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New Asterolecaniidae s.l. (Homoptera: Coccinea) from different regions of the world and some distributional records

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A new genus and four new species of Asterolecaniidae s.l. are described and illustrated: *Forticauda borchsenii* n. gen., n. sp. from India, *Abditococcus mystroxyloini* n. sp. from South Africa, *Mycetococcus sinensis* n. sp. from China, and *Stictacanthus sugonyaevi* n. sp. from Vietnam. New data on distribution are provided for four species: *Bambusaspis bambusae* (Boisduval, 1869) is recorded for the first time from Indonesia (Sumatra), *Hsua cheni* Borchsenius, 1969 from Laos, *Pauroaspis daedalea* Gavrilov-Zimin, 2013 from Thailand and Indonesia (Sumatra), and *Planchonia arabidis* Signoret, 1876 from Cuba.

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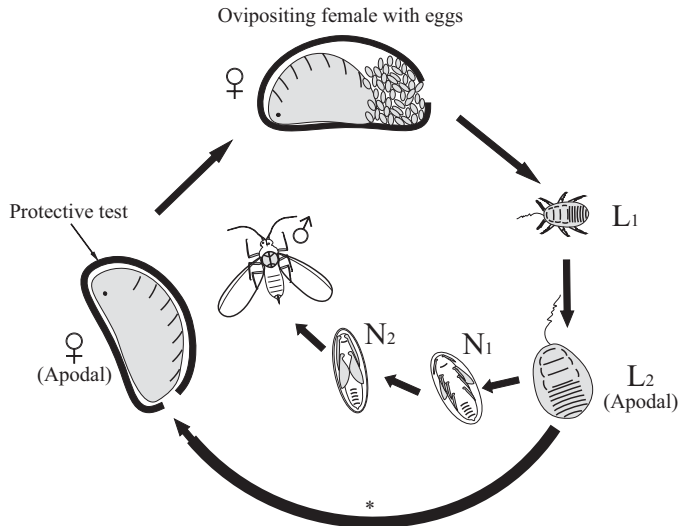
Keywords: pit scale insects; taxonomy; morphology; Asterolecaniinae; Lecanodiaspidinae; morphology; new species; new genus

Introduction

The family Asterolecaniidae Cockerell, 1896 (pit scale insects) comprises more than 400 species in 41 genera of the world fauna (Ben-Dov 2006) and is subdivided into three subfamilies: the nominative one, Lecanodiaspidinae Targioni Tozzetti, 1896, and Cerococcinae Balachowsky, 1942. These subfamilies are often considered as three separate families (see, e.g. Koteja 1974; Lagowska et al. 2015; Hodgson and Williams 2016) in the frame of splitting the suborder Coccinea into numerous “minute” families with partly overlapping diagnostic characters. However, all pit scale insects share a well-defined apomorphic character: the presence of so-called 8-shaped pores (the peculiar wax glands which scattered on dorsum and/or venter of adult females and larvae). Moreover, members of all three subfamilies exhibit similar protective tests, similar ontogenesis, mode of life and cytogenetic features. Due to these characters, all these three groups are traditionally considered as subfamilies of Asterolecaniidae s.l. (see, e.g. Ferris 1955; Brown and McKenzie 1962; Danzig 1980; Danzig and Gavrilov-Zimin 2014; Gavrilov-Zimin 2018a and references therein).

Most species of the pit scale insects are small (one or several millimeters long) delicate animals with vestigial or partly reduced legs in adult females, covered by resinous, more or less translucent protective test (Figure 1). Bisexual and/or parthenogenetic reproduction are known in different species (Brown and McKenzie 1962; Gavrilov 2007; Gavrilov-Zimin 2018b). At least some asterolecaniid genera contain obligate

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* In some species female has 3 immature instars.

Figure 1. Generalized life cycle of Asterolecaniidae s.l. with apodal females. L_{1-2} – larval instars; N_{1-2} – nymphal instars, bearing protoptera (wing buds).

ovoviviparous species, as for example, *Antecerooccus* Green, 1901, *Asterodiaspis* Signoret, 1877, *Cerococcus* Comstock, 1882, *Hsuia* Ferris, 1950, *Hyalococcus* Borchsenius, 1950, *Lecanodiaspis* Targioni Tozzetti, 1869, *Palmaspis* Bodenheimer, 1951, *Planchonia* Signoret, 1870 (see Gavrilov-Zimin 2018a). Meanwhile, as a whole, asterolecaniid reproductive biology and cytogenetics are very poorly studied in comparison with other scale insect families; thus, chromosomal numbers are known for six species only (see for review Gavrilov 2007; Gavrilov-Zimin 2018b).

As for the mode of life, all pit scale insects are obligate phytophagous on angiosperm host plants, most frequently on different Fagaceae, Oleaceae, and Poaceae (Bambuseae).

In the present paper one new genus and four new species of Asterolecaniidae s.l. are described and illustrated, three of them (*Forticauda borchsenii* n. gen., n. sp., *Abditococcus mystroxyloxi* n. sp., *Mycetococcus sinensis* n. sp.) are members of the subfamily Asterolecaniinae, whereas the fourth species (*Stictacanthus sugonyaevi* n. sp.) is referred to the subfamily Lecanodiaspidinae.

Material and methods

The studied material was collected by different specialists, including the present author, in India, China, Thailand, Laos, Indonesia, South Africa, and Cuba (see detail information below for each species). All material is deposited at the Zoological Institute, Russian Academy of Sciences (ZIN RAS) in St. Petersburg, Russia. The numbers with “K” mean unique collecting and preserving numbers for material fixed in acetoethanol and appropriate Canada balsam slides. The double numbers without “K” mean preserving numbers of old material, deposited in ZIN RAS.

The method to prepare permanent microscopic slides with Canada balsam follows the protocol by Gavrilov-Zimin (2018a).



Figure 2. Protective test of *Forticauda borchsenii* n. gen., n. sp.

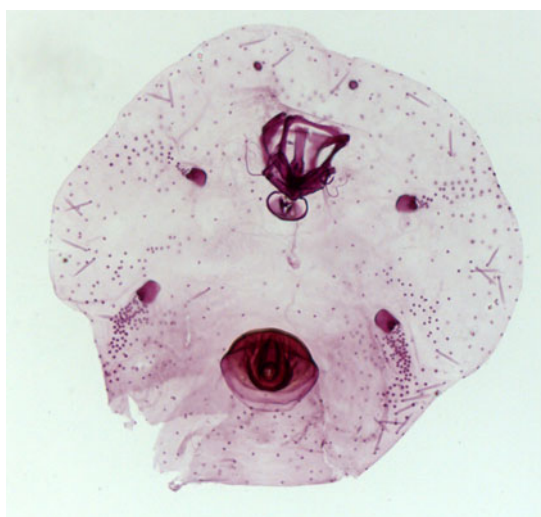


Figure 3. Slide-mounted adult female of *Forticauda borchsenii* n. gen., n. sp.

Descriptions of new taxa

Genus *Forticauda* n. gen.

Type species: *Forticauda borchsenii* n. sp. (Figures 2–4)

Description

Adult female. Body covered with unusual black test, looking like the test of the armored scale insects (Diaspididae), but with small orifice above anal apparatus (Figure 2). Antennae reduced to unsegmented vestiges, bearing each several setae.

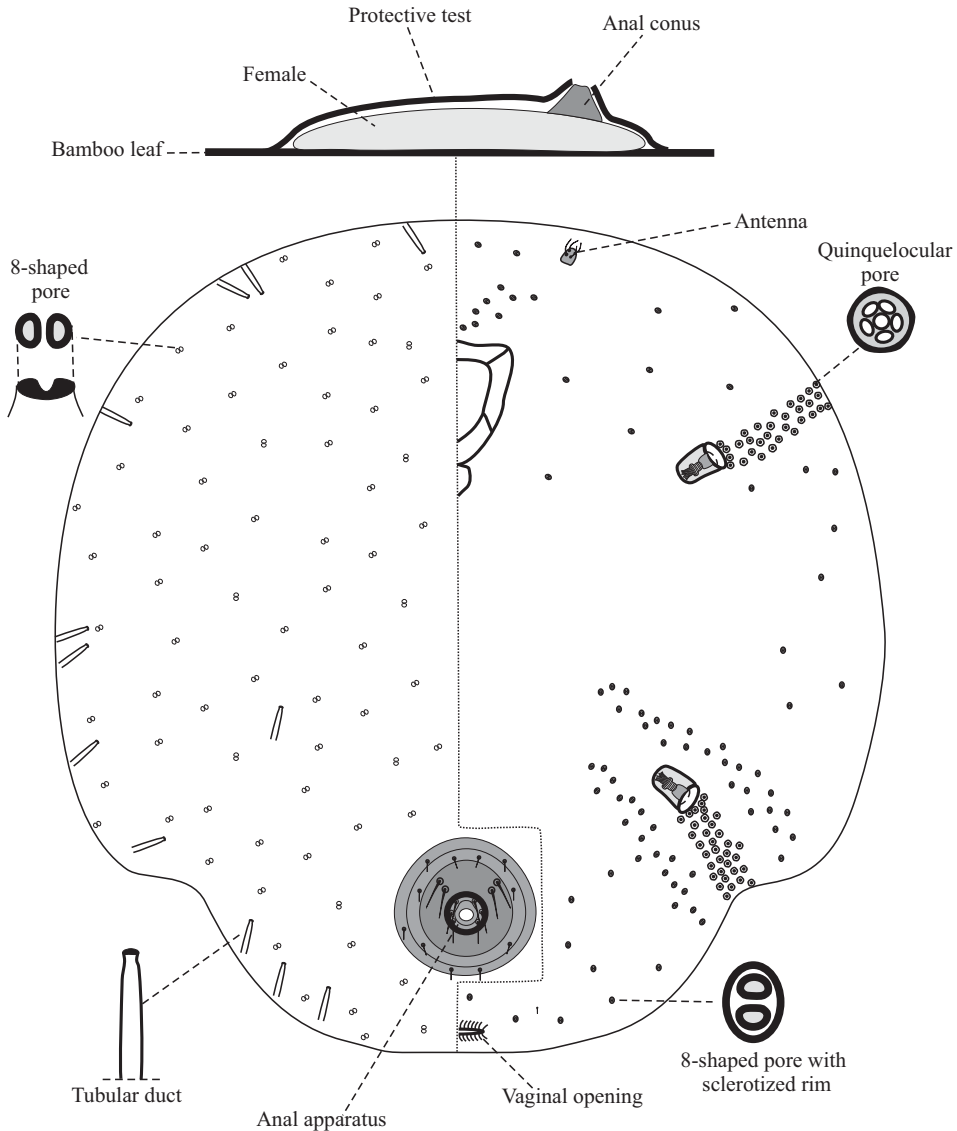


Figure 4. Morphology of *Forticauda borchsenii* n. gen., n. sp., holotype.

Legs are absent. Anal apparatus represented by a sclerotized anal ring, bearing six short setae and located at apex of a sclerotized conical protuberance on dorsum of abdomen (anal conus; Figure 3). Dorsal tubes absent. Multilocular pores absent. Quinquelocular pores forming bands between each spiracle and body margin. Large 8-shaped pores are absent. Small 8-shaped pores sparsely scattered on dorsum and venter. Tubular ducts of characteristic *Asterolecaniinae* type, but without filament, very few, present mainly along body margin. Body setae are absent, excluding those on sclerotized cuticle of anal conus.

Males and larvae of both sexes are unknown.

Taxonomic notes

The new genus differs from all known genera of Asterolecaniidae in the presence of a dorsal sclerotized conical protuberance (anal conus) with anal apparatus at apex; the females of *Forticauda* **n. gen.** lie parallel at the surface of the host plant (leaves of bamboo). Some species of other asterolecaniid genera, such as *Mycetococcus* Ferris, 1918 and *Frenchia* Maskell, 1892 have sclerotized anal lobes or tapered sclerotized apex of abdomen, but directed caudally, according to perpendicular position of the female at the surface of the host plant. Both species of *Mycetococcus* inhabit bark cracks of Fagaceae trees in Mexico and southern USA. All three species of *Frenchia* are gall-inducing insects, connected with endemic Australian trees and shrubs of the families Proteaceae and Casuarinaceae (Lambdin and Kosztarab 1981).

Etymology

The new generic name is derived from two Latin words: “fortis” – hard, strong and “cauda” – tail. Gender feminine.

Forticauda borchsenii* n. sp.Material examined*

Holotype: 198-64, adult female, India: Assam: “Nongkerdem”, on leaves of undetermined bamboo (Poaceae), 12.II.1964, N. Borchsenius leg., ZIN RAS. Paratype: female on separate slide, but with the same collecting data as holotype.

Description

Adult female. Body pyriform, 0.5–0.8 mm long, covered by black test, with small orifice upper anal apparatus of female. Antennae reduced to unsegmented vestiges, each about 10 µm in diameter and bearing several short setae. Spiracles are well-developed, with strongly sclerotized spiracularia, each about 25 µm long. Anal apparatus represented by a sclerotized anal ring, about 10 µm in diameter, bearing six short setae and located at apex of a sclerotized conical protuberance on dorsum of abdomen (anal conus); anal conus about 100 µm in diameter at base. Multilocular pores totally absent. Quinquelocular pores, each about 2–3 µm in diameter, forming bands (3–4 pores wide) between each spiracle and body margin. Large 8-shaped pores are absent. Small 8-shaped pores, each about 3–4 µm long, scattered on dorsum. Peculiar 8-shaped pores with sclerotized rim, each about 3 µm in diameter, forming bands along both sides of posterior spiracular bands of quinquelocular pores, group between antennae and sparsely scattered on other ventral surface of body. Tubular ducts, each about 30 µm long and 2–2.5 µm wide, very few, present mainly along dorsal body margin. Body setae absent, excluding short setae on sclerotized cuticle of anal conus (see [Figure 4](#)).

Etymology

The new species is named in honor of the collector of the type material, the late professor N.S. Borchsenius, famous coccidologist.

Genus *Abditicoccus* Lambdin & Kosztarab, 1975

Abditicoccus mystroxyloni n. sp.

(Figure 5)

Material examined

Holotype: K 1430, adult female, South Africa: Limpopo Prov.: Blouberg, in galls on leaves and twigs of *Mystroxylon aethiopicum* (Thunberg, 1794) (Celastraceae),

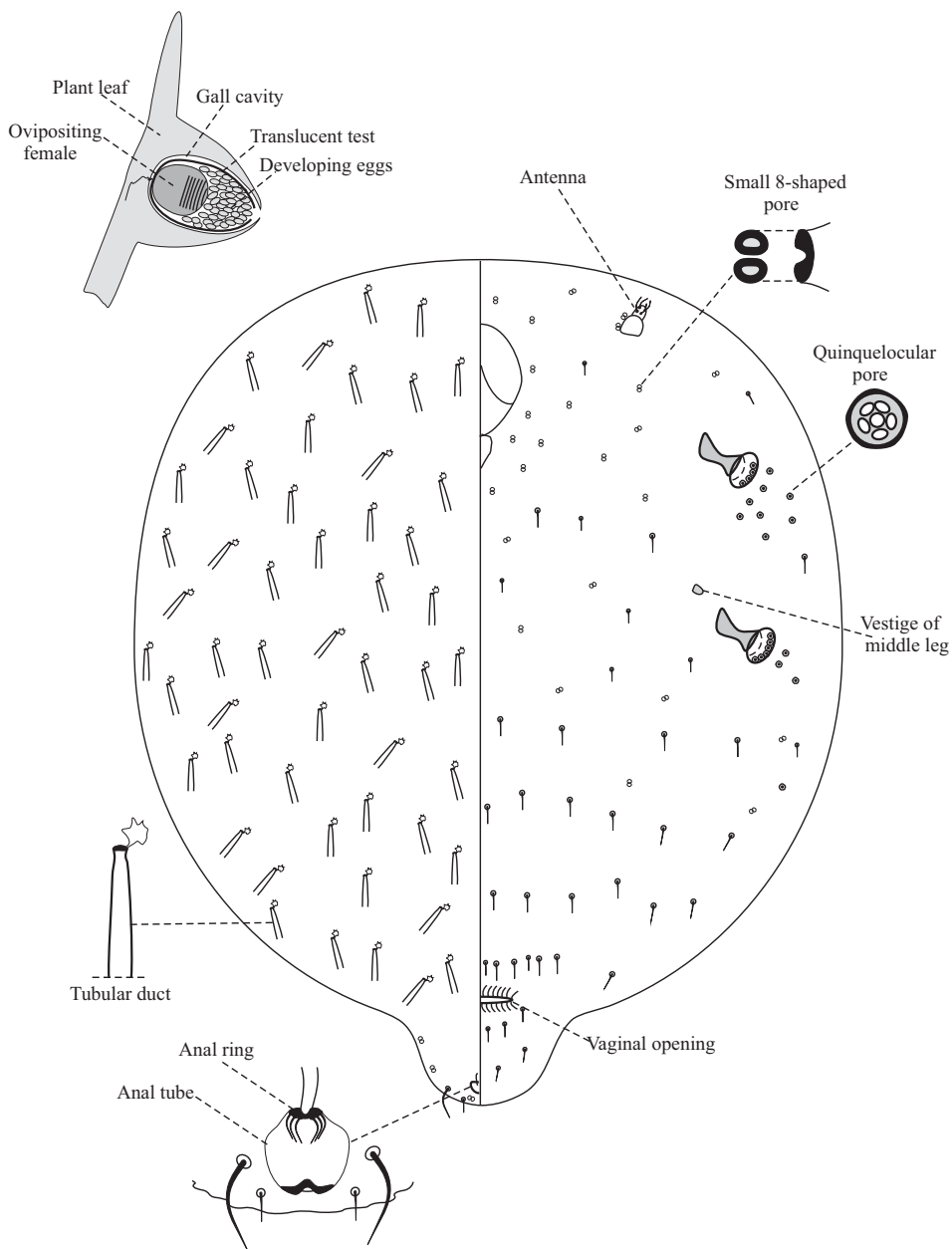


Figure 5. Morphology of *Abditicoccus mystroxyloni* n. sp., holotype.

6.XI.2017, Ph. Chetverikov leg., ZIN RAS. Paratypes: ultimolarva on the same slide as holotype; 2 ultimolarvae and 12 penultimolarvae on seven separate slides with the same collecting data as holotype.

Description

Adult female. Body pyriform, about 1 mm long, covered by a translucent test, characteristic for the family Asterolecaniidae. Antennae reduced to two-segmented vestiges, each bearing several short setae on apical segment. Fore and hind legs totally absent; middle legs reduced to two small tubercles without setae. Anal apparatus small and represented by a short anal tube with narrowed sclerotized opening and anal ring with six short setae. Dorsal tubes absent. Multilocular pores absent. Quinquelocular pores, each about 5 μm in diameter, forming groups near spiracles. Minute discoidal pores of unclear structure occasionally present on both body sides. Large 8-shaped pores are absent. Small 8-shaped pores, each about 5 μm long, few, sparsely scattered on venter, but numerous around mouthparts; several pores present also in marginal zone of last abdominal tergite. Large tubular ducts, each about 30 μm long and 2–2.5 μm wide, with wide terminal filament, scattered on the dorsum. Short spine-like setae forming transverse rows on ventral surface of abdomen and occasionally present on ventral surface of thorax and head.

Female ultimolarvae (probably larval instar III) and penultimolarvae (probably larval instar II) differ from adult female in the absence of vaginal opening, in one-segmented antennae and in the presence of a row of quinquelocular pores along all body margin. Penultimolarva additionally differs from subsequent instars in the absence of large tubular ducts.

Males and male immature instars are unknown.

Taxonomic notes

Up to now the genus *Abditococcus* included only the type species, *A. acaciae* Lambdin & Kosztarab, 1975, described from blister-like galls on stems of *Acacia* sp. (Fabaceae) in South Africa (see the review of South African asterolecaniids in Giliomee and Kozár 2008). The new species produces similar galls, but on leaves of *Mystroxylon aethiopicum* and morphologically differs from the type species in two-segmented antennae, absence of multilocular pores, large groups of quinquelocular pores near spiracles, and in tubular ducts with wide terminal filament.

Etymology

The new specific name is derived from the name of the host plant, *Mystroxylon*.

Genus *Mycetococcus* Ferris, 1918

Mycetococcus sinensis n. sp.

(Figure 6)

Material examined

Holotype: 141-59, adult female, China: Yunnan Prov.: Simao, on *Quercus* sp. (Fagaceae), 3.IV.1957, N. Borchsenius leg., ZIN RAS.

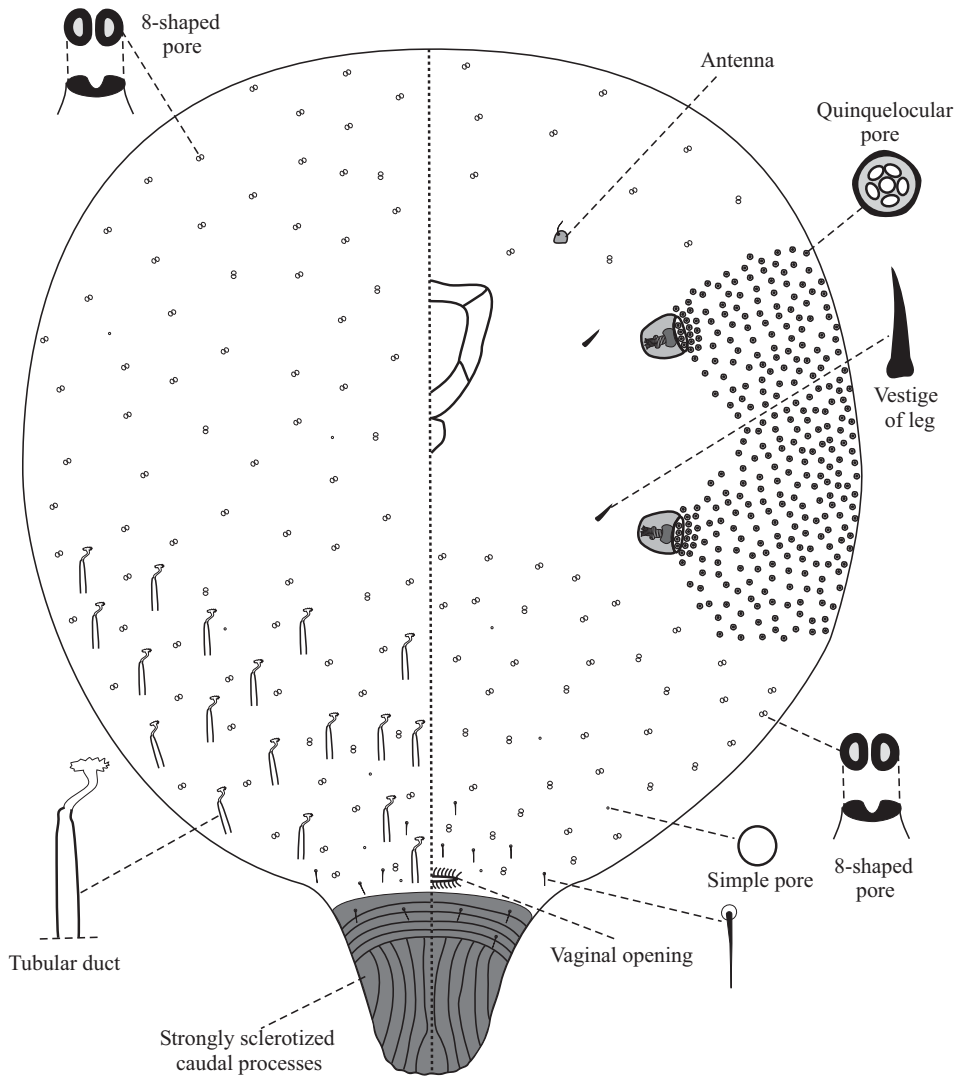


Figure 6. Morphology of *Mycetococcus sinensis* n. sp., holotype.

Description

Adult female. Body pyriform, about 1 mm long, with strongly sclerotized caudal processes. Antennae reduced to unsegmented vestiges, each about 12 μm in diameter, bearing one minute seta. Two first pairs of legs represented by spine-like vestiges, each about 20 μm long. Hind legs absent. Spiracles well-developed, each located inside of strongly sclerotized cuticular funnel. Anal apparatus hidden inside the sclerotized caudal process and not visible in the available female. Multilocular pores absent. Quinquelocular pores, each about 3 μm in diameter, forming two large groups (left and right) between spiracles and body margin. Large 8-shaped pores absent. Small 8-shaped pores, each about 5 μm long, scattered on all body surface excluding medial zone of thoracic sternites. Simple discoidal pores, each about 2 μm in diameter, very few, occasionally present on both sides of the body. Tubular ducts, each about 35 μm long and

2.5–3 µm wide, not numerous, present on dorsal surface of abdomen. Body setae few, minute, present only on posterior abdominal segments and caudal processes.

Taxonomic notes

Up to now the genus *Mycetococcus* Ferris, 1918 included two endemic north-American species, namely *Mycetococcus corticis* (Townsend & Cockerell, 1898) and *Mycetococcus ehrhorni* (Cockerell, 1895) inhabiting bark cracks of *Quercus* spp. and *Lithocarpus* sp. (Fagaceae) (see descriptions and figures in Ferris 1955: 56–60). The new species from China differs from both North-American species in the presence of large marginal groups of quinquelocular pores, presence of vestigial legs and in unpaired sclerotized caudal process (in contrast to paired processes which are in fact modified anal lobes).

Etymology

The species name is a medieval Latin adjective, which means Chinese, originated from China.

Genus *Stictacanthus* Lambdin & Kosztarab, 1973

Stictacanthus sugonyaevi n. sp.

(Figure 7)

Material examined

Holotype: 141-95, adult female, Vietnam: Hoa Binh Prov.: Mai Chau, [without data on host plant], 1.II.1990, E.S. Sugonyaev leg., ZIN RAS. Paratypes: two females on separate slide, but with the same collecting data as holotype.

Description

Adult female. Body is broadly oval, about 3 mm long and 2 mm wide. Antennae are 7–8-segmented, about 300 µm long. Legs are normally developed; claw with minute, poorly visible denticle; claw digitules clavate. Anal apparatus represented by a sclerotized anal ring, about 75 µm in diameter, bearing six long setae and located inside the anal tube, about 200 µm long. Cribriform pores are absent. Multilocular pores, each about 8 µm in diameter, numerous, forming transverse bands and rows on abdominal sternites are present. Quinquelocular pores, each about 5 µm in diameter, forming bands (3–6 pores wide) between each spiracle and body margin. Large 8-shaped pores, each about 10 µm long, and small 8-shaped pores, each about 8 µm long, scattered on dorsum and sparsely present in marginal zone of venter. Tubular ducts, each about 15 µm long and 4 µm wide, scattered on all body surface, but more numerous on dorsum. Wide conical setae forming transverse rows on dorsum. Thick flagellate setae forming row along body margin on dorsum. Occasional setae of different sizes present also on venter, especially in marginal zone and on posterior abdominal sternites.

Males and larvae of both sexes unknown.

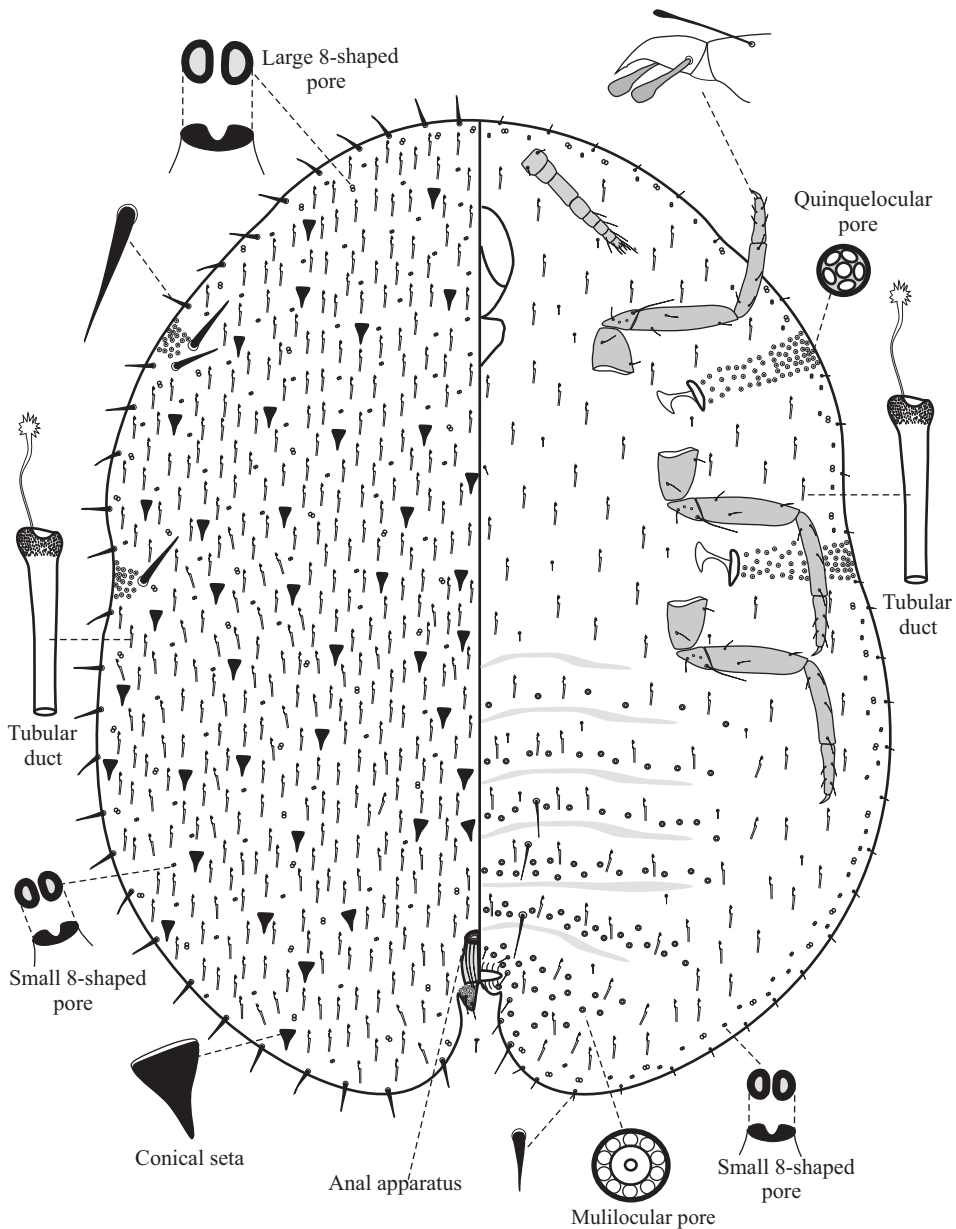


Figure 7. Morphology of *Stictacanthus sugonyaevi* n. sp., holotype.

Taxonomic notes

The genus *Stictacanthus* differs from all other genera of subfamily Lecanodiaspidinae in the presence of dorsal conical setae (Lambin and Kosztarab 1973). Till now, the genus included the only species, *S. azadirachtae* (Green, 1909), known from India, Sri Lanka, and Indonesia (Sumatra). The new species differs from the type one in the following features (see characters of *S. azadirachtae* in brackets): legs are normally developed, each with coxa, trochanter, femur, tibia, and tarsus (legs reduced to two-segmented stumps); cribriform pores totally absent (cribriform plates arranged in two submedial

longitudinal rows on dorsum); dorsal conical setae very thick, about as long as wide at base (dorsal conical setae comparatively thin, about 2–3 times longer than wide).

Etymology

The new species is named in honor of the collector of the type material, the late professor E.S. Sugonyaev, famous entomologist, specialist on parasitic Hymenoptera.

New distributional records

Bambusaspis bambusae (Boisduval, 1869)

Material examined

K 1045, Indonesia: Sumatra: Gunung Leuser National Park, near Bukit Lawang Vill., on leaves of bamboo, 1.I.2013, I.A. Gavrilov-Zimin leg.

Distribution

The species is widely distributed in different tropical and subtropical countries, but is recorded for the first time from Indonesia.

Hsuia cheni Borchsenius, 1969

Material examined

K 1393a, Laos: Luang Prabang: on leaves of bamboo, 16.VI.2017, I.A. Gavrilov-Zimin leg.

Distribution

The species was earlier known from Southern China only. It is the first record for Laos.

Pauroaspis daedalea Gavrilov-Zimin, 2013

Material examined

K 1020, Indonesia: Sumatra: Gunung Leuser National Park, near Bukit Lawang Vill., on thick stem of bamboo, 25.XII.2012, I.A. Gavrilov-Zimin leg. K 1364a, Thailand: Chiang Dao, on thick stem of bamboo, 5.VI.2017, I.A. Gavrilov-Zimin leg.

Distribution

This species was described as endemic of Western New Guinea (Indonesia), but now it is clear that *P. daedalea* has significantly wider distribution. These are the first records for Sumatra Is. (Indonesia) and for Thailand.

Planchonia arabidis Signoret, 1876

Material examined

3 = 90, Cuba: Habana, on leaves and twigs of undetermined tree, 6.XI.1986, I.M. Kerzhner leg.

Distribution

This Palaearctic species was introduced with its host plants in America and recorded many times from different states of the USA and different Islands of the Caribbean Basin. It is the first record for Cuba.

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The author thanks Dr Philipp Chetverikov for collecting *Abditicoccus mystroxylovi* n. sp. and Dr Jan Giliomee for useful comments on this species. I am also very grateful to Prof. Giuseppina Pellizzari for important comments and remarks to the whole text of the manuscript and to Dr Dmitrii Gapon for the consultations in Latin grammar and photo of the test of *Forticauda borchsenii* n. sp. and to Dr Boris Anokhin for his help in preparing the photo of the mounted *F. borchsenii* n. sp. The work was performed in the frame of the state research project no. AAAA-A19-119020690101-6 in Zoological Institute, Russian Academy of Sciences.

Disclosure statement

No potential conflict of interest was reported by the author.

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