

Crane-Flies Injurious to Useful Mush-Rooms in Japan,

with revision of the Japanese *Ula* species and descriptions of a known and three new species and immature stages of two species
(Tipulidae, Diptera)*

By

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Since 1950, we have studies on injurious insects of useful mushrooms and found out many species of 24 families. Of these mushrooms, Japanese pine mushroom (*Armillaria matsutake*) is one of the important vegetables in autumn being very much relished by all Japanese people and its annual output is about 3,000 tons and Kyoto Prefecture is the most famous place of this production. Japanese quercus mushroom (*Cortinellus shiitake*) is an important by-product for the forester and another favourite for Japanese in addition to an export for China and its annual output is about 1,600 tons. Oyster mushroom (*Pleurotus ostreatus*) is not so important as in the above two mushrooms but often locally used on the table.

From pine mushrooms we found 12 species of Diptera including 2 species of the Tipulidae, from quercus mushroom 5 species of Diptera including one of the Tipulidae and from oyster mushroom 8 of Diptera including one of the Tipulidae. Of these Dipterous insects, the Tipulidae and Drosophilidae are the most important pest of the useful mushrooms and the outbreak of these flies has a great and intimate effect on the output and market price of mushrooms. Assistant Prof. Mr. MITIMASA IWAMURA of our university are now studying on the control of these pests, although it is very difficult.

In this paper, we intend to report the systematic of the Tipulidae studied by Mr. H. ISHIDA, Assistant of our laboratory, and Mr. A. NOBUCHI, Post-graduate Student, under my direction on the materials which were bred up in our laboratory from the useful mushrooms. Mr. ISHIDA has found a new species of the genus *Ula* and Mr. NOBUCHI additional two new species. The crane-flies injurious to the useful mushrooms all belong to the genus *Ula*, and at present other crane-flies are not known as yet from Japan. According to Prof. Dr. C. P. ALEXANDER (1920), *Ula* species are all

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fungivorous and hitherto only four species have been known from Japan and the immature forms of these Japanese species were quite unknown. At present, Mr. NOBUCHI found the larvae and pupae of two *Ula* species.

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1. *Ula* HALIDAY 1833 (Ent. Mag., 1 : 153)

1864, *Macroptera* LIOY; Atti dell' Institut Veneto, ser. 3, 9 : 244

Diagnosis:—Compound eyes pubescent ; antennae 17-segmented ; wings with numerous macrotrichia on membrane ; vein Sc_1 very long and cross-vein-like Sc_2 present before the origin of R_s ; vein Cu_1 almost straight, not distinctly deflected at m-cu ; m-cu placed far before the fork of M_{3+4} ; tibiae without spurs ; body usually median in size.

The genus *Ula* belongs to the tribe Pediciini and distinctly characteristic in the presence of numerous macrotrichiae on the wing membrane differing from other genera of the tribe. In 1949, ALEXANDER divided the genus *Ula* into two subgenera : *Ula* and *Metaula*. Japanese species all belong to the former subgenus and the latter subgenus is represented only by a Himalayan species, *U. splendissima* ALEXANDER, which has an unusual cross-vein in cell R_3 .

Key to Japanese species of *Ula*

(General Structure)

1. Sc_2 located about at middle of R, wings pale yellow *perelegans* ALEX.
 Sc_2 located far beyond the middle of R, wings almost brown 2.
2. Caudal margin of abdominal tergites narrowly obscure yellow, sternites pale but 6th to 8th sternites of male brown *cincta* ALEX.
 Abdominal tergites all brown 3.
3. Median cell shorter than vein M_4 and distal section of Cu_1 4.
 Median cell longer than vein M_4 and subequal to distal section of Cu_1 6.
4. R_s longer than R_{2+3+4} and R_{2+3} taken together *fungicola* NOBUCHI (n. sp.)
 R_s rather short and subequal to R_{2+3+4} and R_{2+3} taken together 5.

5. Wings brown ; rostrum and palpi black ; mesonotum and pleura reddish brown
 *kiushuensis* ALEX.
 Wings pale yellowish brown ; rostrum obscure yellow, darker medially above ;
 palpi brown ; mesonotum and pleura yellowish brown *succincta* ALEX.
6. Third segment of maxillary palpi longer than fourth ; median cell of wing
 narrow *shiitakea* NOBUCHI (n. sp.)
 Third segment of maxillary palpi subequal to fourth ; median cell of wing broad
 *longicellata* ISHIDA (n. sp.)

(Male Genitalia)

1. Dististyle round and broad at tip and with about fifteen black spines at distal
 part 2.
 Dististyle tapering at tip and with about nine black spines which are scattered
 3.
2. Caudal margin of ninth tergite with a pair of small dorsal median lobes
 *succincta* ALEX.
 Caudal margin of ninth tergite without dorsal lobes, but with a pair of similar
 lobes on ventral side *cineta* ALEX.
3. Hypopygium dark brown *kiushuensis* ALEX.
 Hypopygium yellow or yellowish brown 4.
4. Dististyle with a rather slender beak-part at distal end *fungicola* NOBUCHI (n. sp.)
 Dististyle with a small beak-part at distal end *shiitakea* NOBUCHI (n. sp.)

Japanese *Ula* species*Ula cineta* ALEXANDER

1924, Philippine Jour. Sci., 24 : 573

This species has been known, hitherto, only on the female specimens which have been collected at Akan and Teppetsu, Hokkaido, and the Mt. Tsurugi, Shikoku. NOBUCHI has found males, females, pupae and larvae of this species from pine mushrooms of Takayama and Kyoto, Honshu.

Ula fungicola NOBUCHI (n. sp.)

This is a new species named by Nobuchi on a male fly found from a pine mushroom of Takayama, Honshu.

Ula kiushuensis ALEXANDER

1933, Philippine Jour. Sci., 51 : 541-542

This is known only on a male from Sobosam, Kyushu.

Ula longicellata ISHIDA (n. sp.)

This is named by ISHIDA in this time on a female fly from an oyster mushroom of Okayama, Honshu.

Ula perelegans ALEXANDER

1924, Philippine Jour. Sci., 24 : 572-573

This is known only on a female fly from Abashiri, Hokkaido.

Ula shiitakea NOBUCHI (n. sp.)

This is named by NOBUCHI, at present, on nine male flies and larvae found from quercus mushrooms of Kyoto, Honshu.

Ula succincta ALEXANDER

1933, Philippine Jour. Sci., 51 : 400

This is known only on a male fly from Mt. Mitake, Tokyo, Honshu.

2. Descriptions by NOBUCHI

Ula cincta ALEXANDER

Male : — Body length about 5.5 mm.; general coloration of body dark brown; wings brown, with faint brown pattern.

Head shiny gray; compound eyes black. Antennae 17-segmented; scape yellowish brown, globular; flagellum black. Rostrum black; maxillary palpi 4-segmented, black; proportional length of palpal segments about 1 : 1.3 : 1.8 : 2.3.

Thorax sparsely haired. Prescutum, scutum and scutellum yellowish brown; postnotum dark brown; pleura gray to black. Halteres light yellow, with knobs dark brown. Mesothoracic stigma light yellow. Legs infuscated, with black hairs; coxae, trochanters and basal part of femora yellow. Wings (Fig. 1) about 7.5 mm long, brownish, subhyaline; stigma brown, its central part paler; pale brown patterns on Sc₂, origin of Rs, r-m, m-cu and distal margin of median cell. Veins yellowish brown or dark brown. Venation : Sc₁ ending at level or fork of R₂₊₃₊₄; Sc₂ beyond the middle of radial stem; Rs about as long as R₂₊₃₊₄ and R₂₊₃ taken together; R₂ as long as R₁₊₂; r-m situated at or slightly beyond fork of Rs, almost as long as m-cu; median cell small, far shorter than M₄; m-cu situated beyond fork of M.

Abdominal tergites densely pubescent, dark brown, each caudal margin yellowish; sternites paler, but caudal three dark brown. Hypopygium yellow; ultimate tergite truncate and setigerous on caudal margin; ventral side of ultimate segment with a median U-shaped incision on caudal margin; dististyle (Fig. 5) relatively large, crowned with about fifteen black spines.

Larva : — Full grown larva (Fig. 8) cylindrical, covered with short pubescence, dusky white, about 8 mm. long, 1 mm. in diameter, with head and spiracular disk black.

Head capsule large, rather narrow; front very narrow, tapering gradually behind ending into a sharp point. Labrum (Fig. 9) somewhat triangular, with setigerous chitinization on lateral part of distal half. Clypeus setigerous on lateral margin, with a large dark transverse area. Mentum (Fig. 10) heavily chitinized, its denticulation obscure, provided with two pairs of small blunt lateral teeth. Antennae very small disc-like, with minute papillae. Mandible (Fig. 11) rather slender, blunt at tip, with five blunt teeth at distal part and a tuft of long hairs on prothecal part. Maxillae (Fig. 12) consisted of two lobes; lateral lobe with palpus, which is rather large; mesal lobe broad, with several sensory organs.

Abdominal segments from second to seventh each with two dorsal line-like creeping-welts which are consisted of minute spinules. Respiratory disk (Fig. 13) pentagonal, fringed with dark delicate hairs, with five chitinized lobes, spiracles large, circular; distance between two spiracles larger than the diameter of each spiracle.

Pupa : — Body length about 8.5 mm. ; thorax yellowish brown, cephalic crest, sheaths of wings and legs dark brown ; abdomen white (Figs. 18 & 19) .

Antennae extending just beyond the base of wing; respiratory horn long, cylindrical, dark brown on basal two-thirds and yellowish brown on apical part. Wing sheaths extending at caudal margin of second abdominal segment. Legs extending beyond fourth abdominal segment. Abdomen with five transversal bands composed of many minute spinules on dorsal side ; eight segment with two pairs of distinct spiracles. In female hypopygium, tergal valves longer and sternal valves slightly up-curved; in male valves all short and blunt.

Specimens : — Males, females, pupae and larvae; Takayama, Gifu-Prefecture; Dec., 1953 ; Miyajima, Kitakuwada, Kyoto ; Dec., 1953 ; obtained from *Armillaria matsutake*.

Ula fungicola NOBUCHI (n. sp.)

Male : — Body length about 7.5 mm. ; general coloration brown to dark brown ; wings about 8 mm. long, strongly tinged brown, with very obscure markings.

Head dark gray, with eyes black. Antennae 17-segmented; scape pale brown; flagellum dark brown, with pale pubescence. Rostrum brown ; maxillary palpi 4-segmented, brown to dark brown ; proportional lengths of palpal segments about 1 : 1.1 : 1.6 : 2.3.

Thorax sparsely haired, brownish black; postnotum darker; pleura yellowish brown, with notepimeron and metapleuron dark. Halteres light yellow, with knobs darker on distal half. Legs infuscated ; coxae and trochanters yellowish ; femora with distal tips dark. Wings (Fig. 2) subhyaline, strongly tinged brown; stigma brown, with

central part relatively paler; faint brown clouds on origin of Rs and on r-m. Venation: Sc_1 beyond the middle of R_{2+3+4} , Sc_2 at basal three-fifths of distance between arculus and origin of Rs, Rs angulated at base, and longer than R_{2+3+4} and R_{2+3} taken together, R_{1+2} subequal to R_2 ; relative lengths of r-m and m-cu about 4:5, r-m at fork of Rs; median cell small, shorter than M_4 .

Abdominal tergites and sternites yellowish brown or dark brown; caudal four segments dark. Hypopygium yellowish brown; caudal margin of ninth tergite evenly round, with long setae; dististyle (Fig. 6) rather large and slender, with about nine black spines.

Specimens:—Holotype male; Oct. 9, 1953; Takayama, Gifu; obtained from *Armillaria matsutake*.

This new species is closely allied to *U. kiushuensis*, but differs in the shape of median cell and shape of dististyle and the arrangement of black spines of dististyle.

Ula shiitakea NOBUCHI (n. sp.)

Male:—Body length about 6.8 mm.; general coloration reddish brown; abdomen dark brown; wings strong tinged brown.

Head shiny gray; compound eyes black. Antennae 17-segmented; scape yellowish brown, subglobe; flagellum black with pale pubescence. Rostrum greyish brown; maxillary palpi 4-segmented, black; comparative lengths of palpal segments about 1:1.3:2.8:1.3.

Prescutum, scutum and scutellum brownish; postnotum rather dark; pleuron dark brown; notepimeron yellowish brown. Halteres pale yellow, with knobs partially dark; mesothoracic stigma yellowish brown, legs dark brown; coxae pale brown, coxae of fore legs slightly dark at base; trochanters yellowish brown. Wings (Fig. 3) about 7 mm. long, subhyaline, tinged brown; brown clouds on r-m, m-cu and distal margin of median cell. Veins yellowish brown to dark brown. Venation: Sc_1 at middle of R_{2+3+4} , Sc_2 at basal three-fifths of distance between arculus and origin of Rs, subequal to length of R_{2+3+4} and R_{3+4} taken together, R_2 almost vanished, relative lengths of crossvein r-m and m-cu 5:8, r-m before fork of Rs; median cell relatively slender, as long as M_4 .

Abdominal tergites dark brown, with pale setae; sternites brown. Hypopygium yellow; caudal margin of ninth tergite arcuated, with distinct setae; dististyle (Fig. 7) slender, with about nine black spines.

Larva:—Head capsule black, large and rather narrow; frons very long and its caudal half very narrow. Labrum (Fig. 14) rather broad, large, conspicuous, densely fringed

with hairs on lateral chitinizations; clypeus with a broad dark chitinization. Mentum (Fig. 15) distinctly denticulated with four pairs of lateral teeth. Mandibles (Fig. 16) rather broad, blunt at tip, with about five blunt teeth. Maxillae (Fig. 17) simple; lateral lobe short, broad, with palpus discoidal; mesal lobe short, broad, truncated.

Specimens : — Males and larva ; Kibune, Kyoto; May 16, 1952 obtained from *Cortinellus Shiitake*.

This species is allied to *U. kiushuensis*, but most distinctly differs in the shape of median cell, structure and coloration of male hypopygium from the allied species.

3. Description by ISHIDA

Ula longicellata ISHIDA (n. sp.)

Female : — Length of body about 6 mm.; general coloration of body brown. Head grey; thorax brown to dark brown; abdominal tergites brownish black, pleura and sternites reddish brown. Legs yellowish brown to dark brown. Wings subhyaline, strongly tinged brown; veins yellowish brown to dark brown, faintly patterned; Rs angulated at origin and spurred, median cell very large; halteres yellowish brown; knobs darker.

Head grey, with eyes pubescent; proboscis dark brown, shorter than the remainder of head. Antennae 17-segmented, with scape dark; pedicel reddish brown, conical; flagellum dark brown, segments elongate-oval or subcylindrical, almost subequal in length, except terminal segment longer than penultimate. Maxillary palpi 4-segmented, slender, dark brown; relative lengths of palpal segments 1 : 1.3 : 1.8 : 1.8.

Thorax sparsely haired; pleura reddish brown. Legs with coxae and trochanters yellowish brown, haired; basal third of femora yellowish brown, passing into darker apically; knees black; tibial spurs 1 : 2 : 2.

Wings (Fig. 4) about 7.5 mm. long, subhyaline, with faintly brown patterns at origin of Rs, tip of Sc₁ to fork of R₂₊₃₊₄, along R₂, cord, m-cu and proximal end of median cell. Veins yellowish brown but on patterned area darkened. Macrotrichiae rather sparsely distributed both on veins and membrane and lacking at extreme wing base and basal half of wing much sparser. Venation: Sc₁ ending at or beyond middle of R₂₊₃₊₄, Sc₂ at basal three-fifths of distance between arculus and origin of Rs; Rs angulated at base and conspicuously spurred but on left wing, which is figured, rather inconspicuously spurred; basal section of R₅ reduced and r-m closs to fork of Rs; median cell very large, and longer than M₄ and subequal to distal section of Cu₁; M₄ almost parallel to distal section of Cu₁.

Abdominal tergite dark brown, very densely pubescent or haired, pleura and

sternites reddish brown; hypopygium reddish brown, tips paler, upcurved.

Specimen : — Holotype female; Kurami, North of Mimasaka-Kamo, Tomada-Gun, Okayama Prefecture; August 29, 1952; obtained from *Pleurotus ostreatus*.

This new species is closely allied to *U. kiushiensis* ALEXANDER and *U. succincta* ALEXANDER, but differs in wing venation, especially spurred Rs and relatively larger median cell and coloration of head. Another allied species is *U. fulva* ALEXANDER, but present species differs in wing venation, especially position of m-cu and larger median cell, spurred Rs and coloration of head, etc.

4. Literature

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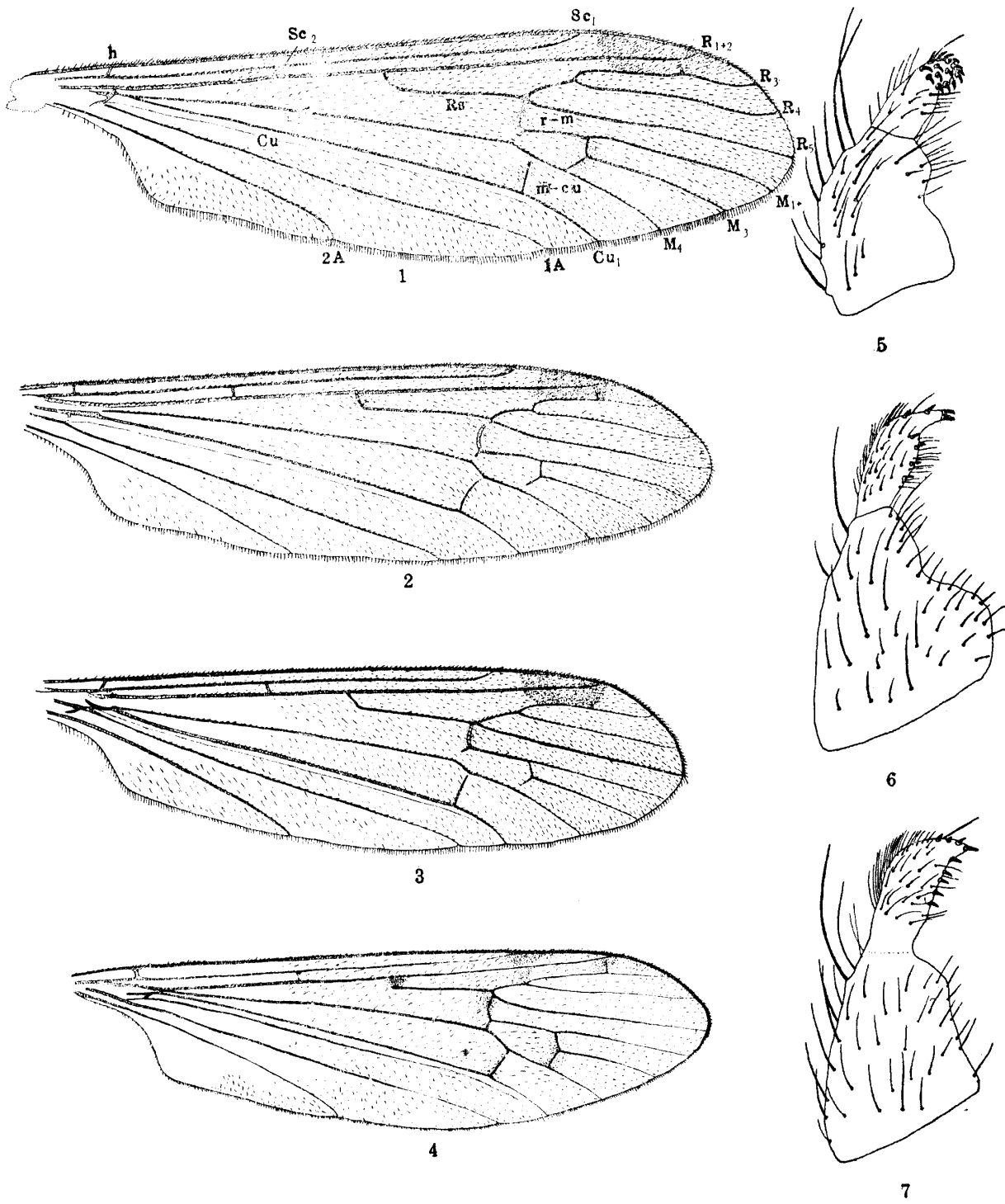
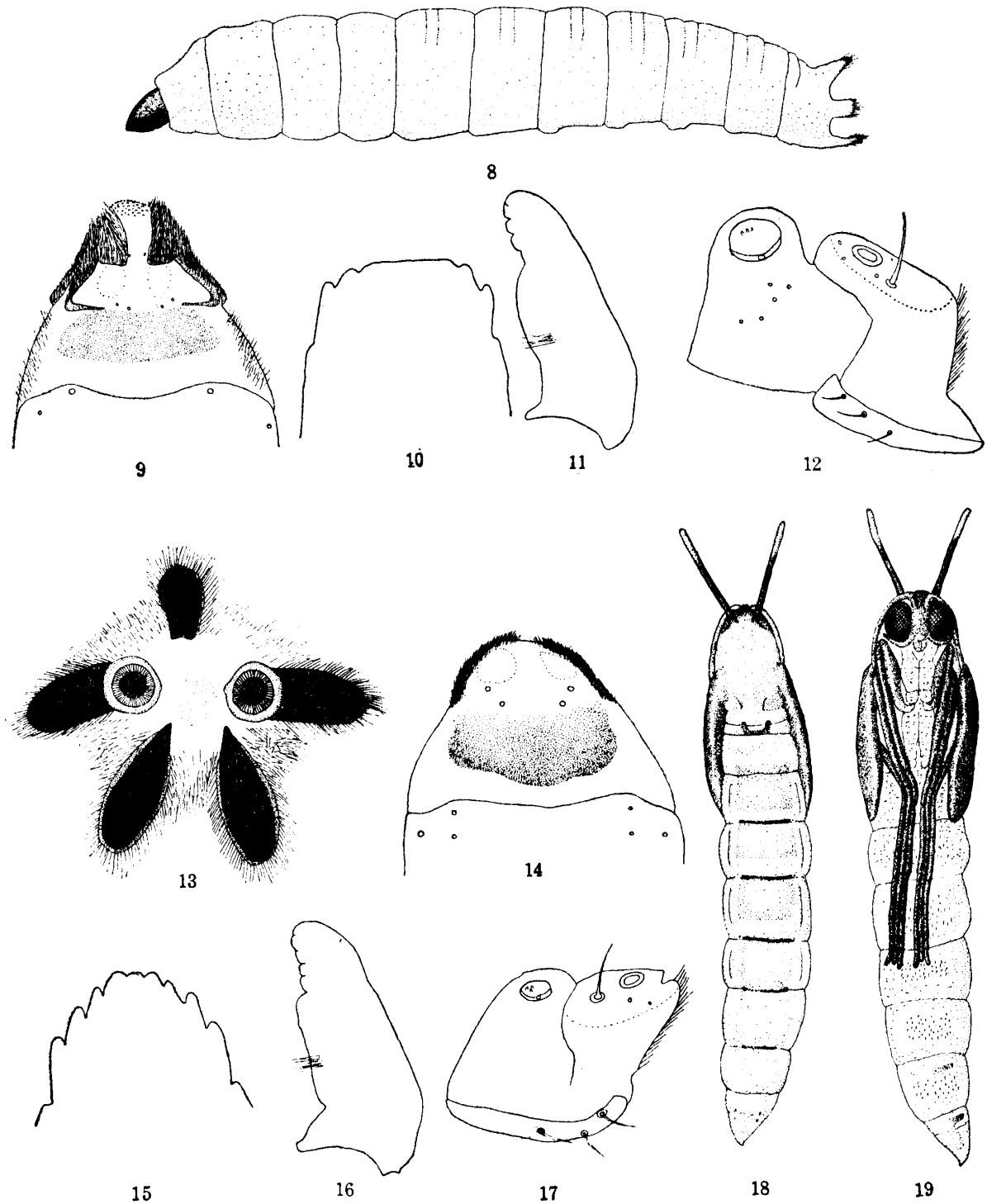


Fig. 1: *U. cincta* ALEX., male wing. Fig. 2: *U. fungicola* n. sp., male wing. Fig. 3: *U. shiitakea* n. sp., male wing. Fig. 4: *U. longicellata* n. sp., female wing. Fig. 5: *U. cincta* ALEX., male dististyle and basistyle. Fig. 6: *U. fungicola* n. sp., male dististyle and basistyle. Fig. 7: *U. shiitakea* n. sp., male dististyle and basistyle.



Figs. 8-13: *U. cincta* ALEX., larva. Fig. 8: larva. lateral aspect. Fig. 9: labrum. Fig. 10: mentum. Fig. 11: mandible. Fig. 12: maxilla. Fig. 13: respiratory disk. Figs. 14-17: *U. shiitaka* n. sp., larva. Fig. 14: labrum. Fig. 15: mentum. Fig. 16: mandible. Fig. 17: maxilla. Figs. 18-19: *U. cincta* ALEX., pupa. Fig. 18: dorsal aspect. Fig. 19: ventral aspect.