

The Myrmecophilous Hoverfly Genus *Microdon* (Diptera, Syrphidae, Microdontinae) in Hokkaidô, Japan, with Descriptions of Four New Species

Teruhiko Hironaga¹ and Munetoshi Maruyama²

¹ Systematic Entomology, Graduate School of Agriculture, Hokkaidô University, Sapporo-shi, 060–8589 Japan
e-mail teruhiro@res.agr.hokudai.ac.jp

² Department of Zoology, National Science Museum, 3–23–1 Hyakunin-chô,
Shinjuku-ku, Tokyo, 169–0073 Japan
e-mail maruyama@kahaku.go.jp

Abstract Six species, including four new species, of the myrmecophilous hoverfly genus *Microdon* (Syrphidae, Microdontinae) are recognised in Hokkaidô, Japan. They are: *M. macrocerus* sp. nov., *M. kidai* sp. nov., *M. yokohamai* sp. nov., *M. murayamai* sp. nov., *Microdon bifasciatus* Matsumura, 1916, and *M. simplex* Shiraki, 1930 (new to Hokkaidô). Larva and puparium of *M. kidai* are described. The following symbiotic hosts are clarified: *M. macrocerus*—*Camponotus* (*Camponotus*) *obscuripes*; *Microdon kidai* and *M. yokohamai*—*Formica japonica* (*fusca* group); *M. murayamai*—*F. lemani* (*fusca* group). *Microdon japonicus* and *M. auricomus* are formerly recorded from Hokkaidô, but as those records are as highly doubtful that the two species could be excluded from the fauna of Hokkaidô. Key to the species of *Microdon* in Hokkaidô, including *M. japonicus* and *M. auricomus*, is appended for accurate identification.

Key words: Symbiotic host, key to species, larva, puparium, Hymenoptera, Formicidae, *Formica*, *Camponotus*.

Introduction

About 20 species of the myrmecophilous hoverfly genus *Microdon* Meigen, 1803, have been known in the Palearctic region. The Japanese fauna of the genus has been still poorly investigated. Recently several unknown species have been discovered from Japan one after another (Katsura, 1996a, b; Ohishi, 2002a, b), though they are mostly unidentified or undescribed. Only two species, *M. japonicus* Yano, 1915, and *M. bifasciatus* Matsumura, 1916, were recorded till lately (Ogata, 1989), but some additional species were currently reported also from Hokkaidô; Kumata *et al.* (1994) recorded *M. auricomus* Coquillett, 1898, from Akan-chô, and Yokohama (1996 a, b) reported two species from Sapporo-shi, which were tentatively identified with *M. latifrons* Loew, 1856, and *M. aff. maritimus* Vi-

olovitsh, 1976.

As a result of field surveys made by our colleagues and by the authors themselves in Japan and investigation of syrphid collections deposited in Hokkaidô University, about a hundred specimens of *Microdon* hoverflies were available for taxonomic studies. Of these, specimens from Hokkaidô are classified into six species, of which four are found to be new to science.

All the species of *Microdon* are considered to be myrmecophiles living in ant nests in their immature stages, but symbiotic host is unknown for most Japanese species. Some of the specimens examined were collected around ant nests, and symbiotic hosts of some species were clarified.

In the present paper, we are going to review the *Microdon* species of Hokkaidô with several new information.

Materials and Methods

The terminology used in the present study follows McAlpine (1981). Taxonomy of *Microdon* is usually very difficult and shape of male genitalia is not so informative in some cases. In the present paper, identification of species is mainly based on the external morphology, in particular, ratio in length of antennal segments, presence or absence of apical spines on scutellum, coloration of abdominal hairs, and ratio of width and length of tarsomeres.

The male terminalia were macerated in 10% KOH solution heated in an incubator (60°C), for five to more than 24 hours on occasion, and then transferred into ethanol and distilled water for washing, after dissected in the glycerol, observed and figured under a microscope.

Holotypes and some paratypes are deposited in the laboratory of Systematic Entomology, Hokkaidô University (SEHU) and the National Science Museum, Tokyo (NSMT).

Taxonomy

Microdon macrocerus sp. nov.

[Japanese name: Higenaga-arinosuabu]

(Figs. 1–8, 39)

“*Microdon latifrons*”: Yokohama, 1996a: 9.

Microdon sp.: Yokohama & Chiba, 1998: 7.

Type series. Holotype: male, Kamimuri (Ikoino-mori), Maruseppu-chô, Hokkaidô, 3 VII 2003, Y. Kida (NSMT). Paratypes: [Hokkaidô]: 2 males, 2 females, same data as holotype; 1 male, same locality and collector as holotype, 1 VII 2000; 1 male, ditto, 11 VI 2003; 1 male, ditto, 13 VI 2003; 1 male, Ishiyama, Sapporo-shi, 22 VI 1916, S. Matsumura (labelled “*Microdon micans* Wied.”) (SEHU); 1 male, Hyakumatsuzawa, Mimami-ku, Sapporo-shi, 26 V–1 VI. 1998, K. Mizota, T. Hironaga, A. Ohkawa & M. Maruyama (by a Malaise trap); 3 females, same locality, collectors and collecting method, 9–16 VI 1998; 1 male, 1 female, Misumai, Minami-ku, Sapporo-shi, 16 VI 1991, M. Yokohama; 1 female, Soranuma-dake, 2 VII 1961, S. Takagi (SEHU); 2

males, Apoi-dake, Samani-chô, 22 VI 1959, S. Uéda (SEHU); 1 male, Nukabira, Kamishihoro-chô, 13 VII 1959, T. Kumata (SEHU); [Honshu]: 6 males, 1 female, Torikura-yama (alt. 1780 m), Ôshika-mura, Nagano-ken, 21 VI 2003, K. Katsura; 1 male, Ôkubo-shitsugen, Shirakawamura, Gifu-ken, 2 VI 2002, K. Harusawa.

Distribution. Japan: Hokkaidô, Honshû.

Symbiotic host. *Camponotus (Camponotus) obscuripes* Mayr, 1879.

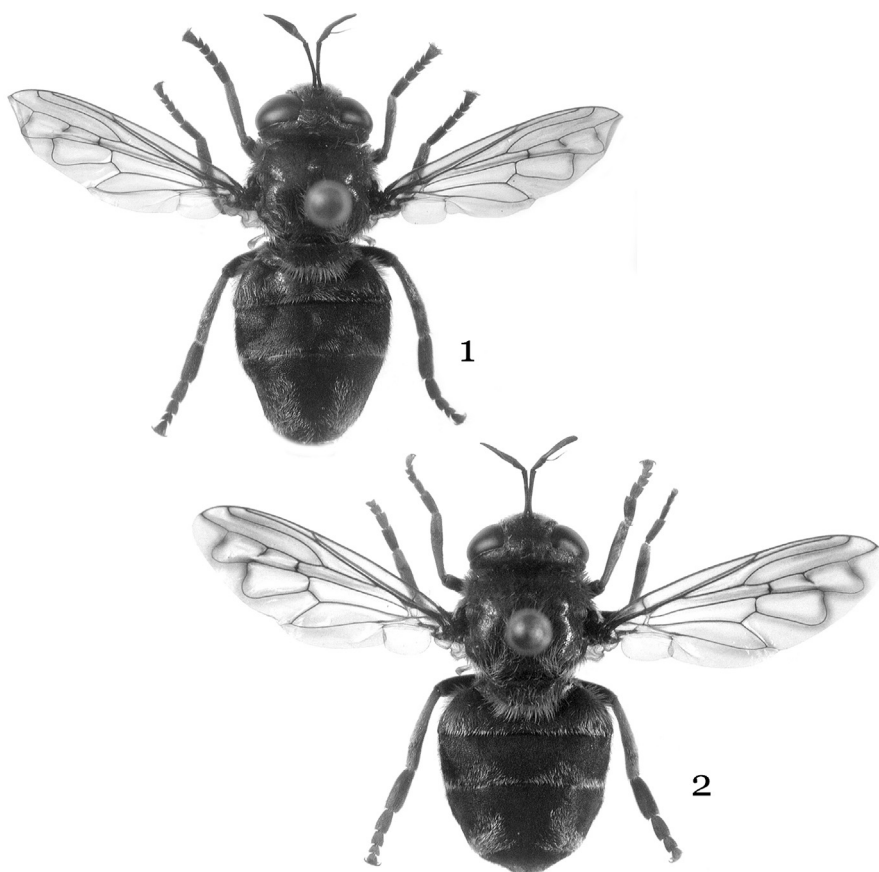
Etymology. Denoting the long antennae.

Diagnosis. This species is similar to *Microdon japonicus*, but easily distinguished from the latter by the 1st flagellomere more than three times as long as pedicel. This species could be determined by the keys of Mutin & Barkalov (1999) and Violovitsh (1983) as “*M. latifrons* Loew, 1856” (= *M. miki* Doezcal et Schmid, 1999) or *M. ignotus* Violovitsh, 1976, but is distinguished from “*M. latifrons*” by the coloration of the legs and the shape of the 2nd tarsomere of hind leg which is usually less than twice as long as width, and distinguished from *M. ignotus* by the face below the antennal base without broad bare part.

Description. Male (Fig. 1). Body length: 11.5–12.2 mm; wing length: 8.2–9.1 mm.

Coloration: Body mostly black. Head black with aeneous lustre; antennae black, slightly brownish; arista dark brown. Thorax black; mesonotum with aeneous shimmer; pleura shining aeneous black but its posterior part brownish. Abdomen black with slight aeneous lustre. Legs black, with tibiae, tarsi and extreme tip of femora brown; tibiae with ill-defined narrow blackish ring after middle; tarsi sometimes darkened. Wings hyaline, slightly brownish; around veins blackish tinged; veins dark brown; squamae yellowish white; halteres yellowish.

Head wider than mesonotum, about 1.9–2.1 times as wide as long or 1.5–1.7 times as high as long; frons 0.24–0.27 times as wide as head at the narrowest part, and clothed with yellowish hairs which become black at middle; vertex clothed with yellow hairs; face 0.53–0.54 times as wide as head at middle level, slightly broadened ventrally, and clothed with light yellow



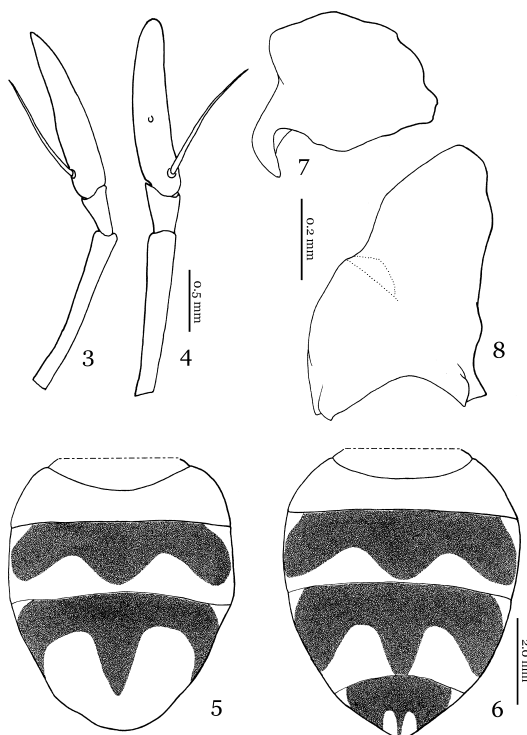
Figs. 1, 2. Facies of *Microdon macrocerus* sp. nov.; 1, male; 2, female.

hairs; occiput clothed with pale yellow hairs which become whitish below; genae very small, and clothed with brownish grey pubescence. Eyes about 1.8 times as high as long in profile and almost glabrous. Antennae (Figs. 3, 4) with scape as long as or slightly shorter than 1st flagellomere; 1st flagellomere more than three times as long as pedicel; arista shorter than 1st flagellomere and about 0.7 times of its length; ratio of scape, pedicel and 1st flagellomere: —3.3–3.8 : 1 : 3.4–3.9.

Thorax: Scutum clothed with pale yellow hairs; scutellum slightly shorter than half width, with posterior margin more or less excavated and bearing two very tiny spines, and clothed with long pale-yellow hairs; anepimeron and upper

part of anepisternum clothed with long pale-yellow hairs; katepisternum clothed with pale yellow hairs on dorsal part and a few hairs mesally.

Abdomen (Fig. 5) oval, about 1.3 times as long as wide, distinctly broader than thorax at 2nd and 3rd tergites, somewhat longer than head and thorax combined, and clothed mainly with pale yellow hairs; 3rd tergite clothed with short black hairs in anterior half, pale hairs at posterior margin faded medially; 4th tergite similarly clothed with black and yellow hairs as in 3rd tergite, and clothed with pale yellow hairs on posterior third, which extended onto anterior part as a V-shape, while all side margins are clothed with similar pale yellow hairs; sternites clothed with long pale-yellow hairs; 4th sternite with posterior mar-



Figs. 3–8. *Microdon macrocerus* sp. nov. — 3, Left antenna, dorsal view; 4, ditto, lateral view; 5, abdomen, dorsal view, male (black areas indicate patterns of black hairs); 6, ditto, female; 7, cercus, lateral view; 8, surstylus, lateral view.

gin truncate; terminalia clothed with very short yellowish hairs; cerci rather broad (Fig. 7); surstyli (Fig. 8) rather short, with a notch, which cannot be seen laterally.

Legs clothed with rather short yellowish hairs; ventral side of each tarsus clothed with orange hairs; fore tarsus with 1st tarsomere about 2.1–2.3 times as long as wide and with 2nd tarsomere longer than wide, 1.3–1.5 times as long as wide; hind tarsus with 1st tarsomere 2.8–3.1 times as long as wide and about as long as the following three segments combined, and with 2nd tarsomere 1.8–2.0 times as long as wide.

Wings about three times as long as wide and about 1.5 times as long as head and thorax combined; squamae with pale fringes.

Female (Fig. 2). Similar to male. Body length: 11.8–12.5 mm; wing length: 10.3–10.8 mm.

Coloration: Abdomen with 5th tergite and sternite black.

Head with frons 0.39–0.42 times as wide as head, gradually broadened forwards, and clothed with black hairs which become pale yellow at sides of anterior half; face 0.51–0.52 times as wide as head at middle level. Antennae with scape longer than 1st flagellomere; ratio of scape, pedicel and 1st flagellomere:—3.7–4.3 : 1 : 3.2–3.9.

Abdomen (Fig. 6) with 5th tergite clothed with short black hairs which become pale yellow to anterolateral corners and posterior apex; 4th and 5th sternites clothed with short orange yellow hairs.

Biology. Y. Kida (pers. comm.) observed several adults flying near the nest of *Camponotus obscuripes* in Kamimuri, Maruseppu-chô. Some were emerged from the entrance to the nest.

Microdon kidai sp. nov.

[Japanese name: Shinonome-arinosuabu]

(Figs. 9–22, 39)

Type series. Holotype: male, Shinreisui, Maruseppu-chô, Hokkaidô, 12–13 VI 2001, M. Maruyama & K. Uesugi (near nests of *F. japonica*) (SEHU). Paratypes: [Hokkaidô]: 12 males, 3 females, same data as holotype; 1 male, same locality, 21 V 2000, coll. pupa, 2 VI 2000, emerged, Y. Kida, (from a nest of *Formica japonica*). 1 male, 3 females, ditto, 8 VI 2001. Y. Kida; 1 female, Kamimuri, Maruseppu-chô, 22 V 2001, coll. pupa, 31 V 2001, emerged, M. Maruyama (from a nest of *Formica japonica*).

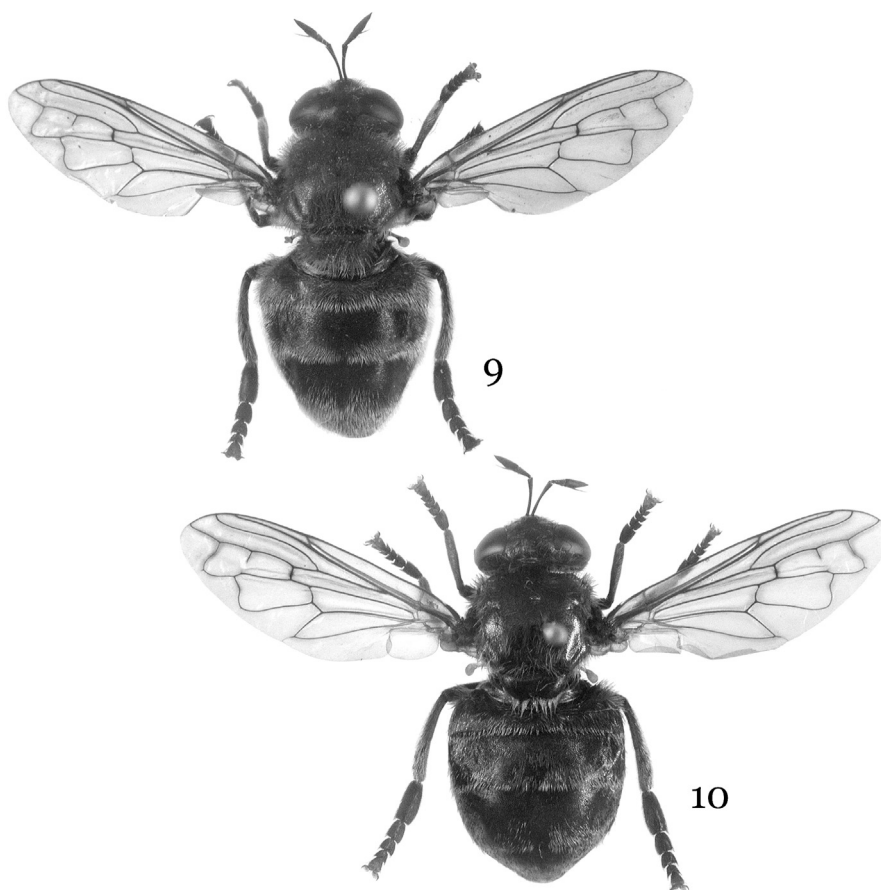
Other material. One larva and 2 pupae, same data as holotype.

Distribution. Japan: Hokkaidô.

Symbiotic host. *Formica japonica* Motschulsky, 1866.

Etymology. Dedicated to Mr. Yasunari Kida for his invaluable contribution to the ant and myrmecophile fauna in Hokkaidô.

Diagnosis. This species could be identified by the keys of Mutin & Barkalov (1999) and Violovitsh (1983) with *M. maritimus* Violovitsh,



Figs. 9, 10. *Microdon kidai* sp. nov., facies; 9, male; 10, female.

1976, described from the Russian Far East, but distinguished from it by the legs entirely black and the shape of male cerci and surstyli. This new species also resembles *M. oitanus* Shiraki, 1930, known from Japan, but differs from it by the face broader (in *M. oitanus*, 0.40–0.43 times as wide as head) and the 3rd abdominal tergite with black hairs anteriorly.

Description. Male (Fig. 9). Body length: 13.0–13.5 mm; wing length: 10.1–11.0 mm.

Coloration: Body mostly black. Head black with bluish lustre; vertex with some purplish lustre; antennae black; arista brown. Thorax with mesonotum shining bluish black; pleura black; anepisternum, anepimeron and katepisternum with bluish lustre. Abdomen black; 2nd and 3rd tergites with aeneous lustre, sternites black with

bluish to greenish reflection, terminalia black with a slight bluish tinge. Legs black; apical segment of each tarsus slightly brownish. Wings hyaline, but more or less brownish toward base and anterior margin, and usually veins emphasized in black; veins dark brown, but rather yellowish on basal part of wing; squamae yellowish white but its margins yellow; halteres pale yellow, but brownish at stem.

Head about as wide as mesonotum, about half as long as wide and nearly 1.5 times as high as long; frons about 0.18 times as wide as head at the narrowest part, and densely clothed with erect black hairs leaving extreme apex and transverse groove, which become pale yellow on eye margins and posterior part of transverse groove; vertex clothed with black hairs which become yellow

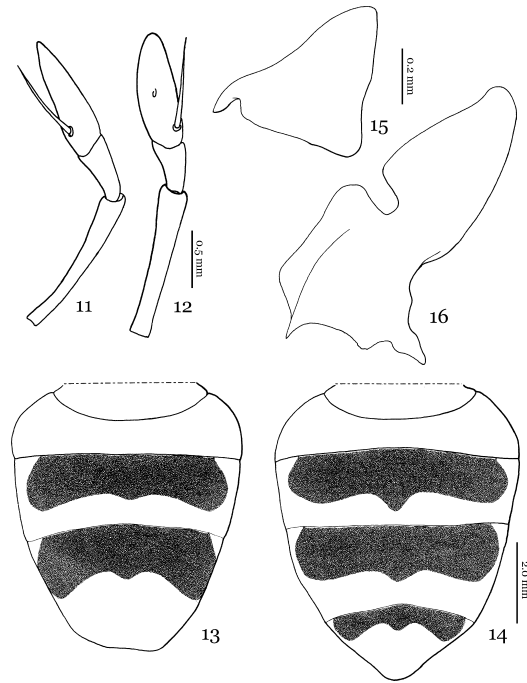
low at posterior part; face 0.47–0.48 times as wide as head, subparallel-sided, and clothed with long pale-yellow hairs; occiput clothed with pale yellow hairs; genae clothed with grayish pubescence. Eyes about 1.8 times as high as long in profile, and sparsely clothed with minute hairs. Antennae (Figs. 11, 12) with scape slightly shorter than two apical segments combined; pedicel about one-third as long as scape; 1st flagellomere about twice as long as pedicel; arista about 0.8 times as long as 1st flagellomere; ratio of scape, pedicel and 1st flagellomere:—2.5–2.6 : 1 : 2.

Thorax: Scutum densely clothed with light orange hairs, which becomes pale yellow laterally; scutellum rather semicircular, about half as long as wide, with posterior margin moderately excavated medially, bearing two distinct short spines, and densely clothed with long pale-yellow hairs; anepimeron and upper part of anepisternum partly with long pale-yellow hairs; katepisternum clothed with pale yellow hairs dorsally and a few hairs on ventromedial margin.

Abdomen (Fig. 13) oval, moderately narrowed behind, strongly broader than thorax at 2nd and 3rd tergites, almost as long as head and thorax combined, about 1.2 times as long as wide, and clothed with pale yellow hairs; anterior two-thirds of 3rd tergite and anterior half of 4th tergite clothed with short black hairs; sternites rather sparsely clothed with pale yellow hairs; posterior margin of 4th sternite roundly notched medially; terminalia clothed with short yellow hairs, cerci subtriangular (Fig. 15); surstyli (Fig. 16) very long and deeply notched at middle.

Legs clothed with pale hairs, many black hairs being mixed on dorsal surface of femora; tarsi clothed with black hairs on dorsal surfaces and with yellow hairs on ventral side; fore tarsus with 1st tarsomere about 1.5 times as long as wide, and with 2nd tarsomere shorter than wide, about 0.9 times as long as wide; hind tarsus with 1st tarsomere about 2.5 times as long as wide and about as long as the following three segments combined, and with 2nd tarsomere about 1.4 times as long as wide.

Wings about three times as long as wide, about



Figs. 11–16. *Microdon kidai* sp. nov. — 11, Left antenna, dorsal view; 12, ditto, lateral view; 13, abdomen, dorsal view, male (black areas indicate patterns of black hairs); 14, ditto, female; 15, cercus, lateral view; 16, surstylus, lateral view.

1.6 times as long as head and thorax combined, and distinctly shorter than thorax and abdomen combined; squamae with yellowish fringes.

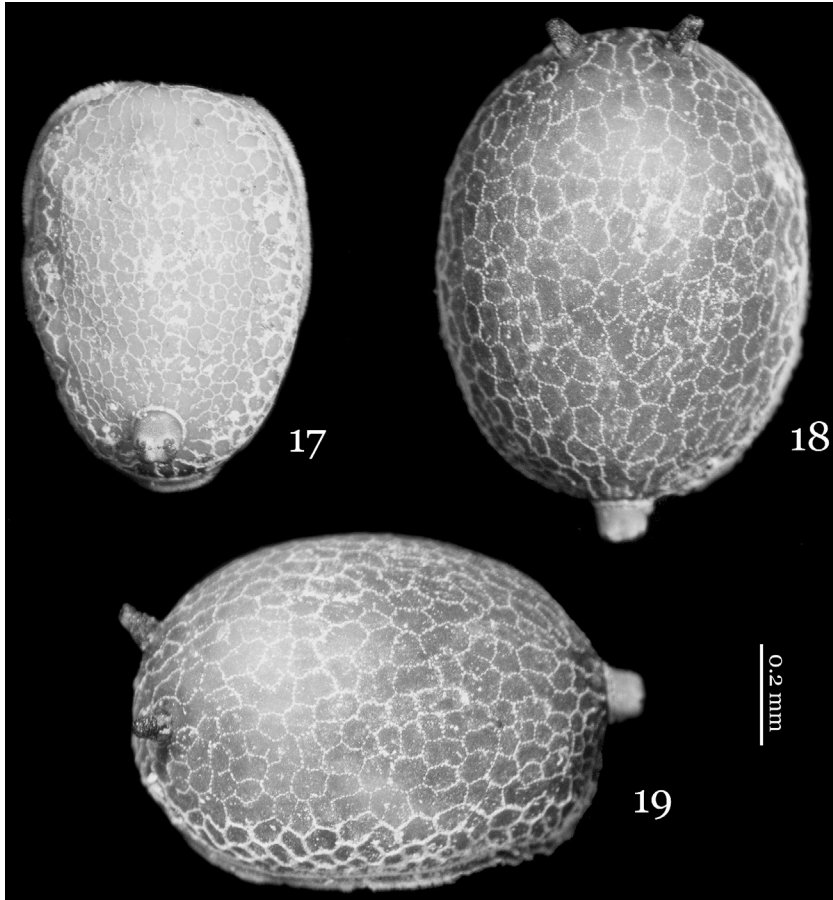
Female (Fig. 10). Quite similar to male. Body length: 13.0–13.9 mm; wing length: 10.8–11.0 mm.

Coloration: Frons with greenish shimmer. Abdomen with 5th tergite shining black; 5th sternite shining black with some greenish reflection.

Head with frons 0.38–0.41 times as wide as head, broadened forwards, evenly clothed with black hairs except eye margins.

Abdomen (Fig. 14) with 5th tergite clothed with pale yellow hairs which become black in anterior margin; 5th sternite clothed with pale yellow hairs.

Larva (inster unknown) (Fig. 17). Length: 8.0–8.1 mm; width: 6.5–6.5 mm. Yellowish white in ground colour; posterior spiracular tubercle dark-



Figs. 17–19. *Microdon kidai* sp. nov., immature stages — 17, larvae, dorsal view; 18, pupa, dorsal view; 19, ditto, dorsolateral view.

er. Surface moderately covered with reticulations, which comprise small projections and become clearer laterad. Posterior spiracular tubercle finely granulate punctured but irregularly rugose around tip. Lateral margin densely ciliated.

Puparium (Figs. 18, 19). Length: 9.8–10.2 mm; width: 7.5–7.9 mm. Reddish brown in ground colour; anterior spiracular tubercles and their basal area brown; posterior spiracular tubercle darker. Surface moderately covered with reticulations, which comprise small projections and become clearer laterad. Anterior spiracular tubercles papilliform, rugose around tips, vertically wrinkled around base. Posterior spiracular tubercle almost unilobed but slightly bifid at apex; surface finely granulate punctured but irregularly

rugose around spiracular openings, in which margins slightly produced. Dorsal fringe very short and weakly ciliated. Ventral fringe penicillated.

Biology. Maruyama observed behaviour of the adults (Figs. 20–22) and the presence of the larvae and pupae on 12–13, June, 2001 at Shinreisui, Maruseppu-chô. Several adults flying or resting on stones around the colonies of *Formica japonica* were observed. Then, several pairs were mating near the entrance of the nest, and in many cases, the females were in just after eclosion and not well stained. In contrast most males were well stained and seemed to have been emerged some days before. Probably male emerges earlier than female and wait for eclosion of female near



Figs. 20–22. *Microdon kidai* sp. nov., living individuals — 20, Female resting on a stone, just after eclosion; 21, mating, posterodorsal view; 22, ditto, lateral view. (Photographed by Hiroshi Sugaya.)

the hosts' nest.

Under stones where *F. japonica* nested, several larvae and pupae of the hoverfly were observed. The larvae were all in the same size, so that it seems probable that two years are needed for this species to become adult from egg.

***Microdon yokohamai* sp. nov.**

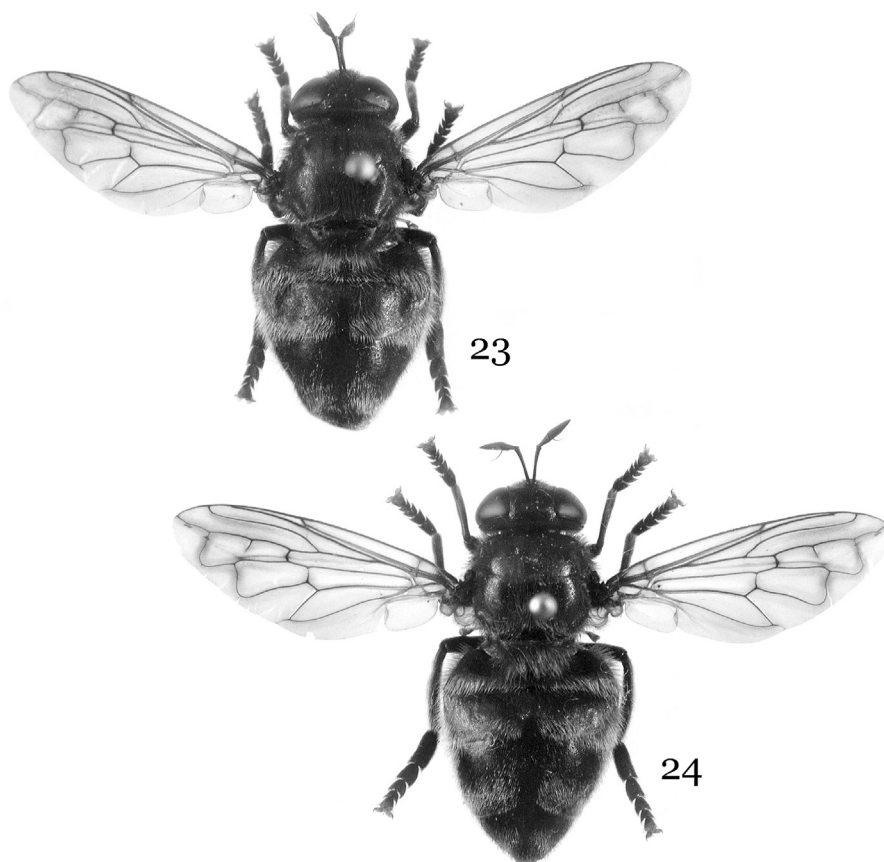
[Japanese name: Nishiki-arinosuabu]

(Figs. 23–30, 39)

“*Microdon* aff. *martimus*”: Yokohama, 1996 b.

Type series. Holotype: male, Takinosawa-rindô (near Sapporo-ko), Minami-ku, Sapporo-shi, Hokkaidô, 5 VII 2000, T. Hironaga (near a nest

of *Formica japonica*) (SEHU). Paratypes: [Hokkaidô]: 1 male, 9 females, same data as holotype; 1 male, same locality, 7 VII 2001, M. Takashima; 1 female, Pankenai-gawa, Utanobori-chô, 28 VI 1999, T. Hironaga; 1 male, Uryû [probably, Uryû-chô], 5 VII 1935, Okada; 1 female, Tenninkyô (alt. 1000 m), Asahi-dake, Biei-chô, 20 VII 2001, O. Tominaga; 3 males, 2 females, Yukomabetsu (alt. 1100 m), Asahi-dake, Higashikawa-chô, 22 VII 2001, K. Katsura; 2 males, Moiwa-yama, Minami-ku, Sapporo-shi, 15 VI 1991, M. Yokohama; 1 female, Kannonzawa, Minami-ku, Sapporo-shi, 26 VI 2002, T. Yoshida; 3 females, Hyakumatsuzawa, Minami-ku, Sapporo-shi, 23–30 VI 1998, K. Mizota, T. Hironaga, A. Ohkawa & M. Maruyama (by a



Figs. 23, 24. *Microdon yokohamai* sp. nov., facies; 23, male; 24, female.

Malaise trap); 4 females, Muine-yama, Minami-ku, Sapporo-shi, 4 VII 1998, M. Ôhara & K. Sugisima.

Distribution. Japan: Hokkaidô.

Symbiotic host. *Formica japonica*.

Etymology. Dedicated to Mr. Mitsuhiro Yokohama, who first reported the presence of this species in Hokkaidô, for his contribution to the clarification of the syrphid fauna of Hokkaidô.

Diagnosis. This species could be determined by using the key by Mutin & Barkalov (1999) and Violovitsh (1983) as *M. maritimus* described from the Russian Far East, but is distinguished from the latter in the legs entirely black and the shape of male surstyli, which have a deep notch at the middle. This new species is also similar to *M. kidai*, and *M. oitanus*, but distinguished from

the former in having narrower face: 0.41–0.43 times as wide as head width (0.47–0.48 times in *M. kidai*); the 3rd abdominal tergite without black hairs anteriorly; and the 4th abdominal sternite with black hairs medially, and from the later by having broader frons (about 0.15 times as wide as head in *M. oitanus* [male]).

Description. Male (Fig. 23). Body length: 12.5–13.9 mm; wing length: 10.1–11.2 mm.

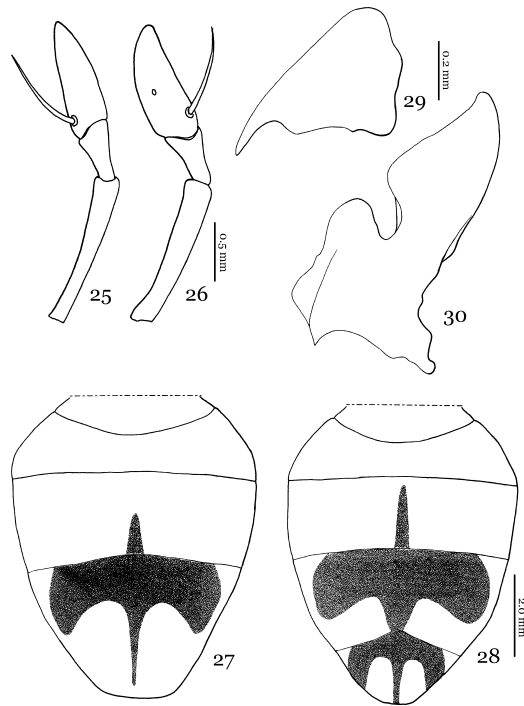
Coloration: Body mostly black. Head black; frons deep black with bluish lustre; face black with bluish lustre; occiput black with bluish or greenish shimmer; antennae black; arista dark brown. Thorax almost black; mesonotum shining greenish black; pleura blackish; anepisternum, anepimeron and katepisternum shining bluish black. Abdomen shining greenish black; 4th ter-

gite deep black with less greenish shimmer; terminalia black. Legs almost all black. Wings hyaline, around the veins emphasized in black; veins dark brown, rather yellowish on basal part of wing; squamae yellowish; halteres orange yellow.

Head about as wide as mesonotum, about half as long as wide and about 1.6 times as high as long; frons about 0.2 times as wide as head at the narrowest part, and clothed with erect black hairs leaving transverse groove and becoming golden yellow to posterior part of vertex; face 0.41–0.43 times as wide as head, subparallel-sided, and clothed with light yellow hairs; occiput clothed with short black hairs and rather long yellow hairs, and with pale yellow hairs in lower half; genae clothed with brownish gray pubescence. Eyes about 1.9 times as high as long in profile and very sparsely covered with minute hairs. Antennae (Figs. 25, 26) with scape as long as or very slightly shorter than two apical segments combined; pedicel about one-third as long as scape; 1st flagellomere twice as long as pedicel and about three-fourths or two-thirds as long as scape; arista slightly shorter than 1st flagellomere; ratio of scape, pedicel and 1st flagellomere: —2.6–3 : 1 : 2.

Thorax: Scutum densely clothed with rather long orange yellow hairs; scutellum rather semi-circular, about twice as wide as long, with posterior margin slightly excavated medially, bearing two very short spines, densely clothed with erect orange-yellow hairs; anepimeron and upper part of anepisternum clothed with pale yellow hairs; katepisternum clothed with pale yellow hairs on dorsal and ventromedial margins, and with a few hairs mesally.

Abdomen (Fig. 27) oval, longer than head and thorax combined, strongly broader than thorax, about 1.4 times as long as wide, moderately narrowed behind, and clothed with pale yellow hairs; 4th tergite clothed with short black hairs in anterior half; sternites rather sparsely clothed with pale yellow hairs; 4th sternite slightly concave in posterior margin, clothed with yellow hairs which become black medially; terminalia clothed with short black hairs; cerci subtriangular (Fig.



Figs. 25–30. *Microdon yokohamai* sp. nov. —
25, Left antenna, dorsal view; 26, ditto, lateral view; 27, abdomen, dorsal view, male (black areas indicate patterns of black hairs); 28, ditto, female; 29, cercus, lateral view; 30, surstylus, lateral view.

29); surstyli very long and deeply notched at middle (Fig. 30).

Legs: femora clothed with black hairs, but with some pale yellow hairs in basal fourth of posterior surface; tibiae clothed with pale yellow hairs, and sometimes intermixed with sub-depressed black hairs on anterior surface; tarsi clothed with black hairs dorsally and orange yellow hairs ventrally; fore tarsus with 1st tarsomere 1.3–1.4 times as long as wide, and with 2nd tarsomere shorter than wide, 0.7–0.9 times as long as wide; hind tarsus with 1st tarsomere 2.3–2.4 times as long as wide and about as long as the following three segments combined, and with 2nd tarsomere 1.1–1.4 times as long as wide.

Wings about 2.8 times as long as wide, 1.5–1.6 times as long as head and thorax combined, and distinctly shorter than thorax and abdomen

combined; squamae with yellowish fringes.

Female (Fig. 24). Quite similar to male. Body length: 12.1–15.5 mm; wing length: 9.8–11.4 mm.

Coloration: Abdomen with 5th tergite shining black; 5th sternite shining black with some greenish reflection.

Head with frons 0.39–0.41 times as wide as head, broadened forwards, and evenly clothed with black hairs.

Abdomen (Fig. 28) with 5th tergite clothed with yellow hairs, which becomes blackish along anterior margin; 4th and 5th sternites entirely clothed with black hairs.

Biology. Behaviour of adults observed by the authors was almost the same as that of *M. kidai*.

***Microdon murayamai* sp. nov.**

[Japanese name: Komachi-arinosuabu]

(Figs. 31–38, 39)

Type series. Holotype: male, Hokkaidô University Tomakomai Experimental Forest (alt. 30–55 m), Takaoka, Tomakomai-shi, Hokkaidô, 16 VI 2002, S. Murayama (near a nest of *Formica lemani*) (SEHU). Paratypes: [Hokkaidô]: 1 male, 1 female, same data as holotype; 1 female, same locality, 30 VI 2002, M. Maruyama (near a nest of *F. lemani*); 1 female, same locality, 3 VII 2003, T. Hironaga; 1 male, Futatsuyama (Kayanuma), Shibecha-chô, 28 VI 2001, K. Ijima; 3 males, 1 female, Shiriuchi-chô, 21 VI 1976, T. Kumata (SEHU); 1 male, Fukushima-chô, 20 VI 1976, T. Kumata (SEHU); [Honshû]: 1 male, Hayachine-san (alt. 600 1000 m), Iwate-ken, 11–12 VII 1980, M. Suwa (SEHU); 4 males, 2 females, Kawairi, Yamato-chô, Fukushima-ken, 14 VI 1998, M. Maruyama.

Distribution. Japan: Hokkaidô, Honshû.

Symbiotic host. *Formica lemani* Bondroit, 1917.

Etymology. Dedicated to Mr. Shigeki Murayama, a collector of the type series.

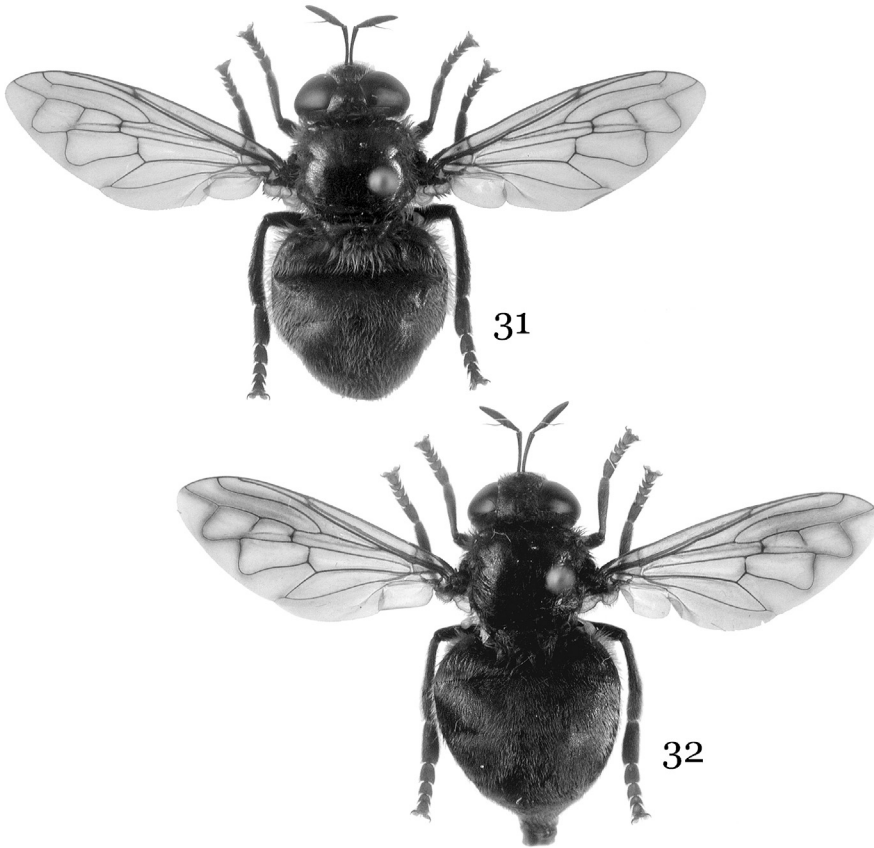
Diagnosis. This new species could be determined as *M. lehri* Mutin, 1999 by using a key of the Syrphidae in the Russian Far East (Mutin &

Barkalov, 1999), which is the original description of this species. Though the description lacks extensive description and figure of this species, the present new species can be distinguished from *M. lehri* in the following character states: pale hairs dominated on the vertex; the 3rd abdominal tergite with a large black patch of hairs medially; the 5th abdominal tergite without black hairs in female. This species is quite similar to *M. auricomus*, but differs from the latter in the 3rd and 4th abdominal tergites always clothed with black hairs. This new species is also similar to *M. devius* (Linnaeus, 1761) but distinguished from it in having black hairs dorsally on each tarsus, scutellum without distinct spines, and black haired part of 4th tergite divided medially.

Description. Male (Fig. 31). Body length: 11.2–11.5 mm; wing length: 8.7–9.2 mm.

Coloration: Body mostly black. Head black with aeneous shimmer; frons shining deep black; face shining aeneous black; occiput black with aeneous lustre; antennae black with base and ventral side of scape brownish; arista brown. Thorax black; mesonotum with bluish lustre; anepisternum, anepimeron and katapisternum with shining bluish to aeneous lustre. Abdomen black to blackish brown with dull greenish lustre; terminalia black with some bluish reflection. Legs dark reddish brown, but the following parts blackish: basal halves of anterior femora, mid and hind femora except ventral surface of apical third, apical thirds of anterior and mid tibiae, hind tibiae and basal two segments of hind tarsi. Wings hyaline, slightly infuscated around veins; veins blackish brown, but rather yellowish on anterior part of wing; squamae whitish but its margins yellowish; halteres yellowish.

Head slightly wider than mesonotum, slightly shorter than half of width and 1.6–1.8 times as high as long; frons 0.16–0.17 as wide as head at the narrowest part, and clothed with black hairs, posterior part to vertex clothed with black and pale yellow hairs; face 0.42–0.43 times as wide as head, subparallel-sided, and clothed with pale yellow hairs; occiput clothed with pale hairs; genae very small, clothed with grayish pubes-



Figs. 31, 32. *Microdon murayamai* sp. nov., facies; 31, male; 32, female.

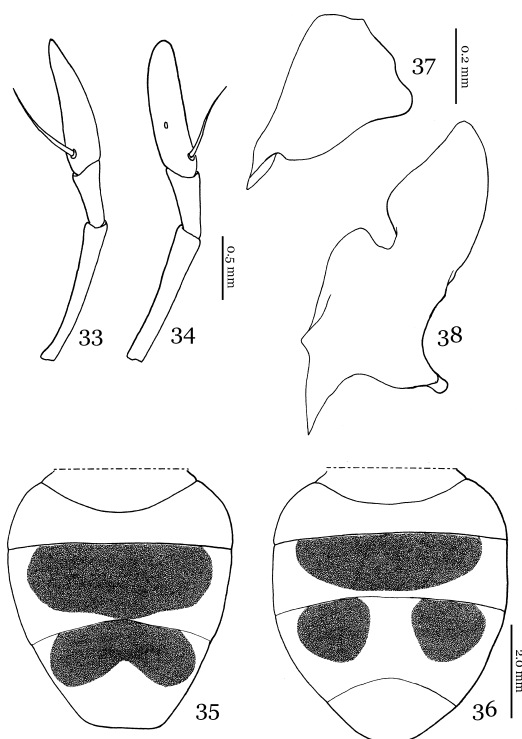
cence. Eyes about 1.9 times as high as long in profile, almost glabrous, but very sparsely with minute hairs. Antennae (Figs. 33, 34) with scape slightly shorter than the following segments combined; pedicel shorter than half of scape; 1st flagellomere twice as long as pedicel; arista shorter than 1st flagellomere; ratio of scape, pedicel and 1st flagellomere:—2.4 : 1 : 2.

Thorax: Scutum clothed with pale yellow erect hairs, which are substituted by black hairs medially; scutellum rather semicircular, about half as long as wide, with posterior margin moderately excavated medially, but without spines, and densely clothed with long orange hairs; anepimeron and upper part of anepisternum rather sparsely clothed with long pale-yellow hairs; dorsal part of katapisternum clothed with

pale yellow hairs and a few hairs on ventromedial margin.

Abdomen (Fig. 35) oval, strongly broader than thorax, about as long as head and thorax combined, about 1.2 times as long as wide, and densely clothed with yellow hairs on dorsum, which become[s] longer and paler to each lateral margin and very short and black at middle of 3rd and 4th tergites; sternites rather sparsely clothed with pale yellow hairs, 4th sternite very shallowly notched medially on posterior margin; terminalia clothed with short pale hairs; cerci subtriangular (Fig. 37); surstyli (Fig. 38) long and notched at middle.

Legs: femora and tibiae clothed with pale yellow hairs, black hairs mainly on dorsal surface (some specimens lacking black hairs on tibiae);



Figs. 33–38. *Microdon murayamai* sp. nov. —
33, Left antenna, dorsal view; 34, ditto, lateral view; 35, abdomen, dorsal view, male (black areas indicate patterns of black hairs); 36, ditto, female; 37, cercus, lateral view; 38, surstylus, lateral view.

tarsi clothed with black hairs on dorsal part and with yellow hairs on ventral surface; fore tarsus with 1st tarsomere about 1.7 times as long as wide, and with 2nd tarsomere shorter than wide, about 0.9 times as long as wide; hind tarsus with 1st tarsomere about 2.8 times as long as wide and about as long as the following three segments combined, and with 2nd tarsomere about 1.5 times as long as wide.

Wings about 2.8 times as long as wide and about 1.5 times as long as head and thorax combined; squamae with yellowish fringes.

Female (Fig. 32). Quite similar to male, but abdomen rather broad. Body length: 10.8–12.4 mm; wing length: 8.9–9.5 mm.

Coloration almost the same as in male.

Head with frons about 0.37–0.40 times as wide as head, and clothed with pale yellow hairs

which become black forwards; ocellar tubercle clothed with black hairs.

Abdomen (Fig. 36) with 5th abdominal tergite clothed with yellow hairs which become paler on lateral parts; 5th sternite clothed with pale yellow hairs.

Biology. S. Murayama (pers. comm.) observed the adults stopping or flying near the entrance of nests of *F. lemani* in Tomakomai.

Microdon bifasciatus Matsumura, 1916

[Japanese name: Futaobi-arinosuabu]

(Fig. 39)

Microdon bifasciatus Matsumura, 1916: 254; Shiraki, 1930: 15; Matsumura, 1931: 346; Shiraki, 1950: 1647; Shiraki & Edashige, 1953: 124; Edashige, 1965: 208; Shiraki, 1968: 9; Peck, 1988: 227; Ogata, 1989: 795; Ohishi, 2002a: 202.

Type material. Holotype: female, Jôzankei, Sapporo, Hokkaidô, 11 VII 1912, S. Matsumura (SEHU).

Additional records. [Hokkaidô]: 1 male, Okushiri-tô, 14 VII 1958, K. Kamijo; 1 female, Uryû [probably, Uryû-chô], 21 VII 1964, K. Kusigemati; 1 female, Nupinai-gawa, Taiki-chô, 11 VII 2000, T. Hironaga; 1 male, Kikonai-chô, 9 VIII 1976, T. Kumata *et al.*

Distribution. Japan: Hokkaidô, Honshû, Shikoku.

Symbiotic host. Unknown.

Remarks. This species is quite distinct among Japanese species of *Microdon* in the elongate abdomen. Though several similar species are known in the adjacent regions of the distribution, e.g., “*Microdon* sp.” from Nansei Islands (Ohishi, 2002a) and a species erroneously recorded as “*M. bifasciatus*” from South Korea (Han & Choi, 2001), *M. bifasciatus* is easily distinguishable from them in having the entirely black legs.

Microdon simplex Shiraki, 1930

[Japanese name: Hime-ruriro-arinosuabu]

(Fig. 39)

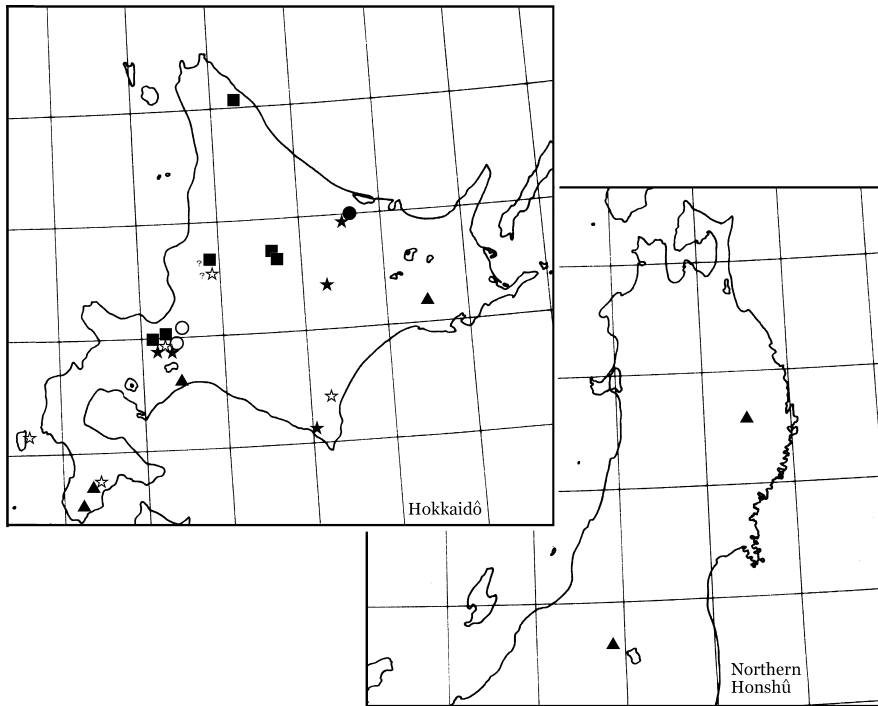


Fig. 39. Collection sites of *Microdon* spp. — *M. macrocerus* (closed stars), *M. kidai* (closed circles), *M. yokohamai* (closed squares), *M. murayamai* (closed triangles), *M. bifasciatus* (open stars), *M. simplex* (open circles).

Microdon caeruleus var. *simplex* Shiraki, 1930: 9; Shiraki & Edashige, 1953: 124.

Microdon caeruleus Brunetti, 1908: 92; Shiraki, 1932: 55, 1950: 1647; Edashige, 1965: 208.

Microdon simplex: Shiraki, 1968: 12; Ohishi, 2002a: 204.

Microdon caeruleus simplex: Peck, 1988: 227; Ogata, 1989, 795; Han & Choi, 2001: 187.

Type material. Not examined.

Additional records. [Hokkaido]: 1 male, 1 female, Botanic Garden, Hokkaido University, Chuo-ku, Sapporo-shi, 22 VII 2003, T. Hironaga; 1 male, Hyakumatsuzawa, Minami-ku, Sapporo-shi, 25 VI 1999, T. Hironaga.

Distribution. Japan: Hokkaido, Honshu, Shikoku, Kyushu, Tsushima; Korea; Taiwan.

Symbiotic host. Unknown.

Remarks. This species has not been well described after the original description and its taxonomic placement is unstable, i.e., sometimes regarded as a subspecies of *M. caeruleus* Brunetti, 1908, or a distinct species. However, this species

is easily distinguished from *M. caeruleus* by the following character states: the scutellum without apical spines, the mid and hind femora black in basal halves, and each tibia paler in the basal half. Therefore, *M. simplex* is regarded as a distinct species in the present study.

This species is newly recorded from Hokkaido.

Doubtful Records from Hokkaido

Microdon auricomus Coquillett, 1898

[Japanese name: Kin-arinosuabu]

Microdon auricomus Coquillett, 1898: 320; Yano, 1915: 8; Shiraki, 1930: 21; Matsumura, 1931: 346; Shiraki, 1932: 56; Shiraki, 1950: 1647; Shiraki, 1968: 5; Peck, 1988: 227; Han & Choi, 2001: 185; Ohishi, 2002a: 201.

Microdon auricomus var. *nigripes* Shiraki, 1930: 22.

Microdon auricomus nigripes: Peck, 1988: 227; Ogata, 1989: 795; Kumata *et al.*, 1994: 1131.

Distribution. Japan: Honshu, Kyushu; Korea.

Symbiotic host. Formica japonica.

Remarks. Kumata *et al.* (1994) recorded the species from Hyôtan-numa, Akan-chô in eastern Hokkaidô. However, we were unable to examine any specimen of this species collected from Hokkaidô in spite of our careful searches of the host nests. This species is similar to some other members of the genus distributed in Hokkaidô, especially *M. murayamai* in general appearance. The above record may be based on misidentification of *M. murayamai*.

***Microdon japonicus* Yano, 1915**

[Japanese name: Arinosuabu]

Microdon japonicus Yano, 1915: 1; Shiraki, 1930: 20; Matsumura, 1931: 347; Shiraki, 1950: 1648; Edashige, 1965: 208; Shiraki, 1968: 3; Peck, 1988: 228; Ogata, 1989: 795; Ohishi, 2002a: 203.

Microdon jezoensis Matsumura, 1916: 255 (synonymized by Shiraki, 1930: 20).

Distribution. Japan: Honshû, Shikoku, Kyûshû.

Remarks. Matsumura (1916) described *Microdon jezoensis* from Sapporo in Hokkaidô, but Shiraki (1930) synonymized it with *M. japonicus*. This caused the record of *M. japonicus* in Hokkaidô. The arrangement by Shiraki (1930) was not based on examination of the types of both the species but only on the original descriptions. Matsumura's (1916) description is lacking details and illustration of body parts, which are indispensable for identification of the taxonomically difficult group. Although the illustration of the facies given by Matsumura (1916) is obscure, it is apparently different from those of *M. japonicus* in the antennal shape, which is somewhat similar to that of *M. macrocerus*. Therefore, adequacy of Shiraki's (1930) arrangement is highly doubtful. Examination of the type of *M. jezoensis* is needed for clarifying the matter, but we were unable to find it in the SEHU collection, where the most part of Matsumura's collection should be deposited. It is probably missing. *Microdon japonicus* is known to be associated with *Lasius japonicus* Santschi, 1941, and the larvae inhabiting the nest of the ant. *M.*

japonicus is normally very common in its distributional range in Honshû. In spite of our investigation of this species, including search for its larvae in the nests of *L. japonicus*, in the fields in Hokkaidô, we have been unable to find it. Thus, the distribution of *M. japonicus* over Hokkaidô is highly doubtful.

Key to the Known Species of *Microdon* in Hokkaidô

1. Body small, less than 10 mm. Second abdominal sternite divided by median membranous part. *M. simplex*
 – Body medium-sized to large, more than 10 mm. Second sternite not divided by median membranous part. 2
2. Abdomen conical, slender, more than 1.6 times longer than wide *M. bifasciatus*
 – Abdomen ovate, broad, less than 1.5 times longer than wide 3
3. First flagellomere about three times as long as pedicel. *M. macrocerus*
 – First flagellomere about twice as long as pedicel 4
4. Scutum usually clothed with dark brown to black hairs 5
 – Scutum without black hairs 7
5. Scutellum with a pair of spines
 *M. japonicus* (record doubtful)
 – Scutellum without spines 6
6. Third and 4th abdominal tergites with distinct large patches of black hairs
 *M. murayamai*
 – Third and 4th abdominal tergites usually without black hairs, rarely with a pair of rather small patches of black hairs anteriorly *M. auricomus* (record doubtful)
7. Third abdominal tergite sparsely covered with pale yellow hairs, densely covered with black hairs anteriorly *M. kidai*
 – Third abdominal tergite almost uniformly and densely covered with pale yellow hairs, without black hairs anteriorly
 *M. yokohamai*

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