



Title	A contribution to the knowledge of the Diaspidini of Japan (Homoptera : Coccoidea) Part 2
Author(s)	Takagi, Sadao
Citation	Insecta matsumurana, 24(1), 4-42
Issue Date	1961-03
Doc URL	http://hdl.handle.net/2115/9669
Type	bulletin (article)
File Information	24(1)_p4-42.pdf



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A CONTRIBUTION TO THE KNOWLEDGE OF THE DIASPIDINI OF JAPAN

(HOMOPTERA: COCCOIDEA)

Part II*

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Phenacaspis group

This group is characterized by the second lobes primarily divided into lobules, by the marginal macroducts of the pygidium not particularly enlarged, and, so far as represented by the Japanese members, by lacking a pair of gland spines between the median lobes. In *Kurvanaspis* and *Nikkoaspis* one or two fimbriate processes occur between the median lobes, and in *Takahashiaspis* there is between the lobes a pair of short spines, but these processes or spines are apparently devoid of microducts.

After carefully examining the first stage in most of the species included in this group I am convinced that the *Phenacaspis* group differs from the *Lepidosaphes* group by having five-segmented antennae. In a few species the number of the antennal segments can not distinctly be determined owing to the presence of deep infrasegmental constrictions, but may very possibly be five. In most of the species examined there is on the head a pair of enlarged dorsal ducts; these are not seen in certain species, and their presence and absence occur even in the same genus.

The genera *Kurvanaspis*, *Nikkoaspis*, and *Unachionaspis* are the same in the fact that the first stage larva lacks any sclerotized or fimbriate processes at the posterior extremity and there is merely between the apical setae a pair of sharp, strongly divergent spines. These genera, which are composed of bamboo-infesting species occurring in Far East, may belong to a common phylogenetic stock, forming a distinct subdivision in the group. So far as represented by a single species which occurs in Japan, the first stage female of *Greenaspis* is peculiar by having very prominent setae around the body as in *Thysanofiorinia* Balachowsky. There is at the posterior extremity of the body, laterad of the apical setae, a pair of bilobulate, narrow, apically divided processes.

In the other genera of the group occurring in Japan the first stage larva is provided at the posterior extremity with two pairs of processes or lobes, the inner pair being bilobulate, with the mesal lobule more or less sclerotized and tricuspid.

* Part I: Insecta Matsumurana, Vol. 23, No. 2, pp. 67-100, December, 1960.

[Insecta Matsumurana, Vol. 24, No. 1, March, 1961]

XI. Genus *Kuwanaspis* MacGillivray

Kuwanaspis MacGillivray (1921, p. 311); Ferris (1941 d, SIII-287); Balachowsky (1954 e, p. 264).

Tsukushiaspis Kuwana (1928, p. 30). *Lepidosaphoides* Lindinger (1930, p. 106).

Type: *Chionaspis hikosani* Kuwana.

The members of this genus feed on Gramineous plants, especially on various bamboos, being distinctly centred in eastern Asia with an extreme concentration in Formosa. In Japan the genus is represented by the following three species.

41. *Kuwanaspis hikosani* (Kuwana)

Chionaspis hikosani Kuwana (1902, p. 76). *Tsukushiaspis hikosani* Kuwana (1928, p. 33). *Kuwanaspis hikosani* Ferris (1936 a, fig. 46). *Kuwanaspis hikosani* var. *hongkongensis* Takahashi (1942, p. 66).

L. & H.: Sado; Tokyo (R. Takahashi leg.); Miura-Hantô, Kanagawa-ken, Honsyu (S. Kanda leg.); Amagi-san, Sizuoka-ken, Honsyu; Ôsaka, Honsyu (R. Takahashi leg.); Hiko-San, Kyusyu. On various bamboos including *Sasa*.

Of the examined specimens but few ones agree in the shape of the pygidial lobes with the figures presented by Kuwana and Ferris, having the lobes entire and pointed apically. The lobes are, in reality, somewhat variable in shape: in most specimens they are often distinctly notched once on one or either side and not sharply but bluntly pointed or even rounded apically. These individuals may represent 'var. *hongkongensis*.'

42. *Kuwanaspis pseudoleucaspis* (Kuwana)

Leucaspis bambusae Kuwana (1902, p. 74). *Chionaspis pseudoleucaspis* Kuwana (1923 c, p. 323) (nec *Chionaspis bambusae* Cockerell). *Tsukushiaspis pseudoleucaspis* Kuwana (1928, p. 31). *Kuwanaspis pseudoleucaspis* Ferris (1941 d, SIII-288); Balachowsky (1954 e, p. 267).

L. & H.: Sado; Namerikawa, Toyama-ken, Honsyu. On bamboo.

43. *Kuwanaspis takahashii* sp. nov.

Adult female. Body enormously elongate owing to the prolongation of the thoracic region, attaining about nine times as long as wide, 1.98 mm. in length at maximum; derm remaining membranous; cephalothorax scarcely narrowing anteriorly; free abdominal segments each little convex laterally; pygidium narrow and rounded apically. Antennae with two slender setae. Anterior spiracles each with a few accompanying disc pores. Dorsal macroducts with the orifice oval and surrounded by a sclerotized rim, occurring along lateral margins of free abdominal segments, extending mesad in an almost continuous, transverse row on third and fourth abdominal segments each, pygidium with about thirty dorsal macroducts on each side mostly arranged in three segmental rows. A few submarginal tubercular gland spines present on first and second abdominal segments each, an elongate marginal one on third and fourth each, pygidium with four single spines on each side. Perivulvar pores absent. Anus circular, moderate in size, situated near base of pygidium. Median lobes prominent, set apart, parallel or slightly divergent, somewhat elongate, deeply notched once on either side, rounded apically, with a pair of slender basal paraphyses. Second lobes distinctly divergent, bilobulate, both

lobules being similar in shape and size to median lobes, with basal paraphyses. Fimbriate marginal processes well represented on pygidium, a narrow one between median lobes, a very broad one between median and second lobes, and laterad of the second lobe there are seven ones which become smaller anteriorly.

Second exuvium of female. Very elongate, attaining 1.00 mm. in length and 0.18 mm. in width. A marginal macroduct between median lobes. Submedian macroducts absent.



Fig. 12. *Kuwanaspis takahashii* sp. nov.
Adult female: pygidium.

Scale. In female elongate, slender, convex dorsally, and white in colour.

L. & H.: Siro-Yama, Kagosima, Kyusyu, on an undetermined bamboo (12. V, 1957).

This species is named in honour of Prof. R. Takahashi, who has described many species of the genus. It may closely resemble *Kuwanaspis bambusifoliae* (Takahashi), from which it may be distinguishable by the absence of perivulvar pores and by the less

numerous macroducts of the pygidium. It may differ from *Kuwanaspis vermiformis* (Takahashi) and *Kuwanaspis phragmitis* (Takahashi) by the absence of perivulvar pores, by the pygidial lobes more produced, and by having a single fimbriate process between the median lobes. It may be distinct from *Kuwanaspis neolinearis* (Takahashi) by the pygidial lobes deeply notched, by having more numerous macroducts on the pygidium, by having a single fimbriate process between the median lobes, etc.

Key to the species

1. Perivulvar pores absent. Second stage female with a marginal macroduct between median lobes. *K. takahashii* sp. nov.
- Perivulvar pores present. Second stage female without a marginal macroduct between median lobes. . 2.
2. Body elongate, attaining about 6.5 times as long as wide at maximum, slightly fusiform or the lateral sides almost parallel through thorax and abdomen; dorsal macroducts rather few; perivulvar pores in five groups, few, one or two pores in the median group, two or three in the laterocephalics each, and two to five in the laterocaudals each; pygidial lobes narrow, distinctly longer than wide, notched once on one or either side and rather rounded apically, or entire and pointed apically; second lobes bilobulate. *K. hikosani*.
- Body fusiform, attaining about 3.5 times as long as wide at maximum; perivulvar pores in five groups, three to seven pores in the median group, five to fourteen in the laterocephalics each, and four to thirteen in the laterocaudals each; lobes almost as long as wide, notched once or twice on each side, rounded apically; second lobes bilobulate. *K. pseudoleucaspis*.

XII. Genus *Nikkoaspis* Kuwana

Nikkoaspis Kuwana (1928, p. 37). *Tsukushiaspis* Takahashi (1934, p. 15) (partim).

Type: *Nikkoaspis shiranensis* Kuwana.

Adult female. Body elongate-pyriform, gradually narrowing anteriorly in prosoma, broadly expanded in abdominal region; pygidium rather small, broad. Dorsal macroducts small, with the orifice oval and surrounded by a slender, sclerotized rim, thickly strewn in lateral region on free abdominal segments, extending mesad mostly along caudal margin of the segments each, pygidium with a number of macroducts scattered; macroducts occurring along pygidial margin without associated marginal prominences. Anus situated towards base of pygidium. Perivulvar pores in five groups. Lobes in two pairs, median lobes widely separated, unilobed or bilobulate, second lobes divided into two to four lobules, all the lobules of both pairs are equal in size, rather small and elongate, often with a subapical notch on one or either side. Two fimbriate marginal processes occurring between median lobes, one or two between median and second, and numerous ones laterad of second lobe, extending anteriorly in a continuous series into prepygidial region of abdomen. Simple marginal gland spines arising irregularly on abdomen, being mingled with fimbriate marginal processes, but never occurring between median lobes, one always present laterad of median lobe and one or two laterad of second. Submarginal gland spines absent on thorax and free abdominal segments.

First stage female. It has been not possible to determine distinctly the number of the antennal segments owing to the presence of infrasegmental constrictions. However,

it is the opinion here adopted that the antennae are five-segmented and each of the second to fourth segments bears a rather deep infrasegmental constriction. Terminal antennal segment nearly as long as the preceding segments united, and annulate. A pair of dorsal ducts present on head. The posterior extremity of the body is slightly emarginate, lacks any lobe-like processes, and is provided with a pair of sharp, strongly divergent spines between the apical setae. Exuvium somewhat elongate.

As stated by Takahashi this genus comes closest to *Kuwanaspis* (= *Tsukushiaspis*). It is, however, regarded here as a distinct genus because of the peculiar body shape and the abundant dorsal macroducts. In addition to the type species, two other species, *Tsukushiaspis hichiseisana* Takahashi from Formosa and *Tsukushiaspis sasae* Takahashi from Chekiang, China, should be referred to this genus.

44. *Nikkoaspis shiranensis* Kuwana

Nikkoaspis shiranensis Kuwana (1928, p. 38).

Adult female. Body remaining membraneous except for small sclerotized areas of pygidium. Antennae set apart, with a long seta and a slender, short one. Anterior spiracles each with ten to twenty-two disc pores in a close cluster. Perivulvar pores numerous. Median lobes usually unilobed, conical, bluntly pointed or very narrowly rounded apically. Second lobes usually bilobulate, each lobule similar in shape and size to median lobe. Fimbriate marginal processes extending anteriorly as far as first or second abdominal segment.

L. & H.: Sapporo, Hokkaido; Iwaki-yama, Aomori-ken, Honsyu; Akakura, Niigata-ken, Honsyu (S. Kanda leg.); Adatara-yama, Hukusima-ken, Honsyu; Awasuno, Toyama-ken, Honsyu; Koma-ga-Dake, Hakone, Honsyu (S. Kanda leg.); Rokkô, Kôbe, Honsyu (R. Takahashi leg.); Hiko-San, Kyusyu. On *Sasa* spp.

This species was originally described from Nikkô, central Honsyu. Siraiwa (1939, p. 7) recorded it from Saghalien.

The abundant specimens at hand are somewhat variable in the shape of the body, the number of the dorsal macroducts, and the fimbriate marginal processes. In particular most of those from Hiko-San are characterized by the body somewhat narrower, by having less numerous dorsal macroducts both on the pygidium and on the free abdominal segments, and by the fimbriate marginal processes which tend to become rudimentary in the prepygidial region of the abdomen.

XIII. Genus *Unachionaspis* MacGillivray

Unachionaspis MacGillivray (1921, p. 307).

Type: *Chionaspis colemani* Kuwana = *Fiorinia signata* Maskell.

Adult female. Body elongate, fusiform; pygidium rounded along its free margin; free abdominal segments each scarcely or rather weakly produced laterally. Antennae set apart, normally with a single seta. Dorsal macroducts moderate in size, distinctly divided into submedian and submarginal series on free abdominal segments, similarly divided or almost scattered on pygidium. Marginal macroducts of pygidium thickly

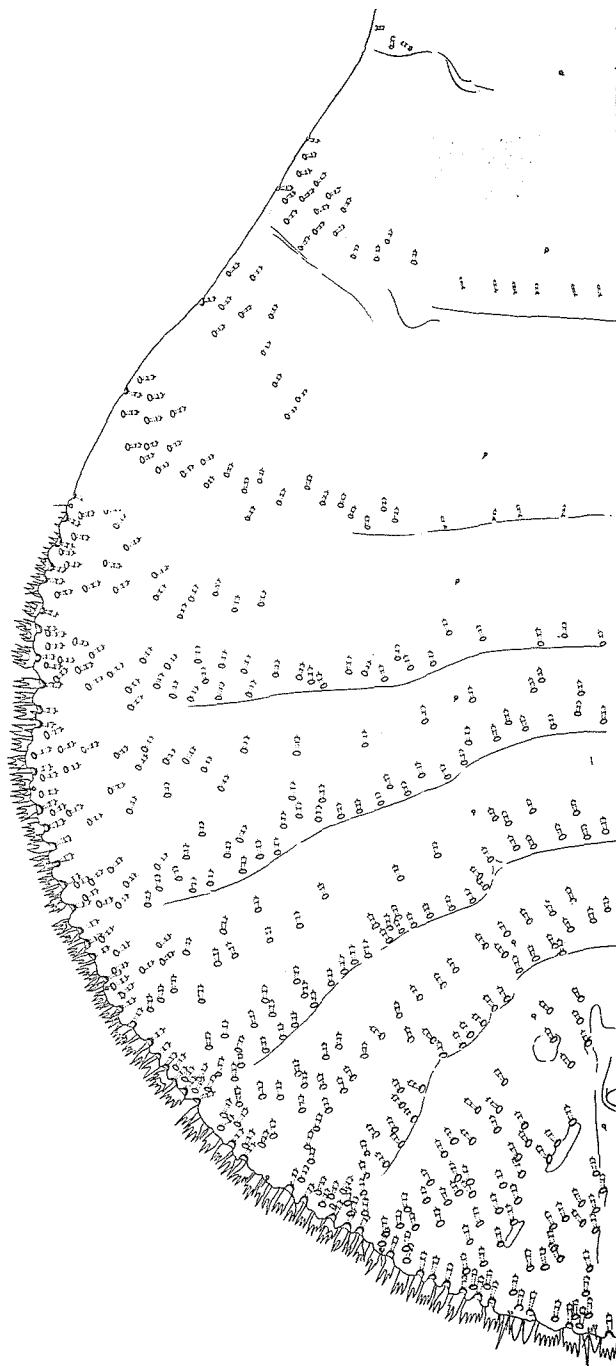


Fig. 13. *Nikkoaspis shiranensis* Kuwana.
Adult female: postsoma.

sclerotized around the orifice, absent between median lobes. Anus rounded, moderate in size, situated towards base of pygidium. Perivulvar pores in five groups. Pygidial lobes represented by very small, more or less conical projections; median lobes non-zygotic, widely separated; second lobes bilobulate, the lobules similar in shape and size to median lobes; third lobes absent. Marginal gland spines of pygidium slender, elongate, absent between median lobes.

First stage female (exuvium). Oval. Antennae five-segmented; third segment annulate and slightly longer than each of the second and fourth; terminal segment annulate and elongate, somewhat longer than the preceding ones united. A pair of dorsal ducts present or absent on head. Posterior extremity of body without any sclerotized lobe-like processes; a pair of sharp, strongly divergent spines between apical setae.

MacGillivray, at the erection of the genus, transferred to *Unachionaspis* five species from *Chionaspis*, but, judging from the literature, this composition may be an unnatural aggregation of unrelated species. As at present understood this genus is composed of three species which occur in Japan on *Sasa* or other bamboos, viz., *U. signata*, *U. bambusae*, and *U. tenuis*, all these having been inadequately described. The first species differs from the others by that the first stage larva lacks a pair of dorsal ducts on the head. However, there are in the succeeding two stages of the female no very particular differences sufficient to recognize this division. This genus shares with *Kuwanaspis* and *Nikkoaspis* the character that the first stage larva lacks any sclerotized or fimbriate processes at the posterior extremity of the body, and it may very possibly be closely related to the two, although it is fairly distinct in the adult female.

45. *Unachionaspis signata* (Maskell)

Fiorinia signata Maskell (1897 a, p. 242). *Chionaspis signata* Kuwana (1928, p. 19). *Chionaspis colemani* Kuwana (1902, p. 77). *Unachionaspis colemani* MacGillivray (1921, p. 337).

Adult female. Body broadest across first abdominal segment, rather abruptly narrowing anteriorly on prosoma, free abdominal segments each but weakly produced laterally. Anterior spiracles each with several accompanying disc pores; posterior spiracles each with but few pores. Submarginal dorsal macroducts present anteriorly as far as second abdominal segment, scattered along free margin of pygidium; submedian dorsal macroducts present on second to sixth abdominal segments; smaller macroducts scattered along lateral margins of meso- and metathorax and first to third abdominal segments. Rather numerous submarginal gland spines occurring on meso- and metathorax, several ones on free abdominal segments each. Median lobes and both lobules of second lobes conical or nearly so, sometimes entire, and pointed or narrowly rounded apically, sometimes distinctly incised, sometimes becoming wider and dentate apically.

L. & H.: Hokkaido (Horokanai; Yûbari) and Kyusyu (Hiko-San; Kirisima-yama, R. Takahashi leg.) on *Sasa* spp.

In the adult females at hand collected in Hokkaido the submarginal macroducts scattered along the pygidial margin are generally less numerous than in those from Kyusyu. Also, while all the examined exuvia of the second stage female from Hokkaido are

provided on each side of the third abdominal segment with two or three submarginal macroducts which are as large as those occurring on succeeding segments, those from Kyusyu always lack such ducts. However, no other particular difference has been seen, and it seems that nothing more than variation is involved in the present material.

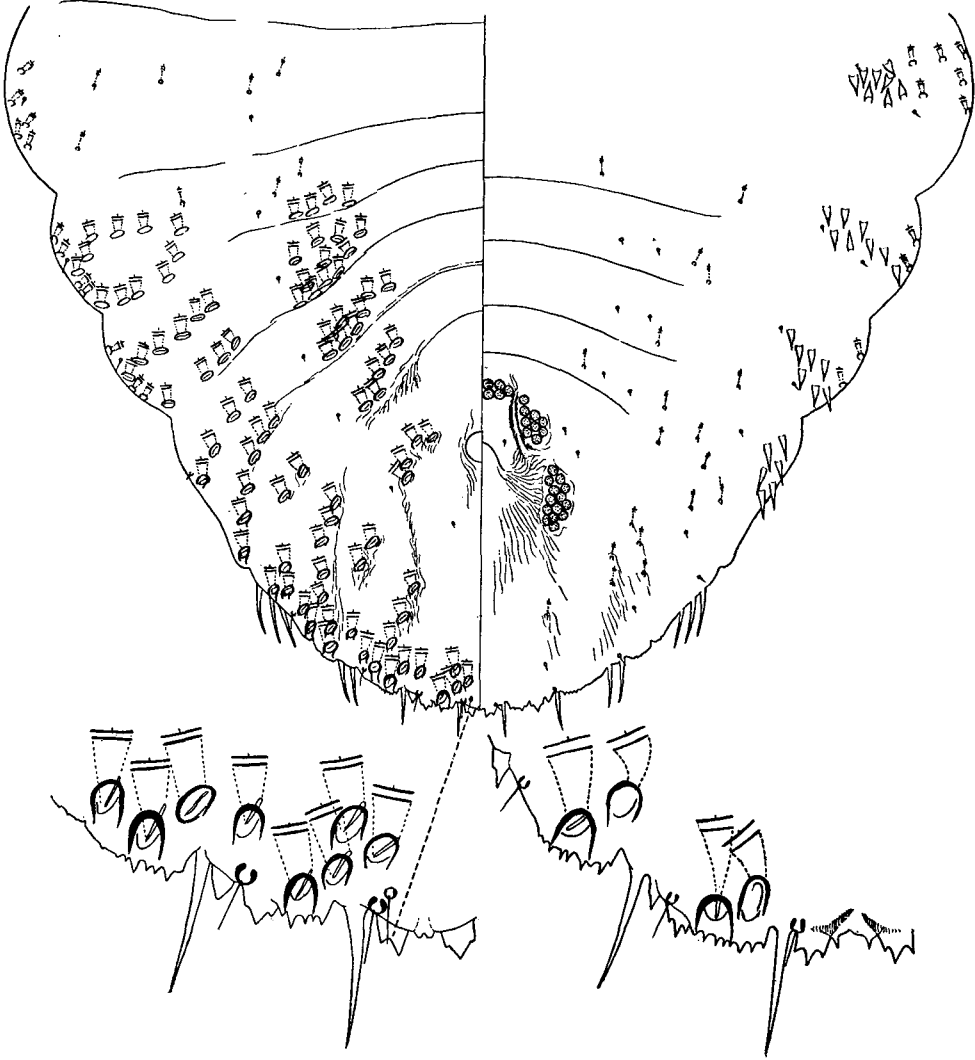


Fig. 14. *Unachionaspis signata* Maskell.
Adult female: abdomen; second exuvium of
female: pygidial margin in dorsal aspect (right).

46. *Unachionaspis bambusae* (Cockerell) comb. nov.

Chionaspis bambusae Cockerell (1896h, p. 21); Kuwana (1928, p. 17).

Adult female. Body broadest across first abdominal segment, gradually narrowing both anteriorly and posteriorly; free abdominal segments each moderately produced

laterally; pygidium broadly rounded. Anterior and posterior spiracles each with a few accompanying disc pores. Macroducts occurring in submarginal region on metathorax and first to fifth abdominal segments, submedian ones absent on first abdominal segment, present or absent on the second, always present on the third to sixth. Gland spines absent in thoracic region, a few submarginal ones present on free abdominal segments

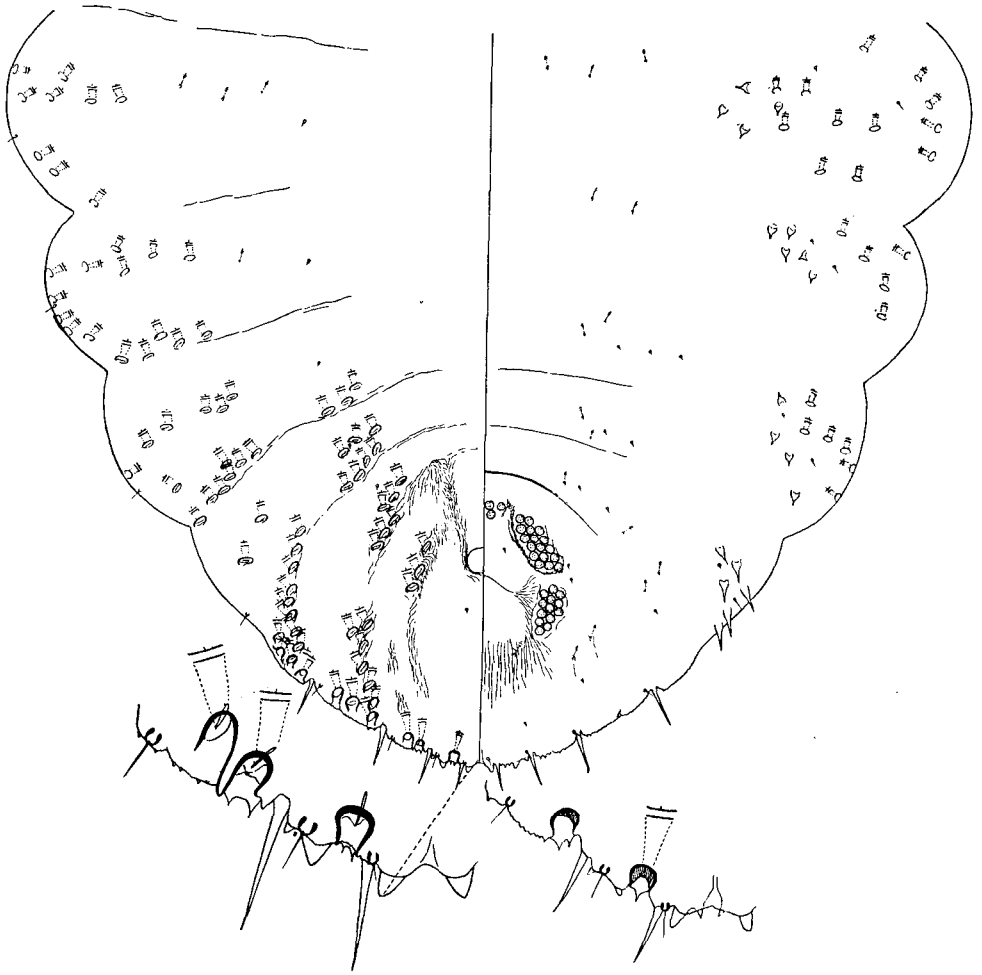


Fig. 15. *Unachionaspis bambusae* (Cockerell).
Adult female: abdomen; second exuvium of
female: pygidial margin in dorsal aspect (right).

each, four single, elongate marginal ones on each side of pygidium. Perivulvar pores rather numerous. Median lobes and both lobules of second lobes very small, entire, the median pair distinctly divergent.

L. & H.: Sapporo, Hokkaido; Toyama-ken, Honsyu; Tokyo. On *Sasa* spp.

47. *Unachionaspis tenuis* (Maskell)

Fiorinia tenuis Maskell (1897 a, p. 242); Kuwana (1925 b, p. 16). *Unachionaspis tenuis* Takahashi et Tachikawa (1956, Transactions of the Shikoku Entomological Society, Vol. 5, Pars 1-2, p. 10). *Chionaspis sakaii* Takahashi (1936 d, p. 2).

Adult female. Body elongate, slender; meso- and metathorax more or less expanded laterally; pygidium narrow. Anterior spiracles each with one or two accompanying disc

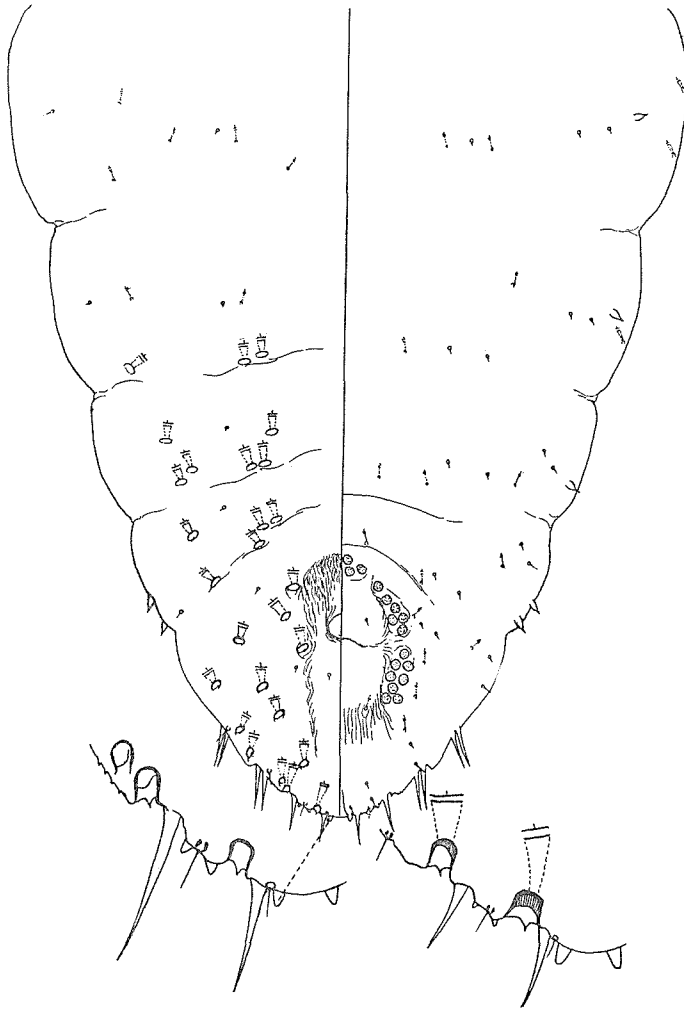


Fig. 16. *Unachionaspis tenuis* (Maskell).
Adult female: abdomen; second exuvium of
female: pygidial margin in dorsal aspect (right).

pores; posterior spiracles with or without a single pore. Dorsal macroducts few, present anteriorly as far as third, or usually second, or at times even first, abdominal segment, almost scattered on pygidium. Two to five tubercular submarginal gland spines present

on mesothorax; similar ones present or absent on metathorax and free abdominal segments, if present few. Median lobes and both lobules of second lobes very small, entire.

L. & H.: Adatara-yama, Hukusima-ken, Honsyu; Tokyo (K. Umeya leg.); Ôsaka, Honsyu. On bamboos including *Sasa*.

In the examined adult females from Adatara-yama and Ôsaka the antennae are provided with a single slender seta, the submedian macroducts are few, the first abdominal segment lacks dorsal macroducts, gland spines occur on the meso- and metathorax and free abdominal segments, and a marginal gland spine is present laterad of each of the second lobes. On the other hand, the adult females collected at Tokyo are characterized by the following characters:—the thoracic region is more strongly swollen laterally, the antennal setae are robust and sometimes occur in pair, the submedian macroducts of the prepygidial segments are numerous and almost scattered, forming an almost continuous longitudinal band on each side of the body, the first abdominal segment is often provided with dorsal macroducts, gland spines are absent on the free abdominal segments, and the marginal gland spines of the pygidium are always two in number laterad of each of the second lobes. The second exuvia of the female collected at Ôsaka lack submarginal macroducts, while those from Adatara-yama and Tokyo are mostly provided with them. In spite of the presence of the variations mentioned above, all the present specimens may possibly belong to a single species.

Key to the species

1. Dorsal macroducts of pygidium few, almost scattered. *U. tenuis*.
 - A distinct single submedian row of macroducts present on each side of pygidium on sixth abdominal segment. 2.
2. Scattered submarginal macroducts present along free margin of pygidium. *U. signata*.
 - Scattered submarginal macroducts absent along free margin of pygidium. *U. bambusae*.

XIV. Genus *Unaspis* MacGillivray

Unaspis MacGillivray (1921, p. 308); Rao (1949); Balachowsky (1954 e, p. 288).

Type: *Chionaspis acuminata* Green.

This genus has been studied by Rao, and *Graphaspis*, *Prontaspis*, and *Ametrochaspis*, all erected by MacGillivray (1921), were accepted as synonyms by him. By this conception this genus now includes ten known species centred in Asia, and is represented in Japan by four species.

48. *Unaspis yanonensis* (Kuwana)

Chionaspis yanonensis Kuwana (1923). *Prontaspis yanonensis* Kuwana (1923 b; 1926, p. 41). *Unaspis yanonensis* Rao (1949, p. 64); Balachowsky (1954 e, p. 293).

H. & L.: Sizuoka-ken, Honsyu (T. Ishii and K. Kamijo leg.); Miyazaki, Kyusyu. On *Citrus*.

49. *Unaspis turpiniae* Takahashi

Unaspis acuminata var. *turpiniae* Takahashi (1934, p. 10). *Unaspis turpiniae* Rao (1949, p. 64); Takahashi (1956, Annotationes Zoologicae Japonenses, Volume 29, No. 1, p. 58).

Adult female. Body elongate, attaining 1.96 mm. in length and 0.35 mm. in width. Cephalothorax elongate, thickly sclerotized at maturity, gradually narrowing anteriorly; head with a slight, rounded lateral protuberance on each side. First abdominal segment sclerotized on the anterior half, scarcely produced laterally; second and third abdominal segments rather strongly produced laterally, the succeeding segments forming pygidium. Antennae set apart, each with a long seta and a much shorter, slender seta. Anterior spiracles with a few accompanying disc pores. Macroducts occurring along lateral margins of thoracic region and free abdominal segments, pygidium with thirteen to sixteen macroducts scattered on each side. Marginal macroducts of pygidium seven in number on each side. Rather abundant tubercular gland spines occurring on first abdominal

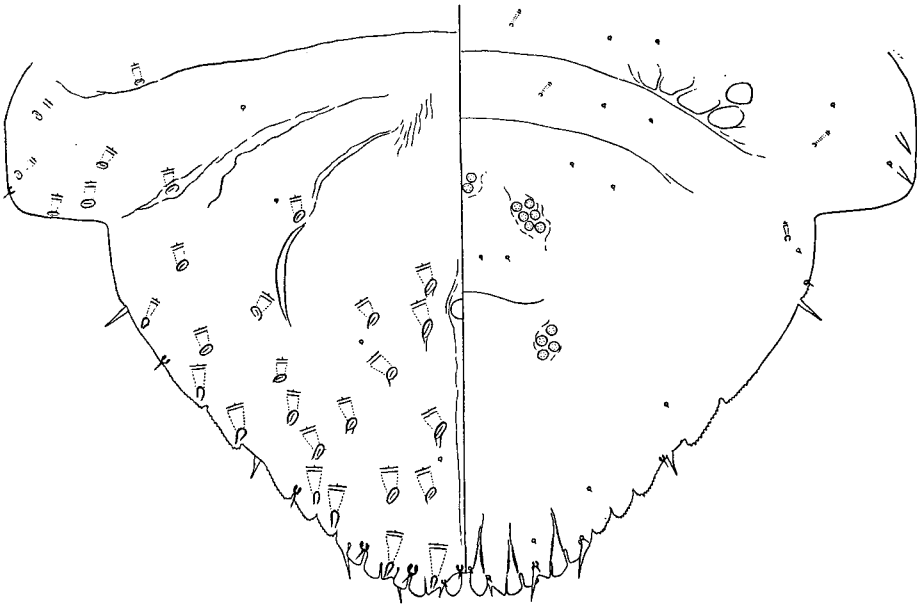


Fig. 17. *Unaspis turpiniae* Takahashi.
Adult female: pygidium.

segment, several elongate ones on second, a few similar ones on third, pygidium with five single marginal gland spines on each side. Anus rounded, rather small, situated about centre of pygidium. Perivulvar pores in five groups, three or four pores in the median group, five or six in the laterocephalics each, and four in the laterocaudals each. Median lobes set close, separated by a space narrower than one of them, parallel, slightly sunken into apex of pygidium, rounded apically. Second and third lobes well developed, bilobulate, each lobule nearly as large as median lobe, slightly dilated, and flattened apically. A pair of slender basal paraphyses present on median lobes each and also on inner lobule of second and third lobes each.

L. & H.: Kagosima, Kyusyu (K. Sato leg.).

This species was originally described from Formosa as a feeder of *Turpinia*, and

later recorded from Kagosima, Kyusyu. Through the kindness of Prof. R. Takahashi I have had the opportunity to examine six adult females.

50. *Unaspis euonymi* (Comstock)

Chionaspis euonymi Comstock (1881 a, p. 313); Kuwana (1928, p. 14). *Unaspis euonymi* Ferris (1937, SI-130); Rao (1949, p. 62); Balachowsky (1954 e, p. 294). *Unaspis nakayamai* Takahashi et Kanda (1939 a, p. 185).

L. & H.: Sapporo, Hokkaido, on *Euonymus* sp.; Tomakomai, Hokkaido, on *Euonymus* sp.; Hiko-San, Kyusyu, on *Euonymus japonicus*; Miyazaki, Kyusyu, on *Euonymus japonicus*.

51. *Unaspis aesculi* Takahashi

Unaspis aesculi Takahashi (1957, Transactions of the Shikoku Entomological Society, Vol. 5, Pars 7, p. 104).

L. & H.: Ôdai-ga-Hara, Nara-ken, Honsyu, on *Aesculus turbinata* (R. Takahashi leg.).

Key to the species

1. Perivulvar pores absent; cephalothorax elongate, strongly sclerotized; median lobes slightly sunken into apex of pygidium; slender basal paraphyses occurring on median lobes and lobules of second and third lobes. *U. yanonensis*.
- Perivulvar pores present. 2.
2. Cephalothorax elongate, strongly sclerotized; median lobes slightly sunken into apex of pygidium; slender basal paraphyses distinctly seen on median lobes and inner lobules of second and third lobes. *U. turpiniae*.
- Body fusiform, cephalothorax remaining membranous; basal paraphyses indiscernible on pygidial lobes. 3.
3. Marginal gland spines of pygidium occurring in pairs; median lobes distinctly projecting. *U. euonymi*.
- Marginal gland spines of pygidium occurring singly; median lobes slightly sunken into apex of pygidium. *U. aesculi*.

XV. Genus *Duplachionaspis* MacGillivray

Duplachionaspis MacGillivray (1921, p. 307); Balachowsky (1954 e, p. 374).

Type: *Chionaspis graminis* Green.

The type species of this genus has been re-examined by Ferris (1936 a, fig. 30). The Japanese member, *D. miscanthae*, appears very close to the type, and there is no doubt about its taxonomic position. This species shows in the first stage no particular characters concerning the head and antennae: the antennae are five-segmented; the terminal segment is slender, slightly longer than the preceding segments united, and distinctly annulate; the interantennal margin of the head is but slightly concave; there is on the head a pair of dorsal ducts. According to Ferris (l.c.), the same characteristics are displayed in the first stage of *D. graminis*, the type of the genus. This genus may possibly be of the Old World including Africa, being composed of many grass-infesting

species.*

52. *Duplachionaspis miscanthae* (Kuwana)

Chionaspis miscanthae Kuwana (1928, p. 10). *Duplachionaspis miscanthi* Takahashi et Tachikawa (1956, Transactions of the Shikoku Entomological Society, Vol. 5, Pars 1-2, p. 10).

Adult female. Body elongate, fusiform, attaining 1.46 mm. in length and 0.64 mm. in width; free segments each slightly produced laterally; pygidium nearly triangular,

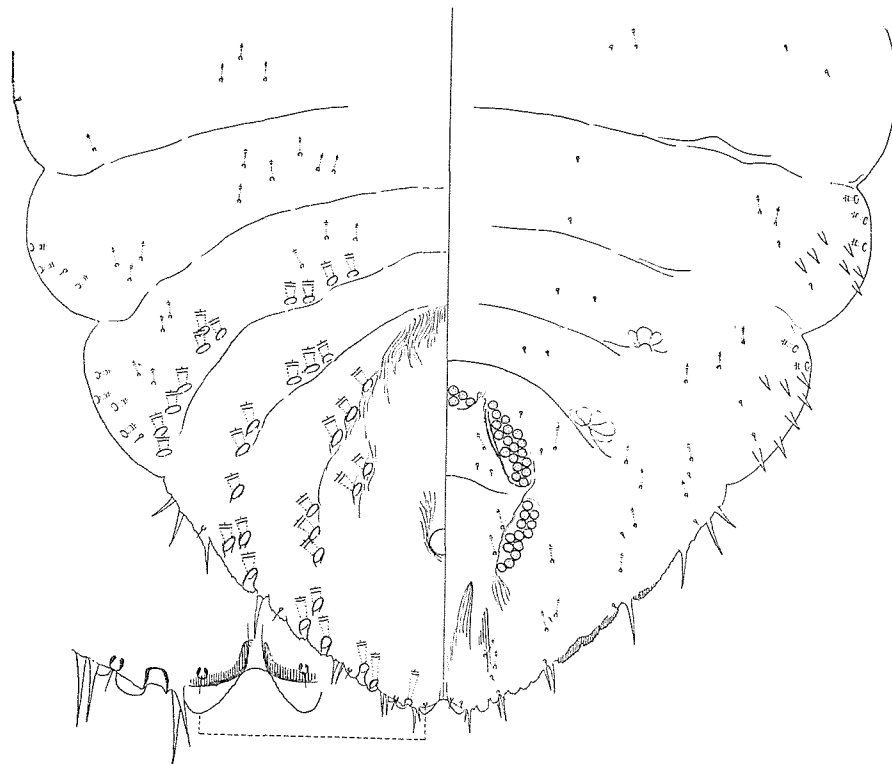


Fig. 18. *Duplachionaspis miscanthae* (Kuwana).
Adult female: abdomen.

* Four American species have been referred to *Duplachionaspis*: *D. boquetensis* Ferris, *D. distichlii* (Ferris), *D. litoralis* Ferris, and *D. spartinae* (Comstock). After giving a definition of the genus, which appears to be very adequate, Balachowsky states (l.c. p. 376):—"... et Ferris y a inclus un certain nombre d'espèces (*spartinae* Comstock; *distichlii* Ferris) qui ne sont certainement pas congénériques avec *D. graminis* Green en raison de la présence d'éléments glandulaires submédians sur VII, de macropores submarginiaux supplémentaires sur VI (toujours absents chez les *Duplachionaspis*) et la disposition irrégulière des macropores pygidiaux. Ces espèces devront faire partie d'un autre genre". Three of the species (*D. distichlii*, *D. litoralis*, and *D. spartinae*) are very peculiar by the fact that the interantennal margin of the head is deeply invaginated in the first stage, which, in addition to this, shows certain noteworthy characters of the antennae (Ferris, 1937, SI-46, -47, -48). Furthermore, "in some of the species the submarginal setae on the ventral side of the pygidial segments are unusually large" (Ferris, 1942, SIV-446, p. 9). After all, as stated by Balachowsky, it is open to such grave doubt that the American species are real members of *Duplachionaspis*.

rather weakly sclerotized. Antennae widely separated, with a single curved seta. Anterior spiracles each with a close cluster of numerous accompanying disc pores; posterior spiracles each with a close cluster of somewhat less numerous pores. Dorsal macroducts arranged in single segmental rows; two to six submedian macroducts on third abdominal segment, three to five on fourth, and two to four on fifth and sixth each; five to eight submarginal macroducts on third abdominal segment, four to seven on fourth, and two to six on fifth. Smaller macroducts scattered along lateral margins of second and third abdominal segments. Minute dorsal ducts occurring on three basal abdominal segments. Gland spines absent on thorax and first abdominal segment, several short submarginal ones on second and third abdominal segments each. Anus circular, moderate in size, situated about middle of pygidium. Perivulvar pores in five groups, numerous. Median lobes rather small, rounded or nearly triangular. Second lobes bilobulate, the lobules broadly rounded apically. Third lobes practically obsolete.

L. & H.: Ôsaka, Honsyu, on *Miscanthus* sp.

This species may come closest to *D. graminis*, but may be distinguishable from the latter by the dorsal macroducts less numerous, by the submarginal macroducts arranged in single rows, etc.

XVI. Genus *Greenaspis* MacGillivray

Greenaspis MacGillivray (1921, p. 307); Hall (1946a, p. 519); Ferris (1952a, p. 6). *Canaspis* MacGillivray (1921, p. 308).

Type: *Chionaspis elongata* Green.

This is a small genus including bamboo-infesting species occurring in Asia. In the course of the present study the following species has been found in Japan.

53. *Greenaspis yunnanensis* Ferris

Greenaspis yunnanensis Ferris (1952a, p. 7).

Adult female. Body very slender owing to the prolongation of the thoracic region, attaining five times as long as wide, 1.8 mm. in length at maximum. Cephalothorax scarcely narrowing anteriorly; free abdominal segments each more or less produced laterally; pygidium rather narrow. Antennae set rather close, with a seta. Anterior spiracles each with a single accompanying disc pore. Dorsal macroducts arranged in three rows on each side, the anteriormost row represented by a few submarginal macroducts occurring in caudal angle of third abdominal segment, the succeeding two rows divided into submedian and submarginal series each consisting of but few ducts; smaller macroducts occurring along lateral margins of first to third abdominal segments, usually few. One or two small gland spines present in caudal angle of metathorax, two to seven slightly longer ones on first abdominal segment, two or three elongate ones on second and third each, two similar, rather robust ones on fourth, pygidium with four single gland spines on each side. Anus rounded, moderate in size, situated near base of pygidium. Perivulvar pores in five groups, three or four pores in the median group, five to seven in the laterocephalics each, and eight to ten in the laterocaudals each. Median lobes

relatively small, divergent. Second lobes bilobulate, both lobules very small, narrow, the inner lobule with a pair of slender basal paraphyses. Third lobes obsolete. Pore prominences of pygidium remarkably toothed.

L. & H.: Miyazaki, Kyusyu, on an undetermined bamboo.

This species was originally described from Yunnan, China. Through the kindness of Prof. H. L. McKenzie I have had the opportunity to examine a part of the type material. The present description and figure are prepared on the basis of the material from Miyazaki.

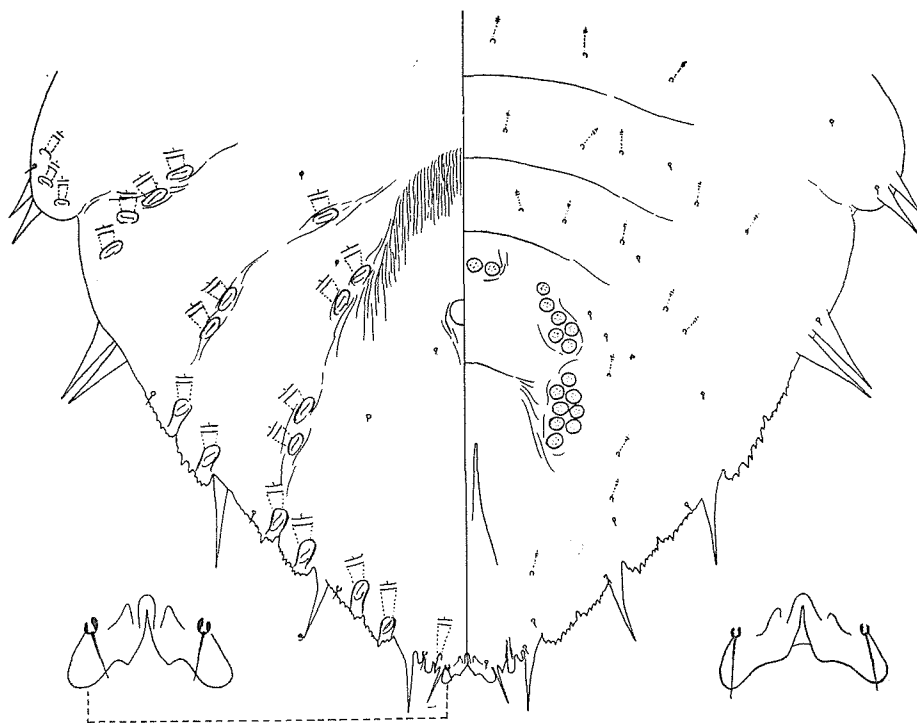


Fig. 19. *Greenaspis yunnanensis* Ferris.

Adult female: pygidium, figured from specimens collected at Miyazaki, and median lobes (right), figured from a specimen collected at Yunnan, China.

Some specimens collected in Japan have been sent to Prof. H. L. McKenzie, who has kindly compared them with specimens from the type material and informed me that they should be identified with *G. yunnanensis*, "mainly because of the projecting and serrate margin of the pygidium at position of third lobe." After my own examinations I am convinced that the Japanese specimens may be best regarded as representing a variant of *G. yunnanensis*, differing slightly from the type form in the shape of the median lobes (Fig. 19).

XVII. Genus *Phenacaspis* Cooley et Cockerell

Phenacaspis Cooley et Cockerell (1903, p. 48); Kuwana (1931a); Hall (1946a, p. 528); Balachowsky (1954e, p. 350); Ferris (1955d; 1956, Microentomology, Volume 21, Part 1). *Chionaspis* Kuwana (1928) (nec Signoret); Takahashi (1953) (nec Signoret).

Type: *Chionaspis nyssae* Comstock.

The opinion proposed by Ferris is here accepted:—the genus *Phenacaspis* is a distinct and valid one with many species centred in eastern Asia. Ten species are herein recognized as members of the genus from Japan. Also *Chionaspis kiushiensis* Kuwana, which was originally described from Hukuoka, Kyusyu, is apparently referable to this genus, but is excluded from the accompanying key as no material of this species is at present available. Furthermore, *Phenacaspis susukicola* Siraiwa, which is identical with *Aulacaspis kuzunoi* Kuwana et Muramatsu, is not referable to *Phenacaspis*, but to the genus *Miscanthaspis* (gen. nov.).

The dimorphic variation stated by Takahashi has been observed in most of the examined species. While the dimorphism produces generally more or less distinct effect on the shape of the median lobes alone and little of the lateral lobes, it is very remarkably shown in *P. wistariae* and *P. linderae*, the variant forms therein differing greatly in the shape not only of the median lobes but also of the second and third lobes.

This genus shows no particular character in the first stage. It should be mentioned here that the basal antennal segment of this stage is usual in shape and not strongly produced anteriorly. In *Phenacaspis susukicola*, which should be referred to *Miscanthaspis*, this segment is peculiar in shape.

54. *Phenacaspis saitamaensis* (Kuwana)

Chionaspis saitamaensis Kuwana (1928, p. 11); Takahashi (1953, p. 53).

Adult female. Body elongate; free abdominal segments each rather strongly produced laterally; pygidium approximately triangular or slightly rounded along its free margin. Antennae set widely apart, with a rather short seta. Anterior spiracles each with a close cluster of accompanying disc pores; posterior spiracles each with a single pore. Submedian dorsal ducts occurring on first to fifth abdominal segments, absent on sixth, those of first and second segments always composed of small ducts alone, those of third to fifth segments composed of mingled macroducts and small ducts, or entirely of small ducts, or, in the case of the last two segments, of macroducts only; the small ducts are variable in number, but are usually rather abundant, and tend to be arranged in irregularly double rows or almost scattered; the submedian macroducts are, if present, always few. Small submarginal dorsal ducts occurring on thorax and first and second abdominal segments, variable in number, being at times few but usually rather abundant, and almost scattered; a few submarginal macroducts occurring on third and fourth abdominal segments, present or absent on fifth. Rather abundant macroducts present along lateral margins of thoracic region and first to third abdominal segments. Gland spines present on metathorax and abdomen. Anus situated close to base of pygidium. Median lobes stout, divergent or almost parallel, rounded apically, the basal zygois elongate, more or

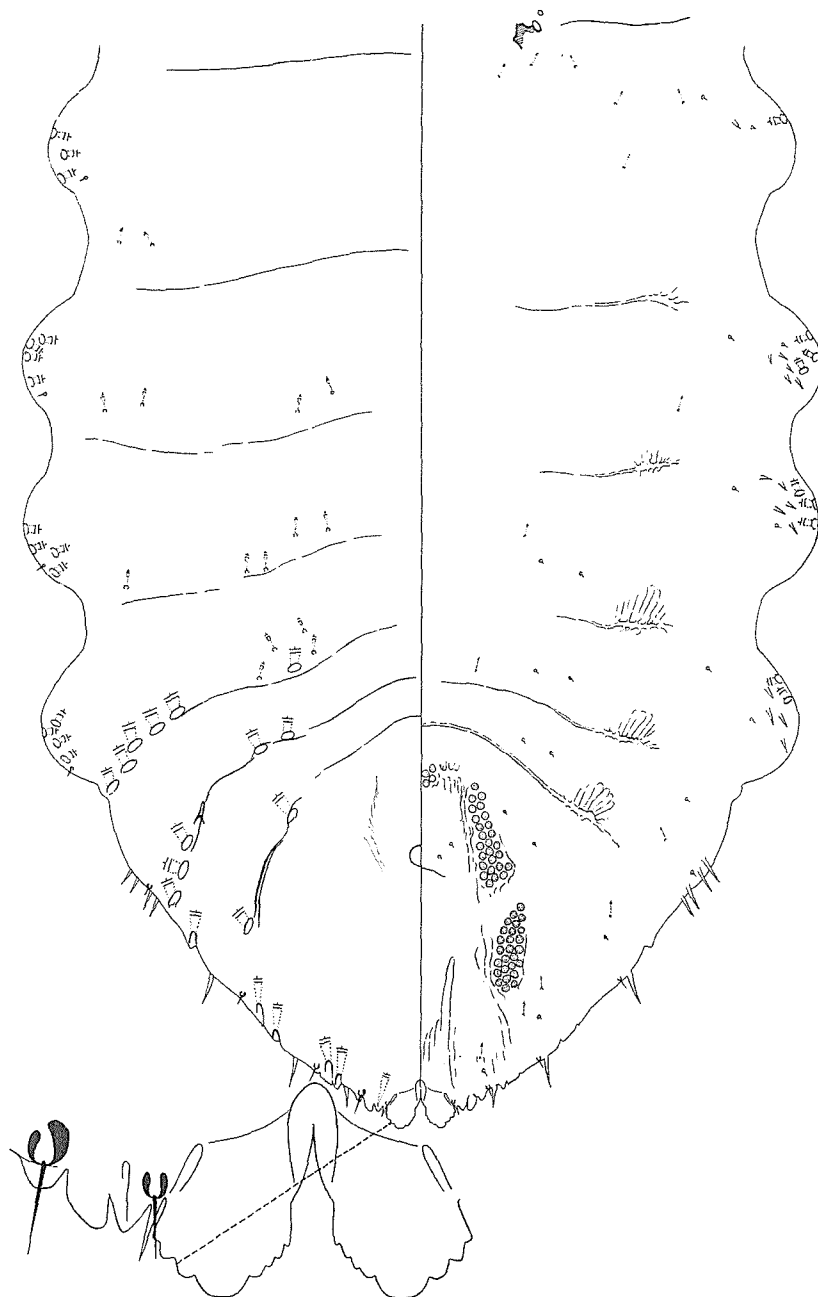


Fig. 20. *Phenacaspis saitamaensis* (Kuwana), type form.
Adult female: postsoma.



Fig. 21. *Phenacaspis saitamaensis* (Kuwana).
Adult female: postsoma.

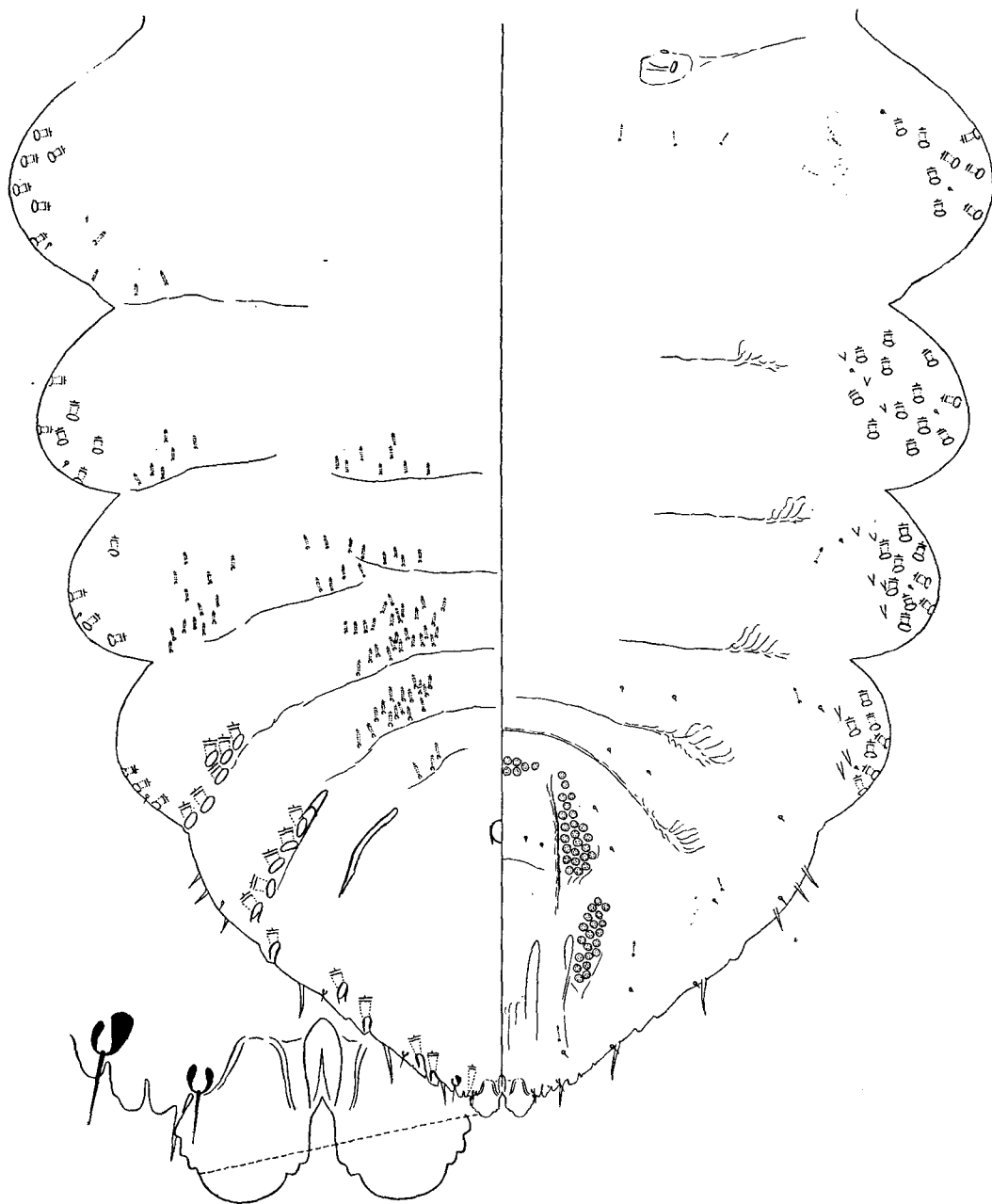


Fig. 22. *Phenacaspis saitamaensis* (Kuwana).
Adult female: postsoma.

less protruding anteriorly. Second lobes small, bilobulate. Third lobes represented by low processes. A pair of setae indiscernible between median lobes, or indicated by a clear spot on inner base of each lobe.

L. & H.: Sapporo, Hokkaido, on *Quercus mongolica* and *Quercus serrata*; Ônuma, Hokkaido, on *Quercus serrata*; Iwaki-yama, Aomori-ken, Honsyu, on *Quercus dentata* and *Quercus serrata*; Sado, on *Quercus serrata*; Tokyo, on *Quercus serrata* (R. Takahashi leg.); Ôsaka, Honsyu, on *Quercus serrata*.

It is difficult to identify positively the present material on the basis of the original description. It is the opinion here adopted that the original description may be based merely on a single form, in which the submedian macroducts are present on the third to fifth abdominal segments and the small dorsal ducts are greatly reduced in number in both submedian and submarginal series. This species is, in reality, very variable in the pattern of dorsal ducts as described and figured herein, being found various forms even in the same colony. As the examined specimens well agree in the pygidial margin with the figures prepared by Kuwana I cannot but think that they should be identified with *P. saitamaensis*.

There may at times be some difficulty to distinguish this species from *P. alnus*, but in the former the submarginal macroducts are practically all of the same size, and the submedian dorsal ducts are absent in the thoracic region, whereas in the latter the submarginal macroducts become smaller interiorly, and there are small submedian dorsal ducts in the thoracic region. The scale insect described by Ferris (1955d, p. 51) under the name *P. saitamaensis* seems to be *P. kuwanai*.

55. *Phenacaspis alnus* (Kuwana)

Chionaspis alnus Kuwana (1928, p. 7). *Chionaspis alnicola* Lindinger (1949, p. 211). *Phenacaspis alnicola* Ferris (1955d, p. 44); Takahashi (1956, Transactions of the Shikoku Entomological Society, Vol. 5, Pars 1-2, p. 8).

L. & H.: Sapporo, Hokkaido, on *Alnus japonica* and *Alnus hirsuta*; Yamanashi-ken, Honsyu, on *Alnus* sp.

56. *Phenacaspis enkianthi* (Takahashi)

Chionaspis enkianthi Takahashi (1953, p. 51). *Phenacaspis enkianthi* Ferris (1956, Microentomology, Volume 21, Part 1, p. 69).

L. & H.: Tokyo, on *Enkianthus* sp.

57. *Phenacaspis wistariae* (Cooley)

Chionaspis wistariae Cooley (1897, p. 280); Kuwana (1928, p. 4); Ferris (1942, SIV-388); Takahashi (1953, p. 48). *Phenacaspis wistariae* Ferris (1955d, p. 53). *Phenacaspis fujicola* Kuwana (1931a, p. 8).

Adult female. Body elongate; free segments each but weakly produced laterally. Antennae set widely apart. Anterior spiracles each with a close cluster of accompanying disc pores; posterior spiracles each with a much smaller cluster of pores. Two to eight submedian macroducts occurring on third abdominal segment, two to seven on fourth and fifth each, and two to four on sixth. Five to eleven submarginal macroducts occurring

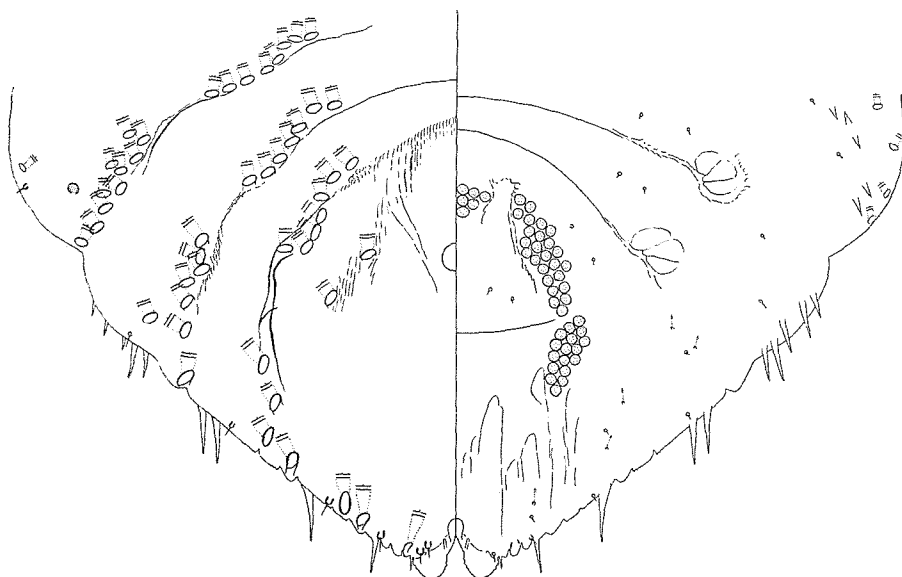


Fig. 23. *Phenacaspis wistariae* (Cooley), type form.
Adult female: pygidium.

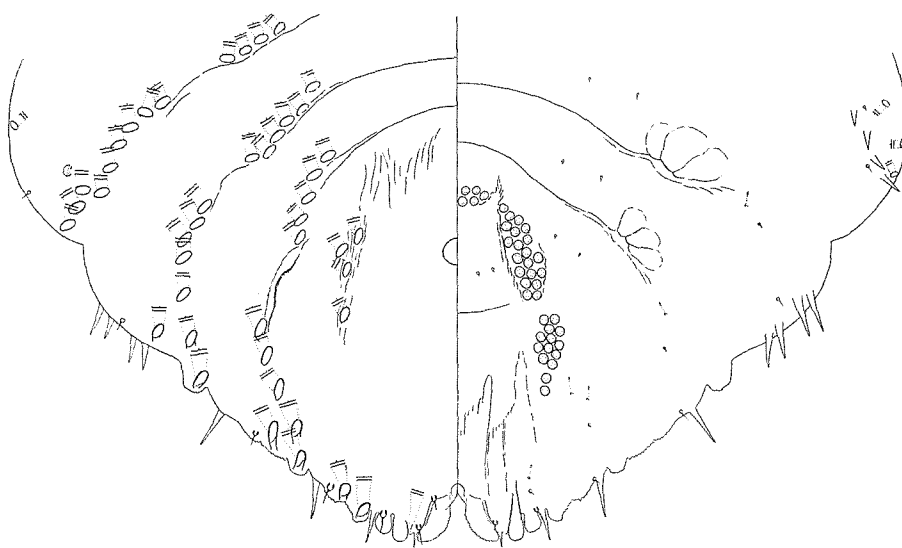


Fig. 24. *Phenacaspis wistariae* (Cooley), *fujicola* form.
Adult female: pygidium.

on third abdominal segment, five to twelve on fourth, and two to six on fifth. One to five lateral macroducts on mesothorax, eight to seventeen on metathorax, nine to sixteen on first abdominal segment, eight to thirteen on second, and three to six on third. Gland spines absent in thoracic region. Anus situated towards base of pygidium. Basal zygois of median lobes tending to be produced anteriorly, its anterior end broadly rounded. A pair of setae indiscernible between median lobes, or indicated by a clear spot on inner base of each of the lobes.

L. & H.: Sapporo, Hokkaido; Kamidaki, Toyama-ken, Honsyu. On *Wisteria*.

As stated by Takahashi (1952a, p. 8; 1953, p. 48) *Chionaspis wistariae* and *Phenacaspis fujicola* are, in reality, variants of the same species: the former occurs on the branches of the host, while the latter represents the leaf-infesting form. I have collected both forms on a single cultivated tree of *Wisteria* at Sapporo. These forms differ greatly in the shape of the pygidial lobes. In the leaf-infesting form the median lobes are deeply sunken into the apex of the pygidium, the second lobes well developed, with the inner lobule slightly dilated apically, and the third lobes well represented, with the inner lobule produced. In the branch-infesting form the median lobes are produced, the second lobes less produced than in the leaf-infesting form, and the third lobes represented merely by low prominences.

58. *Phenacaspis linderæ* (Takahashi)

Chionaspis linderæ Takahashi (1952a, p. 10). *Phenacaspis linderæ* Ferris (1955d, p. 50).

Adult female. Body elongate; free segments each slightly produced laterally. Antennae set widely apart. Anterior spiracles each with a close cluster of accompanying disc pores; posterior spiracles with pores less numerous and variable in number. Submedian macroducts present or absent on third abdominal segment, if present one to four in number, one to four on fourth, one to three on fifth, and occasionally one on sixth. Two to six submarginal macroducts present on third abdominal segment, two to five on fourth, and one to three on fifth. Lateral macroducts often absent, but occasionally a single small one present, on mesothorax, one to four on metathorax, three to seven on first abdominal segment, three to six on second, and two to five on third. Gland spines absent on thorax. Anus situated towards base of pygidium. Basal zygois of median lobes scarcely protruding anteriorly, its anterior end broadly rounded. A pair of setae not discernible between median lobes, or represented by a clear spot on inner base of each lobe.

L. & H.: Kanagawa-ken, Honsyu, on *Parabenzoin praecox* and *Parabenzoin trilobum*; Ôsaka, Honsyu, on a Lauraceous plant (R. Takahashi leg.); Hiko-San, Kyusyu, on *Lindera* sp.

This species was originally described from the leaf-infesting form. It is very close to *P. wistariae*, from which it is distinguished mainly by having less numerous macroducts. It can be expected, accordingly, that the dimorphism in the present species may possibly be like that in *P. wistariae*, of which the two variant forms are now well known. The present specimens collected on the branches of the hosts at Kanagawa-ken and

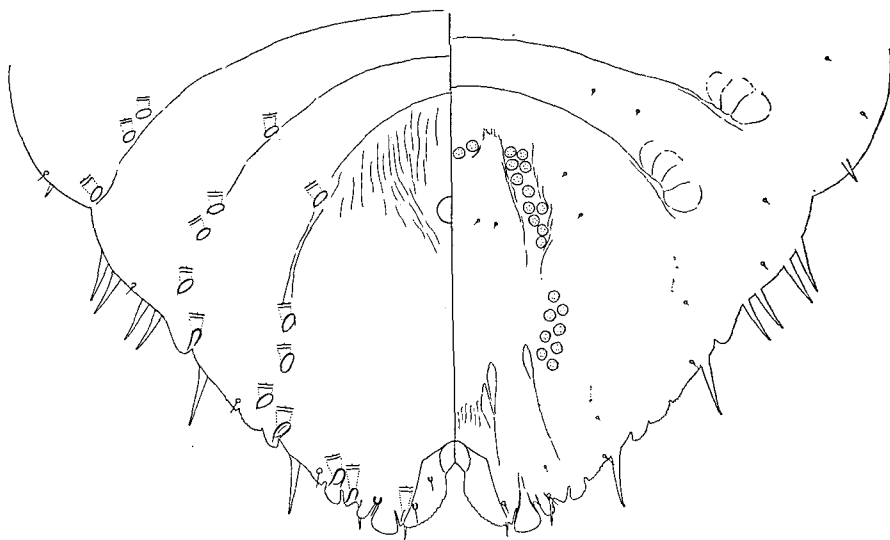


Fig. 25. *Phenacaspis linderæ* Takahashi, type form.
Adult female: pygidium.

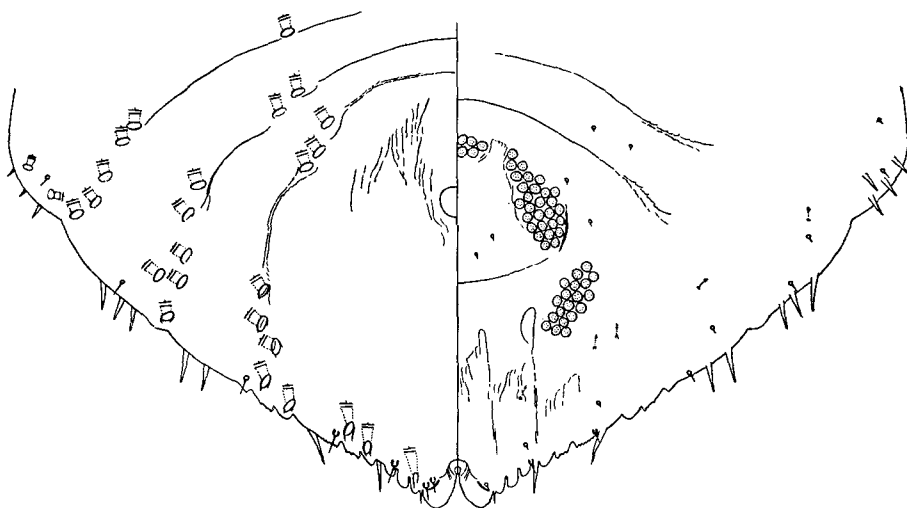


Fig. 26. *Phenacaspis linderæ* Takahashi, branch-infesting form.
Adult female: pygidium.

Hiko-San, being very similar to the type form of *P. wistariae* in the shape of the pygidial lobes, are here regarded as representing the branch-infesting form of *P. linderiae*. In the leaf-infesting form the median lobes are deeply sunken in an incision, the second lobes well developed, with the inner lobule dilated apically, and the third lobes well represented, with the inner lobule produced, whereas in the branch-infesting form the median lobes are rather small, with the apical part distinctly produced beyond the pygidial margin, the second lobes less prominent than in the leaf-infesting form, and the third lobes represented by low, apically serrate processes.

59. *Phenacaspis momi* Kuwana

Phenacaspis momi Kuwana (1931a, p. 9); Ferris (1956, Microentomology, Volume 21, Part 1, p. 71); Takahashi (1956, Transactions of the Shikoku Entomological Society, Vol. 5, Pars 1-2, p. 8).

L. & H.: Tokushima-ken, Sikoku, on *Abies* sp. (T. Inobu leg.).

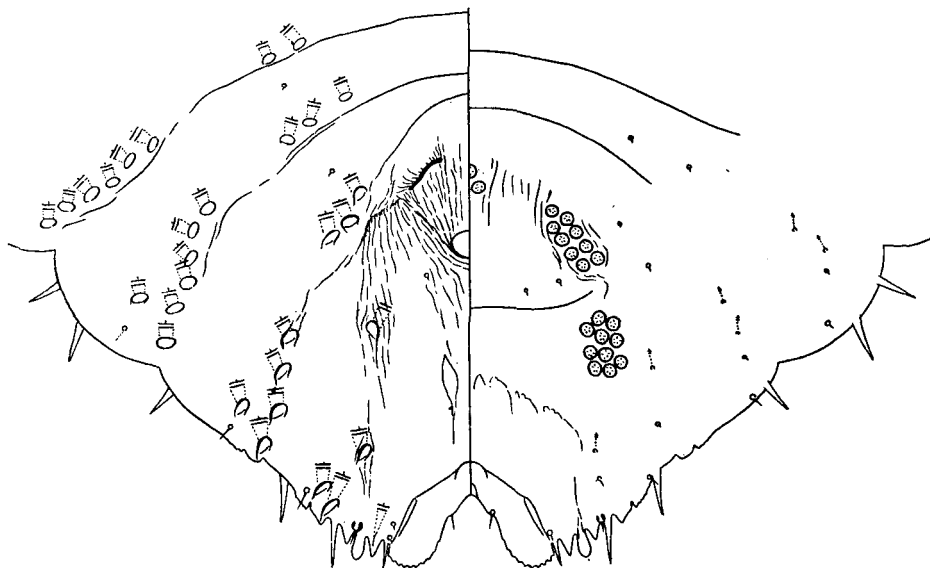


Fig. 27. *Phenacaspis celtis* (Kuwana).
Adult female: pygidium.

60. *Phenacaspis yanagicola* Kuwana et Muramatsu

Phenacaspis yanagicola Kuwana et Muramatsu (1932, p. 95); Ferris (1955 d, p. 54).

L. & H.: Toyama, Honsyu, on *Salix babylonica*.

61. *Phenacaspis celtis* (Kuwana)

Chionaspis celtis Kuwana (1928, p. 8); Takahashi (1952 a, p. 7; 1953, p. 49). *Phenacaspis celtis* Ferris (1955 d, p. 46).

Adult female. Body widest across first abdominal segment; free segments each weakly produced laterally. Antennae set widely apart. Anterior spiracles each with a rather small cluster of accompanying disc pores; posterior spiracles with a single pore.

Submedian dorsal macroducts present or absent on second abdominal segment, always present but few in number on third to fifth, one or two ducts present or absent on sixth, if present slightly displaced posteriorly to the usual position. Several submarginal macroducts present on second to fifth abdominal segments each, one or two present or absent on sixth. Lateral macroducts abundant on thorax and first abdominal segment, several ones occurring on second, and a single one on third. Gland spines present on thorax and abdomen. Anus situated towards base of pygidium. A pair of prominent preanal scars present. Median lobes comparatively very large, with a pair of setae between them, the basal zygois not protruding anteriorly. Second lobes very small, the outer lobule at times almost obsolete. Third lobes represented by low processes.

L. & H.: Sado; Namerikawa, Toyama-ken, Honsyu. On *Celtis*.

62. *Phenacaspis kuwanai* (Takahashi)

Phenacaspis quercus Kuwana (1931 a, p. 6) (nec *Chionaspis quercus* Comstock). *Chionaspis kuwanai* Takahashi (1953, p. 50). *Phenacaspis saitamaensis* Ferris (1955 d, p. 51) (nec Kuwana).

Adult female. Body widest across metathorax or first abdominal segment; pygidium rather small and broad. Antennae set widely apart. Anterior spiracles each with a cluster of accompanying disc pores; posterior spiracles without pores. Dorsal macroducts in single or irregularly double segmental rows; submedian macroducts absent or a few ones present on second abdominal segment, always present on third to fifth, absent on sixth; submarginal macroducts rather numerous on second to fifth. Lateral macroducts abundant on meso- and metathorax and basal two abdominal segments. Gland spines present on meso- and metathorax and abdomen. Anus close to base of pygidium. Median lobes comparatively very large, slightly divergent, minutely serrate, round apically, with a pair of setae between them, the basal zygois scarcely protruding anteriorly. Second lobes very small, bilobulate. Third lobes represented by low processes.

L. & H.: Toyama, Honsyu, on *Quercus* sp. and *Castanea crenata*; Ôsaka, Honsyu, on *Quercus* sp. (R. Takahashi leg.) and *Castanea crenata* (R. Takahashi leg.).

The present specimens agree so closely with the original description and figures that there can be no doubt of the correct identification. While *P. saitamaensis* Ferris (nec Kuwana) is possibly a synonym of *P. kuwanai*, it is open to doubt that the scale insect described by Ferris (1955 d, p. 50) from Formosa under the name *P. kuwanai* is really identical with the present species.

63. *Phenacaspis kiushiuensis* (Kuwana)

Chionaspis kinshinensis Kuwana (1909, p. 155). *Chionaspis kiushiuensis* Kuwana (1928, p. 12).

This scale insect was originally described from specimens collected on *Quercus gilva* at Hukuoka, Kyusyu. No material of this species is at present available.

64. *Phenacaspis cockerelli* (Cooley)

Chionaspis cockerelli Cooley (1897, p. 278). *Phenacaspis cockerelli* Ferris (1955 d, p. 46); Takahashi (1956, Transactions of the Shikoku Entomological Society, Vol. 5, Pars 1-2, p. 8). *Chionaspis aucubae* Cooley (1897, p. 279); Takahashi (1953, p. 50). *Phenacaspis aucubae* Kuwana (1931 a, p. 3). *Chionaspis*

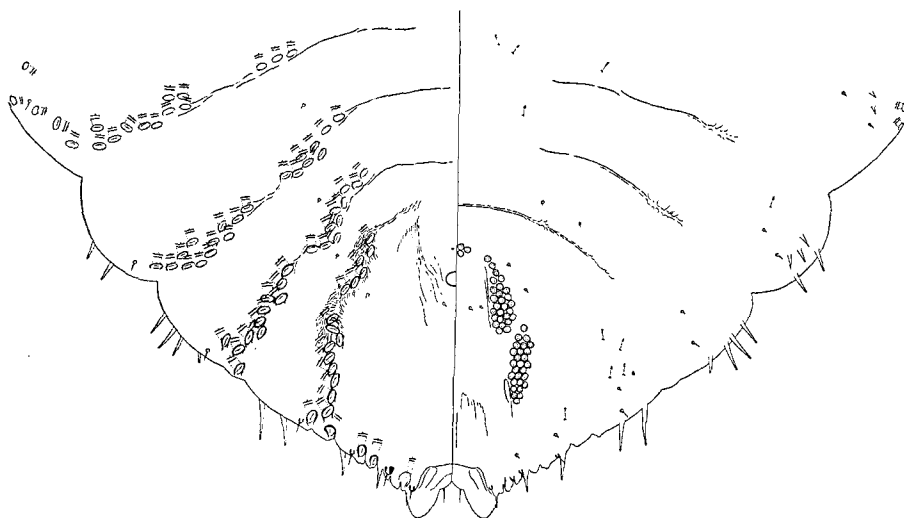


Fig. 28. *Phenacaspis kuwanai* (Takahashi).
Adult female: pygidium.

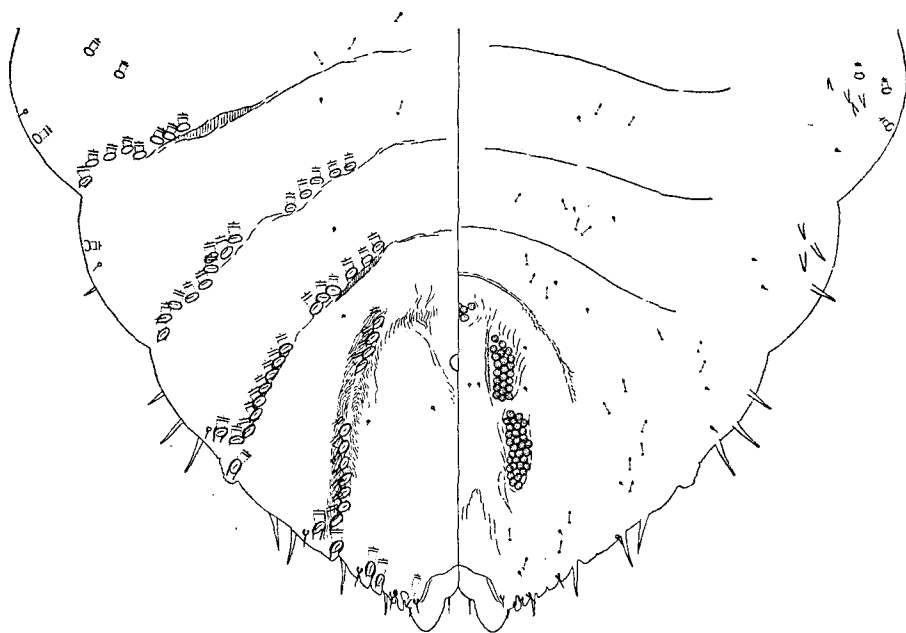


Fig. 29. *Phenacaspis kuwanai* (Takahashi).
Adult female: pygidium.

dilatata Green (1899 a, p. 148). *Phenacaspis dilatata* Kuwana (1931 a, p. 5). *Chionaspis miyakoensis* Kuwana (in Kuwana et Muramatsu, 1931 a, p. 649), **syn. nov.**; Takahashi (1953, p. 54). *Phenacaspis miyakoensis* Ferris (1955 d, p. 51). *Chionaspis akebiae* Takahashi (1952 a, p. 9; 1953, p. 50).

L. & H.: Sado, on *Aesculus turbinata*, *Akebia quinata*, and *Weigela* sp.; Kamidaki, Toyama-ken, Honsyu, on *Weigela* sp.; Hayatuki, Toyama-ken, Honsyu, on a Leguminous plant; Tokyo, on *Akebia trifoliata*, *Aucuba japonica*, and *Ilex crenata*; Yokohama, Honsyu, on *Ilex crenata* (S. Kanda leg.); Amagi-san, Sizuoka-ken, Honsyu, on *Ilex* sp.; Ôsaka, Honsyu, on *Trachelospermum asiaticum*; Hukuoka, Kyusyu, on *Ilex crenata*; Hiko-San, Kyusyu, on *Akebia trifoliata*; Miyazaki, Kyusyu, on *Trachelospermum* sp.; Amami-Ôsima, on an undetermined plant; Kume-zima, Ryukyu, on *Aphananthe*? (K. Sato leg.). Two type specimens of *Chionaspis akebiae*: Tokyo, on *Akebia trifoliata* (R. Takahashi leg).

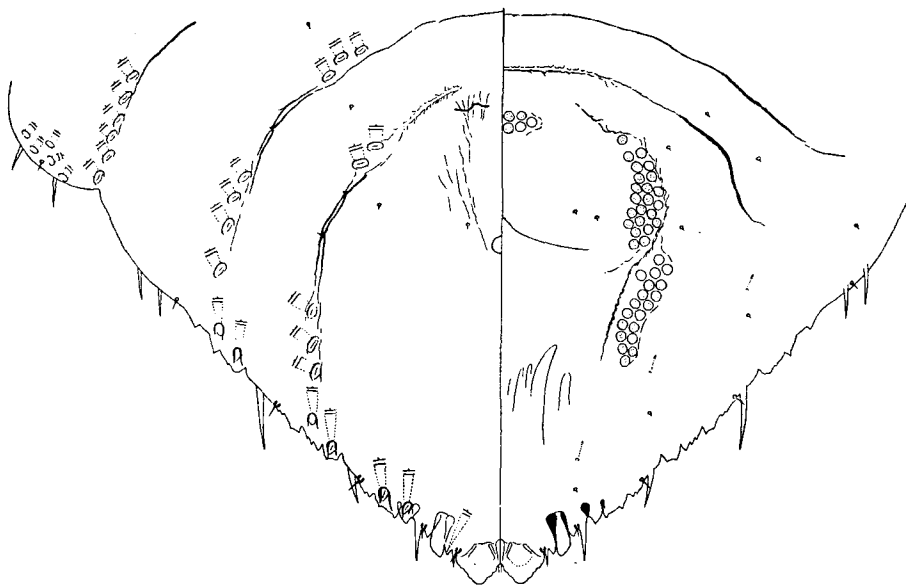


Fig. 30. *Phenacaspis cockerelli* (Cooley), *miyakoensis* form.

Adult female: pygidium, figured from
a specimen collected in Amami-Ôsima.

The present specimens from Amami-Ôsima in part and those from Kume-zima, both of the Ryukyu island group, agree very well with the original description and figure of *Chionaspis miyakoensis*. In these specimens the pygidium is rather narrow, the outer lobule of the second lobe represented by a small, apically pointed projection and completely devoid of paraphyses, and the preanal scars distinctly seen. Many of the specimens collected in the island Sado and the central region of Honsyu should be also regarded as belonging to this form; although, in these specimens, the pygidium is more or less broader and the outer lobule of the second lobe often well developed, the median lobes are about of the same shape as in the specimens from Ryukyu, being very robust

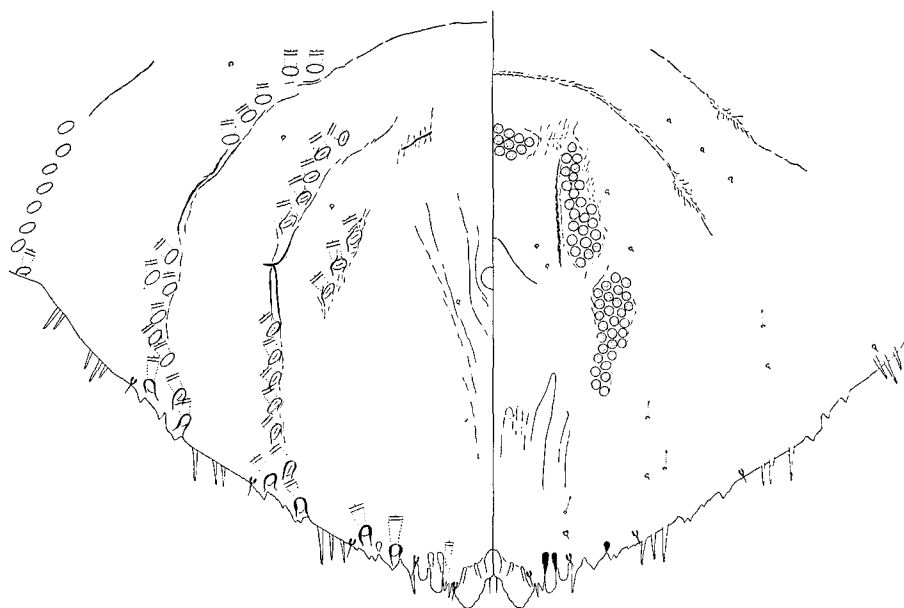


Fig. 31. *Phenacaspis cockerelli* (Cooley), *miyakoensis* form.

Adult female: pygidium, figured from a specimen collected at Hayatuki, Toyama-ken, Honsyu.

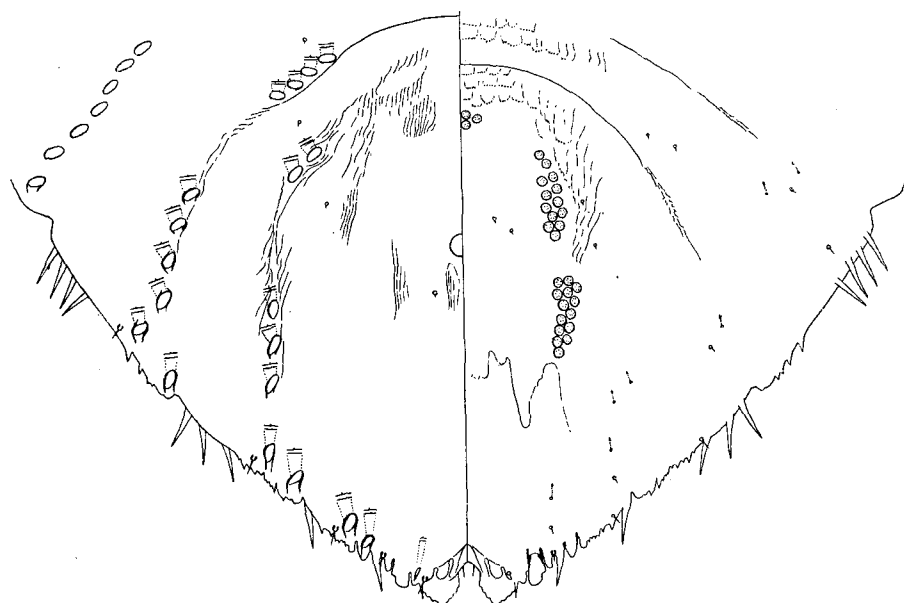


Fig. 32. *Phenacaspis cockerelli* (Cooley), *miyakoensis* form.

Adult female: pygidium, figured from a type specimen of *Chionaspis akebiae*.

with their apical parts distinctly projecting beyond the pygidial margin, the basal paraphyses only faintly developed or completely absent on the inner lobules of the second lobes, and the preanal scars in most individuals very distinctly seen. Through the kindness of Prof. R. Takahashi it has been possible to see two type specimens of *Chionaspis akebiae*, which represent the so-called '*Chionaspis* type.' They resemble very closely the specimens mentioned above, which were collected in Sado and Honsyu; they should be referred to the *miyakoensis* form.

There are at hand numerous females which were collected in Sado, Honsyu, Kyusyu, and Amami-Ôsima and have the pattern which has hitherto been known as the representative of *P. cockerelli*. In these females the median lobes are deeply sunken in an incision, with their apices scarcely or only a little projecting beyond the pygidial margin, the outer lobule of the second lobe well developed, usually with basal paraphyses, and the preanal scars absent.

As stated by Ferris, however, the two forms, *Chionaspis miyakoensis* and *Phenacaspis cockerelli*, are in general very close. I have collected the *miyakoensis* form on the branches and the other form on the leaves of a single plant of *Aucuba japonica* at Tokyo. The examined material collected on *Ilex crenata* at Yokohama by Mr. S. Kanda, possibly from the same colony, also contains both forms. Furthermore, at certain other localities the two forms have been collected on the same host species.

It is the opinion here adopted that *Chionaspis miyakoensis* is not a full species, but, in reality, the branch-infesting form of *Phenacaspis cockerelli*. The so-called '*Chionaspis* type' of *Chionaspis akebiae* is, as suggested by Ferris, identical with the *miyakoensis* form; there is little doubt that *C. akebiae* is a synonym of *P. cockerelli*.

Key to the species

- 1. Submedian series of dorsal ducts composed of very small ducts with or without usual macroducts, occurring on first to fifth abdominal segments, present or absent in thoracic region; similar small submarginal dorsal ducts scattered on thorax and basal two or three abdominal segments. . . . 2.
- Submedian series of dorsal ducts composed of usual macroducts, never occurring on thorax and first abdominal segment, present or absent on sixth abdominal segment. 3.
- 2. Small submedian dorsal ducts absent on thorax; usual submedian macroducts often occurring on third to fifth abdominal segments; submarginal macroducts all practically of the same size.
. *P. saitamaensis*.
- Submedian dorsal ducts mostly arranged in irregularly double rows or practically scattered, a few small ones at times occurring in bottom of pygidium on each side, several ones on fifth abdominal segment, small but somewhat variable in size, and very small ones on first to fourth abdominal segments and thorax; submarginal macroducts on third to fifth abdominal segments, inner ones in each series tending to become smaller; antennae set widely apart; basal zygois of median lobes protruding anteriorly beyond bases of the lobes; a pair of setae indiscernible between median lobes, or represented by a clear spot on inner base of each lobe. *P. alnus*.
- 3. Submedian and submarginal macroducts absent on second abdominal segment. 4.
- Submarginal dorsal macroducts present on second abdominal segment, submedian macroducts present or absent on the segment. 6.
- 4. Basal zygois of median lobes robust, its anterior end broadly rounded; gland spines absent on

- metathorax; sixth abdominal segment with or without submedian macroducts, always lacking submarginal ones. 5.
- Basal zygos of median lobes elongate, distinctly protruding anteriorly beyond bases of the lobes, its anterior end bluntly pointed or very narrowly rounded; a small tubercular gland spine occurring on metathorax on either side; sixth abdominal segment without submedian macroducts, sometimes with a single submarginal one on one or either side; antennae set widely apart; a pair of setae not discernible between median lobes, or indicated by a clear spot on inner base of each lobe. *P. enkianthi*.
5. Lateral macroducts abundant, one to five on mesothorax, eight to seventeen on metathorax, nine to sixteen on first abdominal segment, eight to thirteen on second, and three to six on third; sixth abdominal segment with two to four submedian macroducts on each side. *P. wistariae*.
- Lateral macroducts often absent, but occasionally a single small one present, on mesothorax, one to four on metathorax, three to seven on first abdominal segment, three to six on second, and two to five on third; submedian macroducts present or absent on sixth abdominal segment, if present one in number on each side. *P. linderae*.
6. Median lobes each as wide as or wider than inner lobule of second lobe. 7.
- Median lobes small, deeply sunken in an incision, each distinctly narrower than inner lobule of second lobe; second lobes well developed, the inner lobule projecting beyond apices of median lobes; dorsal macroducts not numerous, one or two submedian ones occurring on sixth abdominal segment on each side; antennae set close together; basal zygos of median lobes not protruding anteriorly; a pair of setae present between median lobes. *P. momi*.
7. Gland spines present in thoracic region; a pair of setae apparently seen between median lobes. . . 8.
- Gland spines absent in thoracic region; a pair of setae not discernible between median lobes, or indicated by a clear spot on inner base of each lobe; sixth abdominal segment with one to four submedian macroducts on each side; antennae set widely apart; basal zygos of median lobes scarcely protruding anteriorly, its anterior end rounded. *P. yanagicola*.
8. Antennae set widely apart; second lobes very small in comparison with median lobes; lateral macroducts abundant, usually more numerous than ten on mesothorax on each side. 9.
- Antennae usually set close together but at times set somewhat apart; second lobes well developed, at least with the inner lobule well represented; lateral macroducts usually less numerous than ten on mesothorax on each side. *P. cockerelli*.
9. A pair of preanal scars present; sixth abdominal segment with or without submedian and submarginal macroducts. *P. celtis*.
- Preanal scars absent; sixth abdominal segment always lacking submedian and submarginal macroducts. *P. kuwanai*.

XVIII. Genus *Fiorinia* Targioni

Fiorinia Targioni; Kuwana (1925 b); Ferris (1937, SI-54); Balachowsky (1954 e, p. 302).

Type: *Diaspis fioriniae* Targioni.

This genus is probably Asiatic, being known a number of species from eastern Asia. It is a unique pupillarial one among the genera referred to the *Phenacaspis* group in Japan. It shows, however, no particular characters in the first stage. In Japan nine species of the genus are herein recognized.

65. *Fiorinia japonica* Kuwana

Fiorinia fioriniae japonica Kuwana (1902, p. 79). *Fiorinia japonica* Kuwana (1925 b, p. 5); Ferris (1942, SIV-394).

L. & H.: Sapporo, Hokkaido, on *Picea excelsa*; Tokyo, on a coniferous plant (R. Takahashi leg.).

66. *Fiorinia fioriniae* (Targioni)

Diaspis fioriniae Targioni (1867, p. 14). *Fiorinia fioriniae* Kuwana (1925 b, p. 3); Ferris (1937, SI-55); Balachowsky (1954 e, p. 303).

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

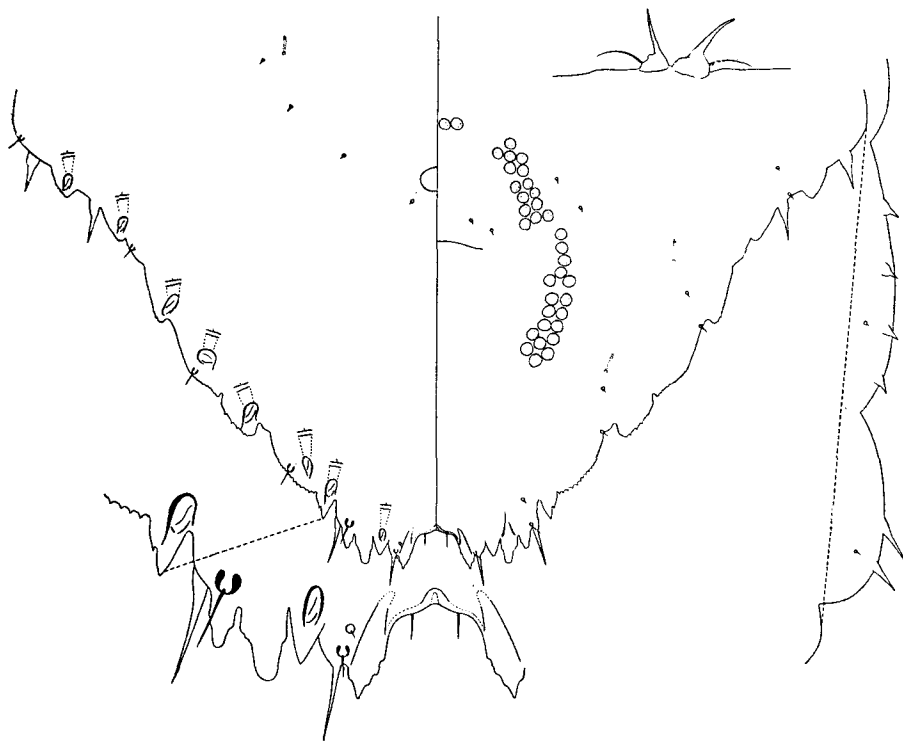


Fig. 33. *Fiorinia separata* sp. nov.

Adult female: pygidium, lateral margin of body, and antennae (upper).

67. *Fiorinia separata* sp. nov.

Adult female. Body membraneous; pygidium approximately triangular or somewhat rounded along its free margin. Antennal tubercles set close together, each produced into a long process; interantennal membraneous process absent. Anterior spiracles each with a few accompanying disc pores. Several microducts scattered between posterior spiracles. Anus situated near base of pygidium. Perivulvar pores in five groups, few in the median group, rather numerous in the lateral groups. Marginal macroducts

normally eight in number on each side, all large and practically of the same size. Median lobes slightly divergent posteriorly, widely separated by a space which is about 2.5 times as wide as one of them, situated in an incision, but their apices distinctly produced, each lobe elongate, with three dentations on the inner margin, and pointed apically, the basal zygotis represented by a slender, rather weakly sclerotized band. Second lobes well developed, bilobulate, the inner lobule somewhat elongate, rounded apically, with a pair of slender basal paraphyses, the outer lobule similar to, but smaller than, the inner one. Third lobes obsolete. A marginal gland spine present laterad of median and second lobes each.

Second exuvium of female. Elongate, attaining 1.49 mm. in length and 0.55 mm. in width. Pygidial margin similar to that of adult female. Five single marginal macroducts on each side, belonging probably to third to seventh abdominal segments.

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

This species is peculiar by the median lobes which are very widely separated.

68. *Fiorinia pinicola* Maskell

Fiorinia pinicola Maskell (1897 a, p. 242); Ferris (1936, p. 2); Balachowsky (1954 e, p. 309). *Fiorinia juniperi* Kuwana (1925 b, p. 8) (nec Leonardi).

L. & H.: Toyama, Honsyu, on *Podocarpus macrophyllus* var. *Maki*; Mozi, Hukuoka-ken, Kyusyu, on *Ficus* sp. (R. Takahashi leg.); Wakasugi-yama, Hukuoka-ken, Kyusyu, on *Podocarpus macrophyllus* var. *Maki*; Hiko-San, Kyusyu, on an undetermined non-coniferous plant; Miyazaki, Kyusyu, on *Pittosporum Tobira*.

This species was originally described as a feeder of *Pinus*. There are at hand many specimens collected not only on the conifer *Podocarpus* but also on three non-coniferous plants. In examining them I have found no particular morphological difference sufficient to divide them into distinct taxonomic units according to their host plants.

69. *Fiorinia vaccinia* Kuwana

Fiorinia vaccinia Kuwana (1925 b, p. 15). *Fiorinia cephalotaxi* Takahashi (1952 a, p. 12), **syn. nov.** *Fiorinia euryae* Takahashi (1956, Annotationes Zoologicae Japonenses, Vol. 29, No. 1, p. 60) (nec Kuwana).

L. & H.: Sapporo, Hokkaido, on *Cephalotaxus Harringtonia*; Sado, on *Cephalotaxus Harringtonia*; Unaduki, Toyama-ken, Honsyu, on *Camellia* sp.; Toyama, Honsyu, on *Torreya nucifera*; Nagano-ken, Honsyu, on *Cleyera japonica* (R. Takahashi leg.); Amagi-san, Sizuoka-ken, Honsyu, on *Torreya nucifera*; Hukuoka, Kyusyu, on *Cephalotaxus Harringtonia*; Hiko-San, Kyusyu, on *Illicium religiosum* and an undetermined non-coniferous plant; Miyazaki, Kyusyu, on *Camellia* sp.; Siro-Yama, Kagosima, Kyusyu, on *Camellia* sp. and *Rhododendron* sp.

This species is in most details so closely similar to *F. pinicola* that it may be open to discussion whether the two are good species or mere variants of a single species. After my careful examinations I am inclined to believe that the two forms should be best treated as distinct species, being distinguishable especially in the second stage: in

F. pinicola the female of this stage is provided with a marginal gland spine on either side just caudad of the marginal macroduct which comes in second from the anterior and may belong to the fourth abdominal segment, whereas in *F. vaccinia* this gland spine is apparently absent. The illustrations of the two given by Kuwana (1925 b, Plate III, fig. f; Plate VI, fig. f) are clear and precise in presenting this difference. In the adult female of *F. pinicola* the antennal tubercles are set close together, without a membranous process between them, each tubercle being produced into a very elongate process, whereas in that of *F. vaccinia* the antennal tubercles are set somewhat apart, often with a membranous process between them, and each of them is usually not elongate in shape, although at times is produced into a somewhat elongate, conical projection.

In the original description it is stated that *F. vaccinia* has a well-developed membranous process between the antennae. However, as mentioned by Takahashi (1956, l.c., '*F. euryae*'), this process is extremely variable in shape and size and sometimes completely wanting, and such variations are often found among individuals in the same colonies.

The present specimens collected on the conifer *Torreya* at Amagi-san agree very well with the original description of *F. cephalotaxi*. It is the opinion here adopted that this scale insect may be a variant of *F. vaccinia*, differing from the type form mainly by the second exuvium of the female remarkably elongate. The interantennal process is, if present, represented by a small, conical process in the *cephalotaxi* form.

The examined specimens collected on the conifer *Cephalotaxus* are all definitely referable to *F. vaccinia*. In this series the exuvium of the second stage female is not so much elongate as in the *cephalotaxi* form, and the interantennal process is well developed in many females. As at present understood *F. vaccinia* is a polyphagous species, feeding not only on various non-coniferous plants but also on conifers, and occurs over the islands of Japan.

70. *Fiorinia theae* Green

Fiorinia theae Green (1900 c, p. 3); Kuwana (1925 b, p. 10); Ferris (1942, SIV-395).

L. & H.: Kusimoto, Wakayama-ken, Honsyu, on *Buxus*? (R. Takahashi leg.).

71. *Fiorinia euryae* Kuwana

Fiorinia euryae Kuwana (1925 b, p. 13).

Adult female. Body membranous throughout except for pygidium. Antennae set rather close, each represented by a small tubercle and a seta, without a membranous process between them. Anterior spiracles each with a small cluster of accompanying disc pores. A small submedian dorsal duct present just cephalad of pygidium on each side. Anus situated towards base of pygidium. Perivulvar pores in five groups, few in the median group, rather numerous in the lateral groups. Marginal macroducts rather small and rather slender, six to nine in number on each side. Submarginal macroducts absent. Median lobes rather small, slightly larger than inner lobule of second lobe, sometimes somewhat sunken into apex of pygidium and slightly divergent, sometimes

almost entirely projecting and parallel. Second lobes with lobules distinctly wider than long, the inner lobule serrate or the apex slightly produced and rounded, the outer lobule represented by a low, serrate, broad process. Marginal gland spines absent on pygidium.

L. & H.: Hukuoka, Kyusyu, on an undetermined plant; Wakasugi-yama, Hukuoka-ken, Kyusyu, on *Eurya japonica*; Amami-Ôsima, on *Eurya emarginata*.

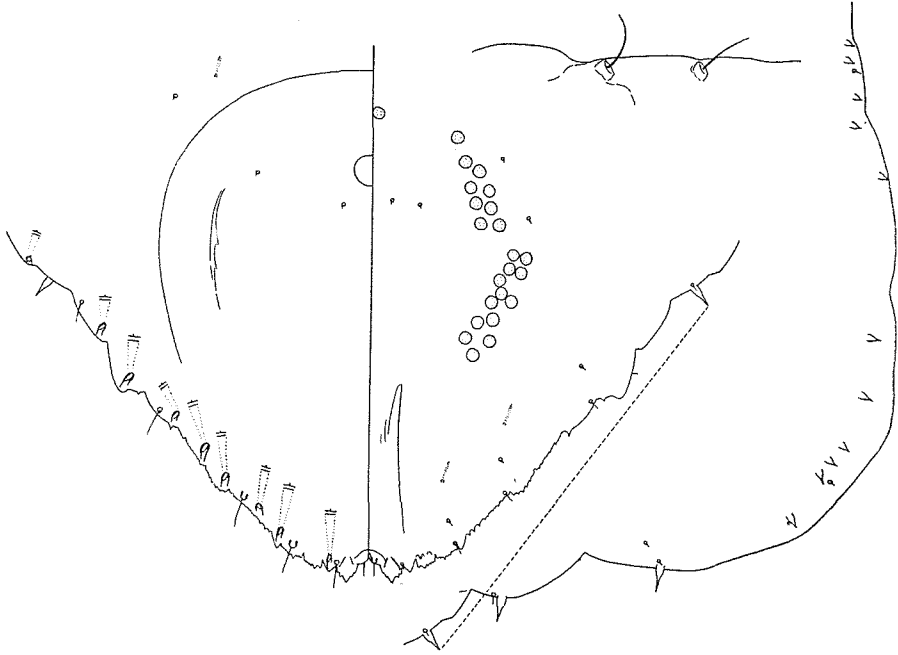


Fig. 34. *Fiorinia euryae* Kuwana.

Adult female: pygidium, lateral margin of body, and antennae (upper).

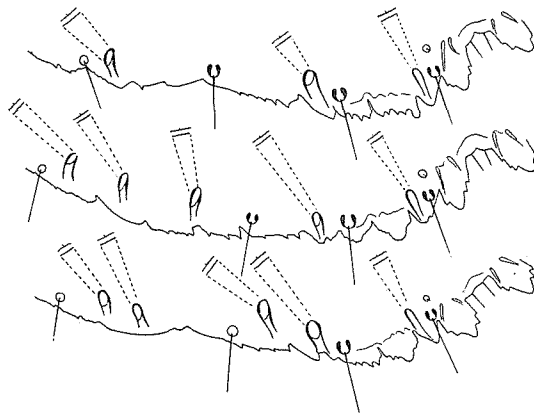


Fig. 35. *Fiorinia euryae* Kuwana.

Adult female: pygidial margins in dorsal aspect.

Takahashi (1956, Annotationes Zoologicae Japonenses, Vol. 29, No. 1, p. 60) unites *F. euryae* with *F. vaccinia*, but the two are distinct species: *F. euryae* is distinguishable from *F. vaccinia* by the slightly smaller and somewhat more elongate marginal macroducts, by lacking gland spines on the pygidium, by the shape of the pygidial lobes, etc. *F. euryae* is somewhat similar to *F. theae*, from which it is distinguished by the larger marginal macroducts of the pygidium, by lacking gland spines on the pygidium, etc.

72. *Fiorinia horii* Kuwana

Fiorinia horii Kuwana (1927 b, p. 151); Takahashi (1934, p. 27).

Adult female. Body somewhat elongate, membraneous throughout except for pygidium. Antennae each represented by a very small tubercle and a long seta; interantennal



Fig. 36. *Fiorinia horii* Kuwana.

Adult female: pygidium, lateral margin of body, and antennae (upper).

process present, mostly represented by a small, low, conical projection. Anterior spiracles each with a small cluster of accompanying disc pores. Microducts scattered in a transverse band between posterior spiracles. One or two small submedian dorsal ducts present just cephalad of pygidium on each side, and a similar submedian one often on the three preceding segments on one or either side. Anus situated somewhat towards base of pygidium. Perivulvar pores in five groups, few in the median group, rather numerous in the lateral groups. Marginal macroducts eight in number on each side, a few submarginal ones usually present in each basal angle of pygidium. Median lobes somewhat sunken into an incision, divergent, robust, rounded and roughly serrate along the free

margin. Second lobes with both lobules each represented by a low, serrate process. Marginal gland spines of pygidium slender, one laterad of median and second lobes each.

L. & H.: Sapporo, Hokkaido; Hiko-San, Kyusyu. On *Rhododendron*.

This species was originally described from central Honsyu. Takahashi recorded it from Formosa.

73. *Fiorinia nachiensis* Takahashi

Fiorinia nachiensis Takahashi (1956, Annotationes Zoologicae Japonenses, Vol. 29, No. 1, p. 60).

L. & H.: Nati-san, Wakayama-ken, Honsyu (R. Takahashi leg.); Ôdai-ga-Hara, Nara-ken, Honsyu (R. Takahashi leg.). On *Rhododendron*.

This species usually lacks gland spines on the pygidium. In the examined specimens, however, there are two females which are provided with marginal spines on the pygidium. In one of them there is a marginal spine just laterad of the second lobe on

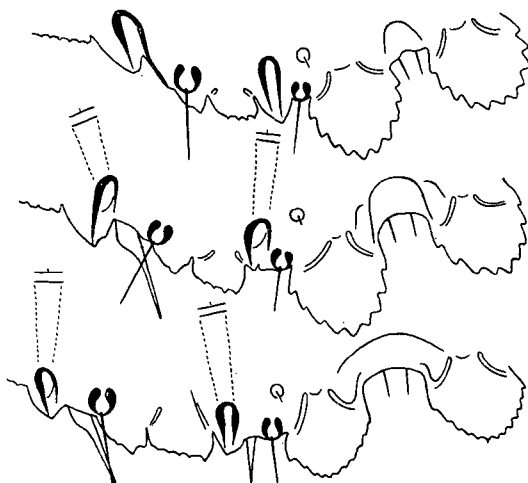


Fig. 37. *Fiorinia nachiensis* Takahashi.
Adult female: pygidial margins in dorsal aspect.

either side, and in the other specimen two marginal spines are seen on each side at the usual positions.

This species is evidently very close to *F. horii*, but is distinguishable from the latter mainly by the number of the marginal macroducts.

Key to the species

1. Median lobes elongate, distinctly, though not entirely, sunken into apex of pygidium; second lobes well developed, the inner lobule longer than wide or approximately as long as wide, distinctly produced, and rounded apically; marginal gland spines present on pygidium, one laterad of median and second lobes each. 2.
- Median lobes approximately as long as wide or somewhat longer than wide, projecting or somewhat sunken into apex of pygidium; second lobes represented by low projections, the inner lobule wider

- than long and serrate, or the apex slightly produced and rounded; marginal gland spines present or absent on pygidium. 6.
2. Marginal ducts of pygidium all large and practically of the same size. 3.
- Marginal ducts of pygidium represented by four large ones and two much smaller ones on each side, the smaller ones being situated cephalad of the large ones; some small submarginal dorsal ducts scattered in each basal angle of pygidium and on the preceding segment, similar submedian dorsal ducts scattered on pygidium laterocephalad of anus and on the preceding segment; antennal tubercles each produced into a long, almost spine-like process; interantennal process absent. *F. japonica*.
3. Marginal macroducts seven or more in number on each side; interantennal process present or absent. 4.
- Marginal macroducts three to five, mostly four, in number on each side, one laterad of median lobe, and also of second, one in the next position on fifth abdominal segment, one usually present although sometimes absent on fourth, and one present at times on third; median lobes slightly expanded apically; antennal tubercles each produced into a long, spine-like process; interantennal process absent. *F. fioriniae*.
4. Median lobes widely separated, slightly divergent posteriorly, the basal zygotis rather rudimentary, represented by a slender, weakly sclerotized band. *F. separata* sp. nov.
- Median lobes distinctly divergent posteriorly, their bases set close, the basal zygotis well developed, represented by a robust, thick sclerosis. 5.
5. Antennal tubercles set close together, each produced into a long, almost spine-like process; interantennal process absent; marginal macroducts eight in number on each side; submarginal macroducts absent; second stage female with a marginal gland spine just caudad of the marginal macroduct which comes in second from the anterior and may belong to the fourth abdominal segment. *F. pinicola*.
- Antennal tubercles set moderately apart, usually not elongate; interantennal process present or absent, if present variable in shape and size; marginal macroducts usually eight in number on each side; a submarginal macroduct at times occurring on third, and also on fourth, abdominal segment; second stage female without a marginal gland spine just caudad of the marginal macroduct which comes in second from the anterior and may belong to the fourth abdominal segment. *F. vaccinia*.
6. Marginal macroducts of pygidium usual in size; interantennal process present or absent, if present represented mostly by a small, low, conical projection. 7.
- Very small ducts occurring along margin of pygidium, as many as ten or eleven in number on each side; median lobes serrate, slightly sunken into apex of pygidium; a marginal spine present laterad of median and second lobes each; minute ducts arranged in a row along margin on each side of body anterior to pygidium, extending anteriorly almost to head, some of them opening through small tubercles; interantennal process present. *F. theae*.
7. Median lobes robust, comparatively large, distinctly larger than inner lobule of second lobe, more or less rounded along the free margin, and serrate; marginal spines present or absent on pygidium. 8.
- Median lobes rather small, slightly larger than inner lobule of second lobe, sometimes somewhat sunken into apex of pygidium and slightly divergent, sometimes almost entirely projecting and parallel; marginal spines absent on pygidium; marginal macroducts six to nine in number on each side. *F. euryae*.
8. Marginal macroducts eight in number on each side, a few submarginal macroducts usually occurring in each basal angle of pygidium; median lobes somewhat sunken into apex of pygidium, divergent;

- marginal spines present on pygidium, one laterad of median and second lobes each. . . . *F. horii*.
- Marginal macroducts three or mostly four in number on each side of pygidium, submarginal macroducts absent; median lobes slightly sunken into apex of pygidium or almost entirely projecting, slightly divergent or almost parallel; pygidial gland spines normally absent, but at times occurring at the usual positions. *F. nachiensis*.

—To be continued—

NOTES ON QUADRASPIDIOTUS MACROPORANUS TAKAGI. This scale insect was originally described from specimens collected on *Cercidiphyllum japonicum* and *Tilia japonica* at Sapporo, Hokkaido. There are at hand other specimens of this species from the following localities and host plants:— Sapporo, Hokkaido, on *Sorbus alnifolia*; Toyama, Honsyu, on *Castanea crenata* and *Prunus Mume*; Ōsaka, Honsyu, on *Quercus serrata*. They are well characterized by having short lateral macroducts in the prepygidial region of the body. The anal opening is somewhat variable in size in the present material; especially, the specimens from *Prunus Mume* differ from the types by having a smaller anal opening, of which the longitudinal diameter is about equal to the length of the median lobes. Of the type specimens six are provided with two marginal macroducts, and the remaining two with one, between the median lobes. However, in the present females, at least in well-prepared specimens, there is seen merely one marginal macroduct between the median lobes.

SADAO TAKAGI

SOME DIASPIDIDAE FEEDING ON INTRODUCED CONIFERS. On June 28, 1960, I had the opportunity to search for scale insects on introduced conifers in the campus of the Experiment Forest of the Tokyo University at Yamabe, Hokkaido. At that time I collected six species of the family Diaspididae on three conifers:— *Aspidiotus cryptomeriae* Kuwana, on *Abies concolor*; *Tsugaspidotus tsugae* (Marlatt), on *Picea excelsa*; *Parlatoria piceae* Takagi, on *Picea pungens*; *Lepidosaphes japonica* (Kuwana), on *Picea excelsa* and *Picea pungens*; *Cynodontaspis piceae* Takagi (MS), on *Picea excelsa*; *Fiorinia japonica* Kuwana, on *Picea pungens*. There are reasons enough to believe that these insect species are native to Japan, and yet on the introduced plants were noticed very heavy infestations with certain species (*Aspidiotus cryptomeriae*; *Cynodontaspis piceae*; *Fiorinia japonica*).

SADAO TAKAGI