

New Species of the Bees of the Genus
Palaeorhiza Perkins from New Guinea Mainly in
the Collection of the Rijksmuseum van
Natuurlijke Historie, Leiden (Hymenoptera,
Colletidae)

Hirashima, Yoshihiro
Entomological Laboratory, Department of Agriculture, Kyushu University

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**New Species of the Bees of the Genus *Palaeorhiza*
Perkins from New Guinea Mainly in the
Collection of the Rijksmuseum van
Natuurlijke Historie, Leiden
(Hymenoptera, Colletidae) ***

Yoshihiro Hirashima

Entomological Laboratory, Faculty of Agriculture,
Kyushu University, Fukuoka

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Seven new species of *Palaeorhiza* are described from New Guinea. They are *Palaeorhiza lieftincki*, *paradoxa*, *purpureoventris*, *cylindrica*, *gressittorum*, *parva* and *wisselmerensis*. Presence of the basitibial plate, pygidial plate and caudal fimbria is reported for *Palaeorhiza (gressittorum)* for the first time. Brief note on the nesting habits of *Palaeorhiza gressittorum* is given, which is the first report of *Palaeorhiza* nests in the ground.

Through the courtesy of Dr. M. A. Lieftinck, I was able to examine a number of specimens of *Palaeorhiza* from New Guinea (mostly from Wisselmeren) which belong to the collection of the Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands. This paper describes 7 new species of *Palaeorhiza* based on that material. In case of *Palaeorhiza gressittorum* sp. n., however, most specimens were derived from a collection of *Palaeorhiza* in the Bishop Museum, Honolulu, Hawaii, which was made by me in New Guinea in 1969.

Palaeorhiza is the only rather large genus of bees that is centered in New Guinea and has a distribution similar to that of the birds of paradise (Michener, 1965). Thus, *Palaeorhiza* is very interesting from a viewpoint of evolution of bees.

Michener (1965) revised the genus and enumerated 60 species, dividing into 4 subgenera. However, I have examined more than that number of new species of *Palaeorhiza* from various sources (mostly in the collection of the Bishop Museum) since 1966 when I begun the study of subgeneric classification of that genus. This paper is the first of my study on that interesting genus of bees, although nothing is concerned with the subgeneric treatment of *Palaeorhiza* in this paper.

Unless otherwise stated, all the holotypes of new species described in this paper are preserved in the collection of the Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands.

* Contribution from the Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka (Ser. 3, No. 27).

Key to the species described in this paper

1. Propodeal enclosure strongly convex, apical portion coarsely sculptured ; brilliant blue-green species with yellow marking confined to lateral portion of face only ; large and robust species.....*lieftincki*, ♀
- Propodeal enclosure not coarsely sculptured..... 2
2. Propodeum with a pair of transverse elevations on apico-lateral portion of enclosure ; propodeal enclosure entirely granular and dull ; head and thorax dark blue-green, metasoma shining purple ; body entirely without yellow marking; more or less large species*paradoxa*, ♀
- Propodeal enclosure not granular, smooth (sometimes finely reticulate) and shining3
3. Propodeum, as seen in profile, with dorsal face horizontal and posterior face vertical; propodeum with a pair of large gibbosities on medio-apical portion ; propodeal enclosure with apical portion (between gibbosities) strongly concave ; head and thorax dark steel blue with rather rich yellow markings; metasoma shining purple ; wings subhyaline, apical portions slightly darkened ; large species*purpureoventris*, ♂
- Propodeum as usual 4
4. Body cylindrical (thorax and metasoma strongly elongate); head and thorax blue-green (with purple tints) with rich yellow markings (a pair of yellow lines even on propodeal enclosure); hairs on metasoma yellowish including those on apical terga and sterna; small species.....*cylindrica*, ♀
- Body as usual; hairs on apical portion of metasoma black or blackish.....5
5. Black and red species, without yellow marking except for head of male only; head, pronotum including tubercles, propodeum except for enclosure and metasoma except for 1st tergum black; mesoscutum, scutellum, metanotum, propodeal enclosure, sides of thorax except for propodeum, 1st tergum and legs dark red; female with complete basitibial plate and conspicuous pygidial plate which is covered with caudal fimbria; hairs black; rather large species.....*gressittorum*, ♀ ♂
- Metallic species with rich yellow markings on head and thorax; hairs on head and thorax not black 6
6. Small species, length about 6.5 mm ; metanotum with a pair of yellow markings laterally ; propodeal enclosure with a pair of longitudinal yellow lines laterally ; dorso-basal portions of hind tibiae of female smooth and shining *parva*, ♀ ♂
- Slightly larger, length about 7 mm; metanotum with a transverse yellow band; propodeal enclosure without yellow marking ; dorso-basal portions of hind tibiae of female thick, robust and coarsely sculptured; claws and claw segments of male, especially those of mid and hind pairs, stout *wisseherenensis*, ♀ ♂

Palaeorhiza lieftincki sp. n.

This is a large, robust, brilliant species which belongs to the group of *Palaeorhiza imperialis* (Smith, 1863) and *Palaeorhiza luxuriosa* (Cockerell, 1910). The female of the new species is distinguished from *imperialis* and *luxuriosa* in having the integument brilliant blue-green (brilliant green in *imperialis* and *luxuriosa*), lateral face marks evanescent and linear (conspicuous and pale yellow in *imperialis* and *luxuriosa*), supraclypeal area without yellow marking (a round pale yellow mark present on the upper portion of supraclypeal area in *imperialis* and *luxuriosa*) and mesoscutum finely punctured (strongly punctured in *imperialis* and *luxuriosa*).

Thus, the new species is easily separable from its relatives.

This species is described from a holotype female only.

Female: Length about 11 mm.

Relative head measurements: Length of head, 43.5 (vertex to antennal sockets, 17; the latter to upper margin of clypeus, 7.5; length of clypeus, 19) ; length of eye, 34; distance between a tangent to lower margins of eyes and apex of clypeus, 8.5 (length of malar space, 6); width of head, 47; width of face, 29.5; upper interocular distance, 24; lower interocular distance, 23; width of clypeus, 17. (15=1 mm).

Head rather small in comparison with large thorax; inner eye margins slightly converging below except for upper one-fourth which converges toward ocelli; apices of mandibles weakly bidentate like *imperialis*; malar space conspicuous, about three-fourths as long as basal width of mandible; clypeus and supraclypeal area strongly convex ; upper portion of supraclypeal area, as seen in front, slightly dilated laterally, with a median sulcus distinct, but frontal line obscure: upper portion of supraclypeal area (lower portion of frons) longitudinally elevated.

Scape long ; flagellum moderately long ; relative measurements of flagellar segments as in *imperialis* (1st flagellar segment longer than broad, approximately as long as or indistinctly shorter than 3rd; 2nd slightly broader than long).

Collar of pronotum distinctly elevated as in *imperialis*, narrowed in middle as seen from above; unlike *imperialis* and *luxuriosa*, lateral portion of scutellum weakly elevated; propodeal enclosure strongly convex (much more convex than in *imperialis*), apical portion somewhat coarsely sculptured (broadly and strongly sculptured in *imperialis* and *luxuriosa*) ; mesepisternum with carina in front of mid coxa weak above, strong and convex below.

Wings with stigma slender and long as in *imperialis*; 2nd submarginal cell a little shorter than three-fourths of 1st ; 1st abscissa of 2nd submarginal cell longer than 3rd abscissa, about one-half as long as 1st intercubitus.

Legs, including hind femora and tibiae, slender as in *imperialis*; dorso-basal portions of hind tibiae narrowly impunctate; apices of hind femora with a tuft of short black hairs as in *imperialis*; inner hind tibial spur densely serrate as in *imperialis*.

Metasoma broad; three basal terga large ; posterior depression of 2nd tergum scarcely impressed in middle.

Clypeus longitudinally finely lineolate, with weak, more or less sparse longitudinal punctures; punctures on clypeus weaker than in *imperialis*; frons longitudinally rugoso- (or striate-) punctate; genal areas, especially posterior and lower portions, longitudinally strongly striate with longitudinal, rather weak punctures. Mesoscutum shiny, with rather weak, not very dense punctures (punctures much weaker than in *imperialis*) ; punctures on scutellum coarser than those on mesoscutum (although weaker than in *imperialis*) ; *pre- and meso-episterna longitudinally strongly and densely striate with longitudinal, rather weak punctures* (longitudinal striation much stronger and punctuation much weaker than in *imperialis*) ; lateral face of propodeum weakly punctured, not striated. Metasomal terga neither strongly nor coarsely punctured (punctures on metasomal terga much

weaker and sparser than in *imperialis*) ; punctures on lateral portions of three basal terga only slightly larger than those on median portions.

Color: Head, thorax and legs (except for tarsi) brilliant blue-green with weak to strong purple reflections (especially on thorax above) ; metasoma blackened with metallic dark blue-green tints: mandibles, process of labrum, apical margin of clypeus and antennae black; tarsi blackish. Wings strongly dusky, veins and stigma fuscous; tegulae metallic (blue-green like mesoscutum) with lateral and posterior margins blackened. Yellow marking restricted to face only; lateral face marks linear, yellow, extending from level of antennal sockets down to anterior base of mandible (but interrupted near middle).

Pubescence: Hairs on head and thorax not conspicuous both in color and density; hairs on apical portion of metasoma (above and beneath) black, not specially dense.

Type material: Holotype female, Paniai 1750 m, Wisselmeren, W.C. New Guinea, IX-XI 1939 (H. Boschma).

Distribution: West New Guinea.

Remarks: I have seen a paired specimens of *lieftincki*, in addition to the type material, from Star Mts., West New Guinea in the collection of Bishop Museum, the female of which slightly differs from the holotype. The latter may represent a subspecies and will be discussed in a separate paper.

This species is named in honor of Dr. M. A. Lieftinck, The Netherlands.

***Palaeorhiza paradoxa* sp. n.**

This is a medium-sized (or rather large), more or less robust, metallic species which is easily separable from all the known species by the characters of the propodeum. It is provided with a pair of small transverse elevations on the apico-lateral portions of the enclosure. The propodeal enclosure is large and horizontal with the apical area vertical, triangular and fairly large. The space between the elevations, namely the apical portion of the enclosure, is broad and neither concave nor carinate behind. In addition, the enclosure is entirely granular and dull. These characters of the propodeum (or propodeal enclosure) are quite unusual for the species of *Palaeorhiza*. The new species is also characterized, so far as the female is concerned, by the absence of yellow marking on any part of the body.

This species is described from a holotype female only.

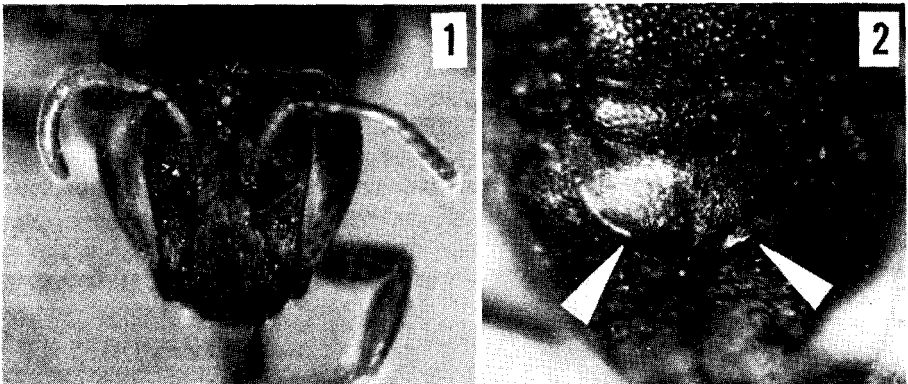
Female: Length about 9 mm.

Relative head measurements: Length of head, 36.5 (vertex to antennal sockets, 13.5; the latter to upper margin of clypeus, 6.5; length of clypeus, 16.5) ; length of eye, 30; distance between a tangent to lower margins of eyes and apex of clypeus, 12 (length of malar space, 5) ; width of head, 39; width of face, 24; upper interocular distance, 19 ; lower interocular distance, 20 ; width of clypeus, 15. (15=1 mm).

Head, as in most other species, distinctly narrower than thorax as seen from above; inner eye margins only slightly converging below except for upper about one-fourth which converges toward ocelli ; clypeus long, widely separated

from lower eye margin (distance between clypeus and lower eye margin slightly longer than diameter of mid ocellus) ; mandibles weakly bidentate; malar space very long, about as long as basal width of mandible ; upper margin of clypeus distinctly arched below; supraclypeal area distinctly convex (which is best expressed when head is seen in profile), upper portion narrow, distinctly elevating between antennae and gradually reducing its height toward frons; frons largely nearly flat; median sulcus of supraclypeal area strong, extending above to mid ocellus as a distinct frontal line; space between ocelli and preoccipital carina strongly slanting posteriorly ; genal areas not well developed.

Scape slender and long; pedicel longer than broad; flagellum not specially long; 1st flagellar segment as long as broad or only slightly longer than broad; 2nd broader than long, shorter than 1st ; 3rd approximately as long as broad; antennal sockets situated much above middle of face, as shown in relative head measurements given above.



Figs. 1 and 2. *Palaeorhiza paradoxa* sp. n., female. **1:** Front view of head, **2:** Propodeal enclosure, showing transverse elevations (by white arrows).

Collar of pronotum narrow, ridged dorsally, low, slightly arched in frontal view, median portion not concave and lateral portions distinctly angulated ; mesoscutum well convex; scutellum and metanotum also convex; **propodeum with a pair of transverse elevations on apico-lateral portions of enclosure; enclosure large, horizontal, with lateral margins convex outwardly; apical portion of dorsal face of enclosure (space between transverse elevations) broad, neither concave nor carinate behind;** mesepisternum with carina in front of mid coxa long and distinct.

Stigma of wing moderately long and broad; 2nd submarginal cell about two-thirds as long as 1st; 1st abscissa of 2nd submarginal cell longer than 3rd abscissa, about one-half as long as 1st intercubitus.

Legs moderately robust ; fore tarsi with polliniferous hairs well developed; fore basitarsi slender and long, slightly longer than next four segments taken together except claws; 2nd segment of fore tarsus oblique, about as long as broad, only slightly larger than 3rd which is also only slightly larger than 4th segment ; claw segment of fore tarsus slender, more than twice as long as broad; hind tibiae thick, dorso-basal portions broad but without special modification,

scanty of hairs; posterior spurs of hind tibiae as usual.

Metasoma oval, well convex dorsally and ventrally; 2nd tergum with basal portion well depressed, median portion distinctly convex, and apical margin slightly depressed (more pronounced laterally), broad, well indicated by absence of punctures.

Head finely lineolate with very weak and sparse punctures for most portions; clypeus, supraclypeal area and face below antennae longitudinally finely lineolate with sparse and very weak punctures, shining; malar space more finely lineolate, impunctate; frons closely and finely lineolate, weakly shining, largely impunctate; vertex lateral to posterior ocelli microscopically reticulate with weak punctures, neither coarsely nor strongly sculptured; genal areas longitudinally finely lineolate with weak and sparse punctures. Mesoscutum strongly and densely punctured, shining; scutellum slightly more strongly and coarsely punctured than median portion of mesoscutum, shining like the latter; metanotum microscopically reticulate, with weak punctures which are slightly more distinct than those on vertex; enclosure of propodeum granular, dull; dorso-lateral faces of propodeum with punctures distinct; posterior (vertical) face of propodeum with punctures obscure; lateral faces of propodeum finely sculptured and densely covered with fine hairs; pre- and meso-episterna microscopically reticulate and densely punctured, punctures about as large and coarse as those on mesoscutum. First tergum transversely finely lineolate, shining, sparsely and weakly punctured; 2nd nearly as in 1st or with punctures a little more distinct; 3rd with microsculpture slightly more distinct, therefore less shining.

Color: Head dark blue-green with delicate purple reflections; mandibles, malar space, labrum, lower part of clypeus and lower paraocular areas piceous or nearly so with or without weak metallic reflections. Antennae black, flagellum brownish beneath. Thorax blue-green with delicate purple reflections; purple tints distinct on anterior face of collar of pronotum, tubercles, posterior face of propodeum and lower margins of lateral faces of propodeum. Wings distinctly dusky, veins and stigma fuscous; tegulae piceous. Legs piceous with purple and slight blue reflections. Metasoma shining purple, with slight greenish tints on apical terga and brassy reflections on intermediate sterna.

Pubescence: Not hairy; hairs on apical segments of metasoma brown or fuscous, those on rest of body primarily whitish; covering hairs on sides of propodeum grayish, not conspicuous in color.

Type material: Holotype female, Paniai 1750 m, Wisselmercn, W.C. New Guinea, IX-XI 1939 (H. Boschma).

Distribution: West New Guinea.

***Palaeorhiza purpureoventris* sp. n.**

This species belongs to the group of *Palaeorhiza perviridis* (Cockerell, 1905). According to my unpublished data, the group is composed of no less than ten species, and most of them are undescribed species. This species is unique in its coloration, both the ground color and yellow maculations.

This species is described from a holotype male only.

Male: Robust, length slightly less than 12 mm.

Relative head measurements: Length of head, 37.5 (vertex to antennal sockets, 14.5; the latter to upper margin of clypeus, 7.5; length of clypeus, 15.5) ; length of eye, 29.5; distance between a tangent to lower margins of eyes and apex of clypeus, 6 (length of malar space, 5) ; width of head, 40; width of face, 25 ; upper interocular distance, 22 ; lower interocular distance, 19; width of clypeus, 13. (15=1 mm).

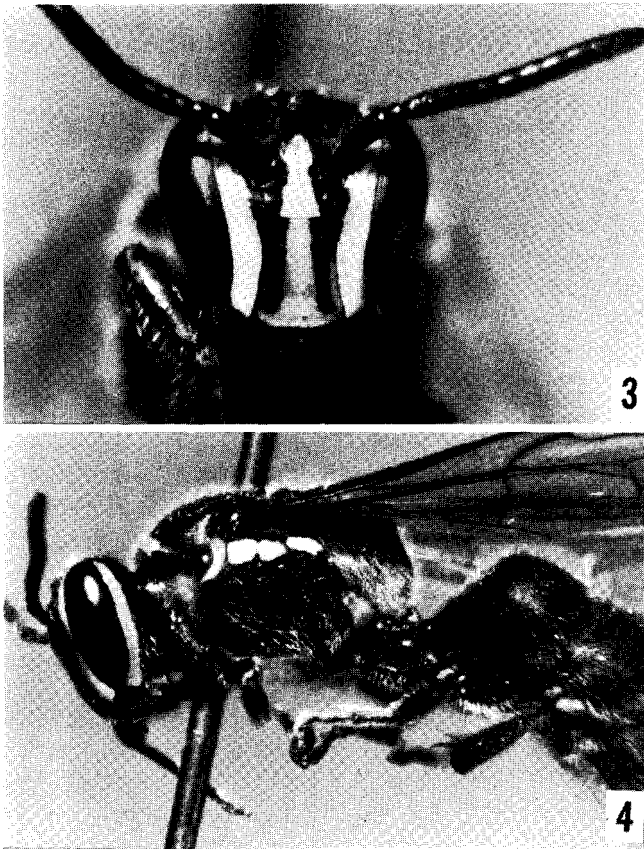
Head rather small for size of thorax; inner eye margins slightly converging below except for upper one-fourth which converges toward ocelli; mandibles distinctly bidentate; face below antennae not narrow (distinctly broader than in male of *perviridis*) ; clypeus long, median portion longitudinally distinctly concave; malar space long and conspicuous, considerably broadened posteriorly (in *perviridis*, it is hardly broadened posteriorly) ; anterior portion of malar space (shortest length) equal to apical width of scape which is fairly robust; clypeus widely separated from eye; distance between clypeus and lower eye margin slightly longer than anterior length of malar space (in *perviridis*, the distance equal to malar space) ; supraclypeal area broad, upper portion broad and dilated laterally, highly elevating between antennae (much more elevating with sharp lateral margins than in *perviridis*) ; upper limit of supraclypeal area not distinct, contiguous to frons; frontal line much weaker than median sulcus of supraclypeal area ; outline of vertex slightly convex (arched) when head is seen in front ; posterior vertex flat and almost horizontal; ocellocapital distance about equal to ocellocular distance, much longer than postocellar distance.

Scape robust, not much elongate; pedicel globular; flagellum more or less long with stout segments; 1st flagellar segment broader than long, slightly longer than 2nd which is much broader than long; 3rd nearly as long as broad.

Thorax large and long; collar of pronotum much narrower than width of thorax as seen from above, median portion slightly concave, lateral portions thick and flat dorsally ; mesoscutum not specially convex; scutellum large, flat; metanotum also flat; **propodeum distinctly convex dorsally, with a pair of large gibbosities apically; space between the gibbosities, namely the apical portion of propodeal enclosure, strongly concave** (according to my unpublished opinion, this is an important character of the group *perviridis*) ; as seen in profile, dorsal face of propodeum horizontal and posterior face of propodeum vertical; mesepisternum with carina in front of mid coxa long and very conspicuous.

Wings not specially long for size of insect; stigma moderate in size; 2nd submarginal cell large, about four-fifths as long as 1st; 1st abscissa of 2nd submarginal cell long, much longer than 3rd abscissa which is also fairly long. Legs moderately robust; claws and claw segments of mid and hind legs robust.

Metasoma long (slightly longer than head and thorax taken together) and nearly cylindrical ; 1st tergum very large, broadest when metasoma is seen from above, medio-basal portion as well as latero-basal portions distinctly convex, with basal face steep (vertical) ; subapical portion of 1st tergum transversely slightly concave; 2nd tergum with basal portion distinctly constricted and median portion strongly convex ; these structures of metasoma similar to *perviridis* but 1st tergum of *purpureoventris* relatively larger ; apical margin of 2nd sternum



Figs. 13 and 4. *Palaeorhira purpureoventris* sp.n., male. **3:** Front view of head, **4:** Side view of head, thorax and basal portion of metasoma.

only slightly convex apically in middle (more distinctly, triangularly convex apically in *perviridis*) ; 3rd sternum with a pair of longitudinal ridges converging inward at apical portion; 4th sternum with a pair of basal, slightly elevated discs not conspicuous.

Clypeus nearly polished with sparse and microscopical punctures ; supraclypeal area longitudinally very finely lineolate, more or less dull, upper portion punctured on lateral margins ; face below antennae polished, punctured like clypeus; space above antennae and lateral to upper portion of supraclypeal area largely impunctate and polished ; space between post ocelli and preoccipital carina subhorizontal, strongly and densely punctured, shining ; genal area shining, longitudinally very finely lineolate, sparsely but distinctly punctured except for colored portion along eye margins where polished with sparse and very weak punctures. Mesoscutum nearly polished (or median portion only microscopically finely reticulate), therefore distinctly shining ; scutellum rather weakly and sparsely punctured, punctures as strong as or slightly weaker than those on

posterior vertex (space between post ocelli and preoccipital carina); scutrum rather weakly and sparsely punctured, punctures slightly weaker than those on mesoscutum; metanotum also nearly smooth like scutellum, sparsely and very weakly punctured; propodeal enclosure microscopically very finely lined, impunctate and shining; rest of propodeum distinctly and densely punctured; pre- and meso-episterna microscopically reticulate, shining, sparsely and distinctly punctured, punctures a little weaker than those on mesoscutum. Punctures well marked on latero-basal portions of three basal terga. Median (elevated) portion of 2nd tergum smooth, shining and sparsely punctured.

Color: Head and thorax shining steel blue with distinct pale yellow (partly greenish) markings as follows: large reverse T mark on clypeus, median longitudinal broad mark on supraclypeal area, broad bands along margins of eyes which are interrupted on both tops and bottoms (malar spaces), narrow line on mandibles, interrupted band on collar of pronotum, a pair of slender longitudinal marks on mesoscutum, evanescent small mark on lateral portions of mesoscutum (near tegulae), transverse mark on axilla, and three transverse marks (which form a transverse band) on sides of thorax below tegulae. Scape entirely black with faint steel blue tints; flagellum black, piceous beneath. Tubercles brownish black with slight purple tints. Wings subhyaline, apical portion slightly darkened; stigma and veins brown; tegulae also brown or more blackish. Legs black or piceous with pale yellow-green markings as follows: broad longitudinal marks on **posterior** faces of fore and mid femora, short and narrow longitudinal marks on basal portions of each tibia; anterior faces of fore tibiae ferruginous or nearly so. Metasoma shining purple (thus, contrast between thorax (plus head) and metasoma conspicuous), with very slight greenish tints in some light.

Pubescence: Hairy species; hairs on most parts of body silvery or white, those on apical terga and sterna blackish; 4th sternum with a transverse row of fuscous erect hairs on apical margin; similar band (hairs more decumbent) on next sternum.

Type material: Holotype male, Paniai 1750 m, Wisselmeren, W. C. New Guinea, IX-XI 1939 (H. Boschma).

Distribution: West New Guinea.

Palaeorhiza cylindrica sp. n.

This is very conspicuous in having the body slender and cylindrical, especially the thorax which is about twice as long as broad and only slightly shorter than the metasoma. The latter is also long and cylindrical.

No related species has been described previously, but I have seen one undescribed species in the collection of the Bishop Museum, Honolulu, Hawaii.

This species is described from a holotype female only.

Female: Length about 7 mm.

Relative head measurements: Length of head, 23.2 (vertex to antennal sockets, 10.2; the latter to upper margin of clypeus, 4; length of clypeus, 9); eye length, 19; distance between a tangent to lower margins of eyes and apex of

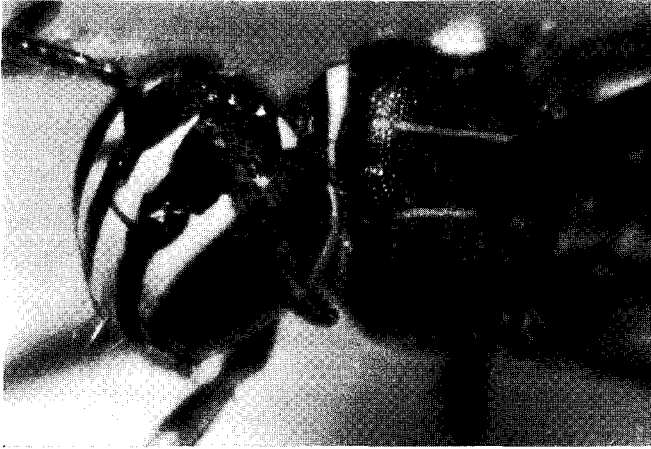


Fig. 5. *Palaeorhiza cylindrica* sp. n., female. Dorsal view of head and anterior part of thorax.

clypeus, 3 (length of malar space, 1) ; width of head, 26.5; width of face, 18; upper interocular distance, 15; lower interocular distance, 13; width of clypeus, 10. (15=1 mm).

Head round as seen in front; antennae situated only slightly above middle of face: inner margins of eyes converging below except upper about one-fourth which converges toward ocelli; profile of head well convex anteriorly; eyes large for size of head ; malar space very narrow anteriorly, widened posteriorly ; distance between lower eye margin and clypeus broad, much broader than malar space ; supraclypeal area rather large, somewhat flat when seen in front, upper portion dilated laterally, upper limit not distinct and not separated from frons (only by maculation) ; median sulcus of supraclypeal area distinct, extending

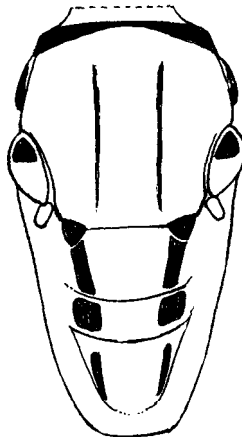


Fig. 6. Sketch of the thorax of *Palaeorhiza cylindrica* sp. n., female. Black portions denote the yellow marking.

above to mid ocellus as a frontal line; frons distinctly convex; space between ocelli and preoccipital carina distinctly slanting, indistinctly concave in middle ; upper portions of genal areas roundly convex, not broad.

Thorax long and cylindrical; collar of pronotum rather low, median portion broadly concave (best seen in frontal view) ; **median portion of mesoscutum, scutellum, metanotum and propodeal enclosure flat;** **the latter large, triangular, horizontal and narrow apex only vertical;** mesepisternum with carina in front of mid coxa distinct.

Stigma of wing rather large (moderately long and broad) ; 2nd submarginal cell about two-thirds as long as 1st; 1st abscissa of 2nd submarginal cell nearly obsolescent (veins interstitial), 3rd abscissa very short.

Legs more or less slender; polliniferous hairs on fore tarsi poor; basitarsus of fore legs shorter than next four segments taken together excepting claws (ratio of length, 7 : 9), 2nd segment of fore tarsi oblique, about as long as broad, only slightly larger than 3rd which is also slightly larger than the smallest 4th segment ; claw segment twice as long as broad, not robust; hind tibia slender as seen from above, basal portion smooth and shining.

Metasoma cylindrical, long ; 1st tergum well convex; 2nd tergum with basal portion slightly constricted: three basal terga large; 4th tergum also broadly exposed.

Head shining ; clypeus, supraclypeal area and lower paraocular areas microscopically lineolate or reticulate, with very weak punctures; frons strongly and densely rugosely punctured ; genal areas longitudinally microscopically lineolate with weak and sparse punctures. Mesoscutum densely rugosely punctured, with punctures on anterior portion small (much weaker than those on frons), becoming stronger toward posterior margin where punctures as strong as or indistinctly stronger than those on frons; scutellum punctured like posterior portion of mesoscutum ; metanotum with punctures small ; propodeal enclosure microscopically reticulate, weakly shining, well separated by absence of punctures from dorso-lateral faces of propodeum where densely and rugosely punctured; pre- and meso-episterna microscopically reticulate and densely punctured, but punctures smaller than those on frons; sides of propodeum finely sculptured with covering of hairs. Metasomal terga nearly smooth, shining, with very weak, not dense punctures (even apical three terga not roughened) ; apical margins of three basal terga rather broadly impunctate.

Color: Head and thorax blue-green with slight to distinct purple tints and with rich yellow markings or portions as follows: basal marks of mandibles on upper margins, spot on labrum, broad median line of face (which is narrowed above and not reaching the mid ocellus), broad bands along eye margins including malar spaces (these bands broadly interrupted near tops of eyes), a pair of transverse marks on vertex laterally, band on collar of pronotum which is indistinctly interrupted in middle, a pair of slender lines on mesoscutum, axillae, longitudinal lines on lateral margins of scutellum, large marks on lateral portions of metanotum, a pair of evanescent apico-lateral lines on enclosure, marks on tubercles, spots on tegulae, and transverse marks on each upper portion of pre-, meso- and meta-episterna; mandibles, labrum, clypeus, face below antennae and genal areas piceous with weak to strong purple reflections. Antennae

piceous, flagellum brown above, yellowish brown beneath. Wings dusky; veins and stigma brownish; tegulae and veins on basal portions of wings ferruginous. Legs light piceous or brownish with slight purple tints; tibiae and tarsi of fore legs ferruginous; apices of femora, anterior faces of fore tibiae, and basal portions of hind tibiae pale yellow (tibiae and tarsi of mid legs not examined). Metasoma piceous with distinct brassy reflections, and partly with purple and bluish tints.

Pubescence: Not hairy; hairs whitish to pale, short; hairs on metasoma glistering, yellowish or only slightly brownish on apical segments.

Type material: Holotype female, Paniai 1750 m, Wisselmeren, W. C. New Guinea, IX-XI 1939 (H. Boschma).

Distribution : West New Guinea.

***Palaeorhiza gressittorum* sp. n.**

This is a rather large, but not very robust, black and red species with rich blackish hairs on the body. The female of this species is very distinctive in having the basitibial plate of the hind legs complete and the pygidial plate of the 6th tergum very conspicuous which is densely covered with black downy hairs. These hairs may be named as a caudal fimbria. This is the first report of the presence of the basitibial plate, pygidial plate and caudal fimbria for the species of *Palaeorhiza*. This species nests in the ground (see below), and it seems probable that these structures correlate with its nesting habits.

This species is described from 89 specimens (75 females and 11 males in Bishop Museum and 3 females in Museum Leiden).

Female: Length about 10 mm.

Relative head measurements : Length of head, 34 (vertex to antennal sockets, 14; the latter to upper margin of clypeus, 6.5; length of clypeus, 13.5); length of eye, 27; distance between a tangent to lower margins of eyes and apex of clypeus, 6.5 (length of malar space, 3); width of head, 40; width of face, 27; upper interocular distance, 22; lower interocular distance, 21.5; width of clypeus, 16.5. (15=1 mm).

Head more or less quadrate in front view (although narrowed below); inner eye margins slightly converging below except for upper about one-fourth which converges toward ocelli; mandibles obliquely tridentate; malar space about or slightly less than one-half of basal width of mandible, slightly shorter than diameter of mid ocellus; clypeus broad and broadly flat; supraclypeal area not very well convex, almost triangular in outline when seen in front, upper portion only very slightly dilated, reducing its height toward frons and not sharply separated from the latter; median sulcus of supraclypeal area and frontal line not distinct; space between post ocelli and preoccipital carina distinctly slanting posteriorly.

Scape long; pedicel globular, longer than broad: 1st flagellar segment about as long as broad or very slightly longer than broad, about as long as 3rd; 2nd broader than long.

Collar of pronotum thin and ridged dorsally, not highly elevated, not notched

in middle; thorax well convex dorsally when seen in profile; scutellum and metanotum well convex; propodeum narrowed and rounded posteriorly; propodeal enclosure large triangular, slanting, median portion flat or slightly concave.

Wings long, as usual; stigma moderate: 2nd submarginal cell about three-fourths as long as 1st; 1st abscissa of 2nd submarginal cell very long, only slightly shorter than 1st intercubitus.

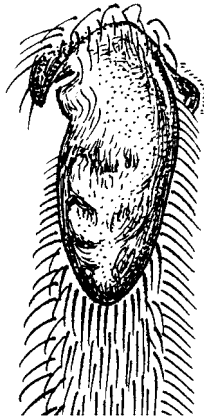


Fig. 7. Sketch of the basitibial plate of *Palaeorhiza gressittorum* sp.n., female.

Legs moderately robust or hind pairs more or less slender; polliniferous hairs on fore tarsi well developed; **hind tibiae with complete basitibial plate on basal portions**; hind tibiae slender; posterior spur of hind tibiae as usual.

Metasoma long elliptical, well convex dorsally and ventrally; 2nd tergum distinctly convex in middle as seen in profile; 1st tergum roundly slanting toward base, not angulate; **6th tergum with pygidial plate distinct**.

Head rather dull; clypeus, supraclypeal area, paraocular areas, frons, and vertex densely microscopically reticulate, with weak, not dense punctures; genal areas more finely reticulate or lineolate, slightly more shining, with much weaker punctures. Mesoscutum and scutellum rather strongly and densely punctured with integuments finely reticulate, nearly dull; metanotum slightly more shining with weaker punctures; propodeal enclosure finely reticulate, rather shining, well marked by absence of punctures. First to 4th metasomal terga very densely punctured with small punctures except for extreme apical margins impunctate, smooth and shining; 2nd sternum strongly and coarsely punctured; 3rd sternum punctured like 2nd but punctures slightly denser on lateral portions.

Color: Black and red with weak metallic (sometimes distinct) tints confined to metasoma only; head black; antennae black, flagellum beneath brownish; thorax dark red with black portions as follows: pronotum including tubercles, latero-basal portions of metanotum and propodeum except for enclosure (apex of enclosure sometimes blackened). Wings distinctly brownish; veins, stigma and tegulae brown. Legs dark red with black parts on coxae, trochanters and

femora of fore legs (coxae, trochanters and femora of fore legs often entirely black in specimens from Mt. Wilhelm). First tergum dark red except for extreme base and apical margin blackened; 2nd and following segments (terga and sterna) shining black with slight green and purple tints (metasomal terga, except for 1st, often distinctly green in specimens from Mt. Wilhelm).

Pubescence : Hairy ; hairs on head and thorax long, not specially dense, black ; sides of propodcum without covering hairs of white tomenta; hairs on legs primarily shining yellowish brown; hairs on metasoma black, broadly nearly bare on median portion of 2nd tergum; *hairs on 6th tergum dense and downy, forming caudal jimbria.*

Male: Length about 8.5 mm, much less robust than female.

Similar to female except for structures of head, legs and metasoma. Head black with yellow markings as follows: stripes on mandibles, labrum, a reverse 'I' mark on clypeus, lateral longitudinal marks on face below antennae and anterior stripes on scapes. Mandibles bidentate; malar space longer than in female, about as long as basal width of mandible, equal to distance between clypeus and lower eye margin; clypeus long, broadly flat; inner eye margins more converging below than in female, Scape rather long, more or less slender; 1st flagellar segment very slightly longer than broad, about as long as 3rd; 2nd broader than long. Claws and claw segments of all legs, especially those of mid and hind pairs, stout. First tergum longer than in female, apical portion transversely slightly concave; 3rd sternum with a pair of longitudinal ridges converging inward at apical portion; 4th sternum with similar ridges not always distinct; 5th sternum with hairs on apical portion decumbent and those on apical margin long, curled and fringe-like.

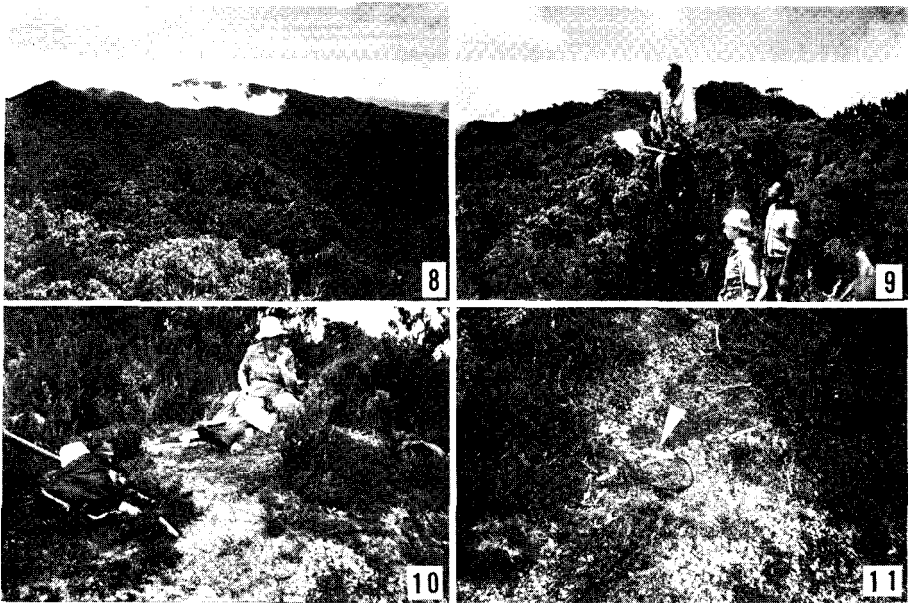
Type material : Holotype female, on the top of hill, **2800** m, along Bulldog Road, 35 km S. E. of Wau, N. E. New Guinea, July 26, 1969 (Y. Hirashima); 57 paratopotypic females and 2 paratopotype males, same data as holotype, in the collection of Bishop Museum; 21 females and 9 males, Keglsugl, 2700-2900 m, Mt. Wilhelm, Eastern Highlands, Papua New Guinea, August 4-11, 1969 (Y. Hirashima), in the collection of Bishop Museum; 3 females, Pengagl Camp, 3300 m, Mt. Wilhelm, Eastern Highlands, Papua New Guinea, 1965 (V. Balgooy), in the collection of Museum Leiden.

Type depository : Department of Entomology, Bishop Museum, Honolulu Hawaii (Type No. 10,473 BISHOP).

Distribution : East New Guinea.

The name of this species is dedicated to Dr. and Mrs. J. Linsley Gressitt Wau Ecology Institute, Wau, Papua New Guinea.

Biology: This species nests in the ground. Nesting site of this species was discovered by me on the top of hill, 2800 m, along the Bulldog Road (2600m) on July 26, 1969 (Figs. 10-11). The nesting site was just a small place, about 4 m², of bare ground which was, however, covered with lichens and was surrounded by dense bushes of *Vaccinium* and other alpine plants. It was a sunny day, and the temperature of midday was thought to be 18-20°C (nights were cold during our camp on the Bulldog Road). When the nesting site was found at noon, many females of this species were returning to burrows from their



Figs. 8-11. Habitat of *Palaeorhiza gressittorum* sp. n. **8:** A view to the south from Bulldog Road (these peaks are about 3000 m in elevation). **9:** On a hill (2800 m) along the Bulldog Road (Dr. Gressitt, Ellyn Gressitt, and 2 natives). **10:** Nesting site of *Palaeorhiza gressittorum* on the top of a hill, 2,800 m. **11:** The same, enlarged (arrow indicates an aspirator)

foraging trips. No other species was intermixed.

Another nesting site was found by me on the road side in Keglsugl, 2700 m, Mt. Wilhelm, on August 4, 1969. There I was interested in their vertical distribution. On our way to Mt. Wilhelm (4600m) and way back to Keglsugl air strip (2700m) (August 4-13, 1969), I collected bees carefully and found that *Palaeorhiza gressittorum* inhabits only up to 2900m. So far as my experience in New Guinea is concerned, this is the highest record of *Palaeorhiza*.

So far as is known, this species inhabits high mountains only.

***Palaeorhiza parva* sp. n.**

This is a small, slender, metallic green species which is richly decorated with yellow on the head, thorax and legs. No allied species has been described previously, but I have seen a number of related species in the collection of the Bishop Museum, Honolulu, Hawaii. Although the ground color is metallic, this species belongs to the group of *Palaeorhiza tetraxantha* (Cockerell, 1911), which is a red and yellow species, in a broad sense.

This species is described from 6 specimens (5 females and 1 male).

Female: Length about 6.5 mm.

Relative head measurements: Length of head, 22.5 (vertex to antenna1 sock-

ets, 10.2; the latter to upper margin of clypeus, 3.3; length of clypeus, 9); length of eye, 18; distance between a tangent to lower margins of eyes and apex of clypeus, 3 (length of malar space, 1); width of head, 26; width of face, 18; upper interocular distance, 15; lower interocular distance, 13; width of clypeus, 10. (15=1 mm).

Head rather small and more or less round in frontal view; inner eye margins converging below except upper about one-fourth which converges toward ocelli; when the head is seen in profile, clypeus distinctly slanting toward apex and supraclypeal area and frons distinctly convex; malar space narrow, widened posteriorly; anterior portion of malar space (the shortest length) distinctly shorter than distance between eye margin and clypeus; supraclypeal area broad as seen in front, with a distinct median sulcus; frontal line well indicated, continues to mid ocellus as a small shining impunctate triangular space.

Antennae short and rather stout; flagellar segments short except only for the terminal one which is longer than broad.

Thorax somewhat distinctly elongate; collar of pronotum with median portion broadly concave; scutellum large and flat; metanotum also flat; propodeum more or less long with a large enclosure which is not strongly slanting; mesepisternum with carina in front of mid coxa weak.

Wings with stigma more or less short, broad; 2nd submarginal cell about two-thirds as long as 1st; 1st abscissa of 2nd submarginal cell short, about as long as 3rd abscissa, much shorter than one-half of 1st intercubitus.

Legs as usual; dorso-basal portion of hind tibia without special modification, shining.

Metasoma long elliptical; three basal terga large; 4th terga also largely exposed; posterior margins of terga largely depressed.

Head shining; clypeus and supraclypeal area microscopically reticulate with weak punctures; colored part of lower portion of supraclypeal area (below the median sulcus) impunctate; paraocular area (colored portion) nearly smooth, shining, with weak and sparse punctures; face with a portion above antennal sockets broadly impunctate, shining; frons densely, strongly and nearly rugosely punctured; vertex also distinctly punctured; a space lateral to lateral ocellus broadly impunctate, shining; genal areas shining, microscopically finely reticulate, with weak and sparse punctures. Mesoscutum densely, strongly and rugosely punctured, interspaces shiny; scutellum with punctures not coarser than those on mesoscutum; metanotum microscopically reticulate with weak and sparse punctures; propodeal enclosure more finely reticulate and more shining than metanotum, impunctate; pre- and meso-episterna densely punctured, but punctures much weaker than those on mesoscutum. First tergum shining, nearly smooth, with weak and sparse punctures; 2nd tergum similar to 1st but punctures slightly coarser; 3rd tergum with coarser punctures.

Color: Head and thorax shining greenish blue, with pale yellow markings (or pale yellow spaces) as follows: large basal marks on mandibles (or sometimes nearly full spaces of mandibles except for apical portions and extreme bases), a spot on process of labrum (divided into two parts by a median fuscous line), margins surrounding eyes (including malar spaces) which are somewhat

broadly interrupted on tops of each eye, L-like marks on lateral portions of vertex (which continues below to paraocular marks), a broad longitudinal median line on clypeus (apical portion of which is \perp -shaped), a bottle-like mark on supraclypeal area (upper portion of which is pointed triangularly toward mid ocellus but not reaching the latter), a band on collar of pronotum (median portion sometimes interrupted), a pair of long, elevated line on mesoscutum, a short line on lateral margins of mesoscutum near tegulae, axillae, longitudinal lines on lateral margins of scutellum, large mark on each lateral portion of metanotum, longitudinal lines on lateral portions of propodeal enclosure, tubercles, a transverse mark on each upper portion of pre-, meso- and meta-episterna (thus, sides of thorax with an interrupted (by sutures) band on upper portion just below wing bases). Flagellum brownish beneath. Wings more or less dusky, veins and stigma brown. Legs black or piceous with metallic (bluish or blue-greenish) reflections; anterior faces of fore tibiae, apical small mark on fore femora (sometimes also hind femora), basal marks on mid tibiae and basal one-third of hind tibiae pale yellow. Metasoma shining, black or piceous with metallic blue (rarely purple tint is intermixed) reflections.

Pubescence: Hairs on head, thorax and legs whitish, not conspicuous; covering hairs on lateral faces of propodeum more or less distinct, especially on lower portions; hairs on metasoma whitish on basal portion, blackish on apical portion (both on terga and sterna).

Male: Very similar to female in general habitus and coloration (both ground color and yellow maculation), but face narrower, clypeus flat, antennae slightly longer (scape short like female), and metasoma longer (1st tergum well convex).

Type material: Holotype female, Paniai 1750 m, Wisselmercn, W. C. New Guinea, IX-XI 1939 (H. Boschma); 4 paratopotype females and 1 paratopotype male, same data as holotype.

Distribution: West New Guinea.

Palaeorhiza wisselmerenensis sp. n.

This species belongs to the group of *Palaeorhiza parallela* (Cockerell, 1905), although a general appearance of the new species is different from that of the latter. The group will be discussed in detail in a separate paper. No species with which the present new species is comparable is known at present. One of the most characteristic features of this species is that the dorso-basal portions of hind tibiae of the female are coarsely sculptured except for the extreme bases.

This species is described from 23 specimens (14 females and 9 males).

Female: Length about 7 mm.

Relative head measurements: Length of head, 28 (vertex to antennal sockets, 11.5; the latter to upper margin of clypeus, 5.5; length of clypeus, 11); eye length, 22; distance between a tangent to lower margins of eyes and apex of clypeus, 4 (length of malar space, 1.8); width of head, 30; width of face, 19.5; upper interocular distance, 17; lower inter-ocular distance, 15; width of clypeus, 12. (15=1 mm).

Head more or less quadrate in front view; inner margins of eyes converging below except for upper one-fourth which converges toward ocelli; clypeus well convex and arched when head is seen in profile; supraclypeal area distinctly convex, and, when seen in front, upper portion narrow but slightly dilated, distinctly elevating between antennal sockets; upper limit of supraclypeal area obscure like *parallela*; malar space about one-half as long as basal width of mandible, slightly broadened posteriorly; space between clypeus and lower eye margin longer than malar space; vertex, when seen in front, well beyond a tangent to summits of eyes; space between ocelli and preoccipital carina distinctly slanting posteriorly.

Scape moderately long; two basal segments of flagellum much broader than long respectively.

Thorax more or less long; collar of pronotum well convex, median portion only slightly concave (best seen in front view) ; mesoscutum not specially convex; scutellum and metanotum also nearly flat; propodeum rather long, much longer than in *parallela*, with enclosure large, largely dorsal ; mesepisternum with carina in front of mid coxa not distinct.

Wings long ; stigma broad but not specially large; 2nd submarginal cell rather large, about or slightly larger than two-thirds of 1st; 1st abscissa of 2nd submarginal cell variable in length, about one-half as long as 1st intercubitus.

Legs more or less long, rather robust; claw segments rather large with stout claws; ***dorso-basal portions of hind tibiae coarsely sculptured except for extreme bases, and these portions broad and robust when seen from above.***

Metasoma long elliptical, well convex dorsally as seen in profile; three basal terga large ; 4th tergum moderately largely exposed; apical portion of 1st tergum and basal portion of 2nd distinctly depressed: median portion of 2nd tergum well convex.

Clypeus and supraclypeal area rather shining, longitudinally finely lineolate, weakly punctured; colored lateral portions of face and space below antennae also shining, with weak and sparse punctures; frons rather dull, densely punctured, punctures small; genal areas longitudinally lineolate (more distinctly so than in clypeus), weakly punctured except for colored (yellow) portion along eye margin smooth and shining. Mesoscutum nearly dull, very densely rugosely punctured, punctures small anteriorly, becoming larger posteriorly ; scutellum densely and rather coarsely punctured like posterior portion of mesoscutum; metanotum weakly punctured; propodeal enclosure finely reticulate, slightly shining, well marked by absence of punctures; pre- and meso-episterna finely reticulate, dull, densely punctured, punctures distinctly weaker than those on median portion of mesoscutum, stronger but sparser than those on frons; punctures on lateral face of propodeum very fine and dense, covered by short dense gray hairs and usually not visible unless covering hairs are scratched out. First tergum finely transversely lineolate, weakly shining, with very weak punctures except for posterior margin impunctate ; 2nd tergum like 1st but punctures slightly stronger; 3rd and 4th terga very finely reticulate-punctate.

Color: Head and thorax dark greenish blue with distinct yellow markings or areas as follows : a spot on process of labrum (sometimes notched by a fuscous

line below), three broad lines on face, similar lines on genal areas along eye margins, a band on collar of pronotum, four lines on mesoscutum, axillae, lateral portions of scutellum, broad band on metanotum, tubercles, and transverse marks on upper portion of pre-, meso- and meta-episterna; mandibles, labrum, malar space, clypeus, lateral portions of supraclypeal area piceous; face below antennae (except for yellow portion) piceous with slight blue tint. Antennae piceous, flagellum beneath reddened. Wings slightly brownish, dusky; veins and stigma brown; tegulae brownish. Legs ferruginous (or red) with yellow markings on basal portions of tibiae not well developed; coxae piceous with bluish tint. Metasoma piceous with blue and purple reflections.

Pubescence: Hairs on frons, mesoscutum and scutellum brownish in some light; hairs on rest of head and thorax, and legs whitish; hairs on apical portion of metasoma fuscous; 6th tergum with hairs dense and appressed like a caudal fimbria (this is one of the important characters for the group of *parallela* in addition to structures of hind tibiae).

Male: Slightly smaller than female. Relative head measurements: Length of head, 29 (vertex to antennal sockets, 11; the latter to upper margin of clypeus, 6; length of clypeus, 12); length of eye, 23; distance between a tangent to lower margins of eyes and apex of clypeus, 4 (length of malar space, 2); width of head, 30; width of face, 19; upper interocular distance, 17; lower interocular distance, 12; width of clypeus, 10. (15=1 mm).

Eyes, as seen in front, slightly larger than those of female; inner margins of eyes strongly converging below, so that lower half of face narrow, considerably narrower than in female; clypeus long, nearly flat, upper portion slightly concave; malar space as long as that of female, much more than one-half of basal width of mandible, about equal to distance between eye margin and clypeus; supraclypeal area nearly as in female, but upper portion more elevating, distinctly defined from frons; lineolation and punctuation of head similar to female.

Scape short, rather thick; flagellum elongate; 1st and 2nd flagellar segments much broader than long respectively (somewhat ring-like), 3rd and following segments much longer than wide; 3rd about as long as or only slightly shorter than 1st and 2nd together.

Thorax sculptured almost as in female.

Legs more robust than in female; **claw segments and claws, especially those of mid and hind legs, large and stout**; unlike female, dorso-basal portions of hind tibiae not coarsely sculptured.

Metasoma with depressions of posterior portion of 1st tergum and basal portion of 2nd more pronounced than in female; metasomal sterna without special modification.

Color: Coloration of head similar to female with following exceptions: mandibles with yellow stripes on anterior margins, labrum largely yellow, yellow line on clypeus (median line of face) broadened toward apical margin, and scape yellow in front (median yellow line on face not reaching to mid ocellus as in female). Coloration of thorax similar to female. Legs ferruginous like female but sometimes darker, with rich yellow markings on femora and tibiae. Metasoma piceous with strong purple and blue reflections.

Type material : Holotype female, Paniai 1750 m, Wisselmeren, W.C. New Guinea, IX-XI 1939 (H. Boschma); 13 paratopotype females and 9 paratopotype males, same data as holotype.

Distribution : West New Guinea.

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