

Diadocidiidae and Borboropsidae (Insecta: Diptera) of Japan, with Descriptions of Two New Species

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Three species of the dipterous family Diadocidiidae and one species of the Borboropsidae are recorded from Japan (Honshu). *Palaeodocidia ishizakii* gen. and sp. nov. of the former family and *Borboropsis yakunoana* sp. nov. of the latter are described and their male genitalia are illustrated. The genus *Palaeodocidia* differs from *Diadocidia* in the numbers of flagellomeres and abdominal tergites, and in peculiar structures of the male genitalia. *Diadocidia spinosula* Tollet, 1948, known from Europe, is recorded for the first time from Honshu, Japan.

Key Words: Diptera, Diadocidiidae, Borboropsidae, new genus and species, Japan.

Introduction

The family Diadocidiidae (Diptera) was treated as a subfamily of the family Mycetophilidae by earlier authors (Landrock 1926; Okada 1936; Laštovka and Matile 1972), but it was considered as a distinct family by recent authors (Stackelberg 1969; Rohdendorf 1974; Krivosheina 1988). Six Holarctic species of the genus *Diadocidia* Ruthe, 1831 were revised by Laštovka and Matile (1972), who divided the genus, on the basis of wing venation, postabdominal structure, and larval morphology, into two subgenera: *Adidocidia* Laštovka and Matile, 1972 and *Diadocidia* s. str. At the same time, a Japanese *Diadocidia ferruginosa* forma *thoracica* Okada, 1936 was raised to specific rank by them. The second Japanese species of Diadocidiidae described herewith as new to science was reared from a larva mined in the sporophore of a fungus (Polyporaceae) in Kyoto by Dr. H. Ishizaki. It is easily separable from all the known species of the genus *Diadocidia* by having the antenna 2+14-segmented and the male eighth tergite well developed. I am led, therefore, to the conclusion that it belongs to a new genus. The third species, *Diadocidia (D.) spinosula* Tollet, 1948, known from Europe, was recorded for the first time from Kyoto and Shiga Prefectures, Honshu, Japan.

The Borboropsidae were treated as a tribe of the family Heleomyzidae (Diptera) by many earlier authors, but were elevated by Papp (1998a) to family rank on the basis of the reduction of the dorsal preapical bristle on each of the fore and mid tibiae. One Holarctic species, *Borboropsis puberula* (Zetterstedt, 1838), and one Palaearctic species, *Nidomyia cana* Papp (1998b), have hitherto been known (Hackman and Andersson 1969; Mathis 1973); the generic assignment of a third species, *Borboropsis steyskali* Mathis, 1973, was questioned by Papp (1998a). I col-

lected an indubitable second Palearctic species of the genus *Borboropsis* in a weedy field beside a stream in Yakuno Town, northern Kyoto Prefecture, in the winter of 2002; this is described below as new to science.

Materials and Methods

Materials are the dried specimens. The male postabdomen and genitalia were macerated with 30% KOH and transferred to distilled water for dissection. After having been drawn, each set of postabdomen and genitalia was preserved in a short polyethylene tubule with glycerol and pinned with the type-specimen.

The holotypes of the new species are deposited in the collection of the Osaka Museum of Natural History (OMNH; Nagai Park, Osaka).

Taxonomy

1. Family *Diadocidiidae* Ruthe, 1831
Palaeodocidia gen. nov.

Type-species: *Palaeodocidia ishizakii* sp. nov.

Diagnosis. Male antenna 2+14-segmented, third flagellomere 1.5 times as long as wide; anepisternum setulose; vein R_1 with apex slightly beyond level of M-forking point; male eighth tergite entire, ninth tergite simple and weakly sclerotized; surstylus with one strong apical tooth; aedeagal tegmen setulose.

Description. Head with incomplete eye bridge; palpus 4-segmented.

Scutum with dorso-centrals (dc) and acrostichals (acr) distinct; scutellum with three pairs of bristles along margin. Wing venation as in *Diadocidia*, cross veins r-m and bm-cu situated in same vertical plane; macrotrichia present throughout wing surface. Fore tibia with one spur and group of setae in circle at inner apex; mid and hind tibiae each with two spurs.

Abdomen with eight tergites (T1–8) and seven sternites (S1–7) well developed; gonocoxites united with each other on ventral side; surstylus conical, densely setose, not bifurcated apically.

Etymology. The generic name is derived from the Greek *palaios*, ancient, in reference to the male plesiomorphic characters, and *diadokidos*, crossbeam; gender feminine.

Discussion. The genus *Diadocidia* consists of two subgenera, *Adidocidia* and *Diadocidia* s. str. The essential characters differentiating these subgenera are as follows: the third flagellomere of the male antenna in *Adidocidia* is more than four times (4–5.5) as long as wide, while less than 3.2 times (2.1–3.2) in *Diadocidia* s. str.; the anepisternum of the thorax is setulose in *Adidocidia*, but bare in *Diadocidia* s. str.; the male ninth tergite is only setose in *Adidocidia*, while it is provided with spines or spine-like setae along its posterior margin in *Diadocidia* s. str.

In the new genus *Palaeodocidia*, the antenna is composed of 14 flagellomeres (15 flagellomeres in the genus *Diadocidia*) and the third flagellomere is much shorter than that in any known species of the genus *Diadocidia*, and the anepister-

num is setulose as in the subgenus *Adidocidia*. The most distinctive characteristic of the new genus is the male postabdominal structure: the eighth tergite is well developed, while being lost in the genus *Diadocidia*; the ninth tergite is simple, weakly sclerotized, and situated just below the cerci in a form of an ellipse; the surstylus has only a strong apical tooth; and the aedeagal tegmen (genital plate) is provided with minute setulae. On the other hand, the species of the genus *Diadocidia* have a rectangular to conical, well-sclerotized, and setose ninth tergite situated between the gonocoxites, and a bifurcate apex on the surstylus (exceptionally bilobate at the base in *D. stanfordensis* Arnaud and Hoyt, 1956; see Laštovka and Matile 1972, fig. 12).

The families Sciaridae and Diadocidiidae+Mycetophilidae have been considered as a monophyletic group, with some distinctive autapomorphic characters, by many workers (Wood and Borkent 1989; Blaschke-Berthold 1994, etc.). In *Diadocidia*, the loss of the sclerite of the eighth abdominal segment, the bifurcate apex of the surstylus, the round apex of the bare aedeagal tegmen, the short aedeagus, and the long parameres are inferred to be apomorphic character states. Contrarily, the common pattern in the Sciaridae and the new genus *Palaeodocidia* of having 14 flagellomeres of the antenna, a distinct sclerite of the eighth abdominal segment, many setulae or spinulae on the aedeagal tegmen, and a distinct apical spine on the surstylus, suggests a possible synplesiomorphy. The female and larval morphologies of *Palaeodocidia* species remain unknown, though, and thus the phylogenetic relationship between the Sciaridae and *Palaeodocidia* can only be fully clarified in the future.

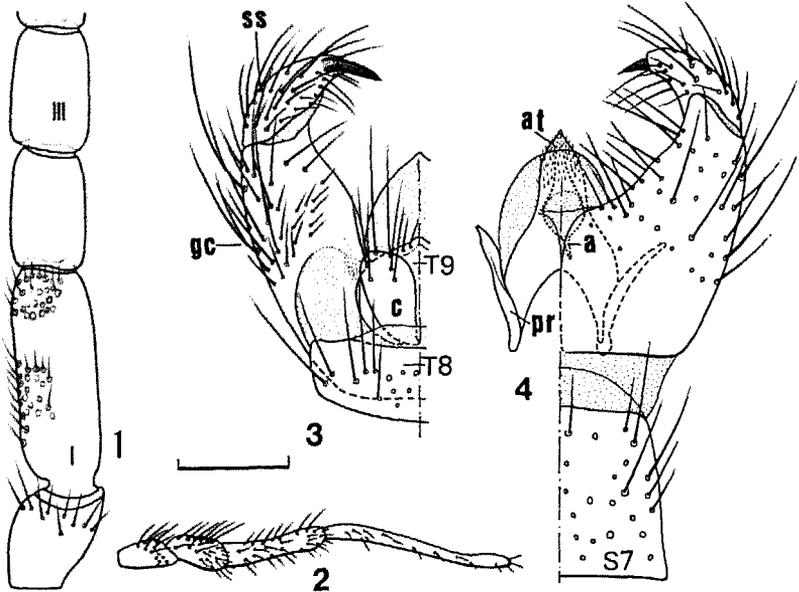
Palaeodocidia ishizakii sp. nov.

[Japanese name: Ishizaki-chabo-kinoko-bae]

(Figs 1-4)

Description. *Male.* Head black; frons sparsely gray-dusted; clypeus and antenna pale brown, but scape, pedicel, and base of first flagellomere testaceous; palpus brownish yellow. Thorax with scutum, pleura, pleurotergite, and mediotergite brown, pronotum and proepisternum yellow, and scutellum yellowish brown; scutum with median part between dc-rows and posterior area paler than lateral sides. Wing hyaline, with macrotrichia pale brown; halter yellow. Legs yellow, tarsi tinged with brown; tibial spurs pale brown. Abdominal tergites (T1-7) and sternites yellowish brown, T8-9 testaceous, gonocoxite and surstylus yellow except for apical black tooth.

Head setulose; eyes sparsely hairy, extended dorsally above bases of antennae but not forming eye bridge as seen in sciarid gnats; dorsal inner margin of eye, consisting of 3-4 ommatidia, separated from each other by slightly less than interocellar distance between posterior ocelli. Antenna 2+14-segmented, scape orbicular and almost equal to pedicel in length; flagellomeres (Fig. 1) gradually narrowing distally, in proportion of 4.0 (first):2.1-2.2 (second to fifth):2.0 (sixth to 10th):1.9 (11th to 13th):2.1 (14th): third flagellomere 1.5 times as long as wide, 10th flagellomere twice as long as wide; each flagellomere densely covered with whitish hairs nearly one quarter as long as segment; first flagellomere with three long setae (not drawn in Fig. 1), 14th flagellomere with two apical setae almost equal in



Figs 1-4. *Palaeodocidia ishizakii* sp. nov., holotype male. 1, Pedicel and first (I) to third (III) flagellomeres; 2, palpus; 3, eighth and ninth tergites (T8 and T9), with cercus (c), gonocoxite (gc), and surstylus (ss), dorsal right half; 4, seventh sternite (S7) and genitalia, with aedeagus (a), aedeagal tegmen (at), and paramere (pr), ventral right half. Scale 0.1 mm for Figs 1, 3, 4, 0.2 mm for Fig. 2.

length to those on first flagellomere. Palpus (Fig. 2) 4-segmented, palpomeres in length proportion of 1.9 : 2.2 : 3.9 : 6.6, first palpomere with several dorsal setae and six sensory pores, second and third palpomeres more densely setose than rest.

Scutum with dc, anteriormost pair of acr, and lateral bristles long; scutellum small, with two pairs of marginal bristles, basal pair twice as long as apical one; anteprenotum with two long propleurals and three setulae; anepisternum densely covered with minute, pale brown setulae. Wing with Sc nearly one-half length of R_1 , R_1 terminating slightly beyond level of M-forking point, R_5 parallel to M_1 and not sinuate at tip, stem of M 1.4 times as long as R_s and one-half length of M_1 . Hind coxa with row of six or seven long setae posteriorly; fore tibia with about 25 setae in circular area of inner apex; spurs on mid and hind tibiae almost equal to each other in length.

Tergite 7 nearly one-half length of S7, almost as long as T8 (Fig. 3). Genitalia (Figs 3, 4): gonocoxite with setae on inner basal part of dorsal side distinctly shorter than lateral setae, and rather long setae along posterior margin of ventral side; surstylus narrowed distally, with strong apical spine-like tooth; aedeagal tegmen setulose; aedeagus short; parameres well developed.

Body length 2.5 mm, wing length 2.8 mm.

Female. Unknown.

Type material. Holotype: male (OMNH TI 172), Nyakoji, Kyoto, 6 Mar. 1991, H. Ishizaki leg. (host fungus collected on 11 Feb. 1991); left antenna and palpus mounted on small glass slide and pinned with specimen.

Distribution. Japan (Honshu).

Larval host fungus. *Lenzites betulina* (L.:Fr.) Fr. (Polyporaceae).

Etymology. The specific name is dedicated to the collector of this interesting gnat, Prof. Hironori Ishizaki, formerly of Nagoya University, Nagoya.

Diadocidia (Diadocidia) spinosula Tollet, 1948
[Japanese name: Toge-hara-chabo-kinoko-bae]

Diadocidia spinosula Tollet, 1948: 285.

Diadocidia (Diadocidia) spinosula: Laštovka and Matile 1972: 214.

The male specimens examined are well coincident with the original description. The genitalia are distinctive in the following points: the ninth tergite is provided with 10 to 12 testaceous, spine-like setae along the caudal margin; the black surstylus is bifurcated shortly on tip.

Specimens examined. One ♂, Exp. Forest of Kyoto Pref. Univ., Ooe, Kyoto, 11 May 1974, T. Kimura leg.; 1 ♂, Mt. Hiei, Ohtsu, 15 July 1973, T. Kimura leg.

Distribution. Europe, Japan (Honshu). New to Japan.

Diadocidia (Diadocidia) thoracica Okada, 1936
[Japanese name: Sesuji-chabo-kinoko-bae]

Diadocidia ferruginosa f. *thoracica* Okada, 1936: 22.

Diadocidia (D.) thoracica: Laštovka and Matile 1972: 216.

Specimen examined. One ♀, Kami-chihara, Yakuno-cho, Kyoto Pref., 29 Apr. 2003, M. Sasakawa leg.

Distribution. Japan (Hokkaido, Honshu). New to Honshu.

2. Family **Borboropsidae** Czerny, 1902

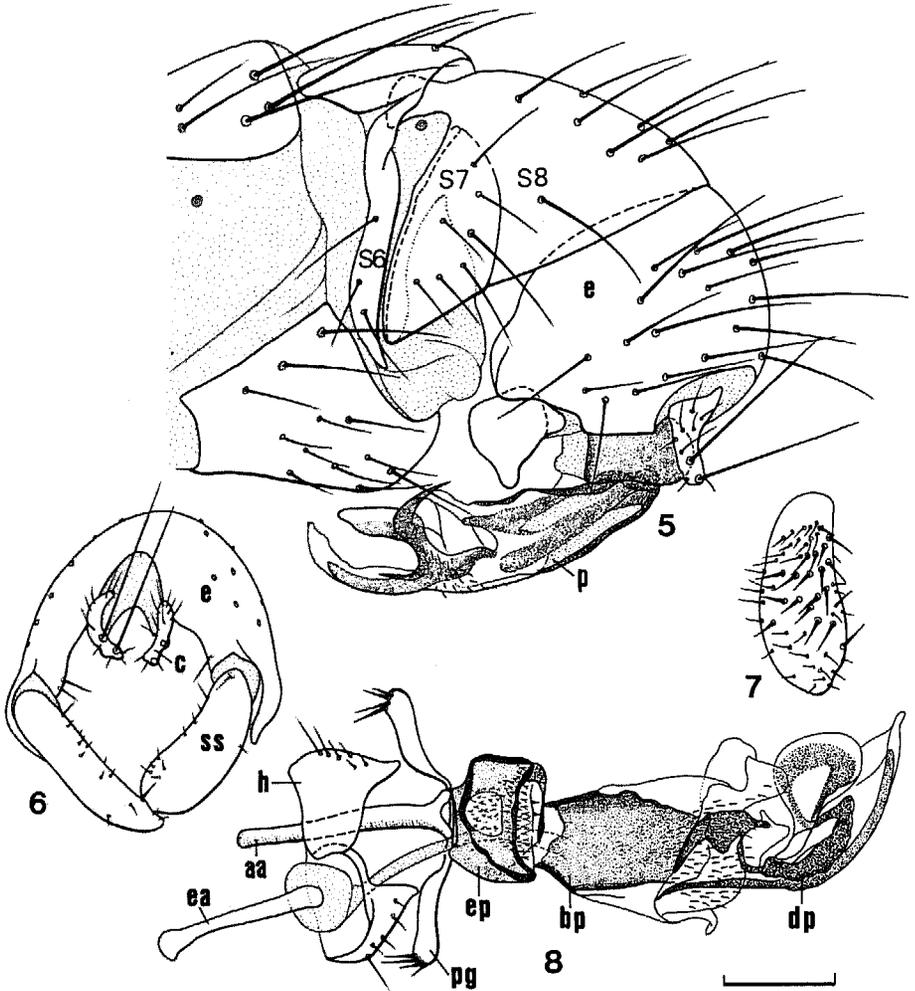
Borboropsis yakunoana sp. nov.

[Japanese name: Yakuno-owai-bae]

(Figs 5–8)

Description. *Male.* Head black, densely whitish-gray-dusted except for frontalia; ventral margin of frontalia and parafacialia brown, gena slightly tinged with brown; face with median carina yellowish dorsally; antenna black; palpus brown. Thorax black; scutum and scutellum densely brownish-gray-dusted; pleura and postnotum gray-dusted. Wing grayish hyaline, anal vein colorless in distal two-thirds; calypter white, with margin orangish and fringe whitish; halter yellow. Legs black; fore knee indistinctly testaceous. Abdomen black; first to third tergites (T1–3) tinged with brown; T1–4 densely and T5–6 slightly gray-dusted; T7, S7+8, and epandrium shiny; S1–5 testaceous.

Frons slightly wider than long, nearly thrice as wide as eye, slightly converging ventrally, with three to four irregular transverse rows of setulae on ventral



Figs 5-8. *Borboropsis yakunoana* sp. nov., holotype male. 5, Postabdomen and genitalia, with sixth to eighth sternites (S6-8), epandrium (e), and phallus (p), lateral view; 6, epandrium (e), cercus (c), and surstylus (ss), posterior view; 7, surstylus, inner view; 8, hypandrium (h) and phallus, with aedeagal apodeme (aa), basiphallus (bp), distiphallus (dp), ejaculatory apodeme (ea), epiphallus (ep) and pregonite (pg), ventral view. Scale 0.1 mm.

half; parafrofrontalia with ventral part projecting beyond eye margin in profile; fronto-orbital bristles two, lateroocline, almost equal to each other in length; ocellar bristle longer than fronto-orbitals, approximately equal to inner vertical bristle in length; eye almost as high as long; face strongly concave, with median carina spindle-shaped just below antennal bases but linear and low ventrally; gena almost as high as eye at middle, with row of three short genal setae; vibrissa long; six or seven setae around vibrissa slightly shorter than three or four peristomal setae. Antenna with flagellomere as long as wide, rounded apically, with white pile, com-

ponent setae nearly one-fifth as long as flagellomere; arista swollen on basal one-fifth, microscopically pubescent.

Scutum with 1+4 dc (anterior three slightly longer than acr), three irregular rows of acr, and pair of prescutellar setae (slightly longer than acr); scutellum with basal bristle half as long as apical one; proepisternal bristle one; anepisternum with long bristle at postero-dorsal corner; katepisternum with one or two setulae before long bristle. Wing: costa with second to fourth sections in proportion of 5:1.5:1 and with 10 short, spiniform setae between apices of R_1 and R_{4+5} ; r-m before middle of discal cell; ultimate section of M_1 about 1.3 times as long as penultimate; ultimate section of CuA_1 nearly one-sixth length of penultimate. Legs: each tibia with short, dorsal preapical bristle, but indistinct on fore tibia; mid tibia with black, curved spur; first to fourth tarsomeres of hind leg densely set with golden-yellow setulae ventrally.

Sixth sternite (S6) narrow, fused dorsally with T6; S7 fused with large S8 on left lateral side (Fig. 5). Genitalia (Figs 5–8): epandrium semicircular in posterior view (Fig. 6); cercus small, with two long apical setae (Figs 5, 6); surstylus almost as long as epandrial height, densely setulose on inner side (Figs 6, 7); hypandrium asymmetrical, setose (Fig. 8); pregonite narrow, with four stout setulae on apex (Fig. 8); epiphallus tubular, short but broad, spinulose on ventral side (Fig. 8); basiphallus well sclerotized, ventral membrane between it and distiphallus setulose (Fig. 8); distiphallus asymmetrical (Fig. 8); aedeagal apodeme about one-half length of phallus (Fig. 8); ejaculatory apodeme narrow, 165 μ m long (Fig. 8).

Body length 2.0 mm, wing length 3.1 mm.

Female. Unknown.

Type material. Holotype: male (OMNH TI 173), Oyugo, Yakuno-cho, Kyoto Pref., 16 Dec. 2002, M. Sasakawa leg.

Distribution. Japan (Honshu).

Remarks. This new species is similar to *Borboropsis puberula* in general appearance, but can be distinguished by the presence of distinct spiniform setae on the costa (absent in *B. puberula*) and the chaetation of the cercus, surstylus, and pregonite (sparsely setose in *B. puberula*; see Papp 1998b, figs 16, 17).

Etymology. The specific name is derived from the type locality.

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References

- Blaschke-Berthold, U. 1994. Anatomie und Phylogenie der Bibionomorpha (Insecta, Diptera). Zoologische Monographien, Bonn 34: 5–206.
- Czerny, L. 1902. Bemerkungen zu den Arten der Gattungen *Anthomyza* Fall. und *Ischnomyia* Lw. Wiener Entomologische Zeitung 21: 249–256.

- Hackman, W. and Andersson, H. 1969. *Trixoscelis puberula* (Zetterstedt), a heleomyzid fly (Diptera). *Notulae Entomologicae* 49: 269-270.
- Krivoshaina, N. P. 1988. Family Diadocidiidae. Pp. 210-211. *In*: Soós, A. and Papp, L. (Eds) *Catalogue of Palaearctic Diptera, Vol. 3 (Ceratopogonidae-Mycetophilidae)*. Elsevier, Amsterdam.
- Landrock, K. 1926. 8. Fungivoridae (Mycetophilidae). Pp. 11-12. *In*: Lindner, E. (Ed.) *Die Fliegen der Paläarktischen Region*. E. Schweizerbart'sche-Verlagsbuch, Stuttgart.
- Laštovka, P. and Matile, L. 1972. Révision des *Diadocidia* holarctiques (Dipt. Mycetophilidae). *Annales de la Société Entomologique de France (N. S.)* 8: 205-223.
- Mathis, W. N. 1973. A review of the genus *Borboropsis* (Diptera: Heleomyzidae). *The Pan-Pacific Entomologist* 49: 373-377.
- Okada, I. 1936. Beitrag zur Kenntnis der Fungivoriden-Fauna Japans, II: Diadocidiinae. *Insecta Matsumurana* 11: 21-24.
- Papp, L. 1998a. Families of Heleomyzoidea. Pp. 425-455. *In*: Papp, L. and Darvas, B. (Eds) *Contributions to a Manual of Palaearctic Diptera, Vol. 3: Higher Brachycera*. Science Herald, Budapest.
- Papp, L. 1998b. Nidomyiini, a new tribe, genus and species of Borboropsidae (Diptera), with the redefinition of the family. *Acta Zoologica Academiae Scientiarum Hungaricae* 44: 297-310.
- Rohdendorf, B. B. 1974. *The Historical Development of Diptera*. University of Alberta Press, Edmonton, 360 pp. [English translation of Rohdendorf 1964]
- Ruthe, J. F. von 1831. Einige Bemerkungen und Nachträge zu Meigen's "Systematische Beschreibung der bekannten europäischen zweiflügeligen Insekten". *Isis* 11: 1203-1222.
- Stackelberg, A. A. 1969. 20. Diadocidiidae. P. 261. *In*: Bei-Bienko, G. Y. (Ed.) [*Keys to the Insects of the European Part of the USSR, Vol. 5. Diptera and Siphonaptera part 1.*] Zoological Institute, Akademiia Nauk USSR, "Nauka", Leningrad. [In Russian]
- Tollet, R. 1948. Notes sur la faune des Hautes-Fagnes en Belgique. XVII. Mycetophilidae (Diptera). *Bulletin & Annales de la Société Royale d'Entomologie de Belgique* 84: 284-287.
- Wood, D. M. and Borkent, A. 1989. Phylogeny and classification of the Nematocera. Pp. 1333-1370. *In*: McAlpine, J. F. and Wood, D. M. (Eds) *Manual of Nearctic Diptera, Vol. 3*. Agriculture Canada Monograph, No. 32. Agriculture Canada, Ottawa/Ontario.