

**Taxonomic Notes on a Malaysian Bee *Lasioglossum carinatum*,
the Type Species of the Subgenus *Ctenonomia*, and its Allies
(Hymenoptera: Halictidae)¹**

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ABSTRACT: *Lasioglossum (Ctenonomia) carinatum* (Cameron), the type species of the subgenus known only by the type specimen from Sarawak, is redescribed. A closely allied species, *L. pavo*, n. sp., the male of which possesses decorative sternal hair fringes, is described from Mentawai Is. near Sumatra. A third allied species, *L. xystonotum* (Vachal), is compared with the above two species. These species form the *L. carinatum* group, which is distinguished from the other groups of *Ctenonomia* (e.g., the *vagans*, *albescens*, and *circ* groups) by glabrous and laterally pointed postlateral corners of the propodeal dorsum.

The Malaysian halictid bee genus *Ctenonomia* Cameron was first erected monobasically for the reception of *C. carinata* from Borneo as being close to *Nomia* but separable on the basis of the female's pectinate inner hind tibial spur (Cameron, 1903). Cockerell (1925) transferred this species to *Halictus*. Blüthgen (1925) followed this change but did not cite this species in his revision of the Indomalayan halictine bees (1926, 1928, 1931), and later both the genus and the species were ignored by specialists. Michener (1965) proposed the use of *Ctenonomia* as the subgeneric name for a large Palaetropic group of species belonging to *Lasioglossum*. He characterized *Ctenonomia* as differing from *Lasioglossum* s. str. in its short robust form, the pectinate inner hind tibial spur of the female, the short, broad labral process of the female, etc., but did not delimit the subgenus or refer to the type species.

The present paper redescribes the holotype of *Lasioglossum (Ctenonomia) carinatum* (Cameron) and compares it to two allied species, *L. (C.) pavo*, new species and *L. (C.) xystonotum* (Vachal). It is still premature to delimit *Ctenonomia* precisely but some species groups of this subgenus are tentatively mentioned. *L. carinatum* is known only from the type specimen (female). Some body parts are in poor condition so that the corresponding figures drawn for *L. pavo* are cited. The description includes some supraspecific features. Type specimens of *L. pavo* and all available specimens of *L. xystonotum* are, for the time being, with S.F.S., to be deposited in the Museum Zoologicum Bogoriense, Bogor, Indonesia and Entomological Institute, Hokkaido University, Sapporo, Japan.

Abbreviations: L, W = maximum length and width, D = minimum distance, ϕ = diameter, and in alphabetical order, AOD = alveocellar D; APL = apical part of clypeus L = L of part exceeding lower orbital line; CAL = clypealveolar D; CPL = clypeal L; EL = eye L; EW = eye W, seen laterally; F_nW = flagellomere n W; GW = gena L, seen laterally; HL, HW = head L, W; IOD = interocellar D; IS = interspaces of punctures; LOD = lower interorbital D; McL, W = marginal cell L, W (L = from end of pterostigma to inner cell end); MNL = metanotum

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L; MOD = maximum interorbital D; MsW = mesosoma W; MtW = metasoma W; OOD = ocellocular D; PDL = propodeal dorsum L; PP = punctures; PsL, PsW = pterostigma L, W; SCL = mesoscutellum L; SL = scape L; Sm2L, Sm3L = submarginal cell 2, 3 L; TgL, W = tegula L, W; T_n = metasomal tergum n ; UOD = upper interorbital D; VOL = verticorbital L (tangential L between summit of vertex and supraorbital line); WD = wing diagonal (D between M - cu bifurcation and inner tip of marginal cell); WtL = wing tip L (from inner end of marginal cell to wing tip).

Lasioglossum (Ctenonomia) carinatum (Cameron)

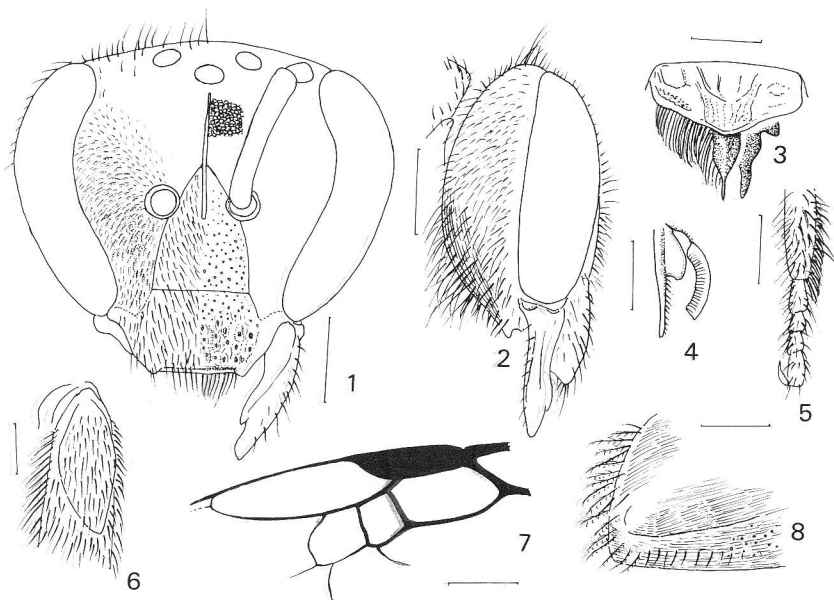
Ctenonomia carinata Cameron, 1903:179, ♀; Sandhouse, 1943:542.

Halictus carinatus Cockerell, 1925:495; Blüthgen, 1925:419.

FEMALE: Body 6.7 mm, wing including tegula 6.7 mm.

Coloration: Black. Mandible, tegula, tergal margins and legs partly chestnut brown tinted. Wings transparent, slightly yellowish, veins and pterostigma dark brown.

Pilosity: In rather poor condition, particularly on face, mesosomal dorsum and terga (partial detaching of hairs not precluded). Generally pale yellow, whitish on face and mesosoma laterally, and dark brown on terga. *Head* (Figs. 1, 2): Vertex with sparse, erect hairs (max. 200 μ), simple but laterally vestigially plumose. Face above with sparse, erect, simple, fine hairs (max. 100–125 μ), recognizable only when seen laterally; denser on paraocular area below, mixed with plumose, appressed hairs but still not completely hiding surface. Supraclypeus and clypeus sparsely haired with surface not hidden, hairs to 150 μ on clypeal center, marginal bristles to 275 μ . Gena (Fig. 2) with short, appressed hairs along outer orbit, without forming dense patch; otherwise with moderately dense, erect, plumose hairs (± 100 μ) above, gradually longer and more distinctly plumose toward hypostoma (max. 250 μ). *Mesosoma*: Pronotum frontally in part and probably also above with dense tomental hairs (actually dirty in the specimen) (cf. Fig. 11). Mesoscutum as if glabrous (partial detaching not precluded) but with sparse, fine, semiappressed, short hairs (± 50 μ , anteriorly to 125 μ). Mesoscutellum similar but hairs longer, 100–125 μ and some, particularly dark brown postmarginal hairs, to 300 μ . Metanotum with dense tomentum hiding surface, laterally with sparse, erect, plumose hairs (± 300 μ). Mesopleuron with erect hairs, above ± 150 μ and plumose, below to 300 μ and weakly plumose. Metapleuron, propodeal side and, less densely, propodeal declivity with dense, appressed tomentum hiding surface. Propodeal scopa well developed (Fig. 21), plumosity denser than in *L. vagans* (Smith) and even *L. splendidulum* (Vachal); propodeal dorsum laterally with sparse, plumose hairs but, unlike the *L. vagans* group, postlateral depressed corner of dorsal enclosure glabrous (Figs. 20, 25, 48). Tegula glabrous posterolaterally, otherwise with sparse, semiappressed hairs, denser and longer (to 125 μ) anteriorly. Legs of usual *Lasioglossum* type. Femoral scopa (cf. Fig. 12) more developed than in *L. vagans*, comparable to *L. splendidulum*. *Metasoma*: Ventrolateral areas of terga 1–4 (T_1 – T_4) with dense long and distinctly plumose hairs (± 250 μ on T_1). Dorsal surface of terga rather poorly haired. T_1 on anterior surface and on disc laterally with only sparse, fine hairs; lateral patch replaced by sparse, fine hairs (30–50 μ); disc virtually glabrous; marginal area laterally with sparse, rather stout,



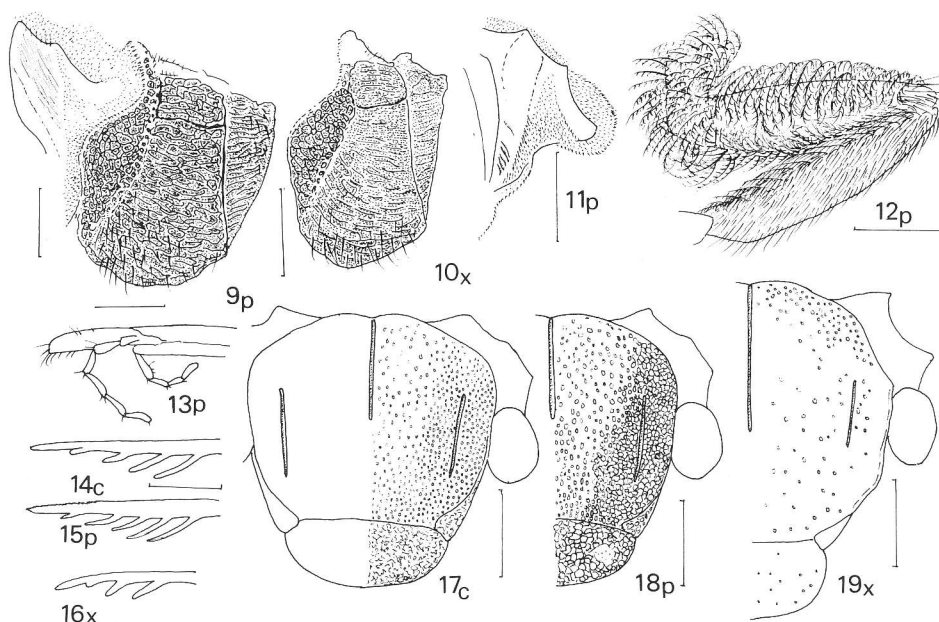
Figs. 1-8. *Lasioglossum carinatum* (female). 1, 2. Head seen frontally and laterally. 3. Labrum, profile shown at righthand. 4. Strigilis (left). 5. Fore basitarsal comb (left). 6. Hind basitibial plate (left). 7. Fore wing partly (left). 8. Metasomal tergum 1 (left). Scale line = 0.5 mm in 1, 2, 5, 7, 8; 0.25 mm in 3, 4; 0.125 mm in 6.

semiappressed hairs forming inconspicuous row (Fig. 8). T_2 - T_4 without visible basal fasciae (probably hidden, cf. *L. pavo*). T_2 with fine setae denser than on T_1 but still looking glabrous, postlaterally with finer bristlelike hairs and premarginal bristle row more conspicuous. On T_3 - T_4 , fine bristles issuing also from anterior surface and denser and stouter laterally and posteriorly, attaining $450\ \mu$ on base of marginal area of T_4 , but these bristles and finer hairs less conspicuous than in *L. vagans* groups. Sterna difficult to see but seemingly of usual *Lasioglossum* type (cf. *L. pavo*).

Metric characters: Hair length and puncture diameter, in which the absolute value is important, are given with microns in *pilosity* and *structure*, respectively. Other measured values, which are mainly used for calculation of ratios, are given below with scale units of the ocular micrometer. Each character arranged in the descending order of dimension, accompanied by the corresponding value in *L. pavo* (=p, mean, $n = 2$) and *L. xystronotum* (x, mean \pm SD, $n = 10$ if unmentioned) (Fig. 49).

A (25 units = 1 mm): WD 67 (p 62.5, x 61.4 ± 2.1), MtW 65 (p 62, x 64.6 ± 2.6 , $n = 5$), MsW 61 (p 57.5, x 61.4 ± 1.8 , $n = 5$), HW 52 (p 50, x 49.4 ± 1.1); HL 47 (p 46, x 44.8 ± 0.9), EL 36 (p 35.5, x 32.8 ± 0.8), MOD 36 (p 34.5, x 34.6 ± 0.8), UOD 28 (p 26.5, x 29.6 ± 0.7), LOD 25 (p 23.5, x 27.0 ± 0.8).

B (40 units = 1 mm): McL 43 (p 41.6, x 40.6 ± 1.4), WtL 41.6 (p 38.4, x 37.4 ± 1.3 , $n = 5$), SL 35 (p 31.5, x 28.8 ± 0.6), CAL 32 (p 30.5, x 28.0 ± 1.3), 5 PsL 32 (p 29, x 29.2 ± 1.2 , $n = 5$), AOD 27 (p 27.2, x 28.6 ± 0.5), TgL 24 (p 22.8, x 24.0 ± 1.0 , $n = 5$), EW 20 (p 20, x 18.6 ± 0.7), SCL 18 (p 18.5, x 18.6 ± 0.5), PDL 18 (p 18, x 16.4 ± 0.7), CPL 17 (p 16.5, x 16.7 ± 1.1), Sm3L 17



Figs. 9–19. *Lasioglossum carinatum* (c), *pavo* (p) and *xysonotum* (x) (female). 9, 10. Meso- and metapleura (left). 11. Pronotum (left, frontally). 12. Hind femur and tibia (left). 13. Apex of mouth parts (left). 14–16. Inner hind tibial spur (right). 17–19. Mesoscutum and -scutellum (right). Scale line = 0.5 mm in 9–13, 17–19; 0.125 mm in 14–16.

(*p* 14.8, *x* 13.4 ± 0.6), GW 15 (*p* 15.5, *x* 15.4 ± 0.9), TgW 15 (*p* 13.2, *x* 13.4 ± 0.6), McW 14 (*p* 16, *x* 14.9 ± 0.9), IOD 13 (*p* 13, *x* 12.3 ± 0.4), MNL 12 (*p* 13, *x* 12.7 ± 0.8), Sm2L 11 (*p* 11.6, *x* 8.6 ± 1.9), APL 11 (*p* 9.5, *x* 9.4 ± 0.5), PsW 11 (*p* 9, *x* 10.2 ± 0.4), OOD 10 (*p* 9.5, *x* 11.8 ± 0.4), VOL 7 (*p* 6, *x* 7.3 ± 0.4).

Important ratios: HW:MsW:MtW = 1:1.17:1.25; HW:HL = 1:0.90; MOD:UOD:LOD = 1:0.78:0.70; CPL:CAL:APL = 1:1.88:0.65; IOD:OOD:VOL = 1:0.77:0.54; EW:GW = 1:0.75; SCL:MNL:PDL = 1:0.67:1.00.

Structure: Head slightly wider than long but not strongly transverse (Figs. 1, 46), rather short triangular. Vertex only gently convex, lateral ocellus slightly below summit, mid line of mid ocellus approximately on supraorbital line, both outer and inner orbits distinctly convergent below. Seen dorsally, gena as long as eye, gently extending postward but not laterad. Vertex finely and homogeneously etched, dully shining; occiput distinctly carinate. Frons flat, finely and homogeneously reticulate, dull; each areola 20–30 μ, not forming distinct rows; area below mid ocellus not triangularly smooth; frontal carina conspicuous, above approaching mid ocellus. Paraocular area above sculptured as on face, below hidden by hairs but reticulation replaced by obscure punctation or dull coriaceous sculpture. Supraclypeus only mildly raised, finely coriaceous and dull, with very weak, shallow punctures (ϕ , 20–25 μ) and interspaces (IS) = 2.0 ϕ PP, lateral margin gently divergent. Epistomal lobe small but present. Clypeus nearly as high as supraclypeus, coriaceous, dully shining as on supraclypeus; above with obscure, very shallow PP, 20–25 μ ϕ and IS = 1.0–2.0, irregular; the rest with coarse, elongate, ill-defined PP, dimension 25 × 32 to 62 × 38 μ with IS linear to 0.5 transverse ϕ ; laterapical

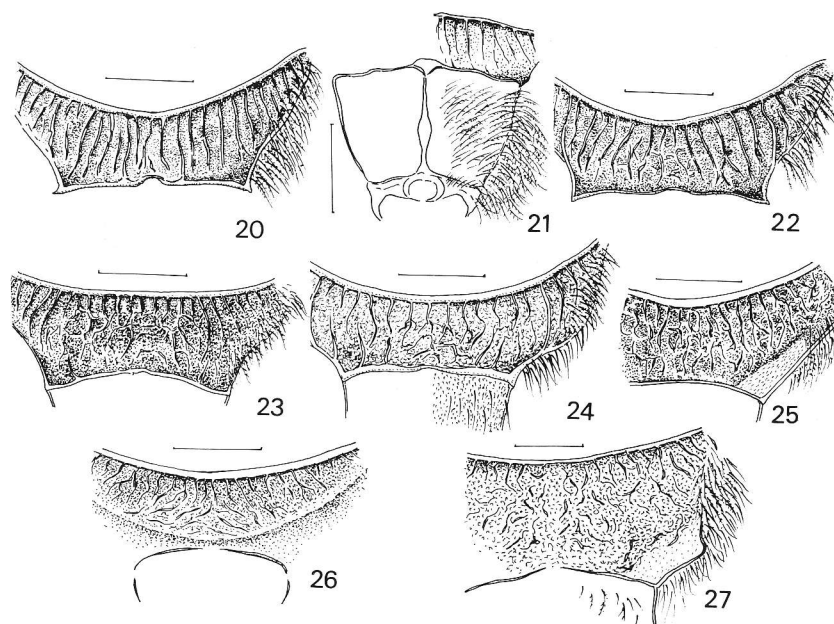
tooth distinct but not prominent. Scape slightly exceeding mid ocellus. Malar space linear. Gena (Fig. 2) slightly narrower than eye, along outer orbit with irregular and ill-defined PP $\pm 20 \mu \phi$; IS dully shining, posteriorly strongly striate to hypostoma. Labrum (Fig. 3) with basal area transverse and flat, surface finely granulate, anterior margin obtuse-triangular and ridged; distal process rather narrow, tapering apicad, basal part with lateral margin slightly convex; distal keel compressed, very thin seen dorsally. Mouthparts (cf. Fig. 13) not examined in detail but seemingly of usual halictine type without elongation of glossa and postpalpal part of maxilla. Mandible bidentate.

Pronotum (cf. Fig. 11) concave seen laterally; seen frontally lateral angle obtuse, not sharply pointed, dorsal ridge carinate and laterally incurved, lateral ridge replaced by mild convexity not extending below; anterior surface finely coriaceous and dully shining, not particularly sculptured, medially longitudinally depressed; dorsal surface invisible medially, interrupted by mesoscutum. Mesoscutum (Fig. 17) anteriomedially truncate, lip vertical, clearly differentiated from dorsal disc but not separated by carina; mesoscutal disc mildly protruded and transverse anteriomedially, homogeneously coriaceous, dull with fine and shallow PP 20–25 $\mu \phi$; medially PP ill-defined and sparse, on anterior $\frac{2}{3}$ with IS 1.0–3.0 ϕ , denser postward to 1.0–1.5 ϕ , laterally PP denser and IS linear, tending to be reticulate (Fig. 47). Mesoscutellum flat, medially not depressed, rather irregularly reticulate. Mesopleuron anteriorly coarsely areolate, the rest and metapleuron transversely striate (cf. Fig. 9).

Propodeal dorsum (Figs. 20, 21, 48) mildly slanting and longitudinally ridged; ridges parallel medially and slightly radiating laterally, IS 50–100 μ wide, smooth and shining, partly irregularly undulating and with weak transverse ridges; laterally distinctly convergent posterad; apical part of lateral margin and posterior margin sharply carinate; postlateral corner depressed, without ridges, smooth and highly shining, with apex sharply pointed laterad; posterior margin conspicuously notched medially. Propodeal declivity transverse, convergent below, encircled with sharp carinae both above and at sides, surface finely granular. Wings of *Lasioglossum* s. str. type (Fig. 7), marginal cell apically apart from wing margin and obscurely appendiculate, tc 2 slightly thinner than tc 1 but not as reduced as tc 3, M apically and r 1 as thin as tc 3, r 1 meeting with M near apex of second submarginal cell. Hamuli 3+1+2. Legs of normal halictine type, strigilis normal (Fig. 4), fore basitarsal comb present (Fig. 5); femoral-tibial scopa well developed (cf. Fig. 12) as in *L. (C.) splendidulum*, more than in *L. (C.) vagans*; basitibial plate complete, apex tapering and dully pointed (Fig. 6); inner hind tibial spur with 4 equidistant teeth (Fig. 14c); hind basitarsus as long as hind tibia.

Metasoma oval. T_1 anteriorly smooth and shining with very sparse fine PP; disc with similar PP, finely lineolate and enamel-lustered; boss (=submedian elevation) very flat and obscure, similarly sculptured but slightly shinier (Fig. 8); postmarginal area slightly depressed and similarly sculptured, but PP denser subapically while absent apically, replaced by lineolation. T_2 basally not much depressed, sculptured as on T_1 with very mild boss but PP slightly coarser, denser and lineolation more conspicuous, giving a rather mat and coriaceous appearance; T_{3-4} similar but duller and more coriaceous.

One specimen examined: Holotype, labelled from top, "Type, red", "B. M. Type. Hym. 17.a. 758", "*Ctenonomia carinata* Cameron type Borneo", "Cameron



Figs. 20-27. Propodeal dorsum of *Lasioglossum* (*Ctenonomia*) spp. (23, male; others, female). 21. Seen dorsoposteriorly, together with propodeal declivity; 20, 22-27. Seen dorsally. 20, 21. *L. carinatum*. 22, 23. *L. pavo*. 24. *L. xystonotum*. 25. *L. vagans*. 26. *L. albescens*. 27. *L. clarum*. Scale line = 0.25 mm in 27; 0.5 mm in others.

coll. 1903-121" (Metasoma glued on a separate paper and attached to the pin), deposited in British Museum (Natural History), London. Collected in Matang, Sarawak, according to the original description.

Lasioglossum (*Ctenonomia*) **pavo**, new species

FEMALE: Body 6.4 mm, wing including tegula 5.8 mm.

Coloration: As in *L. carinatum* but generally darker; tergal margins only dimly brownish, scape black.

Pilosity: Better preserved than in the type of *L. carinatum*. Some parts of the following description may also agree with intact specimens of *L. carinatum*. Head as in *L. carinatum* with rather sparse facial hairs. Pronotal dorsum and lobe with dense bright yellow tomentum, anterior surface laterally broadly covered with similar tomentum (Fig. 11). As in *L. carinatum*, mesoscutum very sparsely haired, seen dorsally as if glabrous; longer hairs dark brown, 125-150 μ ; shorter ones slightly denser, yellowish, $\pm 50 \mu$; both erect; peripherally without tomentum except small, inconspicuous poster lateral patch. Mesoscutellum, mesopleuron (Fig. 9), tegula, propodeum (Fig. 22), legs (Fig. 12), ventrolateral areas of terga as in *L. carinatum*. Inner hind tibial spur with 5 equidistant teeth (Fig. 15, possibly 4-5 in both *L. carinatum* and *L. pavo*). T_1 anteriorly with sparse, simple, erect, yellow hairs, 175-200 μ medially, 100-125 μ laterally; disc anteriorly with sparse, erect hairs ($\pm 75 \mu$), postward very sparse but not glabrous. Basal fasciae on T_{2-3} present laterally (possibly continuous on T_3). Premarginal bristles 150 μ (T_2), 250 μ (T_3) and 300 μ (T_{4-5}), hairs gradually denser and stouter on posterior terga but

marginal areas always narrowly glabrous. Sterna on discs with fairly dense, erect, plumose hairs (150–300 μ), marginally similar but with rather appressed hairs (125 μ).

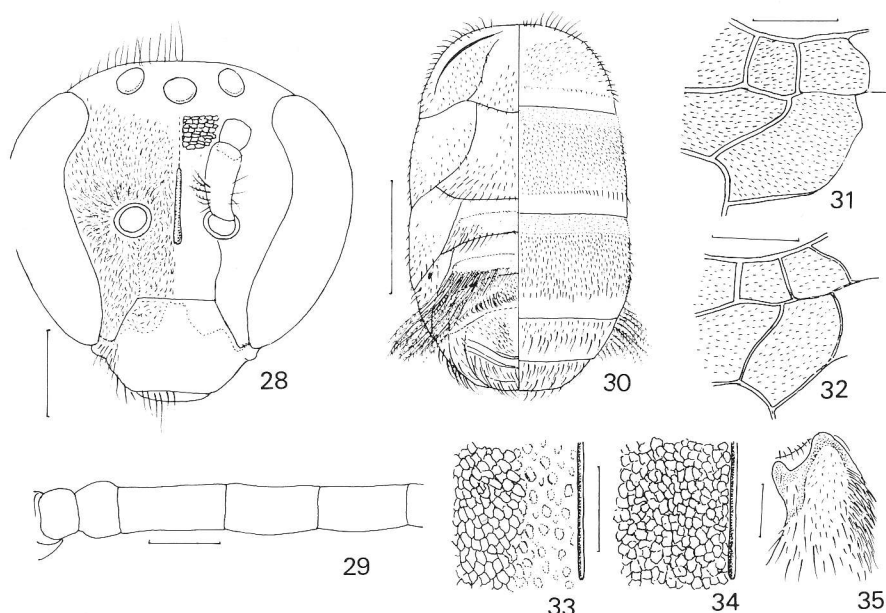
Metric characters: Proportions generally as in *L. carinatum* (Fig. 49), smaller WD, MsW and PsL either reflecting allelomorphic trends or individual variations due to the small sample size ($n = 2$). HW: MsW: MtW = 1:1.15:1.24; HW: HL = 1:0.92; MOD: UOD: LOD = 1:0.76:0.65; CPL: CAL: APL = 1:1.85:0.52; IOD: OOD: VOL = 1:0.73:0.46; EW: GW = 1:0.78; SCL: MNL: PDL = 1:0.73:0.97.

Structure: Differences from *L. carinatum*: (1) Frontal carina shorter, above attaining only level of MOD. (2) Facial reticulation tending to form transverse rows. (3) Reticulation on paraocular area coarser, with areola exceeding 25 μ wide (not precisely examined in *L. carinatum*). (4) Mesoscutum medially more densely punctate and laterally reticulate (Figs. 17, 18). (5) Mesoscutellum with reticulation coarser, particularly on posterior area, laterally with ill-defined smoother area (Figs. 17, 18). (6) In one ♀, propodeal ridges medially more anastomosing, carina forming postlateral margin continuous to anterior margin and median notch of posterior margin of propodeal dorsum weaker seen dorsally (Fig. 22), in another ♀ these features inconspicuous, rather resembling *L. carinatum*. (7) Inner hind tibial spur with 5 teeth. (8) Terga smoother, shinier, lineolation absent on T₁, weak on other terga.

MALE: Body 6.2–6.8 mm, wing including tegula 5.2–6.0 mm.

Coloration: Black, flagellum, seen frontally, dark brown to brown, basal terga with bluish enamel-luster; tergal margins more or less brownish; tegula nearly transparent, pale brownish posteriorly. Coxae, trochanters and hind femur black, partially with brownish tint; fore and mid femora pale brown, posteriorly brown to dark brown longitudinally; fore and mid tibiae pale brown, hind tarsomeres 3 and 4 pale brown; claws chestnut brown. Yellow marks: Scape narrowly at apex; apical $\frac{2}{3}$ of clypeus, with median upward projection either attaining upper margin or not; mandible except chestnut brown apex and dark brown base; labrum; anteroapical angle of pronotum and pronotal lobe, irregular spot on tegula; apices of coxae and trochanters; fore and mid tibiae above longitudinally and below apically; hind tibia except anterior longitudinal pale brown stripe; basitarsus and tarsomeres 1, and 2 except pale brown apex. Wings hyaline; veins brown; pterostigma dark brown.

Pilosity: Hairs rather sparse, though denser and deeper-colored than in ♀. Head (Fig. 28) above as in ♀ (= *L. carinatum*), on face above longer (to 150 μ) and slightly deeper, on paraocular area distinctly deeper (brownish yellow, slightly paler below), denser, appressed, distinctly plumose (75–100 μ) and completely hiding surface, admixed with sparser, semierect, simple to weakly plumose hairs (75–100 μ). Supraclypeus above as on paraocular area, below slightly sparser, both without semiappressed hairs. Clypeus on black part as on supraclypeus below but with semierect simple hairs as on paraocular area below; on yellow part with sparse semierect hairs alone; apical bristles ± 175 μ . Gena as in ♀ but both appressed hairs (above) and longer erect hairs (below) distinctly plumose and pale brownish yellow. Scape with moderately sparse, simple, erect, brownish yellow hairs (100–175 μ). Mesosoma as in ♀. Legs normal, coxae below plumose, gradually less on trochanters and femora below. Setae on wing basally distinctly sparser than in ♀ as in many other halictines (Figs. 31, 32). Ventrolateral areas of terga



Figs. 28–35. *Lasioglossum pavo* (31, 33, female; others, male). 28. Head seen frontally. 29. Basal flagellomeres (left antenna). 30. Metasoma seen ventrally (left) and dorsally (right). 31, 32. Submarginal cells and adjacent areas of right fore wing. 33, 34. Mesoscutal sculpture (left side along median sulcus). 35. Hind basitibial plate. Scale line = 0.5 mm in 28, 31–34; 0.25 mm in 29; 1.0 mm in 30; 0.125 mm in 35.

(Fig. 30) with sparse, simple to poorly plumose hairs ($100\ \mu$ on T_1 , $200\ \mu$ on T_{3-4}). Anterior surface of T_1 medially as in ♀, laterally longer (175 – $250\ \mu$); dorsal surface of T_1 as in ♀ but hairs to $175\ \mu$. T_{2-3} with basal fasciae visible and entire (Fig. 30). Hairs gradually denser from T_2 to T_5 but sparser than in ♀ so that premarginal bristle row clearer on T_2 and still detectable on T_3 ; marginal areas glabrous even on T_5 ; hairs on T_{5-6} 125 – $150\ \mu$. Sternal pilosity given in structure.

Metric characters: (codified and arranged as in ♀).

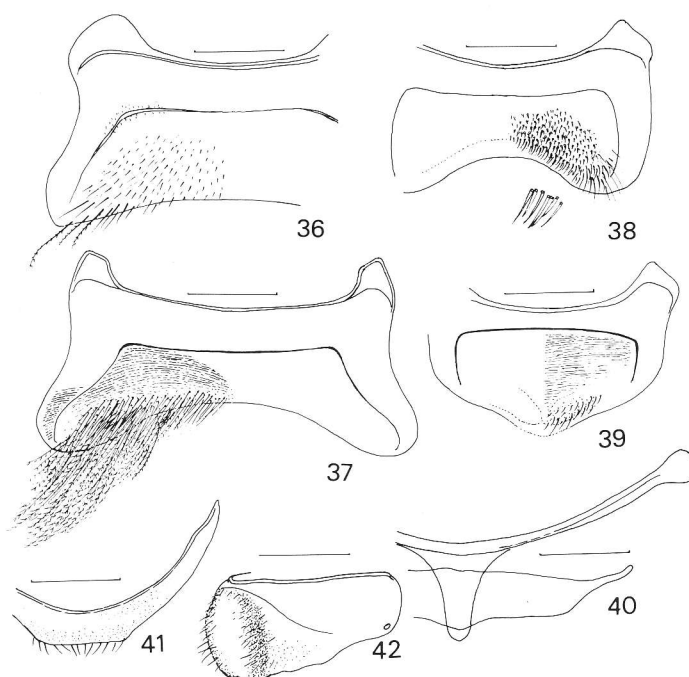
A (25 units = 1 mm): WD 51 (=mean; each value 49, 53); MsW 50 (46, 54); HW 47.5 (45, 50); MtW 46.5 (42, 51); HL 45.5 (43, 48); EL 34.8 (33, 36.5); MOD 31.5 (30, 33); UOD 26 (24, 28); LOD 19.5 (18, 21).

B (40 units = 1 mm): McL 44 (41.6, 46.4); WtL 36.8 (32, 41.6); CAL 29 (27, 31); PsL 29 (28, 30); AOD 25.6 (23, 27); EW 22 (20, 24); TgL 20.8 (19.2, 22.4); GW 18 (16, 20); PDL 17 (15, 19); CPL 16.5 (15, 18); SL 16.5 (16, 17); SCL 16.5 (15, 18); McW 15.7 (14.4, 16); IOD 15.2 (14.5, 16); $F_{11}L$ (Flagellomere 11 L) 15 (14, 16); $Sm3L$ 14.4 (14.4, 14.4); TgW 13.5 (13, 14); F_2L 13 (13, 13); F_3L 12.5 (12, 13); $Sm2L$ 12 (11.5, 12.5); MNL 11 (10, 12); APL 10 (9, 11); OOD 8.5 (8, 9); PsW 8.5 (8, 9); VOL 7.2 (6.5, 8); F_2W (Flagellomere 2 W) 6.5 (6, 7); F_1L 5.5 (5, 6). Hamuli 3+1+2.

HW:MsW:MtW = 1:1.05:0.97; HW:HL = 1:0.95; MOD:UOD:LOD = 1:0.82:0.62; CPL:CAL:APL = 1:1.75:0.61; IOD:OOD:VOL = 1:0.56:0.47; EW:GW = 1:0.67; $F_1L:F_2L:F_3L:F_2W$ = 1:2.36:2.27:1.18; SCL:MNL:PDL = 1:0.67:1.03.

Structure: Head shaped and structured (Fig. 28) as in ♀ (and *L. carinatum* ♀), but slightly longer, outer orbit below much swollen, lateral ocellus attaining summit; seen dorsally gena longer than eye, vertex and occiput as in ♀ with conspicuous occipital carina; facial sculpture slightly coarser and tending to form transverse rows; sculpture of face below hidden by tomentum; PP on yellow clypeal mark with ill-defined margins, 30–35 μ ϕ and IS much shorter. Labrum flat. Mandible normally slender and pointed. Scape curved, very short, apex attaining far below mid ocellus; F_2 – F_{11} very long, distinctly concave above and convex below (Fig. 29); antenna attaining middle of mesoscutum. Mesosoma as in ♀ but mesoscutum distinctly reticulate also medially (Figs. 33, 34). Propodeum (Fig. 23) without strong lateral keel as in one ♀ (Fig. 22), median notch of posterior margin inconspicuous seen dorsally. Wing veins less weakened than in ♀ (Figs. 31, 32). Legs normal; basitibial plate peripherally not delimited, recognized only by absence of punctures (Fig. 35); hind tibia and tarsi normally slender, inner tibial spur with many fine denticles, basitarsus as long as distitarsi.

Metasoma rather cylindrical (Fig. 30), sculptured as in ♀ but PP on disc of T_1 anteriorly and of T_2 more conspicuous and posterior margin of T_2 more depressed. T_3 with PP small, obscure and IS less smooth than on T_2 . Apical terga with coarser sculpture, marginal areas of all terga impunctate. T_7 with gradulus distinctly curved (Fig. 42), represented only by fine line separating pale pregradular area and darker postgradular area. Postgradular area (pygidium) convex (Figs. 41, 42), submedially with sparse bristles (max. 125 μ), medially glabrous, flat and less pigmented, apex (Fig. 42 below) carinate. Sterna, particularly S_4 , peculiar; S_{1-2} normal and sparsely haired, apically slightly outcurved (S_1) or transverse (S_2) (Fig. 30). S_3 (Figs. 30, 36) with apodemal lobe flat and wide; gradulus transverse and uninterrupted though medially thinner, lateral angle obtuse with inconspicuous lamellar appendage, lateral portion divergent; apical margin gently concave, postlaterally rounded and mildly projecting; area of lateral angle of gradulus with fine setae both pre- and postgradularly; postgradular area basally glabrous, apical $\frac{3}{4}$ with sparse simple bristles, medially short ($\pm 75 \mu$), longer postlaterad (to 250 μ) and some bristles plumose. S_4 (Figs. 30, 37) with apodemal lobe narrow and projecting forward; antecosta gently concave; gradulus distinct, median portion slightly concave, medially not weakened, lateral angle obtuse without lamellar appendage, lateral portion widely divergent; apical margin deeply concave, postgradular area medially as long as pregradular area; postlateral corner roundly projecting; apical margin with long and dense peculiar hairs issuing from dark spots, medially 100–200 μ and simple, gradually longer and plumose laterad, attaining 600 μ or more with branches of 50 μ , distinctly exceeding lateral margin of metasoma (Fig. 30). S_5 (Figs. 30, 38) with apodemal lobe wide and pointed; transverse portion of gradulus entire, laterally rectangularly bent and lateral portion parallel-sided as lateral margin; medially postgradular area twice length of pregradular area; posterior margin deeply incised; except basal and apical areas postgradular area with dense dark spots issuing hairs, shorter anteriorly, posteriorly gradually longer, changing to stout bristles (70 μ), postlaterally finer but longer (150), weakly plumose. S_6 (Figs. 30, 39) with apodemal lobe and transverse portion of gradulus as in S_5 ; lateral portion of gradulus shorter and slightly convergent; postgradular area about 5 times longer than pregradular area, mediapically roundly projecting and anterior $\frac{2}{3}$ transversely lineolate; subapically and submedially with sparse dark spots is-



Figs. 36-42. *Lasioglossum pavo*, male apical tergum (T_7) and sterna = S_n . 36-39. S_3 , S_4 , S_5 , S_6 . 40. S_7 , S_8 . 41, 42. T_7 , dorsal and obliquely lateral views. Scale line = 0.2 mm in 40; 0.5 mm in others.

suings short hairs (max. 125 μ), hardly exceeding translucent marginal area. S_7 with long, slender marginal process slightly exceeding S_8 (Fig. 40). Genitalia (Figs. 43-45) distinctly wider than long; gonobase short and small; gonocoxite not continuing gonobasal outline, nearly twice wider than gonobase, slightly wider than long, outer margin distinctly outcurved, apically mildly convex, with sparse lateral setae subapically; gonostylus short, directed downward, apically rounded, not bifid, with rather sparse, short hairs; retrorse lobe nearly as wide as long (Fig. 45), meso-apically roundly projecting, dorsally densely haired, longer apically (75 μ).

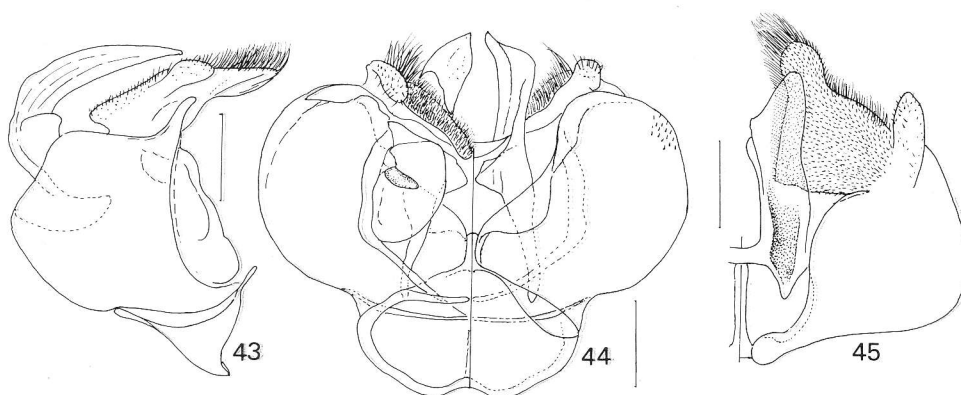
Specimens examined: Holotype (φ) and paratypes (1 φ , 2 $\delta\delta$); Plau Sipora, Mentawai Is., Prov. Sumatera Barat, Indonesia, vii 31 1985, Sk. and S. Yamane.

The female is very similar to *L. carinatum*. Among eight differences enumerated, only items 4 and 5 are conspicuous and exceed the level of intraspecific variations, but it is possible that *L. pavo* represents a distinct subspecies of *L. carinatum*. Therefore the male of *L. carinatum* may also have the peculiar sternal vestiture similar to that of *L. pavo*.

Lasioglossum (Ctenonomia) xystronotum (Vachal)

Halictus xystronotus Vachal, 1894:436, φ ; Bingham, 1897:439, φ ; Blüthgen, 1926: 517, φ .

The females collected from Malaya and Sumatra were tentatively identified to *L. xystronotum* known from Burma (type loc. Palon near Rangoon), Sikkim and Vietnam (Blüthgen, 1926), because the specimens examined by me well coincided



Figs. 43–45. *Lasioglossum pavo*, male genitalia. 43. Lateral view. 44. Dorsal (right) and ventral (left) views. 45. Dorsoapical view (left half). Scale line = 0.2 mm.

with the detailed redescription by Blüthgen. Here mainly the differences from *L. carinatum* are mentioned. The male is unknown.

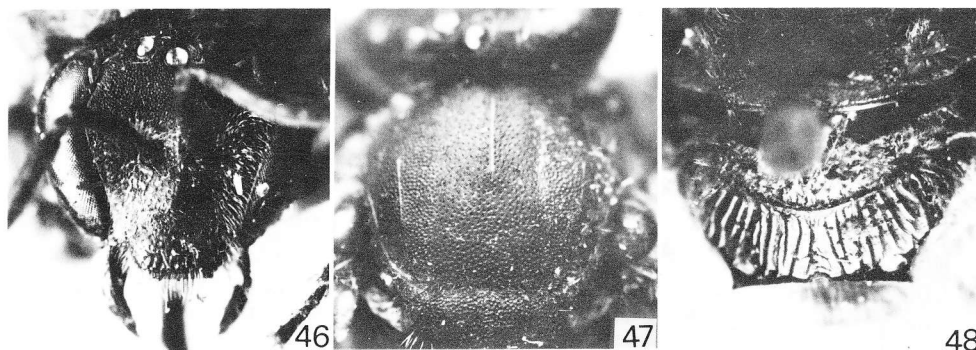
FEMALE: Body 6.1–7.2 mm, wing including tegula 5.3–6.1 mm.

Coloration: As in *L. carinatum* and *L. pavo*.

Pilosity: Similar to that of *L. carinatum* and *L. pavo* but generally darker. Hairs on vertex not plumose even laterally; sparser on clypeus, mesoscutum, mesoscutellum, mesopleuron and metapleuron (Figs. 9, 10). Posterior hairs of mesoscutellum stouter; propodeal scopa shorter and below simple (Figs. 20, 22, 24); hairs on propodeal declivity simple (Figs. 21, 24). Basal fasciae on $T_{2,3}$ confined laterally; bristlelike tergal hairs sparser. Hair length: vertex 175–200 μ , face above $\pm 50 \mu$, clypeal margin and hypostoma 250 μ , mesoscutum 100–125 μ (long hairs) and 25–50 μ (short hairs), mesoscutellum 350 μ , propodeal scopa above 175 μ and below 350 μ (respectively 250 μ and 375 μ in both *L. carinatum* and *L. pavo*).

Metric characters: Values given in account of *L. carinatum*. Proportions slightly deviating from *L. carinatum* and *L. pavo*, particularly in shorter WD, EL, SL, CAL, Sm3L, Sm2L and longer LOD and OOD. HW:MsW:MtW = 1:1.24:1.31; HW:HL = 1:0.91; MOD:UOD:LOD = 1:0.86:0.78; CPL:CAL:APL = 1:1.68:0.56; IOD:OOD:VOL = 1:0.96:0.59; EW:GW = 1:0.83; SCL:MNL:PDL = 1:0.68:0.88.

Structure: Differences from *L. carinatum* and *L. pavo*: (1) Frons distinctly raised, correspondingly mid ocellus with its lower rim on supraorbital line and lateral ocellus nearly attaining summit. (2) Sculpture on vertex posteriorly finely coriaceous, appearing smoother and shinier. (3) Facial sculpture finely reticulate, more similar to that of *L. carinatum* than that of *L. pavo*. (4) Frontal carina as in *L. pavo* but weaker; above replaced by sulcus attaining triangular depression below mid ocellus (sulcus obsolete in *L. pavo*). (5) Paraocular area below finely punctate (20 $\mu \phi$) rather than reticulate. (6) Supraclypeus slightly more raised, finely networked and dull with obscure PP (25 $\mu \phi$ and IS = 2.0 or more). (7) Clypeus also slightly more raised. (8) Hypostomal striation denser. (9) Mesoscutum and mesoscutellum quite differently sculptured; weakly networked or tessellate but not reticulate, shining with enamel-luster, PP 20–25 $\mu \phi$, IS $\leq \phi$ on anterior part of scutum but otherwise much sparser, even attaining IS = 5.0 or



Figs. 46–48. *Lasioglossum carinatum* (female, type specimen). 46. Head seen frontally. 47. Meso-scutum and -scutellum. 48. Propodeal dorsum (photo P. A. W. Ebmer).

more (Figs. 17–19). (10) Transverse striation of mesopleuron above and meta-pleuron much weaker and sparser (Figs. 9, 10). (11) Propodeal dorsum (Figs. 20, 22, 24) with longitudinal ridges more irregular and partly anastomosing, and interspaces wider, coriaceous and dull. (12) Number of teeth of inner hind tibial spur 2+a (small one) ($n = 1$, Fig. 16), 3 ($n = 3$), 3+a ($n = 5$), 4 ($n = 1$). (13) Tergal sculpture closer to that of *L. carinatum* than *L. pavo*, i.e., lineolation and punctures seen on T_2 and even on T_1 .

Specimens examined: 3♀♀, Gombak Reserv. nr. Kuala Lumpur, Malaya vii 31 1970, R. Jander; 5♀♀, Lubuk Gadung (Forest ent. Letter W), xii 11 1984, T. Inoue; 1♀, Lubuk Gadung, Sumatra, xii 21–23 1985, Sk. Yamane; 1♀, Limau Manis nr. Padang, Sumatra, 1980, S. Yamane & K. Nakamura.

Although this species is quite different in mesosomal sculpture, the general habitus, distinctly carinate occiput and propodeal dorsum with sharply pointed postlateral angle indicate its affinity with *L. carinatum*.

On the other hand, further studies including examination of type specimens are necessary to solve the taxonomic status of *L. xystonotum* and allied forms, including the specimens examined by myself. Blüthgen (1926) described *L. xystonotum* var. *inversa* (Java and Sumatra), and *L. notoxystum* (Sikkim), and considered *L. oligosticta* (Cockerell, 1919) from Luzon a variety of *L. xystonotum* (all published as *Halictus*). Comparing the descriptions and notes by Blüthgen and the specimens at my disposal, all these forms seem to differ only by subtle and unstable sculptural features, possibly representing mere intraspecific variation.

Ctenonomia will be precisely defined only after various species groups can be clarified. Here are given some preliminary taxonomic comments. Recently Pesenko (1986) distinguished *Ctenonomia* from other Palaearctic groups of *Lasioglossum* s. str. in his key to females of the Palaearctic species: *Ctenonomia*, inner hind tibial spur pectinate (3–4 teeth); labral process wider; smaller species (5–7 mm); *Lasioglossum* s. str., inner hind tibial spur edentate or serrate with many denticles, rarely pectinate but then generally with 5 teeth or more; labral process narrower; larger species (6.5–7 mm). This distinction may be generally correct, but as Pesenko considered only the four Palaearctic representatives of *Ctenonomia*, some changes are necessary when more Palaecotropical species are dealt with. For instance, the labral process of *L. (C.) carinatum* (Fig. 3) is not much

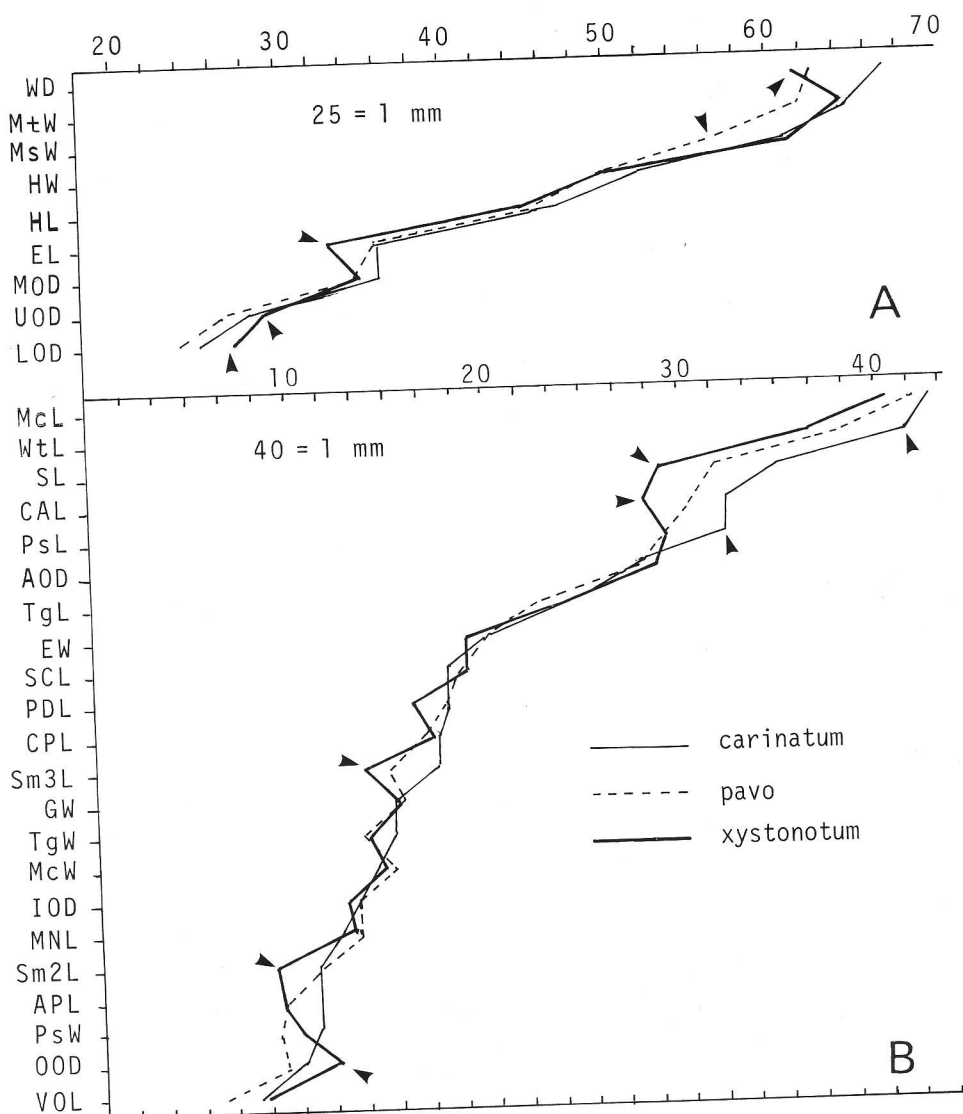


Fig. 49. Comparison of metric characters (female) among *Lasioglossum carinatum*, *pavo* and *xysonotum*. Characters are arranged in both A (25 units = 1 mm) and B (40 units = 1 mm), according to the descending order in *L. carinatum*. Explanation of each character is given on p. 496-497.

wider than that of some *Lasioglossum* s. str. (McGinley, 1986). The inner hind tibial spur is fairly variable within *Lasioglossum* s. str. (McGinley, 1986). It is possible that some still not well studied *Ctenonomia* species would exhibit intermediate states on these characters.

Pesenko (1986) recognized two species groups in *Ctenonomia* species marginally distributed in the Palaearctics: The *L. albescens* group with *L. albescens* (Smith) and *L. gibber* (Vachal) and the *L. vagans* group with *L. vagans* (Smith) (= *Halictus catululus* Vachal, cf. Blüthgen, 1931, p. 327), and *L. cavernifrons* (Blüthgen). Considering some other genuine Oriental species, the four species groups are distin-

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