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Taxonomic Studies on the Halictine Bees of *Lasioglossum* (*Evylaeus*) *lucidulum* Subgroup in Japan with Comparative Notes on Some Palaearctic Species (Hymenoptera, Apoidea)[1),2)]

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Abstract The halictine bees of the *Lasioglossum (Evylaeus) lucidulum* subgroup are reviewed with descriptions of 3 new species from Japan: *L. zunaga* sp. nov., *L. longifacies* sp. nov. and *L. pumilum* sp. nov., and redescriptions of *L. kuroshio* Sakagami et Takahashi and *L. massuricum* (Bliithgen). Comparative notes on 5 Western species, *L. lucidulum* (Schenck), *L. minutissimum* (Kirby), *L. tschibuklinum* (Bliithgen), *L. semilucens* (Alfken) and *L. intermedium* (Schenck) are added to. A key to the studied species is presented.

Introduction

Sweat bees or the subfamily Halictinae are remarkable among bees, or even among animals in general, by their diversity in social behavior and nest architecture (Eickwort, 1981; Eickwort & Sakagami, 1979; Michener, 1974, 1988; Sakagami, 1974; Sakagami & Michener, 1962, Sakagami et *al.,* 1985). However, further comparative studies of these aspects are often hampered by their terrible taxonomic difficulty. Beside their enormous number of species, certainly exceeding 2,000, and the classification which often depends on subtle characteristics such as surface sculpture, etc., the following features make the categorical establishment of supraspecific grouping difficult: 1- Some major groups are rather uniform in one or more of the following characters: Venation in submarginal cells (normal or weakened), structure of tergal ends (chitinization normal or weakened), hairs on tergal ends (dense or not), coloration

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(metallic or not), apex of propodeal dorsum (= enclosure, Mittelfeld) (carinate or not). But some of these states often sporadically appears also in other groups. 2- Alternative character states given above are occasionally obscured by intermediate conditions. 3- Some species groups often form a morphospectrum, of which neighboring pairs are similar but terminal species become fairly different. Sometimes different spectra cross or partly fuse, again making the categorical distinction difficult.

The difficulties are most serious in ***Evylaeus,*** the largest, predominantly holarctic group (Ebmer, 1987) and particularly in its "carinaless complex". One of us (S.F.S., Sakagami & Munakata, 1966; Sakagami & Hayashida, 1968) tentatively divided ***Evylaeus*** in 2 ethogroups, "carinate" and "carinaless" (=non carinate in Michener, 1993). Morphologically "carinate" ***Evylaeus*** species are relatively large and propodeal dorsum apically more or less carinate, whereas carinaless ones smaller and propodeal dorsum apically not carinate, although here again distinction is not categorical. This grouping gave a fairly clear picture among the species ethologically known at that time (Sakagami, 1974). A.- Solitary, and each brood cell connected to the main burrow by means of a lateral, which is narrower and filled with soil after oviposition - ***Lasioglossum s.*** str. and carinaless ***Evylaeus.*** B.- Presence of caste-linked sociality, and cells either directly connected to the main burrow ***("Dialictus"*** and most ***Halictus s.*** str.) or forming a cluster within a cavity (most carinate ***Evylaeus*** and ***Halictus (H.) quadricinctus*** Fabricius). Corrections and additions to this grouping due to the subsequent advanced in the halictine ethosociology will be given by S.F.S. elswhere. Wamcke (1975) divided his ***"Halictus" (=*** *Halictus+Lasioglossum* in our usage) into many subgenera (carinaless ***Evylaeus*** corresponds to his ***Microhalictus, Puncthalictus, Evylaeus, Marghalictus, Pyghalictus).*** Some of these might be natural groups but some others, e.g. ***Microhalictus,*** to which the species treated in this work belong, seem to be so heterogeneous to be called subgenera that these are not adopted below. In view of the taxonomic difficulty in ***Lasioglossum (s.*** lato) mentioned above, for the time being, it may be better to use, the species group system, which is free from the nomenclatorial confusion unlike the subgeneric system.

In such a difficult group as carinaless ***Evylaeus,*** the only way to find a reliable system is the patient successive delimitation of the species groups, some of which may be inevitably conventional as milestones. Only a fraction of such groups was so far tentatively defined in the Palaearctics, e.g. the ***nitidiusculum*** group (Ebmer & Sakagami, 1985), the ***quadrinotatulum*** subgroup (Sakagami ***et al.,*** 1982), the ***leiosoma*** group (Ebmer & Sakagami, 1985), and, although of some green metallic species, the *leucopus* group (Ebmer & Sakagami, 1990).

Among the carinaless ***Evylaeus,*** all species treated below belong to the ***L. tarsatum*** group, which has, together with ***L. nitidiusculum*** and ***L. leiosoma*** groups (see above), propodeal dorsum as long as or longer than mesoscutellum. In Palaearctics Proper, no other groups have such long propodeum, although this state sporadically appears among some unrelated species scattered from the southern periphery of Palaearctics to Indomalayan region (Ebmer & Sakagami, 1985).

Leaving details for the future, the 3 mentioned groups can tentatively be distinguished as below:

The ***L. tarsatum*** group can be divided in 2 conventional subgroups, the species of which mesoscutum is smooth and shiny, with sparser puncture, and those with mesoscutum granular, with punctures denser, though interspaces often wider than diameters of punctures.

The first subgroup includes ***L. tarsatum*** (Schenck), ***L. transpositum*** (Cockerell) and also ***L.***

quadrinotatulum (Schenck) and allied 2 species, though probably forming a separate subgroup by its large size and distinct basilateral hair patches on terga 2-3. All the species treated below belong to the second *L. lucidulum* subgroup. Beside the 4 Japanese species, 5 western species, *L. lucidulum* (Schenck), *L. minutissimum* (Schenck), *L. tschibuklinum* (Bliithgen), *L. intermedium* (Schenck) and *L. semilucens* (Alfken) are synoptically redescribed later in this paper, based on the specimens gifted by P. A. W. Ebmer.

Group	Male antenna	Mesepistemum
nitidiusculum	Long, attaining mesosomal end.	Punctures virtually imperceptible, merging in the granular background.
tarsatum	Shorter, not exceeding the middle of mesoscutum	Variable but punctures perceptible, though often minute.
leiosoma	"	Punctures more distinct and interspaces shiny.

1. Metric characters

Tables 1 and 2 show some measured values of the above species.

Abbreviations of measured parts with some explanations (partly see Sakagami, 1989): **L, W** = maximum length and width; **D** = minimum distance; **BL** = body L (from antenna1 base to metasomal tip, when the body is bent, fore body and metasoma were separately measured and summed up); **WL** = L of forewing including tegula; **HW** = head W; **HL** = head L, from top of vertex to lower margin of clypeus excluding clypeal tooth (not including tooth as adopted by Bltithgen and. Ebmer. The difference by 2 methods is small in most carinaless *Evylueus* though larger in some other groups, e.g. *Lasioglossum s.* str., and many carinate *Evylaeus).* **MsW** = mesosomal W (between outer rims of tegulae); **MtW** = metasomal W; **UOD, MOD, LOD** = upper, maximum and lower interorbital W; **EL** = **eye** L; **CAL** = clypealveolar L; **CPL** = clypeal L; **ACL** = L of apical part of clypeus exceeding lower orbital line (in all 3 cases, excluding clypeal tooth as in HL); **EW, GW** = **eye** and gena W seen laterally, keeping both antenna1 bases at the same plane); **SPL** = scape L; **MCL, MTL, PDL** = mesoscutellum, metanotum and propodeal dorsum L (first the last 2 parts are measured. Both anterior and posterior margins of propodeum are kept at the same place, so that anterior margin of mesoscutellum is seen slightly inclined downward. After the measurement of propodeal and metanotal lengths, the focus is adjusted without moving the specimens to have clearer image of the anterior margin of mesoscutellum); **WD** = wing diagonal L (from *M-Cu* bifurcation to inner tip of marginal cell); **OOD** = ocellocular D; **IOD** = interocellar D; **VOD** = verticorbital D (tangential D between summit of vertex and supraorbital line); **F*n*L, F*n*W** (L and W of flagellomere *n).*

Tables 3 and 4 give some important ratios between 2 body parts. Figure 1 shows the ratio BL/WL in both sexes of the studied species. The ratio is affected by artificial variation of BL,

due to the degree of bending of metasoma against mesosoma. Nevertheless, Fig. 1 clearly shows the descending size order among 4 Japanese species as *ku>lo>zu>pu* in both sexes (except *ku≥lo* in male), and between the conspecific sexes (clearly female > male). The studied Japanese species were on the average larger than the compared western species.

Figure 2 presents the ratio HW/HL, one of the most important metric characters in the bee taxonomy. As seen by the distance from the isometric line, most studied species are HW<HL in both sexes, particularly in *longifacies* and *pumilum* (both sexes) whereas HW=HL in *kuroshio* and *semilucens*.

2. **Non-metric features common to the studied species**

Many if not all of the following features may be also common to other allied species, and will become the common features of the species group when it would be definitely established. For convenience sake, some features common at higher taxonomic levels are included. Terminology mainly follows Michener (1944, 1965) and Eickwort (1969). Important diagnostic features are italicized. Some abbreviations: **PP** = punctures, **IS** = interspaces between punctures (IS 0.5 = 1/2 of the diameter of punctures), **T*n***, **S*n*** = metasomal tergum and sternum *n*, **F*n*** = flagellomere *n*.

Female. Color: Black, not *metallic.* Mandible apically reddish brown. Legs dark brown, slightly paler at articulations. Tegula brown, marginally transparent. Wings transparent, slightly infuscate, veins brown to dark brown. Metasoma blackish brown, tending either black or dark brown. *Tergal margins slightly paler but not semitransparent.* **Color** hue often varies intraspecifically and possibly with slight specific differences, e.g. in *longifacies* metasoma relatively melanic, often showing marked contrast to paler tergal margins. Femur-tibia1 junctions often paler in *lucidulum, tschibuklinum* and *minutissimum* but less in larger species *(longifacies* and *kuroshio).*

Pilosity: Pale, generally whitish *without* admixture of dark hairs. *Plumosity poor.* Tomentum developed only on pronotum laterally and around pronotal lobe. Basilateral patches on T2-4 often (T2) or usually (T3-) hidden by T*n*-1. (Undetected in only one female examined of *L. tschibuklinum).*

Facial hairs variable. Genal appressed hairs fine, dense but poorly plumose, not to only slightly tomental, posteriorly with long semierect hairs. Hair length in *zunaga* (similar in other spp. with size-linked differences): Vertex medially (erect) 100μ (short ones) to 175μ (longer ones), ocellocular and facial area (semiappressed) 75μ, supraclypeus to clypeus (semiappressed) 150-175μ, clypeal margin 200μ, paraocular area along inner orbit (appressed) 75-100μ, gena (appressed) 75μ. *Pronotal dorsum glabrous* (except *kuroshio* and *intermedium).* Mesoscutal hairs, both long-erect ones and short-semiappressed ones, sparse, simple to vestigially plumose, not covering surface, shorter ones recognizable only seen laterally, mesoscutellum similar but erect hairs longer, *metanotal tomentum confined to anterior margin* (or virtually absent in *zunaga). Mesepisternum with both long, erect hairs and finer short hairs sparsely, tomentum virtually absent.* Tegula glabrous except sparse, appressed anterior hairs. Femoral scopa of the usual *Evylaeus* type.

Metasoma. T1 laterally with sparse fringe, disc with very sparse, fine, inconspicuous hairs.

T2-4 with hairs gradually denser on disc, postmarginal area with rows of stout, sparse in parallel postward directing hairs not exceeding tergal margins, on T2 only laterally, on T3 throughout the margin and on T4 similar but merging in preceding discal hairs. *Except* zunaga, *tergal margin with dense, fine oblique-outward directing "fine marginal hairs" on T2-4.* (Figs. 3-9).

Structure. *Head usually longer than wide, sometimes HW=HL* (Table 3, Figs 2, 10-15). Occiput behind not carinate, IOD=OOD. Supraclypeus mildly raised, higher than clypeus. Clypeus below smooth and shining with coarse, ill-defined, often elongate PP as in many halictines. Clypeal tooth very mild. Seen laterally gena distinctly narrower than eye (Table 3), without process, superficially granular and rather shiny posteriorly, striate longitudinally as in many halictines, with sparse, ill-defined PP (±25μø). Labrum (Fig. 16, examined in *zunaga* and *kuroshio)* as in many other consubgeners; median tubercle parallel-sided, with rounded apex; apical margin transverse, medially triangularly ending in narrow process. Mandible bidentate. Mouth parts as in other consubgeners, maxillary palpi and labial palpi 6- and 4- segmented respectively, each segment not particularly elongate. Scape attaining mid-ocellus or not.

Mesosoma: Except *kuroshio,* pronotum anteriorly homogeneously granular; anterior surface of lateral lobe smoother, shiner with superficial sculpture; lateral ridge represented by very mild elevation; above concave, lateral angle obtuse and outer margin mildly incurved. Mesoscutum anteriorly normal, neither truncate nor protruded; *granular, dull with fine, moderately dense PP,* posteriorly smoother. Mesoscutellum sculptured as on mesoscutum, either weakly or imperceptibly depressed medially; submedian elevation medially shiner with sparser PP. Metanotum homogeneously granular. Hypoepimeral area weakly shiny, the rest of mesosomal side dull, weakly but perceptibly punctured; accompanied with irregular ridges, being weak except in *kuroshio* (Fig. 17). Metepisternum transversely striated as in many halictines. Tegula semitransparent, finely and superficially granular. Basitibial plate elongate oval, apex mildly pointed, margin complete. Inner hind tibia1 spur variable (Figs. 18-27), *though all Japanese species with several slender teeth shorter than spur's width.* Second and third transverse cubital veins fairly weakened.

Propodeum with dorsum usually slightly longer, but in some species slightly shorter than mesoscutellum (Table 3, MCL: MTL: PDL), *basally slightly slanting, medially nearly horizontal and apically changing to declivity with round but distinct angle, not demarcated with horizontal carina, basally with longitudinal parallel or slightly diverging ridges, either attaining dorsal end or not, only rarely anastomosing* (except in some females of *kuroshio)* (Figs. 28 - 34). Shield laterally carinate on lower 1/2 - 2/3, homogeneously granular, dull to slightly shining.

Metasoma elongate oval, *T1 smooth and shining, with very sparse and fine punctures, in some species with fine partial lineolation.* T2,3 basally (except *L. kuroshio)* not much depressed, *with lineolation and PP more widespread and denser than on T1 in some species* (Figs. 3-9); lateral convexities on T2,3 mild, postmarginal area not much depressed.

Male. Color: As in female. Tegula pale brown. Clypeus below transversely or flat-conically yellow (sometimes tending white yellow in *L. kuroshio).* Further the following parts either dark or pale (= paler brown or yellow). Labrum entirely darker or partly to entirely pale. Labrum entirely dark or partly to entirely pale. Mandible medially dark or pale. Flagella dark to pale brown. Fore tibia1 articulation dark brown to yellow. Tarsi dark to pale brown.

Pilosity: Hairs generally more whitish than in female in all species. On areas with dense hairs,

much denser, though variable among species. Density of plumose tomentum, ***pumilum,*** *minutissimum,* ***lucidulum > kuroshio > zunaga, longifacies.*** Mesosomal hairs (including pronotal and propodeal tomenta only present in ***kuroshio)*** without conspicuous sexual difference, except for metanotal hairs, being denser in some species. Metasomal hairs: generally as in female. Hairs on discs of T2-4 antero-laterally sparser, rather subappressed and oblique-postward directing. Finer "marginal hairs" far sparser to virtually absent. Sternal hairs issuing from posterior half, simple, semierect to semiappressed.

Structure: Generally = female. Facial and paraocular PP coarser, particularly in *L.* ***zunaga*** and ***longifacies,*** tending to reticulate. F1 attaining mid ocellus. Mesoscutal and - scutellar IS generally wider and shiner. Basitibial plate marginally not sharply demarcated. Hind distitarsus D1≥ D2. Veins slightly less reduced > female (= in ***kuroshio*** and *minutissimum*, distinctly less reduced > female in *pumilum*). Metasoma only slightly more elongate > female, terga smoother and shiner, and sculpture more superficial. Lateral convexities on T2-4 slightly more distinct. T7 apically semilunarly depressed with apical ridge. Visible sterna without deformation. Sterna S7,8 and genitalia as in Figs. 35 and 36. S7 with median lobe parallel-sided and S8 flat-conical. Gonobase short, transverse, semiparallel-sided. Gonocoxite about 3 times longer than gonobase, incompletely following gonobasal contour, outer margin mildly angulate at apical 1/3.

Sexual differences in the halictine bees.

Sakagami & Maeta (1990) enumerated 12 secondary sexual differences widespread in halictine bees. Here these features are rearranged with inclusion of some additional items. Each item is cited by male features. Asterisks are features widespread in various bee groups and double asterisked are those seen in halictines only in particular groups.*)

1* - Body smaller and slender, less robust.
2 - Clypeus below often with yellow marks.
3* - Tibiae and tarsi often paler.
4* - Facial hairs denser and more plumose.
5 - Basal tergal fasciae often less developed.
6 - Submarginal cells with sparser setae.
7 - Punctures coarser and IS smoother.
8* - Eyes larger.
9* - Flagella longer and scape shorter.
10* - Mandible edentate.
11 - Labrum simpler.
12** - Head gigantic in larger males.
13** - Veins *tc* 2-, 3 less reduced.
14 - Basitibial plate reduced.
15 - Inner hind tibia1 spur edentate (exceptions: ***Sudila,*** *Nesohalictus*).
16 - Metasoma more slender.
17** - Tergal convexities more conspicuous.
18 - Tergum V without pseudopygidial area (Eickwort, 1969).

** Seen only in limited groups.

1) All species treated in this study exhibit all these features except 12 and 17.

Gonostylus simple, either mammiform, conical or more slender, with spicules and rather sparse hairs. Ventral retrose lobe maximally about 1/2 long of gonocoxite, tongue-like, apex mildly pointed to obliquely truncate, with or without spicules, and only in *L. kuroshio* densely haired.

3. Descriptions and records of Japanese species

The 3 Japanese species to be newly described below have so far been cited in some faunal papers under the following abbreviations given by one of us (S.F.S.), who identified at least some specimens collected by the authors: *Lasioglossum pumilum* sp. nov. = *L.* (El.= Carinaless *Evylaeus)* sp. 3; *L. zunaga* sp. nov. = *L. (El.)* sp. 4; *L. longifacies* = *L. (El.)* sp. 5. All these records are cited below for each species, to complete geographical distribution so far known, although not all examined specimens are registered as paratypes.

The holotypes and some paratypes are to be deposited in Entomological Institute, Hokkaido University, Sapporo and other paratypes are in Entomological Laboratory, Kyushu University, Fukuoka, A. W. Ebmer's collection in Linz, Austria and some other institutions, or to be returned to private collection of the owners.

Lasioglossum (Evylaeus) zunaga sp. nov.

(Figs. 1, 2, 4, 10, 18, 34, 35, 43, 44)

Lasioglossum (carinaless *Evylaeus)* sp. 4: Sakagami & Fukuda, 1972: 6; Sakagami & Fukuda, 1973: 242; Fukuda et *al.,* 1973: 163; Sakagami *et al.,* 1974: 33; Yamauchi *et al.,* 1974: 223; Usui *et al.,* 1976: 228; Yamauchi *et al.,* 1976: 416; Uehira *et al.,* 1979: 49; Ishii & Yamane, 1981: 47; Munakata & Kudo, 1981: 125; Yamauchi *et al.,* 1982: 420; Munakata & Kobayashi, 1983: 17; Munakata, 1984: 71; Haneda, 1985: 314; Okazaki *et al.,* 1986: 82; Munakata *et al.,* 1987: 22; Yamada & Sakagami, 1988: 15; Yamada *et al.,* 1990: 38; Haneda, 1990: 7; Kato *et al.,* 1993: 164.

Female. BL 4.8-5.7 mm, WL 4.3-4.8 mm (Fig. 1).

Color: Flagella below brown to dark brown.

Pilosity: *Head:* Paraocular hairs and genal appressed hairs simple to poorly plumose, not hiding surface. *Mesosoma: Pronotum frontally and dorsally not tomented.* Mesoscutal long hairs 100-125μ, shorter ones $\pm$25μ. *Metanotum with sparse, fine, inconspicuous hairs, tomentum virtually absent. Pleural hairs not much plumose. Propodeal shield above virtually glabrous, below with sparse, erect plumose hairs* (to 200μ). *Metasoma:* T_1 virtually glabrous, $T_{2,3}$ with hairs on disc and postmarginal area very sparse, *T_3 without "marginal fine hairs"* (Fig. 4).

Structure: *Head:* HL/HW = 1.08 $\pm$ 0.06 (1.05-1 .11, n=10, Table 2, Fig. 2). *Vertex uniformly outcurved, laterally less arcuate* > *L. pumilum* (Figs. 10 vs. 13), ocellus $\pm$1/2 of its short axis below vertex, granular, dully shining, with PP 20-25μ and IS f2.0 seen laterally occiput roundly bending. Ocellocular area superficially granular, rather shining with PP 20$\mu\phi$ and IS 1.0 or more. Frons weakly raised, frons, face, paraocular area coarsely granular and dull, with PP 15$\mu\phi$ and IS 1 .0 or less, tending microreticulate. On paraocular area PP slightly sparser (IS= 1 .0-2.0), below sculpture superficial and IS rather shiny as in many *Evylaeus* spp. Supraclypeus and clypeus above granular and dull, with sparse, ill-defined PP ($\pm$23$\mu\phi$) and IS 1 .O-, on supracly-

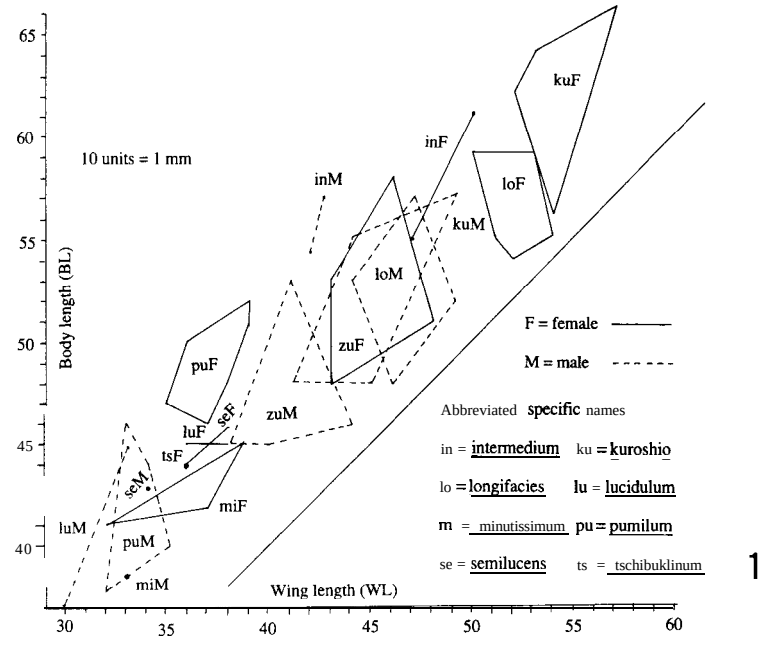


Fig. 1. Body length/wing length ratios of the studied halictine species. Abbreviated specific name codes will be used subsequently in both figures and text.

peus medially 2.0. Scape attaining middle of mid ocellus. *Mesosoma*: Pronotum anteriorly granular and dull, along upper margin shiner, with superficial sculpture. *Mesoscutal PP 12-25μφ,* IS = 1.0-2.0, homogeneously granular and dull. Mesoscutellum similarly sculptured, medially very weakly depressed, submedian elevation sometimes shiner with sparser PP. ***Metepisternum weakly and irregularly macroreticulate. Inner hind tibial spur with 4-5 teeth, basalmost one as wide as spur*** (Fig. 18). ***Propodeum: PDL/MCL = 1.08 ± 0.06 (1.00-1.14, n=10).*** Dorsum homogeneously granular and dull, ***ridges spaced 25-50μ, attaining ±1/2 of dorsal length, neither branching nor anastomosing*** (Fig. 34). ***Metasoma: Tl with very fine PP, virtually glabrous, T2 with fine striation and sparse PP, medially sparser, postmarginal area striate. T3 similar but basally more extensively striate*** (Fig. 4).

Male. BL 4.5-5.3 mm, WL 3.8-4.2 mm.

Color: *Labrum* ***above yellow; sometimes pale brown, below darker. Mandible medially yellow to pale brown.*** Flagella brown to dark brown. ***Fore tibia1 articulation pale brown or yellow. Tarsi pale brown to yellow.***

Pilosity: Similar to female except those given in common features but generally denser, particularly on paraocular area, mesoscutellum, and metanotum anteriorly. ***Head:*** Hairs on vertex, ***paraocular urea,*** gena and along antenna1 socket, both appressed and erect ones, ***distinctly plumose but still only incompletely hiding surface.*** Facial hairs semierect. ***Mesosoma:***

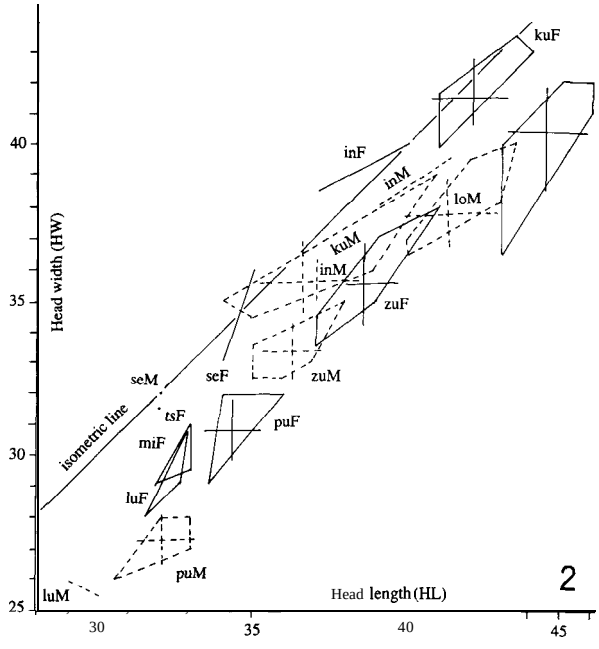


Fig. 2. Head width/length ratios of the studied species (names and codes as in Fig. 1). In 4 Japanese species, x±SD are shown in both sexes (values and *n* given in Tables 1 and 2).

Mesoscutal long and short hairs 150μ and 60μ, respectively; metanotal tomentum occupying anterior 1/3 "marginal fine hairs" on T2,3 absent as in female.

Structure: ***Head:*** HL/HW = 1.08 ± 0.02 (1.04-l. 12, *n*=10, Table 3). As in female but facial and paraocular PP coarser with IS narrower, more tending to microreticulate. Clypeal sculpture more superficial, seen shiner. *Mesosoma*: As in female but generally IS wider and shiner, especially on mesoscutellum. PDL:MCL=1. 11 ± 0.06 (1 .00- 1.17, *n*=10), mesoscutellum medially seldom depressed. ***Metasoma:*** Basal depression on T2 weak as in female. ***Gonostylus mammiform, with sparse, short hairs and sparser longer ones. Ventral*** *retrose* ***lobe*** *parallel-sided, apically* ***obliquely truncate, without hairs and spicules*** (Figs. 43, 44).

Distribution: Japan (Hokkaido: Rishiri Is., Soya, Teshio, Sorachi, Kamikawa, Kushiro, Tokachi, Ishikari, Oshima Districts; Honshu: Aomori, Ibaraki, Yamanashi, Gifu, Fukui Prefs.).

Floral records: ***Anemone flaccida, Taraxacum officinale, Viola grypoceras, Kerria japonica, Rorippa islandica, Spiraea miyabei,*** *Potentilla* ***fructicosa*** var. *rigida,* ***Heracleum*** *dulce,* ***Deutzia gracilis, Thymus vulgaris, Lathyrus japonica, Rosa*** *hybrida,* ***Rosa rugosa, Ranunculus*** *silerifolius,* ***Ranunculus*** sp., ***Sedum kamtschaticum, Rudbeckia laciniata, Geranium***

nepalense ssp. ***thunbergii; Stellaria media, Allium fistulosum, Trifolium repens, Brassica chinensis, Brassica napus, Barbarea orthoceras, Rugularia hodgsonii, Pruella vulgaris*** ssp. ***asiatica, Malus pumila*** var. ***domestica, Anthriscus aemula, Cardamine flexuosa, Picris hieracioides*** ssp. ***japonica.***

Type specimens: Holotype: female, Hokkaido University Botanical Gardens, Sapporo, Hokkaido, 4. vi. ***1959, Deutzia gracilis (S.*** F. Sakagami). Paratypes (Females = F, Males = M): [Hokkaido]: Sapporo: Hokkaido Univ. Bot. Gardens (S. F. Sakagami): 1M, vii. 1958 (emerged from nest, no metasoma); 1959: 1F, 30. iv.; 2F, 6. v.; 2F, 7. v.; 2F, 11. v.; 3F, 13. v.; 1F, 1. vi.; 1F, 4. vi.; 2F, 10. vi.; 1F, 15. vi.; 1F, 21. vi.; 2F1M, 8. vii.; 3F, 20. vii.; 1F, 17. viii.; 1F, 7. ix.; 1F, 14. ix.; 1F, vii.(emerged from nest); Hokkaido Univ. Campus, 1959 (S. F. Sakagami): 2F, 1. v.; IF, 6. v.; 1F, 26. v.; 1F, 27. v.; 1F, 6. vi.; 6F, 11. vi.; 1F, 18. vi.; 2F, 5. vii.; 1F, 10. vii.; 1M, 3. ix.; Mt. Moiwa, Sapporo (H. Kawano): 1F, 3. vi. 1970; 3F, 7. vi. 1970; Teshio: 13F1M, KamiOtoineppu, 6. ix. 1970 (S. F. Sakagami & H. Fukuda); Kushiro: 8F, Kiritappu Highmoor, 1972 (Y. Uehira); 1F, Akkeshi, 14. vii. 1967 (T. Matsumura); 2F1M, Tenneru, Kushiro, 1968 (E. Ohtsuka); Abashiri: 1F, HamaKoshimizu, 10. vi. 1966 (H. Fukuda ***et al.);*** Kamikawa: 3F, Yukomanbetsu, 9. vii. 1968 (K. Yamauchi & T. Matsumura); 2F, Inosawa, Asahikawa, 13. vii. 1969 (H. Fukuda); 1F, Asahiyama, Asahikawa, 13. vii. 1969 (H. Fukuda); Sorachi: 1M, KitaMoshiri, 10. ix. 1969 (H. Fukuda). [Honshu]: Aomori Pref. (M. Yamada):1F, Mt. Kudoji, 7. vi. 1981; 2F, Mt. Bonju, 18. vii. 1982; 1F, 15. v. 1983; 1F, Mt. Iwaki, 28. vi. 1981; 2F, Mt. Hakkoda, 500-1000m, 22. vii. 1984; Gifu Pref.: 1F, Tokuyama, 12. vi. 1977 (K. Yamauchi); 1F, Nigorigo, 1. viii. 1978 (T. Morimoto); 1F, Akigami, 23. v. 1978 (T. Morimoto); Fukui Pref. (Y. Haneda): 1M, Hokeiji, Ohno, 12. viii. 1971; 1M, Asahi, Ohno, 30. vii. 1976. Beside many other specimens were examined but not registered as paratypes, because either mutilated, dirty or used for dissection. (Paratypes preserved in Ebmer's collection: All Sappro: Bot. Gardens: 1F, 6. v. 1959; 1F, 11. v. 1959; Univ. Campus: 2F, 1. v. 1959; 1F, 26. v. 1959).

Lasioglossum (Evylaeus) longifacies sp. nov.

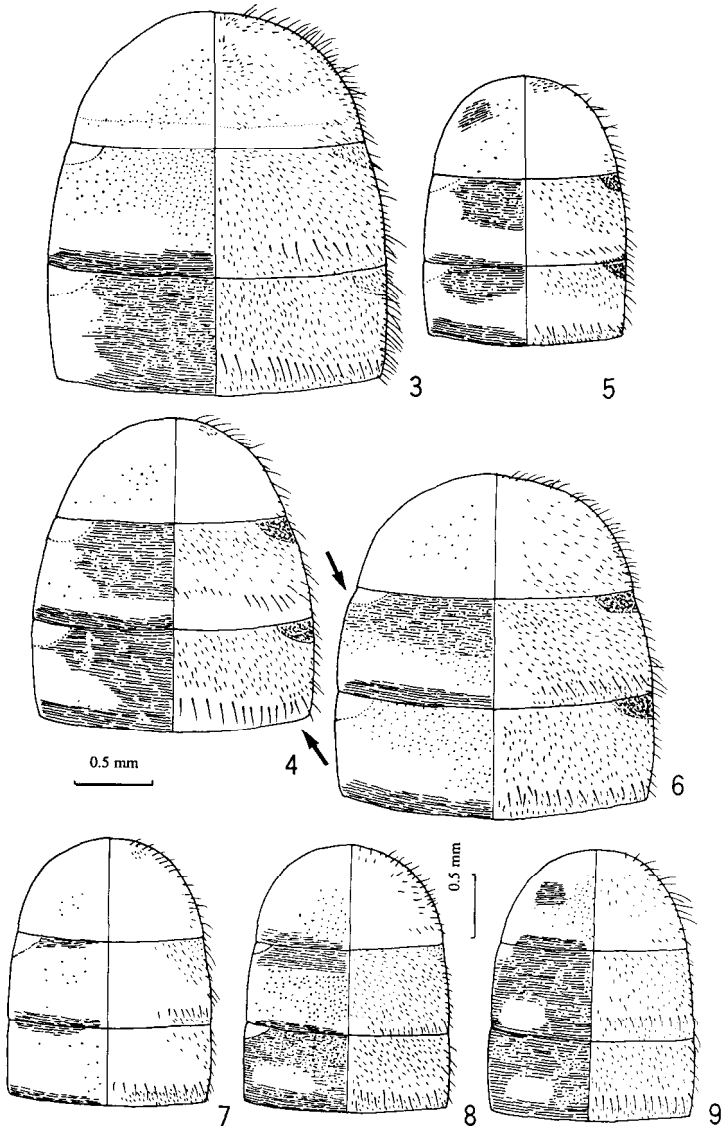
(Figs. 1, 2, 3, 11, 20, 29, 41, 42)

Lasioglossum (carinaless ***Evylaeus)*** sp. 5: Sakagami & Fukuda, 1972: 5; Sakagami & Fukuda, 1973: 247; Sakagami ***et al.,*** 1974: 33; Yamauchi ***et al.,*** 1974: 223; Usui ***et al.,*** 1976: 228; Munakata & Kudo, 1981: 125; Ishii & Yamane, 1981: 49; Yamauchi ***et al.,*** 1982: 420; Munakata & Kobayashi, 1983: 17; Munakata, 1984: 71; Iho & Yamane, 1985: 61; Haneda, 1985: 315; Munakata, 1986: 28; Okazaki ***et al.,*** 1986: 82; Munakata ***et al.,*** 1987: 22; Yamada & Sakagami, 1988: 15; Inoue ***et al.,*** 1990: 467; Kato ***et al.,*** 1990: 370; Haneda, 1990: 7, 9; Yamada ***et al.,*** 1990: 38; Haneda, 1991: 35.

Female. BL 5.4-5.9 mm, WL 4.9-5.5 mm (n=10).

Color: Flagella below dark brown.

Pilosity: ***Head:*** Paraocular hairs and genal appressed hairs simple to poorly plumose, not hiding surface. ***Mesosoma: Pronotum frontally and dorsally not tomented.*** Mesoscutal long hairs 150-175μ, shorter hairs 30-50μ. ***Metanotum without proper tomentum, but short, erect anterior hairs denser, hiding surface.*** Pleural hairs not much plumose. ***Propodeal shield*** = *zu-*



Figs. 3-9. Sculpture (left) and pilosity (right) of T1-3 (females) of *L. longifacies* (3), *zunaga* (4), *pumilum* (5), *kuroshio* (6), *lucidulum* (7), *minutissimum (8)* and *tschibuklinum* (9), shown on the contour figure of metasoma of *L. pumilum* (Fig. 5).

naga, hairs to 250μ. *Metasoma: T1 basally with sparse but distinct lateral patch, disc sparsely but distinctly haired,* postmarginal area with sparse hairs. *T2,3 with hairs on disc and "marginal fine hairs" fairly dense* (Fig. 3).

Structure: *Head:* HL/HW = 1.10 ± 0.03 (1.07-1.15, *n*=10, Table 2, Fig. 11), *longer than in zunaga* (Fig. 2); *vertex and occiput* = zunaga *in shape and sculpture;* lateral ocellus about 1/2

of its short axis below vertex; frons weakly raised; frons, face, paraocular area coarsely granular and dull with PP 15$\mu\phi$ and IS $\leq$1.0, tending microreticulate, on paraocular area slightly coarser (IS = 1.0-2.0), below sculpture superficial and IS rather shiny; supraclypeus and clypeus above = zunaga, but the former medially with IS smoother and slightly shiner; *scape* ***attaining middle of mid ocellus. Mesosoma:*** Pronotum = ***zunaga,*** but along upper margin smoother and shiner; ***mesoscutal PP*** *20-25μ,ϕ* ***IS*** = *0.5-1.0,* ***denser > zunaga,*** sculptured = ***zunaga;*** *mesoscutellum* = zunaga, ***but submedian elevation with PP homogeneous, less sparser and IS less shiny >*** zunaga; ***mesepisternum =*** zunaga; ***inner hind*** *tibial* ***spur with 6-8 teeth*** (Fig. 20). Propodeum: PDL/MCL = 1.07 $\pm$ 0.05 (1.00-1.12, *n*=10); dorsum homogeneously granular, ***ridges about equidistant, exceeding 1/2 of dorsal length, occasionally branching but not anastomosing*** (Fig. 29). ***Metasoma:*** *T1* ***on disc with PP sparse but denser than in other Japanese relatives;*** *T2* ***densely punctured on basal 1/2, postmarginal area striate,*** *T3* ***similar but basally also striate*** (Fig. 3).

Male. BL 4.8-5.7 mm, WL 4.4-4.9 mm (*n*=10).

Color: ***Paler parts variable*** (cf. Variation): *Labrum* ***yellow to yellow brown or brown to dark brown; mandible medially widely or narrowly yellow or dark brown;*** flagella below pale brown, sometimes darker; ***fore tibia1 articulation yellow, rarely pale brown;*** *tarsi* ***yellow, to pale or dark brown.***

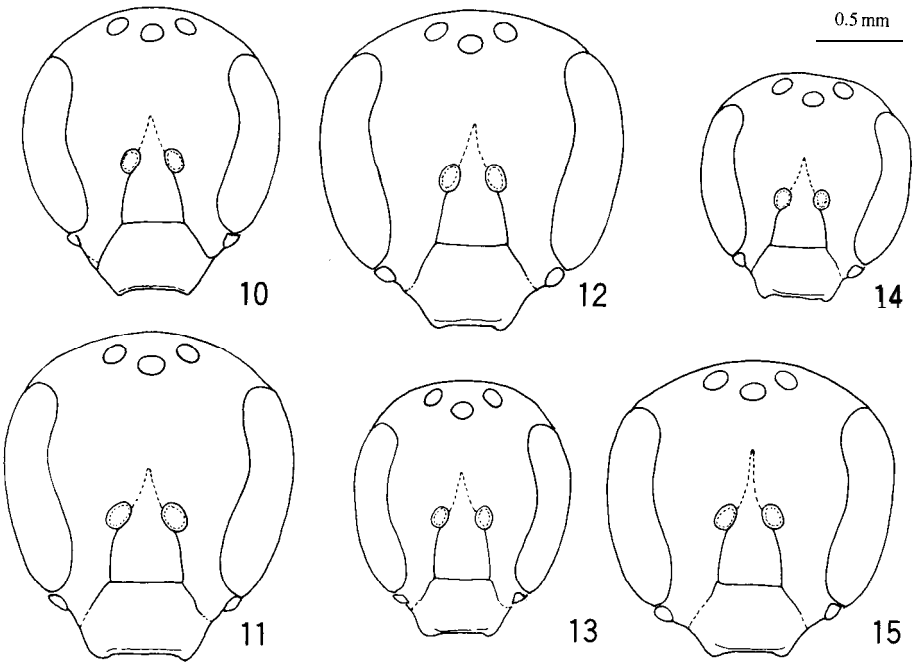
Pilosity: Generally as in ***zunaga*** male, but sexual differences weaker. ***Head:*** Compared with ***zunaga,*** vertex less plumose, facial hairs more appressed though still not hiding surface; para-antenna1 and ***paraocular hairs short relative to body size, the latter distinctly more plumose >*** zunaga, ***hence more contrasting to clypeus and supraclypeus,*** though with individual variation; genal appressed hairs sparser, but more plumose ***> zunaga. Mesosoma:*** Mesoscutal short and long hairs 150 & 60μ, respectively, ***metanotal tomentum occupying anterior IN. Metasoma:*** "Marginal fine hairs" present though sparser > female.

Structure: ***Head:*** HL/HW = 1.08 $\pm$ 0.02 (1.06-1.13, *n*=10, Fig. 2); Similar to female and ***zunaga*** male, Ocellocular area more homogeneously sculptured with no ample smooth area along mid ocellus, reticulation on face and paraocular area more conspicuous. ***Mesosoma:*** Similar to female but IS generally wider and smoother, e.g. on mesoscutum and mesepisternum homogeneously wide; PDL/MCL = 1.08 $\pm$ 0.06 (1.00-1.20, *n*=10); propodeal ridges slightly longer ***> zunaga. Metasoma:*** Basal depression on T2 as weak as in female, ***gonostylus mammiform but more cone-like >*** zunaga, ***with fine short hairs but devoid of long hairs; ventral*** *retrose* ***lobe =*** zunaga ***but medially widened*** (Figs. 41, 42).

Color variation: Table 5 presents the relation between color variation in some body parts of males and the localities arranged southward. All 5 males from Sorachi District (KitaMoshiri) are melanic in all examined parts and a single male from Kyoto clearly flavinic. In other localities a weak southward flavinism is traced, but the number of examined specimens is still small to confine the above trend.

Distribution: Kurile Is. (Itrup Is.), Japan (Hokkaido: Rishiri Is., Soya, Teshio, Kamikawa, Abashiri, Sorachi, Kushiro, Tokachi, Ishikari, Iburi, Oshima Districts; Honshu: Aomori, Miyagi, Ibaraki, Chiba, Yamanashi, Gifu, Fukui, Kyoto, Shimane Prefs.).

Floral records: ***Allium fistulosum, Deutzia gracilis, Potentilla fruticosa*** var. *rigida,* ***Rudbeckia laciniata, Stellaria media, Taraxacum*** *officinale,* ***Lamium album*** var. ***barbatum,***



Figs. 10-15. Head seen frontally (females) of *L. zunaga* (10), *longifacies* (11), *kuroshio* (12), *pumilum* (13), *lucidulum (14)* and *intermedium* (15).

Geranium nepalense ssp. *thunbergii, Rosa rugosa, Fragaria xananassa, Trifolium repens, Picris hieracioides* ssp. *japonica, Aster ageratoides* ssp. *ovatus, Aster glehnii, Geum japonicum, Viola* sp., *Lysimachia clethroides, Euphorbia pekingensis* var. *japonensis, Achyranthea japonica, Prunella vulgaris* ssp. *asiatica, Cardiandra alternifolia.*

Type specimens: Holotype female, Hokkaido Univ. Campus, Sapporo, 6. vi. 1959, *Allium fistulosum.* Paratypes: [Hokkaido]: Sapporo: Hokkaido Univ. Bot. Gardens, 1959 (S. F. Sakagami): 1F, 15. vi.; 1F, 29. vi.; 1M, 17. viii.; 1M, 25. viii.; Hokkaido Univ. Campus, 1959 (S. F. Sakagami): 1F, 8. v.; 1F, 15. v.; 1F, 23. v.; 1F, 27. v.; 1F, 6. vi.; 1F, 25. vi.; Mt. Moiwa, Sapporo, 1972 (H. Kawano): 1F, 20. v.; 1F, 23. v.; 1F, 7. vi.; 1F, 15. vi.; 1F, 15. vi.; Ishikari: 2F, Tobetsu, 19. v. 1974 (M. Ishikawa); Sorachi: 5M, KitaMoshiri, 14. ix. 1969 (S. F. Sakagami & H. Fukuda); Kamikawa: 1F, Inosawa, Asahikawa, 13. vii. 1969 (H. Fukuda); 2F, KamiDaiba, Asahikawa, 24. v. 1985; 1F, 8. ix. 1986 (T. Inaoka); 1F, SugatamiNoIke, Mts. Daisetsu, 1600m, 22. vii. 1967 (H. Fukuda); Kushiro: 6F6M, Tenneru, Kushiro, 1968 (E. Ohtsuka). [Honshu]: Aomori Pref. (M. Yamada):1F, Zatoishi, 19. v. 1984; 1F, Mt. Kuromori, 25. vii. 1981; IF, Mt. Bonju, 18. vi. 1982; 1F, Mt. Chobo, 12. vi. 1984; 1F, Amagamori, Misawa, 17. vi. 1986; Miyagi Pref. Rifucho (K. Goukon): 1F, 4. v. 1980; 1F, 13. vii. 1980; 1F, 24. vii. 1980; 1M, 24. vii. 1980; 1F, 31. viii. 1980; Ibaraki Pref., Mt. Gozenyama, 1976 (M. Kitsukawa): 1M, 22. vii.; 1M, 30. viii.; 1M, 7. ix.; Chiba Pref.: 1M, Mt. Mitsuishi, 29. ix. 1984 (0. Pellmyr); Gifu Pref.: 2F,

Akigami, 29. vi. 1978 (Y. Morimoto); 1M, Takawashi, 7. x. 1974 (K. Yamauchi); Fukui Pref., (Y. Haneda): 1M, Kurodani, Ohno, 30. vi. 1973; 1M, ShimoUchinami, Ohno, 3. viii. 1974; IF, 20. vii. 1973; Kyoto Pref.: 1M, Ashu, 24. ix. 1984 (M. Kato); Shimane Pref.: 2F, Mt. Oyorogi, Point I, 5. viii. 1990 (Shimane Univ. staff). (Paratypes in Ebmer's collection: Sapporo: Bot. Garden, 1959 (S. F. Sakagami,: 1F, 6. v.; 1F, 17. vi.; 1F, Sappro Univ. Campus, 18. vii. 1959 (S. F. Sakagami); 1F1M, Mt. Gozenyama, Ibaraki Pref., 2. ix. 1976 (M. Kitsukawa); 2F, Itrup, Kurile Is., 14. vii. 1976).

Lasioglossum (Evylaeus) pumilum sp. nov.

(Figs. 1, 2, 5, 13, 19, 32, 45, 46)

Lasioglossum (carinaless ***Evylaeus)*** sp. ***3:*** Sakagami & Fukuda, 1973: 247; Yamauchi ***et al.,*** 1974: 223; Usui ***et al.,*** 1976: 228; Yamauchi ***et al.,*** 1982: 420; Munakata, 1984: 71; Munakata, 1986: 28; Haneda, 1985: 314; Yamada *et al*., 1990: 38; Haneda, 1990: 7, 9; Haneda, 1991: 35; Saito ***et al.,*** 1992: 157.

Female. BL 4.2-5.2mm, WL 3.5-3.9mm (n=10). The smallest known Japanese bee.

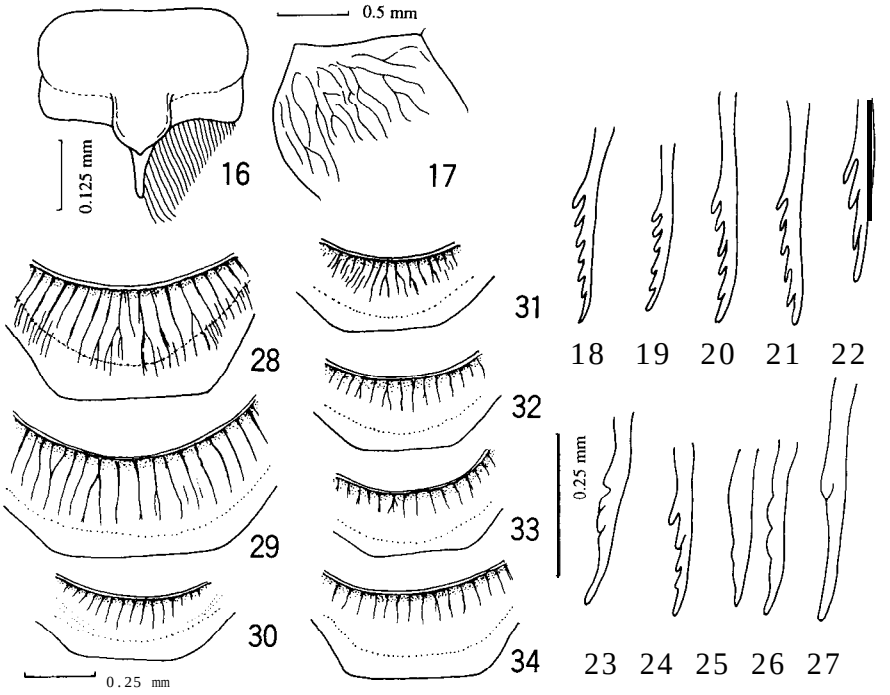
Color: Flagella brown, apically below paler.

Pilosity: ***Head:*** Paraocular hairs slightly plumose, incompletely hiding surface; genal appressed hairs poorly plumose. ***Mesosoma: Pronotum dorsally only anteriorly tomented narrowly (often absent), whereas frontally not.*** Mesoscutal long erect and short appressed hairs 100 and 25μ, respectively. ***Metanotal tomentum represented by anterior hairs slightly denser than in*** longifacies. ***Pleural hairs, especially on metapleuron more plumose than in other species, particularly than in*** zunaga ***and*** longifacies. Propodeal shield = ***longifacies*** (hairs 150μ). ***Metasoma: T1 with basal batch small but distinct, disc and marginal area virtually glabrous. T2,3 disc with moderately dense hairs. "Marginal fine hairs" sparse*** (Fig. 5).

Structure: ***Head:*** Long, HL/HW = 1.11 ± 0.03 (1.06-1.15, n=10, Table 2, Figs. 2, 13). ***Vertex medially flat, laterally more arcuate than in*** zunaga ***and*** longifacies, surface shiny and rather superficial. Occiput not carinate but more acutely bent > ***zunaga*** and ***longifacies.*** Frons more raised > ***zunaga*** and ***longifacies.*** Frons, face and paraocular area with finest (±20$\mu\phi$) and dense PP (IS < ϕ). Both clypeus above and supraclypeus with fine (±20$\mu\phi$) and dense (IS < ϕ) PP. *Scape* ***not attaining mid ocellus. Mesosoma:*** Pronotum sculptured as in ***longifacies. Mesoscutal PP 12-25μ, IS 1.0-1.5, granular but shiner*** > zunaga ***and*** longifacies. Mesoscutellum sculptured as on mesoscutum but PP sparser and shiner. ***Mesepisternum with PP very fine, less than 10$\mu\phi$, parallel ridges virtually absent. Inner hind spur =*** zunaga ***but teeth shorter*** (Fig. 19). ***Propodeum:*** PDL/MCL = 1.11 ± 0.07 (1.00-1.17, n=10). Dorsum very gently and rather uniformly slanting, less roundly > ***zunaga*** but more > ***longifacies;*** shiner: ***ridges short, seldom attaining 1/2 of dorsal length, neither branching nor anastomosing*** (Fig. 32). ***Metasoma:*** T1 virtually smooth and shining with very sparse, finest PP and basilaterally with faint striation. T2,3 basally striate with fine PP, much sparser > ***zunaga*** and ***longifacies.***

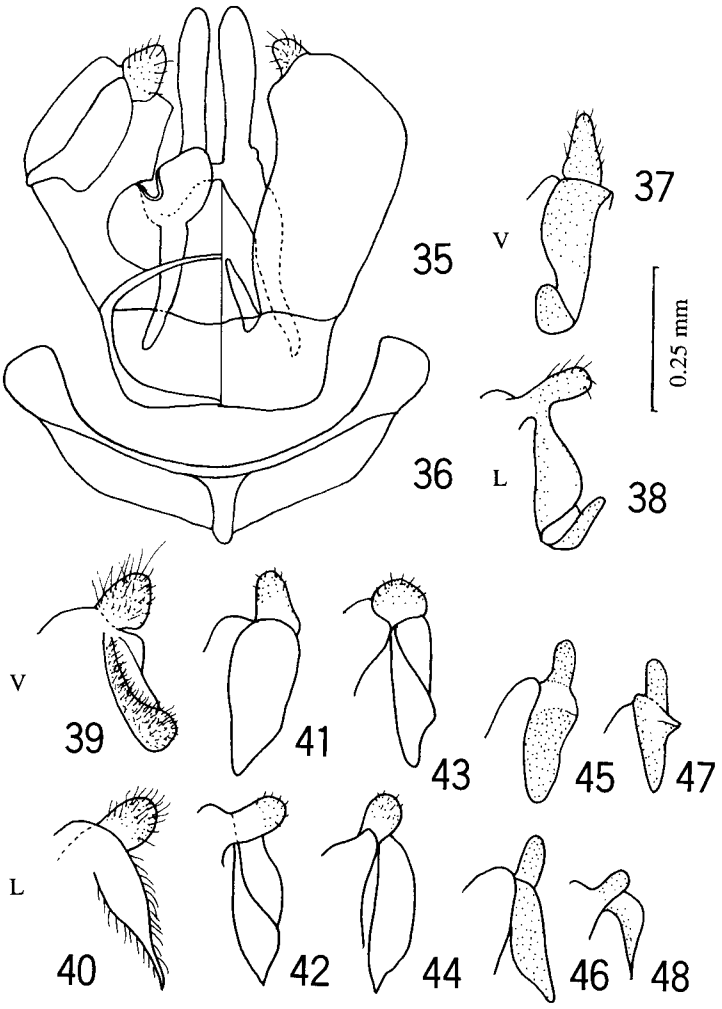
Male. BL 3.8-4.6 mm, WL 3.2-3.5 mm.

Color: *Labrum* ***yellow. Mandible medially yellow to yellow brown. Flagella below brown to dark brown. Fore tibia1 articulation yellow to pale brown.*** *Tarsi* ***yellow brown to pale brown.***



Figs. 16-34. 16-17: Labrum (16) and mesepisternal ridges (17) of *L. kuroshio.* 18-27: Inner hind tibia1 spur (females) of *L.* zunaga (18), *pumilum* (19), *longifacies* (20), *kuroshio* (21), *tschibuklinum* (22), *semilucens* (23), *minutissimum* (24), *lucidulum (25, 26)* and *intermedium (27).* All left tibia. 28-34: Propodeal dorsum (females) of *L. kuroshio* (28), *longifucies* (29), *tschibuklinum* (30), *minutissimum* (31), *pumilum* (32), *lucidulum (33)* and *zunaga (34).*

Pilosity: With general female and male differences given in common features (p. 146). *Head: Hairs on facial, paraocular, para-antennal, supraclypeal and clypeal hairs distinctly plumose, jointly forming tomentum hiding surface completely.* Genal hairs not dense, but distinctly plumose, slightly hiding surface. *Mesosoma:* Mesoscutal long and short hairs 125 and 25μ. Metanotal tomentum = female or *longifucies* female, represented by slightly denser hairs or anterior 2/3. *Metasoma*: As in female except for common male features. Patch on T1 inconspicuous. "Fine marginal hairs" on $T_{2,3}$ present though far sparser.



Figs. 35-48. Male terminalia of the *L. lucidulum* group. Genitalia of *L. zunaga*, left (35) and right (36) views, 7th and 8th sterna of *L. kuroshio* (36). Others are ventral (V) and lateral (L) views of gonostylus and ventral retrose lobe of *L. intermedium* (37, 38), *kuroshio* (39, 40), *longifacies* (41, 42), *zunaga* (43, 44), *pumilum* (45, 46) and *lucidulum* (47, 48).

Structure: *Head*: Long. HL/HW = 1.19 ± 0.03 (n=5, 1.14-1.22). Similar to female. *Mesosoma*: Similar to female but surface generally shiner. Mesoscutellum medially not depressed. PDL/MCL = 1.11 ± 0.07 (1.00-1.20, n=5). *Metasoma*: Basal depression on T2 as weak as in female. *Gonostylus elongate mammiform, slender with finest, sparse hairs. Ventral retrose lobe typically tongue-like, apically tapering, with dense spicules forming transverse*

bands (Figs. 45, 46).

Distribution: Japan (Hokkaido: Teshio, Tokachi, Ishikari, Oshima Districts; Honshu: Aomori, Ibaraki, Mito, Gifu, Fukui Prefs.).

Floral records: ***Primula polyantha, Cardamine leucantha, Anthriscus aemula, Deutzia gracilis, Rorippa islandica, Rosa rugosa, Rosa*** *hybrida,* ***Tradescantia*** *reflexa, Salvia* ***officinalis, Scrophularia grayana, Stenactis*** *annuus,* ***Taraxacum officinale, Agastache rugosa,*** *Achillea millefolium,* ***Rudbeckia laciniata, Potentilla fruticosa, Anaphalis margaritacea, Brassica*** *napus,* ***Brassica chinensis, Allium fistulosum, Allium tuberosum Geranium nepalense*** ssp. ***thunbergii,*** *Capsella* ***bursapastoris.***

Type specimens: Holotype female, Hokkaido Univ. Botanical Gardens, Sapporo, Hokkaido, 27. vii. 1959, ***Rorippa islandica (S.*** F. Sakagami). Paratypes: [Hokkaido]: Sapporo: Hokkaido Univ. Bot. Gardens, 1959 (S. F. Sakagami): 1F, 20. v.; 1F, 25. v.; 1F, 27. v.; 1F, 4. vi.; 2F, 10. vi.; 5F, 22. vi.; 6F, 14. vii.; 4F1M, 27. vii.; 2F, 29. vii.; 6F, 3. viii.; 1M, 11. viii.; 2F, 17. viii.; 2F, 25. viii.; 1F, 7. ix.; 1F, 21. ix.; 2M, 22. ix.; Hokkaido Univ. Campus, Sapporo, 1959 (S. F. Sakagami): 1F, 1. v.; 1F, 27. v.; 2F, 11. vi.; 1F, 18. vi.; 2F, 19. vi.; 1F, 1. vii.; 2F, 5. vii.; 1F, 11. vii.; 1F, 20. vii.; 2F, 3. viii.; 1F, 4. viii.; 1F, 14. viii.; 1F, 19. viii.; 3F, 3. ix.; Teshio: 1F, KamiOtoineppu, 6. ix. 1970 (S. F. Sakagami & H. Fukuda). [Honshu]: Gifu Pref.: 1F, Gifu City, 6. viii. 1973 (G. Sawaki). (Paratypes preserved in Ebmer's collection: Sapporo: Bot. Gardens, 1959 (S. F. Sakagami): 2F, 8. vi.; IF, 11. viii.; 1F, 19. viii.; 1F, 3. ix).

This species might be widespread in Japan, even though not very common, but might have been overlooked for its tiny size. This species is similar to *L.* ***lucidulum*** but can be distinguished by teeth of inner spur of hind tibia fine (Fig. 19 vs. 25, 26), vertex more arcuate laterally (Fig. 13 vs. 14) not wide (Fig. 19 vs. Figs. 25, 26), terga l-3, more lineolate (Fig. 5 vs. 7) and ventral retrose lobe of male larger (Figs. 45, 46 vs. 47, 48).

Lasioglossum (Evylaeus) kuroshio Sakagami et Takahashi

(Figs. 1, 2, 6, 12, 16, 17, 21, 28, 36, 39, 40)

Lasioglossum (carinaless ***Evylaeus) X:*** Takahashi, 1990: 73 [female & male, Hachijojima Is., Tokyo].

Lusioglossum (Evylaeus) kuroshio Sakagami et Takahashi, in Takahashi & Sakagami, 1993: 267 [female & male].

This species is redescribed below synoptically with the other allied species treated in this paper.

Female. BL 5.6-6.0 mm (*n*=10), WL 5.2-5.7 mm (*n*=10).

Color: Flagella below dark brown.

Pilosity: ***Head:*** Paraocular hairs and genal appressed hairs not plumose. ***Mesosoma: Pronotum dorsomedially and frontally homogeneously tomented.*** Mesoscutal long hairs 100μ, short hairs 25-30μ. ***Metanotal*** *tomentum* ***represented by anterior hairs merely a little denser. Pleural hairs slightly denser than in*** zunaga ***and*** longifacies, ***though less than in*** pumilum. ***Propodeal shield with dense appressed hairs completely hiding surface. Metasoma:*** *T1* ***with basilateral patch small but distinct, disc and postmarginal area virtually glabrous.*** *T2,3* ***with*** *discal* ***and postmarginal hairs as dense as, but less regularly directing*** *postward* ***than in***

longifacies (Fig. 6). ***"Fine marginal hairs" of*** *T2,3* ***moderately dense.***

Structure: ***Head distinctly shorter than in*** 3 ***species described above.*** HL/HW = 1.01 ± 0.01 (1.00-1.02, *n*=10, Table 2, Figs. 2, 12). *Vertex flatter* > ***zunaga and longifacies*** but with similar sculpture. Occiput = ***zunaga*** and ***longifacies.*** Ocellocular area very superficially granular, rather shining with PP 10*μø*, dense and homogeneous, IS ≤ P *ø*. Frons flatter > ***zunaga*** and ***longifacies.*** PP ±10*μø*. IS linear, seen microreticulate. Paraocular area with PP ±25*μ* and IS linear to 1.0, granular. Supraclypeus raised as in ***zunaga*** and ***longifacies*** and, like clypeus above, smooth and shining with sparse PP, 15-20*μø* and IS 1 .O-2.0 or more, sharply contrasting to rather granular and dull paraocular area. *Scape* ***attaining middle of mid-ocellus. Mesosoma:*** Pronotum along anterior margin smooth and shining. ***Mesoscutal PP*** *±15μø,* ***IS*** = *0.5-1.5,* ***granular and dull. Mesoscutellum weakly to obsoletely depressed medially, PP sparser and IS smooth and shining. Mesepisternum coarsely granular, PP virtually absent, with weak, principally oblique-longitudinal, parallel but partly anastomosing ridges*** (Fig. 19). ***Inner hind*** *tibial* ***spur with 4-5, rather fine teeth*** (Fig. 21). ***Propodeum:*** PDL/MCL = 1.06 ± 0.04 (1.00-1.17, *n*=10). Dorsum (Fig. 28) with ***ridges mainly*** *25-30μ* ***distant, medially occupying most length of dorsum, laterally descending dorsal slope, both with IS granular but shining; between lateral ridges longitudinally striated downward. Metasoma*** (Fig. 6): *T1* ***smooth and shining, with very sparse PP,*** *T2* ***basally mildly but distinctly depressed.*** *T2,3* ***sculptured as in*** longifacies.

Male. BL 4.8-5.7 mm, WL 4.1-4.9 mm.

Color: ***Clypeal mark sometimes whitish yellow.*** *Labrum* ***entirely black. Mandible medially not pale, dark to blackish brown.*** Flagella below dark brown. ***Fore tibia1 articulation brown, sometimes dark brown.*** *Tarsi* ***pale to dark brown.***

Pilosity: ***More whitish > female, but sexual differences less developed than in other compared species, especially on paraocular area.*** Pronotal tomentum = female. ***Head:*** Vertex medially hairs simple to imperceptibly plumose. ***Facial hairs semiappressed,*** *para-antennal* ***and paraocular hairs rather sparse though partly moderately plumose, mostly simple, not hiding surface.*** Supraclypeal and clypeal hairs rather sparse, contrasting to denser paraocular hairs though the latter not much dense. ***Mesosoma: Unlike 3 species described above, pronotal and propodeal tomenta distinct.*** Mesoscutal short and long hairs 75 and 25 *μ*, respectively. Metanotal tomentum as in female, confined to anterior 1/3. ***Metasoma:*** T1 without basilateral patch. Basilateral hairs of T2,3 slightly sparser and less directly transversely > ***longifacies.*** "Fine marginal hairs" virtually absent.

Structure: ***Head:*** Distinctly shorter than 3 other species described above, HL/HW = 1.03 ± 0.02 (1.00-1.05, *n*=10). ***Mesosoma:*** Similar to female, but integument more smooth and shiny. Mesepisternal ridges weaker, often obsolete, IS shiny. PDL/MCL = 1.06 ± 0.04 (1 .OO-1.12, *n*=10). ***Metasoma:*** Basal depression on T2,3 slightly more distinct > other species (Fig. 6). ***Gonostylus mammiform, with both long and short hairs. Ventral*** *retrose* ***lobe with spicules and, unlike other species, with dense hairs, longer marginally*** (Figs. 39, 40).

Distribution: Japan (Hachijo Is., Honshu: Ibaraki Pref.).

Takahashi and Sakagami (1993) recorded this species from the following places within the Hachijo Is.: Boueidouro, Ohkagou, Mitsune, Eigou. Additional records are as follows: Hachijo Is.: 33 females, 9. iv. 1978, *Rubus* ***trifidus*** (H. Fukuda). Further, we received 1 female and 1 male taken from a nest on Mt. Tsukuba, Ibaraki Pref., 22. vii. 1991 collected by T. Matsumura. He made a phenological survey of this species there and collected further specimens from other

localities within the prefecture. Thus, ***L. kuroshio*** is no longer regarded as endemic to the Hachijo Is., although its range in Honshu is not yet well known.

4. Taxonomic and chorologic synopses of Japanese species of the *L. lucidulum* subgroup

Table 4 gives a synopsis of some major interspecific differences. ***L. kuroshio*** differs in 6 conspicuous features from the other species, while ***L. zunaga*** and ***pumilum*** in two, and ***L. longifacies*** in one, suggesting the highest deviation of ***L. kuroshio*** among 4 Japanese species.

Table 6 presents the number of localities from where each species was recorded. The distribution of the number of records is obviously affected by the intensity of collectings followed by sortings, rather than the real chorologic picture in such a group as halictine bees which is interested by a limited number of researchers. Nevertheless, the table suggests that *L. **longifacies*** seems to be more widespread than other species throughout Japan. On the other hand, the scarcity of records in ***L. pumilum*** may reflect that this species was frequently escaped from being collected by its tiny size. Anyhow, intensive surveys in southern Japan is requested.

5. Comparative notes on some Western allied species

The taxonomic descriptions of 4 Japanese species were made through comparison with 5 Western species. To put our results on a global background, taxonomic notes of these species are briefly given below. As the number of examined specimens, all gifted by P.A.W. Ebmer, was small, it is possible that some variable features might have been described as if stable. Reference lists include only the original description and some relevant articles. The species are arranged below in the descending order of HL/HW (cf. Fig. 2). It must be mentioned that inner hind tibia1 spur of female, all similarly dentate in Japanese species, is different in some Western species.

Lasioglossum (Evylaeus) lucidulum (Schenck)

Figs. (1, 2, 7, 14, 25, 26, 33, 47, 48)

Hylaeus lucidulus Schenck, 1861. Jb. Ver. Naturkd. Herzogath. Nassau 14 (1859): 292 [female], 293 [male].

Evylaeus lucidulus: Knerer, 1969: 926-7 [nest].

Lasioglossum (Evylaeus) lucidulum: Ebmer, 1971: 77 [female], 90 [male], 122 [distribution]; Ebmer, 1975: 240 [nomencl.]; Ebmer, 1988: 664 [distribution].

Female. BL 4.5 mm, WL 4.2-4.3 mm (n=3).

Color: Flagella below brown, apically paler.

Pilosity: ***Head:*** Paraocular hairs slightly plumose, incompletely hiding surface. Genal appressed hairs poorly plumose. ***Mesosoma:*** Long and short mesoscutal hairs 125-150μ and 25μ. Otherwise similar to ***pumilum,*** including propodeal shield and metanotum. ***Metasoma:*** T1 without basal patch, disc and postmarginal area virtually glabrous. T2,3 with discal and "fine marginal hairs" much sparser > ***pumilum*** (Figs. 5, 7).

Structure: ***Head:*** Elongate. HL/HW = 1.09 ± 0.02 (1.06-1.12, *n*=3)(Figs. 2, 14). Vertex as in ***pumilum*** (Fig. 13) but slightly flatter and sculpture slightly coarser with more distinct fine lineolation. Occiput as in ***pumilum*** but less raised. Lateral ocellus a trifle below vertex. Ocellocular sculpture = ***pumilum*** but PP sparser, along ocellus broadly smooth and shiny. Frons slightly flatter than in ***pumilum.*** Frons, face and paraocular area sculptured as in ***pumilum,*** supraclypeus medially with PP sparser, and IS smoother and shiner. Scape not attaining mid ocellus. ***Mesosoma:*** Pronotum = ***pumilum.*** Mesoscutal PP 15-20μ, IS = 1.0-1.5. Mesoscutal and -scutellar sculpture = ***pumilum.*** Mesepistemal PP <10$\mu\phi$, IS = 1.0-1.5, semiparallel ridges (cf. Fig. 17) absent. Inner hind tibia1 spur with 2-3 very flat and broad "teeth" (Figs. 25, 26). ***Propodeum:*** PDL/MCL = 1:1.11 ± 0.5 (1.08-1.12, *n*=3), dorsum = ***pumilum*** (Fig. 33). ***Metasoma:*** Similar to ***pumilum*** but T1 without basilateral lineolation. On T2,3 both PP and lineolation less developed (Figs. 5 vs. 7).

Male. BL 4.0-4.5 mm (4.25 ± 0.25, *n*=2).

Color: As in female, but labrum and mandible medially yellow. Flagella below pale brown. Fore-tibia1 articulation pale yellow. Tarsi pale brown.

Pilosity: = ***pumilum.*** ***Head:*** Facial hairs more, while clypeal hairs less developed. ***Mesosoma:*** Mesoscutal hairs ±100 (long) and 20 (short)μ. Metanotal tomentum more developed > female. ***Metasoma:*** T1 without basilateral patch, "fine marginal hairs" virtually absent.

Structure: ***Head:*** HL/HW = 1.12 and 1.13 (*n*=2). Similar to female. ***Mesosoma:*** Similar to female but IS generally smoother and shiner (cf. foot note, p. 146), especially meso-scutellum broadly smooth with sparse PP, mesopleuron less shiner than other parts. PDL/MCL = 1.00 and 1.09 (*n*=2). ***Metasoma:*** Basal depression on T2 as weak as in female. Gonostylus small, rather slender, with sparse spicules. Ventral retrose lobe small and elongate-triangular (Figs. 47, 48).

Distribution: Eurosiberian (Morroco to Mongol, Ebmer, 1988).

Specimens examined: [Bulgaria]: 1 female, Neusiedl, Tabor, 8. viii. 1968; ["Jugoslavia"]: 2 females and 2 males, Susak, Is. Losin, 14. vii. 1971 (A. W. Ebmer).

This species may be a Western counterpart of ***pumilum,*** but distinguished by head shape (Figs. 14 vs. 13), sculpture and pilosity of metasoma (Figs. 7 vs. 5) and especially hind tibia1 spur (Figs. 25, 26 vs. 19) in female, and genitalia (Fig. 47, 48 vs. 45, 46) in male.

Lasioglossum (Evylaeus) minutissimum (Kirby)

(Figs. 1, ***2, 8, 24, 31)***

Melitta minutissima Kirby, 1802. Monogr. apum. angl.: 63-64 [female & male].

Lasioglossum (Evylaeus) minutissimum: Ebmer, 1971: 77 [female], 88 [male], 122 [distribution]; Ebmer, 1975: 240 [nomencl.]; Ebmer, 1988: [distribution].

Female. BL 4.1 - 4.5 mm, WL 3.2 - 3.8 mm (*n*=3).

Color: Flagella brown, below pale brown.

Pilosity: ***Head:*** Paraocular hairs slightly plumose, inconspicuously hiding surface. Genal appressed hairs poorly plumose. ***Mesosoma:*** Long and short mesoscutal hairs 125 and 25-30μ. Otherwise = ***pumilum. Metasoma:*** T1 without basilateral patch, disc and postmarginal area very sparsely haired. T2,3 so densely haired that "fine marginal hairs" (cf. p. 145) seen less conspicuous (Fig. 8).

Structure: ***Head:*** HL/HW 1.09 ± 0.02 (1.06-1.12, n=3). Vertex rather flat as in ***pumilum,*** distinctly flatter > ***lucidulum.*** Lateral ocellus nearly attaining vertex. Ocellocular sculpture = ***pumilum.*** Frons, face and paraocular area sculptured as in ***zunaga.*** Supraclypeus and clypeus above (= upper part of clypeus) homogeneously granular and dull, with homogeneous PP ($15\mu\phi$, and ≤ IS). Scape not attaining mid ocellus. ***Mesosoma:*** Pronotum anteriorly = ***zunaga.*** Mesoscutal PP 10-20μ, IS 1.0-2.0, granular but relatively shiny. Mesoscutellum = ***pumilum,*** but submedian convexity less broadly smooth and shiny, with PP slightly sparser. Mesepistemum homogeneously and coarsely granular, with very weak PP less than $10\mu\phi$ and IS very narrow. Semiparallel ridges virtually absent. Inner hind tibia1 spur with 2-3 short teeth. ***Propodeum:*** PDL/MCL = 1.00 (n=1). Longitudinal ridges attaining dorsal end longer and denser (±25μ distant > ***lucidulum),*** some ones either branching or anastomosing, laterally with some weak striation between ridges descending downward, as in ***kuroshio*** (Fig. 28) though weaker (Fig. 31). ***Metasoma:*** Both PP and striation on T1-3 much developed than in ***lucidulum,*** somewhat comparable to ***longifacies*** and ***kuroshio*** (Figs. 7 vs. 8, cf. 3, 6).

Male. BL 3.8 mm, WL 3.3 mm (n=1).

Color: Labrum yellow. Mandible medially yellow. Flagella below pale brown. Fore tibia1 articulation pale brown. Tarsi pale brown.

Pilosity: ***Head: = pumilum.*** Plumose hairs hiding surface. ***Mesosoma:*** long and short mesoscutal hairs 100 and 25μ. Metanotum = ***pumilum. Metasoma:*** T1 with fairly dense obliquely, outward-directing appressed hairs. T2 similar but basal hairs absent though present on T3. "Fine marginal hairs" on T2,3 virtually absent.

Structure: ***Head:*** HL/HW = 1.12, similar to female. ***Mesosoma:*** Otherwise = ***lucidulum,*** but scutellar PP denser. ***Metasoma:*** Basal depression on T2 more distinct > T3. Genitalia not examined (cf. Ebmer, 1971, Figs. 101 ***(lucidulum)*** and 102 ***(minutissimum)).***

Distribution: Western Palaearctic from England to Turkey and from Sweden to Sahara, also on Azores and Canary Is.

Specimens examined: [Italy]: 2 females, Cattolica, 7. 11. v. 1958 (W. Grtinvaldt); [Morocco]: 1 female, Mts. Atlas, Agaisuar, 1500m, 10. vii. 1979 (A. W. Ebmer); [Sicily]: 1 male, Naxos, 14. v. 1961 (Gtisenleitner).

This species is nearly same-sized with ***L. lucidulum*** but readily distinguishable by developed pilosity and metasomal sculpture (Figs. 7 vs. 8).

Lusioglossum (Evylaeus) tschibuklinum (Bliithgen)

(Figs. 1, 2, 9, 22, 30)

Halictus *tschibuklinus* Blüthgen, 1931, Mitt. zool. Mus. Berlin, 17: 389-390 [female].

Lasioglossum *(Evylaeus) tschibuklinum*: Ebmer, 1978: 82; Ebmer, 1983: 323 [additional distribution].

Female. BL 4.4 mm, WL 3.6 mm (n=1).

Color: Flagella brown, apically below paler.

Pilosity: ***Head:*** Paraocular hairs slightly plumose, incompletely hiding surface. Genal appressed hairs poorly plumose. ***Mesosoma:*** Pronotal, metanotal and propodeal tomenta absent. Metepistemal hairs, etc. = ***pumilum. Metasoma:*** T1 without basal patch, hairs on T2,3 moderately

dense. "Fine marginal hairs" distinct (Fig. 9).

Structure: *Head:* HL/HW = 1.02 (n=l). Vertex as in ***zunaga,*** coriaceous and dull, with rather distinct striation. Lateral ocellus nearly attaining vertex. Ocellocular area with fine and homogeneous PP, $\pm 12\mu\phi$, IS = 1.0 or less, granular and weakly shining. Facial, supraclypeal and clypeal (above) sculpture as in *lucidulum.* Scape attaining lower rim of mid ocellus. *Mesosoma:* Pronotum as in *zunaga* and *minutissimum.* Mesoscutal PP 12-25$\mu\phi$, IS = 1.0-2.0, finely granular as in *minutissimum*. Mesoscutellum = *minutissimum*. Mesepisternum coarsely and homogeneously granular. Inner hind tibia1 spur with 3, relatively long teeth (Fig. 22). *Propodeum:* PDL/MCL = 1.08, ridges occupying 1/2 of dorsum, slightly denser > *lucidulum* and *pumilum* but < *minutissimum* (Fig. 30 vs. 31, 32, 33), neither branching nor anastomosing. *Metasoma:* Similar to *minutissimum* but PP on T1 more on posterior area and striation confined to postmarginal area. T2,3 with PP much sparser whereas striation far more developed > *minutissimum,* covering whole surface except lateral convexity.

Distribution: Type locality Tschibukli at Bosporous, westward known also from "Jugoslavia" and Greece, where widely sympatric with *minutissimum.* The easternmost record from Hazara, Pakistan (Ebmer, 1983).

Specimens examined: [Iran]: 1 female, Weisser, SSE Nowshar, 1400m, 11. vi. 1977 (Halzschuh & Ressl). Compared with Blüthgen's type by A. W. Ebmer. According to Blüthgen (1931), this species differs from *L. minutissimum* by (1) finer mesoscutal PP, (2) different propodeum and (3) slender and longer metasoma. (1) was not confirmed, (2) was mentioned above and (3) was difficult to confirm in our specimen. Blüthgen also wrote this species as differing from *L. semilucens* in propodeum and T1 apically not polished, the latter was also confirmed in our female. Propodeal ridges were sparser than in *L. semilucens* observed by us. Bliithgen did not mention the dense striation on T2,3 characteristic of our specimen.

Lasioglossum *(Evylaeus)* ***semilucens*** **(Alfken)**

(Figs. 1, 2, 23)

Hylaeus pygmaeus Schenck, 1861 (nec Schenck, 1853), Jb. Ver. Naturkd. Herzogth. Nassau, 14(1859): 293 [female, Germany].

Halictus semilucens Alfken, 1914, Deut. ent. Zs., 1914: 281.

Lasioglossum (Evylaeus) semilucens: Ebmer, 1971: 77 [female], 89 [male], 123 [distribution]; Ebmer, 1988: 20, 663 [distribution].

Female. BL 4.4, 4.6 mm, WL 3.6, 3.8 mm (n=2).

Color: Flagella brown to dark brown.

Pilosity: *Head:* Paraocular and genal hairs not hiding surface. *Mesosoma:* Pronotum frontally and dorsally not tomented. Mesoscutal hairs 100-125μ (long) and 25-30μ (short). Metanotum anteriorly sparsely tomented, incompletely hiding surface. Mesepisternal hairs slightly plumose. Propodeal shield not tomented. *Metasoma:* T1 virtually glabrous though on anterior slope with very poor basilateral patch and sparse lateral hairs. T2,3 with hairs sparse (= *lucidulum)* but denser > *zunaga,* with "fine marginal hairs" though sparse.

Structure: *Head:* slightly shorter than wide. HL/HW = 0.95 (33/34.5, 35/36, n=2). Vertex uniformly outcurved (= *zunaga, intermedium,* ≠ *pumilum*), granular and dully shining, with

weak and sparse PP, 20-25$\mu\phi$, IS 1.5-2.0. Seen laterally occiput roundly bending (= *zunaga,* ≠ *pumilum).* Lateral ocellus a trifle below vertex. Frons distinctly raised (> *pumilum).* Frons, face, paraocular area with dense PP, 15-20$\mu\phi$> IS = linear and granular, seen microreticulate, similar to *zunaga* and *longifacies,* but duller. Supraclypeus coarsely granular, with fine PP 18-20$\mu\phi$, homogeneously but sparsely. IS = 1.0-2.0. Clypeus above similar. Scape not attaining mid ocellus. *Mesosoma:* Pronotum = *zunaga,* less shining > *longifacies.* Mesoscutum with PP 15-20p, IS variable, 0.5-2.0, granular and dull (slightly shiner in 1 female). Scutellum similarly sculptured, medially not depressed. Mesepistemum glanular, with very sparse and weak PP (15-20$\mu\phi$), and with obliquely paralleled fine ridges, somewhat resembling *kuroshio.* Inner hind spur with 4 flat and wide teeth (Fig. 23). *Propodeum:* PDL/MCL = 0.81 ± 0.01 (0.80-0.82, n=2), unlike other species except *intermedium,* less than 1.00. Ridges attaining middle of dorsum, partly branching and weakly bending. *Metasoma:* Sculptured = *minutissimum.*

Male. BL 4.3 mm, WL 3.4 mm.

Color: Black. Flagella dark brown. Yellow parts: Labrum, mandible except tip; fore tibia1 base and apex. Hind leg similarly dark brown but tarsi paler.

Pilosity: = female, Hairs on paraocular area below and supraclypeus laterally nearly covering surface. "Fine marginal hairs" on T2,3 present but much sparser > female.

Structure: Similar to female. Ratios (n=1). Metepisternum with weak semiparallel ridges. Genitalia not examined (cf. Ebmer, 1971, Fig. 104).

Distribution: Eurosiberian, mountaneous in South, from England eastward to Kirgis, and from central Sweden southward to Italy, Greece, Turkey and Afghanistan.

Specimens examined: [Austria]: 1 female, Linz, Umgebung, 10. iv. 1961 (H. Priesner); 1 female, Gemeinde, Reichstal, Graelmtihle, Upper Austria, 28. v. 1967 (A. W. Ebmer); 1 male, Bad Leonfelden, Upper Austria, 29. viii. 1987 (A. W. Ebmer).

This and the next species have heads nearly as long as wide (Fig. 2), and propodeal dorsum shorter than mesoscutellum (Table 3).

Lasioglossum (Evylaeus) intermedium (Schenck)

(Figs. 1, 2, 15, 27, 37, 38)

Halictus intermedius Schenck 1868, Ib. Ver. Naturkd. Herzogth. Nassau, 21/22: 309 [female].
Halictus servulellus Strand 1909, Arch. Naturg., 75: 50 [male].
Lasioglossum (Evylaeus) intermedium: Ebmer, 1971: 77 [female], 89 [male], 123 [distribution]; Ebmer, 1975: 243 [nomencl.], Ebmer, 1988: 661 [distribution].

Female. BL 5.5-6.1 mm, WL 4.7-5.0 mm (n=3).

Color: Flagella below dark brown.

Pilosity: Facial and paraocular hairs not hiding surface. Pronotal dorsum tomented (= *kuroshio).* Mesoscutal hairs relatively long, 150-175μ (long) and ±25μ (short). Metanotal tomentum and mesepistemum = *semilucens.* Propodeal side above with hairs more plumose > other species, seen denser. Propodeal shield not tomented. Hairs of T2 anteriorly denser > *pumilum, zunaga, lucidulum,* = *minutissimum,* sparser > *longifacies, kuroshio.* "Fine marginal hairs" much sparser > female.

Structure: *Head:* Nearly as long as wide HL/HW = 1:0.95 (40/40, 40/40, 38/38.5) (Figs. 2,

15). Structure of vertex and sculpture on frons, face and paraocular area = semilucens, Frons moderately raised (< *semilucens).* Supraclypeus = *semilucens* but IS with finer sculpture. Scape attaining mid ocellus. *Mesosoma:* Mesoscutum = *semilucens.* PP $\pm 20\mu\phi$, IS 1.0-1.5. Mesoscutellum medially not depressed. Mesepistemum with semiparallel ridges as in *semilucens* and sculpture slightly coarser. Inner hind tibia1 spur with l-2 large teeth (Fig. 27). Propodeum = *semilucens,* ridges slightly exceeding 1/2 dorsal length, partly connected with weaker transverse ridges but not typically anastomosing. *Metasoma:* Sculptured as in *pumilum* and *zunaga,* PP denser > *lucidulum,* sparser > *minutissimum, kuroshio* and *longifacies.*

Male. BL 5.4-5.7 mm, WL 4.2 mm (*n*=2).

Color: = female, paler part virtually absent, except clypeus below being yellow in 1 male (black in another male). Flagella and tarsi dark brown.

Pilosity: = female, but paraocular area (below) and supraclypeus laterally slightly denser, incompletely hiding surface. Pronotal tomentum present but less developed. Propodeal side with dense hairs as in female. "Fine marginal hairs" on $T_{2,3}$ virtually absent.

Structure: Mesepisternum shiner with PP coarser and denser > female, correspondingly semiparallel ridges less conspicuous though present. Gonostylus rather elongate, with spicules and sparse hairs, longer than in other species except *kuroshio.* Ventral retrose lobe longer than in other species and medially widened, with sparse spicules but hairs (Figs. 37, 38).

Distribution: Western Palaearctic from Iberia eastward to northern Iran, and northward to Baltic coast.

Specimens examined: [Upper Austria]: 3 females, St. Georgen/G, 14. ix. 1971; 2 males, 23. viii. 1972 (all by A. W. Ebmer).

6. Key to the Species Studied

Here a key to all species studied, 4 Japanese and 5 Western ones, is tentatively given. Obviously the *L. lucidulum* subgroup may include more species, which have still not been accurately studied. Such species, when studied, could successively be included in the following key for a better clarification of the subgroup.

1. Female: Antenna short, 12 segmented. 2
   Male: Antenna long, 13 segmented. 10
2. Pronotal dorsum anteriorly and propodeal shield tomented, head nearly as long as wide. 3
   Pronotal and propodeal tomenta absent. 4
3. Longitudinal ridges of propodeal dorsum attaining dorsal end (Fig. 28). Inner hind tibia1 spur with 4-5 teeth (Fig. 21). . . . . *L. kuroshio* (Japan)
   Propodeal ridges not attaining dorsal end. Inner hind tibia1 spur with l-2 stouter teeth (Fig. 27). . . . . *L. intermedium* (Western Palaearctic)
4. Terga 2-3 without "fine marginal hairs" (Fig. 4). . . . . *L. zunaga* (Japan)
   Terga 2-3 with "fine marginal hairs" (cf. Figs. 3, 5-9). 5
5. Head nearly as long as wide (Fig. 2). . . . . *L. semilucens* (Eurosiberian)
   Head distinctly longer than wide (Figs. 2, 10-14 vs. 15).. 6

6. Larger species. Body length over 5.4 mm, wing length (inluding tegula) over 5.0 mm (Fig. 2). Propodeal ridges nearly attaining dorsal end (Fig. 29). Metasomal sculpture and pilosity well developed (Fig. 3). . . . . *L. longifacies* (Japan)

Smaller species. Body length less than 5.8 mm. Wing length less than 4.8 mm. 7

7. Vertex medially flat, laterally arcuate (Fig. 13). Metasomal sculpture and pilosity less developed (Fig. 5). Inner hind tibia1 spur with 5-6 fine teeth (Fig. 19). . . . . ***L. pumilum*** (Japan)

- Vertex uniformly outcurved (Figs. 10-12, 14-15). Metasomal sculpture and pilosity variable 8

8. Metasomal sculpture and pilosity less developed (Fig. 7). Inner hind tibia1 spur with 2-3 flat "teeth" (Figs. 25, 26). . . . . ***L. lucidulum*** (Eurosiberian)

Metasomal sculpture and pilosity more developed. 9

9. Terga 3-4 more punctate than striate (Fig. 8). . . . . ***L. minutissimum*** (W. Palaearctic)

Terga 3-4 more striate than punctate (Fig. 9). . . . . ***L. tschibuklinum*** (S.W. Palaearctic)

10. Head nearly as wide as long (Fig. 2, "cf." also Figs. 12, 15, conspecific females). 11

Head distinctly longer than wide (Fig. 2, "cf." also Figs. 10, 11, 13, 14, conspecific females). 13

11. Pronotal dorsum anteriorly and propodeal shield tomented. Gonostylus mammiform, with long hairs. Ventral retrose lobe densely haired (Figs. 39, 40). . . . . ***L. kuroshio***

Pronotal dorsum anteriorly and propodeal shield not distinctly tomented. 12

12. Propodeal side with conspicuously plumose hairs. Gonostylus elongate with short and also some long hairs. Ventral retrose lobe spiculated but not haired (Figs. 37, 38). . . . . ***L. intermedium***

Propodeal side without conspicuous plumose hairs. . . . . ***L. semilucens***

13. Longitudinal ridges of propodeum exceeding middle of dorsum (cf. Fig. 29). Large species. Body length over 4.8 mm. Wing length over 4.4 mm. (Fig. 1). . . . . ***L. longifacies***

Smaller. Body length less than 5.3 mm. Wing length less than 4.4 mm (Fig. 1). Propodeal ridges not exceeding middle of dorsum. 14

14. Metasomal sculpture and pilosity more developed as in conspecific female (cf. Fig. 8). . . . . ***L. minutissimum***

Metasomal sculpture and pilosity less developed as in conspecific female (cf. Figs. 4, 5, 7). 15

15. Larger species. Body length over 4.5 mm. Wing length over 3.8 mm. Vertex uniformly outcurved (cf. Fig. 10). . . . . ***L. zunaga***

Smaller. Body length less than 4.6 mm. Wing length less han 3.6 mm. 16

16. Vertex medially flat, laterally arcuate (cf. Fig. 13). Ventral retrose lobe with spicules forming transverse bands (Figs. 45, 46). . . . . ***L. pumilum***

Vertex uniformly outcurved (cf. Fig. 14). Ventral retrose lobe with sparse spicules not banded. . . . . ***L. lucidulum***

Appendix: Redescription of *Lasioglossum (Evylaeus) massuricum* (Bliithgen)

The Blüthgen's original description of this species is fairly exact as usual, but it is redescribed here based upon 1 female from Nepal in order to incorporate it in the *L. lucidulum* subgroup.

Halictus massuricus Bltithgen, 1926: 594 [female, Kashmir, 6-8000 ft, Massuri - Mussoorie]

Halictus massuricus var. ***chaprensis*** Bliithgen, 1926: 595 [female, Bengal, Chapra].

Female (Male unknown). BL 5.3 mm, WL 4.6 mm (n=1). Selected measurements: WD (25 =1 mm) 52, HW 40, UOD 24, MOD 27, LOD 20, HL 37.5 EL 27, CAL 14, CPL 7, ACL 5, EW 10.5, GW 8, MsW 43, MtW 45, MsL±8(broken), MTL 6, PDL 8, IOD (40=1 mm), OOD 9, VOD 8.

Unless mentioned, the specimen examined shares the common features of *L.* ***lucidulum*** subgroup given in pp. 143-145.

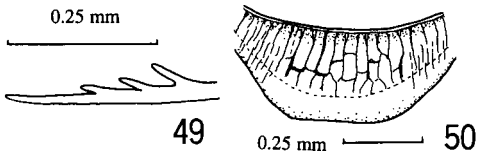
Color: Tegula pale brown. Veins pale brown. Flagella below pale brown. Metasoma entirely reddish (deep orange brown).

Pilosity: Hairs whitish. ***Head:*** Vertex above medially 150μ. Facial, paraocular and genal hairs not tomented but paraocular hairs more plumose than in any other species, incompletely hiding surface. ***Mesosoma:*** Mesoscutal hairs, 125μ (long) and 25μ (short), both sparse. Metanotal tomentum very developed, occupying anterior 3/4 and completely hiding surface there. Propodeal shield tomented though slightly less than in ***kuroshio.*** ***Metasoma:*** T1, basilateral patch absent, lateral fringe sparse, disc virtually glabrous, postmarginal area with sparse "fine marginal hairs" only on lateral comer. T1 disc hairs intermediate between ***tschibuklinum*** (Fig. 9) and *pumilum* (Fig. 5), postmarginal area with "fine marginal hairs" rather densely on lateral comer. T3, disc similar to ***minutissimum*** (Fig. 8), postmarginal area with dense "fine marginal hairs".

Structure: ***Head:*** Shortest among studied species, HL/HW = 0.94. Vertex uniformly outcurved, lateral ocellus distant from vertex 1/2 own short axis. IOD:OOD:VOD = 1:0.9:0.8, UOD:MOD:LOD = 1:1.12:0.83. CPL:CAL:ACL = 1:2.00:0.71. EW:GW = 1:0.76. Scape attaining middle of mid ocellus. ***Mesosoma:*** HW:MsW:MtW = 1: 1.07: 1.12, mesoscutal PP, finer than in other studied species 10-12$\mu\phi$, IS > ϕ, granular and dull, mesoscutellar depression not examined as crushed by pin. Metepistemum with semiparallel reticulation = ***kuroshio.*** Inner hind tibia1 spur with 3 teeth (Fig. 49, 3 in Bliithgen). No. hamuli 1-2-1. Some propodeal ridges attaining dorsal end with weak anastomosis (Fig. 50), laterally with weak striation between ridges downward. IS superficially granular and rather shiny. ***Metasoma:*** T1, slope partly inconspicuously striate, disc with sparse finest PP, seen as if smooth. T2,3 basally and on postmarginal area striate, otherwise rather densely punctate.

Specimen examined: 1 female, Nepal: Napal valley, Godavari, 1400m, 19. iii. 1968 (T. Matsumura, det. *L.* ***massuricum*** by A. W. Ebmer, 1976).

Remarks: Bliithgen (1926) distinguished var. ***chaprensis*** with entirely reddish and T1 having developed striation from the nominate form with metasoma partly black and T1 devoid of developed striation. Because the examined Nepali specimen has the entirely reddish metasoma and T1 devoid of developed striation the difference between the nominate form and var. ***chaprensis*** is considered here an individual variation until further information would be obtained.



Figs. 49-50. Inner hind tibia1 spur (49) and propodeal dorsum of *L. massuricum* (female).

This species shared tomented pronotum and propodeal shield, short head and developed metepistemal sculpture with *L. kuroshio.* In the key to species (p. 164), *L. massuricum* is placed after 2, but differs from *kuroshio* by smaller size, at least partly reddish metasoma, developed metanotal tomentum and finer mesoscutal PP.

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References

Bliithgen, P., 1926. Beiträge zur Kenntnis der indomalayischen *Halictus* - und *Thrincostoma*-Arten. *Zool. Jahrb., Syst.*, 51: 375-698.

Blüthgen, P., 1931. Beitrage zur Kenntnis der Bienengattung *Halictus* Latr., III. *Mitt. zool. Mus. Berlin, 17: 319-398.*

Ebmer, A. W., 1971. Die Bienen der Gattung *Halictus* Latr. s. 1. im Grossraum von Linz (Hymenoptera, Apidae) III. *Naturk. Jahrb. Stadt Linz*, 1971: 63-156.

Ebmer, A. W., 1975. Die Typen und Typoide des Natur-Museums Senckenberg. 54. Von Schenck beschriebene Halictidae (Ins: Hymenoptera: Apoidea). *Senckenbergiana biol.*, *56: 233-246.*

Ebmer, A. W., 1978. *Halictus, Lasioglossum, Rophites* und *Systropha* aus dem Iran (Halictidae, Apoidea) sowie neue Arten aus der Paläarktis. *Linzer biol. Beitr.* 10: l-109.

Ebmer, A. W., 1983. Asiatische Halictidae II. (Apoidea, Hymenoptera). *Ann. Hist.-Nat. Mus. Naturg. Hung., 75: 313-325.*

Ebmer, A. W., 1987. Die europaischen Arten der Gattungen *Halictus* Latreille 1884 und *Lasioglossum* Curtis 1833 mit illustrierten Bestimmungstabellen (Insecta: Hymenoptera: Apoidea: Halictidae: Halictinae). 1. Allgemeiner Teil, Tabelle der Gattungen. *Sencken-*

bergiana biol., 68: 59-148.

Ebmer, A. W., 1988. Kritische Liste der nicht-parasitischen Halictidae Österreichs mit Berücksichtigung aller mitteleuroptiischen Arten (Insecta: Hymenoptera: Apoidea: Halictidae). ***Linzer biol. Beitr., 20: 527-711.***

Ebmer, A. W. & S. F. Sakagami, 1985. Taxonomic notes on the Palaearctic species of the ***Lasioglossum nitidiusculum*** group with description of ***L. allodalum*** sp. nov. (Hymenoptera, Halictidae). *Kontyû.* ***53: 297-3*** 10.

Ebmer, A. W. & S. F. Sakagami, 1985. ***Lasioglossum (Evylaeus) hirashimae*** n. sp., ein Vertreter einer palaotropischer Artgruppe in Japan (Halictidae, Apoidea). ***Nachrichtenbl. Bayerisch. Entomolog., 34: 124-130.***

Ebmer, A. W. & S. F. Sakagami, 1990. ***Lasioglossum (Evylaeus) algirum pseudoannulipes*** (Bltithgen) erstmals in Japan gefunden, mit Notizen über die *L.* ***(E.) leucopus*** Gruppe. (Hymenoptera, Halictidae). ***Jpn. J. Ent., 58: 835-838.***

Eickwort, G. C., 1969. A comparative morphological study and generic revision of the augochlorine bees (Hymenoptera: Halictidae). ***Univ. Kansas Sci. Bull., 48:*** 325-524.

Eickwort, G. C., 1981. Presocial Insects. In Hermann H. R. (ed.). ***Social Insects*** II, 199-280.

Eickwort, G. C. & S. F. Sakagami, 1979. A classification of nest architecture of bees in the tribe Augochlorini, with description of a Brazilian nest of ***Rhynocorynura inflaticeps. Biotropica,*** 11: 28-37.

Fukuda, H., S. F. Sakagami, K. Yamauchi & T. Matsumura, 1973. Biofaunistic survey of wild bees in Hamakoshimizu, eastern Hokkaido. ***Jap. J.*** Ecol., 23: 163-170.

Haneda, Y., 1985. Superfamily Apoidea. pp. 308-328 in "The Catalogue of Insects in Fukui Prefecture" (In Japanese). 404pp., Gov. of Fukui Pref.

Haneda, Y., 1990. On the Apoidea (Hymenoptera) of Fukui Prefecture, Japan. IV. ***Ent. J. Fukui, 7: 2-12*** (In Japanese).

Haneda, Y., 1991. On the Apoidea (Hymenoptera) of Fukui Prefecture, Japan V. ***Ent. J. Fukui, 8: 33-38*** (in Japanese).

Iho, M. & S. Yamane, 1985. Faunistic and biological survey of wild bees at the foot of Gozenyama, Ibaraki Prefecture. ***Bull.*** *Fac. Educ.* ***Ibaraki Univ. (Nat. Sci.), 34: 57-74*** (in Japanese).

Inoue, T., M. Kato, T. Kakutani, T. Suka & T. Itino, 1990. Insect-flower relationship in the temperate deciduous forest of Kibune, Kyoto: An overview of the flowering phenology and seasonal pattern of insect visits. ***Contrb. biol. Lab., Kyoto Univ.,*** 27: 377-403.

Ishii, H. & S. Yamane, 1981. Wild bee survey at the foot of Mt. Yamizo in Ibaraki Prefecture, Japan. *Sci.* ***Rep.*** *Fac. Educ.,* ***Ibaraki Univ. (Nat. Sci.),*** 30: 45-49 (in Japanese).

Kato, M., T. Kakutani, T. Inoue & T. Itino, 1990. Insect-flower relationship in the primary beech forest of Ashu, Kyoto: An overview of the flowering phenology and the seasonal pattern of insect visits. ***Contrb. biol. Lab., Kyoto Univ., 27: 309-375.***

Kato, M., M. Matsumoto & T. Kato, 1993. Flowering phenology and anthophilous insect community in the cool-temperate subalpine forests and meadows at Mt. Kushigata in the central part of Japan. ***Contrb. biol. Lab., Kyoto Univ., 28:*** 119-172.

Knerer, G., 1969. Synergic evolution of halictine nest architecture and social evolution. *Canad.* ***J. Zool., 47:*** 925-930.

Michener, C. D., 1944. Comparative external morphology, phylogeny and a classification of

the bees (Hymenoptera). ***Bull. Amer. Mus. Nat. Hist., 82: 157-326.***

Michener, C. D., 1965. A classification of the bees of the Australian and south Pacific regions. ***Bull. Amer.*** *Mus.* ***Nat. Hist., 130: l-326,*** 15pls.

Michener, C. D., 1974. ***The Social Behavior of the Bees.*** A ***Comparative Study. 404*** pp., Harvard Univ. Press, Cambridge/Mass.

Michener, C. D., 1988. Reproduction and castes in social halictine bees. pp. 75-119. in Engels, W. (ed.), ***Social Insects: An Evolutionary Approach to Castes and Reproduction.*** Springer.

Michener, C. D., 1993. The status of ***Prosopalictus,*** a halictine bees from Taiwan (Hymenoptera, Halictidae). ***Jpn. J. Ent., 61: 61-72.***

Munakata, M., 1984. Change of wild bee fauna at Narukawa between 1963 and 1973. ***J. Hokkaido Univ.*** *Educ.(II,* ***B), 34: 19-73*** (in Japanese).

Munakata, M., 1986. Wild bee survey at Hakodateyama and Akagawa. ***Materials biol.*** *Educ.*, ***21:*** l-3 1 (in Japanese:).

Munakata, M. & K. Kobayashi, 1983. A wild bee survey at Kamekawa, Kikonai, southern Hokkaido. ***Materials biol.*** *Educ.*, ***18: 15-26*** (in Japanese).

Munakata, M. & M. Kudo, 1981. A wild bee survey at Rishiri Is. in 1968 and 1970. ***Materials biol.*** *Educ.*, ***16: 122-130*** (in Japanese).

Munakata, M., M. Tanabe & S. Yoshida, 1987. Comparisons of wild bee surveys at Oshima-Fukushima in 1965, 1978 and 1985. ***Materials biol.*** *Educ.*, ***22: l-26*** (in Japanese).

Okazaki, K., H. Fukuda & S. Higashi, 1986. A preliminary report of wild bee fauna on Mt. Usu. ***Env.*** *Sci.* ***Hokkaido, 9: 79-88.***

Saito, N., S. Yamane & T. Matsumura, 1992. Phenology and flower preferences of wild bees on the campus of Ibaraki University, Mito, central Japan. ***Sci. Rep.,*** *Fac. Educ.,* ***Zbaraki Univ. (Nat. Sci.),*** 41: 153-172.

Sakagami, S. F., 1974. Sozialstruktur und Polymorphismus bei Furchen- und Schmalbienen. In Schmidt, G. H. (ed.) ***Sozialpolymorphismus*** *bei* ***Insekten: 237-293,*** Wissensch., Verlags-gesell.

Sakagami, S. F., 1989. Taxonomic notes on a Malesian bee, *Lasioglossum* ***carinatum,*** the type species of the subgenus ***Ctenonomia,*** and its allies (Hymenoptera: Halictidae). ***J. Kansas ent.*** *Soc.*, ***62: 496-510.***

Sakagami, S. F., A. W. Ebmer, T. Matsumura & Y. Maeta, 1982. Bionomics of the halictine bees in northern Japan. III. ***Lasioglossum (Evylaeus) sakagamii.*** *Kontyû,* 50: 198-211.

Sakagami, S. F. & H. Fukuda, 1972. Autumn bee fauna in Hokkaido University Uryu and Nakagawa Experiment Forests. ***Res. Bull. College Exp. Forest, Coll. Agric., Hokkaido Univ., 29: l-24*** (in Japanese).

Sakagami, S. F. & H. Fukuda, 1973. Wild bee survey at the campus of Hokkaido University. *J. Fac.* ***Sci., Hokkaido Univ., VI. Zool., 19:*** 190-250.

Sakagami, S. F., H. Fukuda & H. Kawano, 1974. Biofaunistic surveys of wild bees. Problems and methods, with results taken at Mt. Moiwa, Sapporo. ***Materials biol.*** *Educ.*, ***9: l-60*** (in Japanese).

Sakagami, S. F. & K. Hayashida, 1968. Bionomics and sociology of the summer matrifilial phase in the social halictine bees, ***Lasioglossum duplex.*** *J. Fac.* ***Sci., Hokkaido Univ., VI. Zool.,*** 16: 413-513.

Sakagami, S. F. & Y. Maeta, 1990. *Lasioglossum (Lasioglossum) primavera* sp. nov., a Japanese halictine bee which overwinters in both female and male adults (Hymenoptera, Halictidae). *Bull. Fac. Agr., Shimane Univ., 24: 52-69.*

Sakagami, S. F., T. Matsumura & Y. Maeta, 1985. Bionomics of the halictine bees in northern Japan. III. *Lasioglossum (Evylaeus) allodalum*, with remarks on the serially arranged cells in halictine nests. *Kontyû, 53: 409-419.*

Sakagami, S. F. & C. D. Michener, 1962. *Nest Architecture of the Sweat Bees. A comparative Study, 135* pp., Univ. Kansas Press, Lawrence.

Sakagami, S. F. & Munakata, 1966. Bionomics of a Japanese halictine bees, *Lasioglossum pallidulum* (Hymenoptera, Apoidea). *J. Kansas ent. Soc., 39: 370-379.*

Tadauchi, O., 1989. Halictidae. pp. 680-682. Supervised by Y. Hirashima, In *"A Check List of Japanese Insects"*, Entomol. Lab, Fac. Agr., Kyushu Univ., Fukuoka, 1767pp.

Takahashi, H., 1990. Wild bee survey in Hachijojima Is., of the Izu Islands, Japan. *Bull. biogeogr. Soc. Japan, 46: 171-178* (in Japanese).

Takahashi, H. & S. F. Sakagami, 1993. Notes on the halictine bees (Hymenoptera, Apoidea) of the Izu Islands: *Lasioglossum kuroshio* sp. nov., life cycles in Hachijojima Is., and a preliminary list of the species in the Izu Islands. *Jpn. J. Ent., 61: 267-278.*

Uehira, Y., Y. Akahira & S. F. Sakagami, 1979. A wild bee survey in Kiritappu highmoor, eastern Hokkaido. *Low Temp. Sci., B, 37: 47-57.*

Usui, M., Y. Nishijima, H. Fukuda & S. F. Sakagami, 1976. A wild bee survey in Obihiro, eastern Hokkaido. *Res. Bull. Obihiro Univ.,* 10: 225-231.

Wamcke, K., 1975. Beitrag zur Systematik und Verbreitung der Furchenbienen in der Turkei (Hymenoptera, Apoidea, *Halictus). Polsk. Pismo Entom., 45: 81-128.*

Yamada, M., M. Munakata & S.F. Sakagami, 1990. Non-parasitic halictid bees in Shimokita and Nanbu Districts (Aomori Prefecture), northernmost Honshu. *J. Aomori-ken biol. Soc., 27: 35-40* (in Japanese).

Yamada, M. & S. F. Sakagami, 1988. Non-parasitic halictid bees in Tsugaru District (Aomori Prefecture), northernmost Honshu. *J. Aomori-ken biol. Soc., 25:* 10-21 (in Japanese).

Yamauchi, K., Y. Morimoto, M. Watanabe, S. F. Sakagami & T. Matsumura, 1982. Bees in *"Insects of Gifu"*, pp. 111-221, 415-430 (in Japanese).

Yamaguchi, K., Y. Murakumo, S. Ogura & S. F. Sakagami, 1974. Biofaunistic survey of wild bees in Minami (Gifu Prefecture), central Japan. *Sci. Rep., Fac. Educ., Gifu Univ. (Nat. Sci.), 5: 220-232* (in Japanese).

Yamaguchi, K., K. Okumura & S. F. Sakagami, 1976. Biofaunistic survey of wild bees in Hida-Hagiwara (Gifu Prefecture), central Japan. *Sci. Rep., Fac. Educ., Gifu Univ. (Nat. Sci.), 5:* 413-423 (in Japanese).

Table 1. Values ($\bar{x}$±SD)[1] of some metric characters (female).

Characters'	Species'						
	zunaga	*longifacies*	*pumilum*	*kuroshio*	*lucidulum*	*minutis-simum*	*tschibuk-lium*
			10 units = 1 mm				
BL	53.1±3.3	56.5k2.8	48.1±2.0	61.6±2.7	45.3±0.5	42.7±1.7	44(l)
WL	44.8±1.6	52.1±1.6	37.4±1.2	54.2±1.3	37.3±0.5	35.8±2.8	36(l)
			25 units = 1 mm				
HW	35.5±1.3	40.4±1.7	30.9±1.0	41.5±1.1	29.3±1.2	29.8k0.8	31.5
HL	38.5k1.2	44.5±1.3	34.4±0.7	42.1±1.2	31.5±0.4	32.6±0.5	32
MsW	39.0±1.8	45.8±1.7	33.1k1.5	47.8±1.2	30.0±1.4	30.0±1.4	32
MtW	40.1±1.7	48.8±1.8	34.6±1.6(9)	49.1±2.1	32.0±0.8	32.7±1.2	34
UOD	22.8±1.0	25.3±0.9	19.7±0.6	23.8k0.9	19.5±1.1	18.7±0.5	19
MOD	24.5±1.3	27.9±0.9	20.9±0.7	28.0±0.8	21.2±1.0	21.3±0.5	23
LOD	18.2±0.9	20.7±0.7	15.3±0.6	22.5±0.7	15.7±0.5	15.7±0.5	18
EL	25.9±0.9	30.7±1.6	23.8±1.0	29.9±0.7	22.0±0.0	22.7±0.9	21
CAL	15.2k0.6	17.2±0.8	13.2±0.6	17.2±0.7	12.0±0.0	12.2±0.2	11
CPL	8.0±0.0	9.1±2.0	7.1±0.5	9.8±0.6	6.7±0.5	6.7±0.5	6
ACL	5.9±0.2	6.7±1.0	5.1±0.4	6.3±0.4	4.0±0.0	4.8±0.2	4
EW	10.0±0.0	10.9±0.5(5)	9.2±0.4(5)	11.1±0.5(5)	9.0±0.0	8.7±0.5	8
GW	7.4±0.5	9.2±0.4(5)	6.4±0.5(5)	7.6±0.8(5)	6.0k0.0	6.7±0.6	6.5
SPL	14.4±0.8	16.2±0.4(5)	11.7±0.4(5)	18.2±0.4(5)	12.0±0.0	11.8±0.0	13
MCL	7.4±0.4	9.0±0.6	6.1±0.5	9.8±0.6	6.0±0.4	6.8±0.2	6.5
MTL	4.7±0.4	5.8±0.2	4.4±0.4	5.8±0.2	4.0±0.0	4.3±0.2	4
PDL	8.0±0.2	9.0±0.7	6.7k0.4	10.6±0.7	6.7±0.2	7.3±0.5	7
WDL	51.2k2.2	61.6±1.9	40.9±1.6	65.6±1.6	42.3±0.5	41.0±1.4	41
			40 units = 1 mm				
OOD	10.3±0.3	11.5±0.5	8.1±0.3	10.1±0.5	8.3k0.5	8.0±0.0	9
IOD	9.1±0.2	9.7±0.5	8.6±0.5	9.1±0.5	8.3±0.5	9.0±0.0	9
VOD	9.3±0.5	10.6±0.5	9.1f0.5	8.0±0.0	7.3±0.5	7.3±0.5	7
F_2L	3.0±0.0(5)	3.7±0.4(6)	2.8±0.2(5)	3.3±0.2(5)	2.5±0.0	2.7k0.5	2.5
F_2W	5.0±0.0(5)	5.6±0.3(6)	4.9±0.5(5)	5.9±0.2(5)	4.2±0.2	4.8k0.2	4

1. Unless parenthetically mentioned, N = 3 in *lucidulum* and *minutissimum*, = *1* in *tschibuklinum* and = 10 in all other species.
2. Further, some selected characters were measured in 2 allied species (both N = 2), *L. semilucens* / *L. intermedium.* BL 46, 44 / 61, 55; WL 38, 36 / 50, 47; HW 34.5, 36 / 39.5, 38; HL 33, 35 / 41, 39; MCL 7.5, 8.5 19.5, 10; PDL6.5, 7 / 7, 7.5; IOD 10, 10 / 11, 11; OOD 10, 9.5 Ill, 10.
3. Abbreviations are explained in the text.

Table 2. Values ($\bar{x}$±SD)[1] of some metric characters (male).

Character?	Species' *zunaga*	*longifacies*	*pumilum*	*kuroshio*	*lucidulum*	*minutissimum*
			10 units = 1 mm			
BL	48.1k2.8	52.7±2.7(9)	41.6±2.9	51.9±2.8	42.5±2.5	38.5
WL	41.1f1.5	46.8±1.5	33.6±1.0	45.2±2.0	31.0±0.5	33.0
			25 units = 1 mm			
HW	33.4±0.7	37.9k1.4	27.2±0.7	35.6±1.4	26.3±0.3	28
HL	36.2±1.0	41.2f1.5	32.3±1.0	36.7±1.9	29.5±0.5	31.5
MsW	34.7±1.1	40.1±2.4	28.4±0.8	37.7±1.5	25.5±0.5	27
MtW	29.9±1.3	35.2±2.4	27.0±2.3	37.1±2.2	23.3±0.8	24
UOD	21.2±0.6	23.8±0.9	18.0±0.6	20.9±0.8	17.8±0.3	19
MOD	22.7±0.7	25.3±1.1	19.0±0.6	23.4±0.7	19.0±0.0	19.5
LOD	14.9±0.2	16.8k0.9	12.5±0.4	15.4±0.7	12.5±0.5	13
EL	24.7r0.5	28.3±0.9	21.6±0.8	26.2k0.9	20.0±0.0	21
CAL	14.6±0.5	16.6±1.0	13.0±0.6	14.8±1.0	11.5±0.5	11
CPL	7.8±0.6	9.4k0.8	7.0±0.0	8.4±1.0	7.0±0.0	7
ACL	5.2±0.3	6.1±0.2	3.9±0.2	5.4±0.7	3.8±0.3	3
EW	10.4±0.5(5)	11.2±0.2(5)	9.8±0.4	11.3±0.6	9.0±0.0	9
GW	7.8±0.7(5)	8.5±0.6(5)	6.2±0.4	7.9±0.8	6.0±0.0	6
SPL	10.6±0.5(5)	10.7±0.4(5)	8.8k0.4	10.0±0.9	8.0±0.0	8.5
MCL	6.6±0.6	8.1±0.4	6.1±0.5	8.4±0.9	5.8±0.2	7
MTL	4.4±0.4	4.9±0.6	4.4±0.4	4.9±0.5	4.0±0.0	4.5
PDL	7.3±0.5	8.7±0.5	6.7±0.4	8.9±0.7	6.0r0.5	7
WDL	47.2±1.6	55.3±2.1	37.2±1.7	48.5±5.6	39.0±0.0	38
			40 units = 1 mm			
OOD	9.9±0.3	10.7±0.5	7.8±0.4	8.5±0.5	7.5±0.5	7
IOD	9.0±0.0	9.9±0.3	9.0±0.0	9.2k0.4	8.0±0.0	8
VOD	9.1±0.3	11.3±0.6	9.4±0.8	8.3±0.6	8.0±0.0	8
F_1L	4.5±0.4	4.9±0.4	4.1±0.2	4.9±0.3	3.8±0.3	4
F_2L	6.0±0.4	8.1±0.5	4.9±0.2	6.9±0.6	5.3±0.3	5.5
F_3L	6.0k0.4		8.0±0.6	5.0±0.0	6.6±0.7	5.8±0.3	5.5
$F_{10}L$	6.6±0.6	8.6±0.7	6.0k0.0	7.1±0.4	6.0±0.0	6.5
$F_{11}L$	9.5±0.5	11.5±0.7	9.1±0.2	9.7±0.4	9.0±0.0	9.5
F_2W	5.8±0.3	7.0±0.2	4.7±0.4	5.6kO.4	4.5±0.0	4.5

1. Unless parenthetically mentioned, N=2 in *lucidulum*, =1 in *minutissimum*, =5 in *pumilum* and =10 in all other species.
2. Further, some selected characters were measured in 2 allied species *L. semilucens* (N=1) / *L. in&-medium* (N=2). BL 43 / 57, 54; WL 34 / 42, 42; HW 32 / 36, 35; HL 32 / 37, 37; MCL 6.5 /6.5, 7.5; MTL 4 / 6, 6; PRD 5 / 5.5, 7; IOD 10 / 9, 10; OOD 10 / 10, 10.
3. Abbreviations are explained in the text.

Table 3-l. Representative ratios of some body parts. Not all ratios are given in ***L. intermedium*** and ***L. semilucens.***

Characters/ratios	Species	Female	Mate
HW:MsW:MtW	***zunaga***	1:1.10:1.13	1:1.03:0.89
Japanese spp.	***longifacies***	1:1.13:1.21	1:1.06:0.93
	pumilum	1:1.07:1.12	1:1.04:0.99
	kuroshio	1:1.15:1.18	1:1.05:1.04
Exotic spp.	***lucidulum***	1:1.02:1.09	1:0.97:0.88
	minutissimum	1:1.01:1.10	1:0.96:0.86
	tschibuklinum	1:1.07:1.13	
	intermedium	1:1.11:1.14	1:1.01:0.92
	semilucens	1:0.94:0.99	1:0.97:0.99
HW:HL	***zunaga***	1:1.08	1:1.08
	longifacies	1:1.10	1:1.09
	pumilum	1:1.11	1:1.19
	kuroshio	1:1.01	1:1.03
	lucidulum	1:1.09	1:1.12
	minutissimum	1:1.09	1:1.13
	tschibuklinum	1:1.02	
	intermedium	1:1.03	1:1.06
	semilucens	1:0.95	1:1.00
UOD:MOD:LOD	***zunaga***	1:1.07:0.80	1:1.07:0.70
	longifacies	1:1.10:0.82	1:1.06:0.66
	pumilum	1:1.06:0.78	1:1.06:0.69
	kuroshio	1:1.18:0.95	1:1.12:0.74
	lucidulum	1:1.09:0.81	1:1.07:0.70
	minutissimum	1:1.14:0.84	1:1.03:0.68
	tschibuklinum	1:1.21:0.95	
	intermedium	1:1.10:0.82	1:1.10:0.73
	semilucens	1:1.09:0.81	1:1.05:0.71
CPL:CAL:ACL	***zunaga***	1:1.90:0.74	1:1.87:0.67
	longifacies	1:1.89:0.74	1:1.77:0.65
	pumilum	1:1.85:0.72	1:1.86:0.56
	kuroshio	1:1.75:0.64	1:1.76:0.64
	lucidulum	1:1.83:0.60	1:1.64:0.54
	minutissimum	1:1.82:0.72	1:1.57:0.43
	tschibuklinum	1:1.83:0.67	
	intermedium	1:1.93:0.81	1:1.76:0.59
	semilucens	1:1.76:0.53	1:1.71:0.59

Table 3-2. Continued.

Characters/ratios	Species	Female	Male
EW:GW	*zunaga*	1:0.74	1:0.75
Japanese spp.	*longifacies*	1:0.84	1:0.76
	pumilum	1:0.70	1:0.63
	kuroshio	1:0.68	1:0.70
Exotic spp.	*lucidulum*	1:0.67	1:0.67
(not measured in *intermedium* and semilucens)	*minutissimum*	1:0.77	1:0.67
	tschibuklinum	1:0.81	
IOD:OOD:VOD	*zunaga*	1:1.13:1.02	1:1.10:1.01
	longifacies	1:1.18:1.09	1:1.08:1.14
	pumilum	1:0.94:1.06	1:0.87:1.04
	kuroshio	1:1.10:0.79	1:0.92:0.90
	lucidulum	1:1.00:0.88	1:0.94:1.00
	minutissimum	1:0.90:0.81	1:0.88:1.00
	tschibuklinum	1:1.00:0.78	
	intermedium	1:0.95:0.82	1:0.95:0.95
	semilucens	1:1.00:0.80	1:0.98:0.85
$F_2L:F_2W$	- g a	1:1.67	1:0.81
	longifacies	1:1.53	1:0.96
	pumilum	1:1.51	1:0.86
	kuroshio	1:2.11	1:0.96
	lucidulum	1:1.66	1:0.85
	minutissimum	1:1.80	1:0.82
	tschibuklinum	1:1.60	
	intermedium	1:1.92	1:0.92
	semilucens	1:1.89	1:0.89
MCL:MTL:PDL	*zunaga*	1:0.64:1.08	1:0.67:1.11
	longifacies	1:0.64:1.07	1:0.60:1.08
	pumilum	1:0.72:1.11	1:0.72:1.11
	kuroshio	1:0.59:1.07	1:0.58:1.06
	lucidulum	1:0.67:1.11	1:0.69:1.05
	minutissimum	1:0.63:1.07	1:0.64:1.00
	tschibuklinum	1:0.61:1.08	
	intermedium	1:0.61:0.82	1:0.53:0.89
	semilucens	1:0.53:0.81	1:0.61:0.78

Table 4. Synopsis of specific characters (* in male, others in female) in 4 Japanese species of the *lucidulum* subgroup.

Character	Species			
	zunaga	*longifacies*	*pumilum*	*kuroshio*
Size (WL mm)	44.8±1.6	52.1±1.6	37.4±1.2	54.2±1.3
Pronotum	not tomented	not tomented	only partly tomented	homogeneously tomented**
Metanotal tomentum	very weak	very weak	slightly developed	very weak
Propodeal shield	not tomented	not tomented	not tomented	tomented**
T_1 basal patch	—**	t	t	+
T_1 hairs	nearly glabrous	sparse* *	nearly glabrous	nearly glabrous
$T_{2,3}$ hairs	very sparse	dense	sparse	dense
Premarginal fine hairs on $T_{2,3}$	—**	t	t	+
HL / HW	1.05-1.10	1.07-1.15	1.00-1.15	1.00-1.02
Vertex	uniformly arcuate	uniformly arcuate	medially flat** laterally arc.	uniformly arcuate
Scape attaining middle of mid ocellus	t	t	—**	t
Propodeal longitudinal ridge	attaining 1/2 dorsal length	exceeding 1/2 dors. L	attaining or not dors. L	exceeding dorsum**
T_1	virtually glabrous	densely PPed	virtually glabrous	very sparsely PPed
Labrum*	pale	pale to dark	pale	dark
Mandible medially*	pale	pale to dark	pale	dark
HL /HW*	1.04-1.12	1.06-1.13	1.14-1.22	1.00–1.05**
Gonostylus*	mammiform, hairs sparse	cone-like, h. sparse	elongate mammiform, h. sparse	mammiform, h. rather dense**
Ventral retrose lobe*	without hairs and spicules	without hairs and spicules	spicules dense forming transverse band**	with spicules and dense hairs**

** Features seen only in the marked species.

Table 5. Relation between color variation and localities in *L. longifacies* males.

Districts or Prefectures from north to south	No. of specimens with dark (D) or pale (P) hue in various body parts							
	Labrum		Mandible		Fore tibial tip		Tarsi	
	P	D	P	D	P	D	P	D
Hokkaido								
Sorachi		5		5		5		5
Kushiro	1	1	2		2		1	1
Ishikari		2	2		2		2	
Honshu								
Miyagi	1	2	3		1	2	3	
Ibaraki	1	4	3	2	5		5	
Gifu	1		1		1		1	
Fukui	1	1	1	1	2		2	
Kyoto	1		1		1		1	
Total	6	15	13	8	14	7	15	6

Color hue: Labrum (P=yellow to yellow brown; D=pale to dark brown); Mandible (P=yellow; D= narrowly yellow or narrowly pale brown); Fore tibial tip (P=yellow; D=pale brown to brown); Tarsi (P=yellow; D=pale to dark brown)

Table 6. The number of localities* where the Japanese species were recorded.

Major district	Hokkaido	Tohoku	Kanto+Chubu	Kinki+Chugoku	Total
zunaga	12	14	11		37
longifacies	16	10	16	3	45
pumilum	4	4	5		13
kuroshio			2		2
Total	32	28	34	3	97

* Taken from distribution in each species, ignoring small districts given parenthetically.