

# Fungus Gnats of the Genera *Exechiopsis* Tuomikoski and *Pseudexechia* Tuom. in Japan (Diptera: Mycetophilidae)\*

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**Abstract.** Five new species of the genus *Exechiopsis* are described from Japan: *mycenae*, *quadridentata*, *sanageyamana*, *tricholomatae* and *yumikoe* spp. n. on fungi of the Tricholomataceae. They are closely related to each other in general appearance, but every species has the characteristic male genitalia. *Exechiopsis indecisa* (Walker) on a fungus of the Russulaceae and *Pseudexechia trisignata* (Edwards) on a fungus of the Coprinaceae are newly recorded from Japan.

**Key words:** Mycetophilidae, *Exechiopsis*, *Pseudexechia*, new species, new record, host fungus, Japan.

## Introduction

The genera *Exechiopsis* and *Pseudexechia* were established by Tuomikoski (1966) on the basis of their plesiomorphic character: the shortness of cubital fork which is not provided with macrotrichia on the veins. The former contains forty-two species at present, and is Holarctic and Neotropical in distribution, while the latter with only four species is not known outside Europe and Nepal (Tuomikoski, 1966; Laštovka & Matile, 1974; Caspers, 1984; Plassmann, 1984; Kallweit & Martens, 1995). No species of these genera have hitherto been recorded from Japan. In the present paper, we intend to report the occurrence of seven species: five of *Exechiopsis* which are all new to science, and *E. indecisa* (Walker) and *Pseudexechia trisignata* (Edwards) which are new to Japan.

## Materials and Methods

Materials used in this study are dried specimens. The coloration of the body, such as the dark vittae on the mesoscutum, or the pale posterior markings on the abdominal tergites, was too variable among the specimens for use as a species key character. The male genital figures (drawn by Sasakawa) are, therefore, given for all species, because their genitalia possess a great number of specific characteristics in a state of ventral fusion of the gonocoxites and the shapes of the lateral, dorsal and ventral stylomeres of gonostylus,

for example.

All the species described below were reared from many different species of fungi. One of the authors, Ishizaki (H.I.) collected the host fungi (except for *Flammulina velutipes* Sing. in Kyoto) from several localities in Aichi and Kyoto Prefectures, Honshu. A number of sporophores were kept at room temperature till the emergence of gnats, unless otherwise stated below.

The holotypes are deposited in the Laboratory of Entomology, Kyoto Prefectural University, Shimogamo, Kyoto, and some of the paratypes in the senior author's collections. The following abbreviations are used: S3(-9): third(-ninth) abdominal sternite(s); T1(-10): first(-tenth) abdominal tergite(s). The scale line in drawings represents 0.1 mm.

## Genus *Exechiopsis* Tuomikoski

Both *Exechiopsis* and *Exechia* Winnertz (1863) are considered to be monophyletic (Tuomikoski, 1966). They are characterized by the presence of long dorso-central and prescutellar bristles, short cubital fork, and long cross vein r-m, and have the same distribution. Phylogenetic discussion on the tribe Exechiini will be given in the last series of this paper.

The genus *Exechiopsis* is divided into two subgenera: *Exechiopsis* s. str. and *Xenexechia* (Tuomikoski, 1966). All the new species described below belong to the subgenus *Exechiopsis*. They are 3.0-4.0 mm in the wing length and have the yellow posterior markings, which are broadened toward lateral margins, on abdominal tergites, and are easily distinguishable from

\* Japanese fungus gnats of the tribe Exechiini (Mycetophilidae) (I)

each other by the characteristics of male genitalia.

The host fungi for only two European species, *Exechiopsis* (*Exechiopsis*) *indecisa* (Walker) and *fimbriata* (Lundström), are known: the former on five *Suillus* species of the Boletaceae and the latter on an unidentified species of the Tricholomataceae (Hackman and Meinander, 1979). *Exechiopsis* (*E.*) *mycena*, *quadridentata*, *sanageyamana*, *tricholomatae* and *yumikoae* n. spp. were reared from five fungus species of the Tricholomataceae, among which *Mycena galericulata* S. F. Gray was a common host fungus for their larvae. Oligophagy was found in *tricholomatae* and *indecisa*. *Exechiopsis indecisa* was reared from *Russula* (Russulaceae) for the first time, although some species of the Boletaceae have been known as the regular host fungi in Europe.

*Exechiopsis* (*Exechiopsis*) *tricholomatae* sp. n.  
(Figs. 1–5)

**Male.** Head with vertex and frons dark brown, gray dusted; orbit above lateral ocellus and dorsal postorbit testaceous; face testaceous to pale brown; clypeus pale brown. Antenna with scape and pedicel testaceous, flagellomeres brown but basal half of first segment yellow; palpus testaceous, sometimes faintly brown tinged on outer side of all segments. Thorax testaceous, densely whitish gray dusted on dorsal side but sparsely on lateral side; scutum and scutellum pale brown, the former with dark part indistinctly divided into three vittae by rows of dorsocentral bristles; mesanepisternum, mesokatepisternum except for dorsal corner, and pleurotergite brown tinged; mediotergite and ventral part of pleurotergite brown, the former subshining. Wing hyaline, very faintly tinged with brown; halter with stalk yellow and knob testaceous to pale brown. Legs yellow; coxae with antero-ventral margins linearly brown tinged; tibiae brown tinged; tarsi and spurs pale brown. Abdomen with T1–2 yellowish brown, T3–5 brown and T6 blackish brown, but T1–2 each yellow on postero-lateral one-half, T3–5 each yellow on postero-lateral one-third to two-fifths, T6 yellow on posterior one-fifth to one-seventh (T5–6 rarely without yellow margins); sternites testaceous but S3–6 distinctly brownish on each anterior half; genitalia testaceous, gonocoxite brown tinged.

Frons and vertex densely setulose; fronto-orbital bristles four to five and long; antenna 2+14-segmented, longer than thorax (70 : 45); pedicel with one dorso-apical seta distinctly longer than the others; flagellomeres in relative length of 40(1st) : 25(2nd) :

27(3rd–7th) : 26(8–9th) : 25(10–11th) : 24(12–13th) : 29(14th); fourth flagellomere about 1.7 times as long as wide; palpus with segments in relative length of 23 : 31 : 85; first segment with sensory pit which is ovate in outline, about three-fifths the length of the segment and provided with many slender, rod-like sensilla; third segment about one-third the width of the first.

Mesoscutum with prescutellar bristles slightly longer than dorsocentrals; scutellum with apical bristles extremely long, accompanying a pair of short setae just before base of the apicals; proepisternum with one bristle. Wing with Sc short and slightly shorter than or equal to r-m; ratio of  $R_1$  :  $R_{1.4}$  (1.37–1.46); ratio of r-m : M petiole 1.8–2.2. Fore tibia only a little shorter than metatarsus (1 : 1.1); hind tibia with a row of 18–20 distal bristles as a loose-comb.

T10 with a pair of long bristles. Gonocoxites (Fig. 2) united with each other only at ventral base and projected distinctly on both inner ventral apices; gonostylus (Figs. 3, 4) lobate in lateral view, accompanying four stylomeres at base; S9 membranous, with a small group of setulae at base; aedeagus (Fig. 5) 180  $\mu$ m long, vase-like, largely membranous but weakly sclerotized laterally, and with a pair of shield-like sclerites at middle of ventral side.

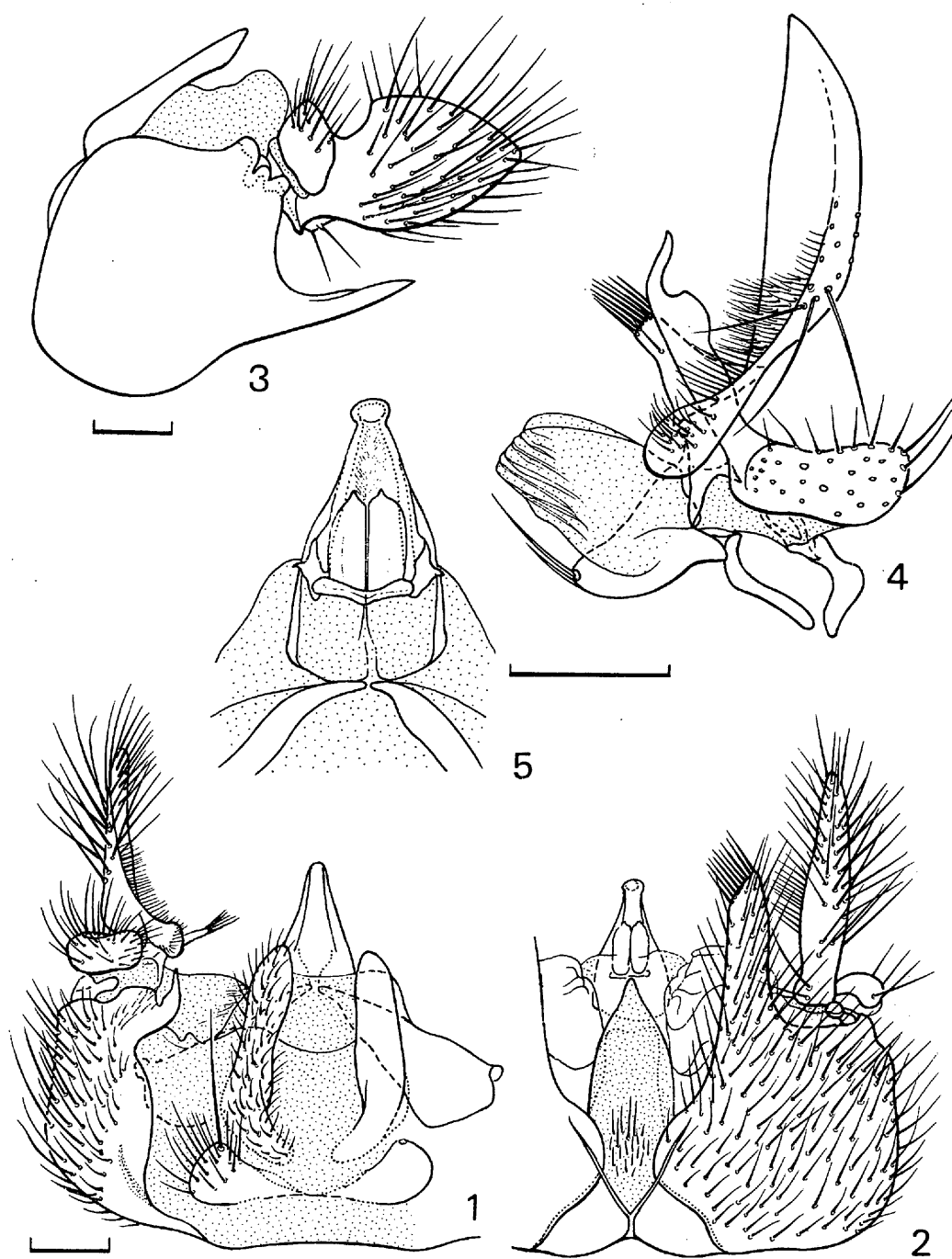
Body length 4.5(holotype)–4.6 mm, wing length 3.3 (holotype)–3.4 mm.

**Female.** Similar to male, but pale postero-lateral parts on abdominal tergites narrower than those of male (especially only one-fifth to one-sixth on T5); ovipositor pale brown; body length 3.9–4.1 mm.

**Holotype male,** Mt. Sanageyama, Toyota, Aichi Pref., emerged on 18 Mar. 1990 (H.I.); host fungus, *Mycena galericulata* (Scop.: Fr.) S. F. Gray, collected on 6 Mar. 1990. **Paratypes:** 1 male and 2 females, Goshō (Old Imperial Palace), Kyoto, 10–12 Jan. 1991 (H.I.), on *Flammulina velutipes* (Curt.: Fr.) Sing., coll. 24 Dec. 1990, H. Sasaki; 1 male, Shizuichi, Sakyo-ku, Kyoto, 14 Jan. 1991 (H.I.), on *Marasmius oreades* (Bolt.: Fr.) Fr., coll. 2 Jan. 1991. (All host fungi belong to the Tricholomataceae.)

**Distribution.** Japan (Honshu).

**Remarks.** This species is allied to European *clypeata* (Lundström) and *furcata* (Lundst.) in the coloration, but differs from the former species in the length of fore metatarsus (in *clypeata*, fore metatarsus equal to tibia in length) and from the latter in the length of cross vein r-m (in *furcata*, r-m only a little longer than M petiole). In addition, the new species is characterized by a number of male genital structures: gonocoxites with a pair of long postero-ventral processes (very



Figs. 1-5. Male genitalia of *Exechiopsis tricholomatae* sp. n. (paratype from Gosho, Kyoto). — 1-3, Gonocoxite, gonostylus, ninth tergite and sternite, and cercus from dorsal (1), ventral (2) and lateral (3) views; 4, stylomeres of gonostylus (dorsal view); 5, aedeagus (ventral view). Scale 0.1 mm.

short in *furcata* and absent in *clypeata*); ninth sternite membranous (well sclerotized in *clypeata* and *furcata*); gonostylus large lobate.

**Etymology.** The specific name refers to the host fungus family Tricholomataceae.

***Exechiopsis (Exechiopsis) yumikoeae* sp. n.**  
(Figs. 6-8)

The new species shows similarity to *tricholomatae* n. sp. in the structures of male genitalia. However, there are some differences between the two species: the boundary between S9 and gonocoxites is indistinct and



Figs. 6–8. Male genitalia of *Exechiopsis yumikoe* sp. n. (paratype from Gosho, Kyoto). See Figs. 1–2 & 5.

membranous in *yumikoe* (Fig. 7), while distinct in *tricholomatae*; dorsal stylomere at base of gonostylus is narrowed gradually toward apex in *yumikoe*, while narrowed just before apex in *tricholomatae*; aedeagus (Fig. 8) is shield-like (165  $\mu$ m in length) and well sclerotized throughout the surface, parameres as wide as aedeagus, and aedeagal apodeme cylindrical and 90  $\mu$ m in length in *yumikoe*, while in *tricholomatae* aedeagus vase-like in outline, parameres broadly expanded, and aedeagal apodeme indistinct.

In addition, *yumikoe* is distinguishable from *tricholomatae* by the following characters: mesoscutum not vittate; palpus entirely testaceous yellow; halter entirely yellow; abdominal tergites with yellow postero-lateral subtriangles: on posterior one-half of T 1, 3 and 4, respectively, and on posterior two-thirds of T2; T5–6 each indistinctly yellow along posterior margin; sternites with yellow parts: on each posterior one-half of S3–5 and one-third of S6 (S1–2 entirely yellow); antenna slightly longer than thorax (62 : 45), flagellomeres in relative length of 32–35(1st) : 22–24 (2nd–3rd) : 21–23 (4–7th) : 20–21 (8–11th) : 18–21 (12–13th) : 24–26 (14th), fourth flagellomere 1.8–1.9 times as long as wide; ratio of r-m: M petiole 1.6–1.7; hind tibia distally with a sparse row of 13–15 bristles. Other external characters as in *tricholomatae* n. sp.

Body length 3.6–3.9 (3.7 in holotype) mm in male

and 3.8–4.0 in female; wing length 3.0–3.3 (3.3 in holotype) in male and 3.2–3.3 in female.

Holotype male, Gosho (Old Imperial Palace), Kyoto, emerged on 21 Mar. 1996 (H.I.); host fungus, *Strobilurus stephanocystis* (Hora) Sing. (Tricholomataceae) collected on 4 Mar. 1996. Paratypes: 5 males and 7 females, same data as for holotype except for emergence date, 20–27 Mar.; 13 males and 11 females, same locality and host fungus as in holotype, 26 Mar.–8 Apr. 1996, fungi collected 17 Feb. 1996 and kept outdoors.

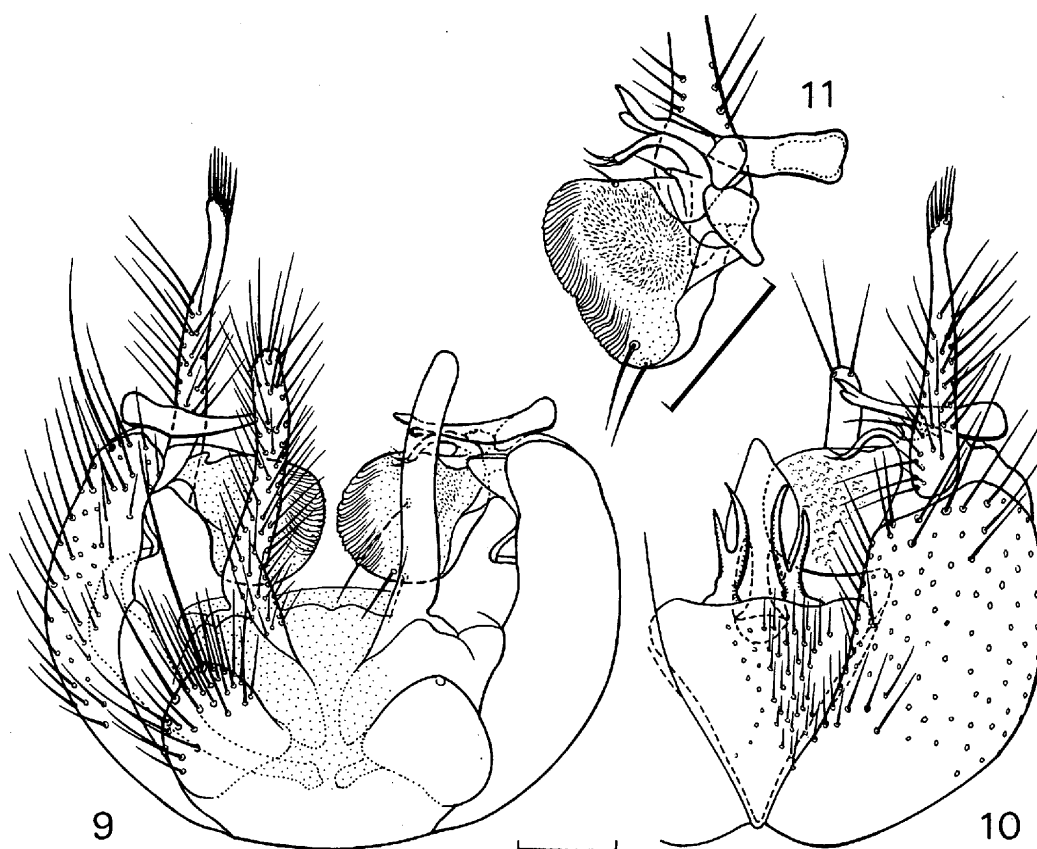
Distribution. Japan (Honshu).

Variation. There is considerable variation in the coloration of abdominal tergites and sternites in some of the females, for instance, T1–2 entirely yellow throughout the whole lateral length, and T3–4 yellow on posterior one-half, T5–6 on one-third and S3–7 on two-thirds, respectively.

Etymology. It is named in honor of Mrs. Yumiko Ishizaki, collector of the host fungi in the garden of Old Imperial Palace, Kyoto.

*Exechiopsis (Exechiopsis) quadridentata* sp. n.  
(Figs. 9–11)

This species agrees in most external characteristics with *tricholomatae* n. sp., so that it will suffice merely



Figs. 9–11. Male genitalia of *Exechiopsis quadridentata* sp. n. (paratype from Korankei, Aichi). — 11, Basal part of stylomeres (dorsal view). See Figs. 1–2.

to indicate the point of difference: T5 in male and T5–6 in female usually yellow on posterior one-third and S 5–6 brownish on anterior two-thirds to three-fourths; halter entirely yellow; antenna slightly longer than thorax (62 : 45), with flagellomeres in relative length of 29(1st) : 21(2nd–5th) : 20(6–9th) : 19(10–13th) : 23–25(14th); ratio of r-m: M petiole 1.7–1.8; hind tibia with 12–15 distal bristles arranged in two isolated rows; gonocoxites separated ventrally by an inverted-triangular S9; gonostylus (Fig. 10) slender, more or less upturned and provided with a row of 7–8 setae on tip; S9 with a pair of bifurcate processes posteriorly; dorsal stylomere (Fig. 11) bare at base and bifurcated shortly at apical end; mesal stylomere basally with a short claw-like process which is bisetulose on tip.

Body length 3.4–3.9 (3.5 in holotype) mm in male and 3.8–4.1 in female; wing length 2.9–3.2 (3.0 in holotype) mm in male and 2.9–3.6 in female.

Holotype male, Korankei, Asuke-cho, Aichi Pref., emerged on 27 Mar. 1992 (H.I.); host fungus, *Mycena* sp. collected on 14 Mar. 1992. Paratypes: 8 males and 9 females, same data as for holotype except for emergence date 25–27 Mar.; 5 females, Honenin Temple, Kyoto, emerged 22–24 Jan. 1992 (H.I.), host fungus

coll. 10 Jan.

Distribution. Japan (Honshu).

Remarks. The median vitta on the mesoscutum is sometimes divided into two narrow stripes on anterior half; the female specimens collected in Kyoto have somewhat dark coloration on the head and abdomen. Host fungus, *Mycena* sp., differs from *M. laevigata* Quél in color and texture of the fruit body.

The gonocoxites and S9 of this new species are somewhat similar to those of European *E. landrocki* (Lundström, 1912) on the basis of his figure, but the posterior processes on S9 of *landrocki* are minutely bifurcated on apices.

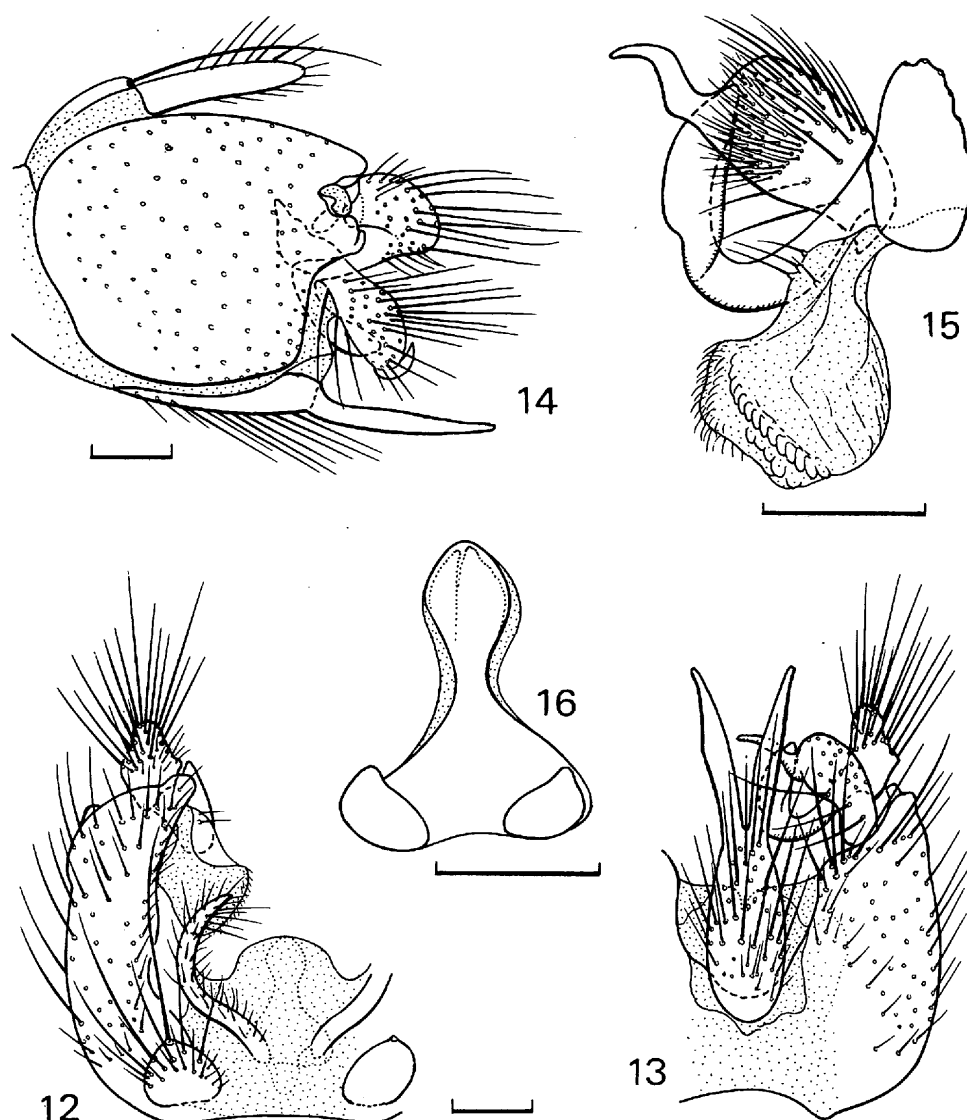
Etymology. The specific name refers to a pair of bifurcate processes on the ninth sternite.

*Exechiopsis (Exechiopsis) indecisa* (Walker)  
(Figs. 12–16)

*Exechia indecisa* Walker, 1856: 22.

*Exechiopsis (Exechiopsis) indecisa*: Tuomikoski, 1996: 179.

The male genitalia of this species are peculiar in the shape of S9 (Fig. 13) and gonostylus (Fig. 15), that is, the former is ovate basally but bifurcated distally, and



Figs. 12–16. Male genitalia of *Exechiopsis indecisa* (Walker) 15, Stylomeres (ventral view). See Figs. 1–3 & 5.

the latter is small but with a long arm which is curved rectangularly at middle and projected ventrally. The ventral stylomere of gonostylus is provided with a sinuate apical process, and mesal membranous stylomere is setose at base, and hairy and granulated along inner margin.

A male specimen examined is small, with wing length 3.7 mm, and has a ratio of r-m: M petiole 1.5, one propleural bristle, and yellow lateral subtriangles on posterior half of T2 and one-third of T3–4. Other essential characters are as follows: mesoscutum pale brown mesally and not divided into vittae, without long prescutellar bristles; T1 entirely brown; aedeagus (Fig. 16) 190  $\mu$ m in length, with basal parameres small but well sclerotized.

Specimen examined. One male, Mt. Sanage-yama, Toyota, Aichi Pref., 29 Oct. 1988 (H. I.); host fungus,

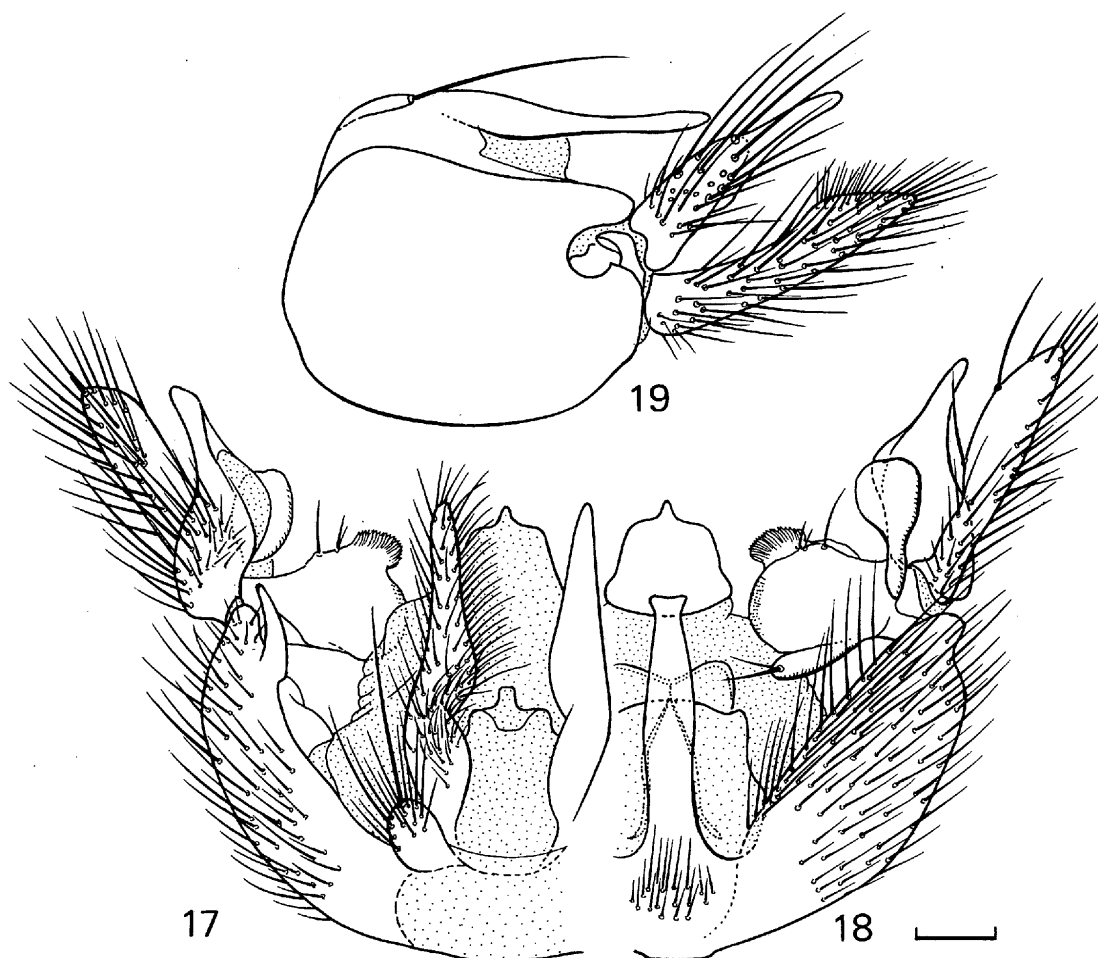
*Russula neoemetica* Hongo (Russulaceae) collected on 20 Oct. 1988.

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

*Exechiopsis (Exechiopsis) mycenae* sp. n.  
(Figs. 17–19)

Both this large species and *sanageyamana* n. sp. described below are distinctive in the presence of two propleural bristles, a long ventral stylomere below base of the gonostylus and a spatular distal process on S9.

Male and female. Head testaceous; frons with brown ventral margin below level of lateral ocelli; clypeus usually yellow; antenna yellowish brown, but scape, pedicel and basal part of first flagellomere



Figs. 17–19. Male genitalia of *Exechiopsis mycenae* sp. n. (paratype from Kisokoma-kogen, Nagano). See Figs. 1–3.

yellow; palpus yellow. Thorax testaceous, very sparsely pruinose; mediotergite and ventral margin of pleurotergite faintly brown tinged; wing hyaline, faintly brown tinged; halter yellow; legs yellow, tarsi brown tinged. Abdominal tergites brown, but T1–2 yellow on lateral side throughout the whole length of the segment; T3–5 with posterior margins yellow on dorsal one-half of T3 and one-third of T4 and 5, but distinctly broadened laterally on T3 and 4 (on posterior three-fifths of lateralmost margin in T3 and one-half in T4); T6 yellow on posterior one-fourth to one-fifth; T7 in female yellow on posterior one-half; sternites yellow but S6 in male and usually S5–7 in female brown tinged.

Differences in appearances and structures of male genitalia from *tricholomatae* n. sp. are as follows: antenna slightly longer than thorax (60 : 45), pedicel with a dorsal seta extremely long (about twice as long as the segment); male flagellomeres in relative length of 34(1st) : 22–23(2nd–5th) : 20–21(6–11 and 13th) : 19(12th) : 28(14th); fourth flagellomere about 1.6 times as long as wide; male palpal segments in relative

length of 25 : 30 : 70, sensory pit on first segment small (about 1/4 length of the segment); scutellum with one or two pairs of short setae before base of apical bristles; proepisternum with two bristles (posterior one slightly shorter than the anterior in male, but almost one-half length of the anterior in female); R<sub>1</sub> 1.6(1.59–1.66) times as long as R; fore metatarsus longer than tibia (1.3–1.4 : 1); hind tibia with two isolated rows which consist of six distal bristles, respectively; gonocoxites (Fig. 17) each with a short process before inner dorsal apex; S9 (Fig. 18) with distal process long but narrow; gonostylus (Figs. 18, 19) distinctly narrowed apically, ventral stylomere subequal to gonostylus in length and cylindrical; mesal stylomere with basal process flask-shaped and bare; aedeagus (Fig. 18) with a bell-like distal process which is brown and darkened apically; body length 4.3–4.6 (4.5 in holotype) mm, wing length 3.8(holotype)–4.1 mm.

Holotype male, Kisokoma-kogen, Nagano Pref., emerged on 18 Oct. 1989 (H. I.); host fungus, *Mycena galericulata* (Scop.: Fr.) S. F. Gray (*Tricholomata-*

ceae), collected on 8 Oct. 1989. Paratypes: 1 male and 2 females, same data as for holotype; 1 female, On-take-kogen, Nagano Pref., 17 Oct. 1989 (H.I.), host fungus coll. 8 Oct.

Distribution. Japan (Honshu).

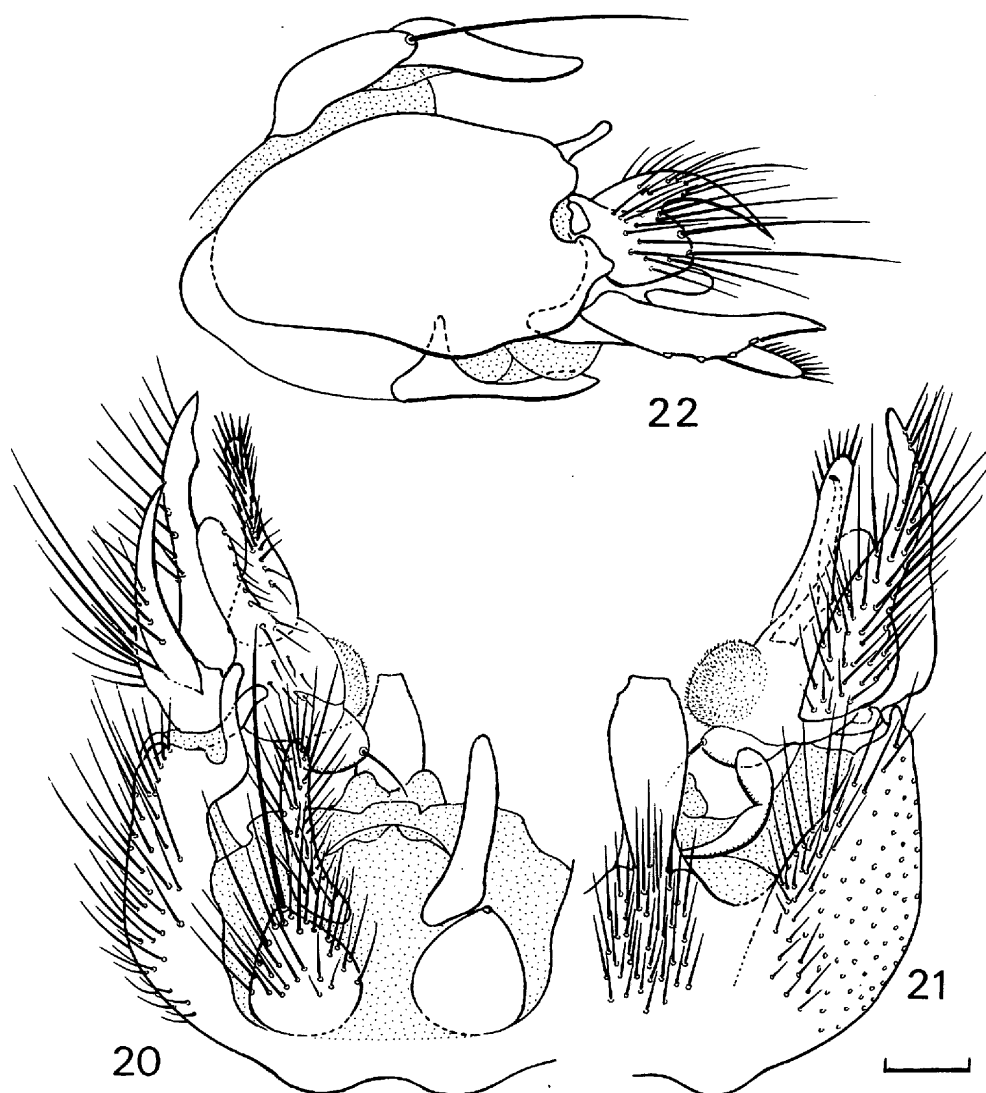
Etymology. The specific name refers to the fungus genus *Mycena*.

***Exechiopsis (Exechiopsis) sanageyamana* sp. n.**  
(Figs. 20–22)

Male and female. This species differs from *mycena* n. sp. in the following points: head brown to dark brown, but dorsal orbit, ventral margin of face and clypeus testaceous; antenna pale brown, but scape, pedicel and base of first flagellomere testaceous; thorax yellowish brown except for yellow antero-lateral parts of mesoscutum, pronotum and

proepisternum; mesoscutum indistinctly trivittate; mediotergite and pleurotergite darkened; T2 yellow triangularly on postero-lateral two-thirds and T3–4 trapezoidally on postero-lateral one-half, T5–6 in male entirely blackish brown, but T5–7 in female each with yellow posterior margin; antennal flagellomeres in relative length of 33(1st) : 21(2nd–3rd) : 20(4–6th) : 19(7–10 & 13th) : 18(11–12th) : 23(14th); fourth flagellomere about 1.3 times as long as wide; male palpal segments in relative length of 25 : 47 : 103; body length 4.7(holotype)–4.8(male) mm, wing length 3.4(holotype)–3.6(male) mm.

Ninth sternite (Fig. 21) more densely setose, with distal process shorter but broader than that of *mycena*, accompanying a pair of finger-like lateral processes at base; gonostylus (Fig. 22) projected posteriorly on dorsal side as a claw; ventral stylomere (Fig. 22) longer than gonostylus and inner lobe of



Figs. 20–22. Male genitalia of *Exechiopsis sanageyamana* sp. n. (paratype from Sanage-yama, Aichi). See Figs. 1–3.



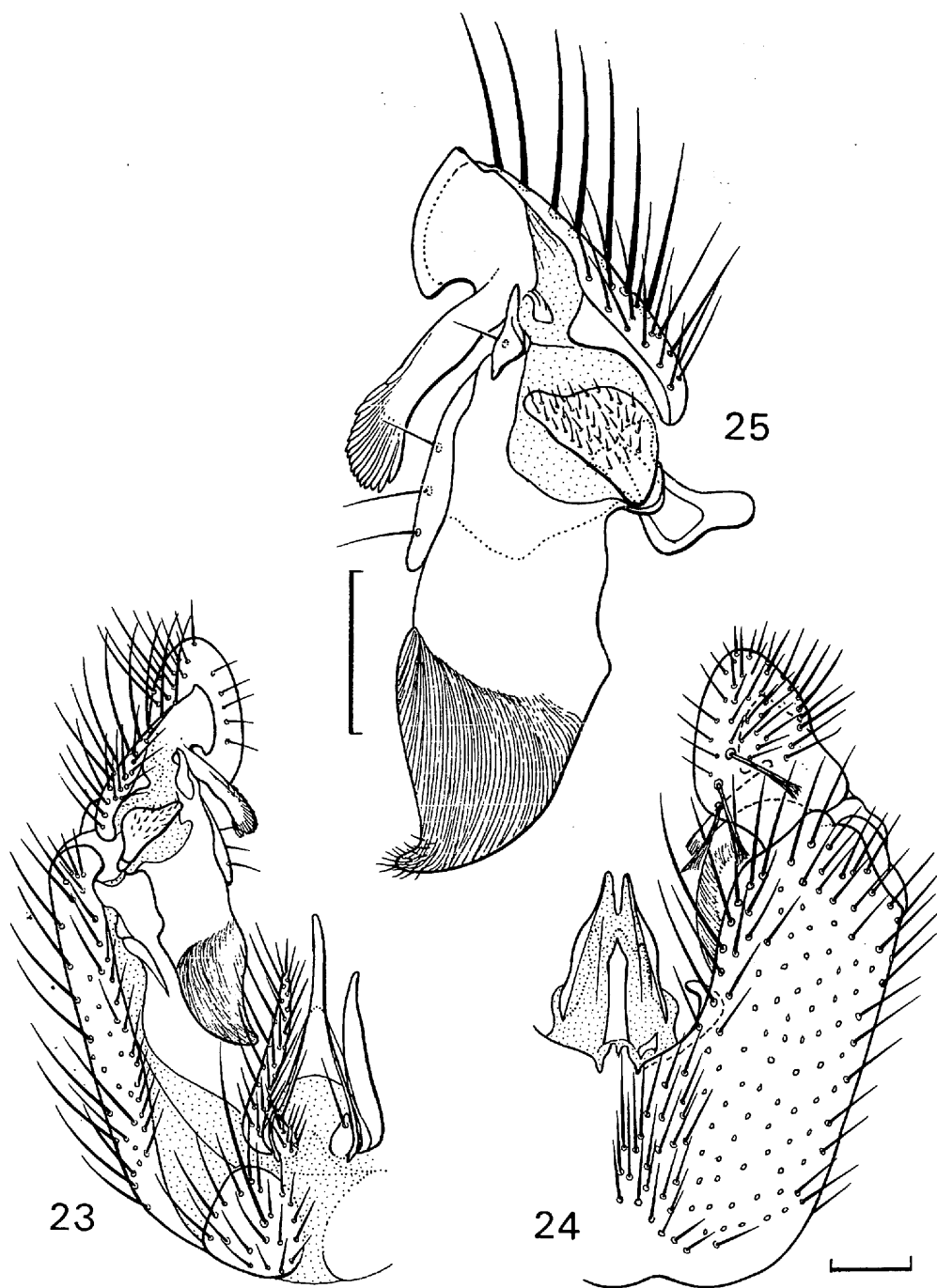
mesal stylomere (Fig. 21) with a seta (two setae in *mycenae*); cercus short (about thrice as long as the length of T10 in *mycenae*).

Holotype female, Mt. Sanage-yama, Toyota, Aichi Pref., emerged on 25 Mar. 1989 (H.I.); host fungus, *Mycena galericulata*, collected on 12 Mar. 1989. Paratype male, same data as for holotype; right antenna, palpus and hind leg, and terminalia in a polyethylene tubule with glycerol and pinned with the specimen.

Distribution. Japan (Honshu).

Remarks. The coloration of male mesoscutum and T5–6 of this species is just the same to that of European *E. pseudopulchella* (Lundström, 1912). However, this species is easily diagnosed by the specific gonostylus and distal process on S9.

Etymology. The species is named after the type locality.



Figs. 23–25. Male genitalia of *Pseudexechia trisignata* (Edwards). See Figs. 1–2 & 4.

## Genus *Pseudexechia* Tuomikoski

*Pseudexechia trisignata* is added to the mycetophilid fauna of Japan, and the host fungus is recorded for the first time.

### *Pseudexechia trisignata* (Edwards)

(Figs. 23–25)

*Exechia trisignata* Edwards, 1913: 370.

*Pseudexechia trisignata*: Tuomikoski, 1966: 180.

This species is characterized by having the bicolor abdomen, a pair of small and setose lobes at inner bases of cerci (Fig. 23), a pair of spatulate inner processes, which are serrated apically, on the gonostylus (Fig. 25), and the oval ventral stylomere, with three peculiar setae, which are a kind of brush-pencils in a form, on ventral side (Fig. 24); body length 4.5 mm, wing length 3.1 mm.

Specimen examined. One male, Mt. Sanage-yama, Toyota, Aichi Pref., 30 Oct. 1989 (H. I.); host fungus, *Psathyrella piluliformis* (Bull.: Fr.) P. D. Orton (Coprinaceae), coll. 22 Oct.

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

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