

A Revision of the *rhopalocerus* Species Group of *Bembecinus* Costa (Hymenoptera: Crabronidae: Bembicinae)

†Friedrich W. Gess¹, Wojciech J. Pulawski², and Sarah K. Gess³

¹ Albany Museum and Rhodes University, Grahamstown, 6139 South Africa

² California Academy of Sciences, San Francisco, California 94118, USA, wpulawski@calacademy.org

³ Albany Museum and Rhodes University, Grahamstown, 6139 South Africa, s.gess@ru.ac.za

Eight new species of *Bembecinus* of the *rhopalocerus* species group are described and illustrated: *damarensis* F. Gess and Pulawski, *gariepensis* F. Gess and Pulawski, *helicicola* Pulawski, *inexpectatus* Pulawski, *karasanus* F. Gess and Pulawski, *namaquensis* Pulawski, *namibius* Pulawski, and *omaruru* Pulawski. *Bembecinus ruficaudus* Bohart, 1997 is herein referred to the synonymy of *Bembecinus mutabilis* (Arnold, 1929). *Bembecinus quadristrigatus somalicus* (Arnold, 1940) is raised to the full species status, with *B. quadristrigatus dubiosus* (Guiglia, 1941) recognized as its synonym. Geographical distributions based on available records are presented for all seventeen species of the *rhopalocerus* species group: *Bembecinus damarensis* F. Gess and Pulawski, *gariepensis* F. Gess and Pulawski, *gilvus* R. Bohart, *helicicola* Pulawski, *hyperocrus* (Arnold), *inexpectatus* Pulawski, *karasanus* F. Gess and Pulawski, *mutabilis* (Arnold), *namaquensis* Pulawski, *namibius* Pulawski, *omaruru* Pulawski, *pakhuisae* R. Bohart, *quadristrigatus* (Arnold), *rhopaloceroideus* (Arnold), *rhopalocerus* (Handlirsch), *somalicus* (Arnold), and *zebratus* R. Bohart. According to the current knowledge, all species are restricted to sub-Saharan Africa, and most occur in the semi-arid to arid Succulent Karoo and Nama-Karoo of South Africa and Namibia. Three species (*gilvus*, *omaruru* and *quadristrigatus*) penetrate the Namib Desert along the courses of drainage channels and one (*somalicus*) is known only from Ethiopia, Kenya, and northeast Tanzania. A summary of flower associations, nesting and prey is provided for those species for which data are available. Flowers visited are principally small, clustered in heads, and of the families Zygophyllaceae, Molluginaceae, Amaranthaceae and Asteraceae. All known prey are Homoptera: Cicadellidae, Flatidae, Issidae, and Nogodinidae.

Bembecinus is a cosmopolitan genus with 188 currently recognized species (Pulawski 2014). Of these, 61 species have been recorded from the Afrotropical Region, and 49 from southern Africa.

Considering the size of the genus it is not surprising that several authors have attempted to divide it into species groups. Arnold (1929) in his account of the southern African *Bembecinus* (treated by him, as previously by Handlirsch, as belonging to *Stizus*) divided the species then known to him into eight species groups. These groups were based upon those proposed by Handlirsch (1892) and were generally in agreement with them. The only divergence was with respect to Handlirsch's *clavicornis* group (based upon *Stizus clavicornis* Handlirsch, 1892, a junior synonym of *Larra cinguliger* F. Smith, 1856). From the *clavicornis* group, renamed by him the *cinguliger* group, Arnold removed *rhopalocerus* Handlirsch to form a new species group, the *rhopalocerus* group, consisting of *rhopalocerus* and his four allied, newly described species (*hyperocrus*, *mutabilis*, *quadristrigatus* and *rhopaloceroideus*). A further species group, the *oxydorcus* group, was

created by Arnold (1929) to separate off *B. oxydorcus* Handlirsch, a species sharing many characteristics with *cinguliger* Smith.

Bohart and Menke (1976) in their overview of the world genera suggested somewhat wider group limits than those proposed by either Handlirsch or Arnold. With respect to the Afrotropical fauna the consequent reduction in the number of species groups was in part achieved by considering the *cinguliger* group to include Arnold's *rhopalocerus* and *oxydorcus* groups.

Bohart (1997) further reduced the number of groups to three, the *Bembecinus caffer* group with two subgroups, the *Bembecinus rhopalocerus* group with two subgroups, *B. rhopalocerus* subgroup and *B. oxydorcus* subgroup, and *Bembecinus tridens* group with seven subgroups. Rather than giving a key he listed the groups with their subgroups giving diagnostic characters to distinguish them.

It was the opinion of the first author (FWG, here supported by WJP), however, that there are sufficient differences, both morphological and biological, between the *B. rhopalocerus* and *B. oxydorcus* subgroups for these to be treated as full groups.

Bohart (1997) thought that *Bembecinus lomii* (Guiglia) was a member of the *rhopalocerus* group, but this opinion is certainly erroneous. Guiglia's original description (1941) clearly mentions an emarginate margin of the propodeal declivity. She says, in the Latin diagnosis: *Margine declivi segmenti mediani incisioe profunda et angusta praedito*, and later in the Italian description: *L'incisione ai margini declivi del segmento mediano è piuttosto stretta e profonda*. In addition, the illustration of the whole insect and that of the propodeum in profile clearly show an emargination. This character decidedly excludes the possibility of *B. lomii* being part of the *rhopalocerus* group, in which the posterior propodeal declivity is non-emarginate.

For some years prior to 1992 Friedrich Gess had been working towards a revision of the *rhopalocerus* species group as defined by him in his unfinished manuscript of 1992, which was set aside whilst he engaged himself in revisions of the masarine genera, meanwhile making a partial revision following Bohart (1997) and collecting together and determining more specimens of *Bembecinus*, thus adding to the knowledge of geographical distributions and flower associations. Regrettably, due to his ill health over many years and his subsequent death on 6 August 2013, his revision was not completed. The present contribution is a further revision and expansion of the 1992 manuscript. It is based on the examination of 1,423 specimens.

Friedrich's descriptions of two new species and recognition of a third have been checked and the descriptions completed by Wojciech Pulawski, who has also added and described five additional new species, a key to the species, Recognition sections under all species, photographs of morphological characters, and whole body photographs of some species.

Photographs of a pair of specimens of most species, maps depicting the known geographical distributions, comments on the geographical distributions of the species, and of their flower associations, nesting and prey have been added by Sarah Gess.

Clearly, although the contribution is based on the work of Friedrich Gess, it has not been checked or approved by him and therefore should errors be found he should not be held responsible for them.

Members of the *rhopalocerus* group occur in Africa south of Sahara. When discussing their distributions, the terms Nama-Karoo, Succulent Karoo, Namib Desert, Savanna and Kalahari have been used. The terms follow the categorization of biomes in southern Africa by Rutherford (in Cowling et al. 1997). Each of the biomes (Fig. 1) is by no means uniform and can be divided into types related, amongst other factors, to latitude, altitude, geology and rainfall patterns (Cowling et al. 1997).

The Nama-Karoo is the largest of the three biomes included in the Karoo-Namib Region. Its

annual rainfall varies but as a generalization can be said to decrease from east to west with the areas of very low precipitation being in the rain shadows of major mountain ranges. Rainfall is bimodal or strongly seasonal and, for some areas, relatively high in summer.

The Succulent Karoo is characterized by predominantly winter rainfall and, as its name suggests, a remarkably high diversity of succulents.

The Namib Desert stretches for 2,000 km in a north-south direction. It is adjacent to the Nama-Karoo and Succulent Karoo biomes and may be considered from many perspectives to comprise the most arid portions of these biomes.

Savanna is a tropical biome, which grades into the arid shrublands of the Nama-Karoo in the Eastern and Northern Cape provinces of South Africa and in Namibia.

The Kalahari does not constitute a separate biome but to the south is considered to be arid Nama-Karoo and to the north arid Savanna. The Kalahari basin is characterized by its infilling being the single largest body of wind-blown sand in the world.

The term *ocular index*, as used in the present paper, is defined as the interocular distance on the vertex divided by the interocular distance at the base of the clypeus. The term *streptaulus* indicates a transverse pronotal sulcus that extends between the bases of the pronotal lobes and that separates the collar from the anterior pronotal rim.

For plotting the distribution maps ArcMap 10.1 GIS by ESRI was used with the coordinates in decimal degrees. Coordinates given as label data have been included in the 'Material examined' species sections. Those not given as label data have been obtained from relevant websites or in the instances where the label data gives the collection locality as a number of kilometres or miles from a fixed point the coordinates have been calculated from maps (Gazetteer as an Appendix compiled by SKG).

Acronyms for institutions in which material is housed follow Evenhuis (2013) The names of the persons responsible for the loans follow in parentheses. These are:

AEIC = American Entomological Institute, Gainesville, Florida (the late Henry K. Townes to FWG).

AMGS = Albany Museum, Grahamstown, South Africa (John Midgley to WJP).

AMNH = American Museum of Natural History, New York, USA (Jerome G. Rozen to FWG).

BMNH = Natural History Museum, London, United Kingdom, formerly British Museum, Natural History (David G. Notton to WJP).

CAS = California Academy of Sciences, San Francisco, California, USA (Wojciech J. Pulawski to FWG).

MHNG = Muséum d'Histoire Naturelle de Genève, Switzerland (Bernard Landry to WJP).

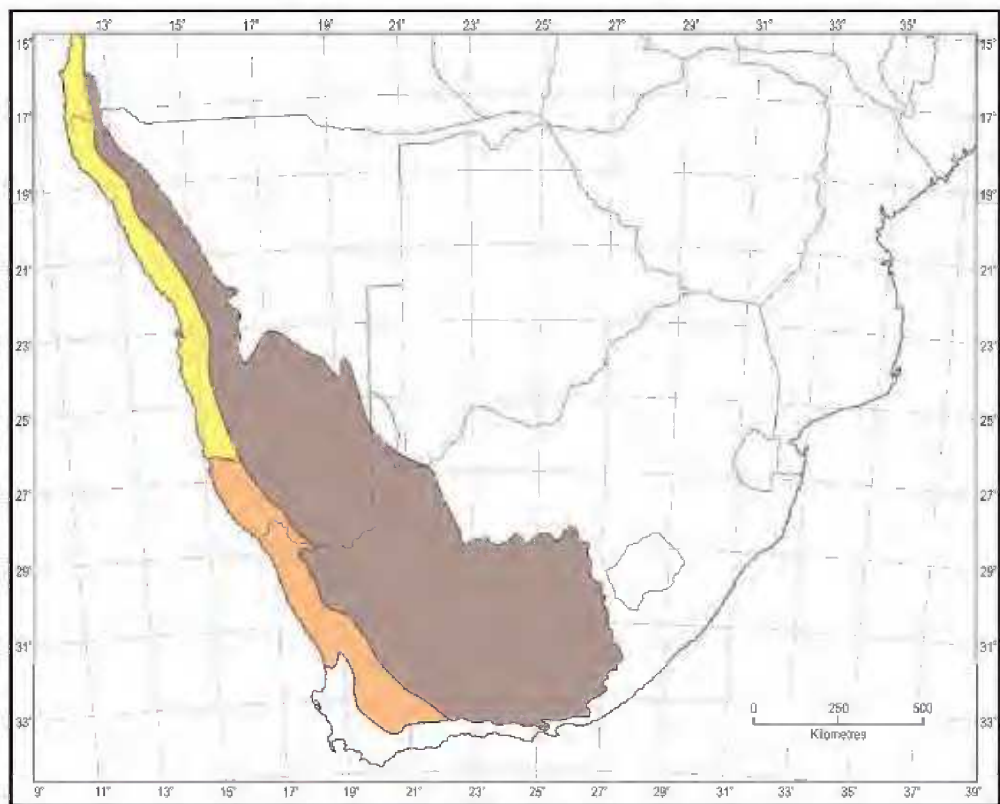


FIGURE 1. Southern Africa. The distribution of Succulent Karoo (orange), Nama-Karoo (brown) and middle and northern Namib Desert (yellow) after Rutherford (1997).

MS = Maximilian Schwarz, Ansfelden, Austria (personal collection, to WJP).

MSNG = Museo Civico di Storia Naturale di Genova, Italy.

NMBZ = Natural History Museum of Zimbabwe, Bulawayo, Zimbabwe, formerly National Museum of Southern Rhodesia (Hamish G. Robertson, SAMC to FWG).

OÖLM = Oberösterreichisches Landesmuseum, Linz, Austria (Fritz Gusenleitner to WJP).

PPRI = Plant Protection Research Institute, Pretoria, South Africa (Connal D. Eardley to WJP).

SAMC = South African Museum, Iziko Museums of Cape Town, South Africa (Hamish G. Robertson to FWG; Dawn Larson to WJP).

TMSA = Transvaal Museum, now National Museum of Natural History, Ditsong Museum, Pretoria, South Africa (Robert W. Toms to FWG).

UCDC = University of California, Davis, R.M. Bohart Museum of Entomology, California, USA (Lynn S. Kimsey to FWG; Steven L. Heydon to WJP).

USNM = United States National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA (Brian Harris to WJP).

ZMB = Museum für Naturkunde, Institut für Systematische Zoologie, Berlin, Germany (Michael Ohl, to FWG and WJP).

ZMUC = Zoological Museum, University of Copenhagen, Copenhagen, Denmark (Lars Vilhelmsen, to WJP).

Key to Species Groups of *Bembecinus*

(based on Bohart, 1997, with modifications derived from the manuscript key of F. Gess)

- 1a. Male flagellomere IX produced into a spine beneath *B. tridens* group
(including *discolor*, *irwini*, *loriculatus*, *meridionalis*, *peregrinus*, *spinicornis*, and *tridens* subgroups)
- 1b. Male flagellomere IX simple 2
- 2a. Male flagellum relatively slender; male sterna simple; female foretarsus with apical tarsomere and arolium not unusually large. Afrotropical and Australian Regions. *B. caffer* group
(including *caffer* and *inermis* subgroups)
- 2b. Male and female flagellum moderately to strongly clavate; male sterna mainly simple, with prong on sternum II in *cinguliger* (F. Smith), *escalerae* (Turner), and *flavopictus* (Arnold); female foretarsus with apical tarsomere and arolium much larger than on other legs. Afrotropical Region. 3
- 3a. Flagellum moderately clavate (Fig. 2b); lateral margin of propodeal declivity only slightly compressed, not excised (Fig. 2c); clypeus sub-triangular, only slightly wider than long (Fig. 2a); length of labrum about 0.7–1.0 × its width (Fig. 2a); female forebasitarsus with a sand rake composed of a small number of long spines; male sternum II simple. Nesting in friable (sandy) soil; nest excavation by means of the raking of dry sand; burrow entrance without a turret (F. Gess and S. Gess 1971; F. Gess 1981) *B. rhopalocerus* group
- 3b. Flagellum conspicuously clavate; lateral margin of propodeal declivity strongly compressed, widely and deeply excised; clypeus more than twice as wide as long; length of labrum about 0.3–0.4 × its width; female forebasitarsus with dense row of short cilia; male sternum II simple in *oxydorcus* Handlirsch, with prong in *cinguliger* (F. Smith), *escalerae* (R. Turner), and *flavopictus* (Arnold). Nesting in non-friable (clayey) soil; nest excavation aided by use of water; burrow entrance surmounted by turret (F. Gess and S. Gess, 1975; S. Gess, 1981) *B. oxydorcus* group



FIGURE 2. Species group characters exemplified by *Bembecinus rhopalocerus*: a – female clypeus and labrum, b – female antenna, c – non-emarginate posterolateral edge of propodeum.

Key to Species of *Bembecinus rhopalocerus* Group

♀♀

Unknown and not included: *Bembecinus namaquensis*

- 1a. Forefemur conspicuously expanded basoventrally, its dorsal margin almost straight (Fig. 20b); clypeus near base roundly angulate in profile (Fig. 20a) *rhopalocerus* (Handlirsch)
- 1b. Forefemur not expanded, somewhat expanded basoventrally in *damarensis*, in which dorsal margin is shallowly concave basally and clypeus is evenly arcuate in profile 2
- 2a. Labrum with large punctures (Fig. 12a), larger than those on scutum, averaging about one diameter apart. ***karasanus* F. Gess and Pulawski, sp. nov.**
- 2b. Labrum with punctures smaller than or equal to those on scutum, averaging several diameters apart. 3
- 3a. Scutum with pair of admedian yellow stripes extending through most of scutum length, and gaster yellow and black; interocellar area yellow (partly so in some *gilvus*). 4
- 3b. Scutum all black mesally or, if with yellow admedian stripes (*omaruru*, many *mutabilis*, some *garipeensis*), then gaster ferruginous (at least with ferruginous apical fasciae on terga), with or without yellow apical fasciae on terga; interocellar area black or with minute yellow spot between midocellus and hindocellus in some *mutabilis* 7
- 4a. Terga II-V each with pair of submedian black stripes (Fig. 22) that extend beyond tergal midlength or with pair of black spots near tergal middle. *somalicus* (Arnold)
- 4b. Terga II-V with narrow black fascia basally or with single median black stripe that extends beyond tergal midlength 5
- 5a. Scape with erect setae along its entire length (except basally) . . . ***namibius* Pulawski, sp. nov.**
- 5b. Scape without erect setae or with erect setae at apex only 6
- 6a. Labrum microscopically reticulate between punctures; forebasitarsus barely broadened (Fig. 8a); lower metapleuron closely, microscopically punctate; length 6.0–10.0 mm *gilvus* R. Bohart
- 6b. Labrum unsculptured between punctures, at least along midline; forebasitarsus broadened (Fig. 18a); lower metapleuron microscopically areolate; length 9.5–14.0 mm *quadristrigatus* (Arnold)
- 7a. Tergum II laterally with erect setae (Fig. 10b), longest setae about 0.5 × midocellar width . . . 8
- 7b. Tergum II without erect setae or setae markedly shorter 10
- 8a. Gastral terga ferruginous, without apical yellow fasciae *hyperocrus* (Arnold)
- 8b. Gastral terga with pale yellow apical fasciae (fasciae ill-defined in *omaruru* with golden tan gaster). 9

- 9a. Clypeus all yellow, practically not angulate near base; minimum interocular distance equal to $2.2 \times$ that between antennal scrobe and base of clypeus **omaruru Pulawski, sp. nov.**
- 9b. Clypeus black basally, roundly angulate near base in profile (Fig.11a); minimum interocular distance equal to $3.2 \times$ that between antennal scrobe and base of clypeus **inexpectatus Pulawski, sp. nov.**
- 10a. Terga all ferruginous or with apical ferruginous fasciae (apical terga may be all or partly black), in some species with yellow apical fasciae 11
- 10b. Terga black and yellow 14
- 11a. Terga largely ferruginous or with ferruginous, apical fasciae, but without yellow apical fasciae *mutabilis* (Arnold)
- 11b. Terga with yellow apical fasciae 12
- 12a. Hindtibial arolium about as long as $0.5 \times$ inner claw; mid- and hindtarsal claws slightly curving inwards at base **helicicola Pulawski, sp. nov.**
- 12b. Hindtibial arolium about as long as $0.25 \times$ inner claw; mid- and hindtarsal claws straight (indistinguishable morphologically, but can be determined by association with topotypical males) 13
- 13a. Southern Namibia, Eastern and Western Cape Provinces of South Africa *rhopaloceroides* (Arnold)
- 13b. Southern Namibia, northwestern part of Northern Cape Province of South Africa **gariensis F. Gess and Pulawski, sp. nov.**
- 14a. Dorsal surface of tergum I yellow except for median, black, nearly rectangular marking (Fig. 6b) that does not attain posterior margin; scape without erect setae; dorsal margin of forefemur somewhat concave basally, ventral margin slightly expanded basally (Fig. 6a) **damarensis F. Gess and Pulawski, sp. nov.**
- 14b. Tergum I black except for narrow, yellow apical fascia; scape apically with several erect setae (setal length at least $0.5 \times$ midocellar width); dorsal margin of forefemur practically straight, ventral margin not expanded basally 15
- 15a. Clypeus all or partly black, mesopleuron black *pakhuisae* R. Bohart
- 15b. Clypeus all yellow, mesopleuron partly yellow *zebratus* R. Bohart



Unknown and not included: *Bembecinus helicicola*

- 1a. Punctures of labrum larger than those of scutum (Fig. 12a) **karasanus F. Gess and Pulawski, sp. nov.**
- 1b. Punctures of labrum smaller than or equal to those on scutum 2
- 2a. Foretibia incrassate in profile (Figs 7b, 19c) 3
- 2b. Foretibia not incrassate 4
- 3a. Foretibial inner surface with oblique impression that is visible in dorsal view as an emargination at tibia's basal third (Fig. 19b) *rhopaloceroides* (Arnold)
- 3b. Foretibia with inner surface flat or nearly so, without emargination in dorsal view (Figs 7a and b) **gariensis F. Gess and Pulawski, sp. nov.**
- 4a. Tergum II with erect setae (Fig. 10c), at least laterally; longest setae about $0.5 \times$ midocellar width 5
- 4b. Tergum II without erect setae or setae markedly shorter 7
- 5a. Clypeus, supraclypeal area, and stripes along orbit pale yellow **inexpectatus Pulawski, sp. nov.**

- 5b. Clypeus, supraclypeal area, and frons all black 6
- 6a. Gastral terga without pale yellow apical fasciae; tergum VII shorter, rounded (Fig. 10d)
 *hyperocrus* (Arnold)
- 6b. Gastral terga with pale yellow apical fasciae (fasciae ill defined in specimens with golden tan gaster); tergum VII longer, roundly triangular (Fig. 16) ***omaruru* Pulawski, sp. nov.**
- 7a. Apical flagellomere curved, excavated posteriorly, only slightly so in *pakhuisae* (Fig. 17b) . 8
- 7b. Apical flagellomere not curved, not excavated posteriorly or insignificantly excavated. . . . 11
- 8a. Gastral terga largely ferruginous (tergum I black basally, following terga all ferruginous or narrowly black basally) *mutabilis* (Arnold)
- 8b. Gastral terga yellow and black 9
- 9a. Tergum VII longer, roundly triangular (Fig. 6d); apical flagellomere markedly curved and excavated (Fig. 6c) ***damarensis* F. Gess and Pulawski, sp. nov.**
- 9b. Tergum VII shorter, roundly trapezoid (Fig. 17c); apical flagellomere slightly curved and excavated (Fig. 17b) 10
- 10a. Apical flagellomere less curved (Fig. 17b); yellow apical fascia of tergum II slightly shorter to longer than black, basal part, at least mesally *pakhuisae* R. Bohart
- 10b. Apical flagellomere in most specimens more curved (Fig. 23a); yellow apical fasciae of tergum II shorter than black, basal part *zebratus* R. Bohart
- 11a. Gastral terga largely ferruginous ***namaquensis* Pulawski, sp. nov.**
- 11b. Gastral terga yellow and black (with some ferruginous on tergum I in *rhopalocerus*) 12
- 12a. Terga II-V with pair of submedian black stripes that extend beyond tergal midlength or with pair of black spots near tergal middle (Fig. 22) *somalicus* (Arnold)
- 12b. Tergum II-V with narrow black fascia basally or with single median black stripe that extends beyond tergal midlength 13
- 13a. Scape with erect setae along its entire length (except basally) . ***namibius* Pulawski, sp. nov.**
- 13b. Scape without erect setae or with erect setae at apex only. 14
- 14a. Distance between clypeus and antennal scrobe equal to about $0.3 \times$ least interocular distance (Fig. 8b); lower gena without erect setae between mandibular base and occipital carina; length 7.0–9.2 mm. *gilvus* R. Bohart
- 14b. Distance between clypeus and antennal scrobe equal to $0.6\text{--}0.7 \times$ least interocular distance; lower gena with erect setae between mandibular base and occipital carina; length 12.1–14.6 mm 15
- 15a. Clypeus roundly angulate basally (best seen in profile, Fig. 20a); tergum VII broadly rounded (Fig. 20c); scutum black mesally *rhopalocerus* (Handlirsch)
- 15b. Clypeus evenly arcuate in profile; tergum VII less rounded, more prominent mesally (Fig. 18d); scutum with pair of admedian yellow stripes *quadristrigatus* (Arnold)

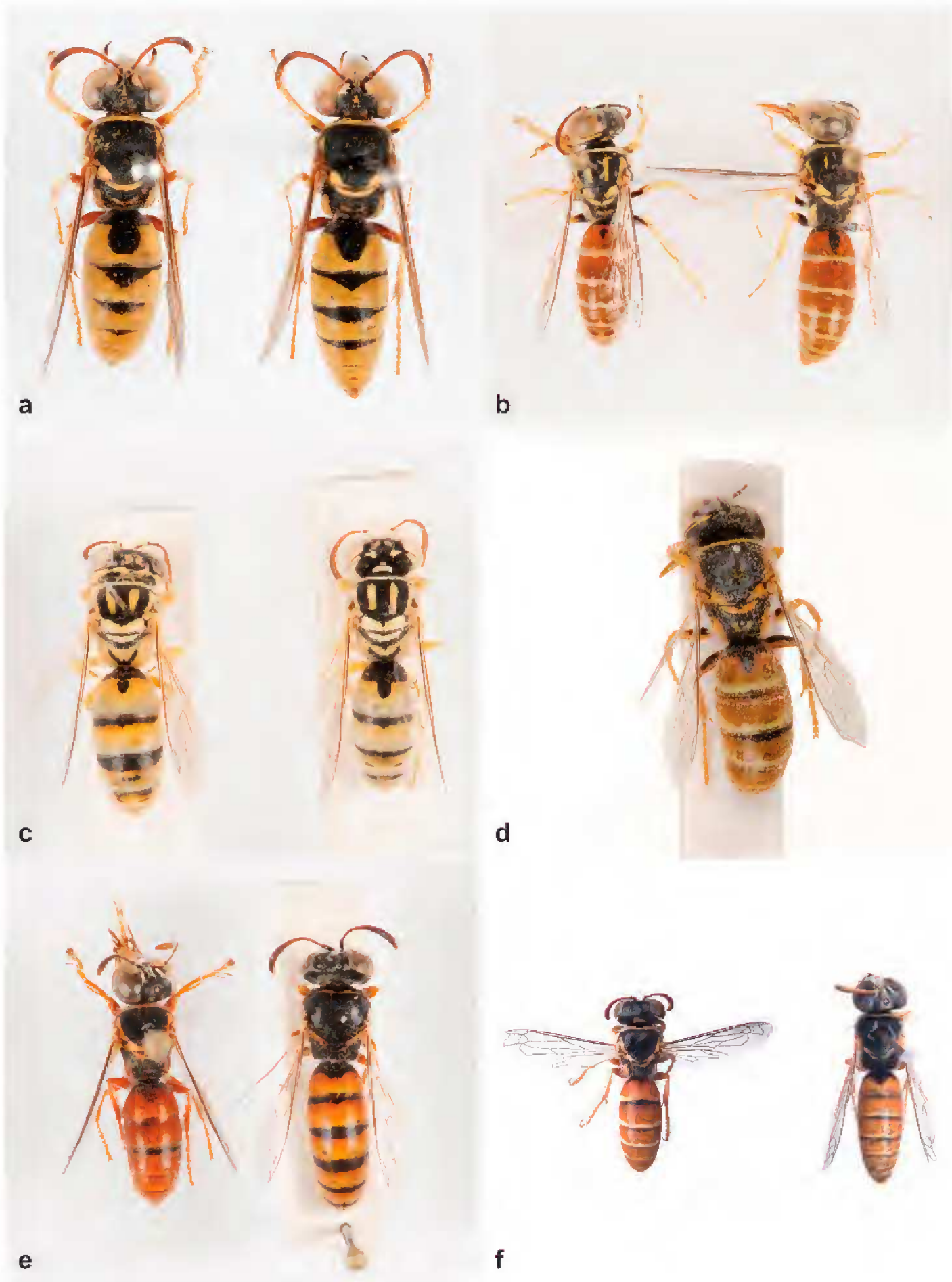


FIGURE 3. *Bembecinus* spp.: a – *damarensis*, female, male, b – *gariensis*, female, male, c – *gilvus*, female, male, d – *helicicola*, female; e – *hyperocrus*, female, male, f – *inexpectatus*, female, male. (approximate lengths of females: a. 12 mm, b. 11.5 mm, 9 mm, d. 10 mm, e. 10 mm, f. 9.2 mm).

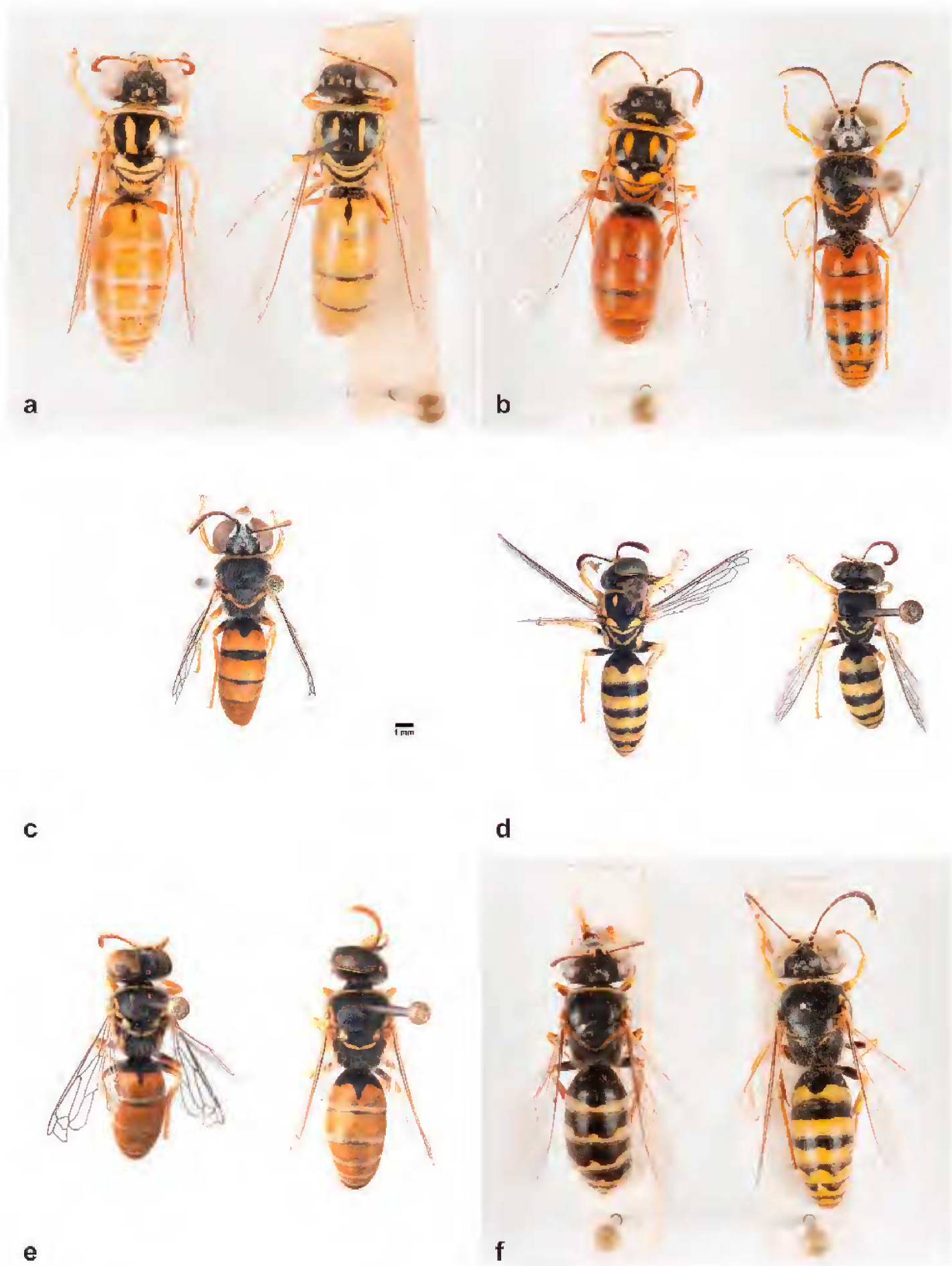


FIGURE 4. *Bembecinus* spp.: a – *karasanus*, female, male, b – *mutabilis*, female, male; c – *namaquensis*, male; d – *namibius*, female, male; e – *omaruru*, female, male; f – *pakhuisae*, female, male. (approximate lengths of females: a. 11 mm, b. 10.5 mm, c. male 11.8 mm, d. 9.7 mm, e. 11.3 mm, f. 15 mm).

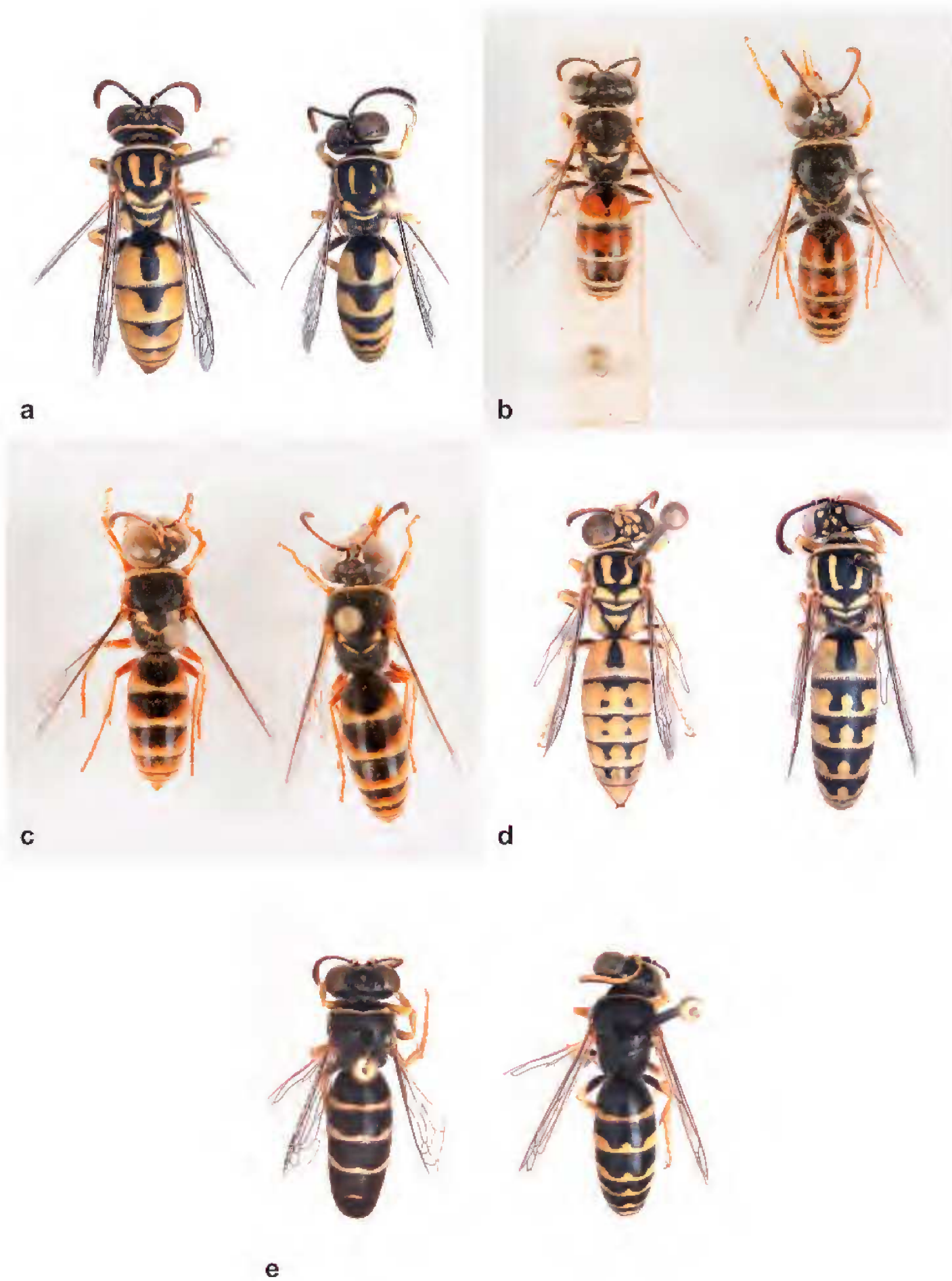


FIGURE 5. *Bembecinus* spp.: a – *quadristrigatus*, female, male; b – *rhopaloceroides*, female, male; c – *rhopalocerus*, female, male; d – *somalicus*, female, male; e – *zebratus*, female, male (approximate lengths of females: a. 11.5 mm, b. 11.5 mm, c. 13 mm, d. 11.8 mm, f. 10.5 mm).

***Bembecinus damarensis* F. Gess and Pulawski, sp. nov.**

Figures 3a, 6a-d.

Bembecinus sp. nov. A (*rhopalocerus* species group): S. Gess and F. Gess, 2003:117 (floral records).

NAME DERIVATION.— The name, a newly coined Neolatin adjective, is derived from the geographical name, Damaraland, a historic province of Namibia, and refers to the provenance of the holotype.

RECOGNITION.— *Bembecinus damarensis* has the scutum black mesally, the mesopleuron largely yellow, and the terga largely yellow (at least terga I-III black basally), without ferruginous color. In the female, the length of the hindtibial arolium is about $0.5 \times$ of the inner claw. The females of *pakhuisae* and *zebratus* are similar, but *damarensis* differs in having the dorsal surface of tergum I yellow except for the median, black, nearly rectangular marking (Fig. 6b) that does not attain posterior margin and the scape without erect setae. Also, the dorsal margin of the forefemur is somewhat concave basally and the ventral margin slightly expanded basally. In the other two species, tergum I is black except for narrow, yellow apical fascia, the scape apically has several erect setae (setal length at least $0.5 \times$ mid-cellular width), and the dorsal margin of the forefemur is practically straight and the ventral margin is not expanded basally. The shape of the forefemur is similar in the female of *rhopalocerus*, in which, however, the clypeus is roundly angulate basally (best seen in profile), whereas evenly convex in *damarensis*.

The male of *damarensis* shares with that of *mutabilis* a conspicuously curved and excavated apical flagellomere (Fig. 6c), markedly more so than in *pakhuisae* and *zebratus*. It differs from that of *mutabilis* in having the scutal punctures averaging about one diameter apart, the mesopleuron yellow, the gastral terga mostly yellow (partly black), tergum VII elongate, roundly triangular (Fig. 6d), and the length of 12.7–14.7 mm. In *mutabilis*, the scutal punctures, near center, average about two diameters apart, the mesopleuron is all or predominantly black, the gaster is ferruginous (with some parts black), tergum VII is short, trapezoid, with apical margin nearly straight (Fig. 13d), and the length is of 10.5–11.5 mm.

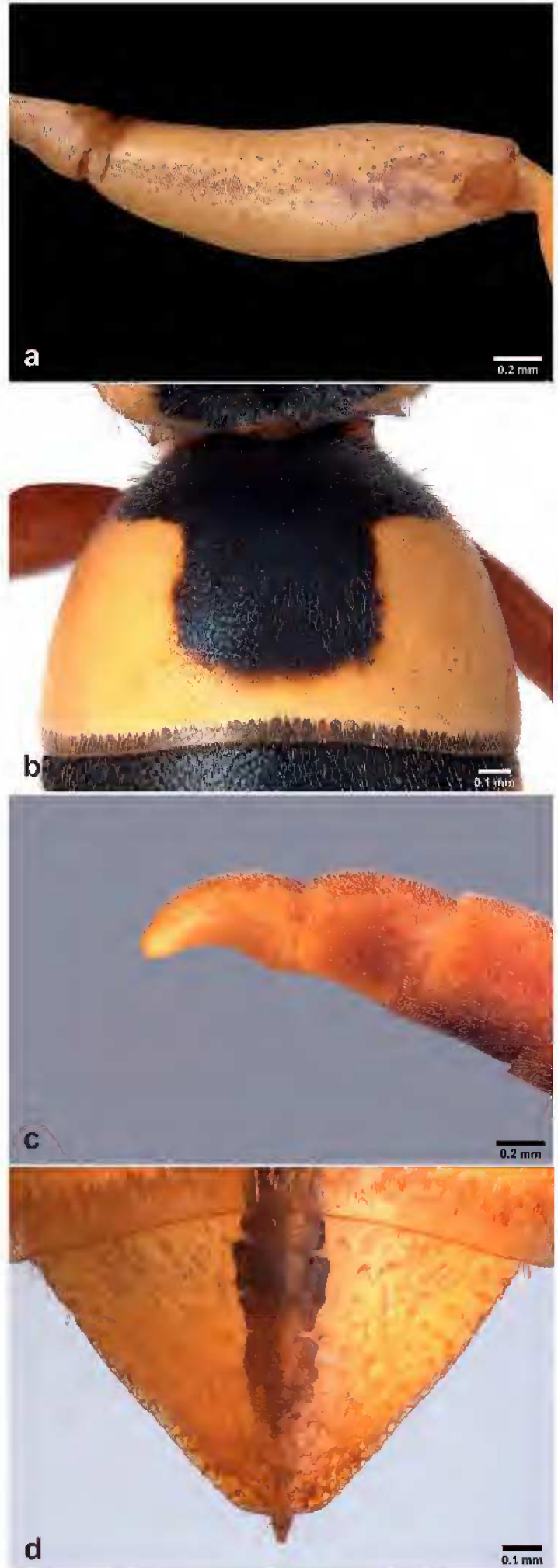


FIGURE 6. *Bembecinus damarensis*: a – female forefemur, b – female tergum I showing color pattern, c – apical flagellomere of male, d – male tergum VII.

DESCRIPTION.— Head black, with the following yellow: mandible except apex, labrum, clypeus, face below antennae and narrowly up to midheight along orbit, streak on frons in midline below anterior ocellus, occasionally small spot touching posterior ocellus anteromedially, gena narrowly above and widely below, cardo, stipes, galea, both pairs of palps, scape except for dorsal black streak, underside of pedicel and of flagellomere I. Rest of antennae ferruginous except for black dorsal surface of pedicel and of flagellomeres VI–IX. Thorax black with the following yellow: entire pronotum except for black streptaulus, a C-shaped marking apically on each propleuron, lateral streak on scutum, tegula, triangular area on each side of scutellum, metanotum except narrowly black basally, and mesopleuron largely. Propodeum black, with the following yellow: anterior third of lateral surface, posterolateral margin, and a pair of spots on preapical part of enclosure. Gaster yellow with the following black: anterior declivity of tergum I, extending posteriorly into subrectangular, median marking on disk, basal transverse band expanded posteriorly in the middle on tergum II, and similar but often less developed markings on terga III and IV. Female legs yellow with the following light ferruginous: outer and inner surface of fore- and midtrochanters and fore- and midfemora and almost entire hindtrochanter and hindfemur, streaks on lower surface of all tibiae, tarsomeres to a variable degree. Male legs predominantly yellow with only the inner surface of hindfemur light ferruginous, inner surface of fore- and midfemora marked with black, and inner surface of hindfemur with ferruginous area marked with black. Wings hyaline, Sc + R black, other veins brown.

Clypeus, face below antennae and halfway up along sides densely covered with decumbent silvery pubescence, rest of face more sparsely so.

♀: Length 12.2–14.7 mm (average of 13: 13.3 mm; holotype: 12.3 mm). Ocular index 1.9–2.0 (average of 13 = 1.9). Minimum interocular distance equal to $2.9\text{--}3.2 \times$ that between antennal scrobe and base of clypeus (average of 8 = 3.0); distance between posterior ocelli $1.4 \times$ ocellocular distance. Clypeus impunctate, markedly convex, fairly evenly curved from base to free margin, its high point near center of disk, its width at insertion of mandibles $1.8\text{--}1.9 \times$ its median length (average of 13 = 1.85). Labrum triangular, markedly shiny, with small, widely separated punctures, sparsely microsculptured unlike clypeus which is densely microsculptured; its width at base subequal to median length. Dorsal margin of forefemur somewhat concave basally, ventral margin slightly expanded basally (Fig. 6a)

♂: Length 12.7–14.7 mm (average of 6 = 13.9 mm). Ocular index 1.9–2.1 (average of 6 = 2.0). Minimum interocular distance equal to $2.1\text{--}2.6 \times$ that between margin of antennal scrobe and base of clypeus (average of 6 = 2.26); distance between posterior ocelli $1.4 \times$ ocellocular distance; width of clypeus at insertion of mandibles $1.5\text{--}1.7 \times$ its median length (average of 6 = 1.6). Flagellomere XI curved, excavate below, hook-like (Fig. 6c). Tergum VII triangular, rounded apically (Fig. 6d).

MATERIAL EXAMINED.— HOLOTYPE: ♀, **NAMIBIA: Otjozondjupa Region:** Osire, 24.xii.1974, H.N. Empey (AMGS). PARATYPES: **NAMIBIA: Otjozondjupa Region:** 44 km SW Otjiwarongo at $20^{\circ}37'S$ $16^{\circ}22'E$, 4.iii.1990, W.J. Pulawski (1 ♀, CAS); Osire, 24.xii.1974, H.N. Empey (8 ♀, 6 ♂, AMGS); 70 km N Okahandja, 16.iii.1990, W.J. Pulawski (2 ♀, 1 ♂, CAS); Okahandja, 2–4.ii.1972, BMNH Southern African Expedition (2 ♀, 8 ♂, BMNH). **Kunene Region:** Kamanyab (sic, = Kamanjab), iii.1925, Mus. Exped. (2 ♀, 1 ♂, SAMC, det. Arnold as *Stizus rhopalocerus* Handl.), same label data (1 ♀, SAMC ex NMB). **Erongo Region:** 17–19 km E Usakos, 18.iii.1976, J.G. and B.L. Rozen (1 ♀, AMNH); 11 km N Karibib, 27.ii.1990, W.J. Pulawski (1 ♀, CAS); 26 km N Karibib, 6.ii.1993, J. Gusenleitner (2 ♀, OÖLM). **Khomas Region:** between Rehoboth and Gamsberg Pass at $23^{\circ}09.43'S$ $16^{\circ}41.97'E$, 11.iii.1999, F.W. and S.K. Gess (1 ♀, 1 ♂, AMGS), visiting flowers of *Hermstaedtia odorata* (Burch.) T. Cooke, Amaranthaceae; 18 km W junction 1237 and

C26 at 23°09'S 16°42'E, 11.iii.1999, F.W. and S.K. Gess (1 ♀, 1 ♂, AMGS), visiting flowers of *Hermbstoetia* sp., Amaranthaceae; Narebis (sic = Naribis?), iii.1921, K.H. Barnard (1 ♀, SAMC, det. Arnold as *Stizus rhopalocerus* Handl.). **Omaheke Region:** Gobasis [= Gobabis], 17.xii.1933, J. Ogilvie (1 ♀, BMNH); Gobabis District, 40 km W Witvlei, 16.ii.1990, W.J. Pulawski (1 ♀, 2 ♂, CAS) and M. Schwarz (2 ♂, CAS; 3 ♂, MS). **Hardap Region:** SW Gibeon at 25°19.76'S 17°28.85'E, 8.iii.1999, F.W. and S.K. Gess (2 ♂, AMGS), one visiting flowers of *Limeum sulcatum* (Klotsch) Hutch., Molluginaceae; SW Gibeon at 25°19.76'S 17°28.85'E, 10.iii.1999, F.W. and S.K. Gess (4 ♂, AMGS), visiting flowers of *Limeum sulcatum* (Klotsch) Hutch., Molluginaceae; SW Gibeon 41 km on 1089 at 25°20'S 17°29'E, F.W. and S.K. Gess, 8.iii.1999 (2 ♂, AMGS), one visiting flowers of *Limeum* sp., Molluginaceae, 10.III.1999 (5 ♂, AMGS), four visiting flowers of *Limeum* sp., Molluginaceae, 24.iii.1999 (1 ♀, AMGS). **SOUTH AFRICA: Northern Cape:** 11 km from Twee Rivieren on Nossob road at 26°24'S 20°41'E, 8–11.iii.1990, F.W. and S.K. Gess (5 ♂, AMGS), visiting flowers of *Limeum aethiopicum* Burm., Molluginaceae.

GEOGRAPHICAL DISTRIBUTION.— Known from the Nama-Karoo/Savanna fringe in Northern Namibia to the Nama-Karoo in southern Namibia and the southern Kalahari to the north of Twee Rivieren (Fig. 24a)

FLORAL ASSOCIATIONS.— Visiting flowers of two families: Molluginaceae (*Limeum sulcatum* (Klotsch) Hutch. and *Limeum aethiopicum* Burm.) and Amaranthaceae (*Hermbstoetia odorata* Burch.) (label data, see Material Examined; S. Gess and F. Gess 2003).

NESTING.— Unknown.

PREY.— Unknown.

***Bembecinus gariensis* F. Gess and Pulawski, sp. nov.**

Figures 3b, 7a, b.

NAME DERIVATION.— The name, a newly coined Neolatin adjective, is derived from Gariiep, the Khoi name for the Orange River, on the raised southern bank of which, at Upington, the majority of the specimens were collected.

RECOGNITION.— *Bembecinus gariensis* is similar to *rhopaloceroideus*. See that species for differences.

STATUS OF THE SPECIES.— *Bembecinus gariensis* and *rhopaloceroideus* differ only by the shape of the male foretibia (as discussed under the latter species), whereas the females are indistinguishable morphologically. We have considered the possibility of the two being just individual or geographic variants of one species. We have rejected this hypothesis, because we have found no intermediate males, and because identical females occur in a number of species within the genus.

DESCRIPTION.— Head black with the following yellow: mandible except apex, labrum, clypeus, face below antennae and narrowly up to midheight along orbit, gena along orbit narrowly dorsally and widely ventrally, stipes laterally, scape (except black dorsally), pedicel and flagellomere I ventrally (rest of antenna ferruginous), in female also sublateral spot on each side immediately below level of anterior ocellus and transverse spot behind each posterior ocellus. Thorax black with the following yellow: pronotal collar, pronotal lobe, and pronotum ventrally of lobe, propleuron with small spot posterolaterally and a pair of small, transverse spots adjacent to posterior margin, adlateral streak and in many specimens pair of admedian streaks on scutum, large part of tegula, triangular lateral spot on scutellum, metanotum (except basally), most of mesopleuron. Propodeum black, with yellow posterolateral margin and yellow spot on lateral surface anteriorly extending top to bottom in female, slightly above midcoxal base in male, in female also with pair of spots toward apex of enclosure. Gaster ferruginous, terga I-V with pale yellow apical fascia, female tergum VI pale yellow except laterally, male terga VI and VII pale yellow (except tergum

VII mesally), and following is black: basal declivity of tergum I and narrow median streak extending through most of its dorsal surface. Legs pale yellow except posterior surface of femora largely black, foretibial venter with black streak, and mid- and hindtibial venters with ferruginous streaks. Wings hyaline, Sc+R black, other veins brown.

♀: Length 11.2–11.7 mm. Ocular index = 2.25–2.52. Minimum interocular distance equal to 2.1–2.2 × that between antennal scrobe and base of clypeus. Distance between posterior ocelli 1.3–1.5 × ocellocular distance. Width of clypeus at mandibular insertion 1.69–1.70 × its median length.

♂: Length 10.2–12.3 mm. Ocular index 2.22–2.47 (average of 17 = 2.36). Minimum interocular distance equal to 1.8–2.1 × that between margin of antennal scrobe and base of clypeus (average of 17 = 2.0); distance between posterior ocelli 1.3–1.7 × ocellocular distance (average of 17 = 1.5). Width of clypeus (measured near mandibular insertion) 1.56–1.70 × midlength (average of 17 = 1.63). Foretibia incrassate (Fig. 7).

MATERIAL EXAMINED.— HOLOTYPE: ♀, **SOUTH AFRICA: Northern Cape Province:** Richtersveld 2816 BB at Road Khubus-Ochta, near Vyfsusters Mountain, 7.x.1987, M. Struck, on flowers of *Psilocaulon subnodosum* (Berger) N.E.Br., Mesembryanthemaceae (Aizoaceae) (AMGS). PARATYPES: **NAMIBIA: !Karas Region:** Aus, 11.ii.1990, W.J. Pulawski (1 ♀, CAS); Aus at 26°40'S 16°15'E, 3.iii.2000, F.W. and S.K. Gess (2 ♀, AMGS); Klinghardtberge, 20.x.1974, R.A. Watmough (1 ♂, PPRI); road 727 80 km S Aus, 8.xii.1994, M. Kuhlmann (1 ♂, ZMB); 16 km S Rosh Pinah at 28°04'S 16°51'E, F.W. and S.K. Gess, 13.x.2000 (2 ♂, AMGS), one visiting flowers of Mesembryanthemaceae, 14.x.2000 (1 ♀, AMGS), visiting flowers of Mesembryanthemaceae, 15.x.2000 (1 ♂, AMGS). **SOUTH AFRICA: Northern Cape Province:** Richtersveld 2816 BB [Degree Reference System (Leistner and Morris 1976) = 28°45'–49'S 16°01'–15'E] at Road Khubus-Ochta, near Vyfsusters Mountain, 7.x.1987, M. Struck (2 ♂, AMGS), on flowers of *Psilocaulon subnodosum* (Berger) N.E.Br., Mesembryanthemaceae [Aizoaceae]; 60 km N Port Nolloth 28°47'S 16°38'E, 27.ix.1997, F.W. and S.K. Gess (1 ♀, 1 ♂, AMGS); Upington, 10–12.x.1966, F.W. and W.H.R. Gess (14 ♂, SAMC).

GEOGRAPHICAL DISTRIBUTION.— Known from the winter rainfall Succulent Karoo of southern Namibia and the Northern Cape Province, South Africa. (Fig. 24b).

FLORAL ASSOCIATIONS.— Visiting flowers of Aizoaceae (Mesembryanthema, *Psilocaulon subnodosum* (Berger) N.E.Br.) (label data, see Material Examined).

NESTING.— Unknown.

PREY.— Unknown.

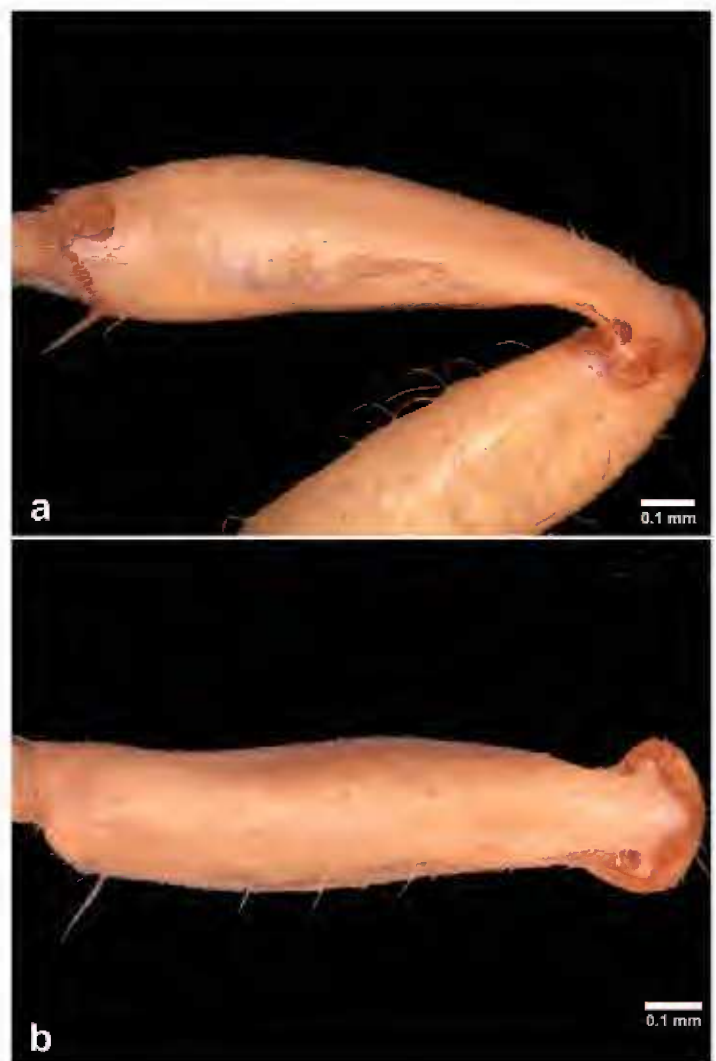


FIGURE 7. *Bembecinus gariopensis*: a – male foretibia in profile, b – male foretibia dorsally.

***Bembecinus gilvus* R. Bohart**

Figures 3c, 8a, b.

Bembecinus gilvus R. Bohart, 1997:168, Fig. 3, ♀. Holotype: ♀, Namibia: Gobabeb (USNM), examined by W. Pulawski.— S. Gess and F. Gess, 2003:115 (floral records); Pulawski, 2014:12 (in catalog of world Sphecidae *sensu lato*).

RECOGNITION.— *Bembecinus gilvus* has the gaster mainly yellow with some black, but without ferruginous color. It also has a pair of admedian yellow stripes on the scutum and a yellow marking between the midocellus and each hindocellus (the two separated in the midline). It differs from similar species (*quadristrigatus*, *somalicus*) in lacking the erect setae along the hypostomal carina (at most a few such setae are present next to the occipital carina), the lower metapleuron closely, microscopically punctate, the body length of 6.0–10.0 mm (rather than 9.5.0–14.0), the female forebasitarsus barely broadened (Fig. 8a), and in the male the distance between the clypeus and the antennal scrobe equal to about $0.3 \times$ least interocular distance rather than $0.6\text{--}0.7 \times$.

MATERIAL EXAMINED.— **NAMIBIA:** **Kunene**

Region: on road 3245 E Skeleton Coast Park ($20^{\circ}14'S$ $13^{\circ}53'E$), F.W. and S.K. Gess, visiting yellow flowers of *Zygophyllum simplex* Linnaeus, Zygophyllaceae (5 ♀, AMGS); 12 km E Springbokwaater at $20^{\circ}15'S$ $13^{\circ}44'E$, F.W. and S.K. Gess, visiting flowers of *Zygophyllum simplex* L., Zygophyllaceae, 13.x.2000 (1 ♀, AMGS), 14.x.2000 (1 ♀, AMGS), 11.iv.2002 (3 ♀, 7 ♂, AMGS). **Erongo**

Region: 20 km NE Hentiesbaai at $21^{\circ}58'S$ $14^{\circ}22'E$, 10.xii.1996, W.J. Pulawski (2 ♀, 2 ♂, CAS); 5 km E Swakopmund, 4.ii.1978, O. Lomholdt (1 ♀, ZMUC); 63 km E Swakopmund at $22^{\circ}45'S$ $15^{\circ}02'E$, 15.ii.1996, W.J. Pulawski (1 ♀, 1 ♂, CAS); 11 km E Walvis Bay at $22^{\circ}59'S$ $14^{\circ}37'E$, 6.xii.1996 (2 ♂, CAS); between Kuiseb and Gaub passes ($23^{\circ}27'S$ $15^{\circ}46'E$) 22.iii.1999, F.W. and S.K. Gess (1 ♀, AMGS); Gaub Pass ($23^{\circ}30'S$ $15^{\circ}46'E$), 19.iii.1997, F.W. and S.K. Gess, on yellow flowers of *Zygophyllum simplex* Linnaeus, Zygophyllaceae (1 ♀, 1 ♂, AMGS); Kuiseb River bed at Rooibank ($23^{\circ}11'S$ $14^{\circ}39'E$), 10.iv.1998, F.W. and S.K. Gess (2 ♀ and 1 ♂ visiting yellow flowers of *Zygophyllum simplex* Linnaeus, Zygophyllaceae, 2 ♀ visiting yellow flowers) (4 ♀, 2 ♂, AMGS); Rooibank Desert Park, 15.xii.1977, Empey (3 ♂, AMGS); 5 km N Gobabeb, Wharton, 31.xii.1978, on *Zygophyllum simplex* Linnaeus (1 ♀, PPRI) and 2.i.1979 (1 ♀, PPRI); Kuiseb-Naukluft Bridge in Namibpark, 15.v.1973, M.F. Johannesmeier (4 ♀, PPRI); Kuiseb Naukluft Bridge, Namib Park, 16.v.1973, M.F. Johannesmeier (2 ♂, AMGS); Gobabeb [Namib Desert Research Station] 6.i.1980, R. Wharton (1 ♀, UCDC, holotype of *Bembecinus gilvus*); Namib Desert Research Station [Gobabeb] at $13^{\circ}33'45''S$ $15^{\circ}02'38''E$, I. Kapofi and M.E. Irwin, 14–26.ii.1997 (1 ♀, CAS), 8–15.ix.1997 (1 ♀, CAS), 24.xi.1997 (10 ♀, CAS), 1–8.xii.1997 (4 ♀, CAS), 15–22.xii.1997 (3 ♀, CAS), 22–29.xii.1997 (3 ♀, CAS), 29.xii.1997 (3 ♀, CAS), 5–12.i.1998 (1 ♀, CAS), 17–24.ii.1998 (13 ♀, CAS); 8 km S Gobabeb, 12.ii.1978 (2 ♂, ZMUC); 88 mi. E [147 km] Walvis Bay, 2.x.1967, E.S. Ross and A.R. Stephen (1 ♀, CAS). **!Karas Region:**

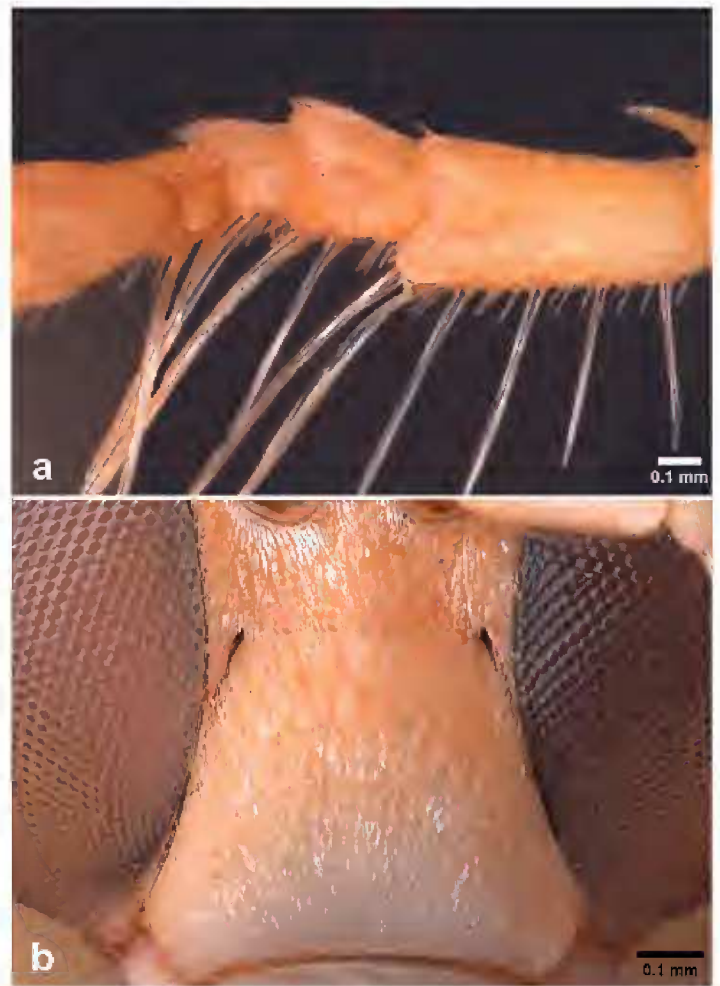


FIGURE 8. *Bembecinus gilvus*: a – female forebasitarsus, b – male clypeus.

SW Gibeon 41 km on 1089 (25°20'S 17°29'E) 10.iii.1999, F.W. and S.K. Gess (8 ♀ and 10 ♂, AMGS), visiting white flowers of *Limeum* sp., Molluginaceae (11 ♀, 15 ♂, AMGS); SW Gibeon 41 km on road 1089 (25°20'S 17°29'E) 24.iii.1999, F.W. and S.K. Gess (2 ♂, AMGS); 16 km S Rosh Pinah at 28°04'S 16°51'E, F.W. and S.K. Gess, 13.x.2000 (1 ♀, AMGS), visiting flowers of *Tripteris*, Asteraceae, 15.x.2000 (1 ♂, AMGS); Great Fish River, Aiais [Ai-Ais], Mus. Staff, xi.1939 (1 ♀, SAMC). **SOUTH AFRICA: Northern Cape Province:** Goodhouse, xi.1936, Museum Staff [SAMC] (4 ♀, SAMC). **Western Cape:** 11 km W Clanvilliam on road to Graafwater, 1.xii.1989, F.W. and S.K. Gess (1 ♂, AMGS).

GEOGRAPHICAL DISTRIBUTION.— Known from Namibia, from the Desert/Nama-Karoo fringe in the north, penetrating the Namib Desert along the courses of the Swakop and Kuiseb rivers, to the Nama-Karoo in the south and across the Orange River into South Africa, with a single record from 11 km west of Clanvilliam in arid sandy Fynbos (Fig. 24c). This record so far south is surprising, however, it is of interest that the specimen was collected in the dry summer month of December, an unusual collecting time for this winter rainfall area which is most commonly visited by insect collectors in the spring, when flowering is at its height. It is clear that summer collecting in the winter rainfall area north to the Orange River is required to establish the complete distribution of this species.

FLORAL ASSOCIATIONS.— Visiting flowers of four plant families: Zygophyllaceae (*Zygophyllum simplex* Linnaeus), Molluginaceae (*Limeum* sp.), Asteraceae (*Tripteris* sp.) and Vahliaceae (label data, see Material Examined; S. Gess and F. Gess 2003).

NESTING.— Unknown.

PREY.— Unknown.

***Bembecinus helicicola* Pulawski, sp. nov.**

Figures 3d, 9.

Bembecinus sp. of *rhopalocerus* species group: F. Gess and S. Gess, 1999:147.

NAME DERIVATION.— The name *helicicola* is derived from two Latin words: *helica*, a snail shell, and the suffix *-cola*, a dweller; with reference to this species habit of seeking shelter in the empty shells of the snail *Trigonephrus* sp., Dorcasiidae.

RECOGNITION.— Like *rhopaloceroideis* and *garipeensis*, *helicicola* has the gastral terga ferruginous, with pale yellow apical fasciae (tergum I black basally). It differs from these two species in having the claws of the mid- and hindtarsi slightly curving inward at base, and in having the hindtarsal arolium about as long as 0.5 × inner claw. In the other two species, the mid- and hindtibial claws are straight, and the hindtarsal arolium is about as long as 0.25 × inner claw.

DESCRIPTION.— Head black, with the following pale yellow: mandible except apex, labrum (black basomedially in holotype), clypeus, face below antenna, narrow stripe along eye orbit up to level of midocellus, gena narrowly along orbit, scape and pedicel ventrally; flagellum brownish yellow ventrally, dark brown dorsally; palpi brown. Thorax black with the following yellow: pronotal collar, pronotal lobe, narrow adlateral streak on scutum, tegula anteriorly (ferruginous posteriorly), triangular lateral spot on scutellum, posterior half of metanotum, and spot of varying



FIGURE 9. *Bembecinus helicicola*: apical hindtarsomere.

size on mesopleuron. Propodeum black, with the following yellow: enclosure posteriorly, posterolateral margin mesally, and small spot on lateral surface anteroventrally. Gaster ferruginous, with pale yellow apical bands on terga; anterior declivity of tergum I black. Legs yellow, femora black dorsally (except apex). Wings hyaline, vein Sc+R dark brown, other veins light brown.

♀: Length 9.4–10.5 mm. Ocular index 2.20–2.30. Minimum interocular distance equal to 2.2–2.5 × that between antennal scrobe and base of clypeus. Distance between posterior ocelli 1.6–1.8 × distance between posterior ocellus and eye margin. Clypeus evenly arcuate in profile, its width at insertion of mandibles 1.6 × its midline. Labrum roundly triangular, its greatest width about 1.2 × midlength. Hindtarsal arolium about as long as 0.5 × of inner claw.

♂: Unknown.

MATERIAL EXAMINED.— HOLOTYPE: ♀, **SOUTH AFRICA: Northern Cape Province:** Richtersveld W Brandkaros at 28°29'S 16°40'E, 15.ix.1996, F.W. Gess, S.K. Gess, and R.W. Gess (AMGS). PARATYPES: same data as holotype (1 ♀, CAS); 60 km N Port Nolloth at 28°47'S 16°38'E, 27.ix.1996, F.W. Gess and S.K. Gess (1 ♀, AMGS)

GEOGRAPHICAL DISTRIBUTION.— Known from two adjacent localities in the Northern Cape Province of South Africa (Fig. 24d).

SNAIL SHELL ASSOCIATION.— All three specimens were collected from empty shells of the snail *Trigonephrus* sp., Dorcasiidae, in which they were found sheltering. In windswept desertic areas snail shells provide shelter for various species of aculeates. Furthermore, some species use shells, sand-filled or empty, as secure nesting sites (F. Gess and S. Gess 1999; S. Gess and F. Gess 2008).

FLORAL ASSOCIATIONS.— Unknown.

NESTING.— Unknown.

PREY.— Unknown.

***Bembecinus hyperocrus* (Arnold)**

Figures 3e, 10a–c.

Stizus hyperocrus Arnold, 1929:295, ♀ (as Brauns's MS name). Holotype or syntypes: ♀, South Africa: Cape Province: Willowmore (TMSA).— Arnold, 1930:20 (in checklist of Afrotropical Sphecidae).— As *Bembecinus hyperocrus* (Arnold): R. Bohart and Menke, 1976:531 (new combination, in checklist of world Sphecidae); S. Gess and F. Gess, 2003:115–116 (floral records), 2006:14 (floral records); Pulawski, 2014:18 (in catalog of world Sphecidae *sensu lato*).

RECOGNITION.— *Bembecinus hyperocrus*, *inexpectatus*, and *omaruru* are the only species within the *rhopalocerus* group having the erect setae on tergum II, although in the female these setae are short dorsally and distinct only laterally (Fig. 10b). In all three species, the gastral terga are mostly ferruginous with some parts black (golden tan in several *omaruru*), and in the males of *hyperocrus* and *omaruru* the clypeus (all or nearly so), the supraclypeal area, and the frons are all black. Unlike *inexpectatus* and *omaruru*, the gastral terga of *hyperocrus* have no pale yellow apical fasciae (the yellow fasciae are ill defined in *omaruru* with golden tan gaster). Subsidiary recognition features of *hyperocrus* are: the female clypeus black basally and markedly roundly angulate in profile (Fig. 10a), the male clypeus and the frons ventrally of the antennal socket are covered with dense, appressed vestiture, partly covering integument (no such vestiture in *omaruru*, the integument easily visible).

MATERIAL EXAMINED.— **NAMIBIA: !Karas Region:** Aus, 8–30.xi.1929, R.E. Turner (1 ♀, SAMC ex NMBZ); Aus (Pad C13) 8.xii.1994, M. Kuhlmann (1 ♀, ZMB)]. **SOUTH AFRICA: Northern Cape Province:** Namaqualand, Richtersveld: Die Koei, 2–5.x.1991, M.W. Mansell (1 ♂,

FIGURE 10. *Bembecinus hyperocrus*: a – female clypeus in profile (arrow indicates the roundly angular portion), b – left side of female terga I and II, c – dorsal parts of male terga I and II in profile, d – male tergum VII.

PPRI); Naib or Boesmanland, between Springbok and Pella, Mus. Staff, x.1939 (2 ♀, 2 ♂, SAMC); Btw. Kamieskroon and Springbok, Namaqualand, Mus. Staff, x.1939 (1 ♀, SAMC); Skouerfontein, 28 17 Cc, 6.x.80, [V.] Whitehead (1 ♂, SAMC); Namaqualand, Springbok, Hester Malan [now Goe-gap] Nature Reserve, 27.ix.1986, M. Struck (1 ♂, AMGS); same locality, 15–21.x.1987, F.W. and S.K. Gess (3 ♀, 10 ♂, AMGS), same locality, 10–12.x.1988, F.W. and S.K. Gess (1 ♀, AMGS), same locality and dates, D.W. Gess (1 ♀, AMGS); Namaqualand, 70 km E Port Nolloth, 26.xi.1974, J.G. and B.L. Rozen (1 ♀, AMNH); Namaqualand, Anenous, 11–13.x.1988, F.W. and S.K. Gess (3 ♀, AMGS), same locality and dates, D.W. Gess (2 ♀, AMGS); Exteenfontein at 28°49.5'S 17°14.4'E, 9.x.2008, B.N. Danforth (1 ♂, CAS), on flowers of *Lebeckia*, Fabaceae; Namaqualand, Concordia, 21.xi.1990, R. Miller and L. Stange (1 ♀, UCDC); Namaqualand, 14 km N Concordia at 29°25.9'S 17°57.2'E, 15.x.2008, B.N. Danforth (1 ♀, CAS); Namaqualand, Farm Arkoep 6 km N Kamieskroon at 30°19'S 17°56'E, 1–2.x.1990, C.D. Eardley (1 ♂, PPRI); Calvinia, 2 Nov., T.D.A. Cockerell (1 ♀, BMNH), 11–16.xi.1931, J. Ogilvie (1 ♀, BMNH); Augustfontein (Calvinia), ix.1947, Museum Expedition [SAMC] (1 ♂, SAMC); Murraysburg District, xi.1935, Museum Staff [SAMC] (4 ♀, 1 ♂, SAMC).

Western Cape Province: [Knersvlakte] Moedverloorn [Moedverloren Nature Reserve] Dorn [rivier] River (1 ♀, UCDC); Tankwa Karoo, Renoster River, xi.1952, Museum Expedition [SAMC] (2 ♀, SAMC); Matjiesfontein, R.E. Turner, 1–6.xi.1928 (2 ♀, BMNH), 7–13.xi.1928 (1 ♀, BMNH), 14–27.xi.1928 (1 ♀, BMNH); Matjiesfontein, R.E. Turner, 1–6.xi.1928 (2 ♂, UCDC), 7–13.xi.1928, (1 ♀, SAMC ex NMBZ); Moordenaars Karoo, Lamerfontein, x.1952, Museum Expedition [SAMC] (4 ♀, 4 ♂, SAMC); Dikome, Merweville, Koup, x.1952, Museum Expedition [SAMC] (2 ♀, SAMC); Koup Siding, xi.1939, Museum Staff [SAMC] (1 ♀, SAMC); 18 m. E Touws River to Hondewater, xii.1962, S.A.M. [SAMC staff] (1 ♂, SAMC); Lammerkraal, Prince Albert District, ix.1947, Museum Expedition [SAMC] (1 ♂, SAMC); Prince Albert District, Tierberg, 26.i.-5.xii.1987,



F.W., S.K. and R.W. Gess (2 ♀, AMGS); 31.x.1967, C. Jacot-Guillarmod (3 ♀, AMGS); Prince Albert District, Tierberg Research Station, 16.xi.1994, V. Mauss (1 ♀, 1 ♂, AMGS). **Eastern Cape Province:** Willowmore, xi.1912, Brauns (1 ♀, SAMC ex NMBZ).

GEOGRAPHICAL DISTRIBUTION.— Known principally from the winter rainfall Succulent Karoo from southern Namibia southwards through Namaqualand in South Africa and from the southern Nama-Karoo in South Africa from the Moordenars Karoo in the west to Willowmore in the east (Fig. 24e).

FLORAL ASSOCIATIONS.— Visiting flowers of four families: Amaranthaceae (*Hermbstaedia glauca* (Wendl. Reichb. Ex Steud.), Zygophyllaceae (*Zygophyllum prismatocarpum* E. Mey. ex Sond.), Campanulaceae (*Wahlenbergia* sp. (label data, see Material Examined; S. Gess and F. Gess 2003, 2006), and Fabaceae (*Lebeckia*) (label data, see Material Examined).

NESTING.— Nesting in level, compacted, friable soil in the Goegap Reserve, near Springbok. Two nests were investigated (S. Gess). Burrows sloping, nest 87/88/61 not yet with a cell, nest 87/88/60 with a single sub-horizontal cell containing a larva and prey. Shaft diameter 5 mm, cell diameter 6 mm, depth of cell 55 mm. (F. Gess and S. Gess, field notes 87/88/60 and 87/88/61, AMGS).

PREY.— Cicadellidae (Homoptera), adults (5 specimens double mounted on pins labeled 87/88/60, AMGS).

***Bembecinus inexpectatus* Pulawski, sp. nov.**

Figures 3f, 11a, b.

NAME DERIVATION.— *Inexpectatus* is a Latin adjective meaning *unexpected*; with reference to the fact that the specimens became unexpectedly available to WJP at the very end of this study.

RECOGNITION.— Like *hyperocrus* and *omaruru*, *inexpectatus* has erect setae on tergum I (although these setae are well defined only on the tergum's side), and subsidiary recognition features are: scape with erect setae along its entire length (except basally), gastral terga predominantly ferruginous, female hindtarsal arolium about $0.25 \times$ length of inner claw. Both sexes differ from *hyperocrus* in having a yellow apical fascia on terga (which is lacking in *hyperocrus*), the male also by an all yellow clypeus (rather than all or partly black) and the absence of setae on most of tergum I and on tergum II dorsally (erect setae present in *hyperocrus*), although this may be a secondary loss due to abrasion. Unlike *omaruru*, the female of *inexpectatus* has the clypeus black basally (rather than all yellow), whereas the reverse is true for the males: the clypeus is all yellow in *inexpectatus*, and nearly all black in *omaruru*. Also, the minimum interocular distance of the female equals $3.2 \times$ that between antennal scrobe and base of clypeus in *inexpectatus*, while $2.2 \times$ in *omaruru*, the female clypeus of *inexpectatus* is roundly angulate near the base in profile (practically

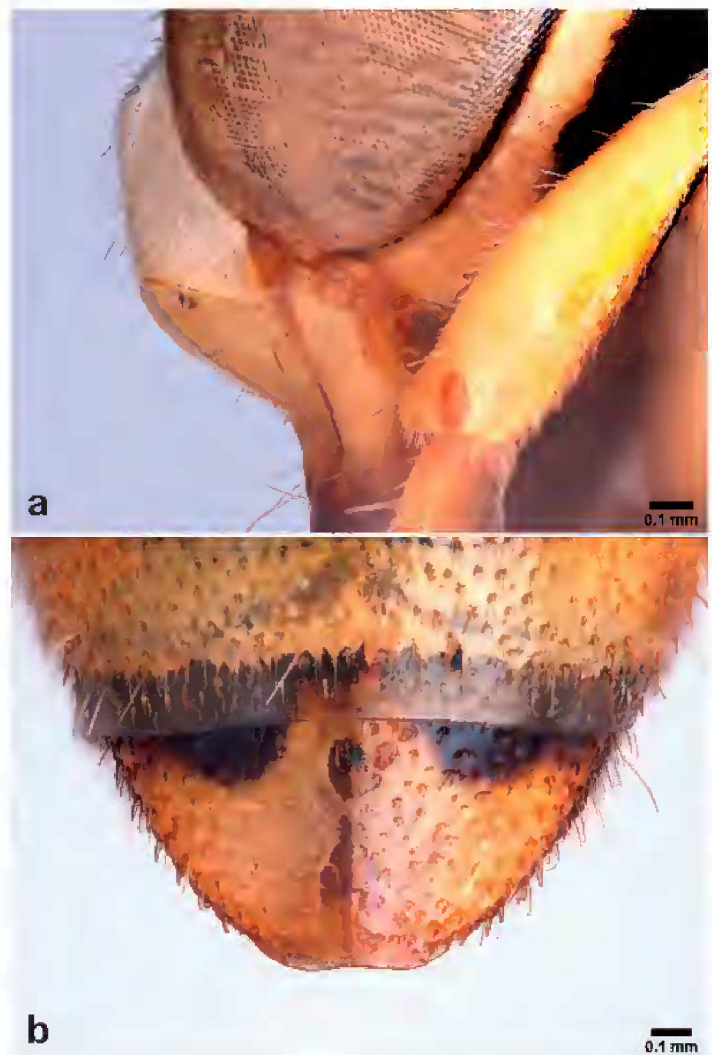


FIGURE 11. *Bembecinus inexpectatus*: a – female clypeus in profile, b – male tergum VII.

not angulate in *omaruru*), and male tergum VII is markedly more rounded in *inexpectatus* than it is in *omaruru* (compare Figs. 11b and 16).

DESCRIPTION.— Head black, with the following yellow: mandible except apex, labrum, clypeus (with black, basal spot in female), face below antenna, narrow strip along eye orbit up to level of midocellus, gena narrowly along orbit, scape, pedicel, and flagellomere I (all three black dorsally), remaining flagellum yellowish brown, brown dorsally; palpi brown. Thorax black with the following yellow: pronotal collar, pronotal lobe, narrow adlateral streak on scutum, tegula, triangular lateral spot on scutellum, posterior half of metanotum, and spot on mesopleuron (large in female, in male dorsoventrally elongate, its height equal $1.5 \times$ of midocellar width). Propodeum black, with posterolateral margin yellow mesally. Gaster ferruginous, with pale yellow apical bands on terga; anterior declivity of tergum I black, expanded posteromesally in male. Legs yellow, posterior surface of forefemur black in male (except dorsally, ventrally, and apically). Wings hyaline, vein Sc+R dark brown, other veins light brown.

Scape covered with erect setae along its entire length (except basally). Setae of tergum II erect laterally (as in Fig. 10b).

♀.— Length about 9.1–9.3 mm. Ocular index 2.4–2.7. Minimum interocular distance equal to $3.2 \times$ that between antennal scrobe and base of clypeus. Distance between posterior ocelli 1.1–1.2 \times distance between posterior ocellus and eye margin. Clypeus roundly angulate near base in profile, its width at insertion of mandibles $1.8 \times$ its midline. Labrum roundly triangular, its greatest width about $1.0 \times$ midlength. Hindtarsal arolium as long as one quarter of inner claw.

♂.— Length about 11.2 mm. Ocular index 2.5. Minimum interocular distance equal to $2.3 \times$ that between antennal scrobe and base of clypeus. Distance between posterior ocelli $1.6 \times$ distance between posterior ocellus and eye margin. Width of clypeus at insertion of mandibles $1.6 \times$ its midline. Labrum roundly triangular, its greatest width $1.1 \times$ midlength. Apical flagellomere simple. Tergum VII obtusely rounded (Fig. 11b).

MATERIAL EXAMINED.— HOLOTYPE: ♀, SOUTH AFRICA: Northern Cape Province: Putsonderwater, October 1939, Mus. Staff [SAMC] (SAMC). PARATYPES: same data as holotype (1 ♂, SAMC; 1 ♀, CAS).

GEOGRAPHICAL DISTRIBUTION.— Known from one locality in the Nama-Karoo of the Northern Cape Province of South Africa (Fig. 24f).

FLORAL ASSOCIATIONS.— Unknown.

NESTING.— Unknown.

PREY.— Unknown.

***Bembecinus karasanus* F. Gess and Pulawski, sp. nov.**

Figures 4a, 12a, b.

NAME DERIVATION.— The name, a newly coined Neolatin adjective, is derived from the Nama word !Karas (meaning Quiver Tree, or *Aloe dichotoma* Masson) as incorporated in the town name, Karasburg, and in the mountains, the Groot Karasberge, which are situated within the triangle formed between the three localities, Karasburg, Keetmanshoop and Aroab, from which the Namibian specimens were obtained.

RECOGNITION.— *Bembecinus karasanus* differs from the other species of the *haplocerus* group in having the punctures of the labrum large, larger than those on the scutum. In the other species, the labrum punctures are fine, either smaller than those on the scutum (most specimens) or as large as those on the scutum.

DESCRIPTION.— Labrum with large punctures (larger than those on scutum), in female aver-

aging less than one diameter apart. Head black with the following yellow: mandible excepting apex, labrum, clypeus, face below antenna and narrowly up to midheight along orbit, spot on each side of frons below level of anterior ocellus in some females, spot between anterior and posterior ocellus (not reaching anterior ocellus in some specimens, absent in many males), in female spot behind posterior ocellus (in some specimens spots joining mesally, forming posteriorly curved band), gena narrowly above and widely below, stipes, galea, both pairs of palpi, scape, pedicel and flagellomere I ventrally; rest of antennae more or less ferruginous with dorsal side darker than ventral side. Thorax black with the following yellow: pronotum except black mesally (narrowly so in female, broadly in male), propleuron except brown anteriorly, scutum adlaterally and a pair of admedian longitudinal streaks (broad in female, narrow in male), tegula, scutellum except variably shaped basomedian area, metanotum except extreme base, mesopleuron except anterior, posterior and dorsal edges. Propodeum in female yellow with the following black: narrow basal band, spot on each side of enclosure (except basally), and in some specimens long streak extending above spiracle and continuing to side of gastropropodeal articulation; in male black with the following yellow: posterolateral margin, anterior half of lateral surface, and enclosure except basally (in some specimens only a pair of small spots on enclosure ventrally are yellow). Color of gaster: see below. Legs yellow or inner surface of mid- and hindfemora light ferruginous, also mid- and hindtarsomeres. Wings hyaline, Sc+R black, other veins brown.

Base and sides of clypeus, face below antennae and halfway up sides covered with inconspicuous, decumbent, silvery pubescence.

♀: Length 9.7–11.8 mm long (average of 14 = 10.4 mm; holotype 11.2 mm). Ocular index 2.2–2.3 (average of 12 = 2.3). Minimum interocular distance equal to 2.0–2.2 × that between antennal scrobe and base of clypeus (average of 3 = 2.1). Distance between posterior ocelli 1.4–1.5 × distance between posterior ocellus and eye margin (average of 12 = 1.5). Clypeus moderately convex, unevenly curved, its highest point close to its base, apical area flattened medially, sparsely and insignificantly punctured; its width at insertion of mandibles 1.7–1.8 × its midlength (average of 12 = 1.7). Labrum triangular, its greatest width 1.1 × midlength. Gaster mostly yellow except the following are whitish: preapical transverse bands (widened laterally on terga I–V), most of tergum VI and most of sterna; testaceous are: apical margins of terga I–VI; and black are: anterior declivity of tergum I ventrally and, in some specimens median, short streak on disk of tergum I and preapical spot on tergum VI.

♂: Length 10.5–11.0 mm (average of 4 = 10.75 mm). Ocular index 2.1–2.2 (average of 5 = 2.15). Minimum interocular distance equal to 2.1–2.3 × that between antennal scrobe and base of clypeus (average of 3 = 2.2). Distance between posterior ocelli 1.4–1.6 × distance between posterior ocellus and eye margin (average of 4 = 1.5). Width of clypeus at insertion of mandibles 1.7 × its midline. Labrum triangular, its greatest width 1.2 × its midlength. Gaster mostly yellow or light



FIGURE 12. *Bembecinus karasanus*: a - female labrum, b - male tergum VII.

brownish, terga I-III to I-V with whitish or yellow preapical fasciae, sterna whitish or yellow, apical fasciae of terga brown or light ferruginous, anterior declivity of tergum I black, extending into median streak on disk. Apical flagellomere simple. Tergum VII subtriangular, narrowly emarginated apically (Fig. 12b).

MATERIAL EXAMINED.— **HOLOTYPE:** ♀, **NAMIBIA: !Karas Region:** Karasburg, 14.xii.1974, H.N. Empey (AMGS). **PARATYPES:** **NAMIBIA: !Karas Region:** Karasburg, 15.i.1975, H.N. Empey (4 ♀, AMGS); Aroab, 4.i.1975, H.N. Empey (1 ♀, AMGS); Keetmanshoop, 15.xii.1974, H.N. Empey (1 ♀, AMGS); 16 km S Rosh Pinah at 28°04'S 16°51'E, 15.x.2000, F.W. and S.K. Gess (2 ♀, AMHS, CAS). **SOUTH AFRICA: Northern Cape Province:** Vioolsdrif on Orange River, Namaqualand, 4–6.x.1966, F.W. Gess and W.H.R. Gess (2 ♂, SAMC); Goodhouse, xi.1936, Museum Staff [SAMC] (7 ♀, SAMC).

GEOGRAPHICAL DISTRIBUTION.— Known from the southern Nama-Karoo of Namibia and the south bank of the Orange River, neighboring on Namibia (Fig. 25a).

FLORAL ASSOCIATIONS.— Unknown.

NESTING.— Unknown.

PREY.— Unknown.

Bembecinus mutabilis (Arnold)

Figures 4b, 13a–d.

Stizus mutabilis Arnold, 1929:295, Figs 48, 48a and b, ♀, ♂. Lectotype: ♂, South Africa: Western Cape Province: Montagu (BMNH), designated by W. Pulawski: **present designation.**— Arnold, 1930:20 (in checklist of Afrotropical Sphecidae).— As *Bembecinus mutabilis*: R. Bohart and Menke, 1976:531 (new combination, in checklist of world Sphecidae); S. Gess, 1996:277, 280 (floral records); S. Gess and F. Gess, 2003:116 (floral records); Pulawski, 2014:24 (in catalog of world Sphecidae *sensu lato*).

Bembecinus ruficaudus R. Bohart, 1997:170, Fig. 6, ♀, ♂. Holotype: ♂, South Africa: Western Cape Province: Doorn River at Moedverloor, now Moedverloren Nature Reserve (UCDC), examined by W. Pulawski. **New synonymy by W. Pulawski.**— Pulawski, 2014:33 (in catalog of world Sphecidae *sensu lato*).

RECOGNITION.— *Bembecinus mutabilis* has a gaster either largely ferruginous (tergum I black basally, several or all following terga all ferruginous or narrowly black basally) or (one female from Montague) with ferruginous apical fascia, but without yellow apical fasciae on terga, and with setae appressed on gastral tergum II. *B. hyperocrus* is similar, but *mutabilis* has the following: the face below the antenna and the clypeus are all yellow in most specimens (the clypeus is black basally in the single female from Upington), male flagellomere XI is markedly curved and excavated (Fig. 13b), male tergum VII is trapezoidal, with apical margin truncate, widely, shallowly emarginate mesally (Fig. 13d), and the ocular index is 2.68–2.92 in the female and 2.67–2.90 in the male. In *hyperocrus*, the setae of tergum II are erect (only laterally so in the female), the face below the antenna and the clypeus basally are black (the entire clypeus and labrum are black in some males), male flagellomere XI is simple (not curved and not excavated), male tergum VII is rounded with the apical margin convex and narrowly emarginate mesally (Fig. 10d), and the ocular index is 2.13–2.26 in the female and 2.08–2.27 in the male. Also similar is *inexpectatus*, which has pale yellow apical fasciae on gastral terga and the apical flagellomere of the male simple (not curved and not emarginate); the apical flagellomere is also simple in the male of *namaquensis* (the female is unknown).

LECTOTYPE SELECTION.— Arnold described *mutabilis* from one female and three males. He labeled the female and one male as Types, and the remaining two males as paratypes. W. Pulawski has designated the male labeled Type as a lectotype, and the female as a paralectotype.

JUSTIFICATION OF NEW SYNONYMY.— Both the holotype male and the female paratypes of *Bembecinus ruficaudus* are identical to *mutabilis*, and the former name is clearly a junior synonym of the later. It should be noted that Bohart's (1979) illustration 6c of the apical flagellomere of the male *ruficaudus* is misleading, as it does not show its curvature. In reality, this flagellomere is markedly more curved and excavated in the holotype than represented, just as in the other males of *mutabilis*.

MATERIAL EXAMINED.— **SOUTH AFRICA:**
Northern Cape Province: Naib or Boesmanland, between Springbok and Pella, Mus. Staff, x.1939 (1 ♀, SAMC); Namaqualand, 67 km E Port Nolloth, 17.x.1972, J.G. Rozen and C. Thompson (2 ♀, AMNH); Namaqualand, Anenous, 11–13.x.1988, F.W. and S.K. Gess (26 ♀, 2 ♂, AMGS), same locality and dates, D.W. Gess (22 ♀, 1 ♂, AMGS), same locality, 12.x.1989, F.W. and S.K. Gess (2 ♀, AMGS); 10 km W Steinkopf [Anenous], 10.xi.19960, R. Miler (1 ♀, UCDC, paratype of *Bembecinus ruficaudus*); Namaqualand, Eksteenfontein, 2817CD, 9.x.1980, V. Whitehead (1 ♂, SAMC); Namaqualand, 42 km S Eksteenfontein at 29°06.8'S 17°26.6'E, 9.x.2008, B.N. Danforth (1 ♀, CAS), on flowers of *Grielim*, Neuradaceae; 53 km S Vioolsdrift at 29°10'S 17°50'E, 12.x.2000, F.W. and S.K. Gess (1 ♀, AMGS); Namaqualand, Springbok, Hester Malan [now Goegap] Nature Reserve, 15–21.x.1987, F.W. and S.K. Gess (1 ♀, AMGS), same locality, 10–12.x.1988, D.W. Gess (2 ♂, AMGS), same locality, 10–11.x.1989, D.W. Gess (7 ♀, AMGS); Springbok, Voelklip, 2 and 7.x.1994, F.W. and S.K. Gess (3 ♀, AMGS); Kamieskroon, Bakleikraal, 9–11.x.1994, F.W. and S.K. Gess (1 ♂, AMGS); Moedverloren Nature Reserve, Knersvlakte, 8.x.1975, R.M. Bohart (1 ♂, UCDC, holotype of *Bembecinus ruficaudus*); Augustfontein (Calvinia), ix.1947, Museum Expedition [SAMC] (1 ♀, SAMC); Niewoudtville, 18–22.xi.1931, J. Ogilvie (2 ♀, BMNH); Van Rhyn's Pass, 11–21.xi.1931, J. Ogilvie (1 ♀, BMNH).
Western Cape Province: Doringboos NE Clanwilliam, 11.x.1999, M. Halada (10 ♀, OÖLM); Bulshoek, Klaver-Clanwilliam, x.1950, Museum Expedition (8 ♀, 3 ♂, SAMC); Pakhuis Pass, 7.x.1975 (2 ♀, UCDC, paratypes of *Bembecinus ruficaudus*); 12 miles [19.31 km] N



FIGURE 13. *Bembecinus mutabilis*: a – apical hind-tarsomere of female showing length of arolium, b – male apical flagellomeres, c – male foretibia in profile, d – male tergum VII.

Clanwilliam, 4.xi.1966, J.G. Rozen (1 ♂, AMNH); Clanwilliam, 20.x.1968, J.G. Rozen and E. Martinez (1 ♂, AMNH); 5 km W Clanwilliam on road to Graafwater, 12.x.1987, F.W. and S.K. Gess (5 ♂, AMGS), same locality, 5–6.x.1988, F.W. and S.K. Gess (1 ♀, AMGS), same locality and dates, D.W. Gess (4 ♂, AMGS); 11 km W Clanwilliam on road to Graafwater, 2–8.x.1990, F.W. and S.K. Gess (1 ♀, 3 ♂, AMGS), 1 ♂ on flowers of *Helichrysum hebelepis* DC., Asteraceae; Clanwilliam Dam, 3–7.x.1988, F.W. and S.K. Gess (6 ♀, 6 ♂, AMGS), 1 ♂ on flowers of *Limeum africanum*, Aizoaceae; same locality and dates, D.W. Gess (3 ♀, 5 ♂, AMGS); E Clanwilliam, 10.x.1999, M. Halada (6 ♀, 1 ♂, OÖLM); Clanwilliam Dam, Caleta Cove, 19–20.x.1989, F.W. and S.K. Gess (1 ♀, AMGS), same locality and dates, D.W. Gess (1 ♀, AMGS); 4 miles [6.44 km] S Clanwilliam on old road to Citrusdal, 6.x.1991, D.W. Gess (1 ♂, AMGS); 10 km S Clanwilliam at 32°13'39"S 18°50'50"E, 5–25.x.2004, M.E. Irwin, F.D. Parker, M. Hauser (3 ♀, 2 ♂, ZMB); 16.5 km S Clanwilliam on old road to Citrusdal, 13.x.1990, F.W. and S.K. Gess (9 ♀, 11 ♂, AMGS), 2 ♀ and 1 ♂ on flowers of *Athanasia trifurcata* (Linnaeus) Linnaeus, Asteraceae; 15 km S Clanwilliam on old road to Citrusdal, 14.xi.1992, D.W. Gess (1 ♀, AMGS); 19 km S Clanwilliam on old road to Citrusdal, 14.xi.1992, D.W. Gess (3 ♀, AMGS); 20 km S Clanwilliam on old road to Citrusdal, 15.x.1994, F.W. and S.K. Gess (1 ♀, AMGS); Olifants River between Citrusdal and Clanwilliam, x-xi.1931, Museum Staff [SAMC] (16 ♀, 16 ♂, SAMC); 20 km N Citrusdal, 27.x.1999, M. Halada (1 ♀, CAS) (4 ♀, 1 ♂, OÖLM); 8 miles [12.88 km] N Citrusdal, ix.1961, SAM (1 ♂, SAMC); Citrusdal District, xi.1948, Museum Expedition [SAMC] (3 ♂, SAMC); Groenkloof, between Clanwilliam and Algeria, 19.x.1989, D.W. Gess (1 ♂, AMGS); Paleisheuwel, xi.1948, Museum Expedition [SAMC] (4 ♀, SAMC), 6.x.1990, F.W. and S.K. Gess (2 ♂, AMGS); Het Kruis, x.1947, Museum Expedition [SAMC] (2 ♂, SAMC); 25 km E Velddrif, 23.x.1972, J.G. Rozen *et al.* (1 ♂, AMNH); Upper Sources, Olifants River, Ceres, xii.1949, Museum Expedition [SAMC] (1 ♀, SAMC); 43 km ENE of Ceres on road to Sutherland, 2–3.xii.1989, F.W. and S.K. Gess (1 ♀, AMGS); Montagu, 1–21.x.1924, R.E. Turner (2 ♀, 6 ♂, BMNH, including lectotype, paralectotype, and 2 paratypes), same locality and dates, R.E. Turner (labeled *Stizus mutabilis* Arn., det. R.H.R. Stevenson and clearly the same material from which the types were drawn) (2 ♀, SAMC ex ZMHB); 18 miles [28.97 km] E Touws River [on road] to Hondewater, xii.1962, SAM [staff] (2 ♀, SAMC); Laingsburg at 33°12'S 20°51'E, 25.xii.1996, W.J. Pulawski (1 ♀, CAS); Koup Siding, Laingsburg, xi.1939, Museum Staff [SAMC] (2 ♀, SAMC); Moordenaars Karoo, Swanepoel, x.1952, Museum Expedition [SAMC] (2 ♂, SAMC); Prince Albert District, Tierberg, 26.xi.-5.xii.1987, F.W., S.K. and R.W. Gess (1 ♀, AMGS); 60 km N Cape Town, 9.xi. 1999, M. Halada (2 ♀, 1 ♂, OÖLM). **Eastern Cape Province:** Willowmore, 12.i.1965, H. Empey (1 ♀, AMGS), 18.x.1970, H. and M. Townes (1 ♀, AEI), 5.x.1971, C. Jacot-Guillarmod (1 ♀, AMGS), same locality, 7.x.1971, F.W. Gess (1 ♂, AMGS); Waterford, 29.x.1967, C. Jacot-Guillarmod (1 ♀, AMGS); Rietbron, 11.i.1965, H. Empey (1 ♀, AMGS).

GEOGRAPHICAL DISTRIBUTION.— Known only from South Africa, widely distributed from the winter rainfall Succulent Karoo of Namaqualand, south through the Olifant's River Valley and eastwards to Willowmore in the Nama-Karoo (Fig.25b).

FLORAL ASSOCIATIONS.— Visiting flowers of four plant families: Asteraceae (*Helichrysum hebelepis* DC. and *Athanasia trifurcata* (Linnaeus) Linnaeus), Amaranthaceae (*Hermbstaedia glauca* (Wendl.) Reichb. Ex Steud.), Aizoaceae (non-Mesembryanthema, *Limeum africanum* Linnaeus) (label data, see Material Examined; S. Gess and F. Gess 2003), and Neuradaceae (*Grielum*) (label data, see Material Examined).

NESTING.— Nesting in friable soil of a stabilized dune mole rat 'hillock' in an area of dry Fynbos to the west of Clanwilliam. One nest was investigated (S. Gess). Burrow entrance was in sloping side of 'hillock', burrow sloping downwards for 84 mm, shaft ending in sub-horizontal cell,

diameter of entrance and shaft 5 mm, diameter of cell 7.5 mm, length of cell 25 mm, depth of cell 56 mm. Female opens and closes the burrow on entering and leaving the nest. Cell containing larva and prey (F. Gess and S. Gess, field notes 90/91/124, AMGS).

PREY.— Cicadellidae (Homoptera) nymphs and adults from nest 90/91/124 (8 specimens in gelatin capsule on same pin as female 90/91/124, AMGS).

***Bembecinus namaquensis* Pulawski, sp. nov.**

Figures 4c, 14a, b.

NAME DERIVATION.— The name, *namaquensis*, a newly coined Neolatin adjective, is derived from the Nama people of South Africa, Namibia and Botswana, and also from Namaqualand of South Africa, where the holotype was collected.

RECOGNITION.— *Bembecinus namaquensis* has a ferruginous gaster (basal terga black basally), without pale yellow apical fasciae, a character shared with *mutabilis*. The female is unknown, but the male differs from *mutabilis* in having the apical flagellomere simple (not curved and not emarginate), and from *gariensis* and *rhopaloceroides* in lacking yellow, apical fasciae on the terga and in having the foretibia not incrassate (incrassate in the lateral view in the other two species).

DESCRIPTION.— Head black, with the following yellow: mandible except apex, labrum, clypeus, face below antenna and narrowly up to level of midocellus along orbit, gena narrowly along orbit, both pairs of palpi, scape and pedicel ventrally (black dorsally), flagellum ventrally (almost black dorsally). Thorax black with the following yellow: pronotal collar, pronotal side and ventral part of right pronotal lobe, narrow adlateral streak on scutum, tegula, triangular lateral spot on scutellum, posterior half of metanotum, and small spot on mesopleuron (spot size less than midocellus). Propodeum black, with posterolateral margin yellow mesally. Gaster ferruginous, tergum I black in about basal half, black area widened mesally; terga II and III with narrow basal band. Legs yellow, with the following black: coxae posteriorly, foretrochanter dorsally and posteriorly, mid- and hindtrochanters dorsally, mid- and hindfemora dorsally. Wings hyaline, vein Sc+R black, other veins brown.

♂: Length 11.8 mm. Ocular index 2.1. Minimum interocular distance equal to $2.1 \times$ that between antennal scrobe and base of clypeus. Distance between posterior ocelli $1.8 \times$ distance between posterior ocellus and eye margin. Width of clypeus at insertion of mandibles $1.6 \times$ its midline, its apical area flattened, asetose. Labrum roundly triangular (Fig. 14a), its greatest width $1.25 \times$ its midlength. Apical flagellomere simple. Tergum VII rounded, shallowly emarginate apically (Fig. 14b).

MATERIAL EXAMINED.— HOLOTYPE: ♂, SOUTH AFRICA: Northern Cape Province: 23 km S Alexander Bay at $28^{\circ}46'S$ $16^{\circ}37'E$, 11.x.2000, F.W. and S.K. Gess (AMGS). PARATYPES: SOUTH



FIGURE 14. *Bembecinus namaquensis*: a – male labrum, b – tergum VII of male.

AFRICA: Northern Cape Province: Richtersveld W Brandkaros at 28°29'S 16°40'E, 15.ix.1996, F.W. Gess, S.K. Gess, and R.W. Gess (1 ♂, AMGS; 1 ♂, CAS).

GEOGRAPHICAL DISTRIBUTION.— Known from two localities in the arid Succulent Karoo of northwestern South Africa (Fig. 25c).

SNAIL SHELL ASSOCIATION.— The two specimens from Brandkaros were collected from empty shells of the snail *Trigonephrus* sp., Dorcasiidae, in which they were found sheltering. In windswept desertic areas snail shells provide shelter for various species of aculeates. Furthermore, some species use shells, sand-filled or empty, as secure nesting sites (F. Gess and S. Gess 1999; S. Gess and F. Gess 2008).

FLORAL ASSOCIATIONS.— Unknown.

NESTING.— Unknown.

PREY.— Unknown.

***Bembecinus namibius* Pulawski, sp. nov.**

Figures 4d, 15a, b.

NAME DERIVATION.— The name, a newly coined Neolatin adjective, is derived from the geographic name *Namib* and the Greek word *βίος*, *life*; with the reference of the species occurrence in the Namib Desert.

RECOGNITION.— *Bembecinus namibius* has erect setae on the whole length of the scape (except basally), a character shared with *hyperocrus* and *omaruru*. In *namibius*, however, the terga are yellowish greenish (black basally), the setae of tergum II are appressed, the clypeus is yellow and evenly rounded in profile. In *hyperocrus* and *omaruru*, the terga are ferruginous (black basally, with pale yellow apical fasciae in *omaruru*), the setae of tergum II are erect (short dorsally, distinct laterally in the female), the male clypeus is black (at least in the basal half), and in *hyperocrus* the female clypeus in profile is roundly angulate basally.

DESCRIPTION.— Head black, with the following yellow: mandible except apex, labrum, clypeus, face below antennae and narrowly up to midheight along orbit in female, up to level of midocellus in male, gena narrowly, in female small spot between midocellus and hindocellus, scape, pedicel (black dorsally), flagellum ventrally (black dorsally). Thorax black with the following yellow: pronotal collar, scutum laterally and with pair of short admedian streaks (admedian streak absent in one male), tegula, triangular lateral spot on scutellum, metanotum except basally, and mesopleuron largely (with only small spot yellow in one male). Propodeum black, with enclosure along lateral margin and lateral margin yellow. Gastral terga yellowish-greenish, black basally (black on tergum I about as long as yellowish part, gradually diminishing on following terga). Femora, tibiae, and tarsi pale yellow, with the following black: forefemur basodorsally, mid- and hindfemora dorsally (except apex yellow) and in the female also anterior surface basally. Wings hyaline, vein Sc+R black, other veins brown.

Scape covered with erect setae along its entire length (except basally).

♀: Length 8.8–10.2 mm. Ocular index 2.7–2.9. Minimum interocular distance equal to 2.1–2.2 × that between antennal scrobe and base of clypeus. Distance between posterior ocelli 1.4 × distance between posterior ocellus and eye margin. Clypeus slightly, evenly convex in profile, narrow-



FIGURE 15. *Bembecinus namibius*: tergum VII of male.

ly asetose and shiny along free margin mesally; its width at insertion of mandibles $1.5\text{--}1.6 \times$ its midlength. Labrum roundly triangular, its greatest width $1.0\text{--}1.3 \times$ midlength.

♂: Length 9.2–10.0 mm. Ocular index 2.5–2.6. Minimum interocular distance equal to $1.8\text{--}1.9 \times$ that between antennal scrobe and base of clypeus. Distance between posterior ocelli $1.5\text{--}1.6 \times$ distance between posterior ocellus and eye margin. Width of clypeus at insertion of mandibles $1.4\text{--}1.5 \times$ its midline. Labrum roundly triangular, its greatest width $1.1\text{--}1.2 \times$ midlength. Apical flagellomere simple. Tergum VII subtrapezoidal (Fig. 15b).

MATERIAL EXAMINED.— HOLOTYPE: ♀, **NAMIBIA: !Karas Region:** Klinghardtberge (= Klinghardt Mountains, Sperrgebiet, a National Park since 2004), 5.ix.1980, V.B. Whitehead (AMGS). PARATYPES: same locality and collector, 3.iv.1980 (1 ♀, CAS), 5.ix.1980 (1 ♂, AMGS; 1 ♂, CAS).

GEOGRAPHICAL DISTRIBUTION.— Known from a single locality in the arid Succulent Karoo of the southern Namib Desert, Namibia (Fig. 25d).

FLORAL ASSOCIATIONS.— Unknown.

NESTING.— Unknown.

PREY.— Unknown.

***Bembecinus omaruru* Pulawski, sp. nov.**

Figures 4e, 16.

NAME DERIVATION.— Named after the Omaruru River, near which the holotype was collected; a noun in apposition to the generic name.

RECOGNITION.— Like *hyperocrus* and *inexpectatus*, *omaruru* has erect setae on tergum II, although in the female these setae are short dorsally and distinct only laterally (as in Fig. 10c). The males of both *hyperocrus* and *omaruru* have the clypeus, supraclypeal area, and the frons all black (in *inexpectatus*, the clypeus, supraclypeal area, and stripes along the orbits are pale yellow). In *hyperocrus*, however, the gastral terga are ferruginous and have no pale yellow apical fasciae, whereas in *omaruru* the terga are either ferruginous or golden tan, with pale yellow apical fasciae (the fasciae are ill defined in golden tan specimens); in the female of

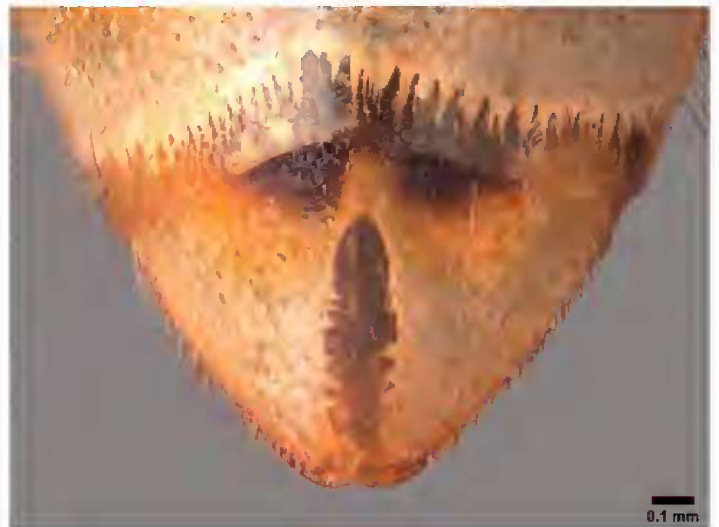


FIGURE 16. *Bembecinus omaruru*: tergum VII of male.

omaruru, the clypeus is all yellow and practically not angulate in profile (in *inexpectatus* and *hyperocrus*, it is black basally, and roundly angulate in profile); in addition, in the female of *omaruru*, the minimum interocular distance is equal to $2.2 \times$ that between antennal scrobe and base of clypeus, while $3.2 \times$ in *inexpectatus*. In the male of *omaruru*, the clypeus and the frons ventrally of the antennal socket have no dense, appressed vestiture and the integument is thus easily visible (in *hyperocrus* the clypeus and the frons ventrally of the antennal socket are covered with dense, appressed vestiture, partly covering integument). The scape covered with erect setae along its entire length (except basally) is a subsidiary recognition feature of this species.

DESCRIPTION.— Head black, with the following yellow: mandible except apex, labrum, narrow stripe on gena adjacent to orbit, and in the female also clypeus, face below antennae and narrowly along orbit up to about one third of frons height, scape, pedicel, flagellomeres I and II (remaining flagellomeres yellowish brown, apical flagellomeres dark dorsally); in male, narrow stripe along clypeus free margin yellow, scape and pedicel yellow ventrally, black dorsally, flagellum yellow. Thorax black, with the following yellow: pronotal collar, pronotal lobe, scutum later-

ally, tegula, triangular lateral spot on scutellum, metanotum except basally, in female also pair of short admedian streaks and mesopleuron anteriorly. Propodeum black, with lateral margin yellow. Gastral terga either ferruginous or golden tan, with apical pale yellow fasciae (fasciae ill defined in golden tan specimens), basal declivity of tergum I black, black extending mesally on horizontal part, tergum II and in male also tergum III narrowly black basally. Coxae black basally, yellow apically; trochanters yellow ventrally, black dorsally; femora yellow, black basodorsally; tibiae and tarsi yellow. Wings hyaline, vein Sc+R black, other veins brown.

Scape covered with erect setae along its entire length (except basally). Setae of tergum II erect, in female short dorsally, distinct laterally (as in Fig. 10c). Hindtarsal arolium as long as one quarter of hindtarsal claw.

♀: Length 10.3–12.8 mm. Ocular index 2.3. Minimum interocular distance equal to $2.2 \times$ that between antennal scrobe and base of clypeus. Distance between posterior ocelli $1.5 \times$ distance between posterior ocellus and eye margin. Width of clypeus at insertion of mandibles $1.7 \times$ its midline. Labrum roundly triangular, its greatest width $1.0\text{--}1.3 \times$ midlength.

♂: Length 11.4–15.5 mm. Ocular index 2.1. Minimum interocular distance equal to $2.4 \times$ that between antennal scrobe and base of clypeus. Distance between posterior ocelli $2.0 \times$ distance between posterior ocellus and eye margin. Width of clypeus at insertion of mandibles $1.6 \times$ its midline. Labrum roundly triangular, its greatest width $1.3 \times$ midlength. Apical flagellomere simple. Tergum VII subtriangular (Fig. 16).

MATERIAL EXAMINED.— HOLOTYPE: ♀, **NAMIBIA: Erongo Region:** 20 km NE Hentiesbaai at $21^{\circ}58'S$ $14^{\circ}22'E$, 10.xii.1996, W.J. Pulawski (CAS). PARATYPES: **NAMIBIA: ERONGO REGION:** 20 km NE Hentiesbaai at $21^{\circ}58'S$ $14^{\circ}22'E$, 10.xii.1996, W.J. Pulawski (1 ♂, CAS); **!Karas Region:** Aus, xii.1929, R.E. Turner (1 ♀, 1 ♂, BMNH).

GEOGRAPHICAL DISTRIBUTION.— Known from two widely separated localities in Namibia: one associated with the drainage channel of the Omaruru River in the northern Namib Desert and the other from the eastern edge of the northern limit of the winter rainfall southern Namib (Fig. 25e).

FLORAL ASSOCIATIONS.— Unknown.

NESTING.— Unknown.

PREY.— Unknown.

***Bembecinus pakhuisae* R. Bohart**

Figures 4f, 17a-c.

Bembecinus pakhuisae R. Bohart, 1997:168, ♀ ♂. Holotype: ♂, South Africa: Western Cape Province: Pakhuis Pass (UCDC), examined by W. Pulawski.— S. Gess and F. Gess, 2003:116 (floral records), 2014:210 (nest situation); Pulawski, 2014:26 (in catalog of world Sphecidae *sensu lato*).

RECOGNITION.— *Bembecinus pakhuisae* has the scutum all black mesally, an all black mesopleuron, and the gastral terga black with yellow apical fasciae, without ferruginous gastral terga (in some males, yellow tergal fasciae may occupy most of tergal length). The female can be recognized by its all or partly black clypeus except for a narrow yellow stripe basally (unlike that of *hyperocrus* in which the clypeus has no basal yellow stripe and, in addition, the terga are ferruginous). In the male, the apical flagellomere is curved and excavated (Fig. 17b), but markedly less so than in *damarensis* and *mutabilis* (see Figs 6c and 13b). For differences with *zebratus*, see the latter species.

MATERIAL EXAMINED.— **SOUTH AFRICA: Northern Cape Province:** Namaqualand: Richtersveld National Park, Koeroegabvlakte at $28^{\circ}11'S$ $17^{\circ}03'E$, 3.x.1995, F.W., S.K. and R.W. Gess (5 ♀, 6 ♂, AMGS), same locality, 17–21 and 24.ix.1995, F.W., S.K. and R.W. Gess (2 ♂ on deep pink

flowers of *Hermbstaedtia glauca* (Wendl.) Reichb. ex Steudl., Amaranthaceae) (7 ♀, 9 ♂, AMGS), same locality, 6.ix.1996, F.W., S.K. and R.W. Gess (1 ♀, 21 ♂, AMGS); Bloukrans Farm near Springbok at 29°43'S 17°55'E, 7.x.1974, R.H. Watmough (7 ♀, 2 ♂, PPRI); [Springbok], Hester Malan [now Geogap] Nature Reserve at 29.17Db [Degree Reference System (Leistner and Morris 1976) = 29°30'–45'S 17°35'–49'E], M. Struck, 4.x.1987 (1 ♀, PPRI) and 15–18.x.1987 (1 ♂, PPRI); Springbok, Hester Malan [now Goegap] Nature Reserve, 17.ix.1983, V. B. Whitehead (1 ♂, SAMC), same locality, 4.ix.1986, M. Struck (2 ♂, AMGS), same locality, 5.ix.1986, M. Struck (1 ♀, AMGS), same locality, 20.x.1986, M. Struck (one stylopized) (2 ♀, AMGS), same locality, 17.xi.1986, M. Struck (1 ♀, AMGS), same locality, 10.x.1987, M. Struck (1 ♀, 1 ♂, AMGS), same locality, 31.x.1987, M. Struck (1 ♂, AMGS), same locality, 15–21.x.1987, F.W. and S.K. Gess (1 ♀ stylopized, 1 ♀ from nest, prey in gelatin capsule on separate pin, Issidae (Homoptera), adults and nymphs) (9 ♀, 9 ♂, AMGS), same locality, 10–12.x.1988, F.W. Gess and S.K. Gess (1 ♀ stylopized) (7 ♀, 5 ♂, AMGS), same locality and dates, D.W. Gess (3 ♀ stylopized) (23 ♀, 16 ♂, AMGS), same locality, 10–11.x.1989, F.W. Gess and S.K. Gess (2 ♀ stylopized) (8 ♀, 13 ♂, AMGS), same locality and dates, D.W. Gess (1 ♀ stylopized) (2 ♀, 12 ♂, AMGS); Anenous, 12.x.1989, F.W. and S.K. Gess (1 ♀, AMGS); Nababeep, 12–13.x.1989, F.W. and S.K. Gess (1 ♂, AMGS); W end of Wildeperdehoek Pass, 14.x.1989, F.W. and S.K. Gess (1 ♂, AMGS); Mesklip, 1.x.1985, F.W. and S.K. Gess (1 ♂, AMGS); between Kamieskroon and Springbok, x.1939, Mus. Staff (2 ♂, SAMC); Farm Arkoep 6 km N Kamieskroon at 30°19'S 17°56'E, 1–2.x.1990, C.D. Eardley (6 ♀, 1 ♂, PPRI); Farm Dassiefontein near Kamieskroon at 30°09' S 17°59'E, 1.x.1990, C.D. Eardley (2 ♂, PPRI); Bowesdorp, ix.1941, Museum Staff [SAMC] (9 ♂, SAMC); Kamieskroon, ix.1930, Museum Staff [SAMC] (5 ♀, 7 ♂, SAMC); Garies, 27.ix.1970, H. and M. Townes (2 ♂, AEI), same locality, 30.ix.1970, H. and M. Townes (1 ♂, AEI); 15 km N the on road to Loriesfontein, 3–8.x.1989, D.W. Gess (1 ♂, AMGS); Augustfontein (Calvinia), ix.1947, Museum Expedition [SAMC] (1 ♀, 1 ♂, SAMC); Niewoudville Flower Reserve at 31°22'18.4"S 19°08'58.2"E, 26.ix.2006, K. Timmermann (1 ♀, BMNH). **Western Cape Province:** Pakhuis Pass, 7.x.1975, R.M. Bohart (23 ♀, 40 ♂, UCDC, holotype and paratypes of *Bembecinus pakhuisae*); E Pakhuis Pass, ix.1947, Museum Expedition [SAMC] (1 ♂, SAMC); 5 km W Clanwilliam on road to Graafwater, 12.x.1987, F.W. and S.K. Gess (2 ♂, AMGS); Clanwilliam Dam, 3–7.x.1988, D.W. Gess (3 ♂, AMGS); Clanwilliam Dam,

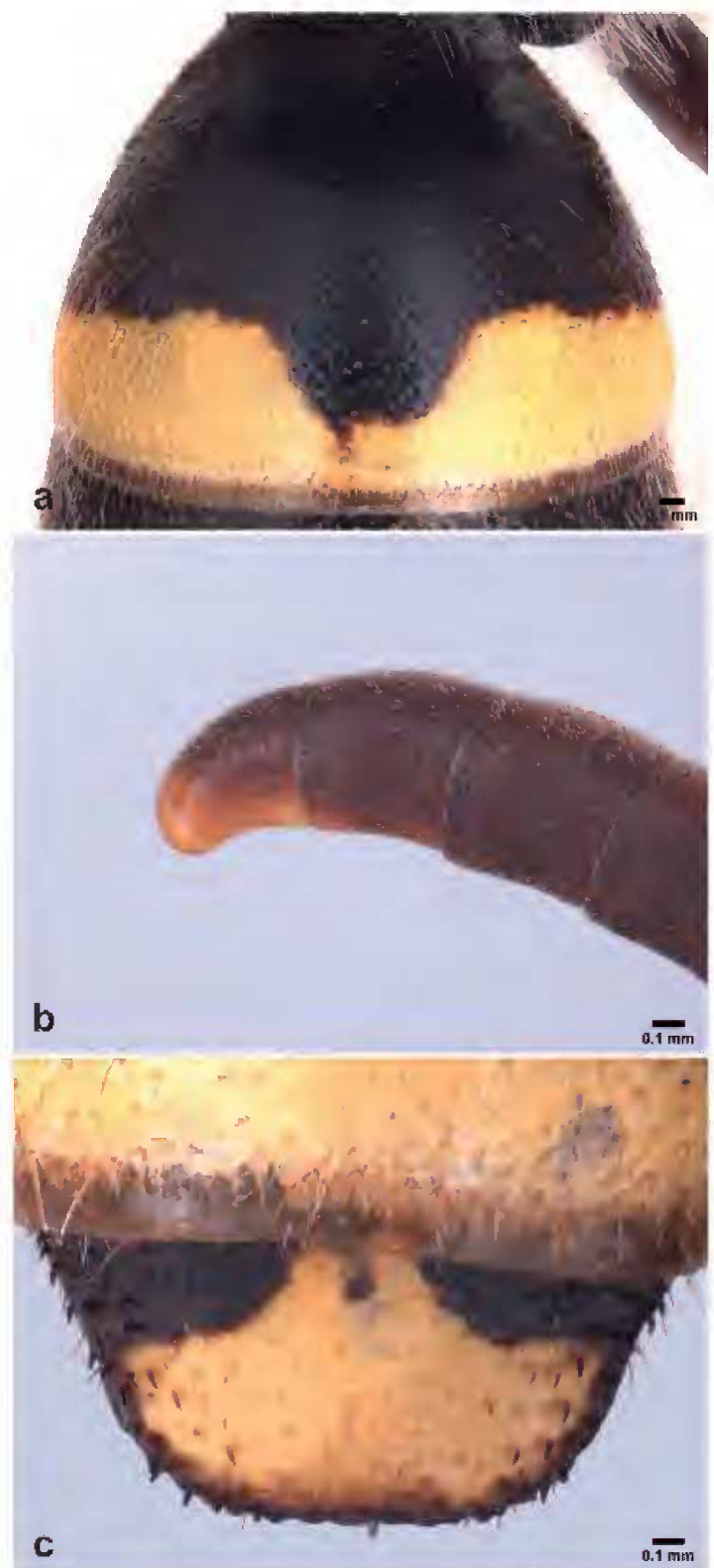


FIGURE 17. *Bembecinus pakhuisae*: a – female tergum I showing color pattern, b – apical flgellomeres of male, c – male tergum VII.

Caleta Cove, 19–20.x.1989, F.W. and S.K. Gess (on flowers of *Athanasia trifurcata* (Linnaeus) Linnaeus, Asteraceae) (1 ♀, AMGS); Moordenaars Karoo, Lammerfontein, x.1952, Museum Expedition [SAMC] (1 ♂, SAMC).

GEOGRAPHICAL DISTRIBUTION.— Known from the winter rainfall Succulent Karoo from the Richtersveld, Namaqualand south through Namaqualand and the Olifant's River Valley, east into the Cederberg and west into the sandveld, and from the Moordenaars Karoo (Fig. 25f).

FLORAL ASSOCIATIONS.— Visiting flowers of two families: Asteraceae (*Athanasia trifurcata* (Linnaeus) Linnaeus) (label data, see Material Examined; S. Gess and F. Gess 2003) and Amaranthaceae (*Hermbstaedtia glauca* (Wendl.) Reichb. ex Steudl.) (label data, see Material Examined).

NESTING.— Nesting in friable soil in the sides of runoff channels in Goegap Reserve, near Springbok. Six nests were investigated (S. Gess). Burrows sloping, with single sub-horizontal cell, angle of slope varied between nests, cell leaves shaft at an angle. Diameter of shaft 5.0–5.5 mm, diameter of cell 8 mm, length of cell 25 mm, cell depths 35–55 mm. Tumulus of excavated sand 20 mm from entrance, 45 mm long, 25 mm across. On entering and leaving the nest female opens and closes burrow. Cell of nest 87/88/20 provisioned. In cell of completed nest 87/88/23 cocoon, shaft filled with sand. (F. Gess and S. Gess, field notes 87/88/20–25, AMGS).

PREY.— Issidae (Homoptera), nymphs and adults (17 specimens in gelatin capsule, pinned with same data as nest builder 87/88/20, AMGS).

***Bembecinus quadristrigatus* Arnold**

Figures 5a, 18a-d.

Stizus quadristrigatus Arnold, 1929:297, Figs 49 and 49a, ♀. Holotype: ♀, Namibia: Kunene Region Kamanyab [= Kamanjab] (SAMC), photographs examined by W. Pulawski.— Arnold, 1930:20 (in checklist of Afrotropical Sphecidae).— As *Bembecinus quadristrigatus* (Arnold): R. Bohart and Menke, 1976:532 (new combination, in checklist of world Sphecidae); S. Gess and F. Gess, 2003:117 (floral records); Pulawski, 2014:29 (in catalog of world Sphecidae *sensu lato*).

RECOGNITION.— *Bembecinus quadristrigatus* has the terga yellow with black, but without ferruginous. It has the scutum with a pair of admedian yellow stripes extending through most of scutum length, and the interocellar area yellow between midocellus and hindocellus. Unlike *gilvus*, the lower gena of *quadristrigatus* has a row of erect setae along the hypostomal carina and the lower metapleuron is microareolate (rather than closely, microscopically punctate). In the female, the labrum is unsculptured between the punctures, at least along midline (microscopically reticulate between the punctures in *gilvus*), and the forebasitarsus is broader than in that species (compare Figs 18a and 8a).

VARIATION.— *Bembecinus quadristrigatus* has two color forms, apparently identical morphologically, both of which occur in Namibia, and one in Angola and South Africa. In the first (including the type of *quadristrigatus*), the metapleuron is all black, and tergum II has a median, subrectangular black mark that is rather well differentiated from the black, basal fascia and that extends beyond the tergal midlength. This form occurs in Namibia, in the Okahandja, Omaruru, Otjiwarongo, and Outjo areas. In the second form, known from Namibia, from the Aus, Karibib, Khorixas, and Usakos areas, and also from the Northern Cape Province of South Africa and from Angola, the metapleuron is all (most specimens) or partly yellow, and the black area on tergum II is (most specimens) reduced to a narrow, basalfascia, or the fascia is semicircularly broadened, also extending beyond the tergal midlength.

MATERIAL EXAMINED.— **NAMIBIA** (typical form): **Kunene Region:** Kamanjab (Arnold, 1929); Khorixas, 4.iii.1990, W.J. Pulawski (1 ♀, CAS); 38 km W Khorixas, 4.iii.1990, W.J.

Pulawski (1 ♀, CAS); **Erongo Region:** Omaruru/Usakos at 21°41'S 15°59'E, 26.iv.2002, F.W. and S.K. Gess (1 ♀, AMGS); 30k S Omaruru on road to Karibib, 21°41'S 15°59'E, 24.iii.1997, F.W. and S.K. Gess (4 ♂, AMGS), visiting deep pink flowers of *Hermbstaedtia odorata* (Burch.) T. Cooke, Acanthaceae. **ANGOLA (yellow form):** Pedive ca 36 mi. E Porto Alexandre, 24–27.vi. 1954, J. Balfour-Browne (8 ♀, BMNH). **NAMIBIA (yellow form): Otjozondjupa Region:** Leeu River 9 km W Okahandja at 21°58'S 16°50'E, 13.ii.1996, W.J. Pulawski (1 ♀, 1 ♂, CAS); 70 km N Okahandja 16.iii.1990, W.J. Pulawski (1 ♀, CAS); Otjiwarongo, 1.i.1975, Empey (1 ♂, AMGS); 44 km SW Otjiwarongo at 20°37'S 16°22'E, 4.iii.1996, W.J. Pulawski (1 ♀, CAS); 3 km NE Kalkfeld, 2.iii.1990, W.J. Pulawski (1 ♀, CAS); 25 km NE Kalkfeld at 20°41'S 16°18'E, 27.ii.1996, W.J. Pulawski (2 ♀, CAS). **Erongo Region:** western end of Grootberg Pass at 19°47'S 14°17'E, 19.iii.2004, F.W. and S.K. Gess (1 ♂, AMGS), visiting flowers of *Emelia mariothina* (O. Hoffm.) C. Jeffrey, Asteraceae; 7 km N Palmwag at 19°51'S 13°54'E 26.iii.2004. F.W. and S.K. Gess (1 ♀, AMGS); near Two Palms, Uniab River at 19°53'S 13°54'E, 27.iii.2004, F.W. and S.K. Gess (1 ♀, AMGS), visiting flowers of *Zygophyllum simplex* L., Zygophyllaceae; 120 km from Khorixas on road to Palm at 20°17'S 14°05'E, 8.iv.1998, F.W. and S.K. Gess (2 ♀, 1 ♂, AMGS); 5 km N Khorixas Rest Camp at 20°20'S 14°55'E, 17.iii.2004, F.W. and S.K. Gess (1 ♀, AMGS), visiting flowers of *Sesamum*, Pedaliaceae; 15 km from Khorixas on road to Palm at 20°26'S 14°54'E, 1.iv.1997, F.W. and S.K. Gess (1 ♀, AMGS); D2344 WNW Omatjete at 20°57'S 15°14'E, 15.iii.2004, F.W. and S.K. Gess (1 ♂, AMGS); Uis to Omaruru at 21°14'S 15°00'E, 14.iii.2004, F.W. and S.K. Gess (2 ♂, AMGS), one visiting flowers of *Heliotropium tubulosum* E. Mey ex Benth, Boraginaceae; 6 km N Omaruru at 21°27'S 15°59'E, 22.ii.1996, W.J. Pulawski (1 ♀, CAS); 23 km N Karibib, 27.ii.1990, W.J. Pulawski (2 ♀, CAS); 15 km W of Karibib, 26.ii.1990, W.J. Pulawski (6 ♀, 5 ♂, CAS); same data but 28.ii.1990 (4 ♀, 4 ♂, CAS); Uis/Henties Bay at 21°27'S 14°45'E, 17.iv.2002, F.W. and S.K. Gess (1 ♀, AMGS), visiting flowers of Acanthaceae; Omaruru/Usakos at 21°41'S 15°59'E,

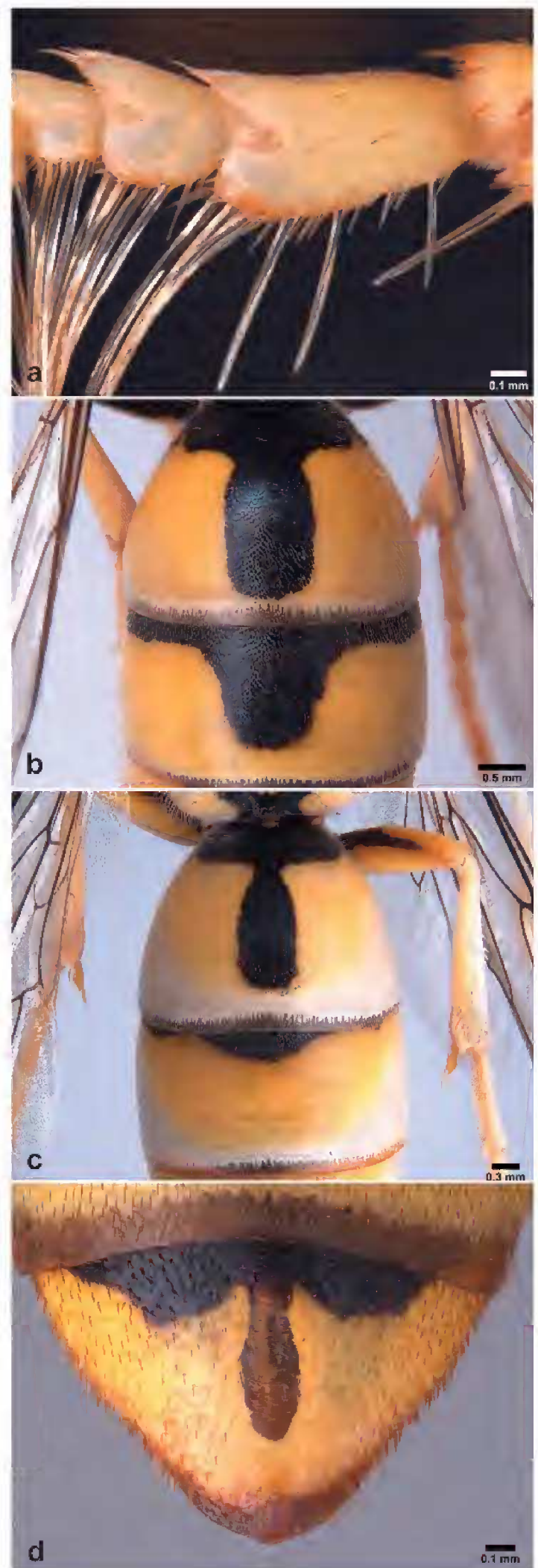


FIGURE 18. *Bembecinus quadristrigatus*: a – female foretarsomere I, b – tergum I of typical form, c – tergum I of yellow form, d – male tergum VII.

26.iv.2002, F.W. and S.K. Gess (1 ♀, 1 ♂, AMGS), visiting flowers of *Hermbstaedtia odorata* (Burch.) T. Cooke, Amaranthaceae; Karibib/Omaruru at 21°51'S 15°55'E, 12.iii.2004, F.W. and S.K. Gess (5 ♀, 1 ♂, AMGS); 15 km W Karibib at 21°56'S 15°42'E, 5.iv.1998, F.W. and S.K. Gess (11 ♀, 2 ♂, AMGS), visiting white flowers; 8 km W Usakos at 21°59'S 15°31'E, 15 Feb 1996, W.J. Pulawski (2 ♀, CAS); 117 km from Swakopmund on road to Usakos at 22°02'S 15°17'E, 16.iii.2000, F.W. and S.K. Gess (1 ♀, AMGS); 34 km SW Usakos at 22°02'S 15°17'E, F.W. and S.K. Gess (17 ♀, AMGS), visiting flowers of *Petalidium lanatum* (Engl.) C.B.Cl., Acanthaceae; between Kuiseb and Gaub passes, F.W. and S.K. Gess, at 23°24'S 15°50'E, 22.iii.1999 (1 ♀, AMGS) and 23°27'S 15°46'E, 22.iii.1999 (1 ♀, AMGS); 1–5 km E Usakos at 21°58'S 15°36'E, 14.iii.2014, J. Halada (2 ♀, 3 ♂, OÖLM); 25 km NEE Usakos at 21°52'S 15°19'E, 17.iii.2014, J. Halada (1 ♂, OÖLM); 5 km N Gobabeb, 26.ii.1979, Wharton (1 ♀, PPRI). **!Karas Region:** Aus, xii.1929, R.E. Turner (1 ♀, 1 ♂, BMNH); Onze Rust at 24°09'S 18°02'E, 17–18.v.1973, C. Jacot-Guillarmod (1 ♀, AMGS); Nomtsas Farm at 24°25'S 16°51'E, 18.iii.1997, F.W. and S.K. Gess (1 ♀, AMGS), visiting flowers of *Sesuvium sesuvioides* (Fenzl) Verdc, Aizoaceae; Nomtsas at 24°25'S 16°51'E, 18.iii.1997, F.W. and S.K. Gess (1 ♂, AMGS), visiting flowers of *Limeum argute-carinatum* Wawra and Peyr, Aizoaceae 5 km S Mariental at 24°40'S 17°57'E, 31.iii.2000, F.W. and S.K. Gess (1 ♀, AMGS); SW Gibeon 41 km on 1089 at 25°20'S 17°29'E, F.W. and S.K. Gess, 8.iii.1999 (1 ♂, AMGS), 10.iii.1999 (1 ♀, 13 ♂, AMGS), visiting flowers of *Limeum* sp., Molluginaceae, and 24.iii.1999 (1 ♀, AMGS). **SOUTH AFRICA (yellow form): Northern Cape Province:** Kalahari Gemsbok National Park, Nossob River bed 11 km NNE Twee Rivieren, 8–11.iii.1990, F.W. and S.K. Gess (5 ♂, AMGS), visiting flowers of *Limeum aethiopicum* Burm., Aizoaceae; Twee Rivieren in Kalahari Gemsbok National Park at 26°28'S 20°37'E, 30.x. 1990, M.W. Mansell (1 ♂, PPRI); 123 km N on road 360 from Upington to Kgalagadi at 27°30'S 20°48'E, 6.iv.2000, F.W. and S.K. Gess (1 ♀, AMGS); 61 km N on road 360 from Upington to Kgalagadi at 27°58'S 20°59'E, 6.iv.2000, F.W. and S.K. Gess (1 ♀, AMGS).

GEOGRAPHICAL DISTRIBUTION.—Known from the Nama Karoo from southern Angola, Namibia and the southern Kalahari in South Africa, and in northern Namibia penetrating the Namib Desert via the drainage channels (Fig. 26a).

FLORAL ASSOCIATION.—Visiting flowers of seven families: Acanthaceae (*Petalidium lanatum* (Engl.) C.B.Cl.), Aizoaceae (non-Mesembryanthema, *Sesuvium sesuvioides* (Fenzl) Verdc), Amaranthaceae (*Hermbstaedtia odorata* (Burch.) T. Cooke), Asteraceae (*Emelia mariothina* (O. Hoffm.) C. Jeffrey), Boraginaceae (*Heliotropium tubulosum* E. Mey ex Benth.), Molluginaceae (*Limeum aethiopicum* Burm. and *Limeum argute-carinatum* Wawra and Peyr), and Pedaliaceae (*Sesamum*) (label data, see Material Examined; S. Gess and F. Gess 2003).

NESTING.—Unknown.

PREY.—Unknown.

***Bembecinus rhopaloceroides* (Arnold)**

Figures 5b, 19a-c.

Stizus rhopaloceroides Brauns, 1911:92 (sleeping on *Datura*). Nomen nudum.

Stizus rhopaloceroides Arnold, 1929:294, Figs 47 and 47a, ♀, ♂ (authorship attributed to Brauns). Syntypes: South Africa: Eastern Cape Province: Willowmore (TMSA).—Arnold, 1930:20 (in checklist of Afrotropical Sphecidae); Handcock, Chawanda, and Mhlanga, 1995: 40 (syntypes in NMZB).—As *Bembecinus rhopaloceroides* (Arnold): Evans, 1966:135 (new combination, observations by Brauns, 1911); R. Bohart and Menke, 1976:532 (in checklist of world Sphecidae); S. Gess, 1996:273 (floral records); S. Gess and F. Gess, 2003:117 (floral records), 2006:14 (floral records); Pulawski, 2014:33 (in catalog of world Sphecidae *sensu lato*).

RECOGNITION.— The female of *B. rhopaloceroides* shares with *gariensis* the ferruginous terga (at least terga I and II) with pale yellow apical fasciae. *Bembecinus inexpectatus* and *omaruru* share this color pattern, but in *inexpectatus* the length of hindtarsal arolium is about $0.5 \times$ of the inner claw, whereas about $0.25\text{--}0.30 \times$ in *rhopaloceroides* and *gariensis*; in *omaruru* the setae of tergum II are erect at least laterally, whereas they are appressed in the females of the other two species. Some *karasanus* are also similar, but in that species the labrum punctures are larger than those on the scutum, whereas markedly smaller in the other two species.

The females of *gariensis* and *rhopaloceroides* are identical morphologically and can only be identified by association with the topotypical males. The geographic distribution is of some help: *rhopaloceroides* occurs in the Eastern, Western, and Northern Cape Provinces of South Africa as well as in southern Namibia, whereas *gariensis* is found in the Northern Cape Province of South Africa as well as in southern Namibia (in other words, *gariensis* is unknown from the Eastern and Western Cape Provinces).

The male of *rhopaloceroides* shares with *gariensis* an incrassate foretibia, with the dorsal margin convex in profile (Fig. 19c, 7a). They differ as follows: in *gariensis*, the foretibial inner surface is flat or nearly so, without emargination in the dorsal view (Fig. 7b); in *rhopaloceroides*, it has an oblique impression that in the dorsal view looks like an emargination at the tibia's basal third (Fig. 19b).

VARIATION.— In most of the specimens examined, terga II and III are ferruginous or with insignificantly narrow black fascia basally and the pale yellow apical fascia not broadened laterally, in some females with a pair of black spots in the middle. The specimens from Aus, Namibia, have the pale yellow apical fasciae of terga broadened laterally; in the female, tergum II has a conspicuous black basal fascia and tergum III has only a minimum of ferruginous (anterior to the pale yellow apical fascia).

In most males, the gaster is all or largely ferruginous (except for the yellow apical fasciae), but all black (except for the apical fasciae) in some specimens; some intermediate specimens have a small amount of ferruginous color on tergum I, just anterior to the yellow apical band.

In the vast majority of specimens, the setae are appressed on tergum II, but they are erect laterally in the single male from Aus, Namibia, up to $0.5 \times$ midocellar width.

MATERIAL EXAMINED.— **NAMIBIA:** Aus, xii.1929, R.E. Turner (1 ♀, 1 ♂, BMNH). **SOUTH AFRICA: North West Province:** Constable, xii.1962, SAM (1 ♀, SAMC). **Northern Cape**

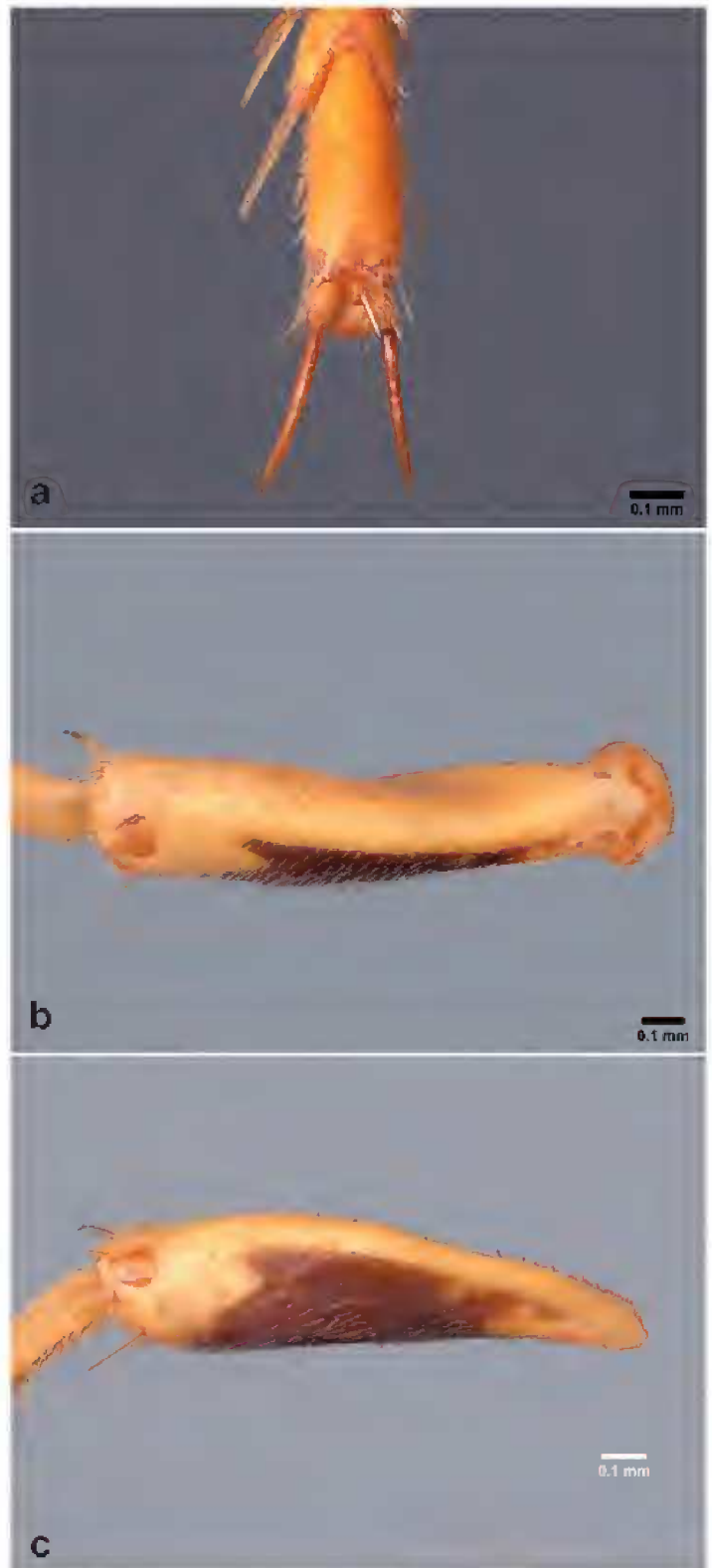


FIGURE 19. *Bembecinus rhopaloceroides*: a – apical hindtarsomere of female showing length of arolium, b – male foretibia in dorsal view, c – male foretibia in profile

Province: Namaqualand, Springbok, Hester Malan Reserve [now Goegap], 3–7.xi.1987, M. Struck (1 ♂, PPRI); Bloukrans near Calvinia, 17.xi.1931, J. Ogilvie (1 ♀, 2 ♂, BMNH); Pofadder, Bushmanland, Mus. Staff, x.1939 (1 ♀, SAMC). **Western Cape Province:** Doringbos [NE of Clanwilliam], 3.xi.1966, J.G. Rozen (1 ♂, AMNH); Clanwilliam, F.W. Gess and S.K. Gess (2 ♂, AMGS); 43 km ENE Ceres on road to Sutherland, 2–3.xii.1989, R.W. Gess (1 ♀, 1 ♂, AMGS), ♀ on flowers of mauve-white “mesem”, Mesembryanthemaceae (Aizoaceae); 18 miles [28.98 km] E Touws River to Hondewater, xii.1962, SAM [staff] (7 ♀, 123 ♂, SAMC); 18 miles [28.98 km] southeast Touwsrivier, 12.xi.1966, J.G. Rozen (3 ♂, AMNH); Koup at 33°07'S 21°17'E, 26.xii.1996, W.J. Pulawski (1 ♀, CAS); Koup Siding, Laingsburg, xi.1939, Museum Staff [SAMC] (1 ♀, SAMC); Dikbome, Merweville, Koup, x.1952, Museum Expedition [SAMC] (1 ♂, SAMC); Laingsburg at 33°12'S 20°51'E, 25 and 26.xii.1996, W.J. Pulawski (4 ♀, CAS); Oudtshoorn, Onverwacht, 9–12.xii.1986, F.W. and S.K. Gess (3 ♀, 1 ♂, AMGS), 1 ♀ and 1 ♂ on flowers of *Zygophyllum retrofractum* Thunb., Zygophyllaceae. **Eastern Cape Province:** Willowmore, no date, H. Brauns (2 ♀, SAMC ex NMZB; 1 ♂, UCDC), same locality, 20.i.1903, H. Brauns (1 ♀, SAMC), same locality, 25.ix.1909, H. Brauns (1 ♂, SAMC), same locality, 1.xii.1909, H. Brauns (1 ♂, SAMC), same locality, 15.i.1910, H. Brauns (1 ♀, SAMC ex NMZB), same locality, 10.i.1912, H. Brauns (1 ♀, SAMC ex NMZB), same locality, ii.1914 (1 ♀, UCDC), same locality, xi.1916, H. Brauns (1 ♀, 1 ♂, AMGS), same locality, 1.xii.1917, H. Brauns (1 ♂, SAMC ex NMZB), same locality, xii.1920, H. Brauns (1 ♀, AMGS), same data (1 ♀, SAMC ex NMZB), same locality, 12.i.1965, H. Empey (1 ♀, 1 ♂, AMGS); near Fullerton, C. Jacot-Guillarmod (3 ♂, AMGS); 4 miles [6.44 km] E Waterford, 29.x.1967, C. Jacot Guillarmod (1 ♀, AMGS).

GEOGRAPHICAL DISTRIBUTION.— Known from southwestern Namibia, the Northern, Western and Eastern Cape Provinces of South Africa. It appears to have a southern distribution from the Succulent Karoo in the west to the Nama-Karoo in the east (Fig.26b).

FLORAL ASSOCIATIONS.— Visiting flowers of three plant families: Asteraceae (*Athanasia trifurcata* (Linnaeus) Linnaeus) (S. Gess and F. Gess 2003), Zygophyllaceae (*Zygophyllum retrofractum* Thunb.) and Aizoaceae (Mesembryanthema) (label data, see Material Examined; S. Gess and F. Gess 2003, 2006).

NESTING.— Unknown.

PREY.— Unknown.

Bembecinus rhopalocerus (Handlirsch)

Figures 5c, 20a-c, 21.

Stizus rhopalocerus Handlirsch, 1895:986, Pl. 11, Figs 4 and 7, ♀. Holotype: ♀, South Africa: Cape Colony = Cape Province: no specific locality (MHNG), examined by W. Pulawski.— Dalla Torre, 1897:529 (in catalog of world Sphecidae); Brauns, 1911:92 (sleeping aggregations on *Datura*); Arnold, 1929:293, Figs 46, 46 a-d, ♀, ♂, Cape Province [Eastern Cape], Willowmore (in revision of southern African Sphecidae).— As *Bembecinus rhopalocerus* (Handlirsch): Evans, 1966:135 (new combination, observations by Brauns, 1911); R. Bohart and Menke, 1976:532 (new combination, in checklist of world Sphecidae); S. Gess, 1996:281 (floral records); S. Gess and F. Gess 2003:117 (floral records), 2014:210 (nest situation), 214 (prey); Pulawski, 2014:33 (in catalog of world Sphecidae *sensu lato*).

RECOGNITION.— *Bembecinus rhopalocerus* has the clypeus roundly angulate basally (best seen in profile (Fig. 20a), whereas it is evenly arcuate in the other species except the female of *B. hyperocrus*. The female has the forefemur unusually broadened ventrally, whereas the dorsal margin is straight or nearly so (Fig. 20b). The female of *B. damarensis* is similar, but has the clypeus evenly arcuate in profile, the ventral broadening of the forefemur less prominent, and the

dorsal margin slightly concave (Fig. 6a). The male of *B. rhopalocerus* has the apical flagellomere straight (neither curved nor emarginate), the setae appressed on tergum II, and the gastral terga yellow and black (except for some ferruginous on tergum I). Unlike *gilvus*, it has a row of erect setae between the mandibular base and the occipital carina. It is similar to *B. quadristrigatus* and *B. somalicus*, but differs, in addition to the shape of the clypeus, in having tergum VII broadly rounded apically (less so in the other two species) and the scutum all black mesally (with a pair of admedian yellow stripes in the other two).

MATERIAL EXAMINED.—**NAMIBIA:** !Karas **Region:** Aus, 8–30.xi.1929, R.E. Turner (3 ♀, 2 ♂, SAMC ex NMZB, 6 ♀, 6 ♂, BMNH); Aus, xii.1929, R.E. Turner (1 ♂, BMNH); Keetmanshoop, 15.xii.1974, H. Empey (1 ♀, AMGS); 30 miles [48.28 km] SE Keetmanshoop, 23.x.1968, J.G. Rozen and E. Martinez (1 ♀, AMNH). **No specific locality:** no date, as S.W. Africa, R.E. Turner (1 ♂, UCDC). **SOUTH AFRICA:** **North West Province:** Constable, xii.1962, SAM [staff] (1 ♀, SAMC). **Northern Cape Province:** Namaqualand, Hester Malan [now Goegap] Nature Reserve, 4.xi.1986, M. Struck (1 ♂, AMGS); Upington, 10–12.x.1966, SAM [F.W. and W.H.R. Gess] (33 ♂, SAMC); Doorn River Falls, xi.1931, A. Mackie (1 ♂, BMNH); Doringbos at 31°59'S 19°14'E, 17.xi.1984, C.D. Eardley (1 ♀, PPRI); Britstown, 28.xii.1970, H. and M. Townes (1 ♀, AEI). **Western Cape Province:** 17.5 km from Clanwilliam on road 363 to Klaver, 9.x.1990, F.W. and S.K. Gess, on flowers of *Athanasia trifurcata* (Linnaeus) Linnaeus, Asteraceae (1 ♂, AMGS); 31.5 km from Clanwilliam on road to Klaver, 9–10.x.1990, F.W. and S.K. Gess, on flowers of *Athanasia trifurcata* (Linnaeus) (2 ♂, AMGS); 24 km NE Clanwilliam, 14.xi.1996, M.A.Metz (1 ♀, CAS); 38 km NE Clanwilliam, 12.xi.1996, M.A. Metz (1 ♀, CAS); Olifants River between Citrusdal and Clanwilliam, x-xi.1931, Museum Staff (2 ♀, 9 ♂, SAMC); 19 km S Clanwilliam on old road to Citrusdal, 14.xi.1992, D.W. Gess (1 ♀, AMGS); Leipoltville, xi.1956, SAM [staff] (6 ♀, SAMC); 43 km ENE of Ceres on road to Sutherland, 2–3.xii.1989, F.W. and S.K. Gess

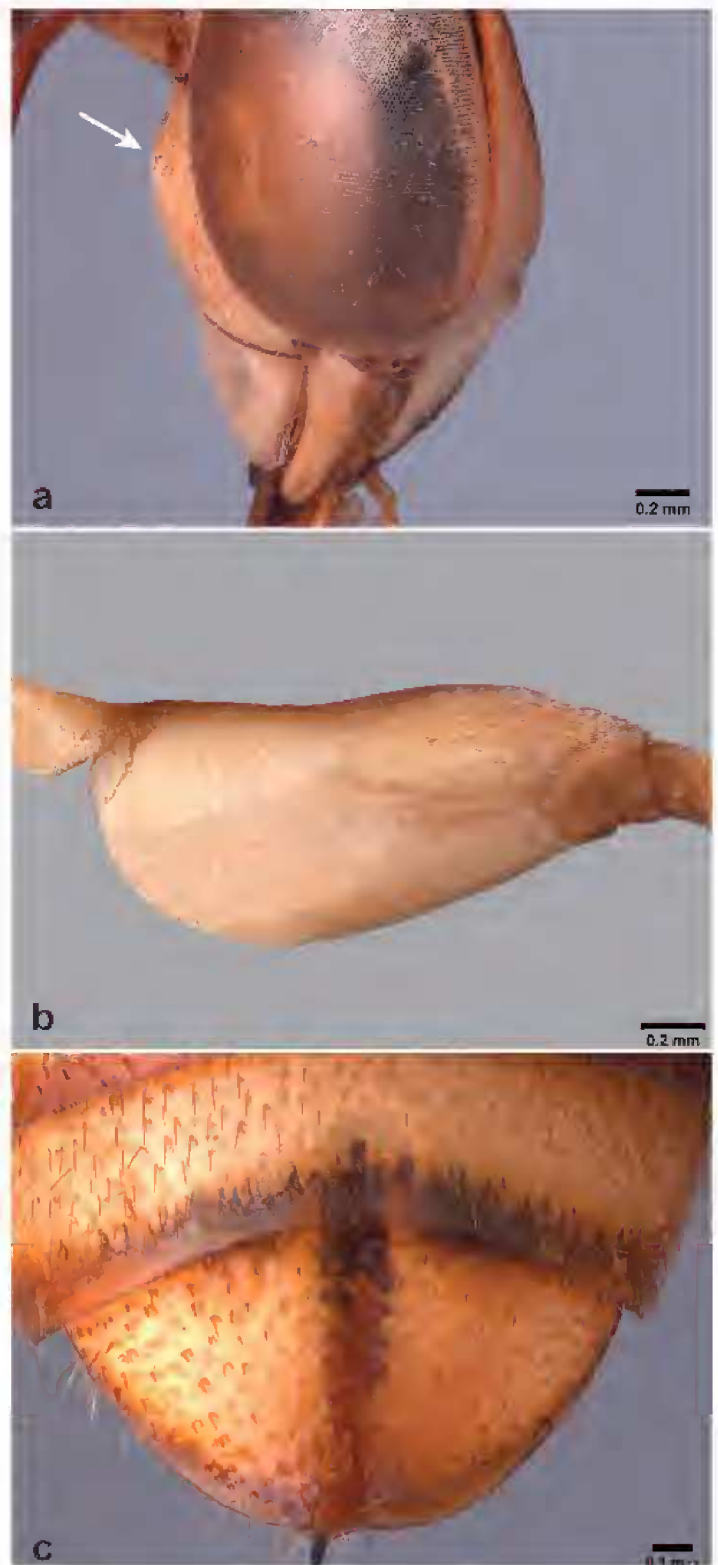


FIGURE 20 (left). *Bembecinus rhopalocerus*: a – ventral part of female head in profile (arrow indicates the roundly angular portion of clypeus), b – female forefemur, c – male tergum VII.



FIGURE 21. *Bembecinus rhopalocerus* at nest entrance.

(1 ♀, AMGS); Hex River, i.1884, no collector, det. Arnold (2 ♀, SAMC); Matijesfontein, 1–18.xii.1928, R.E. Turner (1 ♀, UCDC, det. *Bembecinus mutabilis* by R. Bohart); Whitehill, 26.xi, T.D.A. Cockerell (1 ♀, BMNH); Tankwa Karoo, i.1949, Zinn-Hesse Museum Expedition [SAMC] (1 ♀, SAMC); 18 miles [28.97 km] E of Touws River to Hondewater, xii.1962, SAM [staff] (1 ♂, SAMC); Oudtshoorn, Onverwacht, 9–12.xii.1986, F.W., S.K., H.W. and R.W. Gess (1 ♀; from nests Homoptera prey in dry collection and larvae in wet collection; Gess and Gess fieldnotes 86/87/18 and 86/87/23) (13 ♀, 2 ♂, AMGS); Rietbron, 11.i.1965, H. Empey (1 ♀, 1 ♂, AMGS). **Eastern Cape Province:** Willowmore, 25.ii.1905, H. Brauns (1 ♂, SAMC ex NMZR), same locality, 4.xii.1917, H. Brauns (1 ♀, SAMC ex NMZR), same locality, 21.i.1965, H. Empey (1 ♀, 1 ♂, AMGS); 9 km E Willowmore at 33°15'S 23°34'E, 28.i.1996, W.J. Pulawski (1 ♀, CAS); near Fullarton, 30.x.1967, C. Jacot Guillarmod (1 ♂, AMGS).

GEOGRAPHICAL DISTRIBUTION.—Known from the Succulent Karoo and Nama-Karoo of southern Namibia south through the Succulent Karoo of Namaqualand, the Olifant's River valley, the Tankwa Karoo and east to Willowmore in the Nama-Karoo (Fig. 26c).

FLORAL ASSOCIATIONS.—Visiting flowers of Asteraceae (*Athanasia trifurcata* (Linnaeus) Linnaeus) (label data, see Material Examined; S. Gess and F. Gess 2003).

NESTING.—Nesting in friable soil on a vegetated flood plane in an area of karroid scrub, Onverwacht, Oudtshoorn (Fig. 21). Three single-celled nests were investigated (S. Gess). Burrows sloping, diameter circa 5 mm, reaching a depth of 47–98 mm, ending in a cell circa 9 mm in diameter and circa 23 mm in length; temporary closure maintained within entrance, cells of nests 86/87/18 and 86/87/23 provisioned, provisioning progressive (Gess and Gess, field notes 86/87/15, 86/87/18 and 86/87/23, AMGS).

PREY.—Two species of Homoptera, *Telmosias cf. crito* Fennah (Nogodinidae) and *Sajuba reversa* (Melichar) (Flatidae), all adults, prey extracted from nests 86/87/18 and 86/87/23 (AMGS).

Bembecinus somalicus (Arnold), new status

Figures 5d, 22.

Stizus quadristrigatus race *somalicus* Arnold, 1940:116, Fig. 11 ♀. Holotype ♀, Somalia: Warderi, now Ethiopia: Werder (SAMC), examined by W. Pulawski.—As *Bembecinus quadristrigatus somalicus* (Arnold): R. Bohart and Menke, 1976:532 (new combination, new status, in checklist of world Sphecidae); Pulawski, 2014:30 (in catalog of world Sphecidae *sensu lato*).

Stizus quadristrigatus var. *dubiosus* Guiglia, 1941:78, ♀. Holotype: ♀, Ethiopia: Gabredarre, now Kebri Dehar (MSNG). **New synonymy by W. Pulawski.**—As *Bembecinus quadristrigatus dubiosus* (Guiglia): R. Bohart and Menke, 1976:531 (new combination, new status, in checklist of world Sphecidae); Pulawski, 2014:29 (in catalog of world Sphecidae *sensu lato*).

RECOGNITION.—*Bembecinus somalicus* has a color pattern unique within the *rhopalocerus* group: terga II–V each have a pair of submedian black stripes that extend beyond tergal midlength, as in *B. loriculatus* (F. Smith), or a pair of black spots near the tergal middle.

JUSTIFICATION OF NEW SYNONYMY.—The original description and the illustration of *B. dubiosus* clearly show the unique color pattern identical to that of *B. somalicus*. These two names are therefore synonyms. In addition, the holotypes of the two species originate from adjacent localities that are less than 100 km apart, both in the Somali Region of Ethiopia.

MATERIAL EXAMINED.—**ETHIOPIA: Somali Region:** El Rago, 9.xii.1953, Desert Locust Survey, D.J. Greathead (1 ♀, AMGS); Gabredarre, now Kebri Dehar (Guiglia, 1941); Warderi, now Wereder (1 ♀, SAMC, holotype of *somalicus*). **KENYA: Eastern Province:** Archer's Post at Ewaso Ng'iro River, 12.xii.1969, E.S. Ross (5 ♀, 6 ♂, CAS; 1 ♀, 1 ♂, UCDC); 5 km NNE Isiolo at

0°24.3'N 37°35.7'E, 8–10.vi.2000, M.H. Bourbin, V.F. Lee, and W.J. Pulawski (2 ♀, CAS); near Ewaso Ngiro River opposite Archer's Post at 0°38.1'N 37°40.4'E, 2–8.xii.2002, W.J. Pulawski (14 ♀, CAS); same locality, M.A. Prentice, 2–8.xii.2002 (7 ♂, CAS) and 19–20.xii.2002 (1 ♀, 2 ♂, AMGS; 1 ♀, 3 ♂, CAS). **Coast Province:** Taveta on Lumi River, xii.1912, collector unknown (1 ♀, BMNH); **TANZANIA: Tanga Region:** 2 km NE Mkomazi at 4°37.8'S 38°05.5'E, 29–31.xii.2002, M.A. Prentice (1 ♀, CAS) and W.J. Pulawski (1 ♀, CAS).

GEOGRAPHICAL DISTRIBUTION.— Known from semi-arid to arid areas of the Somali Region of Ethiopia, Kenya, and northeast Tanzania (Fig. 26d).

FLORAL ASSOCIATIONS.— Unknown.

NESTING.— Unknown.

PREY.— Unknown.

Bembecinus zebratus R. Bohart

Figures 5e, 23.

Bembecinus zebratus R. Bohart, 1997:171, Fig. 7, ♀, ♂. Holotype: ♂, South Africa: Western Cape Province: Worcester (UCDC according to original description, but apparently lost). Neotype: ♂, South Africa: Western Cape Province: Worcester, paratype of *B. zebratus* (UCDC) designated by W. Pulawski.— Pulawski, 2014:44 (in catalog of world Sphecidae *sensu lato*).

RECOGNITION.— *Bembecinus zebratus* has the scutum all black mesally, and terga black, not ferruginous, with narrow, yellow apical fasciae. It differs from *damarensis* in having tergum I mostly black except for the narrow, yellow apical fascia, the dorsal margin of the female forefemur practically straight and the ventral margin not expanded basally, the apical flagellomere of the male only slightly curved and excavated (Fig. 23a), and tergum VII is short, trapezoid (Fig. 23b). In *damarensis*, the dorsal surface of tergum I is yellow except for the median, black, nearly rectangular marking that does not attain posterior margin (Fig. 6b), the female forefemur is somewhat concave basally and the ventral margin is slightly expanded basally (Fig. 6a), the apical flagellomere of male is markedly curved and excavated, and tergum VII is significantly longer, roundly triangular (Fig. 6d).

Differences between *zebratus* and *pakhuisae* are slight. In the female of *zebratus*, the clypeus is all yellow and the mesopleuron has a vertical yellow



FIGURE 22. *Bembecinus somalicus*: female tergum II showing color pattern.



FIGURE 23. *Bembecinus zebratus*: a – apical flagellomeres of male, b – male tergum VII.

marking (yellow marking present or absent in the male); in most males, the apical flagellomere is slightly more curved and excavated (Fig. 23a) than in *pakhuisae*, but about the same in the specimen from Niewoudtville, and the yellow, apical fasciae on the terga are markedly narrower (e.g., the fascia of tergum II is markedly shorter than the black, anterior portion). In the female of *pakhuisae*, the clypeus is all or partly black and the mesopleuron is all black (as it is in the male); in the male, the apical flagellomere is slightly less curved and excavated (Fig. 17b), and the yellow apical fasciae on terga are markedly broader (e.g., the fascia of tergum II is slightly shorter to longer than the black, anterior portion).

DESIGNATION OF NEOTYPE.— The holotype of *Bembecinus zebratus* was deposited in UCDC according to the original description, but Steven L. Heydon, Senior Museum Scientist, could not find it there, neither in the type collection nor in the general collection. Apparently, the holotype has been lost, and W. Pulawski designated as a neotype one of the existing paratypes, a male.

MATERIAL EXAMINED.— **SOUTH AFRICA: Northern Cape:** Niewoudtville Flower Reserve, 24.ix.2006, K. Timmermann (1 ♂, BMNH). **Western Cape Province:** Worcester, ix-x.1931, R.E. Turner (1 ♀, BMNH); Worcester, x.1975, R.M. Bohart (9 ♀, 13 ♂, UCDC, neotype and paratypes of *zebratus*).

GEOGRAPHICAL DISTRIBUTION.— Known from the winter rainfall area of South Africa from one locality in southeastern Namaqualand and one in the Western Cape Province of South Africa (Fig. 26e).

FLORAL ASSOCIATIONS.— Unknown.

NESTING.— Unknown.

PREY.— Unknown.

DISCUSSION OF GEOGRAPHICAL DISTRIBUTIONS, FLORAL ASSOCIATIONS,
NESTING, AND PREY

The distribution records here assembled for the *Bembecinus rhopalocerus* species group (Figs. 24–26) make possible the recognition of geographical patterns for some species; for others, however, the number of records remains too few, drawing attention to species, which require purposeful collecting.

Current knowledge of the distributions of the species suggests that most are restricted to southern Africa and within southern Africa to the semi-arid to arid Succulent Karoo and Nama-Karoo (Fig. 26f). Three species (*gilvus*, *omaruru* and *quadristrigatus*) penetrate the Namib Desert along the courses of drainage channels and one (*somalicus*) is known only from Ethiopia, Kenya, and northeast Tanzania.

Bembecinus visit plants not only to obtain nectar for adult nourishment but also when hunting their Homoptera prey. Records of actual visits to flowers by members of the *rhopalocerus* species group are surprisingly few. Records are for 11 families: Asteraceae, Zygophyllaceae, Amaranthaceae, Molluginaceae, Fabaceae, Neuradaceae, Aizoaceae (Mesembryanthema and non-Mesembryanthema), Boraginaceae, Campanulaceae, Pedaliaceae and Vahliaceae. Most commonly the flowers visited are small and grouped in heads, as are those of the first four families listed.

Typically, the species of *Bembecinus* have the female foretarsus equipped with long sand-rakes, and excavate sloping nesting burrows in friable soil. The only known exceptions are two species of the *cinguliger* species group (*cinguliger* and *oxydorcus*) which lack sand-rakes and use water for excavating vertical burrows in non-friable soil (F. Gess and S. Gess 1975; F. Gess 1981; S. Gess and F. Gess 2014). Nesting has been documented for only four species of the *rhopalocerus* group: *hyperocrus*, *mutabilis*, *pakhuisae*, and *rhopalocerus*, but all species of this group have sand-rakes and therefore undoubtedly nest in sloping burrows excavated in friable soil.

Prey records are available for only the above four species of the *rhopalocerus* group. These are all Homoptera of the families Cicadellidae, Issidae, Nogodinidae and Flatidae.

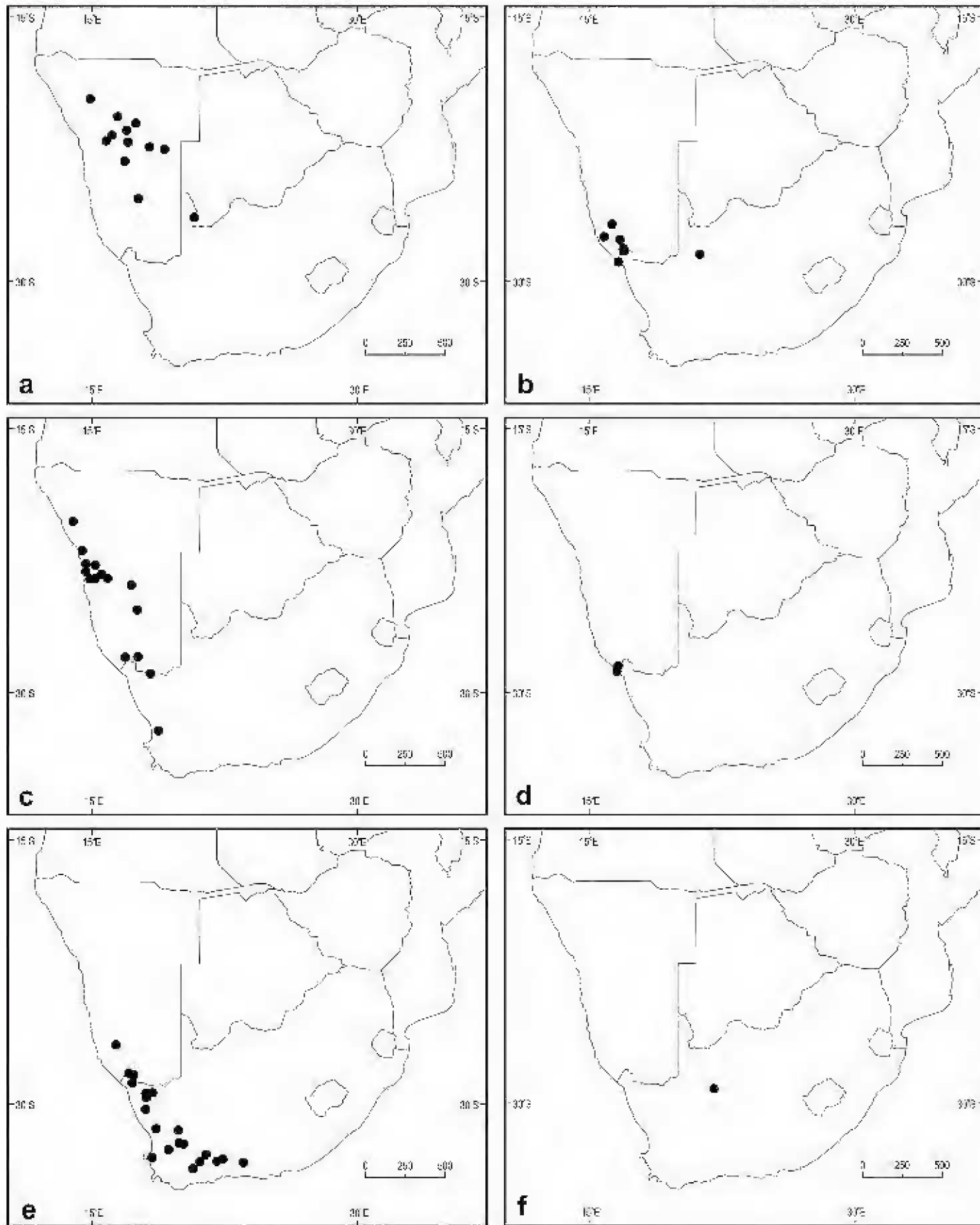


FIGURE 24. Collecting records of *Bembecinus* spp.: a – *damarensis*, b – *gariensis*, c – *gilvus*, d – *helicicola*, e – *hyperocrus*, f – *inexpectatus*.

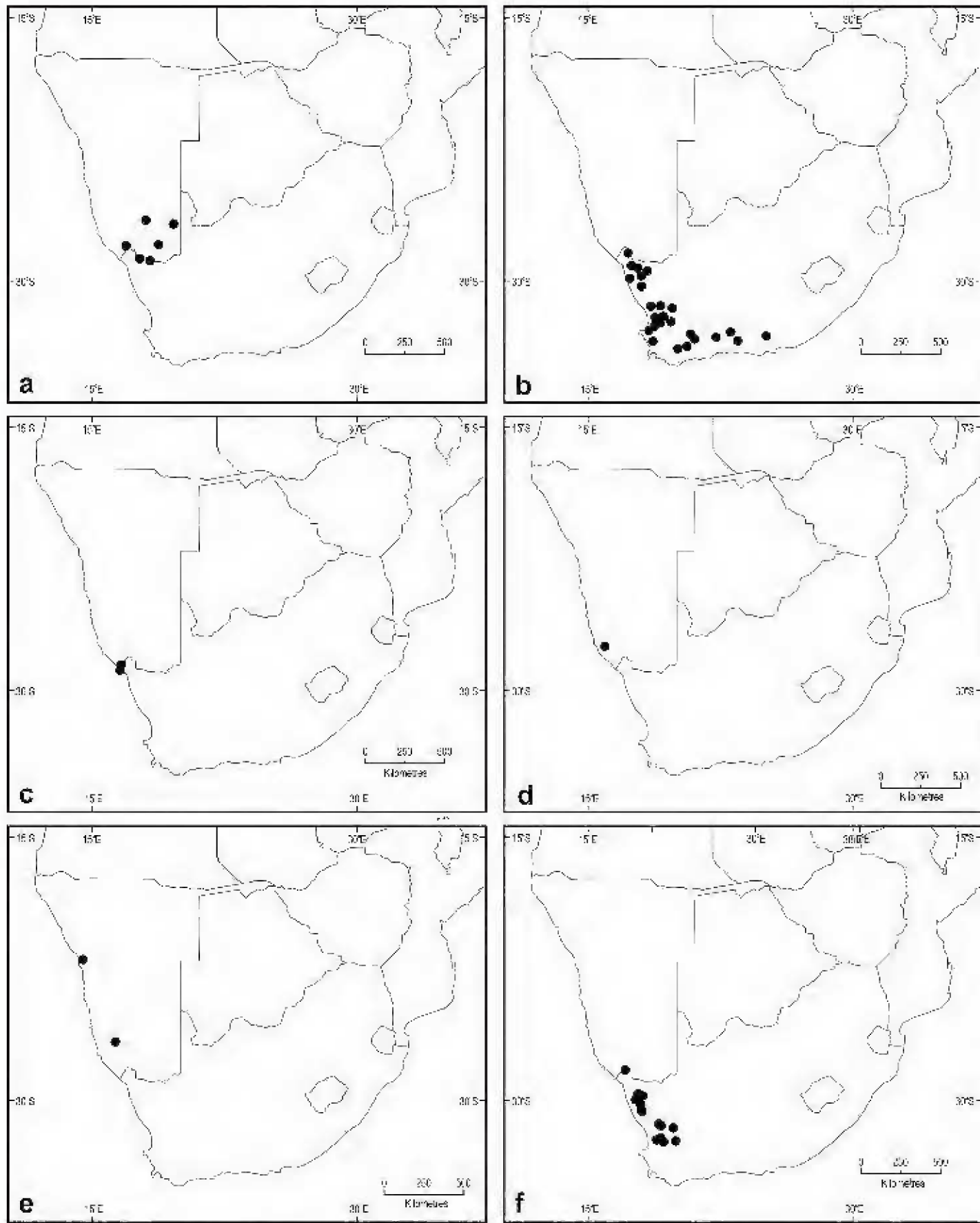


FIGURE 25. Collecting records of *Bembecinus* spp.: a – *karasanus*, b – *mutabilis*, c – *namaquensis*, d – *namibius*, e – *omaruru*, f – *pakhuisae*.

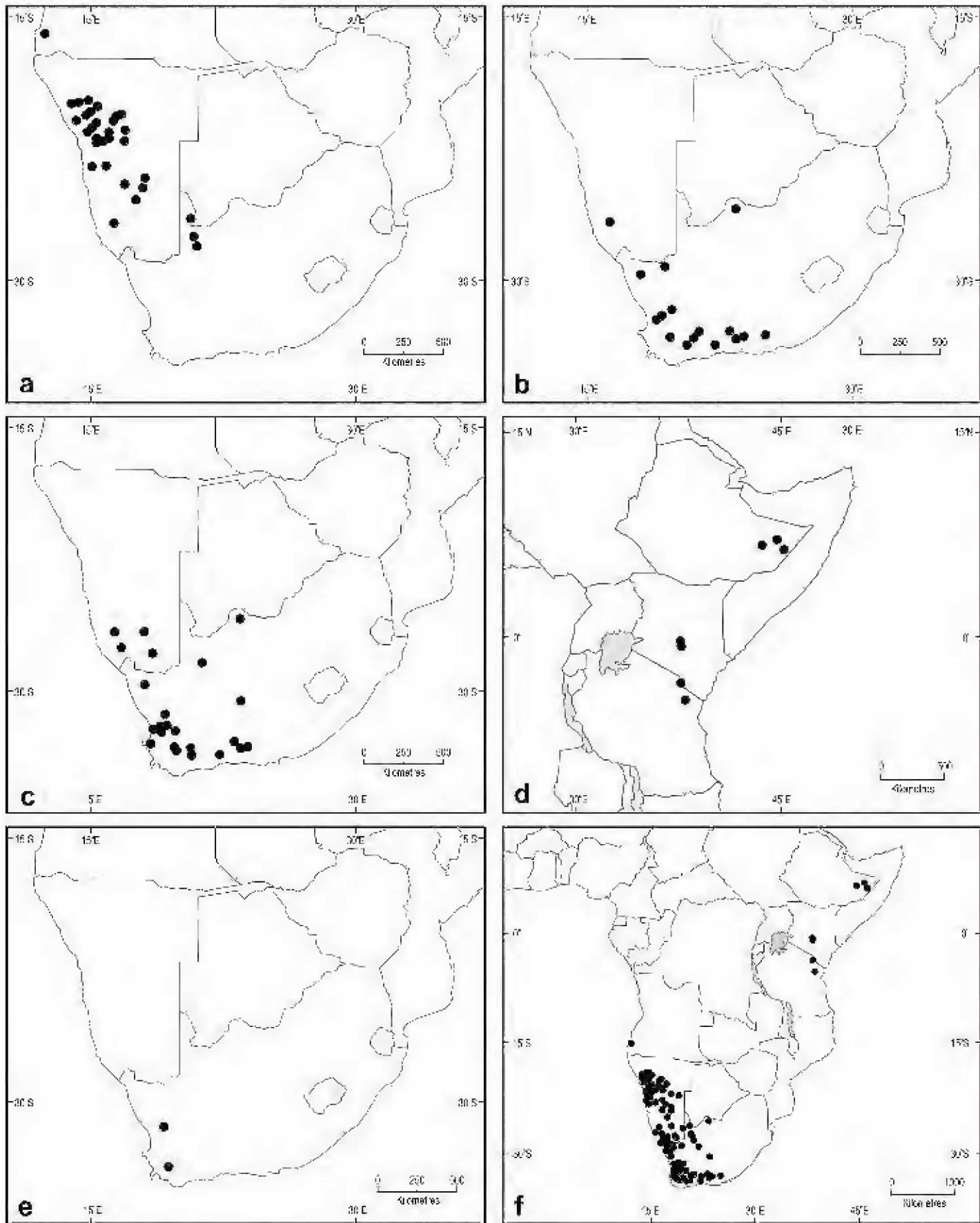


FIGURE 26. Collecting records of *Bembecinus* spp.: a – *quadristrigatus*, b – *rhopaloceroides*, c – *rhopalocerus*, d – *somaticus*, e – *zebratus*, f – all species combined.

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Appendix Gazetteer

| | Degrees and minutes | Decimal degrees |
|--|---------------------|------------------------|
| ETHIOPIA | | |
| El Rago | 6°38'N 45°47'E | 6.6333°N 45.7833°E |
| Kebri Dahar | 6°44'N 44°16'E | 6.7333°N 44.2667°E |
| Wederer | 6°58'N 45°21'E | 6.9667°N 45.3500°E |
| KENYA | | |
| Archer's Post at Ewaso Ngiro River | 0°38'S 37°40'E | 0.6333°S 37.6667°E |
| Isiolo, 5 km NNE | 0°24'S 37°36'E | 0.4000°S 37.6000°E |
| Taveta | 3°24'S 37°41'E | 3.4000°S 37.6833°E |
| TANZANIA | | |
| Mkomazi, 2 km NE of | 4°38'S 38°06'E | 4.6333°S 38.0100°E |
| ANGOLA | | |
| Pedive ca 36 mi. E Porto Alexandre | ca 15°48'S 12°22'E | ca 15.8000°S 12.3667°E |
| NAMIBIA | | |
| Ai-Ais | 27°56'S 17°29'E | 27.9286°S 17.4833°E |
| Aroab | 26°48'S 19°39'E | 26.8000°S 19.6500°E |
| Aus | 26°40'S 16°16'E | 26.6667°S 16.2667°E |
| Aus (Pad C13) | 26°40'S 16°15'E | 26.6667°S 16.2500°E |
| Aus, 80 km south of on road 727 | 27°33'S 16°40'E | 27.5500°S 16.6667°E |
| Gaub Pass | 23°30'S 15°46'E | 23.5000°S 14.7667°E |
| Gibeon, SW of | 25°20'S 17°29'E | 25.3333°S 17.4833°E |
| Gibeon, SW of, 41 km on 1089 | 25°20'S 17°29'E | 25.3333°S 17.4833°E |
| Gobabeb, see Namib Desert Research Station | | |
| Gobabeb, 5 km N of | ca 23°27'S 15°00'E | ca 23.45°S 15.0000°E |
| Gobabeb, 8 km S of | ca 23°49'S 17°14'E | ca 23.8198°S 17.2261°E |
| Gobabis | 22°26'S 18°58'E | 22.4333°S 18.9667°E |
| Grootberg Pass, western end | 19°47'S 14°17'E | 19.7833°S 14.2833°E |
| Hentiesbaai, 20 km NE | 21°58'S 14°22'E | 21.9667°S 14.3667°E |
| Kalkveld, 3 km NE of | 20°51'S 16°12'E | 20.8500°S 16.2000°E |
| Kalkveld, 25 km NE of | 20°41'S 16°18'E | 20.6833°S 16.3000°E |
| Kamanjab | 19°38'S 14°50'E | 19.6333°S 14.8333°E |
| Karasburg | 28°00'S 18°45'E | 28.0000°S 18.7500°E |

| | Degrees and minutes | Decimal degrees |
|--|---------------------|---------------------|
| Karibib, 26 km N of | 21°42'S 15°58'E | 21.7000°S 15.9667°E |
| Karibib, 23 km N of | 21°44'S 15°58'E | 21.7333°S 15.9667°E |
| Karibib, 15 km W of | 21°57'S 15°43'E | 21.9500°S 15.7167°E |
| Karibib to Omaruru | 21°51'S 15°55'E | 21.8500°S 15.9167°E |
| Keetmanshoop | 26°35'S 18°08'E | 26.5833°S 18.0133°E |
| Keetmanshoop, 48.28 km SE of | 27°50'S 18°32'E | 27.8333°S 18.4444°E |
| Khorixas, 38 km W of | 20°27'S 14°45'E | 20.45°S 14.75°E |
| Khorixas, 120 km on rd to Palm | 20°17'S 14°05'E | 20.2833°S 14.0833°E |
| Khorixas Rest Camp, 5 km N of | 20°20'S 14°55'E | 20.3333°S 14.9167°E |
| Khorixas, 15 km on rd to Palm | 20°26'S 14°54'E | 20.4333°S 14.9000°E |
| Klinghardtberge | 27°20'S 15°45'E | 27.3333°S 15.7500°E |
| Kuiseb/Gaub Passes | 23°27'S 15°46'E | 23.4500°S 15.7667°E |
| Kuiseb/Gaub Passes | 23°24'S 15°50'E | 23.4000°S 15.8333°E |
| Mariental, 5 km S of | 24°40'S 17°57'E | 24.6667°S 17.9500°E |
| Namib Desert Research Station, Gobabeb | 23°34'S 15°03'E | 23.5500°S 15.0333°E |
| Naribis | 20°16'S 16°23'E | 20.6667°S 16.3833°E |
| Nomtsas Farm | 24°25'S 16°51'E | 24.4167°S 16.8500°E |
| Okahandja | 21°59'S 16°55'E | 21.9833°S 16.9167°E |
| Okahandja, 70 km N of | 21°22'S 16°50'E | 21.3667°S 16.8333°E |
| Okahandja, 9 km W of, Leeu R. | 21°58'S 16°50'E | 21.9667°S 16.8333°E |
| Omaruru, 6 km N of | 21°27'S 15°59'E | 21.4500°S 15.9833°E |
| Omaruru/Usakos | 21°41'S 15°59'E | 21.6833°S 15.9833°E |
| Omaruru, 30km S of on road to Karibib | 21°41'S 15°59'E | 21.6833°S 15.9833°E |
| Omatjete, WNW on D2344 | 20°57'S 15°14'E | 20.9500°S 15.2333°E |
| Onze Rust | 24°09'S 18°02'E | 24.1500°S 18.0333°E |
| Osire | 21°01'S 17°22'E | 21.0167°S 17.3667°E |
| Otjiwarongo | 20°28'S 16°39'E | 20.4642°S 16.6528°E |
| Otjiwarongo, 44 km SW | 20°37'S 16°22'E | 20.6167°S 16.3667°E |
| Palmwag, 7 km N of | 19°51'S 13°54'E | 19.8500°S 13.9000°E |
| Rehoboth/Gamsberg | 23°10'S 16°42'E | 23.1666°S 16.7000°E |
| Rooibank, Kuiseb River bed | 23°11'S 14°39'E | 23.1833°S 14.6700°E |

| | Degrees and minutes | Decimal degrees |
|---|---------------------|------------------------|
| Rooibank Desert Park | 23°11'S 14°38'E | 23.1833°S 14.6333°E |
| Rosh Pinah, 16 km S of | 28°04'S 16°51'E | 28.0667°S 16.8500°E |
| Skeleton Coast Park, east of on 3245 | 20°14'S 13°53'E | 20.2333°S 13.8833°E |
| Springbokwater, 12 km E of | 20°15'S 13°44'E | 20.2500°S 13.7333°E |
| Swakopmund, 5 km E of | 22°40'S 14°34'E | 22.6667°S 14.5631°E |
| Swakopmund, 63 km E of | 22°45'S 15°02'E | 22.7500°S 15.0333°E |
| Swakopmund, 117 km on rd to Usakos | 22°02'S 15°17'E | 22.0333°S 15.2833°E |
| Uis to Omaruru | 21°14'S 15°00'E | 21.2333°S 15.0000°E |
| Uis to Henties Bay | 21°27'S 14°45'E | 21.4500°S 14.7500°E |
| Uniab River, near Two Palms | 19°53'S 13°54'E | 19.8833°S 13.9000°E |
| Usakos, 17–19 km E of | 21°59'S 15°42'E | 21.9833°S 15.7000°E |
| Usakos, 8 km W of | 21°59'S 15°31'E | 21.9833°S 15.5167°E |
| Usakos, 34 km SW of | 22°02'S 15°17'E | 22.0333°S 15.2833°E |
| Usakos, 1–5 km E of | 21°58'S 15°36'E | 21.9667°S 15.6000°E |
| Usakos, 25 km NEE of | 21°52'S 15°19'E | 21.8667°S 15.3167°E |
| Walvis Bay | 22°57'S 14°30'E | 22.95°S 14.5000°E |
| Walvis Bay, 11 km E of | 22°25'S 14°37'E | 22.9833°S 14.6167°E |
| Walvis Bay, 147 E of | ca 23°15'S 15°24'E | ca 23.25°S 15.4000°E |
| Witvlei, 40 km W of | ca 22°22'S 18°08'E | ca 22.3667°S 18.1333°E |
| Junction 1237 and C26, 18 km W of | 23°09'S 16°42'E | 23.1500°S 16.7000°E |
| SOUTH AFRICA | | |
| Alexander Bay, 23 km S of | 28°46'S 16°37'E | 28.7667°S 16.6167°E |
| Anenous | 29°38'S 18°00'E | 29.6333°S 18.0000°E |
| Bloukrans [Pass] near Calvinia | 31°40'S 19°45'E | 31.6667°S 19.7500°E |
| Brandkaros, west of | 28°29'S 16°40'E | 28.4833°S 16.6667°E |
| Britstown | 30°35'S 23°30'E | 30.5833°S 23.5000°E |
| Bulshoek Dam | 32°03'S 18°49'E | 32.0367°S 18.8203°E |
| Cape Town, 60 km N of | ca 33°24'S 18°40'E | ca 33.4000°S 18.6667°E |
| Calvinia | 31°29'S 19°46'E | 31.4750°S 19.7728°E |
| Ceres, 43 km ENE of on road to Sutherland | 33°14'S 19°42'E | 33.2333°S 19.7000°E |
| Ceres, upper sources of Olifants River | ca 33°05'S 19°14'E | ca 33.0833°S 19.2333°E |
| Citrusdal | 32°35'S 19°01'E | 32.2500°S 19.0000°E |
| Citrusdal, 8 miles (12.88 km) north of | 32°28'S 18°54'E | 32.4600°S 18.9000°E |
| Citrusdal, 20 km N of | ca 32°26'S 18°54'E | ca 32.4333°S 18.9000°E |

| | Degrees and minutes | Decimal degrees |
|--|---------------------|---------------------|
| Clanwilliam | 32°11'S 18°53'E | 32.1786°S 18.8911°E |
| Clanwilliam Dam | 32°12'S 18°54'E | 32.1917°S 18.8950°E |
| Clanwilliam Dam, Caleta Cove | 32°14'S 18°56'E | 32.2389°S 18.9292°E |
| Clanwilliam, 5 km west of on road to Graafwater | 32°10'S 18°15'E | 32.1667°S 18.8333°E |
| Clanwilliam, 11 km west of on road to Graafwater | 32°10'S 18°47'E | 32.1667°S 18.7833°E |
| Clanwilliam, 12 miles (19.3 km) north of | 32°03'S 18°49'E | 32.0367°S 18.8203°E |
| Clanwilliam, 4 miles (6.44 km) south of on old road to Citrusdal | 32°14'S 18°54'E | 32.2333°S 18.9000°E |
| Clanwilliam, 10 km S of | 32°15'S 18°51'E | 32.2500°S 18.9333°E |
| Clanwilliam, 15 km south of on old road to Citrusdal | 32°19'S 18°56'E | 32.3167°S 18.9333°E |
| Clanwilliam, 16.5 km south of on old road to Citrusdal | 32°20'S 18°57'E | 32.3333°S 18.9500°E |
| Clanwilliam, 19 km south of on old road to Citrusdal | 32°21'S 18°57'E | 32.3500°S 18.9417°E |
| Clanwilliam, 20 km south of on old road to Citrusdal | 32°22'S 18°57'E | 32.3667°S 18.9500°E |
| Clanwilliam, 17.5 km north of on road (R363) to Klaver | 32°01'S 18°49'E | 32.0500°S 18.8333°E |
| Clanwilliam, 24km NE of | ca 32°6'S 19°3'E | ca 32.2°S 19.05°E |
| Clanwilliam, 38 kn NE of | ca 32°2'S 19°12'E | ca 32.0333°S 19.2°E |
| Concordia | 29°33'S 18°00'E | 29.5500°S 18.0000°E |
| Concordia, 14 km N of | 29°26'S 17°57'E | 29.4333°S 17.9500°E |
| Constable | 25°49'S 23°26'E | 25.8567°S 23.4333°E |
| Die Koei | 28°17'S 16°59'E | 28.2833°S 16.9833°E |
| Doorn River Falls [north of Nieuwoudtville] | 31°19'S 19°07'E | 31.3167°S 19.1167°E |
| Doringbos, NE of Clanwilliam | 31°58'S 19°14'E | 31.9667°S 19.2333°E |
| Eksteenfontein, Namaqualand | 28°50'S 17°15'E | 28.3333°S 17.2500°E |
| Eksteenfontein, 42 km S of | 29°06'S 17°26'E | 29.1000°S 17.4333°E |
| Garies | 30°33'S 17°59'E | 30.5500°S 17.8833°E |
| Goegap | 29°38'S 17°59'E | 29.6333°S 17.9833°E |
| Goodhouse | 28°54'S 18°15'E | 28.9000°S 18.2500°E |
| Groenkloof, between Clanwilliam and Algeria | 32°19'S 19°02'E | 32.3167°S 19.0333°E |
| Fullarton | 33°11'S 23°50'E | 33.1833°S 23.8333°E |
| Hester Malan Nature Reserve = Goegap | | |
| Het Kruis | 32°36'S 18°45'E | 32.6000°S 18.7500°E |

| | Degrees and minutes | Decimal degrees |
|--|---------------------|------------------------|
| Hex River | 33°24'S 19°46'E | 33.4000°S 19.7667°E |
| Kamieskroon | 30°12'S 17°56'E | 30.2000°S 17.9333°E |
| Kamieskroon, Bakleikraal | 30°13'S.18°03'E | 30.2167°S 18.0500°E |
| Kamieskroon, Bowesdorp | 30°20'S 17°56'E | 30.3333°S 17.9333°E |
| Kamieskroon, 6 km N of, Farm Arkoep | 30°19'S 17°56'E | 30.3167°S 17.9333°E |
| Kamieskroon, Farm Dassiefontein | 30°09'S 17°59'E | 30.1500°S 17.9833°E |
| Khubus/Ochta, near Vyfsusters Mt. | 28°12'S 16°55'E | 28.2000°S 16.9167°E |
| Klaver/Clanwilliam, Bulshoek | 32°01'S 18°47'E | 32.0167°S 18.7833°E |
| Koeroegabvlakte, Richtersveld National Park | 28°11'S 17°03'E | 28.1833°S 17.0500°E |
| Koup | 33°07'S 21°17'E | 33.1167°S 21.2833 °E |
| Laingsburg | 33°12'S 20°51'E | 33.2500°S 21.0000°E |
| Lamerfontein, Moordenaars Karoo | ca 32°22'S 19°54'E | ca 32.2167°S 19.9000°E |
| Lammerkraal, Prince Albert District | ca 33°13'S 22°02'E | 33.2253°S 22.0300°E |
| Leipoldtville | 32°13'S 18°29'E | 32.222°S 18.481°E |
| Matjiesfontein | 32°58'S 18°16'E | 32.9667°S 18.2667°E |
| Merweville, Dikbome, Koup | 32°54'S 21°22'E | 32.9000°S 21.3667°E |
| Mesklip | 29°50'S 17°51'E | 29.83°S 17.85°E |
| Montague | 33°47'S 20°07'E | 33.7833°S 20.1167°E |
| Moordenaars Karoo | ca 32°58'S 20°49'E | ca 32.9667°S 20.8167°E |
| Moedverloren Nature Reserve | 31°24'S 18°34'E | 31.3942°S 18.5610°E |
| Murraysburg | 32°33'S 19°16'E | 32.5500°S 19.2667°E |
| Nababeep, Namaqualand | 29°36'S 17°48'E | 29.6000°S 17.8000°E |
| Naib | 29°21'S 18°20'E | 29.3500°S 18.3333°E |
| Nieuwoudtville | 31°23'S 19.06'E | 31.3667°S 19.1000°E |
| Nieuwoudville Flower Reserve | 31°22'S 19.09'E | 31.3667°S 19.1500°E |
| Nieuwoudtville, 15 km north on road to Loriesfontein | 31°16'S 19.00'E | 31.2667°S 19.0000°E |
| Oudtshoorn, Onverwacht | 33°38'S 22°15'E | 33.6264°S 22.2382°E |
| Pakhuis Pass | 32°04'S 19°05'E | 32.0667°S 19.0833°E |
| PakhuisPass, east of | ca 32°16'S 19°13'E | ca 32.2742°S 19.2092°E |
| Paleisheuwel | 32°28'S 18°43'E | 32.4794°S 18.7208°E |
| Pofadder, Bushmanland | 29°08'S 19°24'E | 29.1286°S 19.3947 °E |
| Port Nolloth, 60 km N of | 28°47'S 16°38'E | 28.7833°S 16.6333°E |
| Port Nolloth, 67 km east of | ca 29°38'S 18°00'E | ca 29.6333°S 18.0000°E |

| | Degrees and minutes | Decimal degrees |
|--|---------------------|------------------------|
| Port Nolloth, 70 km east of | ca 29°38'S 18°00'E | ca 29.6333°S 18.0000°E |
| Putsonderwater | 29°14'S 21°53'E | 29.2333°S 21.8833°E |
| Rietbron | 32°54'S 23°09'E | 32.9000°S 23.1500°E |
| Springbok, Bloukrans Farm | 29°43'S 17°55'E | 29.7167°S 17.9167°E |
| Skouerfontein | 28°47'S 17°10'E | 28.78333°S 17.1667°E |
| Steinkopf, 10 km west of = Anenous | | |
| Tankwa Karoo | ca 32°15'S 19°45'E | ca 32.2500°S 19.7500°E |
| Tankwa Karoo, Renoster River | ca 32°16'S 20°05'E | ca 32.2667°S 20.0833°E |
| Tierberg, Prince Albert District | 33°08'S 22°16'E | 33.1283°S 22.2733°E |
| Touws River/Hondewater | ca 33°39'S 20°46'E | 33.6500°S 20.6667°E |
| Touws River, 18 miles (28.97 km) east of to Hondewater | ca 33°39'S 20°46'E | 33.6500°S 20.6667°E |
| Touws River, 18 miles (28.97 km) SE of | ca 33°39'S 20°46'E | 33.6500°S 20.6667°E |
| Twee Rivieren | 26°28'S 20°37'E | 26.4667°S 20.6167°E |
| Twee Rivieren, 11 km on road to Nossob, river bed | 26°24'S 20°41'E | 26.4000°S 20.6833°E |
| Upington | 28°24'S 21°16'E | 28.40111°S 21.25972°E |
| Upington, 123 km N on road 360 to Kgalagadi | 27°30'S 20°48'E | 27.5000°S 20.8000°E |
| Upington, 61 km N on road 360 to Kgalagadi | 27°58'S 20°59'E | 27.9667°S 20.9833°E |
| Van Rhy'n's Pass | 31°23'S 19°01'E | 31.3833°S 19.0167°E |
| Veldrif, 25 km east of | ca 32°47'S 18°24'E | ca 32.7833°S 18.4000°E |
| Voelklip, south of Springbok | 29°45'S 17°22'E | 29.7500°S 17.3667°E |
| Vioolsdrif | 28°46'S 17°39'E | 28.7750°S 17.6250°E |
| Vioollsdrif, 53 km S of | 29°10'S 17°50'E | 29.1667°S 17.8333°E |
| Waterford, 4 miles (6.44 km) east of | 33°04'S 25°07'E | 33.0667°S 25.1167°E |
| Whitehill [railway station south east of Matjiesfontein] | 33°14'S 20°38'E | 33.2333°S 20.6333°E |
| Wildeperdehoek Pass, west end | 29°56'S 17.38'E | 29.9392°S 17.6250°E |
| Willowmore | 33°18'S 23°30'E | 33.3000°S 23.4833°E |
| Willowmore, 9 km E of | 33°15'S 23°34'E | 33.2500°S 23.5667°E |
| Worcester | 33°39'S 19°26'E | 33.6500°S 19.3333°E |