

Laboulbenia exigua and related taxa (Ascomycetes, Laboulbeniales)

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The *Laboulbenia exigua* group comprises seven species. Three of these species are described as new to science, and two new varieties of *L. exigua* and one new variety of *L. balazucii* are distinguished and described. New taxa are *L. yamadae*, *L. consobrina*, *L. gebleri*, *L. exigua* var. *yaeyamae*, *L. exigua* var. *melanolabiata* and *L. balazucii* var. *exilis*. This fungus group is characterized by grayish yellow to gray-brown thalli with simple inner and outer appendages, dark-spotted or streaked receptacles, and perithecia containing narrow ascospores 3–4(–5) μm in width; the species and varieties occur on *Chlaenius* (Carabidae) and closely allied taxa. The bilobed apex of mature perithecium, owing to the rounded apices of the posterior apical cells of the outer wall cell rows, and 3-celled, curved inner appendage in young thalli, and the deciduous antheridium are also characteristic of this group.

Key Words—Carabidae; *Chlaenius*; Japan; Laboulbeniales; new species; new varieties; Taiwan.

Since Thaxter (1902) described *Laboulbenia exigua* Thaxter on *Chlaenius micans* (Fabricius) (Syn. *C. biguttatus* Motschulsky; Coleoptera, Carabidae, Callistinae, Chlaeniini) from Japan, four morphologically similar species of *Laboulbenia* have been described from France (Picard, 1913), Madagascar (Lepesme, 1943), Japan (Sugiyama, 1979), and Sierra Leone (Rossi, 1986). These species share with *L. exigua* morphological characters such as simple inner and outer appendages with no visible antheridia. All hosts belong to the Chlaeniini, a tribe in the subfamily Callistinae, Carabidae. Line drawings of two species of *Laboulbenia* by Ishikawa (1948) clearly show that the thalli of the two species also have inner and outer appendages similar to those of *L. exigua*. Ishikawa gave no information about hosts or localities where the specimens were collected.

Laboulbenia exigua and its related species are found among the large number of laboulbeniaceus parasites taken from my carabid collection accumulated since 1969. The results of the morphological comparison of the taxa belonging to the *L. exigua* group follow, together with notes on their position on the hosts and the sex ratio of the hosts obtained.

Laboulbenia exigua Group

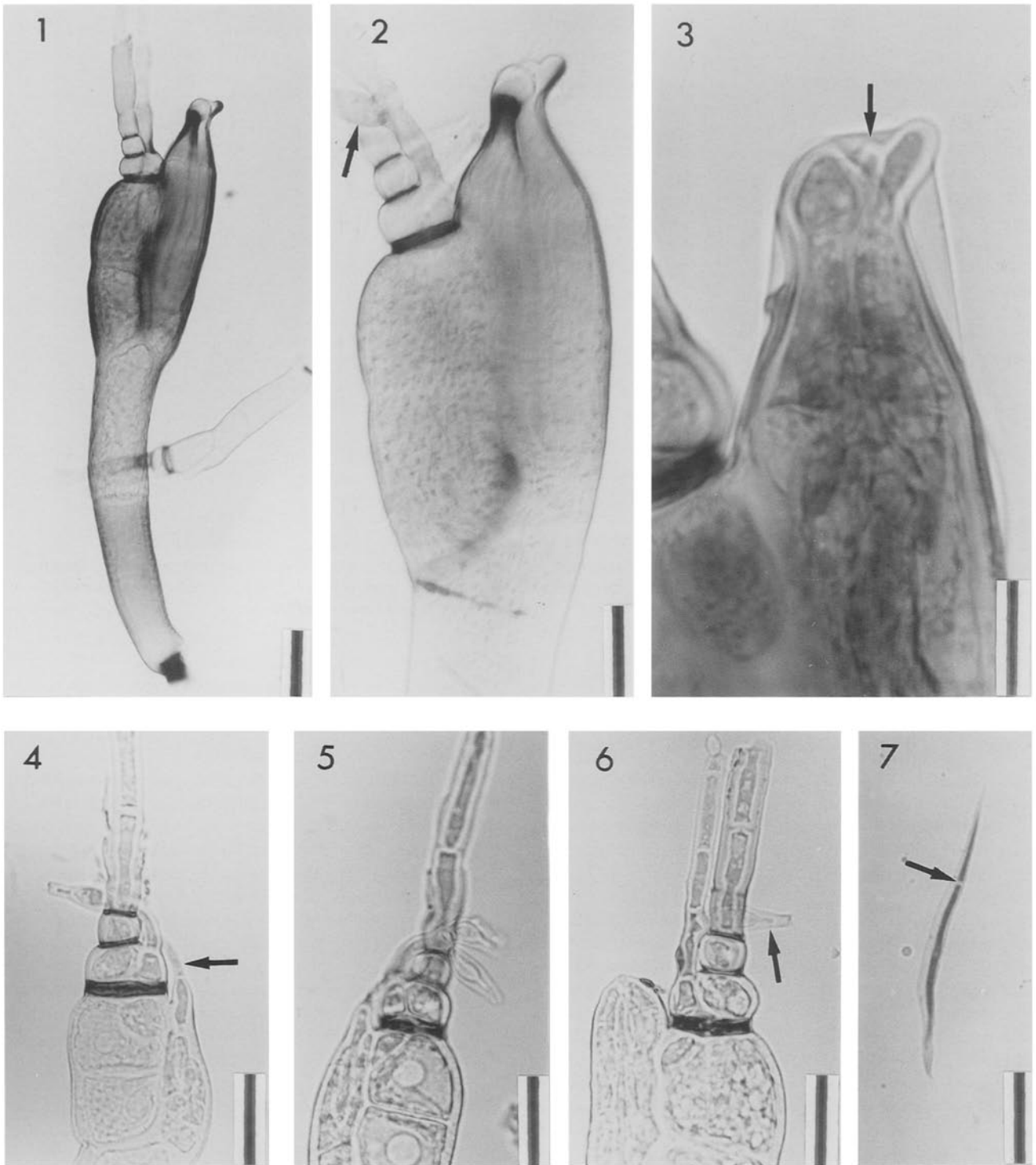
Chlaeniicolous. Mature thallus short to medium in height, grayish yellow to gray-brown, with simple inner and outer appendages, dark-spotted or streaked receptacle and perithecium, and with narrow ascospores. Posterior part of perithecial apex usually bilobed; lobes hyaline above basal blackish band, slightly bending toward anterior side. Anterior part of perithecial apex simple or variably protruding. Suprabasal cell of inner appendage in young thalli almost always strongly bent back-

ward and bearing solitary or sometimes paired, flask-shaped, simple antheridium. Antheridium at first terminal in position, but later lateral because of growth of inner appendage from suprabasal cell, at least in *L. exigua* and *L. consobrina* Terada; antheridium usually disappearing before thallus matures. Trichogyne simple, without blackish septa.

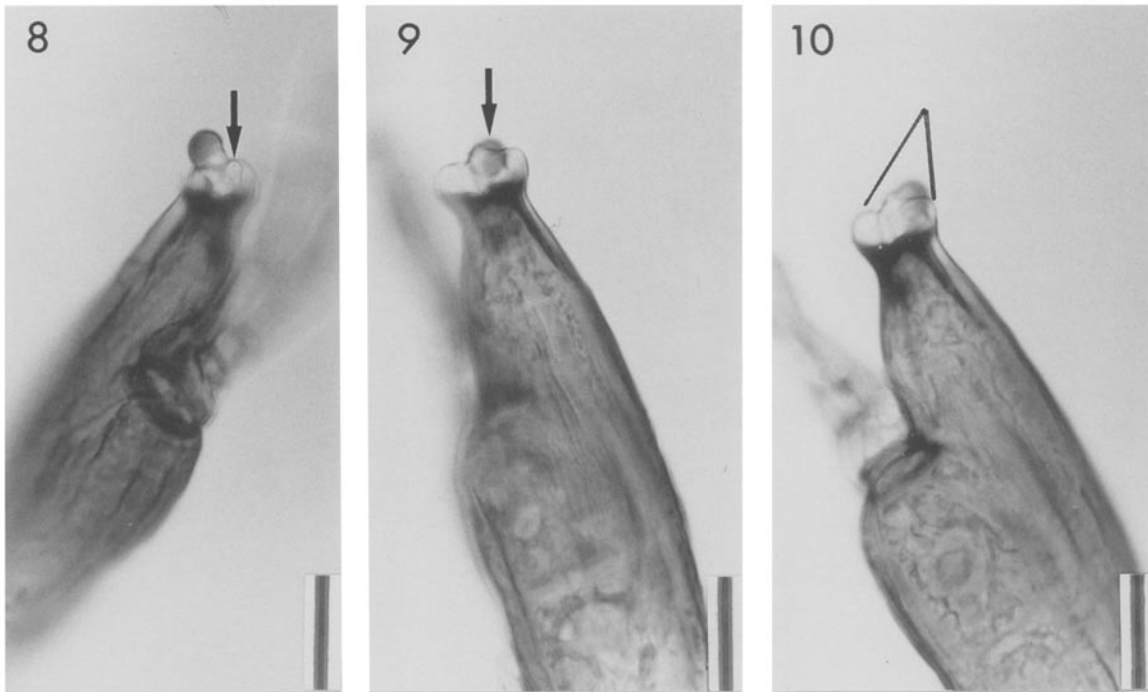
Key to species and varieties

- 1 Outer appendage base consisting of a more or less cubical basal cell (often laterally inflated) and a similar-shaped, slightly smaller suprabasal cell; upper and lower septa of the suprabasal cell constricted and conspicuously blackened even in young thalli. Basal cells of inner and outer appendages subequal in height. Apical anterior part of the perithecium modified in shape 2
- Outer appendage base consisting of a short-cylindrical basal cell and a similar-shaped suprabasal cell; upper and lower septa of the suprabasal cell constricted or not constricted, blackened or hardly blackened. Basal cells of inner and outer appendages unequal in height (the outer basal cell is taller than the inner). Apical anterior part of the perithecium simple (unmodified) or slightly modified in shape 6
- 2 Cell I narrowed toward the base; cell III and cell IV squarish in optical section. Suprabasal cell of inner appendage short (L/W = 1.7–1.8); lower septum conspicuously blackened even in young thalli. Insertion cell situated near the middle of the perithecium. Perithecial apex usually trilobed in optical section *L. consobrina*
- Cell I cylindrical; cell III and cell IV nearly oblong or roundish in optical section. Suprabasal cell of inner

- pendage long (L/W=3.8–6.0), often becoming dark around the base in mature thalli. Insertion cell situated above the middle of the perithecium or below it. Perithecial apex not trilobed in optical section3
- 3 Perithecium with a tongue-shaped, blackish outgrowth (40–61 μm long) at the apex. Cell III and cell IV usually roundish in optical section*L. yamadae* (typical form)
- Perithecium with a short projection (4–9 μm long) at the apex. Cell III and cell IV nearly oblong in optical section 4
- 4 Cell II usually as long as cell I; cell VI as large as cell V. Insertion cell situated high above the middle of the perithecium*L. exigua* var. *exigua*
- Cell II usually longer than cell I; cell VI larger than cell V. Insertion cell situated below the middle of the perithecium5
- 5 Perithecium relatively large, with erect, blackish projection at the apex*L. exigua* var. *melanolabiata*
- Perithecium relatively small, with subhorizontal (laterally directed) projection hyaline except for the blackish outer edge and apical termination*L. exigua* var. *yaeyamae*
- 6 Suprabasal cell of outer appendage shorter than outer basal cell, with upper and lower septa constricted and conspicuously blackened even in young thalli7
- Suprabasal cell of outer appendage subequal to outer basal cell in length, with upper and lower septa slightly or hardly constricted and slightly or hardly blackened even in mature thalli8
- 7 Insertion cell almost adnate to perithecium. Upper 1/4 of perithecium free. Cell II usually shorter than cell I, with lateral sides unequal in length and constricted just above middle; lower septum of cell III higher than lower septum of cell VI; cell VII usually with rounded protrusion*L. torta*
- Insertion cell remote from perithecium. Upper 1/2 of perithecium free. Cell II as long as cell I or slightly longer than cell I, with lateral sides subequal in length; lower septum of cell VI at same level as lower septum of cell III; cell VII not protruding*L. yamadae* (forms lacking a tongue-shaped outgrowth)
- 8 Cell II with lateral sides subequal in length; cell VI and cell III side-by-side. Blackish shade on anterior edge of the perithecial apex reaching the tip*L. gebleri*
- Cell II with lateral sides unequal in length; lower septum of cell III higher than lower septum of cell VI. Blackish shade on anterior edge of the perithecial apex not reaching the tip9
- 9 Cell I narrowed toward the base; cell II usually subequal in length to cell I. Upper and lower septa of suprabasal cell of outer appendage slightly constricted and slightly blackened in mature thalli. Inner appendage short and stout, usually curved backward. Basal part of perithecium concolorous with the middle of the perithecium*L. pasquetii*
- Cell I cylindrical; cell II usually shorter than cell I. Upper and lower septa of suprabasal cell of outer appendage not constricted nor blackened even in mature thalli. Inner appendage relatively long, more or less tapered, not curved backward. Basal part of perithecium distinctly deeper in color than the part above10
- 10 Cell III concolorous with the basal part of the perithecium (incl. cell VI), deeper in color than cell IV. Insertion cell situated near the middle of the perithecium. Apical posterior part of perithecium bilobed*L. balazucii* var. *balazucii*
- Cell III concolorous with cell IV, paler than the basal part of the perithecium. Insertion cell situated high above the middle of the perithecium. Apical posterior part of perithecium unequally bilobed*L. balazucii* var. *exilis*
1. *Laboulbenia exigua* Thaxter, Proc. Amer. Acad. Arts Sci. 38: 37.1902, var. *exigua*, Mem. Amer. Acad. Arts Sci. 13: 333. 1908; Sugiyama, Ginkgoana 2: 48. 1973. Type: On *Chlaenius* (*Spilochlaenius*) *micans* (Fabricius) (Syn. *C. biguttatus* Motschulsky), Japan. Figs. 1–10
- Thallus 223–330 μm long from foot to tip of perithecium (250–290 μm in Thaxter, 1908), dark-spotted or streaked on the lower part of the perithecium and on the upper receptacle. Perithecium, upper receptacle and upper part of cell I deeply suffused with gray-brown or yellowish gray-brown (reddish brown as to perithecium in Thaxter, 1908); cell II, lower part of cell I and appendages yellowish gray-brown or grayish yellow; foot, insertion cell and subapical part of perithecium blackish. Cell I pale in color at the base, darker and spotted on the upper part, cylindrical, 70–105 \times 28–37 μm ; cell II subcylindrical, with lateral sides subequal in length, subequal to cell I in length; cell III deeper in color than cell II, nearly oblong in optical section, 40–47 \times 30–42 μm ; cell IV subequal to cell III in color and size; cell V wedge-shaped, much smaller than cell IV. Insertion cell 18–24 μm broad, adnate to the upper portion of the perithecium. Outer appendage simple, 200–250 μm long (150–184 μm in Thaxter, 1908); basal cell more or less cubical, slightly convex on the lateral sides, 10–16 \times 9–15 μm ; suprabasal cell more or less cubical, slightly smaller than the basal cell, having upper and lower septa constricted and conspicuously blackened; other septa unblackened. Inner appendage simple; basal cell more or less cubical or spheroidal, subequal to the outer basal cell in height; suprabasal cell narrow, cylindrical, 20–24 \times 3–4 μm , often having dark suffusion around the base. Antheridium flask-shaped, solitary or sometimes paired, at first terminal, later lateral, usually evanescent. Perithecium 92–117 \times 34–40 μm (80 \times 26 μm in Thaxter, 1908); upper 1/3 of perithecium free; apical posterior part of perithecium bilobed; lobes hyaline above the basal blackish band, bending slightly toward the anterior side; apical anterior part of perithecium elongating to form a short (4–9 μm long), subhorizontal (laterally directed), hyaline projection with blackish outer edge and termination; cell VI subequal to cell V in size, much smaller than cell III, situated beside cell III. Ascospores hyaline, 1-septate, nar-



Figs. 1-7. *Laboulbenia exigua* var. *exigua*. 1. Mature individual on *Chaenius abstersus*. No. 1158. Bar=30 μ m. 2. Upper portion of mature thallus showing a pattern of pigment spots in wall of receptacle. Arrow indicates antheridium remaining on suprabasal cell of inner appendage. No. 323. Bar=20 μ m. 3. Upper portion of immature perithecium showing apical anterior lobe at right and posterior lobe at left. Arrow indicates tip of inner wall cell row. No. 328. Bar=10 μ m. 4. Young thallus showing outer appendage with constricted, blackish, upper and lower septa and 3-celled, curved inner appendage in which the terminal cell is antheridial. Arrow indicates simple trichogyne with unblackened septum at base. No. 328. Bar=20 μ m. 5. Almost the same stage of development showing paired antheridia on curved suprabasal cell of inner appendage. No. 1160. Bar=20 μ m. 6. Somewhat advanced stage of development showing inner appendage which begins to form an erect sterile branch. Antheridium (arrow) is at lateral side of the branch. No. 328. Bar=20 μ m. 7. Ascospore stained by cotton blue. Arrow indicates original spore septum. No. 1168. Bar=20 μ m.



Figs. 8–10. *Laboulbenia exigua* var. *exigua*. No. 1168. Each bar = 20 μ m. Shapes of perithecial apices observed in different directions. 8. Left view. Arrow indicates small projection just behind anterior lobe: probably the tip of the inner wall cell row. 9. Face view. Arrow indicates anterior lobe. 10. Right view. V-line indicates posterior lobes.

row, 66–75 \times 4 μ m (40 \times 4 μ m in Thaxter, 1908).

Specimens examined: On lower surface of mesothorax and/or prothorax of *Chlaenius (Pachydinodes) absterus* Bates—SHIGA, Otsu, Ishiyama, Nos. 322, 323, 328, 433, 18 July 1974, K. Terada leg.; SHIMANE, Izumo, Nos. 1158, 1165, 1166, 6 June 1993, K. Terada leg. On lower surface of mesothorax and/or prothorax of *Chlaenius (Pachydinodes) virgulifer* Chaudoir—HIROSHIMA, Higashi-Hiroshima, Saijo, No. 319, June 1970, K. Mizuta leg.; Hiroshima, Gion, Otagawa river, No. 1121, 24 July 1988, K. Terada leg., No. 1152, 20 Aug. 1992, M. Ishitani leg.; SHIMANE, Izumo, No. 1159, 6 June 1993, K. Terada leg. On lower surface of mesothorax and/or prothorax of *Chlaenius (Ilaenichus) postalis* Motschulsky—HIROSHIMA, Higashi-Hiroshima, Saijo, Nos. 320, 429, 430, 434, 435, 20 July 1974, K. Mizuta leg.; SHIMANE, Oki, Saigo (Oki Isl.), Nos. 1160, 1168, 10 Aug. 1988, K. Terada leg. On lower surface of mesothorax of *Chlaenius (Spilochlaenius) micans* (Fabricius)—HIROSHIMA, Hiroshima, Nishihara, Otagawa river, No. 1164, 10 Aug. 1993, K. Terada leg. Deposited at K. Terada Herbarium.

Distribution: Japan (Shizuoka, Shiga, Shimane and Hiroshima).

2. *Laboulbenia exigua* Thaxter, var. *yaeyamae* Terada, var. nov. Fig. 11

Differt a var. *exigua* receptaculo longiore et cellula insertionis inferiore. Holotypus: Terada No. 1070 (K. Terada Herbarium).

Specimens examined: On lower surface of mesotho-

rax of *Chlaenius (Pachydinodes) pictus* Chaudoir—OKINAWA, Yaeyama, Taketomi, Ohara (Iriomote Isl.), Nos. 648, 1070 (Holotype), 8 May 1977, K. Terada leg. Deposited at K. Terada Herbarium.

This new variety differs from the typical variety by the long lower receptacle, the insertion cell situated lower than the middle of the perithecium, and the larger cell VI with respect to cell V. The characters of the appendages, the perithecial apex and the color are the same as in the typical variety.

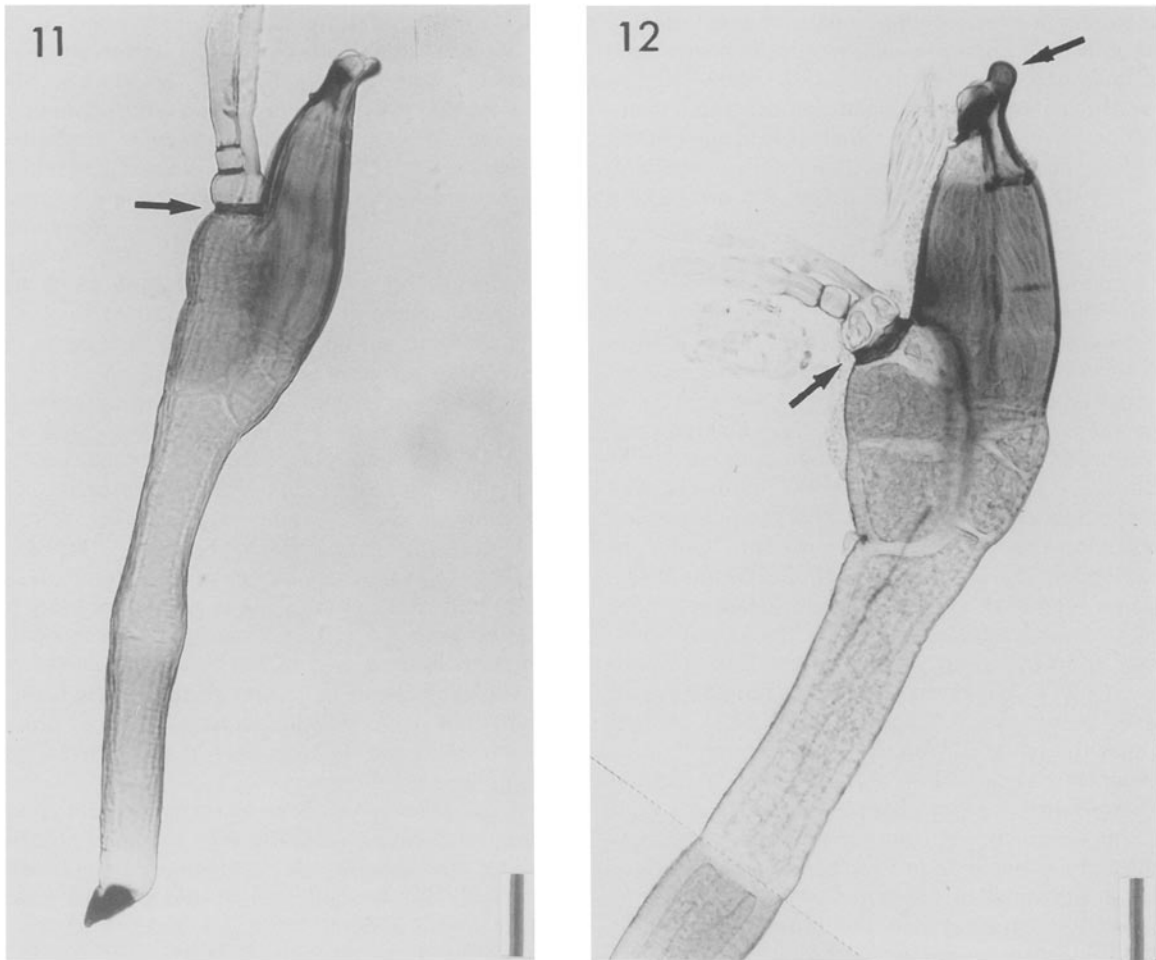
The measurements of the specimens are as follows: Total length to tip of perithecium 300–350 μ m long; cell I 80–110 \times 28–31 μ m; cell II 120–130 μ m long; cell III 30–32 \times 25–30 μ m; insertion cell 16–24 μ m broad; appendages ca. 110 μ m long; outer basal cell ca. 10 \times 10 μ m; inner suprabasal cell 15–20 \times 5 μ m; perithecium 95–119 \times 30–34 μ m; apical anterior projection 7.5–8.5 μ m long.

3. *Laboulbenia exigua* Thaxter, var. *melanolabiata* Terada, var. nov. Fig. 12

Differt a var. *exigua* et var. *yaeyamae* perithecio ad apicem projectura antico erecto denigrato. Holotypus: Terada No. 260A (K. Terada Herbarium).

Specimens examined: On lower surface of mesothorax of *Chlaenius flaviguttatus* MacLeay—TAIWAN, Lan Hsu, No. 260 (incl. Holotype), 11 Aug. 1972, K. Terada leg. Deposited at K. Terada Herbarium.

This new variety resembles var. *yaeyamae* in having the long lower receptacle and the insertion cell situated lower than the middle of the perithecium, but differs from it by the larger perithecium and the erect, blackish an-



Figs. 11–12. Varieties of *Laboulbenia exigua*. Each bar = 30 μm . 11. *L. exigua* var. *yaeyamae* on *Chlaenius pictus*. Arrow indicates insertion cell situated in low position. No. 1070 (Holotype). 12. *L. exigua* var. *melanolabiata* on *Chlaenius flaviguttatus*. Arrow at left indicates insertion cell situated in low position. Arrow at right indicates blackish anterior lobe of perithecium directed upward. Cell VI larger than cell V and unstained spore mass are seen. No. 260C.

terior projection at the perithecial apex. The characters of the appendages and the color are the same as in var. *exigua* and var. *yaeyamae*.

The measurements of the specimens are as follows: Total length to tip of perithecium 340–400 μm long; cell I 110–130 \times 40–45 μm ; cell II 140–160 μm long; cell III 45 \times 40 μm ; insertion cell 19–24 μm broad; outer basal cell 13–14 \times 13–14 μm ; inner suprabasal cell 20–25 \times 5 μm ; perithecium 120–140 \times 47–50 μm ; apical anterior projection 8–9 μm long.

4. *Laboulbenia yamadae* Ishikawa ex Terada, sp. nov. Figs. 13–24
 Syns. *Laboulbenia yamadai* Ishikawa (nom. nud.), Coll. Breed. 10: 313 (305). 1948; *Laboulbenia exigua* non Thaxter sensu Sugiyama, Ginkgoana 2: 48. 1973; *Laboulbenia exigua* non Thaxter sensu Lee, Kor. J. Plant Tax. 16: 135. 1986.

Thallus fuscus, 250–450 μm longus, in receptaculo superiore et perithecio inferiore fuscomaculatus. Cellula I cylindrica, 75–120 \times 40–47 μm ; cellula II subcylindrica,

cellulam I subaequilonga; cellula III rotundata, 52–63 \times 52–63 μm ; cellula IV cellulam III subaequigrandis; cellula V quam cellula IV valde parvior. Cellula insertionis nigricans, 21–26 μm lata, adnata, supra medium perithecii locata. Appendix exterior simplex, 200–250 μm longa; cellula basalis subcubica, interdum breviter cylindrica, 13–16 \times 13–15 μm ; cellula suprabasalis subcubica, ad septa denigrata et constricta. Appendix interior simplex; cellula basalis subcubica, cellula basalis appendicis exterioris subaequilonga; cellula suprabasalis cylindrica, 24–27 \times 7–8 μm . Antheridium ampulliforme, solitarium, terminale, evanescens. Perithecium 105–160 \times 42–53 μm , apice processu 40–61 μm longo nigricanti; cellula VI cellulam V subaequimagna, quam cellula III multo parvior. Ascosporae hyalinae, 1-septatae, angustae, 80–85 \times 5 μm . Holotypus: Terada No. 1157D (K. Terada Herbarium).

Thallus 250–450 μm long from foot to tip of perithecium (220–300 μm in forms lacking a tongue-shaped outgrowth), dark-spotted or streaked on the lower part of the perithecium and on the upper receptacle. Peritheci-

um, upper receptacle and upper part of cell I deeply suffused with gray brown or yellowish gray-brown; cell II, lower part of cell I and appendages yellowish gray brown or grayish yellow; foot, insertion cell and subapical part of perithecium blackish. Cell I pale in color at the base, darker and spotted on the upper part, cylindrical, $75\text{--}120 \times 40\text{--}47 \mu\text{m}$ ($65\text{--}95 \times 29\text{--}38 \mu\text{m}$ in forms lacking a tongue-shaped outgrowth); cell II subcylindrical, with lateral sides subequal in length, subequal to cell I in length, sometimes longer than cell I; cell III deeper in color than cell II, usually roundish in optical section, $52\text{--}63 \times 52\text{--}63 \mu\text{m}$ (nearly oblong in optical section, $40\text{--}45 \times 31\text{--}40 \mu\text{m}$ in forms lacking a tongue-shaped outgrowth); cell IV subequal to cell III in color and size; cell V wedge-shaped, much smaller than cell IV. Insertion cell $21\text{--}26 \mu\text{m}$ broad, usually adnate to the upper portion of the perithecium ($12\text{--}15 \mu\text{m}$, free from the perithecial wall and situated near or above the middle of the perithecium in forms lacking a tongue-shaped outgrowth). Outer appendage simple, $200\text{--}250 \mu\text{m}$ long ($150\text{--}200 \mu\text{m}$ in forms lacking a tongue-shaped outgrowth); basal cell more or less cubical and slightly convex on the lateral sides, sometimes short-cylindrical, $13\text{--}16 \times 13\text{--}15 \mu\text{m}$ (cylindrical, $15\text{--}21 \times 8\text{--}11 \mu\text{m}$ in forms lacking a tongue-shaped outgrowth); suprabasal cell more or less cubical, slightly smaller than the basal cell (short-cylindrical, ca. 2 times shorter than the basal cell in forms lacking a tongue-shaped outgrowth), having upper and lower septa constricted and conspicuously blackened; other septa unblackened. Inner appendage simple; basal cell more or less cubical, subequal to the outer basal cell in height (short-cylindrical, shorter than the outer basal cell in forms lacking a tongue-shaped outgrowth); suprabasal cell cylindrical, $24\text{--}27 \times 7\text{--}8 \mu\text{m}$, often having dark suffusion around the base. Antheridium flask-shaped, solitary, terminal, usually evanescent. Perithecium $105\text{--}160 \times 42\text{--}53 \mu\text{m}$ ($100\text{--}118 \times 34\text{--}38 \mu\text{m}$ in forms lacking a tongue-shaped outgrowth); upper 1/3 of perithecium free (upper 1/2 or 1/3 free in forms lacking a tongue-shaped outgrowth); apical posterior part of perithecium bilobed; lobes hyaline above the basal blackish band, bending toward the anterior side; apical anterior part of perithecium elongating to form a tongue-shaped, $40\text{--}61 \mu\text{m}$ long, laterally directed, blackish outgrowth (there are forms lacking such an outgrowth); cell VI subequal to cell V in size, much smaller than cell III, situated beside cell III. Ascospores hyaline, 1-septate, narrow, $80\text{--}85 \times 5 \mu\text{m}$.

Specimens examined: On lower surface of prothorax of *Chlaenius variicornis* Morawitz—HIROSHIMA, Hiroshima, Yasu-Huruichi, Nos. 412 (typical form and tongue-

lacking form), 418 (tongue-lacking form), 27 June 1975, K. Terada leg.; Ushita, No. 1157 (Holotype and tongue-lacking form), 28 Aug. 1993, K. Terada leg.; SHIMANE, Izumo, No. 1167 (tongue-lacking form), 6 June 1993, K. Terada leg. On the lower surface of prothorax or/and mesothorax of *Chlaenius sericimicans* Chaudoir—OKINAWA, Ishigaki, No. 647 (typical form and tongue-lacking form), 7 May 1977, K. Terada leg.; Yaeyama, Taketomi, Ohara (Iriomote Isl.), Nos. 1071, 1161 (typical form and tongue-lacking form), 7 June 1978, K. Terada leg. Deposited at K. Terada Herbarium.

Distribution: Japan (Shizuoka, Hiroshima, Shimane and Okinawa) and Korea.

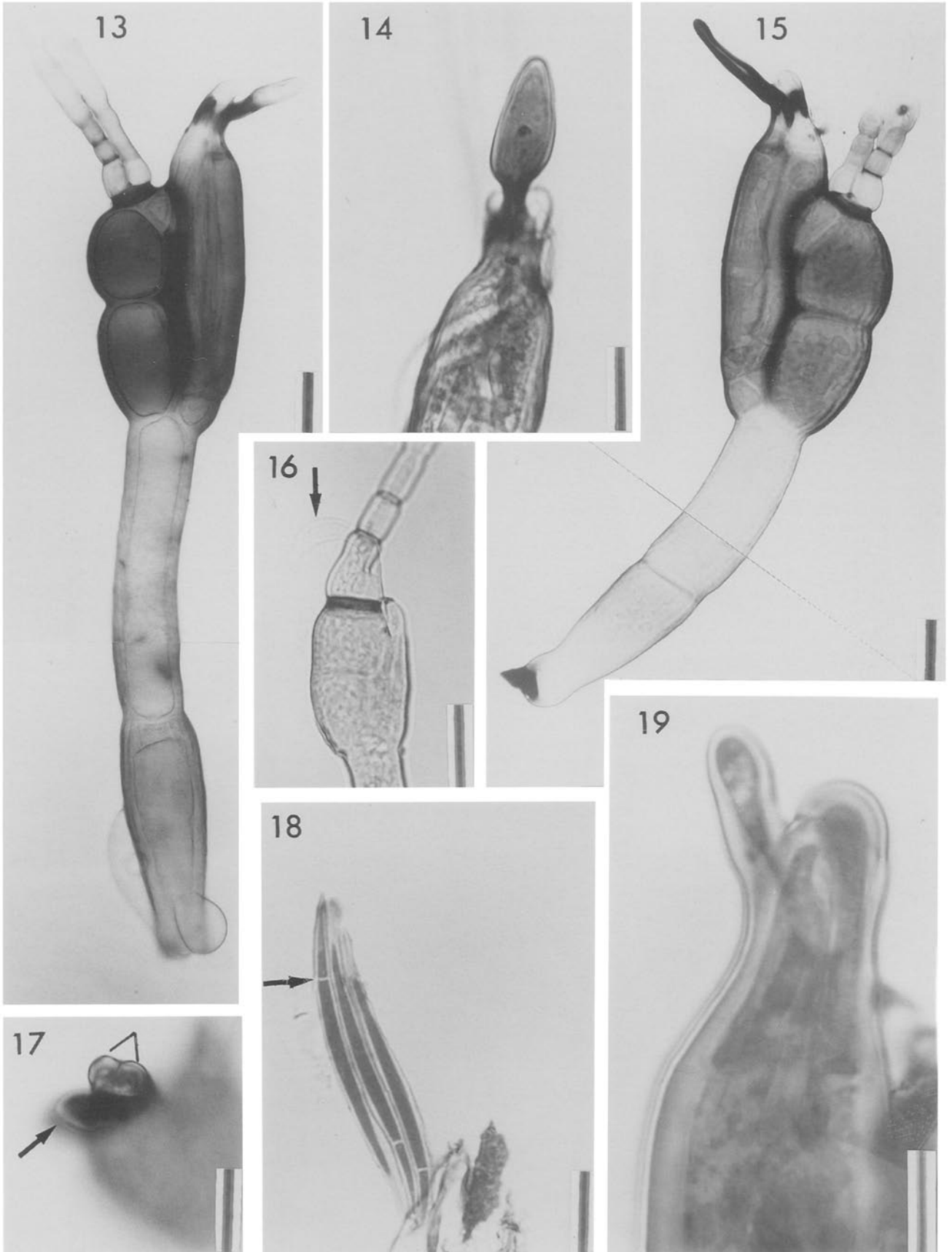
This new species includes three different forms of thallus. The typical form (Figs. 13–15) has a tongue-shaped, blackish outgrowth at the perithecial apex, whereas other forms lack such an outgrowth. One form as shown in Fig. 23 has a very short, erect, apical perithecial projection that fails to lengthen. Fig. 20 shows another form whose perithecium has an erect, slender rostrum with blunt apex. These two forms were each observed with the typical form in the same colony on a small, restricted area of the host body. Therefore, all three forms seem to be conspecific. The thalli of each form may have developed from spores from a single perithecium and differences in the perithecial apex may be genetically determined.

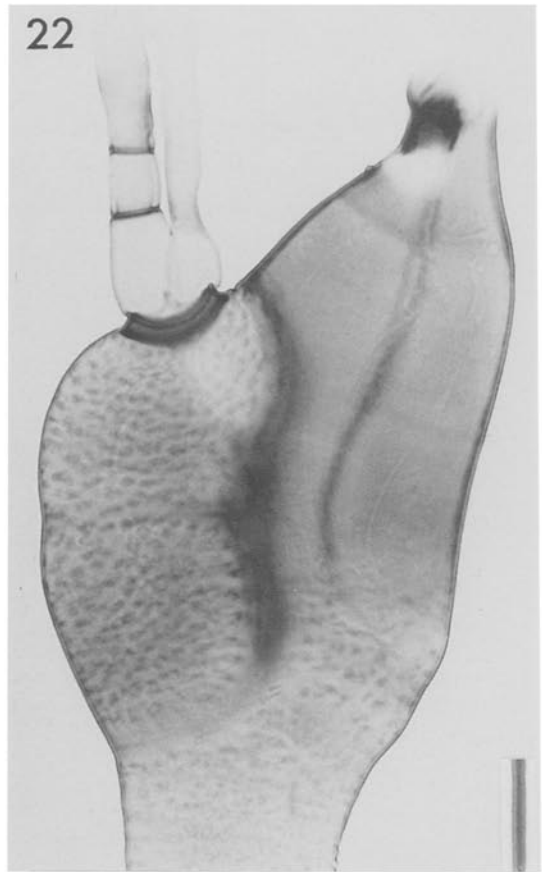
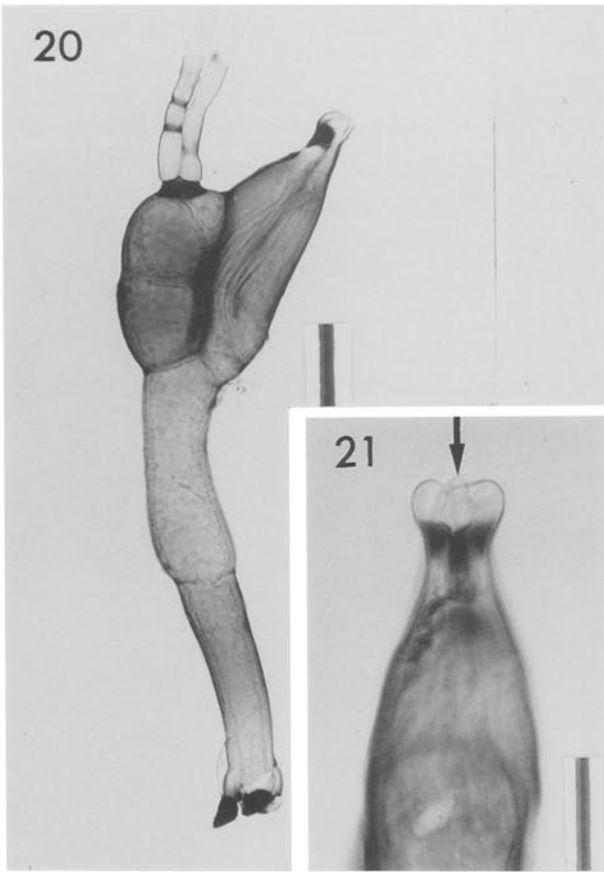
Laboulbenia yamadae on an unknown host was illustrated by Ishikawa (1948), who provided no description for his new species. It is, however, undoubtedly identical with the typical form of the present species (cf. Sugiyama, 1973, pl. 16, fig. 1; Lee, 1986, fig. 1: 7–8). Therefore, I use this specific epithet.

5. *Laboulbenia consobrina* Terada, sp. nov. Figs. 25, 26

Thallus rarus, $144\text{--}171 \mu\text{m}$ longus, in receptaculo superiore et perithecio inferiore fuscomaculatus. Cellula I $49\text{--}58 \mu\text{m}$ longa, deorsum attenuata; cellula II subcylindrica; cellula III subquadrata, $16\text{--}24 \times 16\text{--}24 \mu\text{m}$; cellula IV cellulam III subaequigrandis; cellula V quam cellula IV valde parvior. Cellula insertionis nigricans, $13\text{--}15 \mu\text{m}$ lata, adnata, ad medium perithecii locata. Appendix exterior simplex, $160\text{--}200 \mu\text{m}$ longa; cellula basalis subcubica, $10\text{--}11 \times 10\text{--}11 \mu\text{m}$; cellula suprabasalis subcubica, ad septa denigrata et constricta. Appendix interior simplex; cellula basalis subcubica vel rotundata; cellula suprabasalis breviter cylindrica, $10\text{--}14 \times 6\text{--}8 \mu\text{m}$, septo inferno denigrato. Antheridium ampulliforme, solitari-um, primo terminale, demum laterale, evanescens. Perithecium $68\text{--}79 \times 21\text{--}29 \mu\text{m}$, apice expansum, plerumque trilobatum; cellula VI cellulam V subaequimagna, quam

Figs. 13–19. *Laboulbenia yamadae*. 13. Mature individual with basally blackened perithecial outgrowth, on *Chlaenius variicornis*. No. 1157A. Bar = $30 \mu\text{m}$. 14. Upper portion of mature perithecium showing tongue-shaped, blackish outgrowth whose base is abruptly narrowed. No. 1161. Bar = $20 \mu\text{m}$. 15. Mature individual on *Chlaenius variicornis*. No. 1157D (Holotype). Bar = $30 \mu\text{m}$. 16. Young thallus showing outer appendage with constricted, blackish, upper and lower septa and 3-celled inner appendage in which curved antheridium is seen (arrow). No. 1167. Bar = $20 \mu\text{m}$. 17. Perithecial apex showing posterior lobes (V-line) and tongue-shaped outgrowth (arrow). No. 1161. Bar = $20 \mu\text{m}$. 18. Ascospores stained by cotton blue. Arrow indicates original spore septum. No. 1071. Bar = $20 \mu\text{m}$. 19. Upper portion of immature perithecium showing anterior lobe which elongates upward at left. No. 1161. Bar = $10 \mu\text{m}$.





cellula III valde parvior. Ascospores hyalinae, 1-septatae, angustae, $60-65 \times 3.5 \mu\text{m}$. Holotypus: Terada No. 413A (K. Terada Herbarium).

Thallus $144-171 \mu\text{m}$ long from foot to tip of perithecium, dark-spotted or streaked on the lower part of the perithecium and on the upper receptacle. Perithecium, upper receptacle and upper part of cell I yellowish gray-brown or grayish yellow; cell II, lower part of cell I and appendages grayish yellow; foot, insertion cell and subapical part of perithecium blackish. Cell I pale in color at the base, darker and spotted on the upper part, $49-58 \mu\text{m}$ long, narrowed toward the base; cell II subcylindrical, with lateral sides subequal in length, slightly shorter than cell I or subequal to cell I in length; cell III deeper in color than cell II, squarish in optical section, $16-24 \times 16-24 \mu\text{m}$; cell IV subequal to cell III in color and size; cell V wedge-shaped, much smaller than cell IV. Insertion cell $13-15 \mu\text{m}$ broad, adnate to the middle of the perithecium. Outer appendage simple, $160-200 \mu\text{m}$ long; basal cell more or less cubical, slightly convex on the lateral sides, $10-11 \times 10-11 \mu\text{m}$; suprabasal cell more or less cubical, slightly smaller than the basal cell, having upper and lower septa constricted and conspicuously blackened; other septa unblackened. Inner appendage simple; basal cell more or less cubical or spheroidal, subequal to the outer basal cell in height or slightly taller; suprabasal cell short-cylindrical, $10-14 \times 6-8 \mu\text{m}$, with a distinctly blackish lower septum. Antheridium flask-shaped, solitary, at first terminal, later lateral, usually evanescent. Perithecium $68-79 \times 21-29 \mu\text{m}$, apically trilobed in optical section; upper 1/2 of perithecium free; apical posterior part of perithecium bilobed; lobes erect, hyaline above the basal blackish band; apical anterior part of perithecium elongating to form a short, rounded, erect, blackish projection; cell VI subequal to cell V in size, much smaller than cell III, situated beside cell III. Ascospores hyaline, 1-septate, narrow, $60-65 \times 3.5 \mu\text{m}$.

Specimens examined: On lower surface of mesothorax of *Chlaenius (Chlaeniellus) inops* Chaudoir—HOKKAIDO, Ebetsu, Nishi-Nopporo, Nos. 413 (incl. Holotype), 414, 415, 15 July 1975, K. Terada leg.; HIROSHIMA, Shobara, Nanatsuka, Nos. 410, 411, 12 June 1975, K. Terada leg. Deposited at the K. Terada Herbarium.

The shape of the perithecial apex of this species is so characteristic that *L. consobrina* can be easily distinguished from any other species in the *L. exigua* group.

6. *Laboulbenia pasquetii* Picard, Bull. Soc. Mycol. Fr. **29**: 550. 1913; Maire, Bull. Soc. Hist. nat. Afr. Nord **7**: 28. 1916; Balazuc, Bull. mens. Soc. linn. Lyon **43**: 259. 1974; Balazuc, Bull. mens. Soc. linn. Lyon **51**: 19. 1982. Type: On *Chlaenius (Chlaeniellus) variegatus*

(Fourc.), Tournus, France. Figs. 27-31

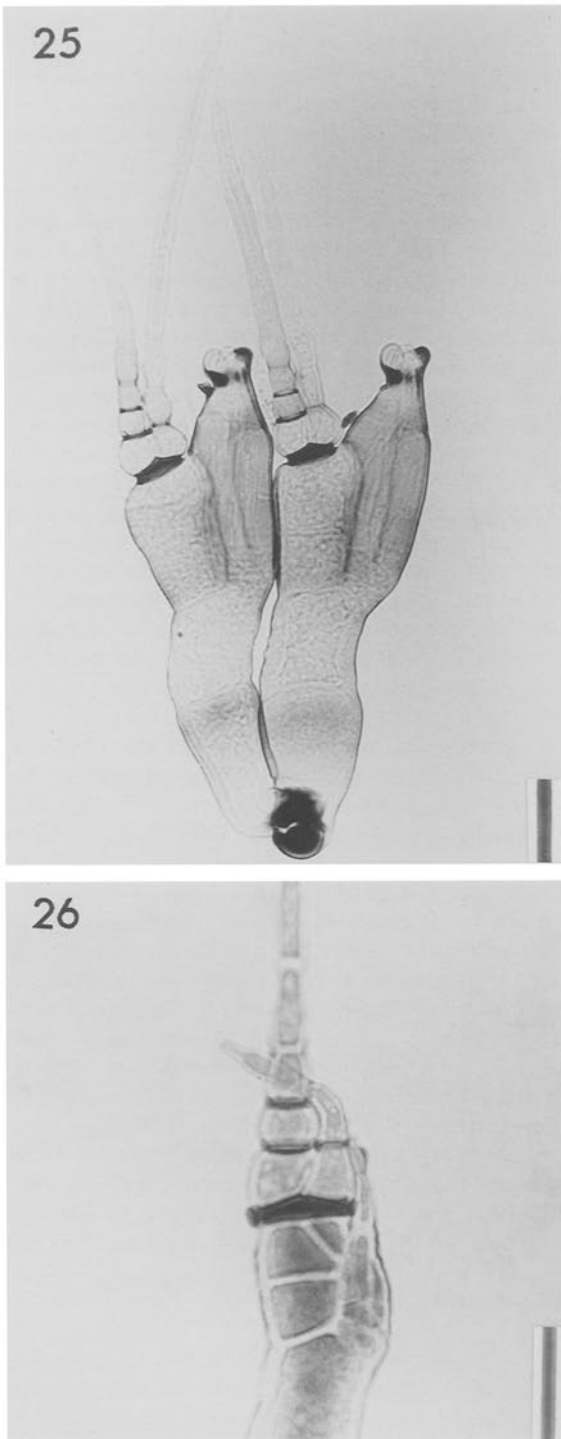
Thallus $140-158 \mu\text{m}$ long from foot to tip of perithecium ($140-150 \mu\text{m}$ in Picard, 1913), dark-spotted or streaked on the lower part of the perithecium and on the upper receptacle. Perithecium, upper receptacle and upper part of cell I yellowish gray-brown (jaune ambre passant au brun in Picard, 1913); cell II, lower part of cell I and appendages grayish yellow; foot, insertion cell and subapical part of perithecium blackish. Cell I pale in color at the base, darker and spotted on the upper part, $27-38 \mu\text{m}$ long, narrowed toward the base; cell II subequal to cell I in length, with unequal lateral sides because the lower septum of cell VI is strongly oblique and reaches a lower level than the lower septum of cell III; cell III deeper in color than cell II, nearly oblong in optical section, $26-37 \times 15-21 \mu\text{m}$; cell IV subequal to cell III in color and size; cell V wedge-shaped, much smaller than cell IV. Insertion cell $10-14 \mu\text{m}$ broad, usually adnate to the subapical portion of the perithecium, sometimes remote from the perithecial wall. Outer appendage simple, $158-184 \mu\text{m}$ long; basal cell short-cylindrical, $16-21 \times 8-11 \mu\text{m}$; suprabasal cell short-cylindrical, subequal to the basal cell in length, having upper and lower septa slightly constricted and slightly blackened; other septa unblackened. Inner appendage simple, short and stout, often strongly bent outward; basal cell short-cylindrical, shorter than the outer basal cell; suprabasal cell short-cylindrical, $10-12 \times 5-6 \mu\text{m}$, lacking dark suffusion around the base. Antheridium flask-shaped, solitary, terminal, evanescent. Perithecium $65-74 \times 21-26 \mu\text{m}$ ($90 \times 36-40 \mu\text{m}$ in Picard, 1913); upper 1/4 of perithecium free; apical posterior part of perithecium bilobed; lobes hyaline above the basal blackish band (blackish suffusion spreads to the tip along the posterior side), bending slightly toward the anterior side; apical anterior part of perithecium simple, with blackish outer edge not quite reaching the tip; cell VI subequal to cell V in size, much smaller than cell III, situated lower than cell III. Ascospores hyaline, 1-septate, narrow, $47-50 \times 4 \mu\text{m}$.

Specimens examined: On pronotum and elytra of *Chlaenius (Agrochlaenius) circumductus* Morawitz—HOKKAIDO, Ebetsu, Nishi-Nopporo, Nos. 416, 574, 945, 7 Aug. 1976, K. Terada leg. Deposited at K. Terada Herbarium.

Distribution: Japan (Hokkaido), Europe and North Africa.

From *L. exigua*, *L. consobrina* and *L. yamadae*, *L. pasquetii* is clearly distinguished by the simple, unmodified perithecial apex. The thalli on *C. circumductus* from Hokkaido are quite similar to those on *C. variegatus* from France, which I have examined through the courtesy of Dr. Balazuc.

Figs. 20-24. *Laboulbenia yamadae* lacking tongue-shaped perithecial outgrowth. 20. Mature individual on *Chlaenius variicornis*. No. 1157. Bar = $30 \mu\text{m}$. 21. Upper portion of mature perithecium showing bilobed apex. Arrow indicates tip of anterior lobe. No. 1167. Bar = $20 \mu\text{m}$. 22. Upper portion of mature thallus showing a pattern of pigment spots in wall of receptacle and perithecial base. No. 418. Bar = $20 \mu\text{m}$. 23. Mature individual on *Chlaenius sericimicans*. Arrow indicates anterior lobe. No. 1161. Bar = $30 \mu\text{m}$. 24. Appendage base of mature thallus. Arrow indicates remnant of antheridium. Probably third cell of inner appendage has been directly changed from antheridium. No. 1161. Bar = $10 \mu\text{m}$.



Figs. 25, 26. *Laboulbenia consobrina*. 25. Pair of mature individuals on *Chaenienus inops*. No. 413A (Holotype). Bar = 30 μm . 26. Young thallus showing outer appendage with constricted, blackish, upper and lower septa and 3-celled inner appendage with blackish septum above basal cell. Simple trichogyne with unblackened septum is seen. No. 415. Bar = 20 μm .

7. *Laboulbenia torta* Sugiyama, Trans. Mycol. Soc. Japan 20: 145. 1979. Type: On *Haplochlaenius costiger*

(Chaudoir), Awa-tomiyama, Chiba, Japan.

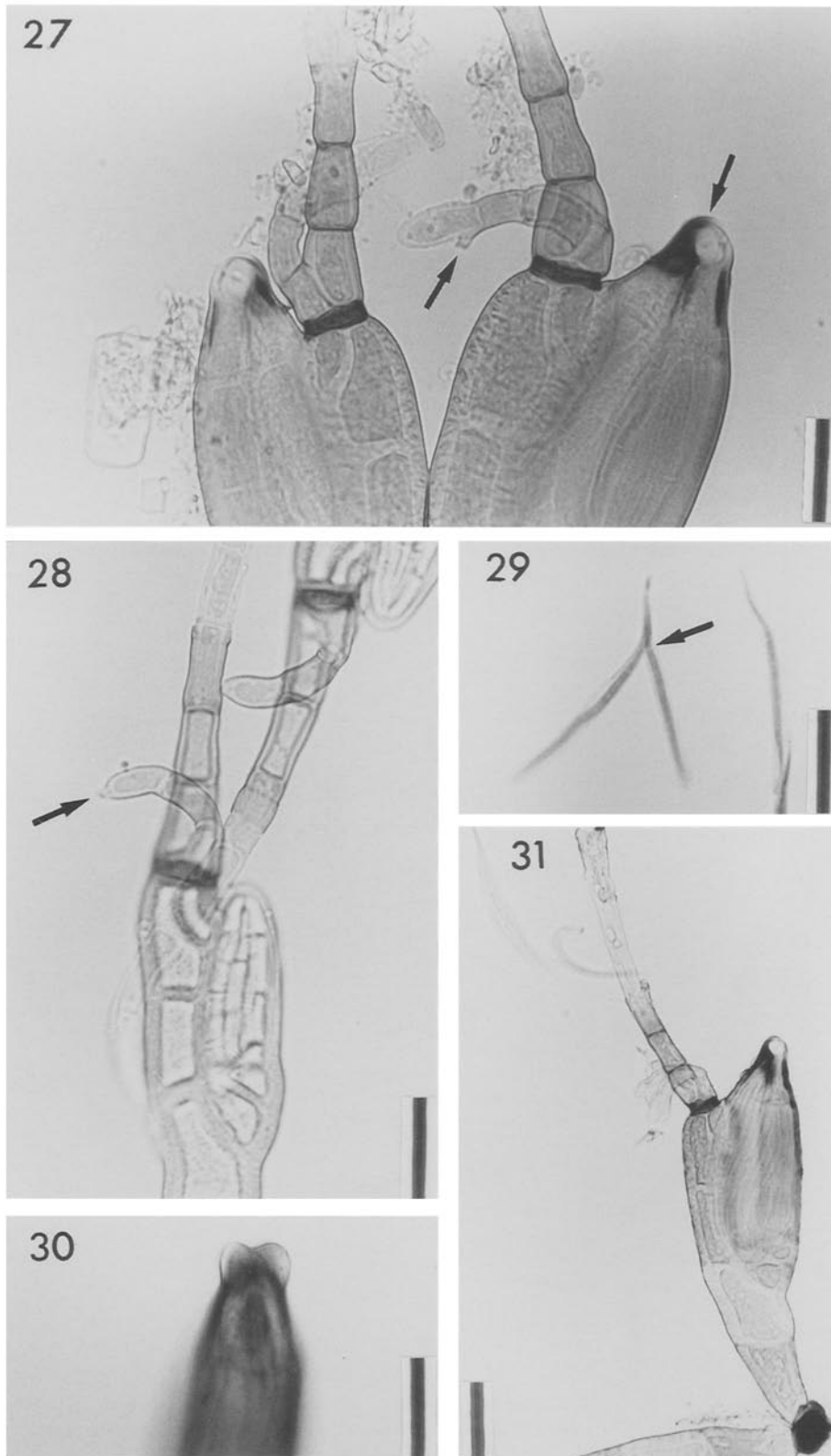
Figs. 32-36

Thallus 140–170 μm long from foot to tip of perithecium (145–197 μm in Sugiyama, 1979), dark-spotted or streaked on the lower part of the perithecium and on the upper receptacle. Perithecium, upper receptacle and upper part of cell I yellowish gray-brown or grayish yellow (hyaline, partly brownish or blackish in Sugiyama, 1979); cell II, lower part of cell I and appendages grayish yellow; foot, insertion cell and subapical part of perithecium blackish. Cell I pale in color at the base, darker and spotted on the upper part, cylindrical, 48–50 \times 20–21 μm (57–72 \times 20–30 μm in Sugiyama, 1979); cell II usually shorter than cell I, often constricted above the middle, with strongly unequal lateral sides because the lower septum of cell VI is oblique and reaches a lower level than the lower septum of cell III; cell III slightly deeper in color than cell II, nearly oblong in optical section, 30–50 \times 12–15 μm (32–37 \times 10–17 μm in Sugiyama, 1979); cell IV subequal to cell III in color and size; cell V wedge-shaped, much smaller than cell IV. Insertion cell 10–13 μm broad (10–12 μm in Sugiyama, 1979), adnate to the subapical portion of the perithecium. Outer appendage simple, 200–250 μm long (137–175 μm in Sugiyama, 1979); basal cell short-cylindrical, 11–14 \times 8 μm ; suprabasal cell short-cylindrical, slightly shorter than the basal cell, having upper and lower septa constricted and conspicuously blackened; other septa unblackened. Inner appendage simple, sometimes very short; basal cell spheroidal, much smaller than the outer basal cell; suprabasal cell narrow, cylindrical, 10–13 \times 3–4 μm , strongly constricted and blackened around the base. Antheridium flask-shaped, solitary, terminal, evanescent. Perithecium 65–70 \times 25–30 μm (75–95 \times 22–27 μm in Sugiyama, 1979); upper 1/4 of perithecium free; apical posterior part of perithecium bilobed; lobes hyaline above the basal blackish band, slightly bending toward the anterior side; apical anterior part of perithecium simple, with blackish outer edge not quite reaching the tip; cell VI larger than cell V, smaller than cell III, situated lower than cell III; cell VII forming a rounded protrusion. Ascospores hyaline, 1-septate, narrow, 50–62 \times 4 μm .

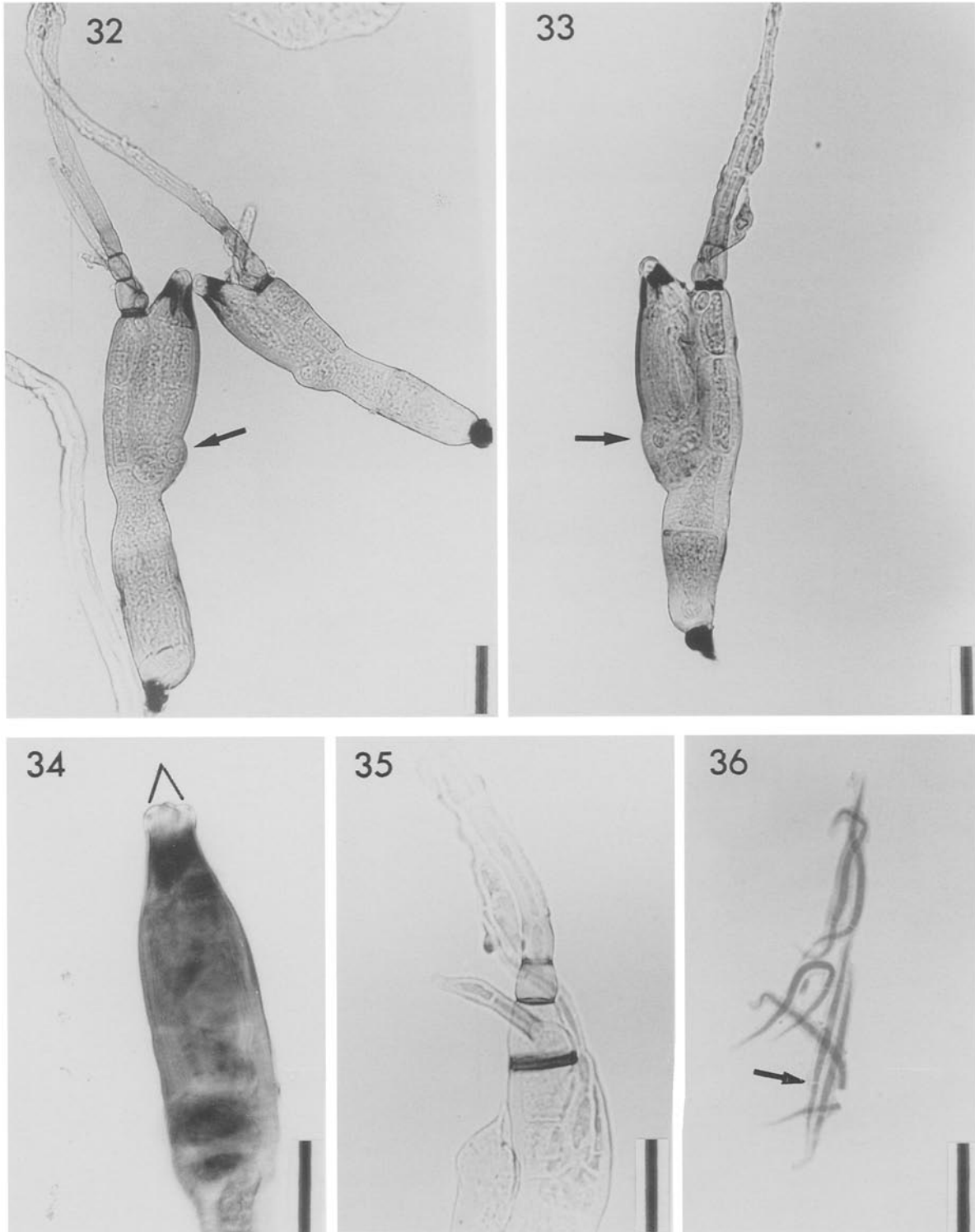
Specimens examined: On pronotum and elytra of *Haplochlaenius costiger* (Chaudoir)—KANAGAWA, Yokohama, Nos. 1068, 1076, 1078, 22 Feb. 1981, K. Terada leg.; HIROSHIMA, Hiroshima, Midorii, Mt. Gongenzan, No. 1155, 29 Aug. 1992, M. Ishitani leg.; OKINAWA, Yaeyama, Taketomi, Ohara (Iriomote Isl.), No. 880, 8 June 1978, K. Terada leg. On elytra of *Epomis nigricans* (Wiedemann)—OKINAWA, Yaeyama, Ishigaki, Nos. 649, 1073, 11 May 1977, K. Terada leg. Deposited at K. Terada Herbarium.

Distribution: Japan (Chiba, Kanagawa, Hiroshima and Okinawa), possibly also Europe and Madagascar.

Laboulbenia torta resembles *L. pasquetii*, but is easily distinguished from the latter species by the cylindrical cell I, the protrusive cell VII, the appendage base having distinctly blackened septa and the different pattern of posterior marking on the perithecial apex. The specimens taken from *E. nigricans* are quite similar to the typi-



Figs. 27–31. *Laboulbenia pasquetii*, No. 945. 27. Upper portion of mature thalli showing 4-celled, curved, stout inner appendages and simple perithecial apices with blackish posterior edge reaching the tip (arrow at right). Arrow at left indicates remnant of antheridium. Bar = 20 μm . 28. Young thalli showing curved, stout, 3-celled inner appendage. Arrow indicates opening of antheridium. Bar = 20 μm . 29. Ascospores stained by cotton blue. Arrow indicates original spore septum. Bar = 20 μm . 30. Upper portion of mature perithecium showing bilobed apex. Bar = 20 μm . 31. Mature individual on *Chaenius circumductus*. Bar = 30 μm .



Figs. 32–36. *Laboulbenia torta*. 32. Mature individuals on *Haplochaenium costiger*, with short inner appendage and protruding cell VII (arrow). No. 1068. Bar = 30 μ m. 33. Mature individual with cell I narrowed toward base, on *Epomis nigricans*. Arrow indicates slightly protruding cell VII. No. 1073. Bar = 30 μ m. 34. Mature perithecium showing a pair of posterior lobes (V-line) and anterior lobe in middle. No. 1068. Bar = 20 μ m. 35. Young thallus showing outer appendage with constricted, blackish, upper and lower septa and 3-celled inner appendage in which terminal cell is antheridial. Simple trichogyne with unblackened septa is seen. No. 1078. Bar = 20 μ m. 36. Ascospores stained by cotton blue. Arrow indicates original spore septum. No. 1155. Bar = 20 μ m.

cal form on *H. costiger* except for a shorter, attenuated cell I (cf. Balazuc, 1982). Material on *Chlaenius ranavalonae* Csiki from Madagascar and on *C. velutinus* Duft., from Ardeche, France, cited by Balazuc, 1982, p. 19, under *L. pasquetii*, was examined by me and I concluded that the two collections seem to be *L. torta*.

8. *Laboulbenia gebleri* Terada, sp. nov. Figs. 37-42

Thallus fuscus, 202-224 μm longus, in receptaculo superiore et perithecio inferiore fuscomaculatus. Cellula I cylindrica, 50-55 \times 20-28 μm ; cellula II subcylindrica, cellulam I subaequilonga; cellula III oblonga, 28-40 \times 15-19 μm ; cellula IV cellulam III subaequigrandis; cellula V quam cellula IV valde parvior. Cellula insertionis nigricans, 13-20 μm lata, remota, prope apicem perithecii locata. Appendix exterior simplex, 160-184 μm longa; cellula basalis breviter cylindrica, 16-19 \times 10-13 μm ; cellula suprabasalis breviter cylindrica, longitudine cellulam basalem aequante. Appendix interior simplex; cellula basalis breviter cylindrica, quam cellula basalis exterior brevior; cellula suprabasalis cylindrica, 15-25 \times 3-5 μm . Antheridium ampulliforme, solitarium, terminale, evanescent. Perithecium 73-84 \times 24-32 μm ; cellula VI cellulae V subaequimagna, quam cellula III valde parvior. Ascospores hyalinae, 1-septatae, angustae, 62-68 \times 4 μm . Holotypus: Terada No. 1162 (K. Terada Herbarium).

Thallus 202-224 μm long from foot to tip of perithecium, dark-spotted or streaked on the lower part of the perithecium and on the upper receptacle. Perithecium, upper receptacle and upper part of cell I deeply suffused with gray-brown or yellowish gray-brown; cell II, lower part of cell I and appendages yellowish gray-brown or grayish yellow; foot, insertion cell and subapical part of perithecium blackish. Cell I pale in color at the base, darker and spotted in the upper part, cylindrical, 50-55 \times 20-28 μm ; cell II subcylindrical, with lateral sides subequal in length, subequal to cell I in length; cell III deeper in color than cell II, nearly oblong in optical section, 28-40 \times 15-19 μm ; cell IV subequal to cell III in color and size; cell V wedge-shaped, much smaller than cell IV. Insertion cell 13-20 μm broad, remote from the perithecial wall, situated opposite the subapical portion of the perithecium. Outer appendage simple, 160-184 μm long; basal cell short-cylindrical, 16-19 \times 10-13 μm ; suprabasal cell short-cylindrical, subequal to the basal cell in length, having upper and lower septa hardly constricted and unblackened; other septa also unblackened. Inner appendage simple, long and slender; basal cell short-cylindrical, shorter than the outer basal cell; suprabasal cell narrow, cylindrical, 15-25 \times 3-5 μm , sometimes becoming dark at the base. Antheridium narrow, flask-shaped, solitary, terminal, evanescent. Perithecium 73-84 \times 24-32 μm ; upper 1/4 of perithecium free; apical posterior part of perithecium bilobed; lobes hyaline above the basal blackish band, slightly bending toward the anterior side; apical anterior part of perithecium simple, with blackish outer edge reaching the tip; cell VI subequal to cell V in size, much smaller than cell III, situated beside cell III. Ascospores hyaline,

1-septate, narrow, 62-68 \times 4 μm .

Specimens examined: On lower surface of mesothorax and/or prothorax of *Chlaenius (Chinelaus) pallipes* Gebl—HOKKAIDO, Samani, Horoman, No. 185, 31 May 1970, K. Terada leg.; AOMORI, Tsugaru, No. 1075, 3 Aug. 1981, A. Torigata leg.; KANAGAWA, Atsugi, No. 1074, 25 March 1979, A. Torigata leg.; HIROSHIMA, Hiroshima, Hesaka, Otagawa river, No. 1077, 30 Sept. 1983, K. Terada leg., No. 1156, 12 June 1993, K. Terada leg., Nos. 1162 (Holotype), 1163, 23 May 1993, K. Terada leg. Deposited at K. Terada Herbarium.

This new species resembles *L. pasquetii*, from which it is, however, distinguished by the subcylindrical cell II with lateral sides subequal in length, the anterior edge of the perithecial apex, which is bordered with blackish suffusion throughout its length (see Fig. 40), and the long, tapered inner appendage.

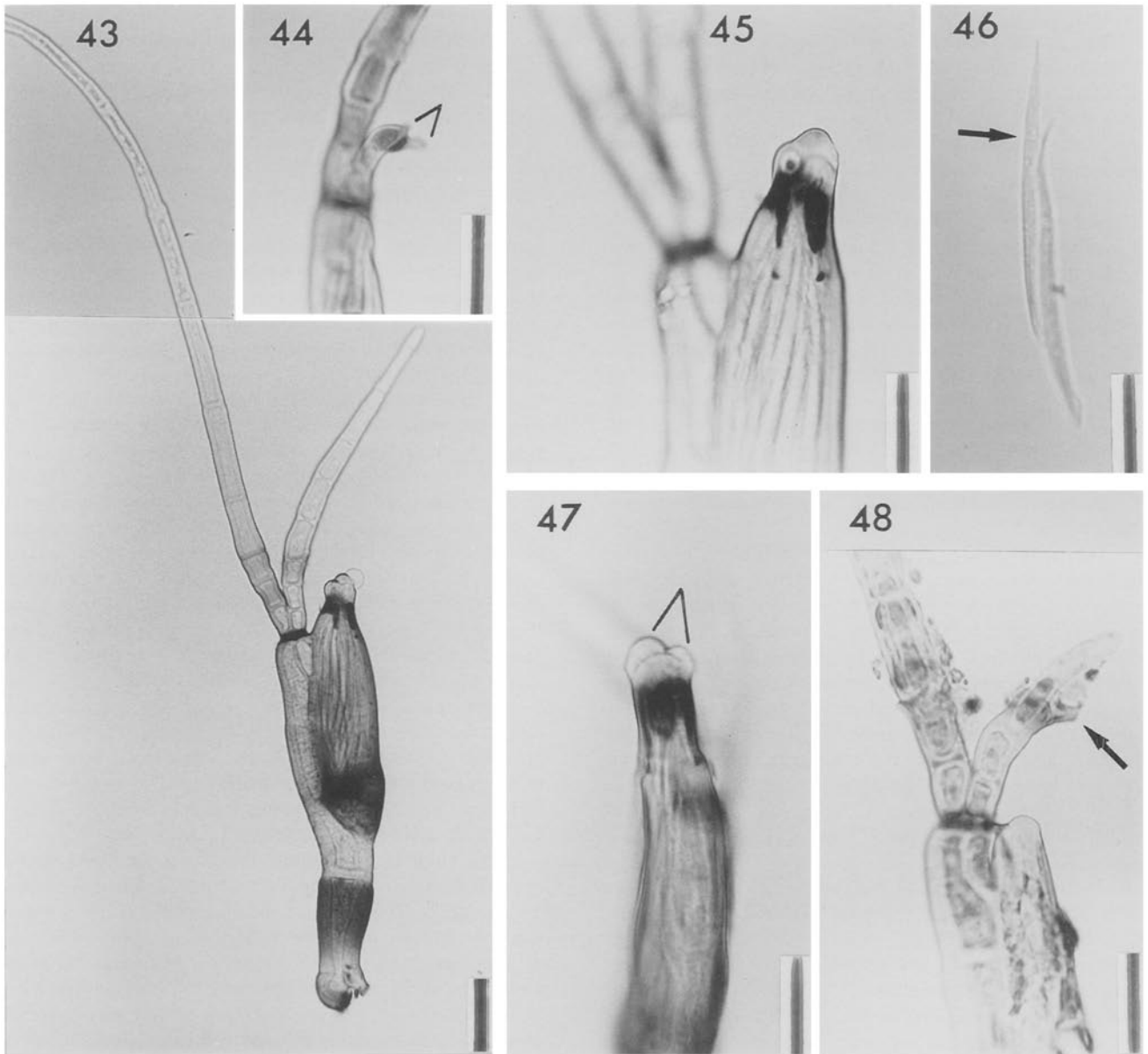
9. *Laboulbenia balazucii* W. Rossi, Accad. Naz. Lincei, Quaderno 260: 78. fig. 10. 1986, var. *balazucii*.

Type: On *Chlaeniostenus angustatus* (Dej.), Gola Forest Reserve, Sierra Leone.

Thallus 155-175 μm long from foot to tip of perithecium, dark-spotted or streaked on the lower part of the perithecium and on the upper receptacle. Perithecium, appendages, cells II and IV, and lower part of cell I grayish yellow (bruno non uniforme in Rossi, 1986); cell III, upper part of cell I and basal part of perithecium including cell VI deeply suffused with gray-brown or almost blackish brown; foot, insertion cell and subapical part of perithecium blackish. Cell I pale in color at the base, darker and spotted on the upper part, cylindrical, 35-40 \times 17-19 μm ; cell II slightly shorter than cell I, with unequal lateral sides because the lower septum of cell VI is oblique and reaches a lower level than the lower septum of cell III; cell III deeper in color than cell II, nearly oblong in optical section, 25 \times 12-13 μm ; cell IV subequal to cell III in size, paler in color than cell III; cell V wedge-shaped, much smaller than cell IV. Insertion cell 10-11 μm broad, adnate to the middle portion of the perithecium. Outer appendage simple, 475 μm long; basal cell very short cylindrical, ca. 9 \times 7.5 μm , sometimes almost cubical in optical section; suprabasal cell very short cylindrical, subequal to the basal cell in length, sometimes slightly longer than the latter, having upper and lower septa hardly constricted and unblackened; other septa also unblackened. Inner appendage simple or sometimes furcate, usually long, more or less tapered; basal cell very short cylindrical, sometimes almost cubical, smaller than the outer basal cell; suprabasal cell short-cylindrical, ca. 9 \times 6.5 μm , lacking dark suffusion around the base. Antheridium usually evanescent. Perithecium 80-85 \times 20-25 μm , having 2 small blackish spots just below the subapical marking; upper 1/2 of perithecium free; apical posterior part of perithecium bilobed; lobes hyaline above the basal blackish band, bending slightly toward the anterior side; apical anterior part of perithecium simple, with blackish outer edge not quite reaching the tip; cell VI subequal to cell V in size, smaller than cell III, situated lower than cell III. Ascospores hyaline, narrow, 1-sep-



Figs. 37–42. *Laboulbenia gebleri*. 37. Mature individual on *Chaenius pallipes*. No. 1162 (Holotype) Bar=30 μ m. 38. Upper portion of mature thallus showing a pattern of pigment spots in wall of receptacle. No. 1163. Bar=20 μ m. 39. Upper portion of mature perithecium showing a single anterior lobe formed by a combination of two apical cells of outer wall cell rows (V-line). No. 1077. Bar=10 μ m. 40. Upper portion of mature thallus showing perithecial apex with blackish outer edge reaching tip (arrow) and outer appendage with unblackened septa. No. 1077. Bar=20 μ m. 41. Young thallus showing outer appendage with unblackened septa and curved, 3-celled inner appendage in which terminal cell is antheridial. No. 1077. Bar=20 μ m. 42. Ascospores stained by cotton blue. Each arrow indicates original spore septum. No. 1156. Bar=20 μ m.



Figs. 43–48. *Laboulbenia balazucii* var. *exilis*. 43. Mature individual on *Chlaenius circumdatus*. No. 1219 (Holotype). Bar = 30 μ m. 44. Appendage base of very young thallus. A pair of short and stout antheridia is seen (V-line). No. 1215. Bar = 20 μ m. 45. Upper portion of mature perithecium showing a pair of small, blackish spots below subapical blackish band. No. 1215. Bar = 20 μ m. 46. Ascospores stained by cotton blue. Arrow indicates original spore septum. No. 557. Bar = 20 μ m. 47. Mature perithecium showing posterior lobes unequal in size (V-line) and anterior lobe in middle. No. 1215. Bar = 20 μ m. 48. Young thallus showing inner appendage with remnant of antheridium on third cell (arrow). No. 1215. Bar = 20 μ m.

tate, ca. 62 \times 3 μ m.

Specimens examined: On elytra and pronotum of *Chlaenius (Chlaeniostenus) angustatus* Dej.—SIERRA LEONE, Gola Forest Reserve, No. 1407 (Holotype in W. Rossi's collection).

Distribution: Sierra Leone.

Above description is based on the type specimens of *L. balazucii* in W. Rossi's collection, which I have examined through the courtesy of Dr. Rossi. The thallus coloration of this species is apparently peculiar owing to

the distinct color contrast. The inner appendage of young thalli of this species is not bent backward and may become furcate later. These facts suggest that *L. balazucii* differs from any other members of the *L. exigua* group. However, the bilobed apex of the perithecium and the narrow ascospores match this group. Therefore, in spite of a little doubt, I include *L. balazucii* in the *L. exigua* group.

10. *Laboulbenia balazucii* W. Rossi, var. *exilis* Terada,

var. nov.

Figs. 43–48

Syns. *Laboulbenia exilis* Ishikawa, (nom. numd), Coll. Breed. 10: 313(305). 1948; *Laboulbenia pseudocolasiana* Balazuc, (nom. nud.), Bull. mens. Soc. linn. Lyon 40: 170. 1971; *Laboulbenia colasi* Lepesme, Bull. Mus. nat. Hist. nat., Paris (2^e sér.) 15: 246. 1943, non *Laboulbenia colasi* Lepesme, Bull. Soc. Mycol. Fr. 58: 190. 1942.

Differt a var. *balazucii* cellula insertionis altiore, cellula III dilutiore, et apice perithecii inaequaliter bilobato. Holotypus: Terada No. 1219 (K. Terada Herbarium).

Specimens examined: On elytra of *Chlaenius (Chlaeniosstenus) circumdatus* Brullé—HIROSHIMA, Shobara, Nanatsuka, Nos. 1215, 1218, 1219 (Holotype), 1220, 29 Aug. 1994, K. Terada leg.; SHIGA, Otsu, Ishiyama, No. 353, 8 Aug. 1974, K. Terada leg. On elytra of *Chlaenius (Chlaenites) spoliatus motschulskyi* Andrewes—CHIBA, Abiko, No. 557, 13 Aug. 1974, sent by M. Mori. Deposited at K. Terada Herbarium.

Distribution: Japan (Chiba, Shiga and Hiroshima) and Madagascar.

This new variety differs from the typical variety by the insertion cell being slightly free from the perithecial wall and located just below the subapical portion of the perithecium, and by the distinctly unequally bilobed apex of the perithecium. Cell III of the receptacle is relatively pale in color in var. *exilis*, but in var. *balazucii* it is deeply suffused with the same color as the perithecial base. I examined a slide of *L. pseudocolasiana* in Balazuc's collection. This slide shows the insertion cell with high location and the cell III not so deep in color. Therefore, *L. pseudocolasiana* is placed in this variety. *Laboulbenia colasi* is also included here for the same reason (see Lepesme, 1943, fig. 2).

The measurements of the specimens are as follows: Total length to tip of perithecium 155–195 μm long; cell I 42.5–52.5 \times 16–18.5 μm ; cell III 30–37 \times 12–13 μm ; insertion cell 10–11 μm broad; appendages 315 μm (longest); outer basal cell 10–11 \times 8–9 μm ; inner suprabasal cell 12.5 \times 7.5 μm ; perithecium 85–115 \times 22.5–26 μm ; ascospores ca. 65 \times 4 μm .

Discussion

Tavares (1985) recognized 20 species groups in the genus *Laboulbenia*, chiefly on the basis of the structure of the appendage system, and stressed other characters as well such as the presence or absence of extra cells in the upper receptacle, perithecial outgrowths, and a constricted perithecial stalk. The structure of the perithecial apex is also important for grouping of species in this genus. The apex of the perithecium is generally formed by four small apical cells cut off from the third tier of each outer wall cell row: these apical cells surround the apical slit terminating in a pore, through which ascospores emerge. Thaxter (1896) called these cells lip cells. In the *L. exigua* group, the posterior part of the perithecial apex is characteristically bilobed owing to the apical cells of the outer wall cell rows, each with rounded apex (Figs. 10, 17, 21, 30, 34, 47). The rigidly united apical cells of the

anterior rows form a single lobe (Figs. 39, 47) or one of the apical cells elongates to form a short or long outgrowth (Figs. 9, 14).

The structure of the appendage system is important also in distinguishing the *L. exigua* group from other groups of *Laboulbenia*. Developmental stages of the inner appendage in young thalli of *L. exigua* are shown in Figs. 4–6. Three successive cells—basal cell, median suprabasal cell and terminal, flask-shaped antheridium—form the three-celled inner appendage of young thalli; the suprabasal cell is bent backward so that the antheridium crosses over the lower portion of the outer appendage (Fig. 4); sometimes paired antheridia are produced (Fig. 5); when growth of the sterile branch of the inner appendage begins, the suprabasal cell straightens itself and, as a result, the antheridium becomes lateral in position (Fig. 6). The antheridia usually disappear before the thalli mature. A single trichogyne elongates toward the opening of the antheridium. It has no blackish septa (Fig. 4). Similar stages are also observed in the other members of the *L. exigua* group besides *L. balazucii*, although the lateral antheridia are not always observed in every species. The inner appendage bears marks of the antheridial apex at the third cell in some members of this group (Figs. 24, 27, and 48). This fact suggests that in these species, the antheridia may become the third cell of the sterile branch after cessation of its function.

The spore width of the *L. exigua* group generally ranges from 3 to 4 μm , with the exception of *L. yamadae*, in which it reaches 5 μm . These values are rather small as compared with 5.5 μm and 5–8 μm for the spore width of *L. proliferans* and *L. flagellata* respectively, described by Thaxter (1896).

The color of a specimen may vary according to the magnification or the amount of light when one uses a microscope. The kind of mounting media and the age of the slide also seem to affect the thallus color. The tone of the color changes throughout the thallus development. In addition, color perception varies with the observer. In the case of the *L. exigua* group, gray-brown is given here as a basic color; yellowish gray-brown is somewhat lighter than gray-brown and blackish brown is darker than gray-brown; grayish yellow is paler than yellowish gray-brown and blackish is the darkest. As the thallus becomes old, orange shades are sometimes added to the basic color. *Laboulbenia balazucii* is unique among the group because of its characteristic coloration.

There seem to be two lineages in the *L. exigua* group. The first lineage includes *L. exigua*, *L. consobrina*, *L. yamadae* and *L. torta*, in which the upper and lower septa of the suprabasal cell of the outer appendage are constricted and clearly blackened even in young thalli. *L. pasquetii*, *L. gebleri* and *L. balazucii* make up the second lineage, in which these septa are not constricted nor blackened, at least in young thalli (when fully matured, these septa may become slightly constricted and slightly blackened in *L. pasquetii*).

Table 1 indicates the number of host individuals obtained in each sex of the host and on each surface (upper and lower) of the host body. The upper side of the host

Table 1. The number of host individuals parasitized by *Laboulbenia exigua* and other species, their sex and the location of the fungus (upper or lower surface).

Host name	Host sex		Host body	
	♂	♀	lower	upper
<i>Haplochlaenius costiger</i>	3	2	0	5
<i>Epomis nigricans</i>	0	2	0	2
<i>Chlaenius circumductus</i>	1	2	0	3
<i>Chlaenius circumdatus</i>	1	3	0	4
<i>Chlaenius spoliatus motschulskyi</i>	0	1	0	1
<i>Chlaenius variicornis</i>	0	5	5	0
<i>Chlaenius sericimicans</i>	0	3	3	0
<i>Chlaenius pallipes</i>	1	6	7	0
<i>Chlaenius micans</i>	0	1	1	0
<i>Chlaenius abstersus</i>	1	6	7	0
<i>Chlaenius virgulifer</i>	1	3	4	0
<i>Chlaenius pictus</i>	0	2	2	0
<i>Chlaenius posticalis</i>	2	4	6	0
<i>Chlaenius inops</i>	1	4	5	0
<i>Chlaenius flaviguttatus</i>	0	1	1	0
Total number of host individuals	11	45	41	15

body as used here includes the pronotum and elytra, on which *L. pasquetii*, *L. torta* and *L. balazucii* were found. The lower side refers to the mesopleuron and/or propleuron, on which *L. exigua*, *L. yamadae*, *L. consobrina* and *L. gebleri* were found. These "lower parasites" are never found on the upper side and vice versa. Such differences in position apparently are not correlated with the sex of the host (see Table 1). Table 1 also indicates that there were four times as many infected female hosts as infected male hosts. Therefore, it is probable that the female chlaeniines in the wild are apt to be parasitized by *L. exigua* and its related taxa more often than the males.

On the elytra of *Chlaenius (Pachydinodes) tetragonoderus* Chaudoir from Iriomote Isl., I have found a number of mature thalli having simple inner and outer appendages. The inner appendages have, however, persistent antheridia and the apical posterior part of the perithecium is not clearly bilobed. Furthermore, the perithecia contain somewhat stout ascospores. These facts lead me to believe that they do not belong to the *L. exigua* group (Terada, unpubl.).

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