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The South African species of the bee genus *Nomada* SCOPOLI, 1770 (Hymenoptera, Apidae)

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A b s t r a c t : The South African species of the bee genus *Nomada* SCOPOLI, 1770 are revised and four species described as new: *Nomada erhardti* KUHLMANN nov.sp. ♀, *N. maximiliani* KUHLMANN nov.sp. ♀, *N. redivivoides* KUHLMANN nov.sp. ♀ and *N. roggeveldi* KUHLMANN nov.sp. ♀. *Nomada kobrowi* BRAUNS, 1912 sp.rev. was formerly synonymised with *N. gigas* FRIESE, 1905, but is a valid species so its status is restored. *Nomada eximia* EARDLEY & SCHWARZ, 1991 syn.nov. is recognized as a synonym of *N. kobrowi*. The previously unknown female of *N. kobrowi* is described for the first time. All species are imaged and a key for the identification of females is provided. The subgenus *Rediviva* (*Redivivoides*) MICHENER, 1981 is recorded as host of *Nomada* for the first time.

Key words : *Nomada*, new species, new synonymy, bees, South Africa.

Introduction

The bee genus *Nomada* SCOPOLI, 1770 currently comprises a total of 778 species and is the fourth largest bee genus worldwide (ASCHER & PICKERING 2023). Most species occur in the northern hemisphere (MICHENER 2007) while only ten have been found in sub-Saharan Africa, with seven of them only known from Ethiopia and another three endemic to South Africa (EARDLEY & SCHWARZ 1991). The latter apparently represent a disjunct distribution area, isolated by a gap of about 3,500 km from the main range of the genus.

Nomada are sparsely haired, wasplike bees, usually with yellow and/or reddish integumental markings. They are cleptoparasites and Old World species are known to be parasites of *Andrena*, *Panurgus* (Andrenidae), *Halictus*, *Lasioglossum*, *Lipotriches* (Halictidae) and *Melitta* (Melittidae) (MICHENER 2007). Species of the genus have been rarely collected in South Africa and little is known about their distribution and biology (EARDLEY & SCHWARZ 1991).

The three South African species display quite different colour patterns with two species having both, yellow and reddish integumental markings (*N. kobrowi* BRAUNS, 1912, *N. gigas* FRIESE, 1905) while one only has reddish-brown maculation (*N. whiteheadi* EARDLEY & SCHWARZ, 1991) and is endemic to the winter rainfall region in the west of the country (EARDLEY & SCHWARZ 1991). Closer inspection of the latter revealed that what was supposed to be a single species in fact represents a complex of at least five taxa. As a consequence, available specimens of *N. whiteheadi*, including type material, were examined and earlier sex associations reassessed.

In this publication four new South African *Nomada* species are described, accompanied by illustrations and updated identification keys to the females of all species. In addition, the female of *N. kobrowi* is described for the first time and new distribution and host records are provided. Synonymies and association of males and females are discussed.

Material and Methods

Terminology as well as measurements used in the descriptions follows those of MICHENER (2007). T is used as abbreviation of metasomal tergum and S for a metasomal sternum. Body length is measured from the vertex to the apex of the metasoma. Length of antennal flagellar segments is measured on the ventral side and the ratio of the lengths of second (F2) to first (F1) flagellar segments calculated (e.g.: F1 = 0.42 mm, F2 = 0.32 mm, ratio F2 : F1 = 0.76 : 1.00).

Images were taken with a digital microscope (Keyence VHX-5000) using the VH-Z20R/Z20T (20x to 200x) zoom lens and the OP-42305 super diffused illumination adapter. Images were stacked for extended depth-of-field and processed using Adobe Photoshop Elements 2021 (Adobe Systems Software Ireland Limited, Republic of Ireland) and then assembled into the figure plates.

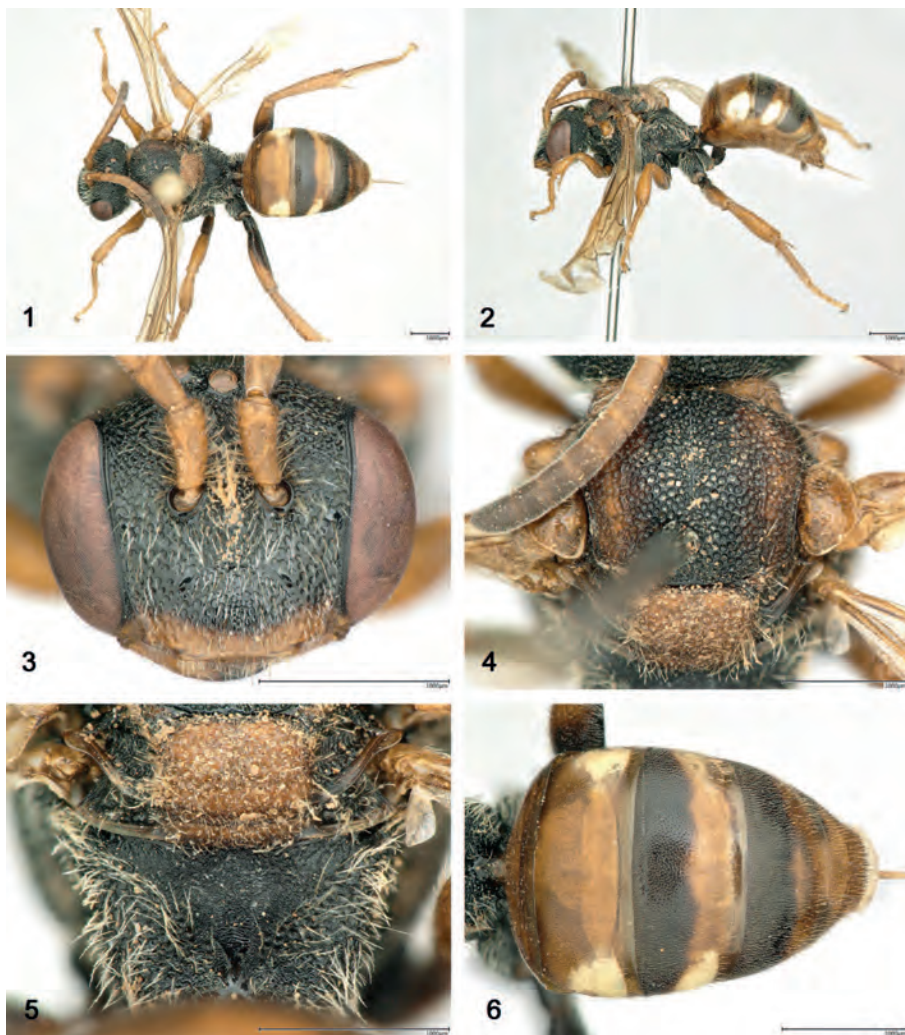
Geographical coordinates not indicated at specimen labels are given in [square brackets].

Acronyms of scientific collections are: DNMNH: Ditsong National Museum of Natural History (former Transvaal Museum: TMSA), Johannesburg, South Africa (T. Bird); RCMK: Research collection of M. Kuhlmann, Zoological Museum of Kiel University, Kiel, Germany; SAMC: Iziko Museums of Cape Town, South Africa (S. van Noort, A. Mayekiso); SANC: South African National Collection of Insects, Pretoria, South Africa (B. Grobbelaar).

Permits for fieldwork and wild bee collecting in South Africa were granted by Cape Nature for Western Cape Province (permit numbers 202/1999, 250/2000, 368/2001, AAA004-00212-0035, AAA004-00446-0035, AAA004-01055-0035, 0056-AAA008-00076, CN44-87-21440) and by Northern Cape Department of Environment and Nature Conservation for Northern Cape Province (025/2002, 056/2003, 0055/04, 0332/05, 0648/06, 0317/07, FAUNA 074/2008, FAUNA 1299/2008, FAUNA 082/2010, FAUNA 557/2011, FAUNA 638/2012, FAUNA 155/2013, FAUNA 1213/2014, FAUNA 0529/2016, FAUNA 0345/2017, FAUNA 0461/2022).

South African *Nomada* species

As no phylogeny of the South African *Nomada* species is available, taxa are arranged in a practical order facilitating their identification: The readily identifiable and quite distinct *N. kobrowi* and *N. gigas* are treated first. These species are known from both sexes (female *N. kobrowi* described here) and are characterized by species specific coloration, namely the conspicuous yellowish maculation of the metasoma. The remaining species are black with rich reddish-brown maculation with *N. roggeveldi* nov.sp. treated first as it is morphologically more isolated (flat clypeus, labrum with single tooth) followed by the other four very similar and presumably more closely related species in alphabetical order.



Figs 1-6: *Nomada kobrowi* BRAUNS, 1912, ♀ (1) dorsal view; (2) lateral view; (3) head; (4) scutum; (5) propodeum; (6) metasoma.

***Nomada kobrowi* BRAUNS, 1912 sp.rev. (Figs 1-22)**

Nomada kobrowi BRAUNS, 1912: 68-69. Holotype ♂ (Vereeniging, South Africa) (DNMNH), examined.

Nomada eximia EARDLEY & SCHWARZ, 1991: 26-27. Holotype ♂ (Machadodorp, South Africa) (Coll. Schwarz, Ansfelden, Austria). Paratype ♂ (SANC) examined. Syn. nov.

Additional material examined: (1 specimen). South Africa: 1♀, Cottesmere (15.7 km 224° SW Underberg), Yell. Pan, moist upland grassland on dolerite, livestock grazed, 29°55'20''S 29°25'38''E, 2-8.xii.2001, leg. S. van Noort, SANC-Pretoria database No. HYMA11122 (SANC).

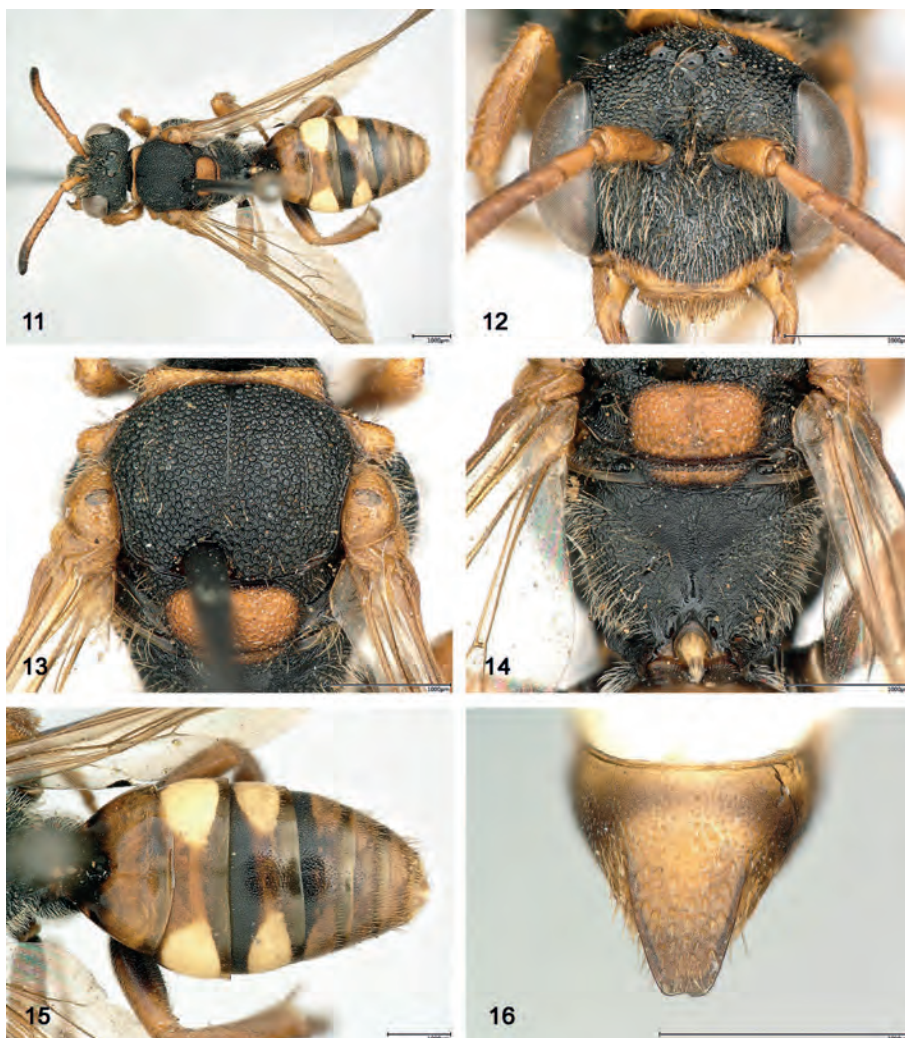


Figs 7-10: *Nomada kobrowi* BRAUNS, 1912, ♀ (7) first and second flagellar segments; (8) clypeus; (9) labrum; (10) pseudopygidial area and pygidial plate.

BRAUNS (1912) described *N. kobrowi* based on a male and directly compared it with *N. gigas*. According to his careful and detailed descriptions, males of both species differ considerably in colour patterns and morphology, thus, clearly represent separate species. Examination of the holotype of *N. kobrowi* confirmed this, so the species status of *N. kobrowi* is here restored. Examination of type material of *N. eximia* revealed that this species is conspecific with *N. kobrowi* and, consequently, is synonymised here. In particular with respect to the conspicuous differences in coloration of the two taxa it is surprising that EARDLEY & SCHWARZ (1991: 19) synonymized both based on the justification that: „The holotype of *N. kobrowi* was found to be an unusually pale coloured specimen of *N. gigas* and is, therefore, here synonymized with the latter”.

The hitherto unknown female of *N. kobrowi* is here described for the first time. The characteristic male was described in detail by BRAUNS (1912) and as *N. eximia* by EARDLEY & SCHWARZ (1991). Thus, to facilitate the identification only images are provided without repeating the description.

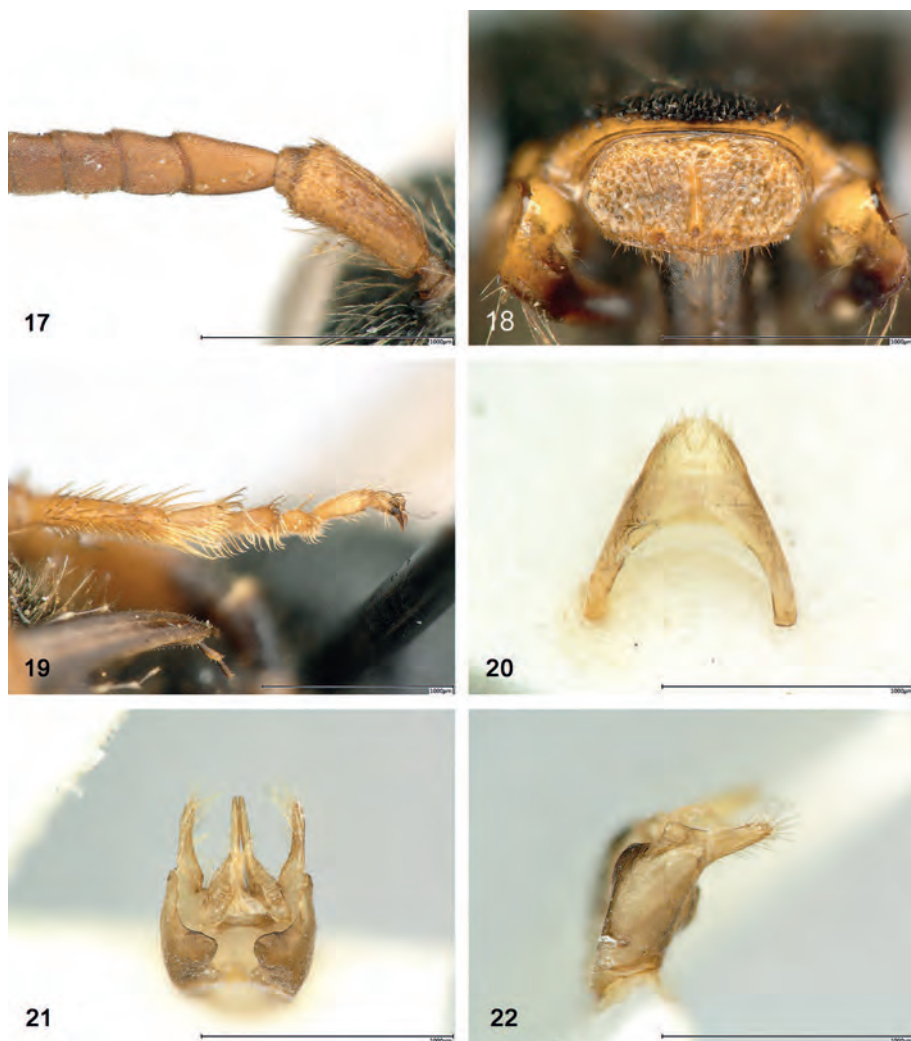
D i a g n o s i s : The female of *N. kobrowi* is immediately recognizable by its unique coloration: Scutellum entirely reddish-brown (Fig. 5), T2-3 laterally each with a pair of yellowish-white spots (Figs 2, 6). Pseudopygidial area of T5 equipped with dense rows of white scale hairs (Fig. 10).



Figs 11-16: *Nomada kobrowi* BRAUNS, 1912, ♂ (11) dorsal view; (12) head; (13) scutum; (14) propodeum; (15) metasoma; (16) pygidial plate.

Description

Female: Body-length: 6.7 mm (Habitus: Figs 1-2). **Head:** Head black, reddish-brown are: antenna (except last three flagellar segments darker), lower margin of the clypeus, lower margin of the malar area, mandible (tip black) (Fig. 3), labrum (Fig. 9). Head broader than long. First flagellar segment longer than second (ratio 1 : 0.77) (Fig. 7), following flagellar segments slightly longer than wide. Supraclypeal area with longitudinal keel raised with highest point slightly below the base of the antenna. Clypeus in lateral view slightly convex, punctation becoming finer towards the middle, between punctures smooth and shiny (Fig. 8). Labrum transversely oval in shape, slightly



Figs 17-22: *Nomada kobrowi* BRAUNS, 1912, ♂ (17) first and second flagellar segments; (18) labrum; (19) front tarsus; (20) metasomal sternum S7; (21) genitalia dorsal; (22) gonostylus lateral.

medio-longitudinally raised, apically with three symmetrically arranged teeth, surface finely punctate, smooth and shiny between punctures (Fig. 9). **Mesosoma:** Integument black, reddish-brown are: pronotum, pronotal lobe, two broad but diffusely delineated longitudinal stripes on the scutum (brighter in the middle) (Fig. 4), tegula, axilla, scutellum, metanotum (Fig. 5). Scutum and propodeum finely punctate, shiny and smooth between punctures; scutellum and metanotum finely punctate, matt; scutellum medially depressed and laterally with distinct swelling. **Wings:** Wing venation yellowish-brown, membrane hyaline yellow. **Legs:** Front leg predominantly reddish-brown, mid legs with black coxa and trochanter reddish-brown with black maculation, hind legs to the middle of the femur black, otherwise reddish-brown. Hind tibia apically with four

short straight reddish-brown spines, outer spine slightly thinner. Metasoma: Integument black; reddish-brown are T1-2 and T5, the posterior half of T3 and the posterior third of T4, T2-3 laterally each with a pair of yellowish-white spots (Fig. 6). S1-6 completely reddish-brown. Punctuation of T1 more scattered than on following terga, punctures are about as far apart as their diameter, following terga densely punctate, punctuation of T2-5 successively coarser, marginal zones of T1-4 smooth and impunctate. Pseudopygidial area with dense rows of white scale hairs, pygidial plate broad and flat triangular, very finely punctate (Fig. 10).

General distribution: Only known from two localities in northeastern South Africa.

Host: Unknown.

Remarks: Males and female are assumed to belong to the same species based on their characteristic colour pattern although they were not collected together. The male holotype of *N. eximia* was published to be in Coll. Schwarz, Ansfelden (Austria) (EARDLEY & SCHWARZ 1991) but could not be located there. Instead, the single paratype (SANC) was examined that was collected together with the holotype.

***Nomada gigas* FRIESE, 1905 (Figs 23-44)**

Nomada gigas FRIESE, 1905: 19. Holotype ♀ (Willowmore, South Africa) (DNMNH), not examined.

Nomada gigantea FRIESE: BRAUNS, 1930: 43: incorrect subsequent spelling.

This characteristic species was described in detail by EARDLEY & SCHWARZ (1991). Thus, to facilitate the identification only images are provided without repeating the description. *Nomada kobrowi* is removed from synonymy with *N. gigas* and its species status is restored because they significantly differ in colour patterns and morphology, thus, clearly represent different species. For details see *N. kobrowi*.

Additional material examined: (63 specimens). South Africa: 1♀, 5 km SE Lekkersing, road side, 29°03'28''S 19°07'16''E, 300 m, 24.ix.2009, leg. M. Kuhlmann (RCMK); 1♂, 40 km SW Springbok, Wildeperdehoek Pass, 29°56'42''S 17°37'57''E, 550 m, 22.ix.2009, leg. M. Kuhlmann (RCMK); 1♀, Kamiesberg Mts., 5 km SE Leliefontein, road side, 30°20'09''S 18°06'24''E, 1400 m, 4.x.2014, leg. M. Kuhlmann (RCMK); 2♀♀, idem., 5.x.2014 (RCMK); 2♀♀, 1♂, 20 km N Nieuwoudtville, Vlei near Hellse Pad, Fynbos, 31°10'34''S 19°01'09''E, 810 m, 28.ix.2014, leg. M. Kuhlmann (RCMK); 2♂♂, 15 km NW Nieuwoudtville, Farm Engelsepunt, Fynbos, 31°14'30''S 18°59'13''E, 830 m, 29.ix.2006, leg. M. Kuhlmann (RCMK); 1♀, 12 km NW Nieuwoudtville, Farm Avontuur, dolerite hill, 31°16'02''S 19°04'05''E, 830 m, 3.ix.2009, leg. M. Kuhlmann (RCMK); 3♀♀, 12 km NW Nieuwoudtville, Farm Avontuur, Fynbos, 31°16'18''S 19°2'55''E, 770 m, 14.ix.2019, leg. M. Kuhlmann (RCMK); 1♀, 30 km N Calvinia, road side, dolerite, 31°21'09''S 19°50'04''E, 880 m, 20.ix.2009, leg. M. Kuhlmann (RCMK); 1♂, Nieuwoudtville, Flower Reserve East, 31°21'56''S 19°08'52''E, 735 m, 19.v.2013, leg. M. Kuhlmann (RCMK); 1♀, 2♂♂, idem., 25.v.2013, (RCMK); 1♀, 6.ix.2002 (RCMK); 1♀, 11.ix.2002 (RCMK); 1♂, idem., 2.vi.2004 (RCMK); 1♀, Nieuwoudtville, Flower Reserve, Pf, 31°22'10''S 19°08'50''E, 770 m, 11.ix.2006, leg. K. Timmermann (RCMK); 1♀, idem., 18.ix.2006 (RCMK); 1♀, Nieuwoudtville, Wild Flower Reserve, dolerite hills, 21.viii.2007, leg. K. Timmermann (RCMK); 1♂, Nieuwoudtville, Wild Flower Reserve, Car Park East, 31°22'18''S 19°08'58''E, 730 m, 14.viii.2010, leg. M. Kuhlmann (RCMK); 1♀, Nieuwoudtville, Flower Reserve, Rondell, Car Park East, 31°22'18''S 19°08'58''E, 730 m, 4.x.2006, leg. M. Kuhlmann (RCMK); 1♀, Knersvlakte, along Gembokrivier-Pad, 31°23'57''S 18°23'11''E, 120 – 195 m, 14.ix.2007, leg. M. Kuhlmann (RCMK); 1♂, Gembokrivier-Pad, 4.5 km NE Grootdrif, road side, 31°25'54''S 18°55'16''E, 170 m, 20.viii.2010, leg. M. Kuhlmann (RCMK); 2♂♂, idem., 10.ix.2010 (RCMK); 2♀♀, Knersvlakte, 5 km N Grootdrif, 31°26'40''S 18°56'23''E, 195 m,

21.ix.2007, leg. K. Timmermann (RCMK); 1♀, idem., leg. Kuhlmann (RMCK); 3♀♀, 6♂♂, idem., 14.ix.2007, leg. K. Timmermann (RCMK); 1♀, 1♂, idem., 28.v.2013, leg. M. Kuhlmann (RMCK); 2♂♂, idem., 5.vi.2013 (RCMK); 1♀, Keiski Mts., 5 km S Farm Nooiensrivier, dolerite hill, 31°45'54''S 19°50'17''E, 1270 m, 29.viii.2010, leg. M. Kuhlmann (RMCK); 9♀♀, Keiski Mts., 5 km S Farm Nooiensrivier, burned area, 1275 m, 28.ix.2009, leg. M. Kuhlmann (RMCK); 4♀♀, idem., 4.x.2009 (RCMK); 1♀, Roggeveld Mts., 2 km SE Farm Allemansdam, burnt area, 31°49'32''S 19°59'55''E, 1290 m, 29.viii.2018, leg. M. Kuhlmann (RMCK); 1♂, Tankwa National Park, Renoster River, yellow pan trap, 32°14'42''S 20°05'49''E, 490 m, 6.v.-4.vi.2014, leg. S. van Noort (SAMC).

General distribution: Widely distributed in the Greater Cape Floristic Region (for definition see BORN et al. 2017).



Figs 23-28: *Nomada gigas* FRIESE, 1905, ♀ (23) dorsal view; (24) lateral view; (25) head; (26) scutum; (27) propodeum; (28) metasoma.



Figs 29-32: *Nomada gigas* FRIESE, 1905, ♀ (29) first and second flagellar segments; (30) clypeus; (31) labrum; (32) pseudopygidial area and pygidial plate.

Host: BRAUNS (1912: 68) first erroneously assumed *Colletes* species to be host of *N. gigas* but later mentioned *Melitta arrogans* (SMITH, 1879) (as *Melitta capensis* FRIESE) (BRAUNS 1930: 43) which can be confirmed by own observations.

***Nomada roggeveldi* KUHLMANN nov.sp. (Figs 45-56)**

Type material: (11 specimens). **Holotype**, ♀: **South Africa**, Sauer, Suurfontein, 3120CC [32°50'S 18°40'E], 1.ix.1994, leg. V.B. Whitehead, SAM-HYM-B007599 (SAMC). **Paratypes:** **South Africa**, 3♀♀, Namaqualand, Bowesdorp [30°09'S 17°56'E], ix.1941, leg. Museum Staff, SANC-Pretoria database No. HYMA02050 (2♀♀ SANC), SAM-HYM-B007601 (1♀ SAMC); 1♀, Roggeveld Mts., 2 km S Farm Perdekloof, rivier, dolerite, 31°47'35''S 19°58'16''E, 1220 m, 2.ix.2017, leg. M. Kuhlmann (RCMK); 2♀♀, Roggeveld Mts., 2 km SE Farm Allemansdam, burnt area, 31°49'32''S 19°59'55''E, 1290 m, 2.ix.2017, leg. M. Kuhlmann (RCMK); 1♀, idem., 29.viii.2018 (RCMK); 1♀, idem., 20.ix.2022 (RCMK); 2♀♀, 6 km NNW Farm Kanariesfontein, 30 km W Sutherland, road side, 32°22'17''S 20°22'50''E, 1310 m, 16.ix.2017, leg. M. Kuhlmann (RCMK).

Diagnosis: The female of *N. roggeveldi* is best identified by the conspicuous flat clypeus (Figs 52, 55). Labrum with low and short longitudinal median carina ending in a single medial tooth (Figs 53, 56). First flagellar segment distinctly longer than second (ratio 1 : 0.53) (Fig. 51). Hind tibia apically with a row of five to seven slightly downward bent brownish-black spines.



Figs 33-38: *Nomada gigas* FRIESE, 1905, ♂ (33) dorsal view; (34) head; (35) scutum; (36) propodeum; (37) metasoma; (38) pygidial plate.

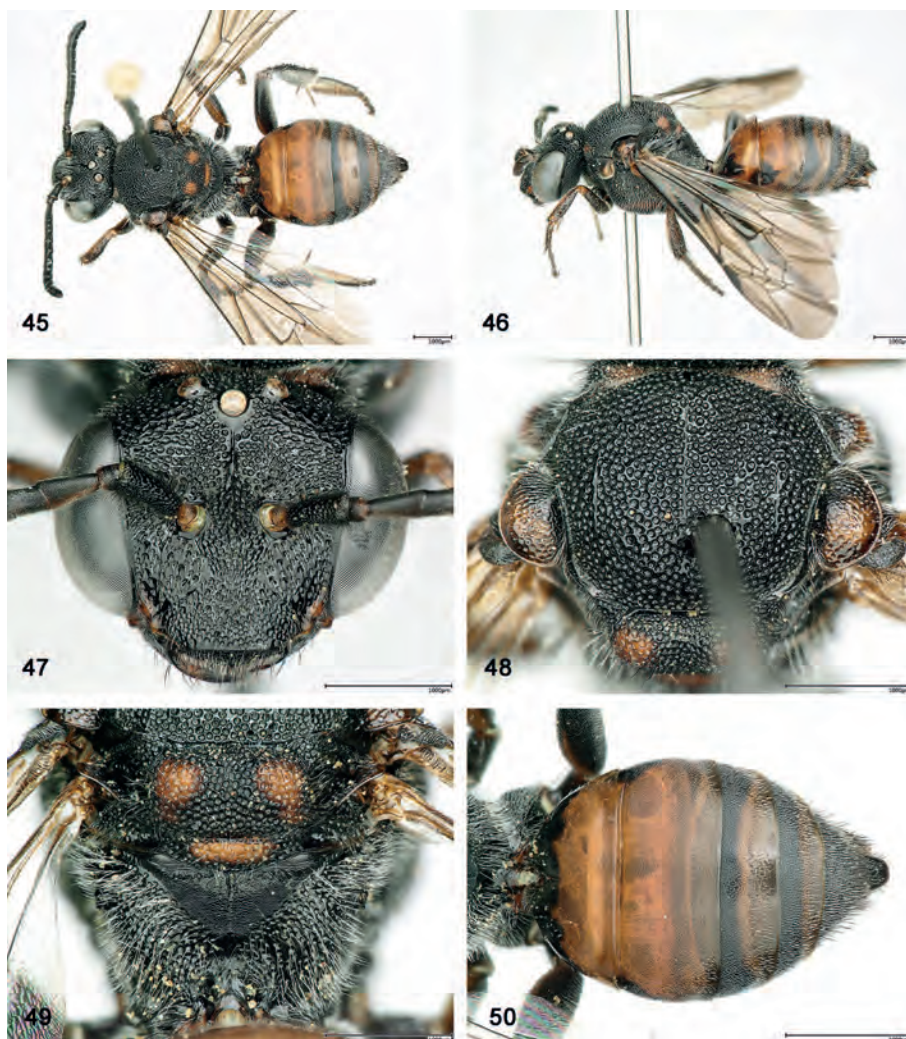
Description

Female: Body-length: 6.5-8.0 mm (Habitus: Figs 45-46). **Head:** Head black, reddish-brown are: antennal scape directly at the base, flagellum ventrally dark reddish-brown (except first flagellar segment orange), malar area and part of the mandible (Fig. 47). Head slightly broader than long. First flagellar segment significantly longer than second (ratio 1: 0.53) (Fig. 51), all other flagellar segments a little longer than wide. Supraclypeal area with raised longitudinal keel that has its highest point between the antennae. Integument around ocelli impunctate. Clypeus flat, with fine and dense elongate punctation, surface between punctures smooth and shiny (Figs 52, 55). Labrum



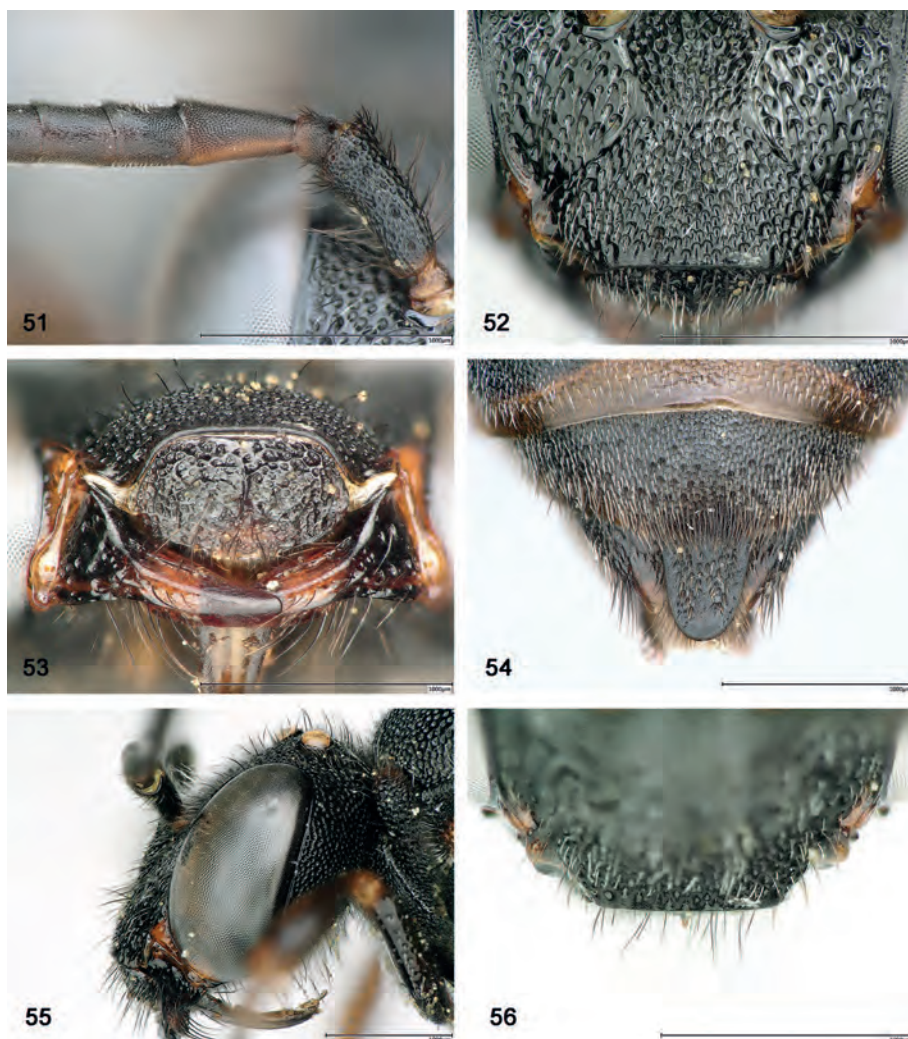
Figs 39-44: *Nomada gigas* FRIESE, 1905, ♂ (39) first and second flagellar segments; (40) labrum; (41) front tarsus; (42) metasomal sternum S7; (43) genitalia dorsal; (44) gonostylus lateral.

transversely oval shaped, with a single medial black tooth, surface finely punctate, smooth and shiny between punctation (Figs 53, 56). Mesosoma: Integument black; reddish-brown are: pronotum except laterally, pronotal lobe, spot on tegula (Fig. 48), scutellum with lateral spots, metanotum with medial transverse oval spot and an inverted-U-shaped maculation on the mesepisternum (variable in size and form) (Fig. 49). Scutum and propodeum finely punctate, shiny and smooth between punctures; scutellum and metanotum with slightly finer punctation, matt; scutellum slightly depressed medially and with distinct lateral swelling (Fig. 49). Wings: Wing venation reddish-brown at the base, apically brownish to black, membrane hyaline brown (Fig. 46). Legs: Front leg predominantly reddish-brown with black and brown maculation,



Figs 45-50: *Nomada roggeveldi* KUHLMANN nov.sp., ♀ (45) dorsal view; (46) lateral view; (47) head; (48) scutum; (49) propodeum; (50) metasoma.

mid and hind legs predominantly brownish-black (Fig. 46). Hind tibia apically with a row of five to seven slightly curved brownish-black spines. **Metasoma:** Metasoma mostly black; reddish-brown are posterior half of T1 and all of T2, on T3-4 with a narrow transverse stripe in front of the marginal zone (Fig. 50). S1-2 reddish-brown. Punctuation of T1 more scattered than on following terga, punctures are about as far apart as their diameter. All other terga densely punctate and matt, punctuation of T2-6 successively coarser, marginal zones of T1-4 smooth. Posterior margin of T5 very slightly concave medially, pseudopygidial area medioapically with long backwards directed black setae surrounded by short appressed silvery hair (Fig. 54). Pygidial plate narrow and flat triangular with rounded tip, finely punctate (Fig. 54).



Figs 51-56: *Nomada roggeveldi* KUHLMANN nov.sp., ♀ (51) first and second flagellar segments; (52) clypeus; (53) labrum; (54) pseudopygidial area and pygidial plate; (55) clypeus lateral; (56) tooth on labrum (dorsal view).

Male: Unknown.

Etymology: Named after the Roggeveld Mountains between Calvinia and Sutherland where most specimens of this species were collected.

General distribution: Found in the Roggeveld Mountains between Calvinia and Sutherland, at the foot of the Kamiesberg Mountains in the wider area of Kamieskroon and in lowlands west of Piketberg.

Host: Unknown.

***Nomada erhardtii* KUHLMANN nov.sp. (Figs 57-66)**

Type material: (1 specimen). **Holotype**, ♀: South Africa: N. Cape, Nieuwoudtville, Flower Reserve East, 31°21'56''S 19°08'52''E, 735 m, 12.viii.2004, leg. M. Kuhlmann (SAMC).

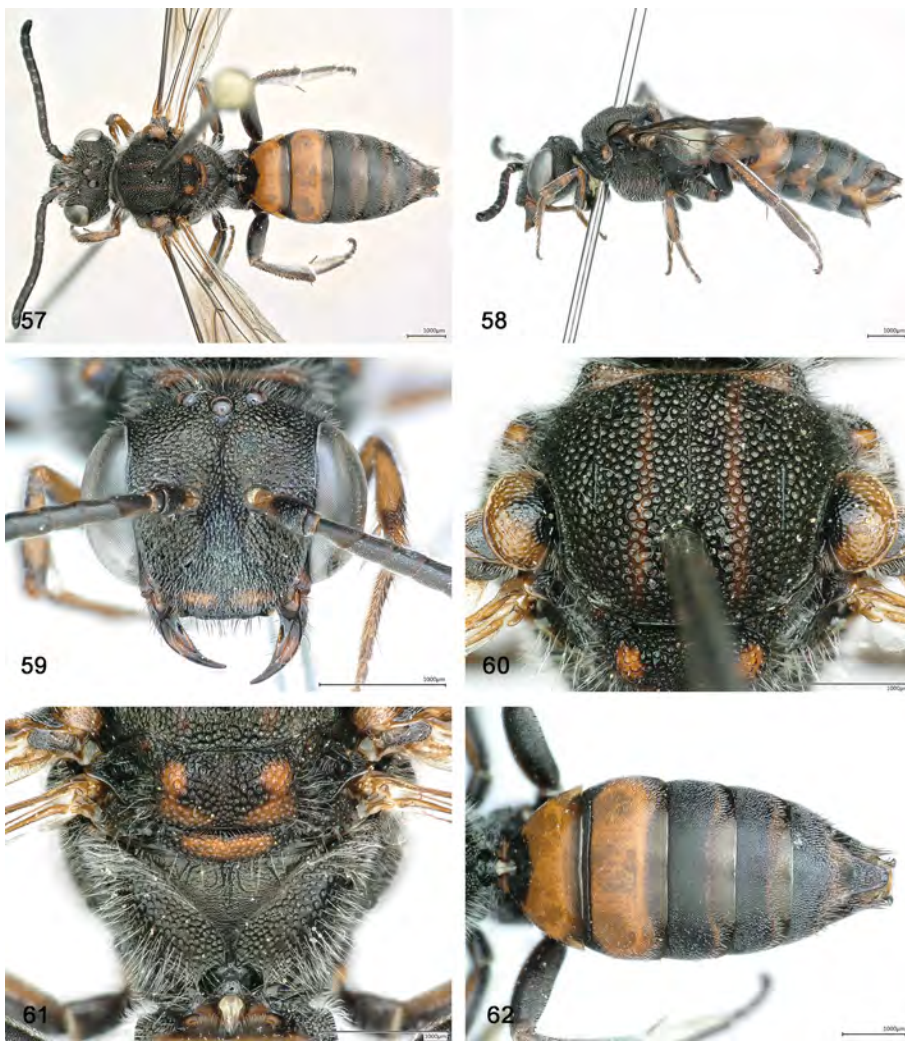
Diagnosis: The female of *N. erhardtii* is very similar to *N. maximiliani*, but can be distinguished by a pair of reddish-brown spots on the clypeus (completely black in *N. maximiliani*) (Fig. 64), scutum with coarser punctation and well-defined pair of reddish-brown longitudinal stripes (Fig. 60) (almost invisible in *N. maximiliani*). Moreover, first and second flagellar segments about equal length (Fig. 63) and pygidial plate broad and finely punctate (Fig. 66).

Description

Female: Body-length: 11.6 mm (Habitus: Figs 57-58). **Head:** Head black, reddish-brown are: base of antennal scape, ventral side of antennal flagellum (except first flagellar segment orange), pair of reddish-brown spots on the lower half of the clypeus, malar area, mandible partly reddish-brown (Fig. 59), lateral margin of labrum (Fig. 65). Head slightly broader than long. First and second flagellar segments about the same length (ratio 1 : 1) (Fig. 63) and longer than wide. Supraclypeal area with longitudinal keel raised with highest point between the base of the antenna. Clypeus in lateral view slightly asymmetrically convex, with the highest part in the upper half and flattened in the lower part, punctation fine and dense, between punctures smooth and shiny (Fig. 64). Labrum transversely oval in shape, medially with three to four small black teeth, surface finely punctate, smooth and shiny between punctures (Fig. 65). **Mesosoma:** Integument black, reddish-brown are: pronotal lobe, pair of longitudinal stripes on the scutum, tegula, axilla (Fig. 60), scutellum with pair of lateral spots on anterior swelling and lower posterior margin, metanotum with broad transversal oval spot (Fig. 61) and horseshoe-shaped maculation on the mesepisternum. Scutum and propodeum finely punctate, shiny and smooth between punctures; scutellum and metanotum with slightly finer punctation, matt (Fig. 60); scutellum medially depressed and laterally with distinct swelling (Fig. 61). **Wings:** Wing venation reddish-brown at the base, apically brownish to black, membrane hyaline brown. **Legs:** Front leg predominantly reddish-brown with black and brown maculations, tibia brownish-black with reddish-brown maculation, mid and hind legs predominantly black with reddish brown maculations (Fig. 58). Hind tibia apically with three bent black spines. **Metasoma:** Metasoma mostly black; reddish-brown are posterior two thirds of T1, all of T2, T3-4 with a narrow transverse stripe in front of the marginal zone (Fig. 62); S1-2 reddish-brown, S3 black with broad reddish-brown stripe posteriorly, S4-5 black with small reddish-brown stripe posteriorly. Punctuation of T1 more scattered than on following terga, punctures are about as far apart as their diameter, following terga densely punctate and matt, punctuation of T2-5 successively coarser, marginal zones of T1-4 smooth and impunctate. Pseudopygidial area on T5 medially with pointed black setae, that are slightly bent upwards and directed backwards, laterally thinner pale silverish setae (Fig. 66). Pygidial plate broad and flat triangular with rounded tip, finely and irregularly punctate (Fig. 66).

Male: Unknown.

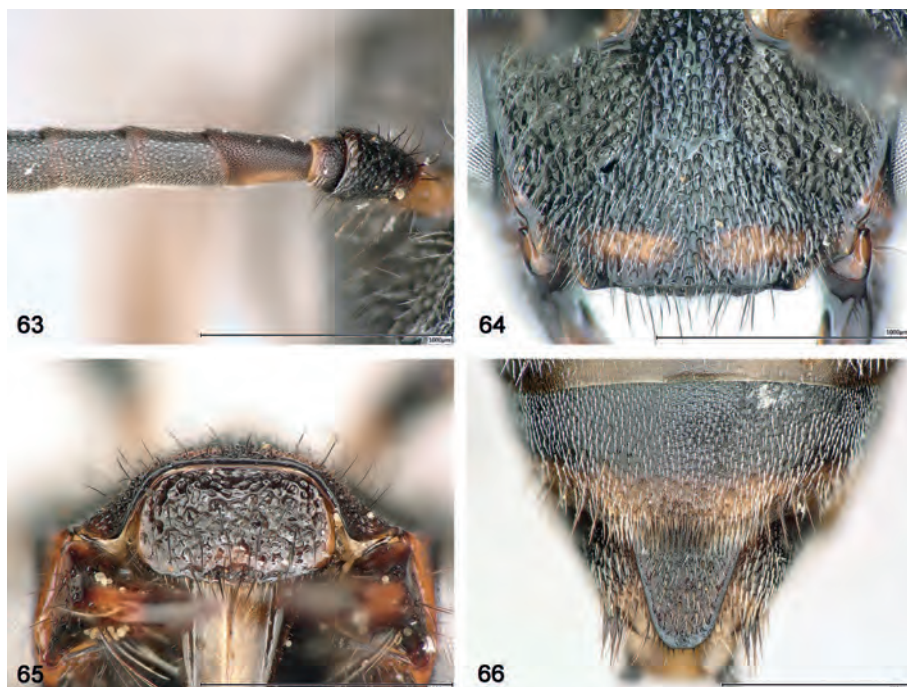
Etymology: The species is dedicated to Hergen Erhardt, Edewecht (Germany), who has joined me for fieldwork and supported South African bee taxonomic projects in various ways over many years.



Figs 57-62: *Nomada erhardti* KUHLMANN nov.sp., ♀ (57) dorsal view; (58) lateral view; (59) head; (60) scutum; (61) propodeum; (62) metasoma.

General distribution: Only known from the type locality in the vicinity of Nieuwoudtville.

Host: Unknown.



Figs 63-66: *Nomada erhardti* KUHLMANN nov.sp., ♀ (63) first and second flagellar segments; (64) clypeus; (65) labrum; (66) pseudopygidial area and pygidial plate.

***Nomada maximiliani* KUHLMANN nov.sp. (Figs 67-76)**

Type material: (2 specimens). Holotype, ♀: South Africa: Middlepos, Hartbeesfontein, 3120CC [31°50'S 20°10'E], 27.viii.1990, leg. V.B. Whitehead, SAM-HYM-B006446 (SAMC). Paratype: South Africa: 1♀, Keiski Mts., 3 km E Farm M'Vera, shale, 31°45'29''S 19°54'13''E, 1190 m, 30.viii.2016, leg. M. Kuhlmann (RCMK).

Diagnosis: The female of *N. maximiliani* is very similar to *N. erhardti*, but can be distinguished by the completely black clypeus (with a pair of reddish-brown spots in *N. erhardti*) (Fig. 74), scutum with finer punctation and almost invisible pair of reddish-brown longitudinal stripes (Fig. 70) (well-defined in *N. erhardti*). Moreover, first flagellar segment slightly longer than second (ratio 1 : 0.81) (Fig. 73), pygidial plate broad and finely punctate (Fig. 76).

Description

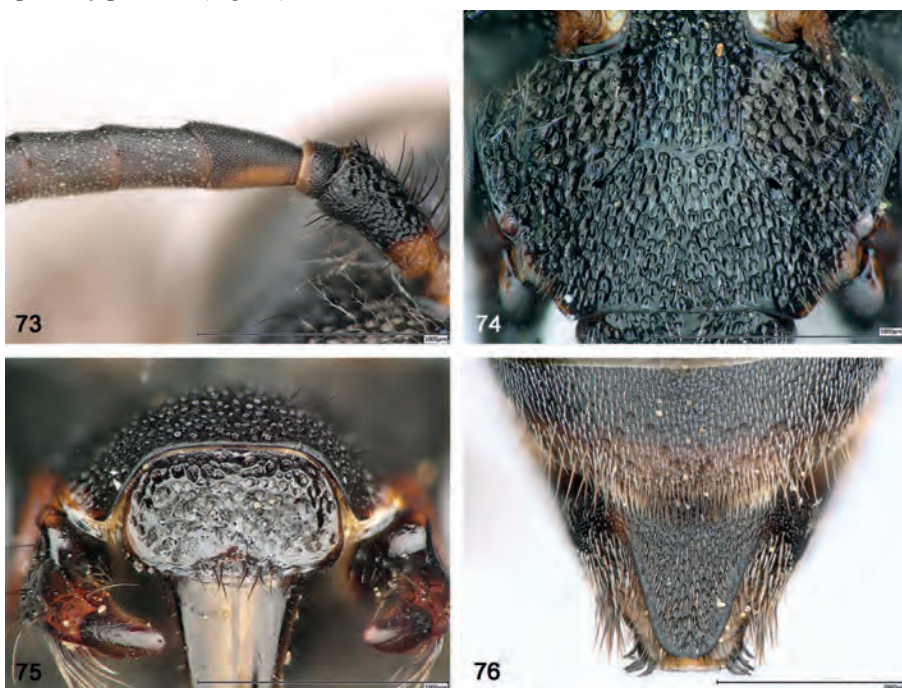
Female: Body-length: 11.4-13.2 mm (Habitus: Figs 67-68). Head: Head black, reddish-brown are: base of antennal scape, ventral side of antennal flagellum (except first flagellar segment orange), lower half of malar area, mandible partly reddish-brown (Fig. 69), lateral margin of labrum (Fig. 75). Head slightly broader than long. First flagellar segment a little longer as the second (ratio 1 : 0.81) (Fig. 73), all flagellar segments longer than wide. Supraclypeal area with longitudinal keel raised with highest point between the base of the antenna. Clypeus in lateral view slightly asymmetrically convex, with the highest part in the upper half and flattened in the lower part, punctation fine and



Figs 67-72: *Nomada maximiliani* KUHLMANN nov.sp., ♀ (67) dorsal view; (68) lateral view; (69) head; (70) scutum; (71) propodeum; (72) metasoma.

dense, between punctures smooth and shiny (Fig. 74). Labrum transversely oval in shape, apical transverse ridge medially with three or four asymmetrically arranged small teeth on upper margin of transverse ridge, surface finely punctate, smooth and shiny between punctation (Fig. 75). Mesosoma: Integument black, reddish-brown are: pronotal lobe, weakly developed pair of longitudinal stripes on the scutum, tegula, axilla (Fig. 70), scutellum with pair of lateral spots on anterior swelling and lower posterior margin, metanotum except lateral margin (Fig. 71) and horseshoe-shaped maculation on the mesepisternum. Scutum and propodeum finely punctate, shiny and smooth between punctures; scutellum and metanotum with slightly finer punctation, matt; scutellum

medially depressed and laterally with distinct swelling. **Wings:** Wing venation reddish-brown at the base, apically brownish to black, membrane hyaline brown. **Legs:** Front leg predominantly reddish-brown with black and brown maculation, tibia brownish-black with reddish-brown maculation, mid and hind legs predominantly black with reddish brown maculation (Fig. 68). Hind tibia apically with four straight black spines, outer spine slightly paler and thinner. **Metasoma:** Metasoma mostly black; reddish-brown are posterior half of T1, all of T2, T3-4 with a narrow transverse stripe in front of the marginal zone, marginal zone of T3-4 yellowish translucent, T5 posteriorly lighter dark brown (Fig. 72), S1-2 mostly reddish-brown with black maculation, S3-5 black with small reddish-brown stripe posteriorly. Punctuation of T1 more scattered than on following terga, punctures are about as far apart as their diameter, following terga densely punctate and matt, punctuation of T2-5 successively coarser, marginal zones of T1-4 smooth and impunctate. Pseudopygidial area on T5 medio-posteriorly with a broad crest of pointed black slightly upwards bent setae, laterally with slightly shorter, pale and backwards directed setae (Fig. 76). Pygidial plate broad and flat triangular with rounded tip, finely punctate (Fig. 76).



Figs 73-76: *Nomada maximiliani* KUHLMANN nov.sp., ♀ (73) first and second flagellar segments; (74) clypeus; (75) labrum; (76) pseudopygidial area and pygidial plate.

Male: Unknown.

Etymology: The species is dedicated to my respected colleague Maximilian SCHWARZ, Ansfelden (Austria), who is a famous and esteemed expert for *Nomada* taxonomy. During the last decades he has supported my work in many ways.

General distribution: Only known from the northern part of the Roggeveld Mountains between Calvinia and Sutherland.

Host: Unknown.

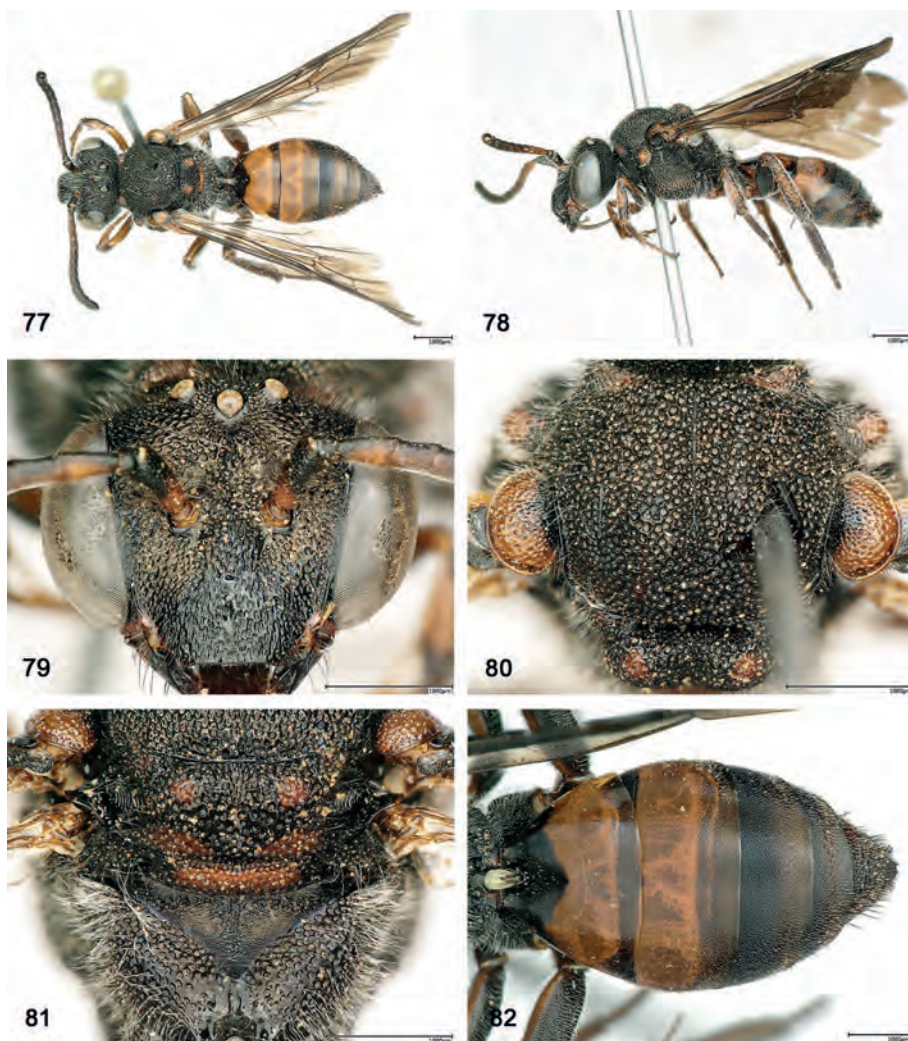
***Nomada redivivoides* KUHLMANN nov.sp. (Figs 77-88)**

Type material: (8 specimens). Holotype, ♀: South Africa: 8 km WNW Leliefontein, Fynbos, road side, 30°15'58''S 18°03'17''E, 1190 m, 10.ix.2017, leg. M. Kuhlmann (SAMC). Paratypes: South Africa: 3♀♀, same label data as holotype (RCMK); 4♀♀, idem., 14.ix.2017 (RCMK).

Diagnosis: The female of *N. redivivoides* is best identified by the medio-longitudinally more dispersed and irregular punctation of the clypeus with interspaces polished and shiny (Fig. 84). In addition, pseudopygidial area apically with a narrow and sparse hair fringe (Fig. 86); pygidial plate narrow and coarsely punctate (Fig. 86).

Description

Female: Body-length: 10.1-13.2 mm (Habitus: Figs 77-78). Head: Head black, reddish-brown are: base of antennal scape, ventral side of antennal flagellum (except first flagellar segment orange), malar area, base and tip of mandible (Fig. 79), labrum usually with small medioapical brown spot (varies from completely black to larger spot) and laterally coloured margin (varies from entirely black to small reddish-brown margin) (Fig. 85). Head slightly broader than long. First flagellar segment longer than second (ratio ventrally 1 : 0.76) (Fig. 83), all flagellar segments longer than wide. Supraclypeal area with longitudinal keel raised with highest point slightly below the base of the antenna. Clypeus in lateral view slightly asymmetrically convex, with the highest part in the upper half and flattened in the lower half, coarse irregular punctation, between punctures smooth and shiny, medially small smooth polished surface (Figs 84, 87). Labrum transversely oval in shape, apical transverse ridge medially with three small teeth, the middle tooth is slightly higher arranged than the lateral teeth, surface irregularly punctate, smooth and shiny between punctation (Figs 85, 88). Mesosoma: Integument black, reddish-brown are: pronotum dorsally, pronotal lobe, two longitudinal stripes on both sides of the scutum (they vary from completely black to clear coloured stripes), tegula, axilla (Fig. 80), scutellum with pair of lateral spots on anterior swelling and lower posterior margin, metanotum except lateral margin and horseshoe-shaped maculation on the mesepisternum (Fig. 81). Scutum and propodeum finely punctate, shiny and smooth between punctures; scutellum and metanotum with slightly finer punctation, matt; scutellum medially depressed and laterally with distinct swelling. Wings: Wing venation reddish-brown at the base, apically brownish to black, membrane hyaline brown (Figs 77-78). Legs: Front leg predominantly reddish-brown with black and brown maculation, tibia brownish-black with a medial reddish-brown maculation, mid and hind legs predominantly black with reddish brown maculation (Fig. 78). Hind tibia posteriorly with four to six straight black spines, outer spine sometimes slightly more distance to the others. Metasoma: Metasoma mostly black; reddish-brown are posterior half of T1, all of T2, T3-4 with a narrow transverse stripe in front of the marginal zone, T5-6 posteriorly lighter dark brown (Fig. 82), S1-2 mostly reddish-brown, S3-5 black with small reddish-brown stripe posteriorly. Punctuation of T1 more scattered than on following terga, punctures are about as far apart as their diameter. All other terga densely punctate and matt, punctuation of T2-6 successively coarser, marginal



Figs 77-82: *Nomada redivivoides* KUHLMANN nov.sp., ♀ (77) dorsal view; (78) lateral view; (79) head; (80) scutum; (81) propodeum; (82) metasoma.

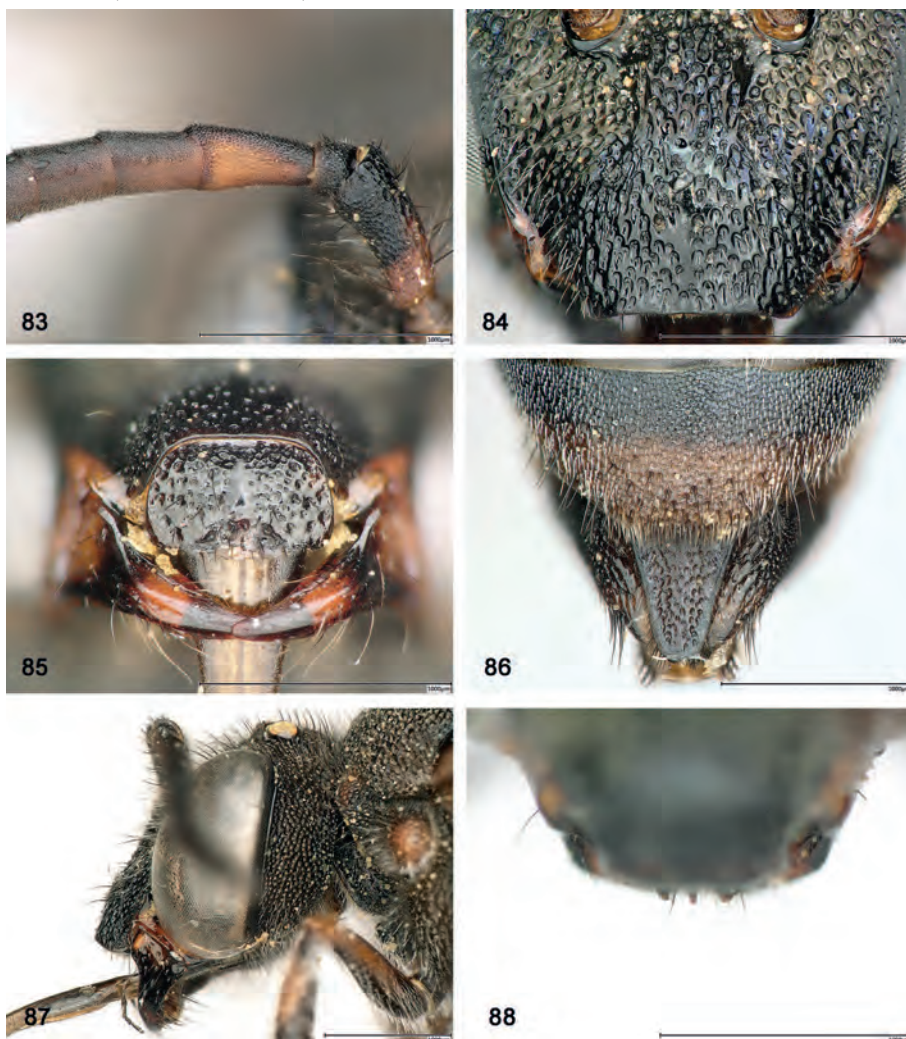
zones of T1-4 smooth and impunctate. Pseudopygidial area on T5 narrow and with sparse hairs. Medially with brownish-black and laterally with pale setae (Fig. 86). Pygidal plate narrow and flat triangular with a rounded tip, coarsely punctate (Fig. 86).

Male: Unknown.

Etymology: The species is named after the subgenus *Redivivoides* MICHENER, 1981 of its assumed host species *Rediviva (Redivivoides) variabilis* (KUHLMANN, 2012). Noun in apposition.

General distribution: Only known from the Kamiesberg Mountains in the wider vicinity of Kamieskroon.

Host: Females were observed to inspect and enter nests of *Rediviva* (*Redivivoides*) *variabilis* (KUHLMANN, 2012).



Figs 83-88: *Nomada redivivoides* KUHLMANN nov.sp., ♀ (83) first and second flagellar segments; (84) clypeus; (85) labrum; (86) pseudopygidial area and pygidial plate; (87) clypeus lateral; (88) teeth on labrum (dorsal view).

***Nomada whiteheadi* EARDLEY & SCHWARZ, 1991 (Figs 89-110)**

Nomada whiteheadi EARDLEY & SCHWARZ, 1991: 18-19. Holotype ♀ (Graafwater, South Africa) (SAMC), examined.

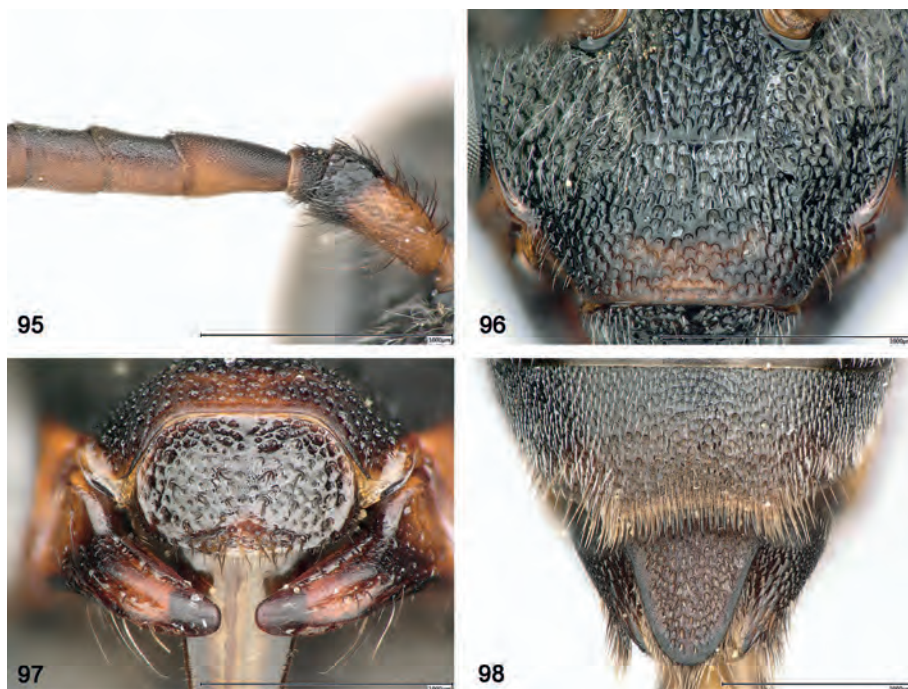
Additional material examined: (12 specimens). South Africa: 3♀♀, 8 km WNW Leliefontein, Fynbos, road side, 30°15'58''S 18°03'17''E, 1190 m, 14.ix.2017, leg. M. Kuhlmann (RCMK); 2♀♀, Garies, Diknek, 3017AD [30°19'S 17°16'E], 18.viii.1995, leg. V.B.

Whitehead (SAMC); 1♀, Nieuwoudtville, Wild Flower Reserve, Car Park East, 31°22'18''S 19°08'58''E, 730 m, 14.viii.2010, leg. M. Kuhlmann (RCMK); 1♀, Graafwater [32°09'S 18°33'E], x.1947, leg. Mus. Exp. (SAMC); 1♀, Cl. William [Clanwilliam], Capland [32°11'S 18°53'E], 20.viii.1927, leg. Dr. Brauns (SAMC); 2♀♀, Paleisheuvel, Alexandershoek, 3218BC [32°18'S 18°43'E], 12.ix.1991, leg. V.B. Whitehead (SAMC); 1♀, Sauer, Suurfontein, 3120CC [32°50'S 18°40'E], 1.ix.1994, leg. V.B. Whitehead (SAMC); 1♀, idem., Sauer, Suurfontein, 3218DC, 25.viii.1994 (SAMC).

Although the female of *N. whiteheadi* was described by EARDLEY & SCHWARZ (1991) it is here redescribed to highlight the differences to its previously unknown close relatives.



Figs 89-94: *Nomada whiteheadi* EARDLEY & SCHWARZ, 1991, ♀ (89) dorsal view; (90) lateral view; (91) head; (92) scutum; (93) propodeum; (94) metasoma.



Figs 95-98: *Nomada whiteheadi* EARDLEY & SCHWARZ, 1991, ♀ (95) first and second flagellar segments; (96) clypeus; (97) labrum; (98) pseudopygidial area and pygidial plate.

The male of *N. whiteheadi* was described by EARDLEY (1993) based on three specimens, one of them collected in Vanrhynsdorp was examined and perfectly matches the description (located in SAMC, not in DNMNH (former TMSA) as indicated in the publication). The two other males mentioned by EARDLEY (1993) were not available for study. Thus, redescription and images are solely based on this individual. However, there are indications that females and males might be incorrectly associated (see "Remarks" below).

D i a g n o s i s : The female of *N. whiteheadi* is unique by the conspicuous apical, broad comb of strong flat and black, slightly upwards bent setae of the pseudopygidial area on T5 (Fig. 98). The male is characterised by the comparatively dense and long greyish-white pubescence of head and mesosoma (Figs 99-102). Pygidial plate finely punctate, narrow and flat triangular with rounded tip (Fig. 104). Genitalia and S7 as illustrated (Figs 108-110).

D e s c r i p t i o n

F e m a l e : Body-length: 9.6-13.2 mm (Habitus: Figs 89-90). **Head:** Head black, reddish-brown are: antennal scape except tip, ventral side of antennal flagellum (except first flagellar segment orange), lower margin of the clypeus (to a variable extent), malar area, base and tip of mandible (Fig. 91). Coloration of labrum variable, from completely black to yellowish-orange, intermediate forms sometimes with small apical brown spot(s) and yellowish-orange margin(s) (Fig. 97). Specimens from higher altitude generally more



Figs 99-104: *Nomada whiteheadi* EARDLEY & SCHWARZ, 1991, ♂ (99) dorsal view; (100) head; (101) scutum; (102) propodeum; (103) metasoma; (104) pygidial plate.

blackish. Head slightly broader than long. First flagellar segment longer than second (ratio 1 : 0.76) (Fig. 95), all flagellar segments longer than wide. Supraclypeal area broadly adjoining the clypeus, longitudinal keel raised with highest point between the base of the antenna. Clypeus in lateral view slightly asymmetrically convex, with the highest part in the upper half and flattened in the lower half, punctation fine and dense, between punctures smooth and shiny (Fig. 96). Labrum transversely oval in shape, arcuate apical transverse ridge with medially three or four asymmetrically arranged small, yellowish translucent teeth on its upper margin, surface finely punctate, smooth and shiny between punctation (Fig. 97). Mesosoma: Integument black, reddish-brown are:



Figs 105-110: *Nomada whiteheadi* EARDLEY & SCHWARZ, 1991, ♂ (**105**) first and second flagellar segments; (**106**) labrum; (**107**) front tarsus; (**108**) metasomal sternum S7; (**109**) genitalia dorsal; (**110**) gonostylus lateral.

pronotal lobe, pair of longitudinal stripes on the scutum (variable in extent), tegula, axilla (Fig. 92), scutellum with pair of lateral spots on anterior swelling and lower posterior edge, metanotum except lateral margin and horseshoe-shaped maculation (variable in extent) on the mesepisternum (Fig. 93). Scutum and propodeum finely punctate, shiny and smooth between punctures; scutellum and metanotum with slightly finer punctation, matt; scutellum medially depressed and laterally with distinct swelling. Wings: Wing venation reddish-brown at the base, apically brownish to black, membrane hyaline brown (Fig. 90). Legs: Front leg predominantly reddish-brown with black and brown maculation, tibia brownish-black with transversal reddish-brown spot, mid and hind legs

predominantly black with reddish-brown maculation (Fig. 90). Hind tibia apically with three to four straight black spines, outer spine sometimes slightly paler and thinner. Metasoma: Metasoma mostly black; reddish-brown are posterior half of T1, all of T2, T3-4 with a narrow transverse stripe anterior of the marginal zone, T5-6 posteriorly lighter dark brown (Fig. 94), S1-3 mostly reddish-brown with black maculation, S5-6 black with small reddish-brown stripe posteriorly. Punctuation of T1 more scattered than on following terga, punctures are about as far apart as their diameter, following terga densely punctate and matt, punctuation of T2-6 successively coarser, marginal zones of T1-4 smooth and impunctate. Posterior margin of T5 medially emarginate and slightly raised, pseudopygidial area on T5 posteriorly with a crest of strong blunt black, slightly upwards bent setae that are directed backwards, this crest partly covered by a sparse transverse patch of thinner long yellowish to silverish hairs (Fig. 98). Pygidial plate broad and flat triangular with rounded tip, finely punctate (Fig. 98).

M a l e : Body-length: 11.3 mm (Habitus: Fig. 99). Head: Head black, reddish-brown are: lower 2/3 of antennal scape, ventral side of antennal flagellum (except first flagellar segment orange), lower margin of the clypeus, malar area, mandible except tip and lateral maculation (Fig. 100), medioapical margin of labrum (Fig. 106). Head broader than long and covered with dense silverfish hair. First flagellar segment longer than second (ratio 1 : 0.77) (Fig. 105), all flagellar segments longer than wide. Supraclypeal area with longitudinal keel raised with highest point below the base of the antenna. Clypeus in lateral view slightly asymmetrically convex, with the highest part in the upper half and flattened in the lower part, punctuation fine and dense, between punctures smooth and shiny. Labrum transversely oval in shape, no visible teeth, surface irregularly finely punctate, smooth and shiny between punctuation (Fig. 106). Mesosoma: Integument black, reddish-brown are: pronotal lobe, pair of longitudinal stripes on the scutum, tegula, axilla (Fig. 101), scutellum with pair of lateral spots on anterior swelling and lower posterior margin, metanotum and horseshoe-shaped maculation on the mesepisternum (Fig. 102). Scutum and propodeum finely punctate, shiny and smooth between punctures; scutellum and metanotum with slightly finer punctuation; scutellum medially depressed and laterally with distinct swelling. Entire mesosoma except propodeum with long silverish hairs. Wings: Wing venation reddish-brown at the base, apically brownish to black, membrane hyaline brown. Legs: Front leg predominantly reddish-brown with black and brown maculation, mid and hind legs predominantly brown with reddish brown maculation. Hair fringes on the front tarsi (Fig. 107). Metasoma: Metasoma black; reddish-brown are: posterior half of T1 except marginal zone and black transverse stripe anteriorly of the marginal zone, anterior half of T2, posterior margin of T6 (Fig. 103), stripe in the middle of S1, anterior margin of S2 with narrow stripe, reddish-brown maculation on the anterior margin of S3. Punctuation of T1 more scattered than on following terga, punctures are about as far apart as their diameter, following terga densely punctate and matt, punctuation of T2-6 successively coarser, marginal zones of T1-6 smooth and impunctate. Pygidial plate narrow and flat triangular with rounded tip, finely punctate (Fig. 104). Terminalia: Genitalia (Figs 109-110) and S7 (Fig. 108) as illustrated.

General distribution : The species is endemic to the winter rainfall region in the west of South Africa.

Host : Females were observed to inspect and enter nests of *Rediviva* (*Redivivoides*) *variabilis* (KUHLMANN, 2012).

Remarks: None of the three males, that were assigned to *N. whiteheadi* by EARDLEY (1993), was collected together with females. Thus, without additional information (e.g. DNA barcoding) they cannot be assigned with certainty to *N. whiteheadi* or one of the other very similar four or even five (including the more distantly related *N. roggeveldi* nov.sp.) species. However, until new evidence becomes available and for taxonomic stability this male is provisionally further treated as *N. whiteheadi*, although there are some doubts about its identity.

For sex association in *Nomada* general colour pattern and morphology of the labrum turned out to be useful characters (J. Smit, pers. comm.). While colour patterns are very similar in the five species of this complex, the male misses the arcuate apical transverse ridge with medially three or four asymmetrically arranged small teeth on its upper margin. They are typical for the females of *N. erhardti* nov.sp., *N. maximiliani* nov.sp., *N. redivivoides* nov.sp. and *N. whiteheadi* (Figs 65, 75, 85, 97). In addition, the male is unusually hairy (Figs 99-102). Hence, it seems unlikely that this male belongs to *N. whiteheadi* and it might even represent a hitherto unknown new species.

Unidentified male *Nomada* sp. (Figs 111-122)

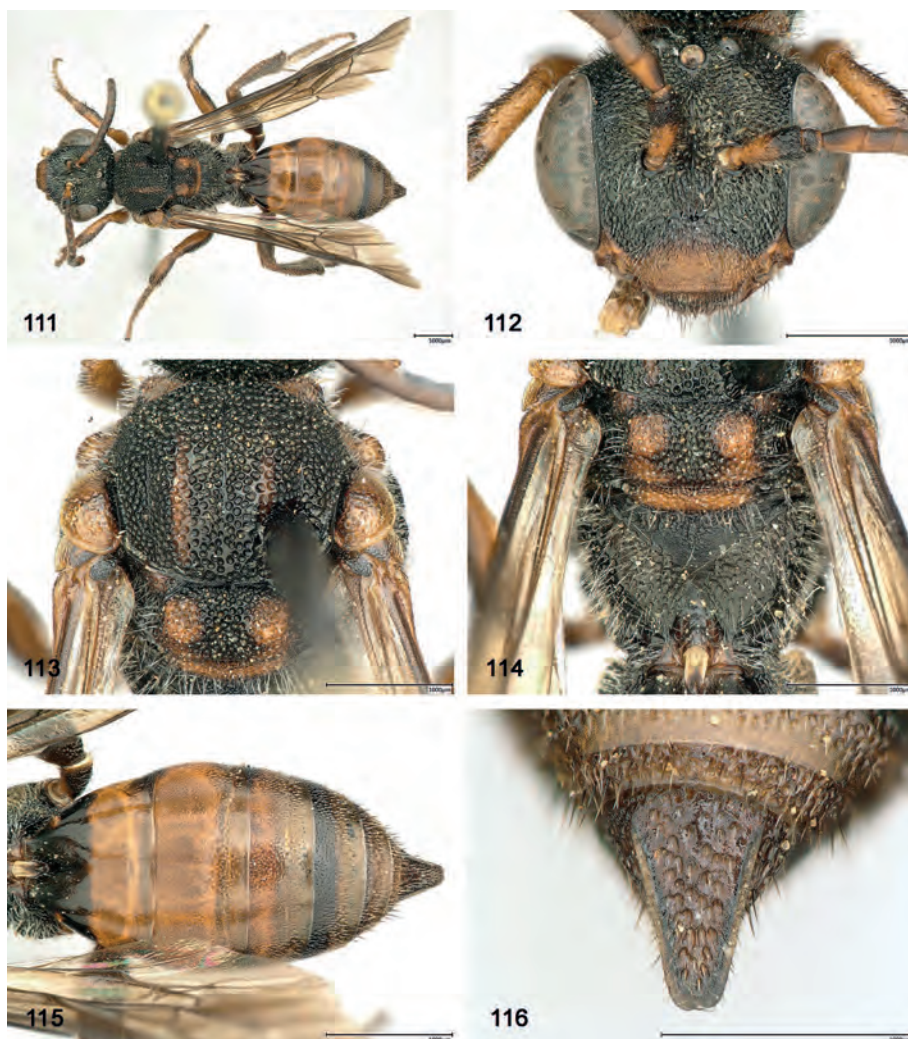
Material examined: (1 specimen). South Africa: 1♂, Kotzesrus, Farm Rondabel, 3017DD [30°58' S 17°50' E], 29.viii.1996, leg. V.B. Whitehead, SAM-HYM-B008067 (SAMC).

This specimen is clearly different from the presumed male of *N. whiteheadi*. It is only described but not named because it was collected separately and cannot reliably associated with any of the females. Morphology of the labrum, namely the arcuate apical transverse ridge with medially three or four asymmetrically arranged small teeth on its upper margin (Fig. 118), suggests that it might be the unknown male of either *N. erhardti* nov.sp., *N. maximiliani* nov.sp., *N. redivivoides* nov.sp. or *N. whiteheadi*. Females of these species have a similarly structured labrum (Figs 65, 75, 85, 97). However, it is also possible that the male represents a new species different from the ones treated in this publication. A description is here provided to encourage and facilitate future studies.

Diagnosis: The male *Nomada* sp. indet. is characterised by the following character combination: labrum with arcuate apical transverse ridge that medially has three or four asymmetrically arranged small teeth on its upper margin (Fig. 118), first flagellar segment longer than second (ratio 1 : 0.77) (Fig. 117), scutum with a pair of two reddish-brown longitudinal stripes (Fig. 113), front tarsi with hair fringes (Fig. 119), metasoma with reddish-brown maculation (Fig. 115), pygidial plate narrow and coarsely punctate (Fig. 116), genitalia and S7 as illustrated (Figs 120-122).

Description

Male: Body-length. 11.7 mm (Habitus: Fig. 111). **Head:** Head black, reddish-brown are: lower 2/3 of antennal scape, ventral side of antennal flagellum (except first flagellar segment orange), lower margin of clypeus, malar area, mandible except tip (Fig. 112), labrum (Fig. 118). Head broader than long. First flagellar segment longer than second (ratio 1 : 0.77) (Fig. 117), all flagellar segments longer than wide. Supraclypeal area with longitudinal keel raised with highest point between the base of the antenna. Clypeus in lateral view slightly asymmetrically convex, with the highest part in the upper half and flattened in the lower part, punctation fine and dense, between punctures smooth and shiny (Fig. 112). Labrum transversely oval in shape, apical transverse ridge medially with three to four small teeth, tooth in the middle black and longer, lateral teeth smaller and



Figs 111-116: Unidentified *Nomada* sp., ♂ (111) dorsal view; (112) head; (113) scutum; (114) propodeum; (115) metasoma; (116) pygidial plate.

brownish translucent, labrum unevenly and finely punctate, smooth and shiny between punctation (Fig. 118). Mesosoma: Integument black, reddish-brown are: pronotal lobe, pair of longitudinal stripes on the scutum, tegula, axilla (Fig. 113), scutellum with pair of lateral spots on anterior swelling and lower posterior margin (Fig. 114), metanotum and inverted U-shaped maculation on the mesepisternum. Scutum and propodeum finely punctate, shiny and smooth between punctures; scutellum and metanotum with slightly finer punctation; scutellum medially depressed and laterally with distinct swelling. Wings: Wing venation reddish-brown at the base, apically brownish to black, membrane hyaline brown (Fig. 111). Legs: Front leg predominantly reddish-brown with black and



Figs 117-122: Unidentified *Nomada* sp., ♂ (117) first and second flagellar segment; (118) labrum; (119) front tarsus; (120) metasomal sternum S7; (121) genitalia dorsal; (122) gonostylus lateral.

brown maculation, mid and hind legs predominantly brown with reddish brown maculation. Hair fringes on the front tarsi (Fig. 119). Metasoma: Metasoma black, reddish-brown are: posterior half of T1, all of T2-3 except a black narrow transverse stripe on the upper margin, marginal zone of T4-T6 slightly reddish-brown (Fig. 115), posterior half of S1, all of S3, S4-6 marginal zone slightly reddish-brown. Punctuation of T1 more scattered than on following terga, punctures are about as far apart as their diameter, following terga densely punctate and matt, punctuation of T2-6 successively coarser, marginal zones of T1-6 smooth and impunctate. Pygidial plate narrow and flat triangular with rounded tip, coarsely punctate (Fig. 116). Terminalia: Genitalia (Figs 121-122) and S7 (Fig. 120) as illustrated.

General distribution: Only known from a site in coastal lowland west of Bitterfontein.

Host: Unknown.

Key for the identification of female *Nomada* in South Africa

The identity of the male *N. whiteheadi* and another unnamed male is doubtful (see explanations above). Only the males of *N. kobrowi* and *N. gigas* are known with certainty. The illustrations, in combination with the descriptions, should enable the identification of those males. Hence, a key only to female *Nomada* of South Africa is provided here.

- 1 Scutellum completely reddish-brown (Fig. 5) *Nomada kobrowi* BRAUNS
- Scutellum with two reddish-brown spots (e.g. Figs 27, 49) 2
- 2 Metasoma with yellowish-white transverse stripe on T2 (Fig. 28) *Nomada gigas* FRIESE
- Metasoma black and reddish-brown, without yellowish-white maculation 3
- 3 Clypeus flat (Figs 52, 55); labrum medially with single tooth (Figs 53, 56); scutum black (Fig. 48) *Nomada roggeveldi* nov.sp.
- Clypeus protruding and convex (e.g. Figs 84, 87); labrum with three to four teeth (e.g. Figs 85, 88); scutum with pair of (sometimes faint) reddish-brown longitudinal stripes (e.g. Figs 70, 92) 4
- 4 Pseudopygidial area of T5 apically with a broad comb of strong flat and black, slightly upwards bent setae (Fig. 98); basal 2/3 of antennal scape reddish-brown, apical third black (Fig. 95) *Nomada whiteheadi* EARDLEY & SCHWARZ
- Pseudopygidial area of T5 medioapically with more delicate round and brown to black, straight setae (Figs 66, 76, 86); less than basal half of antennal scape reddish-brown, apical part black (e.g. Fig. 83) 5
- 5 Clypeus medio-longitudinally with more dispersed and irregular punctuation, interspaces polished and shiny (Fig. 84); pseudopygidial area apically with sparse hair fringe (Fig. 86); pygidial plate narrow and coarsely punctate (Fig. 86) *Nomada redivivoides* nov.sp.
- Clypeus completely densely punctate (Figs 64, 74); pseudopygidial area apically with dense hair fringe (Figs 66, 76); pygidial plate broad and finely punctate (Figs 66, 76) 6
- 6 Clypeus completely black (Fig. 74); scutum with finer punctuation, pair of longitudinal stripes dark reddish-brown and hardly visible (Fig. 70) *Nomada maximiliani* nov.sp.
- Clypeus apically with a pair of reddish-brown spots (Fig. 64); scutum with coarser punctuation, pair of longitudinal stripes reddish-brown and well visible (Fig. 60) *Nomada erhardtii* nov.sp.

Discussion

In the present study, four new species of the bee genus *Nomada* are described, bringing the total number of species known from South Africa to seven. Due to the apparent general rarity of these bees and the difficulty to find males, sex association is a problem. Only for two species both, male and female, are known with certainty. This can only be overcome by further collecting of fresh material that can be used for DNA barcoding.

Fieldwork is also urgently required to get more information about the biology of the species, in particular the host bees. To date *Nomada* species have been known to be parasites of *Andrena*, *Panurgus* (Andrenidae), *Agapostemon*, *Halictus*, *Lasioglossum*,

Lipotriches (Halictidae), *Melitta* (Melittidae), *Exomalopsis* and *Eucera* (Apidae) (MICHENER 2007). In this study for the first time the melittid (sub)genus *Rediviva* (*Redivivoides*) was confirmed as the host of *Nomada*.

Currently eight *Melitta* species (EARDLEY & KUHLMANN 2006, DELLICOUR et al. 2014, MICHEZ et al. 2014) and seven species of *Rediviva* (*Redivivoides*) (KUHLMANN 2012, KUHLMANN et al. 2020) are known from South Africa. Additionally, *Andrena notophila* COCKERELL, 1933 (EARDLEY 2006) occurs in the country, which is another potential host of *Nomada*. Thus, it can be expected that further *Nomada* species exist in the country.

Acknowledgements

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Zusammenfassung

Die südafrikanischen Arten der Bienengattung *Nomada* SCOPOLI, 1770 werden revidiert und vier neue Arten beschrieben: *Nomada erhardti* KUHLMANN nov.sp. ♀, *N. maximiliani* KUHLMANN nov.sp. ♀, *N. redivivoides* KUHLMANN nov.sp. ♀ und *N. roggeveldi* KUHLMANN nov.sp. ♀. *Nomada kobrowi* BRAUNS, 1912 sp.rev. war mit *N. gigas* FRIESE, 1905 synonymisiert, stellte sich aber als eigenständige Art heraus. *Nomada eximia* EARDLEY & SCHWARZ, 1991 syn.nov. wird mit *N. kobrowi* synonymisiert und das bislang unbekannte Weibchen erstmals beschrieben. Alle Arten werden fotografisch dokumentiert und ein Bestimmungsschlüssel für die Weibchen vorgelegt. Die Untergattung *Rediviva* (*Redivivoides*) MICHENER, 1981 wird erstmals als Wirt für *Nomada* nachgewiesen.

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