 5, Pars 7, p. 107).

L. & H.: Paratype, Ôsaka, Honsyu, on *Quercus glauca* (R. Takahashi leg.).

—To be continued—