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Bees of the Genus *Palaeorhiza* Perkins (Hymenoptera, Colletidae) of the Bismarck Archipelago and Solomon Islands Collected by the Noona Dan Expedition, 1961-62

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Abstract. Bees of the genus *Palaeorhiza* Perkins from the Bismarck Archipelago, Papua New Guinea, and Solomon Islands, taken by the Noona Dan Expedition, 1961-62 are reported. Six new species are *Palaeorhiza cyanosoma, P. danae, P. morpho, P. peterseni P. simplex* and *P. venusta*, and a new subspecies is *P. sculpturalis poseidon*. One species, *P. tetraxantha* (Cockerell), is recorded from the Bismarck Archipelago for the first time.

Key words: taxonomy, Hymenoptera, Colletidae, Noona Dan Expedition, Bismarck Archipelago, Solomon Islands, *Palaeorhiza*, new species and new subspecies.

This paper is dedicated to the late Dr. Bϕrge Petersen, Zoological Museum, University of Copenhagen, who was a distinguished hymenopterologist and a chief member of the Noona Dan Expedition.

Introduction

The Noona Dan Expedition was made by the naturalists of Denmark from August 1961 to September 1962 to the southwestern Philippine Islands, the Bismarck Archipelago, Papua New Guinea, and Solomon Islands. The naming of the expedition is rather witty, because Noona Dan is the name of the motor ketch used by the expedition, which is said to be very useful for the expeditional activities.

The senior author of this paper was fortunate enough to meet Dr. B. Petersen, a chief member of the expedition, at Zoological Museum, Copenhagen in June 1967. He happened to see the *Palaeorhiza* specimens collected by the expedition in the Bismarck Archipelago and Solomon Islands, and was fortunate enough to be able to borrow them for this study.

Palaeorhiza is the only large genus of bees that is centered in New Guinea, and, interestingly, has a distribution similar to that of the birds of paradise (Michener, 1965). So far as we know, most of the bees of *Palaeorhiza* are beautiful and variable in color and habitus. However, it became clear, as our studies go, that their classification is not easy.

The senior author found a very interesting species in the *Palaeorhiza* collection of the Noona Dan Expedition, and established a new subgenus *Noonadania* in 1978 based on *Palaeorhiza sculpturalis*, which is of course included in this paper.

Unexpectedly and very unfortunately, however, Dr. B. Petersen passed away in 1996. We express our sincere condolences for him. At the same time, we regret that we could not publish this paper while he was alive.

Material and Methods

A total of 39 specimens of *Palaeorhiza* taken by the Noona Dan Expedition were examined. They represent eight species, including six new species and a new subspecies.

They are divided into five subgenera. In this paper,

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the terminology follows Michener (1965) and subgeneric classification follows Hirashima (1978a, 1978b, 1981, 1989) and Hirashima & Lieftinck. (1982).

All the holotypes described in this paper are preserved in the Zoological Museum, Copenhagen, Denmark.

Genus *Palaeorhiza* Perkins, 1908

Palaeorhiza Perkins, 1908, Proc. Hawaiian Ent. Soc, 2: 27-35.
Type species: *Prosopis perviridis* Cockerell, 1905.
Palaeorhiza: Michener, 1965, Bull. Amer. Mus. Nat. Hist., 130: 142-147.

Subgenus *Callorhiza* Hirashima, 1989

Callorhiza Hirashima, 1989, Esakia, (28): 2.
Type species: *Prosopis apicatus* Smith, 1863.

This is still a very large subgenus of *Palaeorhiza*, including many diverse species in color and habitus.

(1) *Palaeorhiza (Callorhiza) cyanosoma* sp. nov.
(Figs. 1-2)

This is a medium sized, robust species, completely shining metallic blue, except for a few pale yellow markings on head, side of thorax and legs (Fig. 2). No related species has been known before.

Female. Length 8-9 mm.

Color. Metallic blue, shining, with slight purple tint, especially on prothorax. Pale yellow markings as follows: longitudinal narrow line along inner eye margins, median longitudinal line on clypeus, nearly triangular mark on supraclypeal area, a pair of small spots on upper portion of supraclypeal area (sometimes absent), narrow and short line on gena along eye margin, large mark on tubercles (prothoracic), square mark behind of it below tegulae (sometimes evanescent), and rather small marks on bases of all tibiae. Wings nearly hyaline.

Structure. Inner eye margins converging below (Fig. 1); face smooth, with weak and sparse punctures. Thorax with scutum smooth, with very sparse and weak punctures; scutellum and metanotum nearly impunctate; dorsal face of propodeum rather short, with large enclosure smooth, impunctate, well convex basally, slanting apically. Legs with hind tibiae not strong, more or less robust basally. Metasoma smooth, with weak and sparse punctures like scutum; 1st tergum nearly impuntate.

Pubescence. Hairs very sparse or nearly absent except for propodeum which is covered with very short, white, appressed hairs; these hairs especially conspicuous on the broad posterior face of propodeum. Hairs on legs also sparse, not conspicuous except for pollen-collecting hairs on fore tarsi well developed.

Unfortunately this is known by the female only.

Etymology. The specific name *cyanosoma* means a blue body in Greek.

Type materials. Holotype: female, Bismarck Islands, New Britain, Yalom 1000m, 22 May 1962, Noona Dan Exp. 61-62. Paratypes: 1 female, New Britain, Warongoi Vail., Gazelle Pen., 100m, 25 May, 1956 (J.L. Gressitt) in Bishop Museum; 1 female, New Britain, Vunabakan, 180 m, 10 km E. of Keravat, 16-20 November 1959 (T.C. Maa) in Bishop Museum.

Distribution. New Britain.

(2) *Palaeorhiza (Callorhiza) danae* sp. nov.
(Figs. 3-4)

This is another noteworthy species and no related species is heretofore known. It is unique in having the following characteristics: more or less small, slender species, piceous (head and thorax) and red (metasoma and legs), with no yellow marking on any part of the body except for a narrow evanescent (yellow-like?) line along the inner eye margins and an evanescent mark (yellow-like?) on supraclypeal area.

Female. Length about 6.5 mm.

Color. As stated above, except clypeus and supraclypeal area somewhat reddened, and 2 apical metasomal terga black. Wings subhyaline.

Structure. Head with inner eye margins convergent below (Fig. 3); clypeus and lower paraocular areas nearly smooth, impunctate; face shining. Thorax with scutum slightly shining, with small, rather dense punctures allover; scutellum like scutum, but punctures smaller (very weak) and sparser; propodeal enclosure well convex, smooth, shining; dorsal face of propodeum lateral to the enclosure very weakly and more or less densely punctuate; sides of thorax shining, with small and rather dense punctures, which are weaker and sparser than those on scutum. Metasoma with 1st tergum smooth, shining, impunctate; 2nd tergum nearly so, but minutely and sparsely punctuate; the following terga somewhat roughened.

Pubescence. Hairs sparse, very short, white, those on propodeum except enclosure short, dense, white and

rather conspicuous in some angles, those on apical terga and sterna fuscous or blackish.

Unfortunately this is known by the female only.

Etymology. Named after Danae in Greek mythology.

Type material. Holotype: female, Bismark Archipelago, Mussau, Talumalaus, 19 January 1962, Noona Dan Exp. 61-62.

Distribution. Bismark Archipelago.

(3) *Palaeorhiza (Callorhiza) simplex* sp. nov.
(Figs. 5-8)

This species belongs to the species-group of *Palaeorhiza (Callorhiza) fulva* Cheesman, but is distinct and is easily recognizable in having the metasoma entirely fulvous, not blackened on the apical segments like *fulva*.

Female. Length about 7 mm.

Color. Body including legs entirely fulvous except as follows: clypeus, supraclypeal area, paraocular area, mandible, malar space, genal area, band on pronotum, mark on pronotal tubercle, lateral margin of scutum, 2 median longitudinal lines on the latter, scutellum and metanotum pale yellow or obscurely so. Sometimes these pale yellow markings on thorax absent excecpt pronotum. Wings subhyaline.

Structure. Head smooth, shining, nearly impunctate (or with sparse, microscopical punctures on upper portion of face); malar space short, but well noticeable. Scutum shining, with dense, very small punctures like *Palaeorhiza tetraxantha*; propodeal enclosure shining, smooth. Metasoma with 1st tergum very shining, smooth; 2nd tergum also shining, smooth, with sparse, microscopical punctures; following terga also shining and smooth.

Pubescence. Hairs inconspicuous, very short, white; those on legs and apical protion of metasoma slightly yellowish or reddened.

Male. A little smaller than female.

Diagnosis. Very similar to female except the head which is elongate as shown in Fig. 7. Malar space long, about as long as basal width of mandible. Yellow markings on thorax more clear than in female, and axillae, scutellum, metanotum and propodeal enclosure all pale

Figs. 1-11. *Palaeorhiza* bees. 1-2, *P. (Callorhiza) cyanosoma*, ♀; 3-4, *P. (Callorhiza) danae*, ♀; 5-6, *P. (Callorhiza) simplex*, ♀; 7-8, *P. (Callorhiza) simplex*, ♂; 9-10, *P. (Callorhiza) tetraxantha*, ♀; 11, *P. (Callorhiza) tetraxantha*, ♂. 1, 3, 5, 7, 9, 11, frons; 2, 4, 6, 8, 10, body in lateral view.

yellow.

Etymology. The specific name *simplex* means simple or simplex in Latin.

Type materials. Holotype: female, Rennell Island, Niupani, Solomon Isl., 22 August 1962, Noona Dan Exp. 61-62. Paratopotypes: 6 females and 2 males, same data as holotype. Paratypes (other than Noona Dan Exp.): 2 females and 2 males, Rennell Islands, March 1965 (Torben Wolf) in Zoological Museum. Paratype from New Britain' 1 female, Vaisisi, 9. July 1962, Noona Dan Exp. 61-62. Paratypes from New Irland: 1 female, Lemkamin, 11. April 1962, Noona Dan Exp. 61-62; 1 female, Scleinitz Mts. Lelet Plateau, Oct. 1959 (W.W.Brandt), in Bishop Museum.

Distribution. Solomon Islands and Bismarck Archipelago.

(4) *Palaeorhiza (Callorhiza) tetraxantha* (Cockerell, 1911)

(Figs. 9-11)

Meroglossa tetraxantha Cockerell, 1911, Proc. Linnean Soc. New South Wales, 36: 160.

Brief redescription.

Female. Length about 7 mm.

Color. Head black with large, striking, yellow markings as shown in Fig. 9; genal area nearly all yellow. Scutum black with 4 longitudinal yellow markings which are very striking; scutellum black medially, yellow laterally; metanotum yellow, with median black portion small; propodeal enclosure yellow except median portion piceous or nearly black; dorsal portion of propodeum except enclosure fulvous (or red). Legs reddened or yellowish. Metasoma fulvous or red except apical tergum and sternum black.

Structure. Head with malar space very short anteriorly, slightly widened posteriorly. Scutum with small, very dense punctures; propodeal enclosure more or less long, well convex, smooth, shining. Metasoma with 1st tergum nearly polished, impunctate, shining.

Male is not known.

Specimens examined. 2 females, Bismarck Isl., New Britain, Yalom 1000 m, 20 May 1962, Noona Dan Exp. 61-62; 1 male, New Ireland, Danu, Calili Bay, 29 April 1962, Noona Dan Exp. 61-62.

Distribution. Solomon Islands and Bismarck Archipelago (new record).

Subgenus *Cnemidorhiza* Hirashima, 1981

Cnemidorhiza Hirashima, 1981, Esakia, (17): 1.
Type species: *Prosopis elegans* Smith, 1864.

This subgenus is unique in having the basal portion of hind tibia roughly sculptured in the female.

(5) *Palaeorhiza (Cnemidorhiza) venusta* sp. nov.

(Figs. 12-15)

Palaeorhiza (Cnemidorhiza) sp. from New Britain, Hirashima, 1981, Esakia, (17): 18.

This is closely related to *Palaeorhiza delicata* Hirashima, 1981, but is easily separable by the well developed yellow markings on the whole body.

Female. Length about 8 mm, robust.

Color. Head with frons above antennae and vertex area metallic dark blue; clypeus piceous with median, longitudinal, broad yellow line which extends to the middle ocellus; paraocular area widely yellow; malar space yellow; genal area broadly yellow behind eye; labrum and basal portion of mandible yellow (malar space and mandible not yellow in *delicata*). Thorax with scutum, scutellum, metanotum and dorsal face of propodeum metallic dark blue like frons, with well developed yellow markings as follows; 4 broad, longitunal lines on scutum, axilla, lateral mark on scutellum, metanotum except narrow central area, propodeal enclosure except median portion, and most part of lateral face of propodeum; lateral portion of pronotum yellow (not yellow in *delicata*); anterior part of mesepisternum yellow; posterior part of mesepisternum metallic like scutum with large, irregular yellow markings (Fig. 13) (mesepisternum metallic with small, interrupted, round yellow marks on upper portion only in *delicata*). Legs red, marked with yellow. Metasoma red, except apical segments darkend or 3rd and following terga largely blackened ; basal 2 terga with broad, conspicuous yellow markings (yellow markings obscure or absent in the holotype of *delicata*). Wings slightly yellowish.

Structure. Head with inner eye margins subpararell (Fig. 12); malar space narrow, well noticeable. Scutum very densely punctuate like *delicata*, punctures small, but a little larger (evident) than in *delicata*; propodeal enclosure nearly smooth, shining; mesepisternum punctate like scutum. Metasoma with 1st tergum smooth, shining, with small, close punctures; 2nd and following terga with punctures slightly more evident.

Pubescence. Hairs on scutum very short, downy, slightly reddened; hairs on propodeum white. Legs with hairs slightly golden; fore tarsi with pollen collecting hairs well developed. Metasoma with hairs inconspicuous basally, long and fuscous apically (but paler when terga reddened).

Male. Very similar to female except usual sexual differences.

Structure. Head slightly elongate as seen in front (Fig. 14); face narrow, with inner eye margins slightly converging below; malar space evident, but not elongate (nearly as broad as, or only slightly longer than in female). Yellow markings on metasoma present only on 2 basal terga as in female.

Etymology. The specific name means charming or beautiful in Latin.

Type materials. Holotype: female, Bismarck Isl., New Britain, Yalom 1000 m, 12 May 1962, Noona Dan Exp. 61-62. Paratopotypes: 9 females and 1 male, same data as holoype (except collected on 13-22 May). Paratype other than Noona Dan Exp.: 1 male, New Britain, Gazelle Pen. Mt. Sinewit, 1100-1200m, 15-16 XI 1962 (L. Sedlacek), in Bishop Museum.

Distribution. New Britain.

Subgenus *Heterorhiza* Cockerell, 1929

Heterorhiza Cockerell, 1929, Mem. Queensland Mus., 9: 316.

Heterorhiza: Michener, 1965, Bull. Amer. Mus. Nat. Hist., 130: 146.

Type species: *Palaeorhiza melanura* Cockerell, 1911.

This subgenus is unique in having the propodeal enclosure with strong, dense, radiating ridges; 7th metasomal tergum with a pair of lateroapical hornes.

A key to the known species of *Heterorhiza* is given by Hirashima & Lieftinck (1982).

(6) *Palaerohiza (Heterorhiza) peterseni* sp. nov.
(Figs. 16-19)

This new species is a relative of *Palaeorhiza (Heterorhiza) eximia* (Smith) from Moluccas so far as the long malar space and red metasoma are concerned, but is distinct and easily separated from the latter in having the thorax more broadly yellow, punctures on scutum smaller (weaker), and close ridges on propodeal enclosure longitudinal (Figs. 17 and 19).

Female. Length about 8 mm, rather robust.

Color. Head yellow (including genal area and occipital region along preoccipital carina) and black portion limited on face and vertex. Thorax largely yellow (i.e., pronotum, scutum, scutellum metanotum, propodeum and sides of thorax yellow) except 3 broad darkened (partly reddened and blackened) longitudinal marks on scutum and a median black longitudinal area on scutellum. Legs red-yellow. Metasoma with 4 basal terga and sterna red, 2 apical terga and sterna black or nearly so; base of 1st tergum blackened. Wings slightly brownish.

Structure. Head elongate (Fig. 16) ; inner eye margins converging below; malar space very long, slightly longer than basal width of mandible. Thorax with scutum very densely punctuate, punctures small; propodeal enclosure longitudinally fluted; side of thorax (mesepisternum) with punctures slightly stronger than those on scutum. Metasoma with puntures very weak or weakly shagreened.

Pubescence. Hairs scanty, white or nearly so; propodeum with dense, short white hairs except enclosure; those on legs and metasoma pale golden, except for those on apical segments blackish.

Male. Slightly smaller than female.

Very similar to female except usual sexual differences. Malar space slightly more elongate than in female (Fig. 18), and scutum more paler in color (scutum pale red-brown with 4 longitudinal yellow lines).

Etymoloogy. The specific name is dedicated to the late Dr. Bϕrge Petersen, Zoological Museum, Copenhagen, a famous entomologist in Denmark and the chief member of the Noona Dan Expedition. He was very kind to the senior author when he visited Zoological Museum in 1967.

Type materials. Holotype: female, Bismarck Isl., New Britain, Yalom 1000m, 20 May 1962, Noona Dan Exp. 61-62. Paratopotype: 1 female, same data as holotype. Paratype: 1 male, New Britain, Gazelle Pen., St. Paul's 350m, Sept. 9, 1955 (J.L. Gressitt), in Bishop Museum.

Distribution. New Britain.

Subgenus *Noonadania* Hirashima, 1978

Noonadania Hirashima, 1978, Esakia, (12): 68.

Type species: *Palaeorhiza sculpturalis* Hirashima, 1978.

(7) *Palaeorhiza (Noonadania) sculpturalis poseidon* subsp. nov.
(Figs. 20-22)

Palaeorhiza (Noonadania) sp., Hirashima, 1978, Esakia, (12): 71.

This was already noted by Hirashima (1978) along with the description of *Palaeorhiza (Noonadania) sculpturalis*. At that time he thought that this is a good species, but is treated as a subspecies of *sculpturalis* in this paper. This is known by the female only.

Diagnosis. Female of this new subspecies is separated from that of the nominate subspecies known from the mainland of New Guinea primarily by the weaker and sparser punctures of the body, especially on the scutum. The sculpture of the dorsal face of propodeum, which is characteristic to this species, more simple than that of the nominate subspecies (Fig. 22). The frontal view of the female head is shown in Fig. 20.

Etymology. The subspecific name refers to Poseidon of the Greek mythology.

Type materials. Holotype: female, Bismarck Isl., New Britain, Yalom 1000m, 19 May 1962, Noona Dan Exp. 61-62. Paratopotype: 1 female, same data as holotype. Paratypes: 2 females, New Irland, Lemkamin, 12-14 April 1962, Noona Dan Exp. 61-62; 1 female, New Irland, Schleinitz Mts. Lelet Plateau, October 1959 (no date), (W.W. Brandt) in Bishop Museum.

Distribution. New Britain and New Irland.

Figs. 12-24. *Palaeorhiza* bees. 12-13, *P. (Cnemidorhiza) venusta*, ♀; 14-15, *P. (Cnemidorhiza) venusta*, ♂; 16-17, *P. (Heterorhiza) peterseni*, ♀; 18-19, *P. (Heterorhiza) peterseni*, ♂; 20-22, *P. (Noonadania) sculpturalis poseidon*, ♀; 23-24, *P. (Palaeorhiza) morpho*, ♀. 12, 14, 16, 18, 20, frons; 13, 21, body in lateral view; 17, 19, 22, propodeum in posterior view; 15, 23, head and thorax diagonally; 24, abdomen in dorsal view.

Subgenus *Palaeorhiza* Perkins, *sensu stricto*

Palaeorhiza Perkins, 1908, Proc. Hawaiian Ent. Soc, 2: 29.

Type species: *Prosopis perviridis* Cockerell, 1905.

As already stated by Hirashima (1978), our recognition of this subgenus is different from that of Michener (1965). It was revealed that this subgenus is a more or less large group of rather large, robust species, often strongly metallic. Grouping of the species is given by Hirashima (1978).

(8) *Palaeorhiza (Palaeorhiza) morpho* sp. nov. (Figs. 23-24)

Palaeorhiza (Palaeorhiza) sp. from New Britain, Hirashima, 1978, Esakia, (11): 118.

This is unique and easily recognizable in having the white apical hair bands (broadly interrupted medially) on the 3 basal metasomal terga (Fig. 24). Unfortunately this is known by the female only.

Female. Length ahout 9 mm, more or less slender.

Color. Head, thorax and metasoma black with slight coppery tint and enamel-like luster, with the following yellow markings: 3 longitudinal lines on face (Fig. 23), line on genal area along eye-margin, evanescent small mark on vertex, transverse band on pronotum, 4 longitudinal rather narrow lines on scutum, axilla, large lateral mark on scutellum, transverse lateral marks on metanotum, lateral longitudinal marks on propodeal enclosure, mark on pronotal tubercle, 3 subquadrate marks on upper portion of side of thorax behind tubercle, and a short narrow line along lower portion of pre-episternal groove. Malar space and mandibles black. Legs piceous with yellow markings on each tibia. Metasoma without yellow marking; 1st tergum only slightly reddened. Wings slightly brownish.

Structure. Head more or less round in frontal view; malar space about half as long as (or a little shorter than) basal width of mandible, widened posteriorly; face roundly convex when the head is seen from side. Scutellum large, flat; propodeal enclosure not well defined by lateral line, *longitudinally concaved, with latero-apical tubercles distinct*. Punctures on scutum not dense and not strong; punctures on scutellum weaker and sparser; both are shining; propodeal enclosure weakly shagreened, dull; 1st metasomal tergum smooth, shining, nearly impunctate.

Pubescence. Hairs scanty, white or whitish; those on apical 3 terga and sterna longer and blackish.

Etymology. The specific name refers to Morpho, the name of Aphrodite at Lacedaemon in Greek mythology, meaning shapely or beautiful.

Type material. Holotype: female, Bismarck Isl., New Britain, Yalom 1000m, 20. May 1962, Noona Dan Exp. 61-62.

Distribution. New Britain.

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