

The *Gilpinia abieticola* Species Group (Hymenoptera, Diprionidae)

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Abstract The *Gilpinia abieticola* species group (Hymenoptera, Diprionidae) is proposed for *G. abieticola* (Dalla Torre, 1894) from Europe and Siberia, *G. albiclavata* Hara and Nakamura, 2015 from Japan (Honshu), *G. hokkaidoensis* n. sp. from Japan (Hokkaido) and *G. kojimai* n. sp. from Japan (Honshu). This species group is recognized only by the combination of some structural and color characters in the female. *Gilpinia abieticola* (= *Lophyrus abietis* Stein, 1886, a primary homonym of *Lophyrus abietis* Harris, 1841) is redescribed based on the type material and a lectotype is designated for *Lophyrus abietis* Stein, 1886. Descriptions of the two new species and a key to all four species and the closely similar male of *G. hercyniae* are given. The larva of *G. kojimai* feeds solitarily on the needles of *Pinus pumila* (Pall.) Regel.

Key words: Hymenoptera, Diprionidae, *Gilpinia abieticola*, redescription, *Lophyrus abietis*, lectotype designation, *Gilpinia hokkaidoensis*, *Gilpinia kojimai*, new species.

Introduction

Gilpinia (Hymenoptera, Diprionidae) is a sawfly genus consisting of 38 Palearctic and Oriental species (Taeger *et al.*, 2010; Hara and Nakamura, 2015). The Euro-Siberian *Gilpinia abieticola* (Dalla Torre, 1894) has been recognized by the combination of the richly white- or yellow-marked body, the dark band between eyes crossing the frontal and ocellar areas, the short flagellar rami, the simple posterior spur of the hind tibia and the large oval scopa in female (Enslin, 1917; Reeks, 1941; Gussakovskij, 1947; Ermolenko, 1975; Beneš and Krístek, 1979; Viitasaari and Varama, 1987; Zhelokhovtsev, 1988). Recently, Hara and Nakamura (2015) described *G. albiclavata* from Honshu, Japan, which is morphologically closely similar to *G. abieticola*, and referred to the occurrence of two additional Japanese species, which are externally hardly distinguishable from *G. abieticola*.

We here redescribe *G. abieticola* in detail based on the type specimens, designate a lectotype for *Lophyrus abietis* Stein, 1886, describe *G. kojimai* n. sp. from Honshu, Japan and *G. hokkaidoensis* n. sp., from Hokkaido, Japan, and propose treating these three species and *G. albiclavata* as comprising the *G. abieticola* species group.

Material and Methods

Material used in this work is kept in the following institutions: BMNH=Natural History Museum, London; HU=Hokkaido University, Sapporo; NMW=Naturhistorisches Museum, Wien; NSMT=National Museum of Nature and Science, Tsukuba; SDEI=Senckenberg Deutsches Entomologisches Institut, München; USNM=National Museum of Natural History, Washington, D.C. Specimens are listed under the material examined section. We also examined

and dissected the ovipositors or genitalia of the following specimens of *Gilpinia polytoma* (Hartig, 1834) and *G. hercyniae* (Hartig, 1837). *Gilpinia polytoma*—ESTONIA: 1♂, “Painurmi”, “VII · 2 · '39”, Sellssetal (NSMT). GERMANY: 1♂, “Sierne 87” (SDEI); 1♂, Ottobeuren, Kohlstattkopf, VI. 2000, M. Goßner (SDEI); 1♀, Berlin, Marzahn, 1. IX. 2012, Köhler (SDEI). GERMANY or CZECH REPUBLIC: 1♂, Ore Mountains, Lange (SDEI). AUSTRIA: 1♂, “Tschech 1872” “Wand 6/S 866” (NMW); 1♂, “Tschech 1872 Piesting” (NMW); 1♂, Pulgarn, “9. 8. 32”, H. Priesner (NSMT); 1♂, Tirol, “Kilabühler Horn” “24.7.85. Handl” (NMW). CZECH REPUBLIC: 2♀, “Moravia Kuničky Krístek” (NSMT). HUNGARY: 1♂, Hegyalja, “Kemeuce v.”, 13. VII. 1955, Erdős (NSMT). SLOVENIA: 1♀, Laško, 10–11. V. 1976, A. Shinohara (NSMT). CROATIA: 1♂, Plitvička Jezera, 8. V. 1976, A. Shinohara (NSMT). *Gilpinia hercyniae* —SWEDEN: 1♂, “A” VII-13-38” (USNM); 1♂, Vittangi, “VIII · 22 · 38” (USNM). USA: 1♀, Maine, Bar Harbor, 28. VI. 1936, A.E. Brower (USNM); 1♂, Maine, Bar Harbor, 24. V. 1937, bred (USNM); 1♀, Maine, Portage, 2. V. 1936, bred (USNM); 1♀, *do.* but 19. V. 1936; 1♂, *do.* but 17. VI. 1938; 1♂, “Wilmington Vt. VI-79”, “Picea rubra” (USNM).

See Hara and Nakamura (2015) for terminology and methodology of morphological examination and photography.

Results and Discussion

Gilpinia abieticola species group

Female. Head anteriorly black at least above toruli, but dorsally pale (Fig. 1). Mesoscutum with median lobe widely pale along notaulus and lateral lobe laterally with pale marking. Mesoscutellum pale, narrowly black along anterior and posterior margins. Mesepisternum at least centrally pale. Legs black with pale areas; femora except for trochantelli black, apically pale. Second to eighth abdominal terga pale along antero-lateral or anterior margins.

Postocellar area weakly or moderately convex (Fig. 1); anterior and lateral furrows distinct. Clypeus with ventral margin very slightly concave (Fig. 3B, E, M). Flagellar rami short, becoming inconspicuous on apical flagellomeres (Fig. 3D, F, K, N); first flagellomere 1.0–1.5×length of second along dorsal margin, with ramus about 0.3×length of first flagellomere along dorsal margin. Prepectus very small, far apart from postspiracular sclerite; pronotum and mesepisternum usually contiguous above prepectus. Mesoscutellum with anterior edge angled at 110–150° (Fig. 4); in dorsal view, mesoscutellar appendage not visible, except usually for narrow apex. Metascutellum small, not or strongly convex. Hind leg (Fig. 6A–B, E–F) with posterior (inner and longer) tibial spur tapering apically or rod shaped, and its length 0.9–1.2×breadth of tibia, 0.8–1.0×(rarely 1.1×) length of first tarsomere (excluding pulvillar pad); length of second and third tarsomeres combined 1.1–1.7×length of first. Ovipositor sheath in dorsal view about 3.0×as wide as cercus (Fig. 7A, E, H, L); scopa oval and large, with height about 1.5–2.0×width (Fig. 7B, G, I, M). Hypopygium with posterior margin very shallowly concave or slightly notched medially, without pair of posteromedial projections (Fig. 1B, G, J). Lance in lateral view with dorsal margin weakly concave at middle, mid-apically with longitudinal membranous area along ventral margin (Fig. 7D, K, O); posterior projection of processus articularis large, in dorsal view about 2.5–3.0×as long as wide, with distinct basal suture (Fig. 7C, J, N) (indicated by arrow in Fig. 7C; this suture present on ventral side). Lancet (Fig. 8) with ventral margin not or weakly convex at second annulus in outline and dorsal membranous area relatively narrow, widest at middle of lancet; first annulus without serrula, with row of spines (=ctenidium) not reaching ventral margin of lancet; serrulae simple, except for two or three apical serrulae, each is posteriorly angularly convex.

Male. Head, thorax and dorsum of abdomen mostly black (Fig. 2A–C, G–H, L); dorsum of abdomen at most laterally pale on some apical

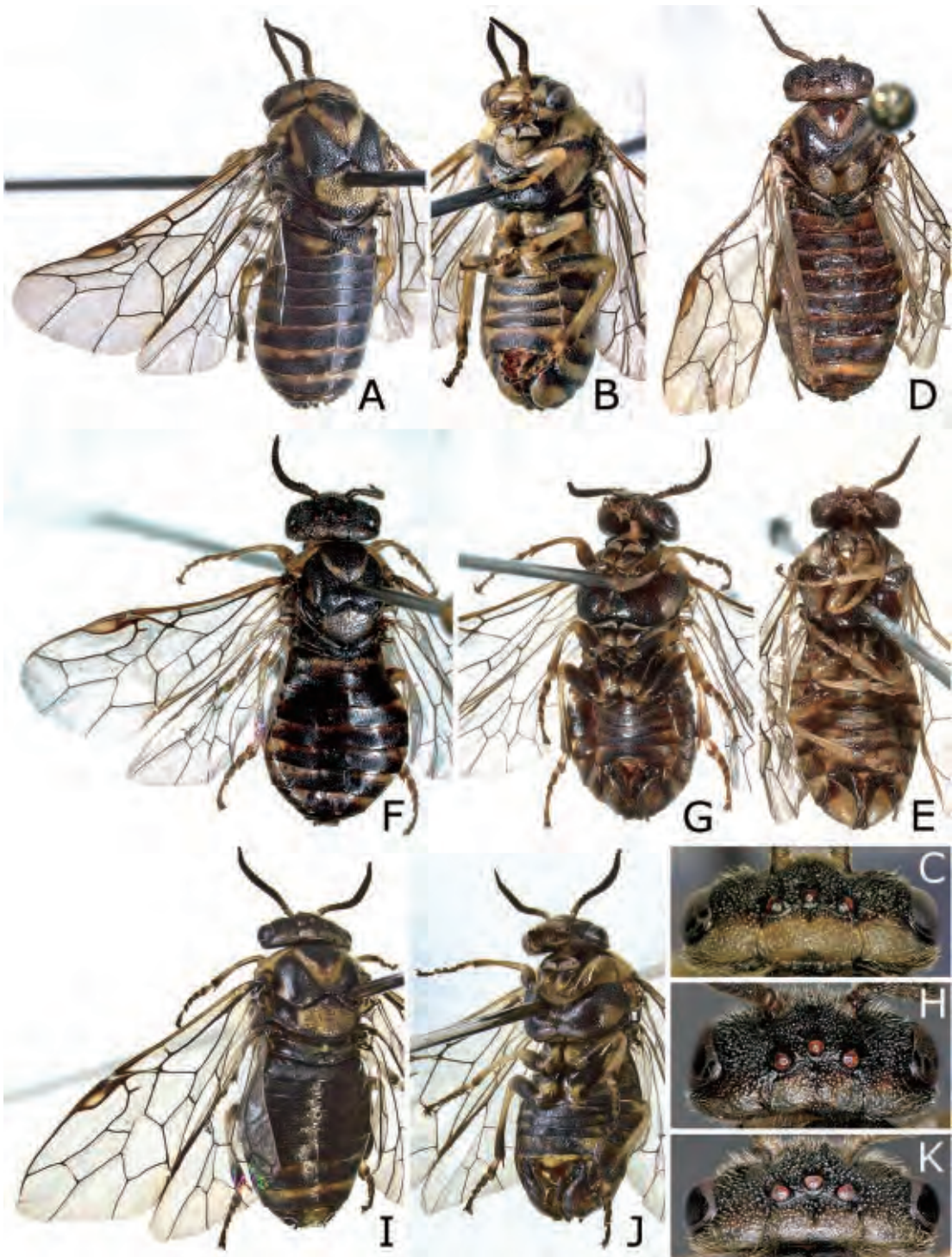


Fig. 1. Female: *Gilpinia abieticola* (A–E), *G. hokkaidoensis* (F–H) and *G. kojimai* (I–K). — A, D, F, I, Dorsal or dorsolateral view; B, E, G, J, ventral or ventrolateral view; C, H, K, head, dorsal view. — A–C, Zittau; D–E, lectotype; F–K, holotypes.

terga (ninth and 10th terga usually hidden and invisible). Legs mostly pale.

Structure as in female except for usual sexual differences. Antenna with 22–27 antennomeres. Hind leg (Fig. 6C–D, G) with posterior tibial spur tapering apically, $0.6\text{--}0.9 \times$ length of first tarsomere; length of second and third tarsomeres combined $1.0\text{--}1.3 \times$ length of first. Basiparamere with parapenis very long (Fig. 9A–B, E, I–J, M). Harpe in ventral view with medial margin concave and apex nearly pointed or narrowly rounded. Valviceps pigmented throughout, in lateral view narrow, apically curved ventrally (Fig. 9C, F, K, N), with spine at apex and minute or inconspicuous spines around sensory pores in narrow apical area delimited by sharp line anteriorly and dorsally (Fig. 9D, G–H, L, O–P). Ergot long (Fig. 9C, F, K, N).

Remarks. Benson (1939) divided *Gilpinia* into two species groups, the *G. polytoma* group and the *G. socia* group, by the shape of the inner hind-tibial spur in the female. *Gilpinia polytoma* species group has a broadened spur, which is unique to the group in the Diprionidae and even in the Tenthredinoidea and strongly supports the monophyly of this species group. *Gilpinia socia* species group has a usual simple spur, and no characters suggesting its monophyly have been found. *Gilpinia abieticola* species group is a part of the *G. socia* species group. It is proposed here based on the close similarity between the members and not based on the possession of certain unique characters suggesting monophyly.

The females of the group are very similar to those of *G. polytoma* and *G. hercyniae*, but the latter two belong to the *G. polytoma* species group. The males of this species group (that of *G. hokkaidoensis* is unknown) are very similar to that of *G. hercyniae*. These species differ from the other congeners in that the valviceps is pigmented throughout and in lateral view it is narrow and curved ventrally, with a pointed apex,

and the ergot is long (Figs. 9C, F, K, N, 10C, E). Known males of the species of the *G. abieticola* group and that of *G. hercyniae* are separated by the characters given in the key below. The male of *G. abieticola* is also very similar to that of *G. polytoma* in external characters, but in the latter species the valviceps in lateral view is relatively wide and apically with a wide non-pigmented area (Fig. 10A–B).

Gilpinia abieticola (Dalla Torre, 1894)

(Figs. 1A–E, 2A–F, 3A–H, P–Q, 4A–F, 5A–F, 6A–D, 7A–G, 8A–D, 9A–H)

Lophyrus abietis Stein, 1886: 141 [primary homonym of *Lophyrus abietis* Harris, 1841 = *Neodiprion abietis* (Harris, 1841)].

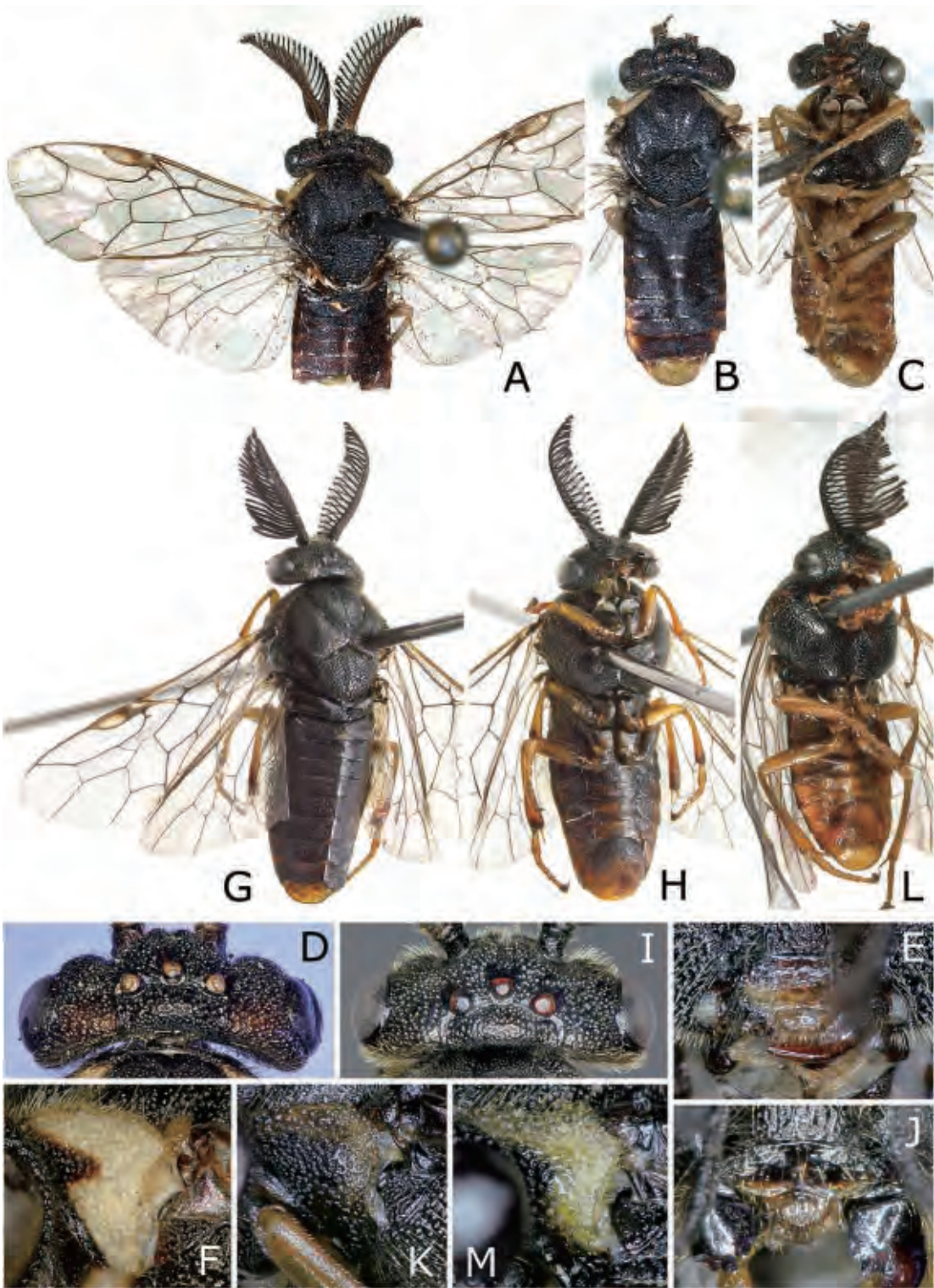
Lophyrus abieticola Dalla Torre, 1894: 293 [replacement name for *Lophyrus abietis* Stein, 1886]; Konow, 1905: 42; Enslin, 1914: 178, 179, 180; Enslin, 1917: 557, 562.

Gilpinia abieticola: Benson, 1939: 341; Reeks, 1941: 181, 186, 187; Gussakovskij, 1947: 162, 224, 225, 229 [part]; Thalenhorst, 1955: 353–361; Lorenz and Kraus, 1957: 28; Thalenhorst, 1960: 513–524; Vehrke, 1961: 179; Verzhutskii, 1966: 55; Verzhutskii, 1973: 119, 123, 124; Thalenhorst, 1968: 338–350; Smith, 1975: 412 [part]; Ermolenko, 1975: 133, 134, 159, 180; Naito, 1976: 5, 6 [part]; Beneš and Krístek, 1979: 90, 92, 93; Verzhutskii, 1981: 74; Pschorn-Walcher, 1982: 105; Viitasari and Varama, 1987: 53; Zhelokhovtsev, 1988: 78 [part]; Larsson *et al.*, 1993: 458; Liston, 1995: 55; Taeger *et al.*, 1998: 86 [part]; Pschorn-Walcher and Altenhofer, 2000: 283; Westendorff, 2006: 48; Taeger *et al.*, 2006: 460; Taeger *et al.*, 2010: 204 [part]; Hara and Nakamura, 2015: 38.

Diprion abieticola: Kontuniemi, 1960: 1, 80.

Female [character states of lectotype in brackets]. Length 6.0–8.0 [7.5] mm. Black, with yellow markings, without metallic reflection (Fig. 1A–B, D–E). Head yellow, with black transverse band between eyes crossing frontal and ocellar areas (Figs. 1C, 3A–B, E); this band sometimes dorsally becoming brown [brown]; facial groove sometimes slightly brown [slightly brown]; ante-

Fig. 2. Male: *Gilpinia abieticola* (A–F), *G. kojimai* (G–M). —A–B, G, Dorsal or dorsolateral view; C, H, L, Ventral or ventrolateral view; D, I, Head, dorsal view; E, J, Ventromedial part of head, anterior view; F, K, M, Pronotum, anterolateral view. —A–F, Chodau; G–M, Mt. Yokote-yama.



rior tentorial pit black; border between supraclypeal area and clypeus sometimes narrowly brown [narrowly brown]; malar space ventrally narrowly brown, sometimes with brown to black vertical band (Fig. 3E) [with faint brown vertical band (Fig. 3B)]; gena black narrowly along eye margin (Fig. 3C); occiput mostly black. Antenna brown to black brown, often basally yellow or yellow brown [yellow brown]. Mandible basally yellow, apically red brown. Labrum dark brown, basally pale, or entirely pale brown (Fig. 3B, E) [dark brown, basally pale]. Palpi pale yellow, basally somewhat darkened. Pronotum yellow, narrowly black anteriorly (Fig. 1A–B). Mesepisternum except for pectus yellow with black margins (Figs. 1B, E, 5A, C); pectus black. Legs brown to black, yellow on apices of coxae, most of trochanters and trochantelli, apices of femora, fore and middle tibiae except for narrow apices and ventral parts of apical two-thirds, hind tibia except for apical fourth, and bases of tarsomeres; fore and middle femora sometimes anteriorly mostly yellow [fore femur anteriorly mostly yellow]; trochanters often widely darkened [somewhat darkened]; tibial spurs yellow to brown. Wings nearly clear hyaline; stigma pale brown, basally and marginally darkened; in fore wing, veins black, pale brown on C, most of section of R1 basal to stigma, apical section of R1, and most of A. Abdomen dark brown to black; first tergum with yellow or brown marking [brown]; second to seventh terga and sterna yellow anteriorly, but second to fourth or fifth terga not or narrowly so medially; eighth tergum yellow anteriorly and black posteriorly, with black anterolateral spot; ninth tergum yellow, black on narrow anterolateral margin and on dorsal area except for narrow dorsomedial area; tenth tergum black, medially yellow. Cercus dark brown. Ovipositor sheath black; scopa yellow to brown.

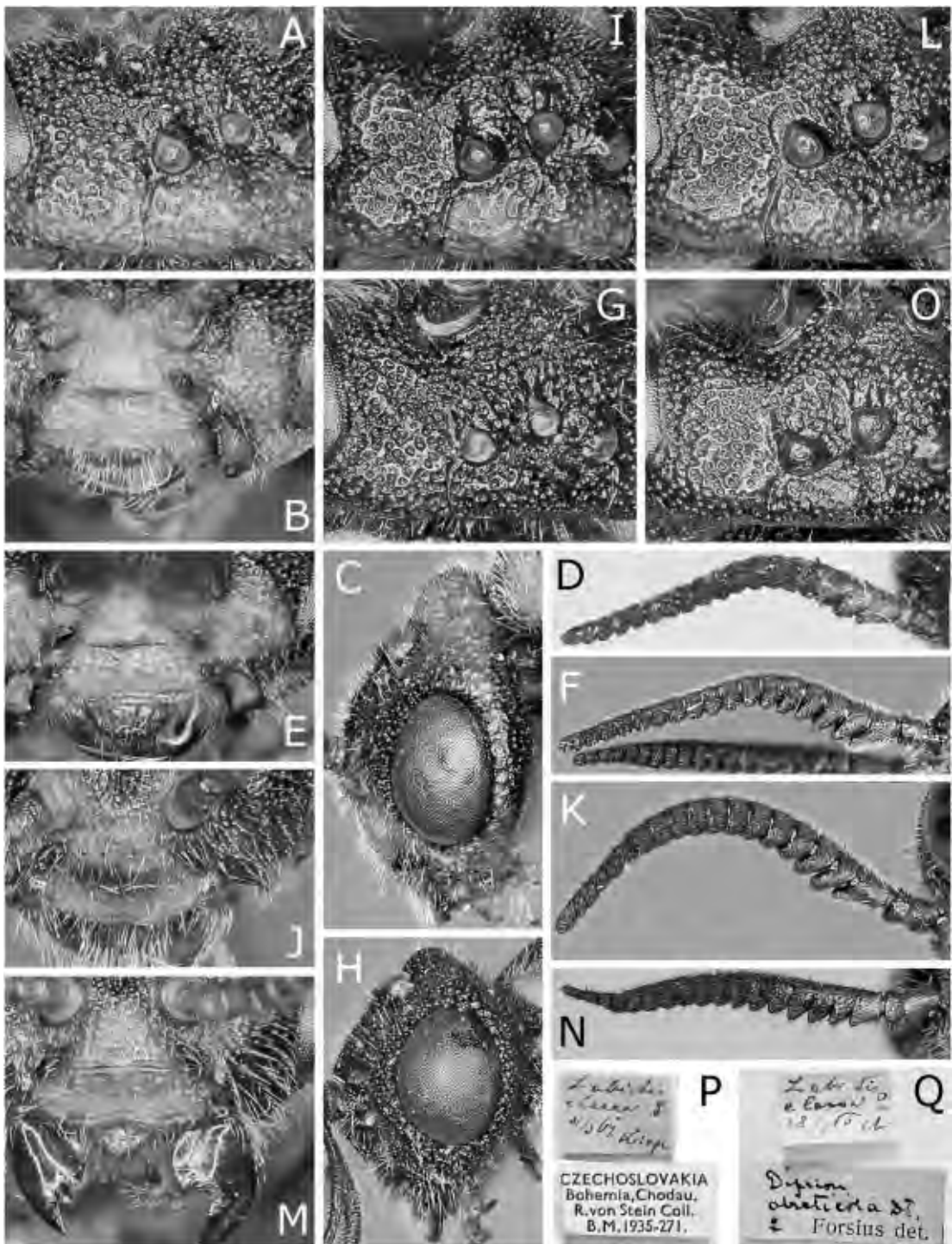
Head and thorax densely punctured, moderately or weakly shiny [moderately]. Frontal area and its adjacent areas with punctures mostly contiguous (Fig. 3A). Supraclypeal area and dorsal area of clypeus weakly punctured (Fig. 3B, E). Ventral area of clypeus and labrum nearly smooth. Punctures on mesonotum and mesepisternum mostly contiguous and well defined (Figs. 4A–D, 5A–D).

Postocellar area with width 1.7–2.0 [2.0] × length (Fig. 1C). Distances between eye and lateral ocellus, between lateral ocelli, and between lateral ocellus and posterior margin of head 0.9–1.2:1.0:0.7–1.0 [1.2:1.0:0.8]; distances between eye and lateral ocellus and between lateral ocellus and posterior margin of head 1.2–1.4:1.0 [1.4:1.0]. Distance between eyes 1.9–2.1 [2.1] × eye height. Distance between torulus and eye 1.2–1.6 [1.6] × distance between toruli. Malar space 1.2–1.9 [1.5] × width of median ocellus, 0.2–0.3 [0.3] × eye height. Antenna (Fig. 3D, F) with 18–20 [20] antennomeres. Ovipositor sheath as in Fig. 7A–B, E–G.

Lance (Fig. 7C–D) with eight annular sutures and middle sutures weakly oblique. Lancet (Fig. 8A–D) with 10 or rarely nine annuli (Fig. 8D) [10 annuli], abruptly narrowing apically beyond seventh annulus; length of lancet from its apex to ventral end of most basal (first) row of spines (=ctenidium) 3.1–3.5 [3.4] × maximum width of lancet; first row of spines distinctly oblique, with ventral end located basal to dorsal end; fourth row of spines (=ctenidium+serrula) about as long as second row of spines; serrula of second annulus somewhat smaller than that of third; eighth and ninth annuli each nearly straight, less oblique than middle annuli, and spinose throughout or often not spinose dorsally [ninth annulus not spinose dorsally].

Male. Length 5.7–6.3 mm. Black (Fig. 2A–

Fig. 3. Head (A–C, E, G–J, L–M, O), female antenna (D, F, K, N) and label (P, Q): *Gilpinia abieticola* (A–F, female; G–H, male), *G. hokkaidoensis* (I–K, female) and *G. kojimai* (L–N, female; O, male). —A, G, I, L, O, Anterolateral view; B, E, J, M, anteroventral part, anterior or anteroventral view; C, H, lateral view; D, F, K, outer lateral view (D, reversed); N, inner lateral view, reversed. —A–D, Lectotype; E–F, Zittau; G–H, Chodau; I–N, holotypes; O, Mt. Yokote-yama; P, lectotype of *Lophyrus abietis*; Q, paralectotype of *Lophyrus abietis*.



C). Head brown to dark brown between postocellar area and eye (Fig. 2D); supraclypeal area sometimes dark brown; clypeus dark brown, ventrally brown yellow (Fig. 2E), or yellow except for narrow dorsal margin. Labrum pale brown. Mandible apically red brown. Palpi pale yellow, basally somewhat darkened. Antenna dark brown to black. Pronotum posterolaterally widely pale yellow (Fig. 2F). Legs yellow (Fig. 2C); coxae basally widely black; femora often widely brown to dark brown posteriorly (according to Stein, 1886, femora usually not darkened); tarsi sometimes apically narrowly black. Wings (Fig. 2A) as in female. Abdomen dorsally with sixth to eighth terga anterolaterally yellow brown or slightly pale (Fig. 2B), ventrally yellow or yellow brown, slightly darkened along narrow posterior margins of sterna and laterotergites (Fig. 2C); subgenital plate anteriorly slightly and narrowly darkened. Basiparamere of genital capsule dark, harpe somewhat pale (Fig. 9A–B).

Punctuation as in female, but punctures generally more dense and distinct (Figs. 3G, 4E–F, 5E–F). Supraclypeal area densely punctured (Fig. 2E).

Structure as in female except for usual sexual differences. Postocellar area with width $2.0\text{--}2.2 \times$ length (Fig. 2D). Distances between eye and lateral ocellus, between lateral ocelli, and between lateral ocellus and posterior margin of head $1.0:1.0:0.6$; distances between eye and lateral ocellus and between lateral ocellus and posterior margin of head $1.6\text{--}1.7:1.0$. Distances between eyes $1.9\text{--}2.0 \times$ eye height. Distance between torulus and eye $1.2\text{--}1.4 \times$ distance between toruli. Malar space $1.6\text{--}1.8 \times$ width of median ocellus, $0.3 \times$ eye height. Antenna (Fig. 2A) with 22–27 antennomeres; flagellum with 18–22 biramose flagellomeres (basal and preapical flagellomeres uniramose, and apical flagellomere not ramose) (see also Stein, 1886).

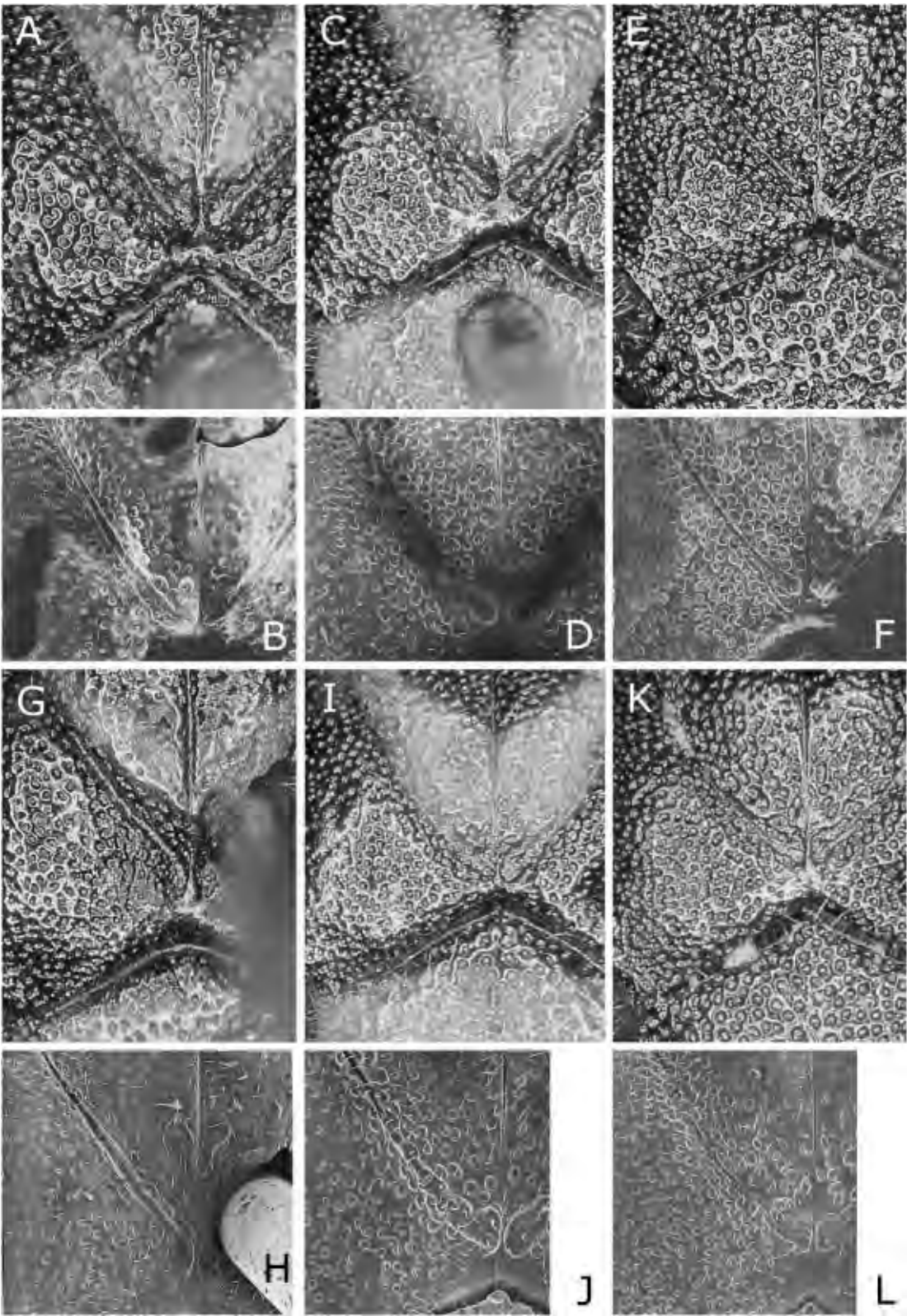
Genitalia as in Fig. 9A–H. Basiparamere in ventral view with parapenis tapering apically, nearly straight, with apex narrowly rounded. Valviceps in lateral view with very small spine at apex and ventral margin weakly rounded near apex; apical area narrow, with longest axis $4.1\text{--}4.5 \times$ shortest axis.

Material examined. Lectotype (hereby designated) (Fig. 1D–E): ♀ labeled “*L. abietis* e. larva ♀ 31/3 69 Keivpa [?]” “CZECHOSLOVAKIA Bohemia, Chodau. R. von Stein Coll. B. M. 1935-271” (Fig. 3P) (BMNH). Paralectotype: 1 ♀, “*L. abietis*, e larva ♀ 28/7 85 Ch” “*Diprion abieticola* DT ♀ Forsius det.” (Fig. 3Q) (USNM).

Stein (1886) described *Lophyrus abietis* based on nine adults reared from 35 larvae collected in the Chodau area in Czech Republic and three other specimens, including one female reared from a larva collected in “sächsischen Erzgebirge”. The “sächsischen Erzgebirge” belongs to Saxony, Germany (A. Taeger, personal communication, 2014). Stein (1886) did not designate types, and these 12 adult specimens are regarded as syntypes.

In the Stein collection now kept in the Natural History Museum, London (BMNH) (Horn *et al.*, 1990), there are eight specimens labeled “*abietis*” but six of these were collected (or emerged) in 1887. One male labeled “*L. abietis*, e larva 21/3 86 Ch” may have emerged from a larva collected in 1885 and referred to in Stein (1886) but the emergence of the adults in 1886 was not mentioned in the paper and therefore it cannot be regarded as a syntype. The remaining specimen, a female labeled “*L. abietis*, e. larva ♀ 31/3 69 Keivpa[?]” (Fig. 3P), agrees with the data of a female mentioned by Stein (1886, 151), “das letzte, ein am 31. März 1869 ausgekrochenes Thier, stammt aus dem sächsischen Erzgebirge”, though the last word on the hand-written label, apparently a locality name, is illegible. This

Fig. 4. Medial part of mesonotum, dorsal view: *Gilpinia abieticola* (A–D, female; E–F, male), *G. hokkaidoensis* (G–H, female) and *G. kojimai* (I–J, female; K–L, male).—A, C, E, G, I, K, Digital microscope using ring-light; B, D, F, H, J, L, SEM.—A–B, Lectotype; C–D, Zittau; E–F, Chodau; G–J, holotypes; K–L, Mt. Yokote-yama.



specimen certainly belongs to Stein's original type series. We also examined one female labeled "L. abietis, e larva ♀, 28/7 85 Ch" (Fig. 3Q) kept in the National Museum of Natural History, Washington, D.C. (USNM). We designate the female syntype in BMNH as a lectotype of *Lophyrus abietis* Stein, 1886. The female in USNM also agrees with the data of Stein (1886) and is a paralectotype.

Other material examined: CZECH REPUBLIC: 1♂, "L. abietis, e larva 21/3 86 Ch" "CZECHOSLOVAKIA Bohemia, Chodau. R. von Stein Coll. B. M. 1935-271" "Dissection on slide Series. No. 1. 30. 1. 1964/8." (BMNH); 1♂, "abietis, 10/5 87 Ch" (USNM); 1♀, "Bohemia Prachatitz" "23. 7. 84. Handl." (NMW). GERMANY or CZECH REPUBLIC: 3♀, Ore Mountains between Czech Republic and Germany, Lange (SDEI); 1♀, same locality (SDEI). GERMANY: 1♀, Ottobeuren, "Kohlstattkopf", VII. 2000, M. Goßner (SDEI); 1♀, "Leipzig Fla[?] 18. 4. 92 Braun", Konow (SDEI); 1♀, "Lückendorf bei Zittau, 6. 7. 11, Sieber" (SDEI). AUSTRIA: 1♀, "Piesting Tschek" (NMW); 1♀, "Tschek 1872 Piesting." "abietis enel[?] 6/7 65" (NMW); 1♂, "Tschek 1872 Piesting." (NSMT); 1♀, "Piesting." "Wand 10/S 866" (NSMT). BOSNIA AND HERZEGOVINA: 1♀, "Treskavica pl. Bosnia, Fodor." (NSMT).

Distribution. Europe (for more details, see Taeger *et al.*, 2006); Siberia (Verzhutskii, 1966).

The records from Japan by Takeuchi (1940), Togashi (1961), Okutani (1967) and Naito (1976) are most probably erroneous (see Hara and Nakamura, 2015).

Host plants. Pinaceae: *Picea abies* (L.) ("*Pinus abies* L." in Stein, 1886; "*Picea excelsa* Link" in Lorenz and Kraus, 1957) and *P. obovata* Ledeb. (Verzhutskii, 1966).

Okutani's (1967) record of *Pinus pumila* (Pall.) Regel. was based on a misidentification of

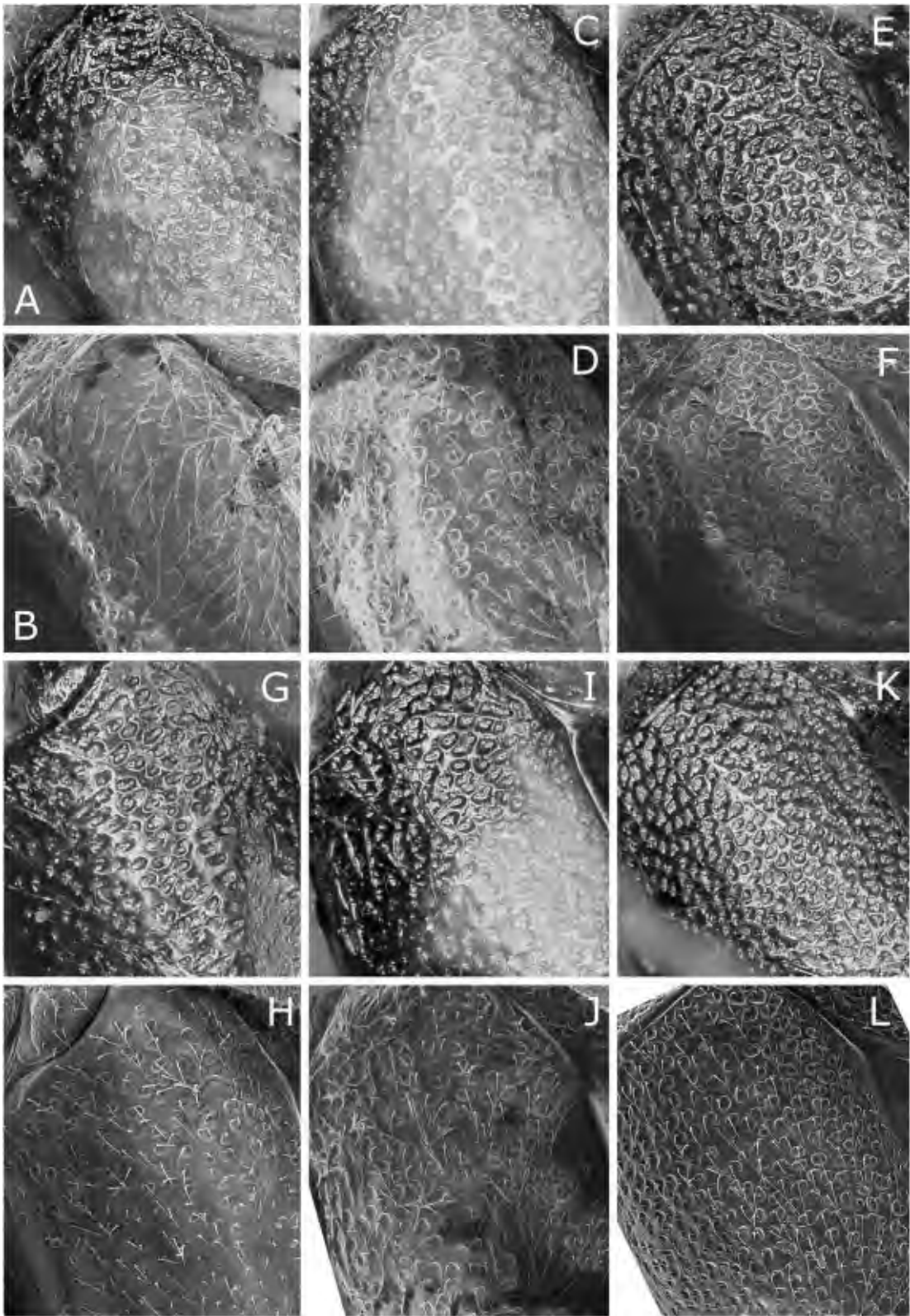
the sawfly (Okutani, 1970).

Remarks. *Gilpinia abieticola* is similar to *G. albiclavata*, *G. hokkaidoensis* and *G. kojimai* in the female and also to *G. hercyniae* in the male, but these species are distinguished from each other by the characters given in the key below.

Reeks (1941) separated the males of *G. abieticola*, *G. polytoma* and *G. hercyniae* by the coloration of the hind femur, the punctuation on the thoracic dorsum and the shape of the valviceps. His treatment was accepted by Ermolenko (1975) and Beneš and Krístek (1979). We recognized that the valviceps shows distinct differences among the three species (*cf.* Figs. 9–10), but the coloration and the punctuation may not be useful in separating males of these three species. Reeks (1941) wrote that the hind femur is posteriorly mostly black and the punctuation on the thoracic dorsum is coarse in *G. abieticola* and *G. hercyniae*, while the hind femur is mostly yellow and the punctuation is fine in *G. polytoma*. However, in our material, the coloration of the femur and the punctuation is not distinctly different among the three species.

The number of biramose antennomeres is 21–23 for "*G. polytoma*" (probably including *G. hercyniae*) and 19 or 19–20 for *G. abieticola* in Enslin (1917) and Gussakovskij (1947), but it overlaps in *G. abieticola*, *G. hercyniae* and *G. polytoma* according to Reeks (1941) and in our material. Enslin (1917) and Zhelokhovtsev (1988) used the antennal length to separate *G. abieticola* from *G. polytoma* and *G. hercyniae*, but the antenna very often curls up, so that the accurate measurement is difficult. Viitasaari and Varama (1987) used the color and pilosity of the area just in front of the median ocellus, the color of the clypeus and the color of the tenth abdominal tergum (= "viimeinen selkäkilpi") in the key to the males of the European *Gilpinia* species, though they suggested rather wide variability of

Fig. 5. Dorsal part of mesepisternum, lateral view: *Gilpinia abieticola* (A–D, female; E–F, male), *G. hokkaidoensis* (G–H, female) and *G. kojimai* (I–J, female; K–L, male). —A, C, E, G, I, K, Digital microscope using ring-light; B, D, F, H, J, L, SEM. —A–B, Lectotype; C–D, Zittau; E–F, Chodau; G–J, holotypes; K–L, Mt. Yokote-yama.



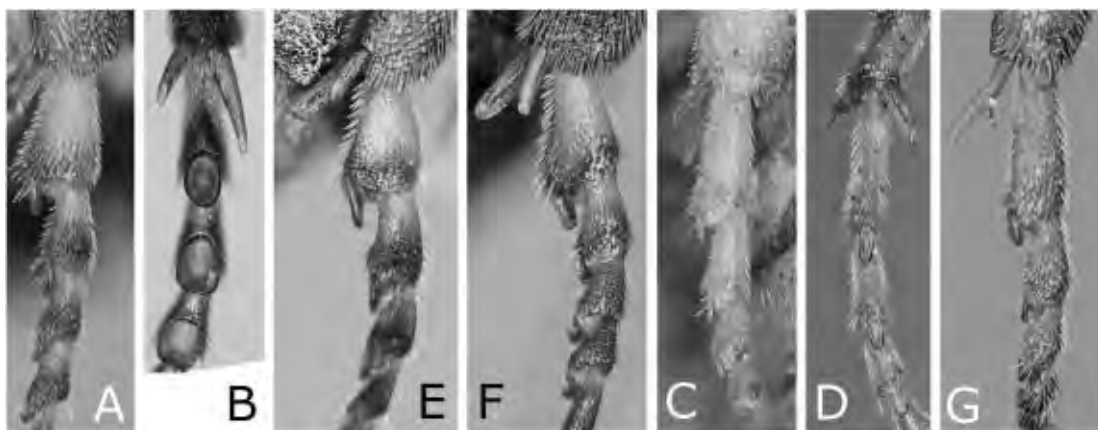


Fig. 6. Hind leg (from apex of tibia to third or fourth tarsomere): *Gilpinia abieticola* (A–B, female; C–D, male), *G. hokkaidoensis* (E, female) and *G. kojimai* (F, female; G, male).—A, Left leg, anterior view; B, D, right leg, ventral view; C, E–F, *do.*, anterior view, reversed; G, *do.*, posterior view, reversed.—A–B, Zittau; C–D, Chodau; E–F, holotypes; G, Mt. Yokote-yama.

these characters. In our limited material, the area in front of the median ocellus is narrowly yellow in *G. abieticola*, narrowly or rather widely yellow or black in *G. polytoma* and black in *G. hercyniae*, and the area is narrowly or widely glabrous in all the three species. The clypeus is mostly (or its wide ventral margin) yellow, pale brown or brown in *G. abieticola* and *G. hercyniae*, and mostly yellowish white or yellow in *G. polytoma*. The tenth tergum is often difficult to observe. In the specimens with a visible tenth tergum, it is brown in *G. abieticola* and *G. hercyniae* and yellow or brown in *G. polytoma*. We consider that these characters are rather difficult to use for the separation of these three species, although the frequency of character states may differ between them.

Gilpinia hokkaidoensis n. sp.

[Japanese name: Kita-shima-matsuhachi]

(Figs. 1F–H, 3I–K, 4G–H, 5G–H, 6E, 7H–K, 8E–H)

Female [character states of holotype in brackets]. Length 6.0–7.0 [7.0] mm. Black, with pale yellow to yellow markings, without metallic reflection (Fig. 1F–G). Head yellow, anteriorly with black marking between eyes (Fig. 1H); this

black marking dorsally margined with brown, sometimes lateroventrally extending to malar space (Fig. 3J) [extending to malar space]; postocellar area usually medially dark brown (Fig. 1H) [medially dark brown]; pale area between postocellar area and gena narrow or wide [narrow]; border of supraclypeal area and clypeus dark brown (Fig. 3J); anterior tentorial pit black; area between facial groove and malar space yellow, or black and with yellow or brown spot near by facial groove [black with brown spot]; malar space anteriorly black; gena yellow except for black area along eye margin, or yellow or brown ventrally and black dorsally [yellow ventrally and black dorsally]; occiput mostly black. Antenna dark brown to black, basally yellow or brown [brown]. Mandible basally brown, apically red brown. Labrum dark brown (Fig. 3J). Palpi yellow, basally somewhat darkened. Pronotum yellow, narrowly black anteriorly (Fig. 1F–G). Mesepisternum except for pectus dark brown to black, centrally with yellow marking [yellow marking present only on left mesepisternum]; pectus black (Fig. 1G). Legs brown to black; apices of coxae yellow; trochanters and trochantelli partly yellowish; apices of femora, fore and middle tibiae except for narrow apices and apical parts of ventral sides, hind tibia except

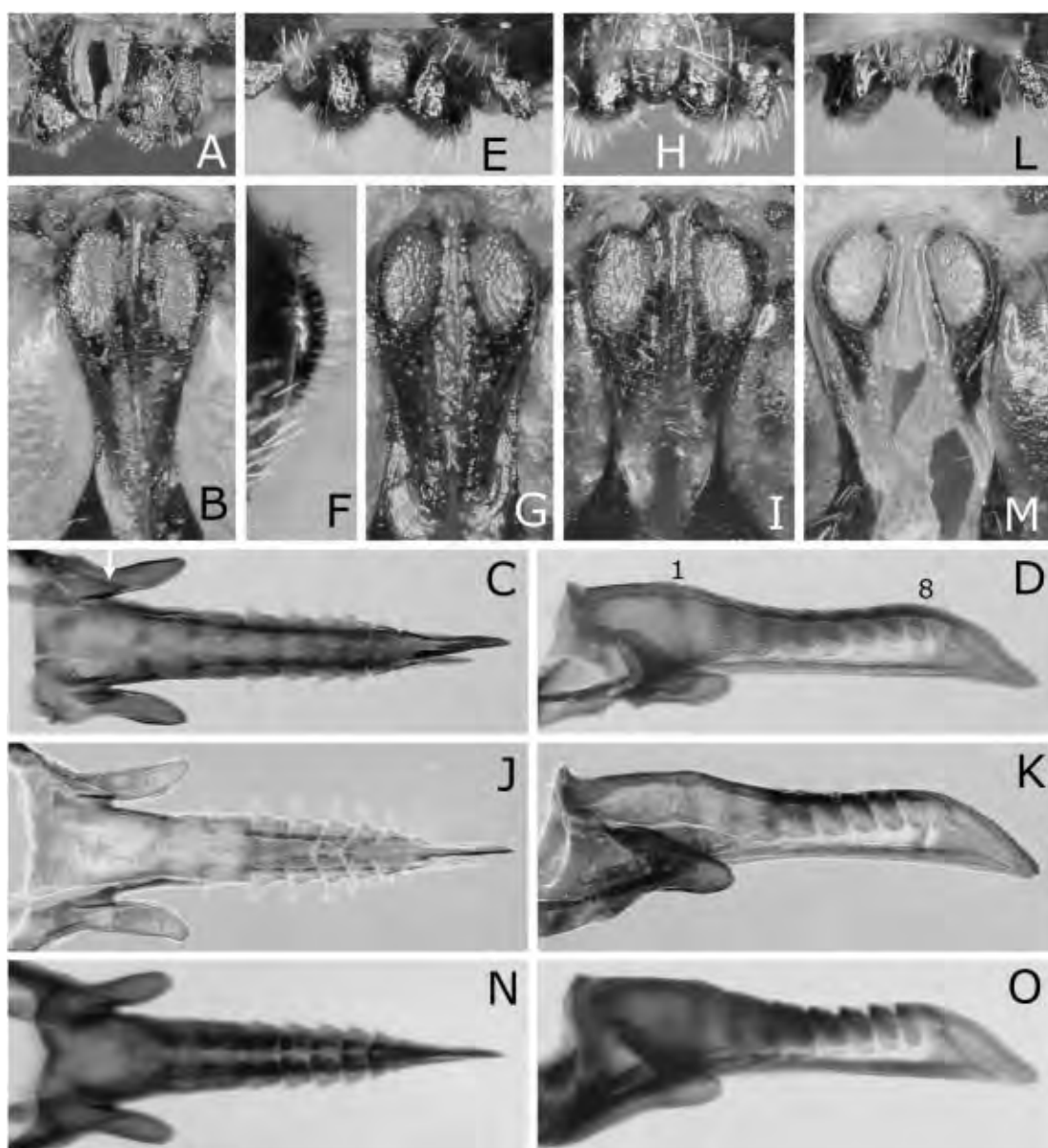


Fig. 7. Ovipositor sheath (A–B, E–I, L–M) and lance (C–D, J–K, N–O): *Gilpinia abieticola* (A–G), *G. hokkaidoensis* (H–K) and *G. kojimai* (L–O).—A, E, H, L, Posterodorsal view; B, G, I, M, posterior view; F, lateral view; C, J, N, dorsal view; D, K, O, lateral view; 1, 8 in D, first (most basal) and eighth (most apical) annular sutures.—A–D, Lectotype; E–G, Zittau; H–I, holotype; J–K, locality unknown; L–O, holotype.

for apical third and bases of tarsomeres yellow; tibial spurs yellow to brown. Wings nearly clear hyaline; stigma pale brown, basally and marginally dark brown; in fore wing, veins dark brown to black, yellow to pale brown on C, most of section of R1 basal to stigma, apical section of R1

and most of A. Abdomen dark brown to black; first tergum often with wide yellow brown area medially [with yellow brown area]; second to seventh terga yellow anteriorly, but anterior terga not or narrowly so medially; laterotergites yellow anterolaterally; sterna anteriorly or anterolater-

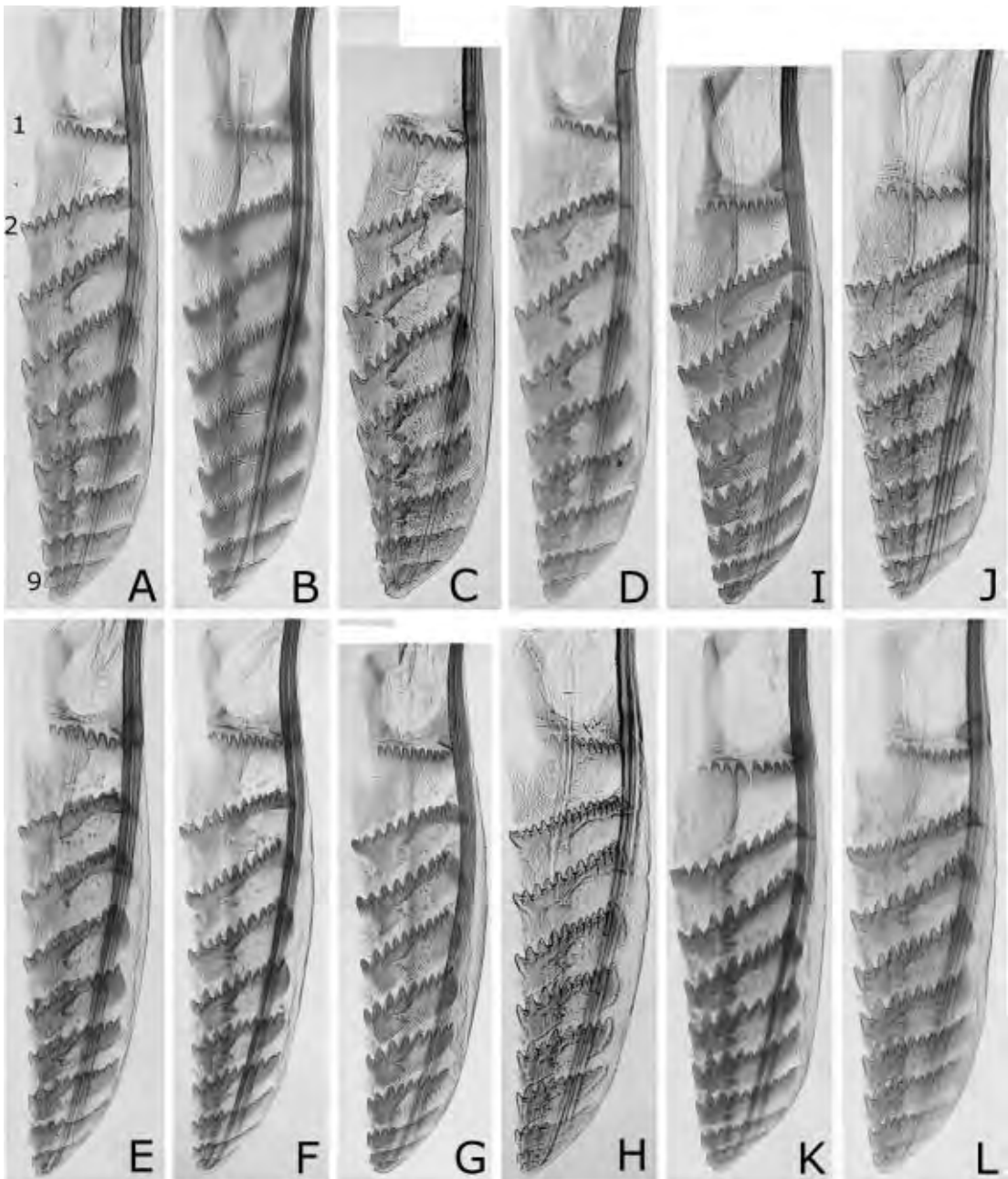


Fig. 8. Lancelet: *Gilpinia abieticola* (A–D), *G. hokkaidoensis* (E–H) and *G. kojimai* (I–L). 1, 2, 9 in A, First (most basal), second and ninth row of spines.—A, Lectotype; B, Chodau; C, Leipzig; D, Piesting; E, holotype; F, Aizankei; G, locality unknown; H, Tomakomai; I, holotype; J–L, Mt. Yokote-yama.

ally yellow [anterolaterally]; eighth tergum anteriorly yellow, with small black spot anterolaterally; ninth tergum yellow or brown [yellow], black on narrow anterior margin and dorsal area

except for brown narrow dorsomedial area; tenth tergum black, medially yellow or brown [yellow]. Cercus dark brown. Ovipositor sheath black; scopa yellow or brown [yellow].

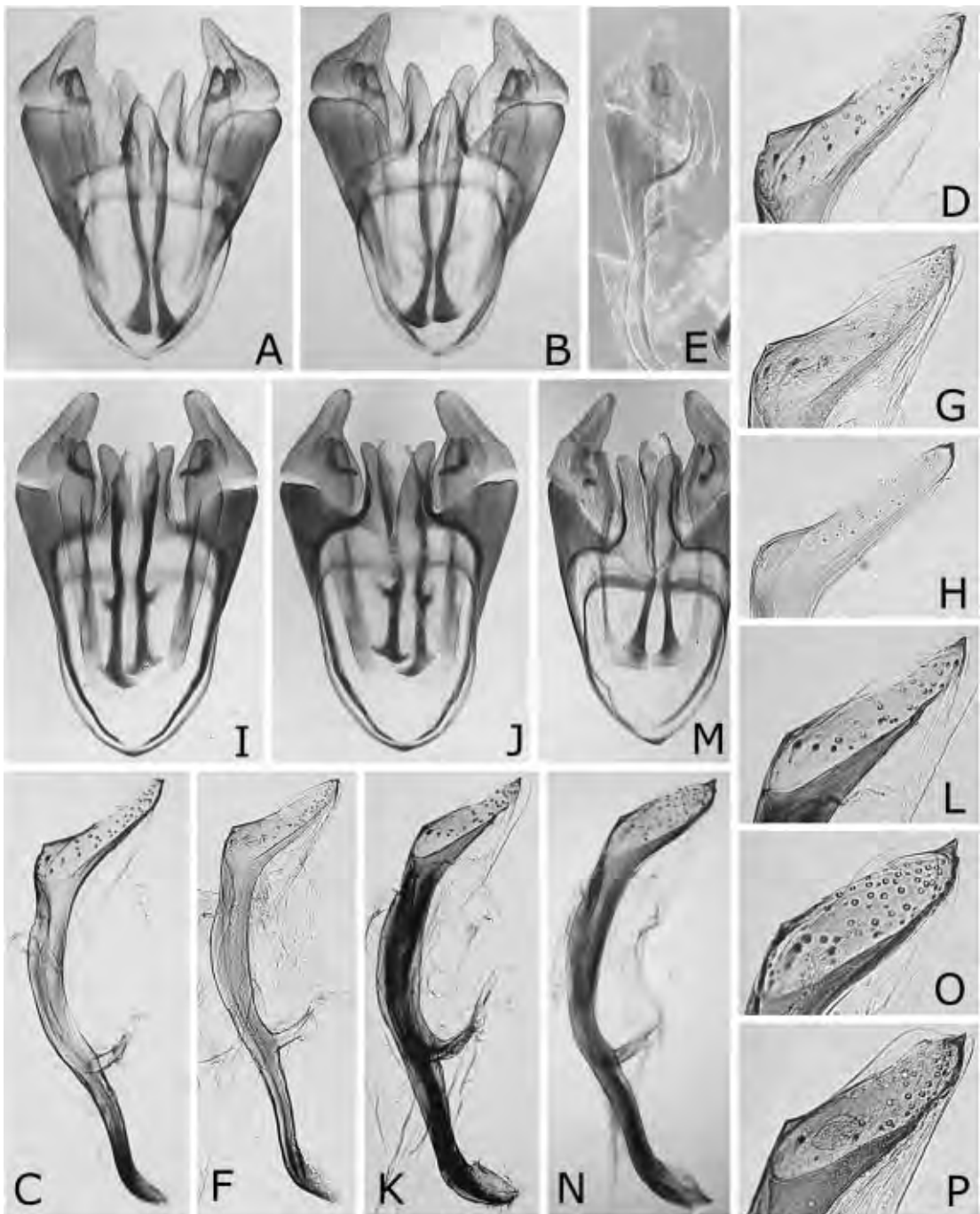


Fig. 9. Genitalia: *Gilpinia abieticola* (A–H) and *G. kojimai* (I–P).—A, I, Genital capsule, dorsal view; B, E, J, M, *do.*, ventral view; C, F, K, N, penis valve, lateral view, left dorsal (K, reversed); D, G–H, L, O–P, apical part of valviceps, lateral view, left dorsal (L, reversed).—A–D, Piesting; E–H, Chodau; I–P, Mt. Yokote-yama.



Fig. 10. Penis valve: *Gilpinia polytoma* (A–B) and *G. hercyniae* (C–F).—A–C, E, Lateral view, left dorsal (E, reversed); D, F, apical part of valviceps, lateral view, left dorsal (F, reversed).—A, Ottobeuren; B, Pulgarn; C–D, Wilmington; E–F, Portage.

Head and thorax densely punctured, moderately shiny. Frontal area and its adjacent areas with punctures mostly contiguous (Fig. 3I). Supraclypeal area and dorsal part of clypeus weakly punctured (Fig. 3J). Ventral part of clypeus nearly smooth. Labrum weakly punctured. Punctures on mesonotum and mesepisternum predominantly contiguous and well defined (Figs. 4G–H, 5G–H); those on posterior part of median mesoscutal lobe sometimes ill-defined [ill-defined].

Postocellar area with width 1.7–2.1 [1.7] × length (Fig. 1H). Distances between eye and lateral ocellus, between lateral ocelli, and between lateral ocellus and posterior margin of head 1.1–1.2:1.0:0.8–1.1 [1.1:1.0:0.9]; distances between eye and lateral ocellus and between lateral ocellus and posterior margin of head 1.1–1.3:1.0 [1.3:1.0]. Distance between eyes 1.8–2.0 [1.9] × eye height. Distance between torulus and eye 0.9–1.2 [1.2] × distance between toruli. Malar space 1.1–1.7 [1.7] × width of median ocellus, 0.2–0.3 [0.3] × eye height. Antenna (Fig. 3K) with 20–21 [20] antennomeres. Ovipositor sheath as in Fig. 7H–I.

Lance (Fig. 7J–K) with eight annular sutures and middle sutures weakly oblique. Lancet (Fig. 8E–H) with 10 annuli, gradually narrowing apically; length of lancet from its apex to ventral

end of most basal (first) row of spines (=ctenidium) 3.2–3.4 [3.4] × maximum width of lancet; first row of spines oblique, with ventral end located anterior to dorsal end; fourth row of spines (=ctenidium+serrula) about as long second row of spines; second serrula somewhat smaller than third serrula; eighth and ninth annuli each curved, not spinose dorsally.

Male. Unknown.

Material examined. Holotype: ♀ (Fig. 1F–G), labelled “Yamada-onsen 800m, Tokachi, Hokkaido, 28–30. VI. 1995, A. Shinohara” (NSMT). Paratypes: 2 ♀, “Lot 11-J. IV-15-1937” “770” (NSMT); 1 ♀, Hokkaido, Tomakomai, 23. VI. 1959, T. Kumata (HU); 1 ♀, Hokkaido, Aizankei, 16. VII. 1960, S. Takagi (HU); 1 ♀, same locality, 15. VII. 1963, A. Nakanishi (NSMT).

Etymology. The species epithet is derived from the locality.

Distribution. Japan: Hokkaido.

Host plants. Unknown.

Remarks. *Gilpinia hokkaidoensis* is distinguished from similar species in the key below.

This species may be associated with *Abies* or *Picea*, because the holotype was collected at a site where *Abies* and *Picea* are abundant but

Pinus is not found.

***Gilpinia kojimai* n. sp.**

[Japanese name: Shima-haimatsu-habachi]

(Figs. 1I–K, 2G–M, 3L–O, 4I–L, 5I–L, 6F–G, 7L–O, 8I–L, 9I–P)

[Shima-haimatsu-habachi] (Japanese name only): Anonymous, 1986: 198; Nakamura, 2004: 33.

Female [character states of holotype in brackets]. Length 6.5–7.5 [6.8] mm. Black, with yellow markings, without metallic reflection (Fig. 1I–J). Head yellow, anteriorly with black marking between eyes (Fig. 1K); this black marking narrowly margined with brown dorsally, extending posteriorly along midline on postocellar area, and extending to malar space lateroventrally (Figs. 1K, 3M); anterior tentorial pit black; narrow or wide yellow spot present near facial groove [narrow]; malar space black; gena black, ventrally yellow; occiput mostly black. Antenna dark brown to black, basally narrowly or widely yellow to brown [widely yellow to brown]. Mandible basally brown yellow, apically red brown. Labrum brown yellow to dark brown [brown]. Palpi pale yellow or brown yellow, basally somewhat darkened. Pronotum yellow, narrowly black anteriorly (Fig. 1I–J). Mesepisternum black, with yellow marking at middle and pectus black, very often posteromedially yellow or brown [brown]. Legs brown to black; apices of coxae yellow; trochanters and trochantelli partly yellowish; apices of femora, fore and middle tibiae except for narrow apices, hind tibia except for apical fourth and bases of basal tarsomeres yellow; tibial spurs yellow to brown. Wings nearly clear hyaline; stigma pale brown, basally and marginally black; veins mostly black; in fore wing, C yellow, apically darkened, and most of section of R1 basal to stigma and most of A pale brown. Abdomen dark brown to black; first tergum black, often with yellow marking medially [entirely black]; second to eighth terga yellow anteriorly, but anterior terga not or narrowly so medially; sterna anteriorly or anterolaterally yellow [anterolater-

ally]; ninth tergum black, dorsomedially narrowly yellow, posterolaterally narrowly dark brown or widely brown [narrowly dark brown]; tenth tergum dark brown, medially yellow or brown [yellow]. Cercus black. Ovipositor sheath black; scopa yellow.

Head and thorax densely punctured, moderately shiny. Frontal area and its adjacent areas with punctures predominantly contiguous (Fig. 3L). Supraclypeal area and dorsal part of clypeus weakly punctured (Fig. 3M). Ventral part of clypeus nearly smooth. Labrum weakly and sparsely punctured. Punctures on mesonotum and mesepisternum predominantly contiguous and well defined (Figs. 4I–J, 5I–J); punctures on mesonotum rarely predominantly separated [contiguous].

Postocellar area with width 2.0–2.3 [2.1] × length (Fig. 1K). Distances between eye and lateral ocellus, between lateral ocelli, and between lateral ocellus and posterior margin of head 1.0–1.2:1.0:0.8–1.0 [1.2:1.0:1.0]; distances between eye and lateral ocellus and between lateral ocellus and posterior margin of head 1.2–1.3:1.0 [1.2:1.0]. Distance between eyes 1.9–2.2 [2.2] × eye height. Distance between torulus and eye 1.2–1.3 [1.2] × distance between toruli. Malar space 1.5–1.7 [1.6] × width of median ocellus, 0.3 × eye height. Antenna (Fig. 3N) with 19–21 [20] antennomeres. Ovipositor sheath as in Fig. 7L–M.

Lance (Fig. 7N–O) with eight annular sutures, and middle sutures weakly oblique. Lancet (Fig. 8I–L) with 10 annuli (10th annulus inconspicuous), abruptly narrowing apically beyond seventh annulus; length of lancet from its apex to ventral end of most basal (first) row of spines (=ctenidium) 2.6–2.9 [2.6] × maximum width of lancet; first row of spines nearly erect; fourth row of spines (=ctenidium+serrula) slightly shorter than second row of spines; second serrula somewhat smaller than third serrula; eighth and ninth annuli each nearly straight, less oblique than middle annuli, and not spinose dorsally.

Male. Length 5.5–6.5 mm. Black (Fig. 2G–H). Head sometimes dark brown between postocellar area and eye as in Fig. 2D. Clypeus ventrally narrowly or widely brown yellow to

brown (Fig. 2J), or entirely black. Labrum yellow, brown or black. Mandible apically red brown. Palpi pale yellow, basally somewhat darkened. Antenna dark brown to black. Pronotum posterolaterally narrowly or somewhat widely brown or yellow (Fig. 2K, M); pale area ventrally not extending beyond postspiracular sclerite, in only one specimen extending beyond this sclerite. Legs brown yellow (Fig. 2H, L); coxae basally widely black; trochanter and trochantelli narrowly or widely darkened; femora narrowly or widely brown to dark brown posteriorly, often also basally; middle and hind tibiae sometimes narrowly darkened apically. Wings as in female. Abdomen almost entirely black or dorsally with sixth or seventh to eighth terga each anterolaterally brown, ventrally dark brown to black, brown yellow to brown on sixth to seventh sterna, sixth to eighth laterotergites, wide posterior area of subgenital plate, and narrow anterolateral areas of second to fifth laterotergites (Fig. 2H) (in one specimen, also pale on subgenital plate and wide areas of fourth and fifth sterna and laterotergites, as in Fig. 2L). Basiparamere of genital capsule dark, harpe somewhat pale (Fig. 9I–J, M).

Punctuation as in female (Figs. 3O, 4K–L, 5K–L). Supraclypeal area densely punctured (Fig. 2J).

Structure as in female except for usual sexual differences. Postocellar area with width $2.2\text{--}2.6 \times$ length (Fig. 2I). Distances between eye and lateral ocellus, between lateral ocelli, and between lateral ocellus and posterior margin of head $1.0\text{--}1.1:1.0:0.6\text{--}0.7$; distances between eye and lateral ocellus and between lateral ocellus and posterior margin of head $1.5\text{--}1.8:1.0$. Distances between eyes $1.9\text{--}2.3 \times$ eye height. Distance between torulus and eye $1.1\text{--}1.4 \times$ distance between toruli. Malar space $1.4\text{--}2.0 \times$ width of median ocellus, $0.3\text{--}0.4 \times$ eye height. Antenna (Fig. 2G) with 23–26 antennomeres.

Genitalia as in Fig. 9I–P. Basiparamere in ventral view with parapenis weakly curved laterally, slightly or distinctly tapering apically, with apex narrowly rounded. Valviceps in lateral view with

distinct apical spine and ventral margin weakly or moderately rounded near apex; apical area narrow, with longest axis $3.8\text{--}4.3 \times$ shortest axis.

Material examined. Holotype: ♀ (Fig. 1I–J), labelled “JAPAN, HONSHU, Nagano pref., Yamanouchi, Mt. Yokote-yama, coll. larva on *Pinus pumila*, 30. VIII. 2012, coc. 1–8. IX., em. 17–28. IX. 2012, H. Kojima” (NSMT). Paratypes: 1 ♂, Nagano Pref., Mt. Yokote-yama, em. 30. VII. 1984, host *Pinus pumila*, H. Kojima (NSMT); 1 ♂, *do.*, but em. 2. VIII. 1984; 1 ♀, *do.*, but em. 3. VIII. 1984; 9 ♀5 ♂, same data as holotype (NSMT); 1 ♀, *do.*, No. 34; 8 ♂, offspring of No. 34, em. 15. XI. – 1. XII. 2012 (NSMT); 1 ♀, No. 44, same data as holotype (NSMT); 2 ♂, offspring of No. 44, em. 12–18. XI. 2012 (NSMT); 9 ♀6 ♂, same data as holotype, but coll. larva on *Pinus pumila*, 10. IX. 2013, coc. –17. IX., em. 28. IX.–30. X. 2013 (NSMT).

Etymology. This new species is named after Haruyoshi Kojima, who discovered this species.

Distribution. Japan: Honshu (Nagano Pref., Mt. Yokote-yama) (Anonymous, 1986).

Host plants. Pinaceae: *Pinus pumila* (Pall.) Regel (Anonymous, 1986).

Remarks. The differences between *Gilpinia kojimai* and the most similar species are shown in the key below. Anonymous (1986) already reported on the occurrence of this species (as an undescribed species) on *Pinus pumila* stands on Mt. Yokote-yama, but the species was left undescribed.

Host plants are *Pinus* for *G. kojimai* and *G. albiclavata*, while they are *Picea* for *G. abieticola*. *Gilpinia kojimai* and *G. albiclavata* are associated with the same plant, *P. pumila*, and occur in the alpine regions of central Honshu. However, the two species differ in the larval habit and distribution in addition to the slight adult differences. Larvae of *G. kojimai* are always solitary (H. Kojima, personal communication, 2014), while the larvae are solitary or gregarious in *G. albiclavata* (Hara and Nakamura, 2015). The former species has been collected only in a small area near the top of Mt. Yokote-yama in Shiga-

kogen Highland. On the other hand, the latter species is widely distributed on Yatsugatake Mountains, Akaishi Mountains, Hida Mountains, Kiso Mountains and Mt. Hakusan, but not in Shiga-kogen Highland.

Key to species of *Gilpinia abieticola* group

The following key contains the members of *G. abieticola* species group, *G. abieticola*, *G. albiclavata*, *G. hokkaidoensis* (male unknown) and *G. kojimai*, and the male of *G. hercyniae*.

1. Female..... 2
- Male..... 5
2. First abdominal tergum pale, narrowly dark along margins (very rarely widely dark with pale medial marking); antenna with 17–19 antennomeres; malar space $1.8\text{--}2.2\times$ width of median ocellus; mesepisternum with punctures usually ill defined; lance with seven sutures; lancet with nine annuli. [Pectus narrowly or mostly pale; lancet gradually narrowing apically, with length from apex to ventral end of first (most basal) row of spines $2.6\text{--}2.8\times$ maximum width and first row of spines nearly erect.] *G. albiclavata*
- First abdominal tergum predominantly dark with pale medial marking or entirely dark (Fig. 1A, F, I); antenna with 19–21 antennomeres; malar space $1.1\text{--}1.9\times$ width of median ocellus; mesepisternum with punctures well defined (Fig. 5A, C, G, I); lance with eight sutures (Fig. 7D, K, O); lancet with 10 annuli (rarely nine annuli) (Fig. 8)..... 3
3. Pectus entirely black (Fig. 1B, G); lancet narrow, length from apex to ventral end of first row of spines $3.1\text{--}3.5\times$ maximum width (Fig. 8A–H); first row of spines distinctly oblique. 4
- Pectus very often posteromedially pale (Fig. 1J); lancet wide, length from apex to ventral end of first row of spines $2.6\text{--}2.9\times$ maximum width (Fig. 8I–L); first row of spines nearly erect. [Lancet abruptly narrowing apically beyond seventh annulus.] *G. kojimai*
4. Lancet abruptly narrowing apically beyond seventh annulus (Fig. 8A–D); eighth and ninth annuli nearly straight..... *G. abieticola*
- Lancet gradually narrowing apically (Fig. 8E–H); eighth and ninth annuli curved. *G. hokkaidoensis*
5. Valvaceps with very small apical spine (Fig. 9D, G, H). [Pronotum posterolaterally with wide pale yellow area ventrally extending beyond postspiracular sclerite; subgenital plate entirely yellow to yellow brown; malar space $1.6\text{--}1.8\times$ width of median ocellus; antenna with 22–27 antennomeres.] *G. abieticola*
- Valvaceps with distinct apical spine (Figs. 9L, O–P, 10D, F). 6
6. Valvaceps with long apical spine (Fig. 10D, F); subgenital plate entirely yellow to yellow brown. [Pronotum posterolaterally with wide yellow area ventrally extending beyond postspiracular sclerite; malar space $1.5\text{--}1.8\times$ width of median ocellus; antenna with 23–28 antennomeres.] *G. hercyniae*
- Valvaceps with short apical spine (Fig. 9L, O–P); subgenital plate usually basally or entirely black. 7
7. Pronotum posterolaterally with yellow or brown area usually not extending beyond postspiracular sclerite ventrally; malar space $1.4\text{--}2.0\times$ width of median ocellus; antenna with 23–26 antennomeres. *G. kojimai*
- Pronotum posterolaterally with wide pale yellow area extending beyond postspiracular sclerite ventrally; malar space $1.9\text{--}3.0\times$ width of median ocellus; antenna with 22–24 antennomeres.

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