

## A Revision of the Wasp Tribe Palarini Schrottky, 1909 (Hymenoptera: Apoidea: Crabronidae)

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The tribe Palarini, including the genera *Mesopalarus* Brauns and *Palarus* Latreille, is redefined and revised for the first time. Mesopalarini Lomholdt, 1985, are synonymized with Palarini Schrottky, 1909. A cladistic analysis of the tribe is performed, and a key to species of *Palarus* is provided. In *Palarus*, one new species is described by Pulawski: *arabicus* (Saudi Arabia), and the following five by Pulawski and Prentice: *furtivus* (Namibia, South Africa), *gao* (Burkina Faso, Mali), *jaxartes* (Kazakhstan, Turkmenistan), *gynaecotrichus* (Burkina Faso, Ivory Coast, Togo), and *nama* (Namibia, South Africa), while *Palarus handlirschi* var. *nigrior* Arnold, 1923, is raised to a subspecies of *maculatus* and *Palarus handlirschi* var. *occidentalis* Arnold to full species rank. *Palarus almeriensis* Gayubo, Asis, and Tormos, 1992 is reduced to a subspecies of *ambustus* Klug, 1845. The following are new synonyms in *Palarus*: *aurantiacus* Radoszkowski, 1893, *spinolae* de Saussure, 1854, *spinolae niger* de Beaumont, 1949, and *leleji* Nemkov, 2005 = *fulviventris* Latreille, 1812; *beaumonti* Bytinski-Salz, 1957, and *incertus* Radoszkowski, 1893 = *funerarius* F. Morawitz, 1889; *fabi* Nurse, 1903 = *laetus* Klug, 1845; *fortistriolatus* Cameron, 1907 = *variegatus* (Fabricius, 1781); *handlirschi* Brauns, 1911 = *maculatus* Dahlbom, 1845; *hastatifrons africanus* de Beaumont, 1949, and *hastatifrons oceanicus* de Beaumont = *hastatifrons* Turner, 1919; *multiguttatus* Arnold, 1960, *rothschildi* Magretti, 1908, and *rothschildi croesus* Arnold, 1951 = *oneili* Brauns, 1899; *rochei* Guichard, 1988 = *bisignatus* F. Morawitz, 1890.

The tribe Palarini is an Old World group of apoid wasp comprised of the genera *Palarus* and *Mesopalarus* that represent one of the most morphologically and biologically divergent groups of Crabroninae. The members of the tribe are, for the most part, recognizable at a distance by their often brightly marked, robust body. Although including only two genera, the tribe is diverse morphologically, particularly with respect to the gaster.

Until recently, Palarini included the single genus *Palarus* (Bohart and Menke, 1976), whereas the phylogenetic affinities of *Mesopalarus* had been problematic, partly because the male was unknown. Brauns (1899) thought *Mesopalarus* was a relative of *Palarus*, and Arnold (1923) suggested affinity with the miscophine genus *Paranysson*, based on similarities in overall coloration, body, and head form. Bohart and Menke (1976) placed *Mesopalarus* in the Miscophini as a distant relative of *Paranysson*, although pointing out similarities with, of all taxa, the philanthine genus *Pseudoscolia*. It is now clear, however, that characters shared by *Mesopalarus* and Miscophini are symplesiomorphic, and are not a proper basis for associating these taxa. Gess (1996) described the male and found several characters to link *Mesopalarus* with *Palarus*, and Prentice (1998, unpublished doctoral thesis) placed *Mesopalarus* in Palarini. Although close relatives, the two genera are widely divergent in a range of characters, as detailed below.

**TECHNICAL TERMS.**—Most morphological terms used here are as in Bohart and Menke (1976), but the following are different, may be unfamiliar, need further clarification, or are new. Several of these terms follow Prentice (1998).

**Adductor convexity:** the convex median surface of the base of the mandible.

**Adductor ridge swelling:** the ventral (= posterior) convexity that forms the apical margin of the posteroventral mandibular notch. See also posteroventral subbasal mandibular tooth.

**Adlateral carina:** a carina next to the lateral margin, e.g., the oblique carina on each side of the basal concavity of tergum I, or the longitudinal carina near the lateral free margin of male tergum VII.

**Admarginal carina of propodeum:** a new term for the transverse carina near the propodeal hindmargin (just above the gastral articulation) that extends laterad to the hindcoxa.

**Anterior pronotal groove:** a new term indicating a transverse groove near the anterior margin of the pronotum.

**Condylar ridge:** a ridge on the ventral surface of the mandible that extends from near the mandibular condyle to near the outer mandibular apex. In Palarini, a portion of the ridge is expanded to form the posteroventral subbasal mandibular tooth.

**Disk:** central, convex part of a sclerite, e.g., scutal disk, scutellar disk.

**Episcrobal area:** the portion of the mesopleuron above the scrobal groove and below the subalar fossa (from Budrys, 1990, 1993). Bohart and Menke (1976) called it the hypoepimeral area, a morphologically inaccurate term meaning “area under the epimeron”.

**Frontal swelling:** a raised, conspicuously convex part of the frons above and between the antennal sockets and below the midocellus.

**Galeal crease:** a transversely to longitudinally oriented line of articulation or reduced sclerotization on the galea. The crease arises near the base of the maxillary palpus.

**Genitalia:** the basal and apical portions are separated by a prominent bend.

**Gonocoxite:** the paired, lateral-most, forceps-like part of the male genitalia. This has often been termed the gonostyle (e.g., Bohart and Menke 1976), but recent apoid wasp workers have preferred gonocoxite (e.g., Prentice 1998; Melo 1999), as used by others (e.g., Michener 1944; E. Smith 1970).

**Humeral plate:** a sclerotized plate located basad of the origin of the costal and subcostal veins of the forewing and partly covered by the tegula.

**Inner subbasal mandibular tooth and notch:** a tooth and associated notch of the cutting edge of the basal half of the mandible (the cutting edge is the trimmal carina of Michener and Fraser, 1978).

**Intersubmarginal veins:** the 1<sup>st</sup> and 2<sup>nd</sup> radiomedial crossveins of the forewing.

**Lateroclypeal notch:** a small, discrete notch on the clypeal free margin positioned near the ventral end of the lateroclypeal sulcus. Typically the notch opposes the subbasal mandibular notch.

**Lateroclypeal sulcus:** a vertical sulcus emerging from the anterior tentorial pit and separating the median part of the clypeus, or medioclypeus, from the lateral portion, or lateroclypeus (Lomholdt, 1985). The sulcus corresponds to the lateroclypeal ridge on the inner wall of the head.

**Lateroclypeus:** the lateral portion of the clypeus, laterad of the lateroclypeal sulcus (Lomholdt, 1985).

**Macula (adjective: maculate):** a white, yellowish, or yellow spot caused by underlying pterine pigment showing through translucent cuticle.

**Medioclypeus:** the area between the lateroclypeal sulci (Lomholdt, 1985).

**Midocellar width:** the diameter of the midocellus measured transversely. This measure is made from the very edge of the ocellar lens which is typically slightly beyond the light area of the ocellus. We prefer this term to “midocellar diameter” because the midocellus is oval in the *Palarus latifrons* species group.

**Ocellar triangle:** the area between the ocelli and the ocelli themselves.

**Ocellocular distance:** shortest distance between lateral ocellus and compound eye.

**Orbit:** the very margin of the cranium in contact with the compound eye (i. e., the ocular sclerite).

**Paraocular macula:** a macula that covers nearly all of the paraocular area below the vertex, but is absent from the rest of the frontal area.

**Posteroventral subbasal mandibular tooth:** an obtuse tooth on the basal portion of the posterior edge of the mandible that represents an expansion of the basal portion of the condylar ridge. The tooth forms the proximal margin of the posteroventral mandibular notch (= externoven-tral mandibular notch of Bohart and Menke, 1976).

**Precoxal carina:** an obtuse, vertically oriented and sometimes barely indicated mesopleural carina before the midcoxa in some members of the *variegatus* group of *Palarus*. Bohart and Menke (1976) called an analogous structure of some Crabronini either the precoxal carina or verticaulus. We prefer the precoxal carina because the term verticaulus implies a grooved form (*aulon* is Greek for channel).

**Preepisternal area:** part of mesopleuron anterad of episternal sulcus, frequently (e.g., Bohart and Menke, 1976) but incorrectly called the prepectus.

**Pronotal collar:** the posterior, typically raised portion of the pronotum. The anterior boundary of the collar is formed by the streptaulus.

**Propleural hamus:** a curved lamella at the posterolateral corner of the propleuron.

**Pygidial process, lateral:** a new term to describe the toothlike elaboration of the pygidial carina of the males of Palarini (except for the *maculatus* group of *Palarus*). The process is mostly preapical, but more basal in the *interruptus* group of *Palarus* and in *Palarus laetus*.

**Pygidial process, median:** a new term to describe the toothlike median apex of tergum VII in some male *Palarus*.

**Scutal flange** (Bohart and Menke 1976:409, 453; Menke 1988): a curving lateral scutal carina that borders the tegula. Called parascutal carina by Tulloch (1935), Gibson (1985), and Ronquist and Nordlander (1989).

**Scutellar flange:** posterolateral, translucent margin of scutellum, posterad of lateral fossa.

**Scutellum:** shortened term for mesoscutellum.

**Scutum:** shortened term for mesoscutum.

#### **Setae**

**reflective:** generally thick setae that prominently reflect light from their internal surface and often impart a silvery appearance to the frons and, in some species, to parts of the thorax and propodeum.

**sinuous:** generally thin and often elongate setae, subtly sinuous in shape. These setae may impart a slight woolly appearance to the gena and propodeum, as in the *maculatus* group.

**Simple:** without any specialized structure or modification, e.g., the simple second sternum of the females of *Mesopalarus* and most *Palarus*.

**Sternum, tergum:** abbreviated terms for gastral sternum, gastral tergum.

**Streptaulus:** a transverse pronotal sulcus that extends between the bases of the pronotal lobes and separates the collar from the anterior pronotal rim.

**SOURCES OF MATERIAL.**— This study is based on the examination of 4,997 specimens. The following is a list of institutional and personal collections where the material is housed (the capitalized abbreviations preceding the names are used in the text to designate these collections; the name of the contact person is omitted if no material was borrowed for this study):

- AMG: Albany Museum, Grahamstown, South Africa (Friedrich W. Gess).  
 AMNH: American Museum of Natural History, New York, New York, USA (James M. Carpenter, John S. Ascher).  
 BALDOCK: David W. Baldock, Milford, Surrey, United Kingdom (personal collection).  
 BMNH: The Natural History Museum, London, Great Britain, formerly British Museum (Natural History) (George Else).  
 CAS: California Academy of Sciences, San Francisco, California, USA.  
 CSE: Christian Schmid-Egger, Herrsching-Breitbrunn, Germany (personal collection).  
 DB: Denis Brothers, School of Biological and Conservation Sciences, University of KwaZulu-Natal, Scottsville, South Africa (personal collection).  
 FSAG: Faculté Universitaire des Sciences Agronomiques, Gembloux, Belgium (Alain Pauly).  
 KU: Snow Entomology Collection, University of Kansas Natural History Museum (Zachary H. Falin).  
 KRAKÓW: Zakład Systematyki i Ewolucji Zwierząt, Polska Akademia Nauk, Kraków, Poland (Waldemar Celary).  
 LACM: Natural History Museum of Los Angeles County, Los Angeles, California, USA (Roy R. Snelling).  
 LAUSANNE: Musée Cantonal de Zoologie, Lausanne, Switzerland.  
 MILANO: Museo Regionale di Scienze Naturali, Milano, Italy.  
 MNHN: Muséum National d'Histoire Naturelle, Paris, France (Claire Villemant).  
 MS: Maximilian Schwarz, Ansfelden near Linz, Austria (personal collection).  
 MÜNSTER: Westfälisches Museum für Naturkunde, Münster, Germany.  
 NHMW: Naturhistorisches Museum, Wien, Austria (the late Stefan Schödl).  
 NRS: Naturhistoriska Riksmuseet, Stockholm, Sweden.  
 OHL: Michael Ohl, Berlin, Germany (personal collection).  
 OÖLM: Oberösterreichs Landesmuseum, Linz, Austria (Fritz Gusenleitner).  
 OXUM: Oxford University Museum of Natural History, Oxford, United Kingdom.  
 PPRI: Plant Protection Research Institute, Pretoria, South Africa (Connal D. Eardley).  
 RMNH: Nationaal Natuurhistorisch Museum, Leiden, the Netherlands, formerly Rijksmuseum van Natuurlijke Historie (Kees van Achterberg).  
 SAM: South African Museum, Iziko Museums of Cape Town, Cape Town, South Africa (Margie Cochrane).  
 STUTTGART: Staatliches Museum für Naturkunde in Stuttgart, Stuttgart, Germany (Till Osten via Michael Ohl).  
 TMP: Transvaal Museum, Pretoria, South Africa (Barbara Dombrowski, Martin Kruger).  
 UCD: Bohart Museum of Entomology, University of California, Davis, California, USA (Steven L. Heydon).  
 USNM: United States National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA (the late Karl V. Krombein).  
 USU: Utah State University, Logan, Utah, USA (Terry L. Griswold).  
 ZMHU: Zoologisches Museum der Humboldt Universität, Berlin, Germany (Frank Koch).  
 ZMMU: Zoological Museum, Moscow State University, Russia (Alexandr V. Antropov).  
 ZMUC: Zoological Museum, University of Copenhagen, Copenhagen, Denmark (Lars Bjørn Vilhelmsen).



### PALARINI SCHROTTKY

Palarini Schrottky, 1909:249. Based on *Palarus* Latreille, 1802 (stem: *Palar*). Originally spelled Palaridae.

Palarini Börner, 1919:185. Based on *Palarus* Latreille (stem: *Palar*-).

Mesopalarini Lomholdt, 1985:22. Based on *Mesopalarus* Brauns (stem: *Mesopalar*). New synonym.

**AUTHORSHIP.**— Menke (1997) accepted Börner (1919) as the author of Palarini, but Menke and Pulawski (2002) demonstrated that the name was first used by Schrottky (1909:249).

**RECOGNITION.**— Palarini may be recognized as members of Crabroninae by the following combination: lack of a preapical tooth on the inner mandibular margin, presence of a posteroventral subbasal mandibular tooth or step in most species, lack of volsella, and the presence of a single midtibial spur (spur lacking in three species of *Palarus*). The tribe has the other characters of the subfamily, as listed by Bohart and Menke (1976), with the only exception that the clypeus is somewhat lengthened in some species (*Palarus bisignatus* and *hastatifrons*), rather than transverse. The larvae of *Palarus* (unknown in *Mesopalarus*) are also clearly identifiable as Crabroninae by their preapical anus (Grandi, 1961; Gayubo et al., 1992), an important synapomorphy of the subfamily.

The tribe differs from other Crabroninae in the separation of the antennal socket from the epistomal sulcus by at least 0.5 antennal socket diameter (e.g., Figs. 2a, 49a, b); a longitudinal orientation of the galeal crease (Figs. 2e, 7a); the female labrum divided by a transverse carina into basal and apical portions (carina conspicuous except concealed by clypeus in *Mesopalarus* and the *maculatus* group of *Palarus*); a highly modified male tergum VII that in most species bears two or three processes; presence of an adlateral carina on male tergum VII (carina tooth-like in *Mesopalarus*, tubercle-like in *Palarus latifrons*, absent in *Palarus interruptus* and *gynaecotrichus*); and a prominently raised transverse elevation on male sternum II. In the other Crabroninae, the antennal socket is in contact with the epistomal sulcus except in *Trypoxylon* and *Pisoxylon* (in which, unlike Palarini, the inner orbit is emarginate); the galeal crease is oriented transversely across the galea (except longitudinally in *Laphyragogus ajjer* de Beaumont, *pictus* Kohl, and *visnagae* de Beaumont, and in *Tachysphex mkomazi* Pulawski); the labrum has no transverse carina; male tergum VII is simple and has no adlateral carina; and male sternum II has no transverse elevation (except in most *Larissus rieki* Menke).

**DESCRIPTION.**— In addition to the above characters, Palarini share the following: maxillary palpus short, shorter than half length of stipes; labial palpus short, shorter than half length of prementum; paramandibular process not lengthened, not fused with clypeus; postspiracular carina of mesopleuron absent; episternal and scrobal sulci present; propodeal enclosure visible externally, apex extending onto propodeal posterior surface, with median impression dorsally (Figs. 3b, 17, 25a, 29f, 56e, 61); forewing and hindwing vein cu-a prefurcal; marginal cell truncate; two recurrent veins present; jugal lobe of hindwing about half length of anal area; midcoxae widely separated, hindcoxae contiguous or nearly so; female tergum VI with pygidial plate; volsella absent.

**INCLUDED GENERA.**— The tribe consists of two genera, *Mesopalarus* and *Palarus*. Their differentiating characters are summarized in Table I.

**PHYLOGENETIC ANALYSIS.**— Prentice (1998) found that the tribe Palarini is a member of the following clade: ... + Dinetini + (Eremiasphecini + Laphyragogini) + (Palarini + (Larrini + (Miscophini + Trypoxylini + (Botynostethini + (Oxybelini + Crabronini))))). The following species have been selected as the outgroup: *Dinetus pictus* (Fabricius), *Laphyragogus pictus* Kohl, *Liris niger* (Fabricius), and *Lyroda subita* Say, representatives of Dinetini, Laphyragogini, Larrini, and Miscophini, respectively. Autapomorphies for the species of *Palarus* have been excluded.

TABLE I. Comparison of *Mesopalarus* and *Palarus*

Character	<i>Mesopalarus</i>	<i>Palarus</i>
Female gena:	unusually wide (Fig. 2c)	narrow
Head (color):	all black	at least clypeus partly yellow
Frontal swelling:	mesally divided	undivided
Clypeus:	with inverted V-shaped carina	without such carina
Lateroclypeal sulcus:	absent	present
Occipital carina:	separated from hypostomal carina by slightly more than midocellar width	reaching and fusing with hypostomal carina
Hypostoma:	vertical	inclined
Inner mandibular margin:	without tooth or notch	with subbasal tooth and associated notch
Mandibular adductor convexity:	markedly broadened	not broadened
Galeal crease:	fully developed, extending obliquely across width of galea (Fig. 2e)	shortened (Fig. 7a)
Glossa:	long, narrow, deeply emarginate (Fig. 2e, f)	short, broadly bilobed (Fig. 7a, b)
Propleural hamus:	present (Fig. 2d)	absent
Scutal flange:	broadened posteriorly, acutely expanded apically (Fig. 3a)	not broadened posteriorly, not projecting apically
Mesosternal precoxal sulcus:	absent medioventrally	present
Male mesothoracic venter:	with tubercle mesally before midcoxa (Fig. 4a)	without such tubercle
Propodeal enclosure:	not delimited by sulcus (Fig. 3b)	delimited by sulcus
Number of submarginal cells:	two	three
Foretrochanter:	unusually long in female (Fig. 3c), as long as distance from propleuron to foretrochanteral base; angulate in male (Fig. 3d).	of usual length, shorter than distance from propleuron to foretrochanteral base, simple in male
Foretarsal rake spines:	fine, dense, arising dorsally on apex of tarsomere I and on tarsomere II (Fig. 3e)	more robust, sparse, blade-like, arising from tarsomere's lateral margin
Male tergum VII:	without ventral lamella	with translucent lamella near ventral margin apically
Male sternum II (central elevation):	with a pair of anterolateral carinae (each carina produced into admedian tooth), posterior transverse carina with two prominent teeth, and broadly interrupted, low preapical carina posterad of elevation (Fig. 4e, f)	without teeth
Male sternum VI:	with dense lateral brush of short, thick setae (Fig. 4b)	without lateral brush of setae

## CLADISTIC ANALYSIS

The following is the list of characters examined in our study (the characters of the *variegatus* group of *Palarus* are attributed to the unknown female of *Palarus arabicus*).

- Head (color):** 0. all black, 1. clypeus yellow in one sex only, 2. clypeus at least partly yellow in both sexes (state 1 is found in *Dinetus pictus* and *Laphyragogus pictus*, state 2 in *Palarus*)
- Vertex width:** 0. hindocellus separated from orbit by more than hindocellar width in both sexes, 1. separated from orbit by more than midocellar width in female only, 2. separated from orbit by less than hindocellar width in both sexes (state 1 is found in *Mesopalarus* and *Dinetus pictus*, state 2 in the *maculatus*, *histrion*, and *variegatus* groups of *Palarus*).
- Postocellar depression:** 0. absent, 1. present (present in the *histrion* and *variegatus* groups of *Palarus*).
- Longitudinal crest of postocellar area:** 0. absent, 1. present (state 1 present in *Palarus comberi*, *nama*, and *obesus*).
- Frontal swelling:** 0. absent, 1. undivided, 2. mesally divided (state 1 is found in *Laphyragogus pictus* and in *Palarus*, state 2 in *Mesopalarus*)
- Frontal swelling:** 0. not delimited laterally, 1. delimited laterally by sulcus (sulcus present in the *interruptus* group of *Palarus*).
- Frontal paraocular macula:** 0. absent or present only above clypeus, or frons largely yellow, 1. well developed (state 1 is found in the *interruptus* group of *Palarus*).
- Antennal socket:** 0. in contact with epistomal sulcus, 1. separated from epistomal sulcus (separated in *Laphyragogus pictus* and all Palarini).
- Lateroclypeal sulcus:** 0. absent, 1. present (present in all *Palarus*).
- Inverted V-shaped carina on clypeus:** 0. absent, 1. present (present in *Mesopalarus*).
- Medioclypeal flange:** 0. simple, 1. differentiated into admedian and adlateral portions (differentiated in the *laetus* subgroup of *Palarus*).
- Lateroclypeal notch:** 0. absent or rudimentary, 1. present (present in all *Palarus* except the *laetus* subgroup).
- Posterior clypeal surface:** 0. without row of setae along free margin, 1. with row of setae (setae present in the *interruptus*, *histrion*, and *variegatus* groups of *Palarus*).
- Occipital carina:** 0. separated from hypostomal carina, 1. fused with hypostomal carina (fused in *Liris niger* and *Palarus*).
- Genal setae (length):** 0. shorter than basal mandibular width, 1. at least about as long as mandibular width in male and many females, 2. at least about as long as mandibular width in both sexes (state 1 is found in *Palarus rufipes*, state 2 in *Laphyragogus pictus*, in the *maculatus* group of *Palarus*, and in *Palarus bernardi*, *dongalensis*, *jaxartes*, and *latifrons*).
- Hypostoma:** 0. inclined, 1. vertical (vertical in *Mesopalarus*).
- Inner mandibular margin:** 0. with preapical tooth, 1. with subbasal tooth or notch, 2. without tooth or notch (state 0 is found in *Dinetus pictus*, state 1 in *Liris niger* and *Palarus*, state 2 in *Mesopalarus*).
- Posteroventral mandibular tooth and notch:** 0. well defined, 1. variable, 2. poorly defined (state 1 is found in *Palarus funerarius* and *laetus*, state 2 in *Palarus hastatifrons*, *histrion*, and *parvulus*).
- Labrum (transverse crest):** 0. absent, 1. present (present in Palarini).
- Labrum (shape):** 0. not or minimally convex, 1. conspicuously convex (convex in the *interruptus*, *histrion*, and *variegatus* groups of *Palarus*).
- Labrum (lateral expansion):** 0. without expansion, 1. expansion present (unique to *maculatus* group of *Palarus*).
- Galeal crease (orientation):** 0. oriented transversely, 1. oriented longitudinally (oriented longitudinally in *Laphyragogus pictus* and all Palarini).
- Galeal crease (length):** 0. fully developed, 1. shortened (shortened in all *Palarus*).
- Glossa:** 0. long, narrow, deeply emarginate, 1. short, narrowly bilobed, 2. short, broadly bilobed (state 1 is found in *Liris niger* and *Lyroda subita*, state 2 in *Palarus*).
- Streptaulus:** 0. separated from anterior pronotal groove, 1. fused with anterior pronotal groove (fused in *Mesopalarus* and the *maculatus* group of *Palarus*).

- Pronotal collar:** 0. raised posteriorly as narrow wedge, 1. not raised posteriorly as narrow wedge (state 1 is present in the *maculatus* groups of *Palarus*).
- Propleural hamus:** 0. absent, 1. present (present in *Liris niger* and *Mesopalarus*).
- Scutal flange:** 0. not broadened, 1. broadened (broadened in *Mesopalarus*).
- Mesopleural setae:** 0. not concealing integument, 1. entirely concealing integument at least below scrobe (state 1 is found in *Palarus laetus*, *parvulus*, and *pictiventris*).
- Mesosternal prexocal sulcus:** 0. complete, 1. absent medioventrally (absent in *Mesopalarus*).
- Metapleuron:** 0. uniformly microsculptured, dull, 1. punctate, 2. impunctate or with a few punctures, ridged dorsally in many specimens (state 1 is found in *Mesopalarus* and the *latifrons* group of *Palarus*, state 2 in the *histrion* and *variegatus* groups).
- Propodeal enclosure:** 0. not delimited by sulcus, 1. delimited by sulcus (state 1 is found in all *Palarus*).
- Propodeal dorsum (apicomedian area):** 0. ridged, 1. microsculptured (microsculptured only in the *maculatus* group of *Palarus*).
- Propodeal dorsum (setae):** 0. not reflective, 1. reflective (state 1 is found in *Dinetus pictus* and *Palarus laetus*, *parvulus*, and *pictiventris*).
- Number of submarginal cells:** 0. three, 1. two (state 1 is found in *Dinetus pictus* and *Mesopalarus*).
- Foretrochanter:** 0. short, nonangulate 1. elongate in female, angulate in male (elongate and angulate, respectively, in *Mesopalarus*).
- Foretarsal rake spines:** 0. sparse, stiff, 1. dense, flexible (dense in *Mesopalarus*).
- Hindfemur:** 0. without apical lobe, 1. with apical lobe (lobe present only in the *maculatus* group of *Palarus*).
- Length of midfemoral setae:** 0. smaller than midocellar width, 1. about as long as midocellar width in female, 2. about as long as midocellar width in male, 3. about as long as midocellar width or longer (state 1 is found in *Palarus gynaecotrichus*, state 2 in *Palarus comberi* and *obesus*, state 3 in *Palarus maculatus* and *nama*).
- Female head dorsally:** 0. not unusually wide, 1. unusually wide (state 1 is found in *Mesopalarus*).
- Female labrum (lateral expansion):** 0. expansion absent, 1. expansion present (expansion present in the *maculatus* species group of *Palarus*).
- Female labrum (longitudinal carina):** 0. carina absent, 1. carina present (carina present in the *interruptus*, *histrion*, and *variegatus* groups of *Palarus*).
- Dorsal spines of female midbasitarsus:** 0. about 20 or fewer, 1. about 30 or more (state 1 is found in *Palarus comberi* and *obesus*).
- Female hindtarsomeres II and III:** 0. apical spines equal in length, 1. outer apical spine markedly longer than inner spine (state 1 found in *Laphyragogus pictus* and the *histrion* group of *Palarus*).
- Female terga:** 0. with apex simple, 1. with apex double-edged or minimally truncate (double-edged in the *interruptus*, *histrion*, and *variegatus* groups of *Palarus*).
- Female tergum I:** 0. without adlateral carina, 1. with adlateral carina or swelling (carina present in the *histrion* subgroup and in the *variegatus* group of *Palarus*).
- Female tergum VI (apex):** 0. not thickened, 1. thickened dorsoventrally (thickened in the *interruptus*, *histrion*, and *variegatus* groups of *Palarus*).
- Female tergum VI (side):** 0. without longitudinal carina beneath pygidial plate, 1. carina present (carina present in the *interruptus*, *histrion*, and *variegatus* groups of *Palarus*).
- Female pygidial plate (sculpture):** 0. punctate, 1. coarsely ridged, 2. finely ridged (state 1 is found in the *maculatus* and *latifrons* groups of *Palarus*, and state 2 in the *variegatus* group).
- Female pygidial plate (platform):** 0. without raised platform; 1. with well-defined, raised platform (platform found only in the *maculatus* group of *Palarus*).
- Female sternum II:** 0. without transverse elevation, 1. elevation present, 2. with additional long platform behind elevation, 3. with additional short platform behind elevation (state 1 is present in *Palarus oneili* and *pentheri*, state 2 in *Palarus bernardi*, *dongalensis*, *fulviventris*, *gao*, *klugi*, *rufipes*, and *variegatus*, state 3 in *Palarus jaxartes* and *saundersi*).
- Female sternum VI:** 0. without flange, 1. with small flange overlapping ventral margin of tergum VI (flange present in the *interruptus*, *histrion*, and *variegatus* groups of *Palarus*).
- Male mesothoracic venter:** 0. without tubercle, 1. with tubercle before coxa (tubercle present in

*Mesopalarus*).

**Male forefemur:** 0. simple, 1. concave anteroventrally (state 1 is found in *Dinetus pictus* and in *Palarus bernardi* and *dongalensis*).

**Male foretibia:** 0. without black, apicoventral mark, 1. mark or marks present (state 1 found in *Palarus fulviventris* and *klugi*).

**Male forebasitarsus (shape):** 0. simple, 1. conspicuously widened (widened in *Palarus bernardi*, *dongalensis*, and *rufipes*).

**Male forebasitarsus (ventral setae):** 0. without row of ventral setae, 1. row of ventral setae present (state 1 is found in *Palarus jaxartes* and *saundersi*).

**Male forebasitarsus (ventral preapical tubercle):** 0. tubercle absent, 1. tubercle present (state 1 is found in *Palarus arabicus*, *jaxartes*, *oneili*, and *saundersi*).

**Male forebasitarsal rake spines:** 0. not broadened, 1. broadened, 2. spatulate (state 1 is found in *Dinetus pictus* and *Palarus rufipes*, state 2 in *Palarus bernardi* and *dongalensis*).

**Male mid- and hindtibiae with erect setae on venter:** 0. setae absent, 1. setae present (present in *Palarus comberi*, *nama*, and *obesus*).

**Male midtibial spur:** 0. present, 1. absent (spur absent in *Dinetus pictus* and in *Palarus bernardi*, *jaxartes*, and *saundersi*).

**Male midbasitarsus:** 0. simple, 1. markedly flattened laterally (state 1 is found in *Palarus fulviventris* and *klugi*).

**Male midtarsomeres II and III:** 0. simple, 1. with circular, translucent, apicoventral pad (pad present in *arabicus*, *jaxartes*, *oneili*, and *saundersi*).

**Male hindbasitarsus:** 0. not flattened, 1. flattened (state 1 is found in *Palarus bernardi* and *dongalensis*).

**Male tergum I:** 0. without adlateral carina, 1. with adlateral carina (carina present in *Palarus obesus* and the *histrion* and *variegatus* groups of *Palarus*).

**Male tergum VII:** 0. simple, 1. modified (in Palarini).

**Male tergum VII (orientation of apicomedian portion):** 0. apicomedian and basal portion in the same plane, 1. apicomedian portion curving ventrad at about the same angle as basal portion, 2. apicomedian portion either curving ventrad at about the same angle as basal portion, or markedly more, 3. apicomedian portion curving ventrad markedly more than basal portion (state 1 is found in *Palarus gao*, *jaxartes*, and *variegatus*, state 2 in *Palarus fulviventris*, state 3 in *Palarus bernardi*, *dongalensis*, *klugi*, *oneili*, *pentheri*, *rufipes*, and *saundersi*).

**Side of male tergum VII (concavity):** 0. simple, 1. conspicuously concave (concave in *Palarus bernardi*, *dongalensis*, and *rufipes*).

**Side of male tergum VII (additional carina):** 0. carina absent, 1. with additional carina between pygidial plate and adlateral carina (state 1 is found in *Palarus oneili* and *pentheri*).

**Side of male tergum VII (setae):** 0. inconspicuous, 1. conspicuous (state 1 is found in *Palarus bernardi*, *dongalensis*, *pentheri*, and *rufipes*).

**Male pygidial plate (lateral process):** 0. process absent, 1. basolateral process present, 2. apicolateral process present, not elevated or slightly elevated, 3. apicolateral process markedly elevated above tergal apex, 4. processes largely or completely fused together (state 1 is found in *Mesopalarus* and the *interruptus* group of *Palarus*, state 2 in the *histrion* group, state 3 in most members of the *variegatus* group of *Palarus*, state 4 in *Palarus arabicus*, *klugi*, *pentheri*, and *saundersi*).

**Male pygidial plate (basolateral expansion):** 0. expansion absent, 1. expansion present (present in *Palarus furtivus*, *maculatus*, and *occidentalis*).

**Adlateral carina on male tergum VII:** 0. absent, 1. present (in *Palarus* except *gynaecotrichus* and *interruptus*), 2. present, tubercle-like (in *Palarus latifrons*), 3. present, spine-like (in *Mesopalarus*).

**Adlateral carina of male tergum VII (shape):** 0. not expanded or slightly expanded, 1. conspicuously, roundly expanded (conspicuously expanded in *Palarus comberi*, *nama*, and *obesus*).

**Male sternum II:** 0. simple, 1. with transverse elevation (elevation present in all Palarini).

**Male sternum II (V-shaped ridge):** 0. ridge absent, 1. ridge present before elevation (ridge present in *Palarus comberi* and *obesus*).

**Male sternum II (transverse ridge before elevation):** 0. without ridge, 1. ridge present (present in *Palarus*





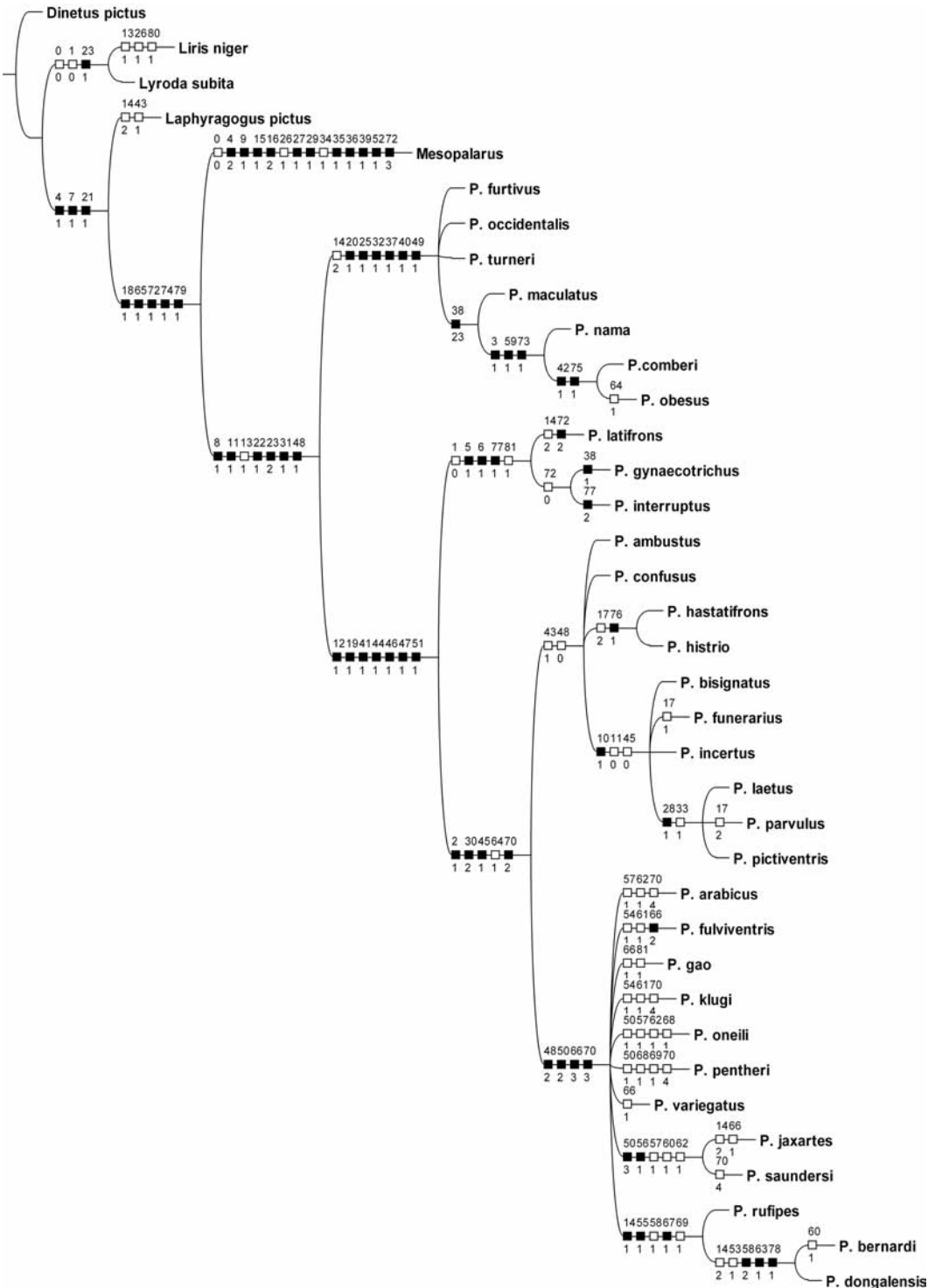


FIGURE 1. Phylogenetic tree of Palarini.

*Mesopalarus* Brauns, 1899

*Mesopalarus* Brauns, 1899:416. Type species: *Mesopalarus mayri* Brauns, 1899, by monotypy.

**INCLUDED SPECIES.**— *Mesopalarus* includes only one species, *mayri*, from South Africa and Namibia.

*Mesopalarus mayri* Brauns, 1899

Figures 2-6.

*Mesopalarus mayri* Brauns, 1899:420, ♀ (as *Mayri*, incorrect original capitalization). Holotype: ♀, South Africa: Port Elizabeth (TMP), examined.— Arnold, 1923c:16 (in revision of *Mesopalarus*), 1930:7 (in checklist of Afrotropical Sphecidae); Bohart and Menke, 1976:306 (listed); Gess, 1996:72 (description of ♂, revision, relationships).

*Mesopalarus turneri* Arnold, 1931:205, ♀ (as *Turneri*, incorrect original capitalization). Holotype: ♀, Namibia: Aus (BMNH), examined. Synonymized with *Mesopalarus mayri* by Gess, 1996:72.— Bohart and Menke, 1976:306 (listed).

**DESCRIPTION.**— In addition to the features listed in Table I, *Mesopalarus mayri* has the following: lateroclypeal notch absent, a rudimentary adlateral carina of tergum I present in larger males, female sternum II simple, female pygidial plate with minimally raised median longitudinal line (Fig. 3f), male gonocoxite membraneous ventrally (Fig. 5b). Male tergum VII: Fig. 4c, d. Male genitalia: Fig. 5a, b.

Gaster, thorax, and propodeum black, mandible yellowish basally. Legs red, forefemur yellow ventrally (except near base) and apically, foretibial dorsum yellow, in many specimens also mid- and hindtibial dorsum. Gaster either all red (most males) or black apically (some males), in female segments IV-VI black, but gaster all black in one of two females from Calvinia, South Africa.

**LIFE HISTORY.**— Nothing is known of the life history of *Mesopalarus*, but Pulawski found males perching on small objects over hard-baked soils in Western Cape Province, South Africa in January and December 1996 and January 1997. This behavior may be responsible for their unusually large, nearly holoptic eyes. Conclusions drawn from the female morphology are equivocal. The unusually large female head, with its particularly broad genae, indicates a powerful mandibular musculature that could be adaptive for digging burrows in hard soils. On the other hand, the unusually fine, soft and long spines of the foretarsal rake are reminiscent of those of *Prosopigastrea* and *Tachysphex costae* (De Stefani Perez) which are known to reuse abandoned nests of other aculeates. These species probably sweep the cell floor prior to reuse it.

**COLLECTING PERIOD.**— South Africa: 27 December through 31 January; Namibia: December.

**GEOGRAPHIC DISTRIBUTION** (Fig. 6).— Western South Africa, southern Namibia.

**RECORDS.**— **NAMIBIA: Lüderitz District:** Aus (2 ♀, BMNH, including holotype of *Mesopalarus turneri*). **SOUTH AFRICA: Eastern Cape Province:** Port Elizabeth (1 ♀, TMP, holotype of *Mesopalarus mayri*, labeled Algoa Bay, gaster and right wings missing), Venterstad at 30°47'S 25°48'E (Gess, 1996), Wil-lowmore at 33°10'S 23°37'E (1 ♀, TMP, H. Brauns collection, only thorax and propodeum present including wings and most legs). **Northern Cape Province:** Buffels SW Springbok (1 ♂, OÖLM), Calvinia at 31°27'S 19°46'E (2 ♀, AMNH). **Western Cape Province:** 48 mi E Barrydale (1 ♀, AMNH), Clanwilliam: Bulshoek (1 ♂, CAS), Malmesbury at 33°28'S 18°43'E (Gess, 1996), Outdshoorn to Zebra (Gess, 1996), 5 km W Robertson at 33°49'S 19°49'E (2 ♂, CAS), Tierberg Farm 23 km NE Prince Albert at 33°10'S 22°15'E (1 ♀, 4 ♂, CAS), 14 road km N Uniondale at 33°32'S 23°11'E (4 ♂, CAS).

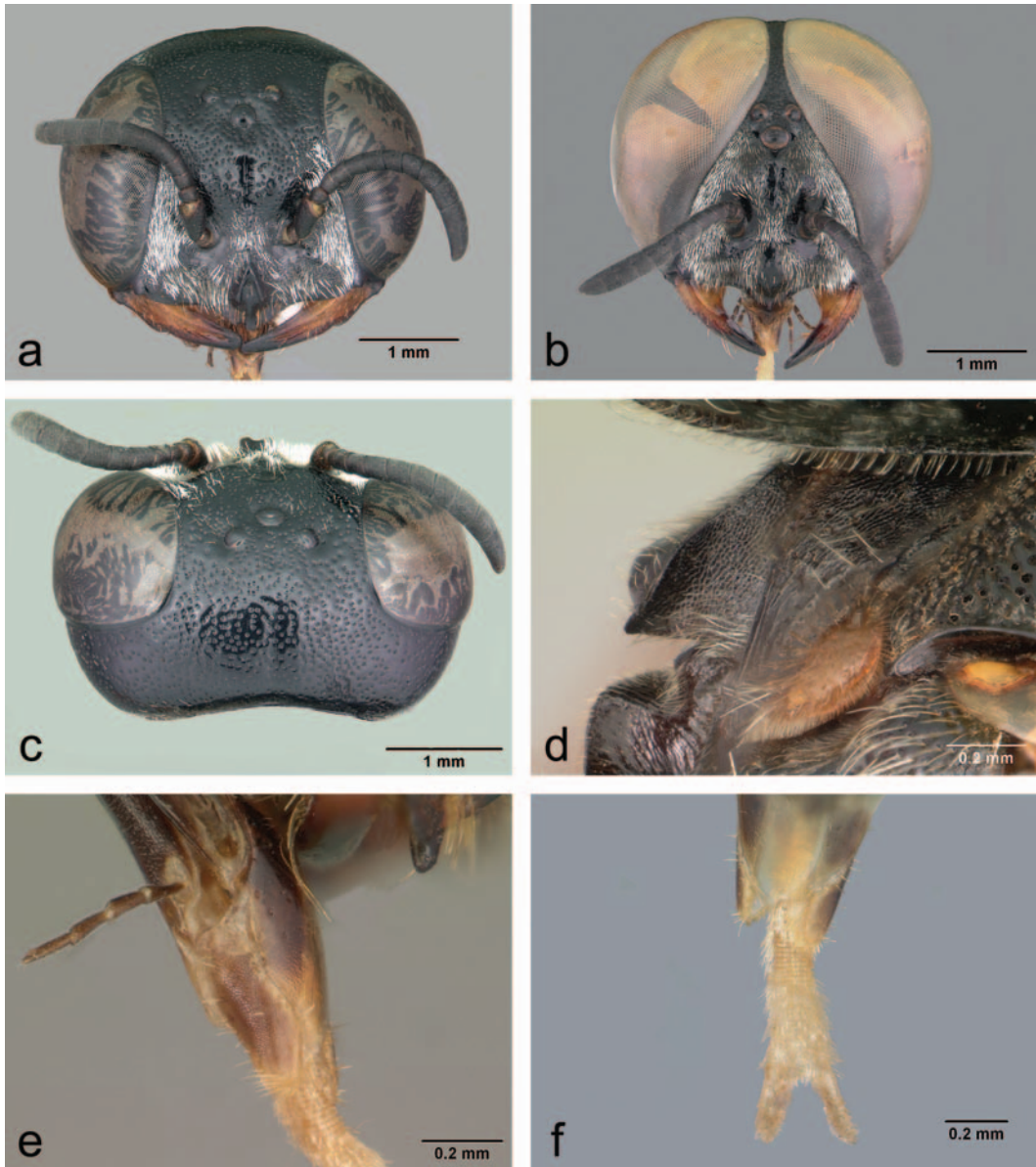


FIGURE 2. *Mesopalarus mayri* Brauns: a – female head in frontal view; b – male head in frontal view; c – female head in dorsal view; d – propleural hamus; e – galea; f – glossa.

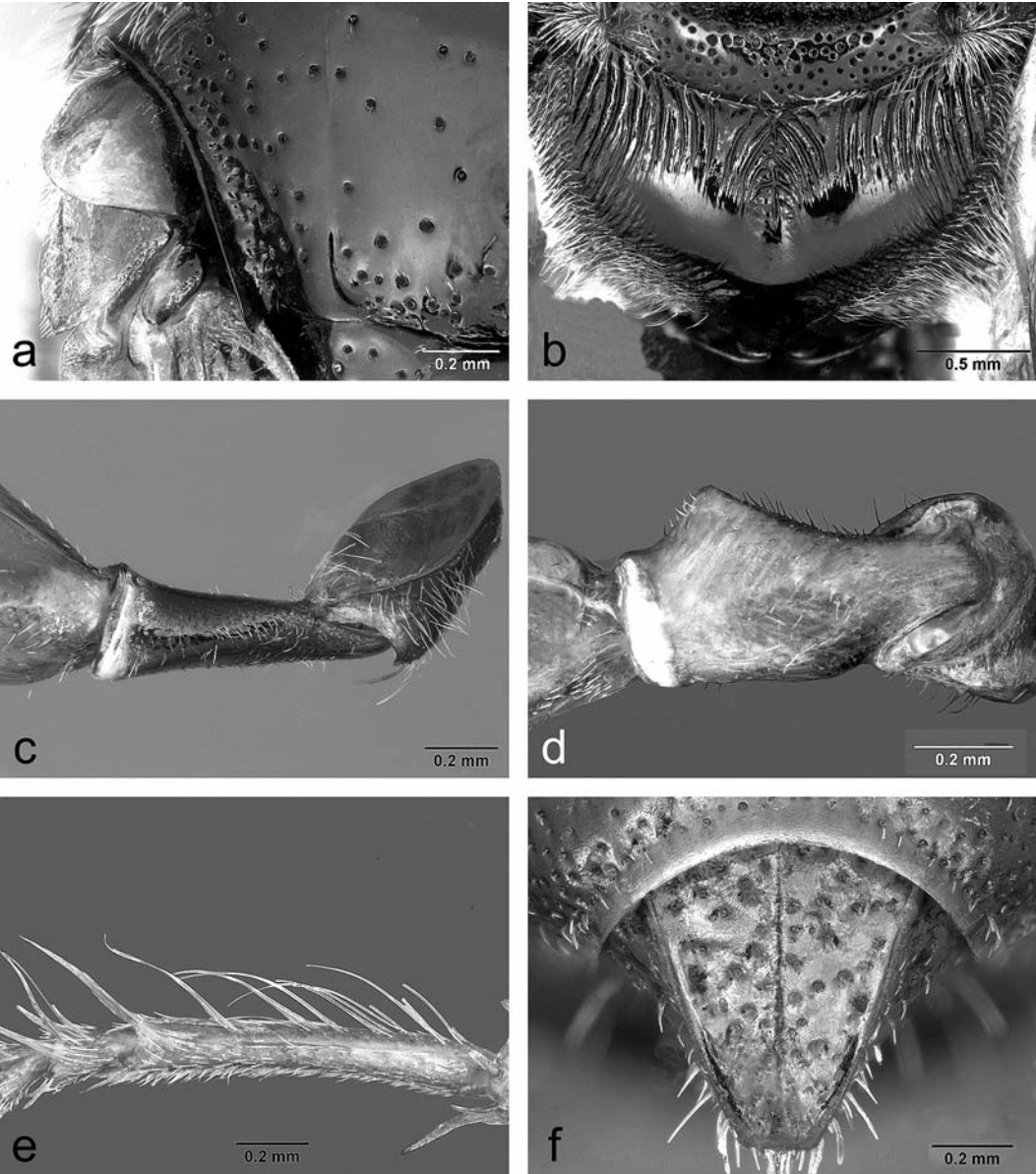


FIGURE 3. *Mesopalarus mayri* Brauns: a – mesonotal flange; b – propodeal dorsum in dorsal view; c – female foretrochanter; d – male foretrochanter; e – female foretarsus showing spines; f – female pygidial plate in dorsal view.



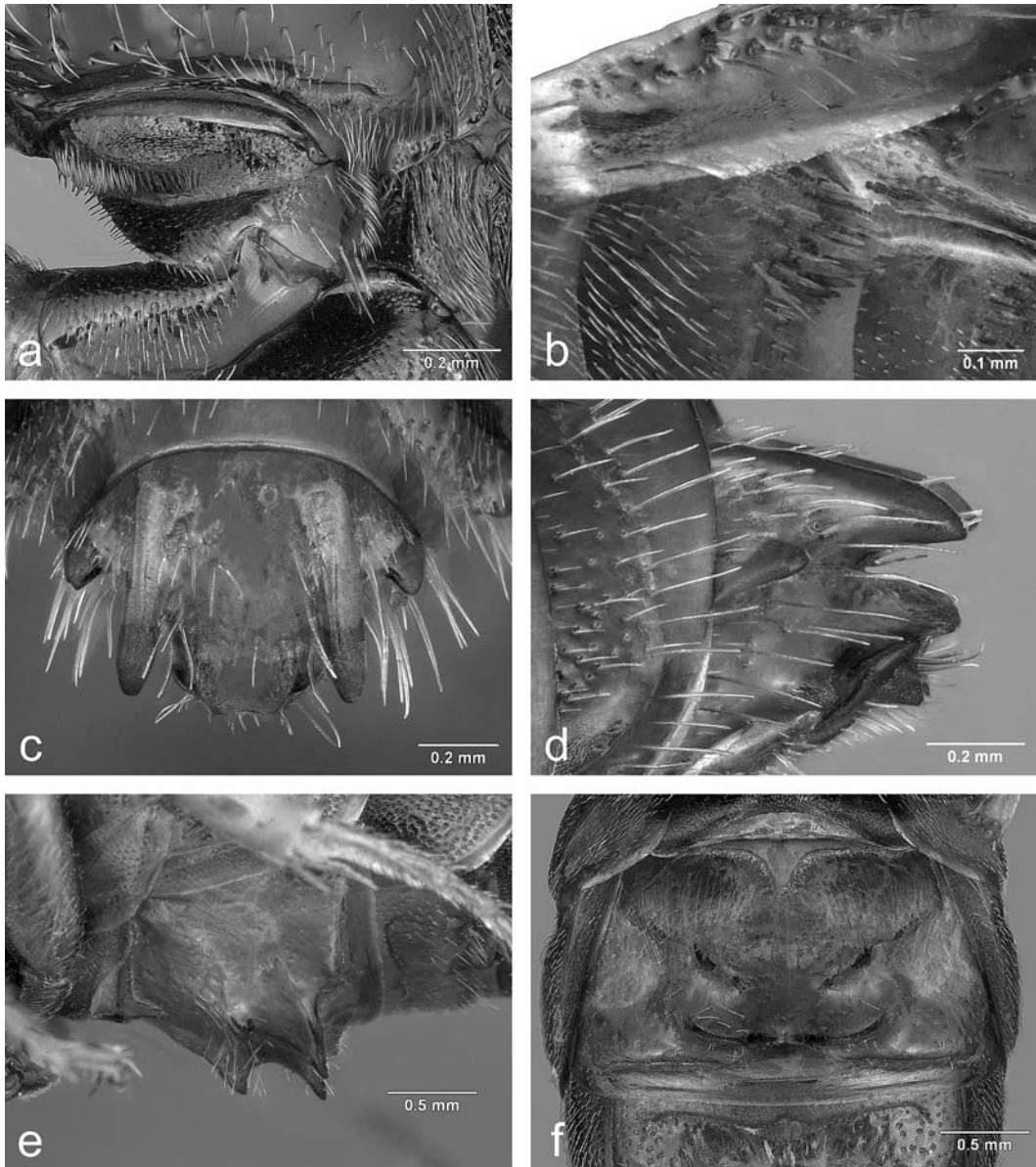


FIGURE 4. *Mesopalarus mayri* Brauns ♂: a – midcoxa and trochanter showing precoxal tubercle; b – sternum VI with lateral brush of setae; c – tergum VII in dorsal view; d – same in lateral view; e – sternum II in lateral view; f – same in ventral view.

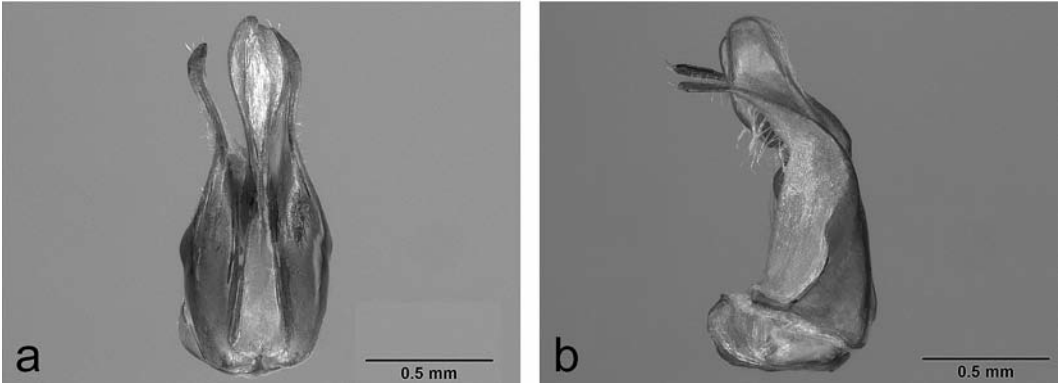


FIGURE 5. *Mesopalarus mayri* Brauns ♂: a – genitalia in dorsal view; b – genitalia in lateral view.

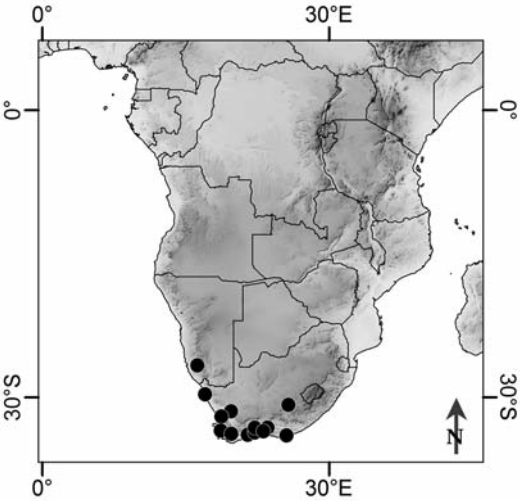


FIGURE 6. Collecting localities of *Meopalarus mayri* Brauns.

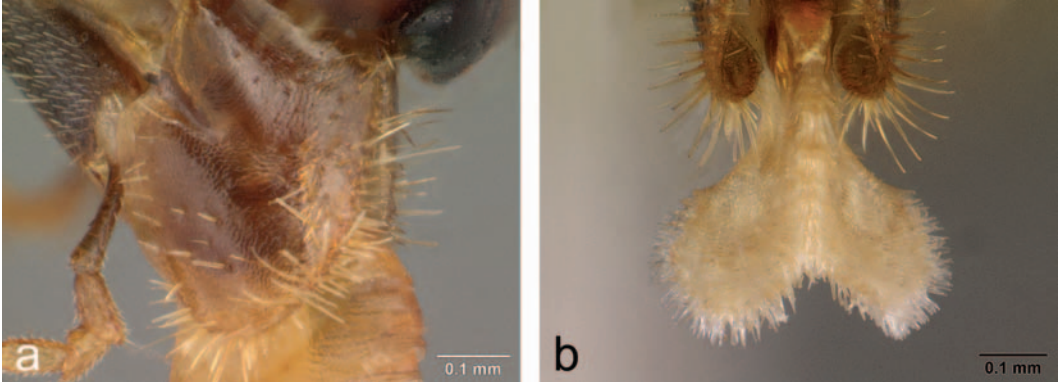


FIGURE 7. Characters of *Palarus* exemplified by *Palarus maculatus* Dahlbom: a – galea; b – glossa.



## *Palarus* Latreille, 1802

*Palarus* Latreille, 1802:336. Type species: *Tiphia flavipes* Fabricius, 1793 [= *Palarus rufipes* Latreille, 1812], junior secondary homonym of *Palarus flavipes* (Fabricius, 1781), by monotypy.

*Gonius* Panzer, 1806:176. Type species: *Philanthus flavipes* (Fabricius, 1804) [= *Crabro flavipes* Fabricius, 1781 = *Tiphia variegata* Fabricius, 1781], by monotypy.

*Gonius* Jurine, 1807:203, junior homonym of *Gonius* Panzer, 1806. Type species: *Philanthus flavipes* (Fabricius, 1793 [= *Crabro flavipes* Fabricius, 1781 = *Tiphia variegata* Fabricius, 1781], by monotypy.

**RECOGNITION.**—*Palarus* differs from all other apoid wasps in the form of its galeal crease, which is reduced to a short, longitudinal remnant (Fig. 7). It can also be recognized by the combination of a yellow clypeus, a lateroclypeal sulcus, and three submarginal cells. The yellow clypeus with lateroclypeal sulci is also found in some *Gastrosericus* (e.g., *hombori* Pulawski, *lepidus* Pulawski, *moricei* E. Saunders), but in that genus the number of submarginal cells is two. Except for *furtivus* and *maculatus*, *Palarus* also has plumose apical glossal filaments (Fig. 2), a condition that occurs elsewhere among apoid wasps only in *Philanthus*, so far as known.

**EARLIER CLASSIFICATIONS.**—Turner (1911) was the first to provide a classification of *Palarus*, dividing it into five groups based solely upon the form of the male tergum VII. Our phylogenetic analysis, however, demonstrates that some of his groups are unnatural. Arnold (1923), Honoré (1941), Guichard (1988), and Nemkov (2005) revised the species of southern Africa, Egypt, Arabia, and Russia and adjacent countries, respectively, but did not contribute to the subgeneric classification. De Beaumont (1949) provided the most important review of the genus so far and simplified the intrageneric groupings of Turner (1911).

**NOMEN NUDUM IN PALARUS.**—Casolari and Casolari Moreno (1980:124) listed a *Palarus tricolor* in their catalog of the Spinola collection, with no specimen present. Such a species was never described and the name, a nomen nudum, has no status in zoological nomenclature. Signor Guido Pagliano could not find the respective specimens either (his letter of 15 May 2006).

**LIFE HISTORY.**—*Palarus* primarily prey upon other Aculeata, and Rathmayer (1962a:459, 1962b:1151) demonstrated experimentally that *Palarus variegatus* is the only wasp known to be immune to the venom of *Philanthus triangulum* (Fabricius). There are also three records of *Palarus* taking Diptera (Brauns, 1911; Gayubo et al. 1992; Kazenas 1994). A range of hymenopteran families, as well as Diptera, may be used by a single provisioning female, and both Diptera and Hymenoptera may be stored in the same cell by *Palarus ambustus almeriensis* (Gayubo et al.

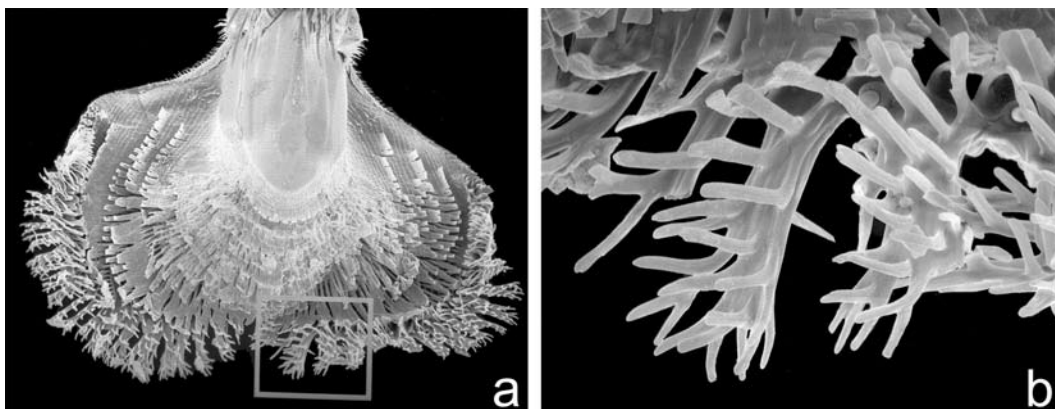


FIGURE 8. Characters of *Palarus* exemplified by *Palarus variegatus* (Fabricius): a – glossa  $\times 85$ ; b – glossal filaments  $\times 390$ .

1992). Those Diptera that have been reported (Stratiomyiidae, Bombyliidae, and Syrphidae) superficially resemble Aculeata, and it is tempting to speculate that this is the reason for their occasional use by *Palarus* (either at the individual or species level). *Palarus* have been observed to capture their prey in flight as well as on flowers (Ahrens 1925:63; Clauss 1985:157; Grandi 1954:169; Guichard, 1988:133; Gayubo et al. 1992:31), whereas *interruptus* and *latifrons* attack honeybees at hive entrances (Cherian and Mahadevan 1937; Clauss 1985). Ahrens (1925) noticed a female of *variegatus* intercepting *Philanthus triangulum* in flight and paralyzing it on the ground after the two fell down. He also recorded a female robbing another female that was flying home with her prey (the initial owner recovered and retook the prey).

A list of known prey is given in Table II below.

**Table II. Prey of *Palarus***  
(Table continued on next page)

Species	Prey	Source
<i>Palarus ambustus almeriensis</i>	Stratiomyidae: <i>Nemotelus pantherinus</i> ; Apidae: <i>Colletes ligatus</i> , <i>Halictus tectus</i> (as <i>vestitus</i> ), <i>Halictus</i> sp., <i>Lasioglossum interruptum</i> , <i>Lasioglossum</i> sp. near <i>virens</i> , <i>Lasioglossum</i> sp.; Crabronidae: <i>Mischophus nicolai</i> , <i>Tachysphex</i> sp. near <i>gracilitarsis</i> , <i>Tachysphex nitidior</i> , <i>Tachysphex pseudopanzeri</i> , <i>Tracheliodes quinquenotatus</i>	Gayubo et al., 1992:30
<i>Palarus confusus</i>	Apidae: <i>Lasisoglossum clypeare</i> , <i>Lasioglossum malachurum</i> , <i>Lasioglossum morio</i> , <i>Lasioglossum quadrisignatum</i> (as <i>Halictus nigerrimus</i> ), <i>Panurgus calcaratus</i> ; Crabronidae: <i>Tracheliodes quinquenotatus</i>	Ferton, 1912:365-366 (as <i>histrion</i> )
<i>Palarus fulviventris</i>	Crabronidae: <i>Stizus</i> sp.	Honoré, 1941:195 (as <i>spinolae</i> )
<i>Palarus fulviventris</i>	Apidae: spp.; Crabronidae: <i>Bembix</i> sp., <i>Cerceris</i> sp., <i>Stizus</i> sp., <i>Tachysphex</i> sp.; Ichneumonidae: spp.; Mutillidae: spp.; Sphecidae: <i>Ammophila</i> sp.; Vespidae: spp.	Myartseva, 1976:80 (as <i>aurantiacus</i> )
<i>Palarus fulviventris</i>	Apidae: <i>Anthidium</i> sp.	This paper
<i>Palarus funerarius</i>	Apidae: spp.; Formicidae: alate spp.	Myartseva, 1976:81
<i>Palarus funerarius</i>	Apidae: <i>Halictus</i> sp.; Crabronidae: <i>Oxybelus</i> sp, <i>Tachysphex</i> sp; Tiphiidae: <i>Myzinum</i> sp.	Kazenas, 2001:165
<i>Palarus hastatifrons</i>	Apidae: <i>Andrena</i> sp.	de Beaumont, 1949:633
<i>Palarus interruptus</i>	Apidae: <i>Apis cerana</i> (as Indian honey bee)	Cherian and Mahadevan, 1937:65 (as <i>orientalis</i> )
<i>Palarus laetus</i>	Crabronidae: <i>Cerceris fischeri</i> , <i>Cerceris luxuriosa</i> (as <i>subimpressa</i> )	Honoré, 1941:194
<i>Palarus latifrons</i>	Apidae: <i>Apis mellifera</i> , undetermined small Apidae; Masaridae: <i>Ceramius capicola</i> ; Scoliididae: <i>Elis</i> sp. ♂	Brauns, 1911:117
<i>Palarus latifrons</i>	Apidae: <i>Apis mellifera</i>	Botha, 1975:16; Clauss, 1985:157
<i>Palarus maculatus</i>	Diptera: undetermined small Hymenopteron-like species; Apidae: <i>Nomia</i> sp. (♂); Tiphiidae: <i>Myzinum</i> sp. (as <i>Plesia</i> )	Brauns, 1911:117 (as <i>handlirschi</i> )
<i>Palarus occidentalis</i>	Apidae: <i>Tetraloniella abrochia</i>	This paper
<i>Palarus oneili</i>	Apidae: small species; Tiphiidae: <i>Myzinum</i> sp. (as <i>Myzine</i> )	Brauns, 1911:117
<i>Palarus oneili</i>	Apidae: <i>Lipotriches</i> sp., <i>Meliturgula braunsi</i> ; Crabronidae: <i>Bembecinus cinguliger</i> , <i>Bembecinus haemorrhoidalis</i>	This paper
<i>Palarus pentheri</i>	Mutillidae: <i>Pseudocephalotilla multicarinata</i> ♂; Vespidae: <i>Antodynurus oogaster</i>	This paper
<i>Palarus pictiventris</i>	Bombyliidae: <i>Heterotropus sulphureus</i> ; Syrphidae: <i>Paragus tibialis</i>	Kazenas, 1994:115
<i>Palarus rufipes</i>	Apidae: <i>Anthidium bellicosum</i> ; Crabronidae: <i>Tachysphex fulvitaris</i> (as <i>acrobates</i> ); Scoliididae: <i>Scolia quadripunctata</i> ; Vespidae: <i>Polistes gallicus</i>	Ferton, 1912:365 (as <i>humeralis</i> )
<i>Palarus rufipes</i>	Vespidae: <i>Polistes</i> sp.	de Beaumont, 1949:633

Table II (continued). Prey of *Palarus*

Species	Prey	Source
<i>Palarus variegatus</i>	Apidae: <i>Ammobates</i> sp., <i>Andrena</i> sp., <i>Sphecodes</i> sp., <i>Thyreus</i> sp. (as <i>Crocisa</i> ); Crabronidae: <i>Cerceris</i> sp., <i>Liris</i> sp. or <i>Tachysphex</i> sp. (as <i>Lyrops</i> ), <i>Philanthus</i> sp.; Ichneumonidae: <i>Ichneumon</i> sp.; Mutillidae: <i>Mutilla</i> sp.; Scoliidae: <i>Scolia</i> sp.; Tiphidae: <i>Myzinum</i> sp., <i>Tiphia</i> sp.	Dufour, 1841:354 (as <i>flavipes</i> )
<i>Palarus variegatus</i>	Vespidae: <i>Eumenes</i> sp., <i>Odynerus</i> sp., <i>Polistes gallicus</i>	Fabre, 1856 (as <i>flavipes</i> )
<i>Palarus variegatus</i>	Vespidae: <i>Eumenes</i> sp., <i>Odynerus</i> sp., <i>Polistes gallicus</i>	Girard, 1879:951 (as <i>flavipes</i> )
<i>Palarus variegatus</i>	Apidae: <i>Halictus</i> sp.	Nicolas, 1894 (as <i>flavipes</i> )
<i>Palarus variegatus</i>	Apidae: <i>Andrena</i> sp., <i>Apis mellifera</i> , <i>Halictus sexcinctus</i> , <i>Melitta</i> sp., <i>Osmia</i> sp., <i>Panurgus</i> sp., <i>Sphecodes</i> sp.; Crabronidae: <i>Cerceris</i> sp., <i>Crabro</i> sp., <i>Diodontus</i> sp., <i>Oxybelus</i> sp., <i>Philanthus triangulum</i> (as <i>apivorus</i> ), <i>Tachytes</i> sp., unspecified crabronids; Sphecidae: <i>Podalonia</i> sp. (as <i>Psammophila</i> ); Ichneumonidae: spp.; Mutillidae: <i>Mutilla</i> sp. Tiphidae: <i>Tiphia</i> sp.	Ahrens, 1925:60-63 (as <i>flavipes</i> )
<i>Palarus variegatus</i>	Crabronidae: <i>Cerceris</i> sp., <i>Oxybelus</i> sp.; Mutillidae: <i>Myrmosa</i> sp. Tiphidae: <i>Tiphia</i> sp.	Sato, 1926:38-39 (as <i>saishuensis</i> )
<i>Palarus variegatus</i>	Apidae: <i>Megachile bombycina</i> ; Crabronidae: <i>Cerceris rubida</i> ; Ichneumonidae: <i>Barylypa humeralis</i>	Scobiola, 1951:273
<i>Palarus variegatus</i>	Apidae: <i>Andrena ovatula</i> , <i>Andrena barbilabris</i> (as <i>sericea</i> ), <i>Andrena</i> sp., <i>Chelostoma florissomme</i> , <i>Colletes hylaeiformis</i> , <i>Lasioglossum calceatum</i> , <i>Lasioglossum discum</i> (as <i>Halictus morbillosus</i> ), <i>Lasioglossum leucozonium</i> , <i>Lasioglossum nigripes</i> , <i>Megachile argentata</i> , <i>Nomada roberjeotiana</i> , <i>Osmia</i> sp., <i>Tetralonia ruficornis</i> ; Crabronidae: <i>Alysson spinosus</i> (as <i>fuscatum</i> ), <i>Bembecinus tridens</i> , <i>Cerceris arenaria</i> , <i>Dryudella ? stigma</i> , <i>Lestica clypeata</i> , <i>Oxybelus haemorrhoidalis</i> (as <i>melancholicus</i> ), <i>Pemphredon rugifer</i> (as <i>unicolor</i> ), <i>Tachysphex panzeri</i> ; Scoliidae: <i>Scolia quadripunctata</i> ; Tiphidae: <i>Tiphia femorata</i> ; Vespidae: <i>Eumenes pomiformis</i> , <i>Odynerus parietum</i> , <i>Polistes nimpha</i>	Móczár, 1952:120
<i>Palarus variegatus</i>	Apidae: <i>Andrena</i> sp., <i>Apis mellifera</i> ♂, <i>Dasygaster</i> sp., <i>Halictus</i> sp., <i>Nomia</i> sp., <i>Osmia</i> sp., <i>Sphecodes</i> sp.; Crabronidae: <i>Astata</i> sp., <i>Bembecinus hungaricus</i> , <i>Bembecinus tridens</i> , <i>Cerceris flavilabris</i> (as <i>ferrei</i> ), <i>Cerceris sabulosa</i> , <i>Larra anathema</i> ♂, <i>Philanthus triangulum</i> , <i>Tachysphex panzeri</i> ; Scoliidae: <i>Campsoscolia sexmaculata</i> ♂; Sphecidae: <i>Ammophila heydeni</i> ; Tiphidae: <i>Tiphia femorata</i> ; Vespidae: <i>Polistes gallicus</i>	Grandi, 1954:172-174, 1961:188-189
<i>Palarus variegatus</i>	Beijing area, China: Apidae: <i>Lasioglossum politum pekingense</i> (as <i>Halictus pekingensis</i> ); Crabronidae: <i>Cerceris pekingensis</i> , <i>Pison punctifrons</i> . Mongolia: Apidae: <i>Andrena</i> sp., <i>Halictus</i> sp., <i>Hylaeus</i> spp., <i>Nomada</i> sp.; Crabronidae: <i>Astata</i> sp., <i>Cerceris quadricolor</i> , <i>Cerceris</i> sp.; Formicidae: <i>Camponotus</i> sp.; Ichneumonidae: <i>Amblyteles vadatorius</i> ; Pompilidae: <i>Ceropales maculatus</i> ; Tiphidae: <i>Tiphia</i> sp.	Tsuneki, 1969:18-20
<i>Palarus variegatus</i>	Apidae: <i>Halictus sexcinctus</i> ; Crabronidae: <i>Oxybelus argentatus</i> , <i>Philanthus triangulum</i> ; Scoliidae: <i>Trielis quinquecincta</i> ; Vespidae: <i>Polistes nimpha</i>	Simon Thomas, 1972
<i>Palarus variegatus</i>	Apidae: <i>Colletes</i> sp., <i>Halictus pollinosus</i> , <i>Halictus scabiosae</i> , <i>Halictus</i> sp., <i>Lasioglossum malachurum</i> , <i>Nomia diversipes</i> ; Crabronidae: <i>Oxybelus latro</i> , <i>Philanthus triangulum</i> ; Leucospidae: <i>Leucospis</i> sp.; Sphecidae: <i>Podalonia tydei</i> , <i>Prionyx kirbii</i> ; Vespidae: <i>Polistes dominulus</i> , <i>Vespula germanica</i>	Gayubo et al., 1992:30
<i>Palarus variegatus</i>	Apidae: <i>Andrena</i> sp., <i>Halictus</i> sp., <i>Panurgus</i> sp.; Crabronidae: <i>Cerceris</i> sp., <i>Philanthus</i> sp., <i>Tachytes</i> sp.; Tiphidae: <i>Tiphia</i> sp.	Blagoveshchenskaya, 1994 (as <i>flavipes</i> )
<i>Palarus variegatus</i>	Apidae: <i>Andrena</i> sp., <i>Camptopeum friesei</i> ; Crabronidae: <i>Bembecinus tridens</i> , <i>Ectemnius confinis</i> ; Sphecidae: <i>Podalonia luffi</i> ; Vespidae: <i>Pterochelus phaleratus</i>	Shkuratov, 2001:17

Dufour's (1841) and Móczár's (1952) statements that *Palarus variegatus* kills the prey by twisting its neck was not confirmed by Grandi (1954).

Faussek (1906) and Grandi (1928, 1961) observed the use of forelegs in *variegatus* for digging nests in a sandy substrate, as did Cherian and Mahadevan (1937) for *interruptus*. The gallery of *variegatus* ends in a single cell; Myartseva (1976) observed one cell in the nests of *funerarius* in June, and three or four cells in July. Ferton (1912) observed a temporary closure of the nest during the provisioning period in *confusus* (as *histrion*) but not in *rufipes* (as *humeralis*). The nest entrance is permanently open during the provisioning period in *interruptus* (Cherian and Mahadevan 1937) and *variegatus* (Móczár 1952; Grandi 1954, Tsuneki 1969), although incomplete closure is sometimes practiced (Móczár 1952). Prey is carried in flight, under the female's venter (Móczár, 1952). According to Grandi (1961), the wasps enter the gallery without dropping the prey at the entrance, while Móczár (1952) reports that the prey is dropped at the nest entrance, and dragged in subsequently. Grandi (1961) noticed 5-7 prey per cell, with the wasp's egg on the first prey.

The males spend the nights in burrows in the ground, sometimes several together (Brauns, 1911).

Grandi (1954, 1961) and Gayubo et al. (1992) described the mature larvae of *Palarus variegatus* and of *P. ambustus almeriensis*, respectively.

**DAMAGE TO APICULTURE.**— Botha (1975) and Clauss (1985) reported serious damage to apiculture caused by the banded bee pirate, *Palarus latifrons*, in South Africa and Botswana, respectively. Cherian and Mahadevan (1937) reported considerable losses in the populations of Indian honey bee (i.e., *Apis cerana* Fabricius) in India, caused by *Palarus interruptus*.

### Key to Species

Unknown and not included: female of *Palarus arabicus*.

1. Labrum not or minimally convex, with unsculptured apicolateral expansion, fully concealed when mandibles closed (Fig. 9b); length of ventrolateral scapal setae exceeding width of scape; pronotal collar markedly depressed, not raised as narrow wedge (Fig. 9d), streptaulus dorsally fused with anterior pronotal groove (Fig. 9e); metapleuron evenly microsculptured, dull; median impression of propodeal dorsum microsculptured (Figs. 17, 25a); hindfemur with apical lobe (Fig. 10a), lobe rudimentary in some males. Female: apex of tergum VI not thickened dorsoventrally; pygidial plate with well-defined median platform whose margin is parallel to that of plate (Fig. 10b-d). Male: tergum VII without lateral pygidial process (**maculatus group**) . . . . . 4
- Labrum convex, without apicolateral expansion, separating fully closed mandible from clypeus (Figs. 29b, 47c-e, 50c, 55e, f); length of scapal setae smaller than scapal width; pronotal collar raised posteriorly as narrow wedge (Figs. 29d, 32a), streptaulus well separated from anterior pronotal groove (Fig. 29e); metapleuron punctate or unsculptured (at most with a few punctures); median impression of propodeal dorsum not microsculptured; hindfemur without apical lobe. Female: apex of tergum VI thickened dorsoventrally (Figs. 30c, d, 43c); pygidial plate without median platform. Male: tergum VII with lateral pygidial process (Fig. 30e) . . 2
2. Vertex wider, hindocellus separated from orbit by more than hindocellar width (Figs. 32c, d, 35c, d, 38c, d), without depression behind hindocelli; frontal swelling delimited laterally by sulcus that extends dorsad from lateral margin of antennal socket; frontal paraocular macula present (Figs. 29a, 35a), in many specimens continuous with macula on vertex; metapleuron punctate, with conspicuous setae; propodeal dorsum without conspicuous adlateral depression,

- with well-defined punctures except on median depression that is about 1.0-1.5 midocellar widths wide (Fig. 29f); propodeal side punctate throughout. Female: pygidial plate conspicuously ridged (Figs. 30b, 35e). Male: terga I and VII without adlateral carina, pygidial plate with basolateral process, not emarginate apically (Figs. 30e, 32e, f, 35f); gonocoxite with dense brush of long setae ventrally (Figs. 33, 36, 38); penis valves dorsally fused for less than half their length, with preapical dorsal ridges (Fig. 39) (*interruptus* group) . . . . . 11
- Vertex narrower, hindocellus separated from orbit by at most its shortest axis, nearly touching orbit in most specimens (Figs. 41a, 55a), with well-defined depression immediately behind hindocelli; frontal swelling not delimited laterally by sulcus; frontal paraocular macula short (just above clypeus) or frons all or largely yellow; metapleuron impunctate and asetose or with inconspicuous setae and a few, sparse punctures; propodeal dorsum with conspicuous adlateral depression and either all carinulate or with large median microsculptured depression (that is several midocellar diameters wide), punctate only laterally, punctures small; propodeal side impunctate at least anteriorly. Female: pygidial plate sparsely punctate or with numerous fine ridges (Fig. 98a). Male: terga I and VII with adlateral carina, pygidial plate with apicolateral process (e.g., Figs. 41d, 87e, f, 95d, e, 99c, d) except in *pentheri* and *saundersi*; gonocoxite without dense brush of long setae ventrally (e.g., Figs. 42b, 99f); penis valves dorsally fused for more than half their length, without preapical dorsal ridges . . . . . 3
3. Female: hindtarsomeres II and III each with outer apical spine markedly longer and thicker than inner lateral spine (Fig. 41b); sternum II without transverse elevated crest, pygidial plate without apparent longitudinal ridges (Figs. 41c, 57a). Male tergum VII with pygidial plate not raised or slightly raised above tergal apex, tridentate (Figs. 41d, 52a, 52b) (*histrion* group). 13
- Female: hindtarsomeres II and III each with outer apical spine as long and thick or slightly longer than inner lateral spine; sternum II with transverse, elevated crest; pygidial plate with minute but well-defined longitudinal ridges (Fig. 98a). Male tergum VII with pygidial plate raised above tergal apex, apically bidentate or pointed (e.g., Figs. 63d, e, 75a-d, 79e, f, 87e, f, 95d, e, 99c, d) (*variegatus* group) . . . . . 22
4. Postocellar area with longitudinal crest (Fig. 12); eyes practically holoptic. Male: midtibia (except basally), hindtibia, and midbasitarsus with dense, erect setae on venter (Fig. 23b, c); tergum VII with pygidial plate nearly parallel-sided and adlateral carina expanded (Figs. 13f, 20b, 23f), visible in dorsal view. . . . . 5
- Postocellar area without crest, somewhat raised along midline in female of *turneri* in which eyes are dichoptic (Fig. 27a). Male: mid- and hindtibiae and midbasitarsus without dense erect setae on venter; tergum VII with pygidial plate either evenly broadening toward base (Fig. 27d) or conspicuously, roundly expanded basally (Figs. 15c, 18d, f, 25c); adlateral carina expanded only insignificantly, invisible in dorsal view . . . . . 7
5. Hindocellus nearly circular, convex; frons with small macula above each antennal socket; scutum yellow anterolaterally, tergum I with erect setae only laterally. Female: lateroclypeal notch separated from lateroclypeal sulcus; dorsum of midbasitarsus with fewer than 20 spines (as in Fig. 18b). Male: precoxal mesopleural declivity delimited by swelling anterolaterally, without sharp tubercle laterally; adlateral carina of tergum VI markedly expanded anteriorly (Fig. 20a), that of tergum VII evenly arcuate (Fig. 20b); pygidial plate about as wide as long (Fig. 20b); sternum II uniformly concave anterad of elevation, posterior surface of elevation (posterad of crest) sparsely setose; sterna III-V concave basomesally . . . . . *nama* Pulawski and Prentice, sp. nov., p. 351



- Hindocellus oblong, somewhat flattened; frons and scutum all black; tergum I with erect setae mesally as well as laterally. Female: lateroclypeal notch almost in line with lateroclypeal sulcus; dorsum of midbasitarsus with about 30 dorsal spines (Figs. 13b, 22). Male: precoxal mesopleural declivity delimited by sharp tubercle anterolaterally; adlateral carina of tergum VI evenly arcuate (Fig. 23e), that of tergum VII markedly broader anteriorly than posteriorly; pygidial plate longer than wide; sternum II with broadly V-shaped to nearly transverse ridge before elevation; posterior surface of elevation (posterad of crest) all densely setose or with densely setose band; sterna III-V not concave basomesally . . . . . 6
  
- 6. Median depression of posterior propodeal surface bordered by sharp carina. Male: anteroventral tubercle of midcoxa inconspicuous; hindfemur flattened anterobasally, minimally concave; tergum I without adlateral carina and associated tubercle; sternum II: posterior surface of elevation higher than midocellar width, without well-defined row of sinuous setae. Arabian Peninsula to India . . . . . *comberi* Turner, p. 340
- Median depression of posterior propodeal surface bordered by obtuse carina. Male: anteroventral tubercle of midcoxa conspicuous (Fig. 23a); hindfemur not flattened anterobasally; tergum I with adlateral carina and associated tubercle; sternum II: posterior surface of elevation lower than midocellar width, with well-define row of sinuous setae. West Africa . . . . . *obesus* Arnold, p. 353
  
- 7. Least interocular distance wider, equal to  $0.9-1.2 \times$  midocellar width in female (Fig. 27a), to about  $0.4 \times$  in male; postocellar area with linear impunctate strip mesally; humeral plate all yellow or yellowish white (with minimal dark spots). Female: impunctate strip of postocellar area continuing as impression at level of eye hindmargin; tergum I with single uninterrupted macula. Male: mesopleural setae shorter than midocellar width (except anterad of episternal sulcus); pygidial plate uniformly broadening toward base (Fig. 27d) . . . . . *turneri* Brauns, p. 358
- Least interocular distance narrower, no more than  $0.5 \times$  (female) and  $0.2 \times$  (male) midocellar width (eyes practically holoptic in many specimens); postocellar area without impunctate strip or (female of *furtivus*) with ill-defined strip anteriorly; posterior half of humeral plate brown to black. Female: vertex without impression at level of eye hindmargin; tergum I with a pair of maculae (possibly with single uninterrupted macula in some *occidentalis*). Male: length of mesopleural setae equal to midocellar width of more; pygidial plate expanded basally (Figs. 18c-f, 25c) . . . . . 8
  
- 8. Longest setae of posteroventral midfemoral surface about equal to midocellar width; impunctate median area of propodeal dorsum narrower, its preapical width (one midocellar width from apex) smaller than dorsum's midlength (Fig. 17) (*maculatus* Dahlbom, p. 346) . . . . . 9
- Longest setae of midfemoral venter markedly shorter than midocellar width; impunctate median area of propodeal dorsum wider except in some *furtivus*, its preapical width (one midocellar width from apex) greater than dorsum's midlength (Fig. 25a) . . . . . 10
  
- 9. Tergum I with pair of large lateral maculae (macula larger than tegula); adlateral carina of male sternum VI dull, not raised . . . . . *maculatus maculatus* Dahlbom, p. 349
- Tergum I all black or (most males) with pair of small lateral maculae (macula about as large as tegula); adlateral carina of male sternum VI sharp, somewhat raised . . . . . *maculatus nigrrior* Arnold, p. 349



10. Female: least interocular distance about  $0.1-0.2 \times$  midocellar width; scutum black. Male: sternum III-VI at most with a few, sparse punctures and associated setae anterad of apical depression; adlateral carina of tergum VI obtuse, nonprominent (Fig. 25b) . . . . . *occidentalis* Arnold, p. 356
- Female: least interocular distance at least  $0.3 \times$  midocellar width; scutum yellow anterolaterally. Male: sternum III-VI densely punctate and setose; adlateral carina of tergum VI sharp, prominent (Fig. 15b) . . . . . *furtivus* Pulawski and Prentice, sp. nov., p. 344
11. Hindocellus separated from orbit by more than midocellar width (Fig. 35c, d); supraantennal swelling delimited laterally by dark sulcus. Female: hindfemoral outer surface without preapical spines; setae erect on femora, tibiae, and gaster, longer than midocellar diameter on femora, dense on gaster (Fig. 32b); hindtibia with three rows of spines; apical depressions of terga I and II punctate; lateral margin of pygidial plate nearly straight (Fig. 32e). Male: maculae intense yellow. West Africa. . . . . *gynaecotrichus* Pulawski and Prentice, sp. nov., p. 364
- Hindocellus separated from orbit by midocellar width or less (Figs. 32c, d, 38c, d); supraantennal swelling delimited laterally by pale sulcus. Female: hindfemoral outer surface with one or two preapical spines (spines lacking on one leg in occasional specimens); setae shorter than midocellar width on femora, appressed on tibiae, sparse, appressed on gaster; hindtibia with four rows of spines; apical depressions of terga I and II impunctate; lateral margin of pygidial plate convex basally, concave subapically (Fig. 30b). Male: metanotal and gastral maculae whitish. . . . . 12
12. Most genal setae sinuous, longer than basal mandibular width (Fig. 38a); tergal punctures well defined (Fig. 38b); dorsal length of flagellomere I  $1.8-2.0 \times$  apical width. Female: distance between hindocelli clearly shorter than ocellular distance (Fig. 38c, d). Male: tergum VII rounded apically; gonocoxite with single brush of ventral setae (Fig. 38f). Sub-Saharan Africa, Saudi Arabia . . . . . *latifrons* Kohl, p. 370
- Most genal setae straight (angled apically), shorter than basal mandibular width (Fig. 35a); punctures of terga I and II minute to evanescent except laterally (Fig. 35b); dorsal length of flagellomere I  $1.2-1.3 \times$  apical width. Female: distance between hindocelli about equal to ocellular distance. Male: tergum VII truncate apically (Fig. 35e, f); gonocoxite with two discrete brushes of ventral setae (Fig. 36). India, Sri Lanka. . . . . *interruptus* (Fabricius), p. 367
13. Medioclypeus with flange uniform, not differentiated into admedian and adlateral portions, without narrowing or discontinuity (Figs. 47c-e, 49a, b); lateroclypeal notch well defined. Female: tergum I with adlateral carina. Male: clypeal free margin without median lobe (Figs. 47d, 49b) (*histrion* subgroup) . . . . . 14
- Medioclypeus with flange differentiated into admedian and adlateral portions that are separated by narrowing or discontinuity (Figs. 50a-c, 51a, b, 55c-f); lateroclypeal notch absent (vast majority of specimens) or minimal. Female: tergum I without adlateral carina, at most with linear swelling. Male: clypeal free margin with median lobe (Figs. 50b, 51b, 55d, f) (*laetus* subgroup) . . . . . 18
14. Posteroventral mandibular tooth and notch poorly defined (Fig. 47e); frons maculate along midline (Figs. 47a, 49a, b); propodeal posterolateral surface with prominent carinulae that obscure punctation. Female: width of clypeus (from condyle to condyle) smaller than  $3 \times$  length along midline (Figs. 47c, 49a); apex of tergum VI sharply pointed in profile. Male: sternum II with lateral transverse swelling anterad of elevation . . . . . 15

- Posteroventral mandibular tooth and notch well defined; frons without macula along midline except in some *ambustus*; propodeal posterolateral surface with slight carinulae that only partly obscure punctation. Female: width of clypeus (from condyle to condyle) greater than  $3 \times$  length along midline; apex of tergum VI rounded in profile (Fig. 43c). Male: sternum II without transverse swelling anterad of elevation. . . . . 16
- 15. Glossal lobe without strip-like extension; minimal length of gena, in dorsal view, greater than midocellar width (Fig. 49c); least interocular distance  $1.2-1.5 \times$  midocellar width in female,  $1.4-1.6 \times$  in male; in most specimens midfrontal macula fused with paraorbital macula (Fig. 49a). Female: clypeus shorter, length along midline smaller than  $0.4 \times$  distance between clypeal condyles (Fig. 49a). . . . . *histrion* Spinola, p. 386
- Glossal lobe with strip-like extension (Fig. 47f); minimal length of gena, in dorsal view, smaller than midocellar width (Fig. 47b); least interocular distance  $0.5-1.0 \times$  midocellar width in female,  $0.8-1.4 \times$  in male; midfrontal macula separated from paraorbital macula (Fig. 47a). Female: clypeus longer, length along midline greater than  $0.4 \times$  distance between clypeal condyles (Fig. 47a). . . . . *hastatifrons* Turner, p. 383
- 16. Preepisternal area of upper mesopleuron densely punctate, punctures no more than one diameter apart (Fig. 45a, b); mesopleuron conspicuously microsculptured between punctures . . . . . *confusus* Turner, p. 381
- Preepisternal area of upper mesopleuron sparsely punctate, all or many punctures several to many diameters apart (Fig. 43a, b); mesopleuron unsculptured or with evanescent microsculpture between punctures (*ambustus* Klug, p. 378) . . . . . 17
- 17. Upper metapleuron impunctate. North Africa . . . . . *ambustus ambustus* Klug, p. 380
- Upper metapleuron with 6-15 small punctures. Southern Spain . . . . . *ambustus almeriensis* Gayubo, Asís, and Tormos, p. 380
- 18. Mesopleuron (all or largely) sparsely punctate (punctures several to many diameters apart), with a few inconspicuous, nonreflective setae that do not conceal integument (Fig. 51e); propodeal enclosure with well-defined ridges both mesally and laterally, with inconspicuous, nonreflective setae. . . . . 19
- Mesopleuron densely punctate (punctures 1-3 diameters apart), with dense, reflective setae that all or largely conceal integument (Fig 56d); propodeal enclosure (except many *laetus*) with sculpture markedly finer laterally than mesally, laterally with conspicuous, clearly reflective setae (Fig. 56e, 61a). . . . . 20
- 19. Medioclypeus longer, its length along midline about three quarters of distance between clypeal condyles or slightly more (Fig. 50a, b); posteroventral mandibular tooth gradually lowering toward mandibular apex, notch unsharply defined (Fig. 50c). Female: medioclypeal flange without tooth or longitudinal ridge next to lateroclypeal sulcus . . . . . *bisignatus* F. Morawitz, p. 389
- Medioclypeus shorter, its length along midline about two thirds of distance between clypeal condyles (Fig. 51a, b); posteroventral mandibular tooth in most specimens nearly straight to rounded distally but well defined, mandibular notch sharply defined (Fig. 51c), but tooth gradually lowering and notch ill defined in many females from Pakistan (Fig. 51d). Female: medioclypeal flange with or without tooth and longitudinal ridge next to lateroclypeal sulcus. . . . . *funerarius* F. Morawitz, p. 391

20. Gena (except in ventral third or so) with dense, reflective setae (Fig. 55b); area between mid- and hindocellus swollen, as long as  $1.8 \times$  midocellar width (Fig. 55a); episcrobal area of most specimens all or largely glabrous (Fig. 56d). Female: very apex of tergum VI evenly rounded, without discontinuity between dorsal and ventral margins (Fig. 57b). Male: apicomedian pygidial process longer, equal to 0.6-0.9 of distance between tips of lateral processes; lateral process raised above and ending before apex of adlateral carina (Fig. 57d); pygidial carinae converging toward apex (Fig. 57c). . . . . *laetus* Klug, p. 397
- Gena at most with a few reflective setae; area between mid- and hindocellus not swollen, as long as  $1.1 \times$  midocellar width or shorter; episcrobal area all setose or nearly so (Fig. 59b). Female: apex of tergum VI with discontinuity between dorsal and ventral margins (Fig. 59c). Male: apicomedian tooth of tergum VII shorter, equal to 0.4-0.5 of distance between tips of apicolateral processes; lateral process ending posterad of apex of adlateral carina (Fig. 59e); pygidial carinae parallel or diverging toward apex (Figs. 59d, 61b) . . . . . 21
21. Posteroventral mandibular notch nearly reduced, practically absent (Fig. 59a) in African populations, small but well defined in those from Sinai and Jordan; asetose median area of propodeal dorsum several times width of midocellus. Female: clypeal free margin inconspicuously, shallowly emarginate mesally, emargination not flanked by tooth . . . . .
- . . . . . *parvulus* de Beaumont, p. 403
- Posteroventral mandibular notch well defined; asetose median area of propodeal dorsum not wider than midocellus (Fig. 61). Female: clypeal free margin conspicuously emarginate mesally, emargination flanked by tooth . . . . . *pictiventris* F. Morawitz, p. 406
22. Females . . . . . 23
- Males . . . . . 33
23. Posteromedian concavity of sternum II (posterad of transverse crest and associated row of setae) without additional platform; crest dentate . . . . . 24
- Posteromedian concavity of sternum II (posterad of transverse crest and associated row of setae) with additional platform that is delimited by obtuse swelling; crest simple or dentate . . . . . 25
24. Pronotal collar, scutum anterolaterally, scutellum, and metanotum (except laterally) reddish . . . . . *pentheri* Brauns, p. 441
- Pronotal collar and scutum anterolaterally pale yellow or black, in many specimens also scutellum and metanotum (reddish in some). . . . . *oneili* Brauns, p. 436
25. Sternum II, posterad of transverse crest and associated row of setae, with short, transverse platform, distance between platform's apex and sternal margin greater than platform's length (Figs. 79a, 95a) . . . . . 26
- Sternum II, posterad of transverse crest and associated row of setae, with elongate, rounded platform, distance between platform's apex and sternal margin smaller than platform's length (Figs. 65f, 73c, 77a, 84a, 90a, 98c, d) . . . . . 27
26. Genal setae straight, shorter than midocellar width; least interocular distance  $0.6-0.7 \times$  midocellar width; pygidial plate with lateral margin not concave; additional transverse carina of sternum II (posterad of crest) prominent, well defined (Fig. 94a) . . . *saunderi* Morice, p. 450

- Genal setae sinuous, those near hypostomal carina nearly  $1.5 \times$  midocellar width; least interocular distance about equal to midocellar width; pygidial plate with lateral margin slightly concave at about midlength (Fig. 79c); additional transverse carina of sternum II (posterad of crest) nonprominent, obtuse laterally, sharp only in median third or so (Fig. 79a) . . . . .  
 . . . . . *jaxartes* Pulawski and Prentice, sp. nov., p. 430
- 27. Genal setae sinuous, those near hypostomal carina exceeding midocellar width (Fig. 65b); transverse section of mesopleural precoxal carina without angular prominence . . . . . 28
  - Genal setae straight or angled at apex, not exceeding midocellar width; transverse section of mesopleural precoxal carina with angular prominence (prominence rudimentary in some *fulviventris* and *rufipes*). . . . . 29
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 . . . . . *bernardi* de Beaumont, p. 411
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 . . . . . *dongalensis* Klug, p. 416
- 29. Forebasitarsus slightly widened (Fig. 65d); apicoventral foretibial margin emarginate posterad of spur socket, cuticle dark adjacent to emargination (Fig. 90c); foretibial venter, basad of spur, in most specimens with conspicuous, falciform seta (Fig. 90c) . . . . . *rufipes* Latreille, p. 445
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- 33. Forebasitarsus conspicuously widened, with rake spines broadened (Figs. 66e, 69e, 91c); side of tergum VII concave (Figs. 67f, 70b, 92b) . . . . . 34
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- (Fig. 91c); hindbasitarsus not flattened, about twice as long as posterior hindtibial spur; hindtarsomeres II and III asymmetrical, somewhat expanded apicolaterally (Fig. 91f), hindtarsomere II more than twice as long as wide apically; side of tergum VII without oblique ridge in anterior half, with dense setae that fully conceal integument (Fig. 92b); apex of tergum VII (beneath lateral pygidial process) with setae sparser, not concealing integument; sternum II with anterior margin of elevation sharply carinate; sterna V and VI sparsely, inconspicuously punctate and setose; antenna black, thorax and propodeum predominantly black, wings (except apically) conspicuously infumate with violet shimmer; gaster black . . . *rufipes* Latreille, p. 445
- Flagellomeres VIII-XI not concave basoventrally; forecoxa with apicomedian brush of long setae; at least some forecoxal setae sinuous; forefemoral anteroventral surface with well-defined concavity (Fig. 66c); foretibia not triangular, with a few spatulate setae on outer margin (Fig. 66d); forebasitarsal rake spines spatulate, spines shorter than half basitarsal width (Figs. 66e, 69e); hindbasitarsus flattened dorsoventrally (Fig. 67c, d), its length at most  $1.3 \times$  that of posterior hindtibial spur; hindtarsomeres symmetrical (not expanded apicolaterally), hindtarsomere II less than twice as long as wide apically; side of tergum VII with prominent, oblique ridge in anterior half, with setae not concealing integument (Figs. 67f, 70b); apex of tergum VII (beneath lateral pygidial process) with setae denser, concealing integument (except mesally in *bernardi*); sternum II with anterior margin of elevation obtuse; sterna V and VI densely, conspicuously punctate and setose; antenna, thorax, and propodeum largely and gaster all or predominantly yellow and/or reddish, wings hyaline or slightly yellowish . . . 35
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- spicuously setose (Fig. 87f), with carina between pygidial plate and adlateral carina . . . . .  
 . . . . . *pentheri* Brauns, p. 441
- Most punctures of mesothoracic venter, before precoxal sulcus, several to many diameters apart; side of tergum V without tooth; pygidial plate diverging posteriorly in basal half (Figs. 63b, 82e, 95d), in lateral view separated by shallow emargination from tergal apex (Figs. 63c, 75c, d, 95e); side of tergum VII inconspicuously setose, without carina between pygidial plate and adlateral carina . . . . . 38
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- Midtibial spur present (although short); forebasitarsus without ventral row of erect setae; tergum IV without adlateral carina; apex of tergum VII well defined, located slightly posterad of apex of pygidial plate (Figs. 63c, 82f); elevation of sternum II not carinate anteriorly, not dentate posteriorly; sternum VIII asetose preapically . . . . . 39
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- Flagellum almost cylindrical (Fig. 63a); posteroventral mandibular tooth not produced into point; forebasitarsus with oblong, black, preapical tubercle on venter; midbasitarsus not flattened laterally; midtarsomeres II and III each with circular, translucent, apicoventral pad; pygidial plate not emarginate apically (Fig. 63b); tergal maculae whitish, interrupted. . . . .  
 . . . . . *arabicus* Pulawski, sp. nov., p. 409
40. Genal setae sinuous; midtibia without spur; adlateral carina of tergum VII not expanded . . . . .  
 . . . . . *jaxartes* Pulawski and Prentice, sp. nov., p. 430
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- Venter of forebasitarsus without oblong, black, preapical tubercle; midbasitarsus not curved in profile, not thicker apically than near midlength or gradually broadening toward apex; venter of midtarsomeres II and III without lamellar, translucent pads; tergum VII without basal carina between pygidial plate and adlateral carina . . . . . 42
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- laterally (i.e., markedly higher than wide), curved in dorsal view, its ventral margin with row of spines that are closely spaced on basal half (Fig. 74b, c); midtarsomeres II and III ventrally each with inconspicuous, transverse, glabrous area between setal patch and apical margin; adlateral carina of tergum VII, in basal half, broadened and bent ventrad (Fig. 75c, d) . . . . .
- ..... *fulviventris* Latreille, p. 420
- Longest genal setae markedly shorter than midocellar width; mesothoracic venter with many punctures and corresponding setae before precoxal sulcus (most punctures 2-4 diameters apart); foretibia without black apicoventral spot; midbasitarsus slightly flattened, straight in dorsal view, ventrally with row of widely spaced spines; venter of midtarsomere II and III without glabrous, apical area, setal patch extending to apical margin; adlateral carina of tergum VII, in basal half, expanded but not bent ventrad (Figs. 77f, 99d) . . . . . 43
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- Forecoxa with acute apicomedian prominence; midcoxa with posteroventral carina or well-developed tubercle; midtarsomere II with cluster of posteroventral spines; adlateral carina of tergum VII double-edged in posterior half, microridged between edges (Fig. 77f); that of sternum VI not pointed posteriorly (Fig. 77f); antenna all or predominantly yellowish red dorsally . . . . . *gao* Pulawski and Prentice, sp. nov., p. 427

### SPECIES DESCRIPTIONS

Repetitive characters have been omitted from the descriptions below. Unless indicated otherwise, the following states apply:

Genal setae straight (sinuous in *bernardi*, *dongalensis*, *jaxartes*, and in male and many females of *rufipes*).

Median depression of posterior propodeal surface bordered by obtuse carina or no carina (bordered by sharp carina in *comberi*).

Foretibia with nonemarginate apicoventral margin, without falciform seta (apicoventral margin emarginate and one or two falciform setae present in *rufipes*).

Female: foretibia with apicoventral margin not emarginate posterad of spur socket, without dark marginal cuticle (emarginate and with dark marginal cuticle in *rufipes*).

Female: forebasitarsus not widened (widened in *rufipes*).

Female: midbasitarsus with fewer than 20 dorsal spines (about 30 spines in *comberi* and *obesus*).

Male: clypeus not particularly convex adjacent to lateroclypeal notch, not particularly inflated there (markedly convex and inflated in *bernardi*).

Male: occipital carina complete (effaced subdorsally in *dongalensis*).

Male: ventral length of flagellomere I greater than apical width (smaller than apical width in *bernardi*).

Male: ventral mandibular tooth not produced into a ventrally (= posteriorly) directed point (produced in the male of *klugi*).

Male: mesothoracic venter slightly concave (markedly concave in male or *bernardi* and slightly less so in *rufipes*).

Male: forecoxa apicomediaally not expanded into narrow platform that is delimited by carina (expanded, carinate in *fulviventris* and *gao*).

- Male: forecoxal setae not sinuous (most setae sinuous in *bernardi* and *dongalensis*).
- Male: forefemur not concave anteroventrally (concave anteroventrally in *bernardi* and *dongalensis*).
- Male: foretibia not markedly triangular as seen in posterior view (triangular in *rufipes*).
- Male: foretibia without black, apicoventral mark (mark or marks present in *fulviventris* and *klugi*).
- Male: venters of mid- and hindtibiae and of mid- and hindbasitarsi without dense, erect setae except hindbasitarsus with usual erect setae, part of cleaning apparatus (venters of mid- and hindtibiae except basally and of mid- and hindbasitarsi with dense, erect setae in *comberi*, *nama*, and *obesus*).
- Male: forebasitarsus not widened, without black markings and dark appressed setae on venter, without ventral preapical tubercle, without ventral row of erect setae (conspicuously widened, with row of dark, appressed setae on venter in *bernardi*, *dongalensis*, and *rufipes*, with ventral, preapical tubercle in *arabicus*, *jaxartes*, *oneili*, and *saundersi*, with ventral row of erect setae on at least apical third in *jaxartes* and *saundersi*).
- Male: midtarsomeres II and III without translucent, apicoventral pads (with a circular, translucent, apicoventral pad in *arabicus*, *jaxartes*, *oneili*, and *saundersi*).
- Male: hindfemur not flattened anterobasally (flattened in *comberi*).
- Male: hindtarsomeres II and III symmetrical, not expanded apicolaterally (expanded apicolaterally in *rufipes*).
- Male: hindtarsomere II not elongate: length smaller than twice width (greater than twice width in *rufipes*).
- Male: tergum IV without adlateral swelling (swelling present in *saundersi*).
- Male: tergum VII without basal carina or oblique ridge between pygidial plate and adlateral carina (basal carina present in *oneili* and *pentheri*, oblique setose carina present in *bernardi* and *dongalensis*), its side not conspicuously concave (conspicuously concave in *bernardi*, *dongalensis*, and *rufipes*).
- Male: sternum II with anterior margin of elevation not curved and not sharply carinate (curved and sharply carinate in *saundersi*), posterior margin of elevation not produced into a series of teeth (prominent teeth present in *saundersi*, Fig. 95b, obtuse teeth present in *bernardi* and *dongalensis*).
- Gonocoxite basoventrally with sclerotized portion not elongate (elongate in *bernardi*, Fig. 68b, and *dongalensis*, Fig. 70d).

### ***maculatus* group**

**RECOGNITION.**— Members of this group differ from other *Palarus* in having a unique labrum: not or minimally convex, length about one quarter width, with unsculptured apicolateral expansion (Fig. 9c), fully concealed when mandibles closed (Fig. 9b), in the female with transverse carina straight and concealed under the clypeus, without median carina on distal half; clypeus not produced anteriorly between lateroclypeal notches (Fig. 9a), with no gap or minimal gap between free margin and folded mandibles (Fig. 9b); posterior clypeal surface without row of setae adjacent to free margin; scape with numerous long erect setae ventrolaterally (setal length exceeding width of scape); pronotal collar depressed, not raised as narrow wedge (Figs. 9d, 27b), streptaulus fused with anterior pronotal groove (Fig. 9e); mesosternal and metasternal posterior margin not expanded into flange, respective coxal articulations exposed (Fig. 9f); metapleuron uniformly microsculptured, dull; first recurrent vein inserting on first submarginal cell, well separated from first inter-submarginal vein; hindfemur with apical lobe (Fig. 10a), lobe rudimentary in some males; hindtarsomere III with a pair of apicolateral and in many specimens of apicoadlateral dorsal spines; tergal



FIGURE 9. *Palarus maculatus* species group exemplified by female of *Palarus maculatus* Dahlbom: a – head in frontal view showing nearly contiguous eyes; b – head in ventral oblique view showing closed mandibles concealing labrum; c – lower portion of female clypeus and labrum; d – pronotum in lateral view; e – posterior part of head, pronotum, and anterior portion of scutum in dorsal view showing streptaulus fused with anterior pronotal groove; f – mesocoxal and metacoxal area showing mesosternal and metasternal free margin not expanded into flange (respective coxal articulations exposed).

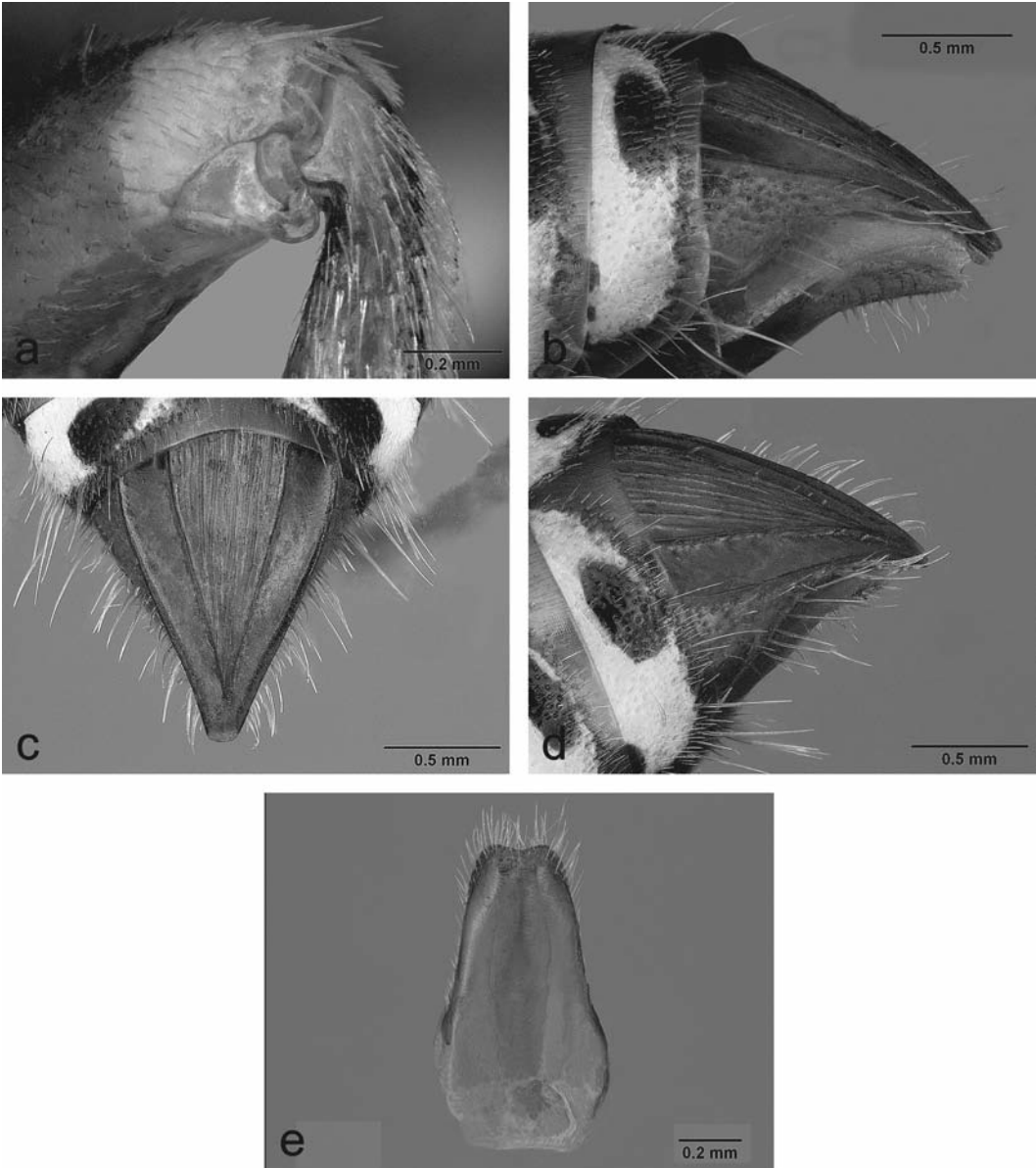


FIGURE 10. *Palarus maculatus* species group exemplified by *Palarus maculatus* Dahlbom: a – female hindfemoral lobe; b – female tergum VI in lateral view; c – female pygidial plate in dorsal view; d – female pygidial plate in lateral oblique view; e – male sternum VIII, ventral face.



free margin simple in female, minutely truncate or double-edged in male. Female: pygidial plate with well-defined inner platform (Fig. 10b-d); side of tergum VI without longitudinal carina below margin of pygidial plate, its ventral portion not curved inwards; tergal apex minimally protruding over sternal apex, which is thin dorsoventrally (Fig. 10d), its sides not fused preapically; sternum VI without small flange overlapping ventral margin of tergum VI. Male: tergum VII either not expanded or roundly expanded basolaterally, without lateral process above adlateral carina; penis valve unique among *Palarus*: conspicuously angulate at ventral base of apical expansion (Fig. 11b).

**DESCRIPTION.**— In addition to the characters given under Recognition above, the seven included species share the following:

Frontal swelling not margined laterally by sulcus. Interantennal area either with or without longitudinal crest. Vertex not broadly swollen between mid- and hindocelli except mesally swollen in *comberi* and *obesus*. Midocellus separated from hindocellus by clearly less than midocellar width. Hindocellus nearly touching orbit. Lateroclypeal notch present. Postocellar area without impression. Gena narrow as seen from above (occipital carina separated from eye margin at vertex by less than half midocellar width). Posteroventral mandibular notch well defined. Mesopleural setae distinctly shorter in male than in female. Metapleuron impunctate and asetose or with inconspicuous setae and a few, sparse punctures. Propodeal dorsum with well-defined adlateral depression, with median depression microsculptured and several midocellar widths wide; dorsum shallowly punctate (not ridged) laterad of median impression. Propodeal side impunctate at least anteriorly; area between side and posterior surface densely punctate (punctures densest in dorsal corner, less than one diameter apart) and with sinuous setae that are more than twice midocellar width long; admarginal carina complete mesally (almost narrowly interrupted in some *obesus*). Outer and inner apical spines of hindtarsomeres II and III equal in length. Tergum I without adlateral carina (except carina present in male of *obesus*), its apical depression punctate. Gonocoxite all sclerotized. Setae longer than basal mandibular width at least on gena and propodeum (genal setae sinuous), suberect to erect on tergum I at least behind spiracle (but all appressed in some *turneri*).

Non-maculate areas of head, thorax, and propodeum black (with exceptions in some *comberi* and some *maculatus maculatus*); head overall black except clypeus yellow (small area below anterior tentorial pit black); small admedian macula present above antennal socket (see individual species for exceptions); mandible yellow on basal half, reddish brown to dark brown apically; antenna brown to black. See descriptions of individual species for additional details. Wing membrane hyaline to slightly infumate.

♀.— Position of lateroclypeal sulcus in relation to notch varying from species to species. Midcoxal ventral surface without preapical tubercle. Pygidial carina not raised above plate's plane on apical half. Sternum II simple.

♂.— Occipital carina separated from eye orbit at vertex by less than half midocellar width except more in *turneri*. Flagellomeres without obvious setation. Midcoxal venter without posteroventral carina. Midtibial spur not shortened, about  $0.5 \times$  length of midbasitarsus. Tergum IV without adlateral swelling. Tergum V without adlateral tooth or tubercle. Tergum VI with adlateral carina. Sternum I without paired preapical swellings. Sternum II with preapical, transverse elevation. Sternum VIII not constricted preapically, its dorsum (= inner surface) without median carina, its venter uniformly setose near apex, without specialized row of setigerous punctures (Fig. 10e). Gonocoxite without dense brush of long setae ventrally (Fig. 11b), without membranous ventral area near midlength (Fig. 11b). Penis valves dorsally fused for less than half their length (Fig. 11a), without longitudinal sclerotized ridges apically, angulate at ventral base of apical expansion (Fig. 11b).

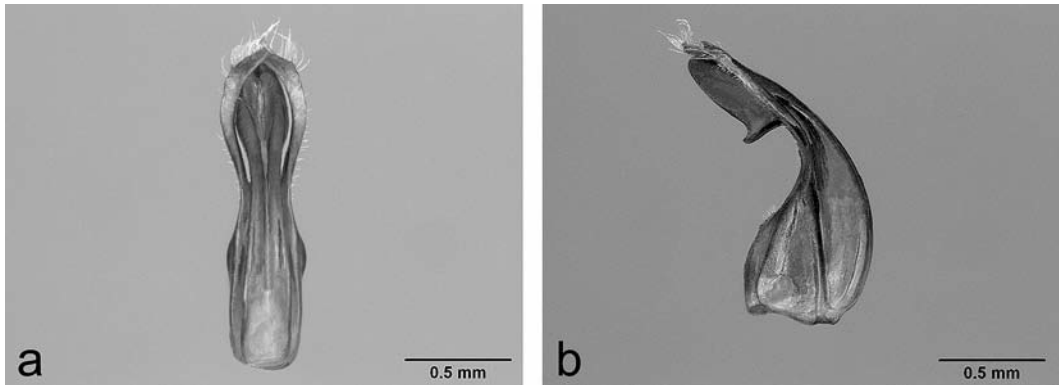


FIGURE 11. *Palarus maculatus* species group exemplified by *Palarus maculatus* Dahlbom ♂: a – genitalia in dorsal view; b – genitalia in lateral view.

### *Palarus comberi* Turner

Figures 12-14.

*Palarus comberi* Turner, 1911:483, ♀, ♂. Holotype: ♂, Pakistan: Karachi (BMNH), examined.— Ramakrishna Aiyar, 1916:553 (in catalog of Indian aculeates described after Bingham, 1897); Bohart and Menke, 1976:291 (listed); Guichard, 1988:134 (Saudi Arabia).

**RECOGNITION.**— Unlike all other *Palarus*, *comberi*, *nama*, and *obesus* have an obtuse crest on the postocellar area (Fig. 12), and male tergum VII with the adlateral carina conspicuously, roundly expanded (Figs. 13f, 20b, 23f). *Palarus comberi* and *obesus* have about 30 dorsal spines on the female midbasitarsus, and male sternum II has a V-shaped ridge before the elevation. In the other *Palarus*, the postocellar area has no crest, the female midbasitarsus has fewer than 20 dorsal spines, and male sternum II has no V-shaped ridge before the elevation. The hindocellus of *comberi* and *obesus* is oblong, slightly sunken along the admedian edge, the lateroclypeal notch is in-line with the lateroclypeal sulcus, and the male pygidial plate not broadened anteriorly. In the other members of the *maculatus* group, the hindocellus is a different shape and not sunken along the admedian edge, the lateroclypeal notch is separated from the sulcus, and male tergum VI is differently shaped.

*Palarus comberi* is unique in the genus in having the median depression of the posterior propodeal surface bordered by a sharp rather than obtuse carina and the male hindfemur flattened anterobasally, minimally concave. It differs from *obesus* in having male midcoxa with inconspicuous anteroventral tubercle (tubercle conspicuous in *obesus*), male tergum I without an adlateral carina and associated tubercle (carina and tubercle present in *obesus*), and by the form and setation of male sternum II (posterior surface of elevation higher than midocellar width, without well-defined row of sinuous setae, whereas lower than midocellar width and with well-defined setal row in *obesus*). The

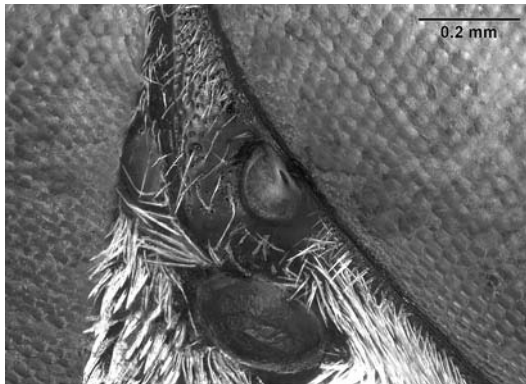


FIGURE 12. *Palarus comberi* Turner ♀: ocellar and postocellar area in lateral oblique view showing crest.





FIGURE 13. *Palarus comberi* Turner: a – propodeal dorsum of female; b – female midbasitarsus; c – male gastral segments II-VII in lateral view; d – male sternum II and part of tergum II in lateral view; e – male tergum VI in lateral oblique view showing adlateral carina; f – male tergum VII dorsally.

three males of *comberi* that we have examined are unique in having a discrete, yellowish white macula on the precoxal lobe (in front of midcoxa), but this character may not be constant; unlike the other species of the group, they have a discrete, yellowish white macula on the mid- and hindtrochanters and a large, yellowish white, irregularly shaped, full-length macula on the mid- and hindfemora.

**SPECIES DELIMITATION.**— Specimens of *comberi* differ considerably between localities (see

Description below), particularly in scutal setation, form and setation of male sternum II, shape of the clypeus (which varies markedly more than in the other species of the group), and thoracic maculation. Our limited material does not allow us to ascertain whether these specimens represent geographic populations of a single species or a series of discrete species. For now, we interpret them as part of a single, geographically variable species, although *obesus* may be the westernmost geographic form of *comberi*. However, as the two differ by several significant characters with no known intermediates (see Recognition above), we prefer to treat them as distinct species.

**DESCRIPTION.**—Clypeus in female varying from about  $2.15 \times$  as wide as long (specimen from Nuk-e-Djube, Iran) to  $2.6\text{--}2.8 \times$  as wide as long (specimens from Disa, India), about  $2.2\text{--}2.3 \times$  as wide as long in male. Postocellar area with longitudinal crest that extends far onto interocellar area (Fig. 12). Hindocellus somewhat flattened, oblong, slightly sunken along admedian edge. Least interocular distance about  $0.1\text{--}0.2 \times$  midocellar width. Area between mid- and hindocellus setose, punctate, and dull, like adjacent areas. Occipital carina separated from eye outer orbit at vertex by less than length of hindocellus. Pronotum with groove-like median depression (depression effaced in some specimens from Disa, India). Scutal punctures from about four to many diameters apart near center, elsewhere about 1-3 diameters apart; setae suberect (specimens from Karachi, Pakistan, and Disa and Jodhpur area, India) to appressed toward center (those from Jaisalmer, India; Kharan, Pakistan; Nuk-e-Djube, Iran; and El Riyadh and Hofuf, Saudi Arabia), length about  $0.5 \times$  midocellar width to slightly more. Width of impunctate median area of propodeal dorsum (measured at one midocellar width before dorsal hindmargin) smaller than length of dorsum along midline (Fig. 13a). Median depression of posterior propodeal surface bordered by sharp carina. Longest setae of midfemoral venter (near femoral base) slightly sinuous, shorter than midocellar width in female, sinuous and as long as midocellar width in male. Tergum I either without adlateral carina or (specimens from Karachi) with slight carina before spiracle. Erect setae of tergum I conspicuously dense laterally, markedly sparser mesally.

Frons with minute trace of macula above antennal socket in some specimens; mandible in some specimens with well-defined basal macula, reddish preapically, black apically, ventral margin darkened; flagellum brown (Saudi Arabia) to black (India). Thorax and propodeum black (propodeum brown in specimen from El Riyadh) except the following maculate: pronotal collar laterally, part of pronotal lobe (specimens from Jaisalmer, Kharan, Nuk-e-Djube, and Hofuf), narrow strip along anterior portion of scutal flange (a female from Jaisalmer), preepisternum dorsally (macula reduced or absent in some specimens from Karachi and Disa), scutellar disk laterally in specimens from Jaisalmer and Hofuf, all in specimens from Kharan and Nuk-e-Djube, scutellar flange, postscutellum (all black in specimens from Karachi and Disa), posterolateral metanotal edge, precoxal lobe, metasternum partly in male, tegula, and essentially all of humeral plate. Coxae reddish to black, with or without apical maculae (maculae conspicuous in all males examined). Forefemur dark brown to black, with large apicoventral macula; female midfemur with apicoventral macula, hindfemur with apical macula, remainder progressively more reddish in specimens from El Riyadh, Hofuf, Kharan, Nuk-e-Djube, and Jaisalmer, dark brown in those from Karachi and Disa; male mid- and hindfemora dark brown, with large, somewhat irregular macula that extends from apex to base and onto trochanters. Female tibiae reddish in specimens from El Riyadh, Hofuf, Kharan, Nuk-e-Djube, and Jaisalmer (dorsum maculate or hindtibial macula interrupted mesally), brown in those from Karachi and Disa (narrowly maculate basally, also apically on fore- and midtibiae); male tibiae brown (fore- and midtibiae maculate dorsally, hindtibiae maculate anteroventrally in specimen from Karachi, anteriorly in those from Jaisalmer and Jodhpur area). Female tarsi reddish, foretarsomere varying from maculate basally and apically (Disa) to all maculate (El Riyadh); male tarsi brown or fore- and midtarsomeres maculate. Gastral ground color

black in specimens from Karachi, Disa, and Jodhpur area, reddish in others, maculae yellowish white or yellow; in specimens from El Riyadh, Hofuf, Kharan, Nuk-e-Djube, and Jaisalmer tergum I with entire or narrowly interrupted fascia, terga II-V in female, II-VI in male, with entire or narrowly interrupted fascia before apical depression, and female tergum VI partly fasciate; in specimens from Karachi and Disa tergum I with broadly interrupted fascia, terga II-V in female, II-VI in male, with broadly interrupted fascia before apical depression, and female tergum VI dark brown; in males from Jodhpur area tergum I with broadly interrupted fascia and terga II-VI with narrowly interrupted fascia; male tergum VII all dark brown.

♀.— Vertex without punctures along edge of crest, without median, impunctate strip. Lateroclypeal notch almost in-line with lateroclypeal sulcus, separated by less than  $0.1 \times$  midocellar width. Dorsal length of flagellomere I  $2.9\text{--}3.2 \times$  apical width. Foretarsomere IV with two fully developed rake spines. Midbasitarsus with about 30 dorsal spines (Fig. 13b). Pygidial plate with platform irregularly rugose to irregularly ridged. Length 11.1–12.7 mm.

♂.— Dorsal length of flagellomere I  $2.9\text{--}3.0 \times$  apical width. Precoxal mesopleural declivity with sharp, elongate tubercle laterally, not delimited by swelling anteriorly. Mesopleural setae about as long behind episternal sulcus as midocellar width or slightly shorter, in specimens from Disa, Jodhpur area, and Karachi sinuous, erect, in that from Jaisalmer slightly sinuous, subappressed. Midcoxa with minimal anteroventral tubercle just dorsad of anterior trochanteral articulation. Hindfemur flattened anterobasally. Venters of mid- and hindtibiae (except basally) and of mid- and hindbasitarsi with dense, erect setae (as in Fig. 23b, c). Inner hindtibial spur  $3.4\text{--}3.5 \times$  midocellar width in males from Disa, Jodhpur area, and Karachi, and  $2.8 \times$  in that from Jaisalmer. Adlateral carina of tergum VI sharp but not angulate posteriorly (Fig. 13e). Tergum VII: pygidial plate with lateral margins parallel or slightly converging apically (Fig. 13f), well separated from adlateral carina, which is roundly expanded basally. Sternum II with V-shaped to nearly transverse ridge before elevation (Fig. 13d), top of elevation concave in specimen from Karachi, posterior surface of elevation tall (height greater than midocellar width), with sinuous, modestly dense (specimen from Jaisalmer) to very dense setae (specimens from Karachi, Jodhpur area, and Disa), setae not arranged in well-defined rows. Sterna III–VII densely punctate (most punctures on sternum VI one diameter or less apart), with dense, erect, sinuous setae (Fig. 13c); sterna III–VII without stiff setae bordering apical depressions. Length 13.0–14.0 mm.

**COLLECTING PERIOD.**— India: August through October; Iran: 18 May; Pakistan: 24 April and October; Saudi Arabia: 21–26 April and 15 June.

**GEOGRAPHIC DISTRIBUTION** (Fig. 14).— Arabian Peninsula, southern Iran, southern Pakistan, and northwestern India.

**RECORDS.**— **INDIA:** Gujarat: Disa = Deesa (5 ♀, 1 ♂, BMNH, including 2 ♀ paratypes of *comberi*; 1 ♀, CAS). Rajasthan: Jaisalmer (2 ♀, BMNH; 1 ♀, 1 ♂, CAS), 40 km S Jodhpur (1 ♂, CAS; 1 ♂, STUTTGART). **IRAN:** Baluchistan: Nuk-e-Djube 15 km E Bampur at  $27^{\circ}13'N$   $60^{\circ}30'E$  (1 ♀, CSE). **PAKISTAN:** Baluchistan: Kharan (1 ♀, BMNH). **Sind:** Karachi (1 ♀, 1 ♂, BMNH, holotype and paratype of *comberi*). **SAUDI ARABIA:** El Riyadh (1 ♀, CAS), Hofuf (1 ♀, BMNH).

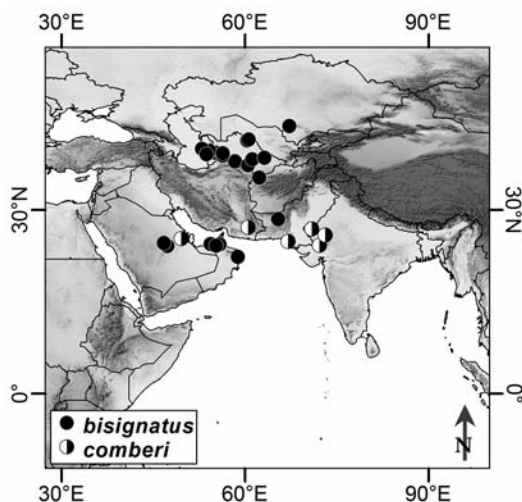


FIGURE 14. Collecting localities of *Palarus bisignatus* F. Morawitz and *Palarus comberi* Turner.



*Palarus furtivus* Pulawski and Prentice, sp. nov.

Figures 15, 16.

**DERIVATION OF NAME.**—*Furtivus*, a Latin adjective meaning hidden or secret, as the species is rarely collected.

**RECOGNITION.**—*Palarus furtivus*, known from central Namibia and northwestern South Africa, resembles *maculatus*, *occidentalis*, and *turneri* in lacking a longitudinal crest on the postocellar area (crest present in *comberi*, *nama*, and *obesus*). The female differs from these three species by the presence of an anterolateral scutal macula, the male by the presence of dense, long erect setae on sterna III-VI and contrastingly short setae on the midfemoral venter (the setae on both midfemoral venter and sterna III-VI are short, inconspicuous in the males of *occidentalis* and *turneri*, and long, erect, sinuous in that of *maculatus*). Also, the female of *furtivus* has the least interocular distance slightly wider than *maculatus* ( $0.3 \times$  midocellar width rather than  $0.2 \times$  or less), and the male the adlateral carina of sternum VI (Fig. 15b) sharply defined, distinctly raised. This carina is dull and not raised in the male of *maculatus maculatus* (Fig. 18d), and prominent in *maculatus nigrior* (Fig. 18f) which does not occur sympatrically with *furtivus*. In addition, *furtivus* has a pronotal macula, a feature not found in *occidentalis* and found only uncommonly in *maculatus*, and the mesopleural setae of the male are somewhat shorter than in *maculatus*.

**DESCRIPTION.**—Clypeus about  $2.5 \times$  as wide as long or less in female, about  $2.35 \times$  in male. Postocellar area without obtuse crest. Hindocellus convex, nearly circular, not sunken along admedian edge. Least interocular distance  $0.25-0.30 \times$  midocellar width in female,  $0.1-0.2 \times$  in male. Area between mid- and hindocellus setose, punctate, and dull, like adjacent areas. Occipital carina separated from eye outer orbit at vertex by less than length of hindocellus. Pronotal collar without groove-like median depression. Scutal punctures about 1-3 diameters apart near center, setae suberect near center, length about  $0.5 \times$  midocellar width. Width of glabrous depression of propodeal dorsum (measured at one midocellar width before posterior end) equal to or slightly greater than

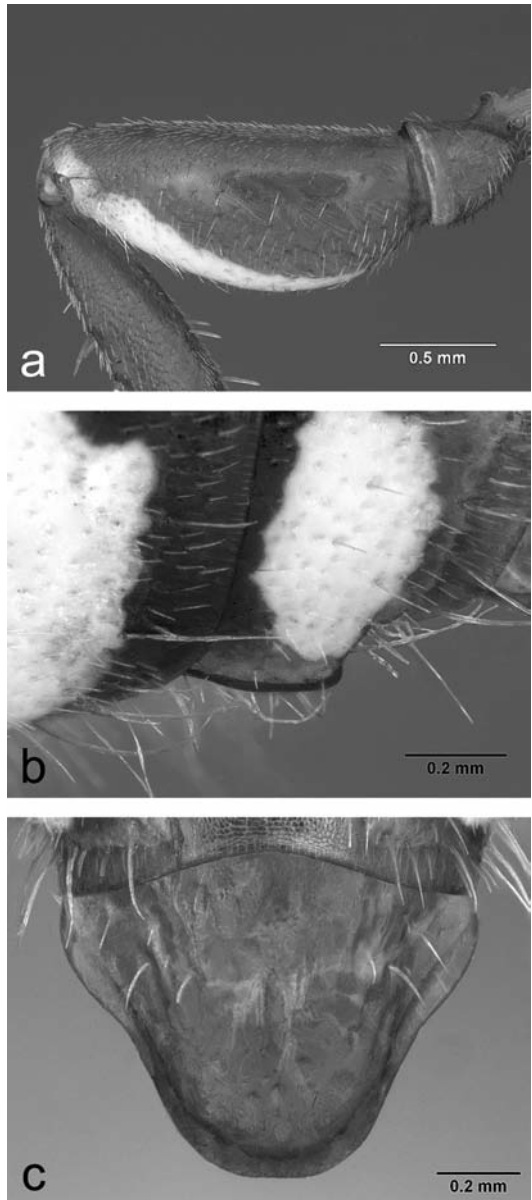


FIGURE 15. *Palarus furtivus* Pulawski and Prentice, sp. nov.: a – female midfemur; b – adlateral carina of male sternum VI; c – male tergum VII dorsally.

midlength of propodeal dorsum, except distinctly less in one female examined. Longest setae of midfemoral venter not sinuous, equal to half midocellar width or shorter (Fig. 15a). Erect setae of tergum I present both laterally and mesally.

Maculae whitish; frons with macula above each antennal socket, in one specimen with minimal median macula just above clypeus; flagellum light reddish brown; mandible with well-defined macula on basal half in female, about basal third in male; thorax and propodeum black, except the following maculate: pronotal collar laterally (macula small in male), scutum anterolaterally (female only), preepisternum dorsally (macula larger than tegula), tegula, and anterior half of humeral plate. Coxae immaculate, reddish brown in female, brown in male; femora red in female, in male either all dark brown to black or hindfemur red; fore- and midfemora with ventral macula (except basally); hindfemur with outer, apical macula; tibiae red in female, light brown to reddish in male, with full length dorsal macula (midtibia) or ill-defined dorsal macula (fore- and hindtibiae); tarsi reddish in female, in male light brown to reddish except foretarsus yellowish. Gaster: in female anterior terga dark brown, posterior terga progressively more reddish; in male terga dark brown to black except tergum VII red to brown; sterna red to brown; terga I-V in female, I-VI in male, with whitish fascia before each apical depression (macula narrowly interrupted on tergum I in female, interrupted on all but tergum II in male); apical tergum with traces of yellowish white in female, immaculate in male.

♀.— Postocellar area with rudimentary, impunctate strip. Lateroclypeal notch separated from lateroclypeal sulcus by about  $0.5 \times$  midocellar width. Dorsal length of flagellomere I  $2.7\text{--}2.8 \times$  apical width. Foretarsomere IV with single rake spine or (some specimens) with additional, smaller spine. Inner platform of pygidial plate with longitudinal, nearly parallel ridges. Length 8.7–9.5 mm.

♂.— Dorsal length of flagellomere I  $2.5\text{--}2.9 \times$  apical width. Mesopleural setae near center shorter than midocellar width. Precoxal mesopleural declivity delimited by swelling anterolaterally, without sharp tubercle laterally. Midcoxa without anteroventral tubercle. Midbasitarsus with row of spines in distal half ventrally. Hindfemur not flattened anterobasally. Adlateral carina of tergum VI prominent, sharply angulate posteriorly (Fig. 15b). Tergum VII: pygidial plate broad, extending over adlateral carina (thus appearing as tergal margin in dorsal view), roundly expanded basally (Fig. 15c). Sternum II without V-shaped ridge before elevation, posterior surface of elevation tall (height greater than midocellar width), without sinuous setae or with one or two such setae. Sterna III–VII densely punctate (most punctures on sternum VI more than one diameter apart), with dense, erect, sinuous setae before apical depressions; sterna III–VII with a few stiff setae bordering apical depression. Length 9.5–11.8 mm.

**GEOGRAPHIC DISTRIBUTION** (Fig. 16).— Central Namibia to western South Africa.

**RECORDS.**— **HOLOTYPE:** ♂, Namibia: Rehoboth District: 23 km N Rehoboth, 17 Feb 1990, W.J. Pulawski (CAS). **PARATYPES: NAMIBIA: Keetmanshoop District:** road C17 NNE Koës to Gochas at  $25^{\circ}39'S$   $19^{\circ}24'E$ , 8 Mar 2000, F.W. and S.K. Gess (3 ♂, AMG). **Maltahöhe District:** Aandster Farm, 16 Feb 1974, M.E. Irwin (1 ♂, UCD); road D811 S Maltahöhe at  $25^{\circ}15'S$   $17^{\circ}01'E$ , 23 Mar 1999, F.W. and S.K. Gess (1 ♀, 1 ♂, AMG); no spe-

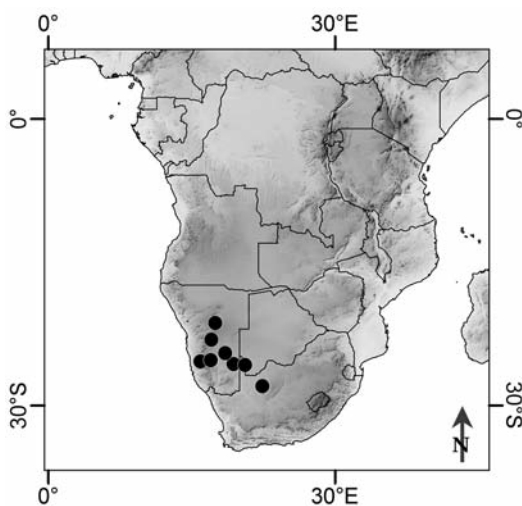


FIGURE 16. Collecting localities of *Palarus furtivus* Pulawski and Prentice, sp. nov.

cific locality, 17 Feb 1974, M.E. Irwin (1 ♂, UCD). **Mariental District:** 41 km SW Gibeon at 25°20'S 17°29'E, F.W. and S.K. Gess, 10 Mar 1999 (2 ♀ AMG; 2 ♀, CAS) and 24 Mar 1999 (2 ♂, AMG); Gross Nabas 24 km SE Stampriet at 24°30'S 18°32'E, 30 Mar 2000, F.W. and S.K. Gess (1 ♀, AMG). **Rehoboth District:** 23 km N Rehoboth, 17 Feb 1900, M. Schwarz (1 ♂, MS), W.J. Pulawski (4 ♂, CAS). **SOUTH AFRICA: Northern Cape Province:** 40 km W Olifantshoek, 29 Jan 1988, R. Miller and L. Stange (1 ♂, MS); 78 km N Twee Rivieren in Kalahari Gemsbok National Park, 28 Mar 1990, M. Schwarz (1 ♂, CAS).

### *Palarus maculatus* Dahlbom

Figures 17-19.

*Palarus maculatus* Dahlbom, 1845:468, ♀. Holotype or syntypes: ♀, South Africa: Cape Province: no specific locality (lost). Neotype: lectotype of *Palarus handlirschi* Brauns, **here designated** (TMP), examined.—Kohl, 1885:426 (original description copied, as *maculatus*), 428 (in checklist of world *Palarus*); Dalla Torre, 1897:659 (in catalog of world Sphecidae); W. Schulz, 1912:95 (type not found in Lund); Bohart and Menke, 1976:291 (listed).

*Palarus handlirschi* Brauns, 1911:117 (preying on aculeates and bee-like Diptera). Nomen nudum.

*Palarus handlirschi* Brauns, 1912:653, ♀, ♂. Lectotype: ♀, South Africa: Eastern Cape Province: Willowmore (TMP), **here designated**, examined. **New synonym.**—Arnold, 1923:7 (in revision of Afrotropical *Palarus*); Bohart and Menke, 1976:291 (listed).

*Palarus handlirschi* var. *nigrrior* Arnold, 1923:8, ♀. Holotype: ♀, Zimbabwe: Sawmills or Victoria Falls (SAM), examined.—Arnold, 1930:7 (in checklist of Afrotropical Sphecidae), 1935:498 (Botswana: Gemsbok Pan).—As *Palarus handlirschi nigrrior*: Bohart and Menke, 1976:291 (new status, listed).

**RECOGNITION.**—Unlike other members of the group, *maculatus*, *furtivus*, and *occidentalis* have a black scutellum and metanotum, female lateroclypeal notch separated from lateroclypeal sulcus by about  $0.5 \times$  midocellar width, male tergum VII with a simple adlateral carina and pygidial plate contrastingly, roundly expanded basally; they also lack a longitudinal crest or an unsculptured line on the postocellar area (a rudimentary line is present in the female of *furtivus*). Unlike *furtivus* and *occidentalis*, the setae of the midfemoral venter in *maculatus* are as long as the midocellar width, erect, sinuous (Fig. 18a), rather than markedly shorter than the midocellar width, not sinuous, mostly appressed. Unlike *occidentalis*, *maculatus* has a narrow impunctate depression of the propodeal dorsum: the depression's width, measured at one midocellar width before the dorsal hindmargin, is smaller than the dorsum's midlength (Fig. 17), whereas more than dorsum's midlength in *occidentalis*; and male sterna III-VI are densely punctate and setose (with a few punctures and associated setae in *occidentalis*).



FIGURE 17. *Palarus maculatus* Dahlbom ♀: propodeal dorsum

**NEOTYPE DESIGNATION.**—The type material of this species is apparently lost. It could not be located in the Zoological Museum, Lund, Naturhistoriska Riksmuseet, Stockholm, or Museum für Naturkunde der Humboldt Universität, Berlin, i.e., the three institutions where Dahlbom specimens are preserved (as the curators, Roy Danielsson, Bert Viklund, and Michael Ohl, respectively, kindly informed us). We believe that *Palarus maculatus* is identical with *handlirschi* (see Justification of New Synonymy), and we fix this interpretation by designating the lectotype of *handlirschi* as a neotype of *maculatus*.



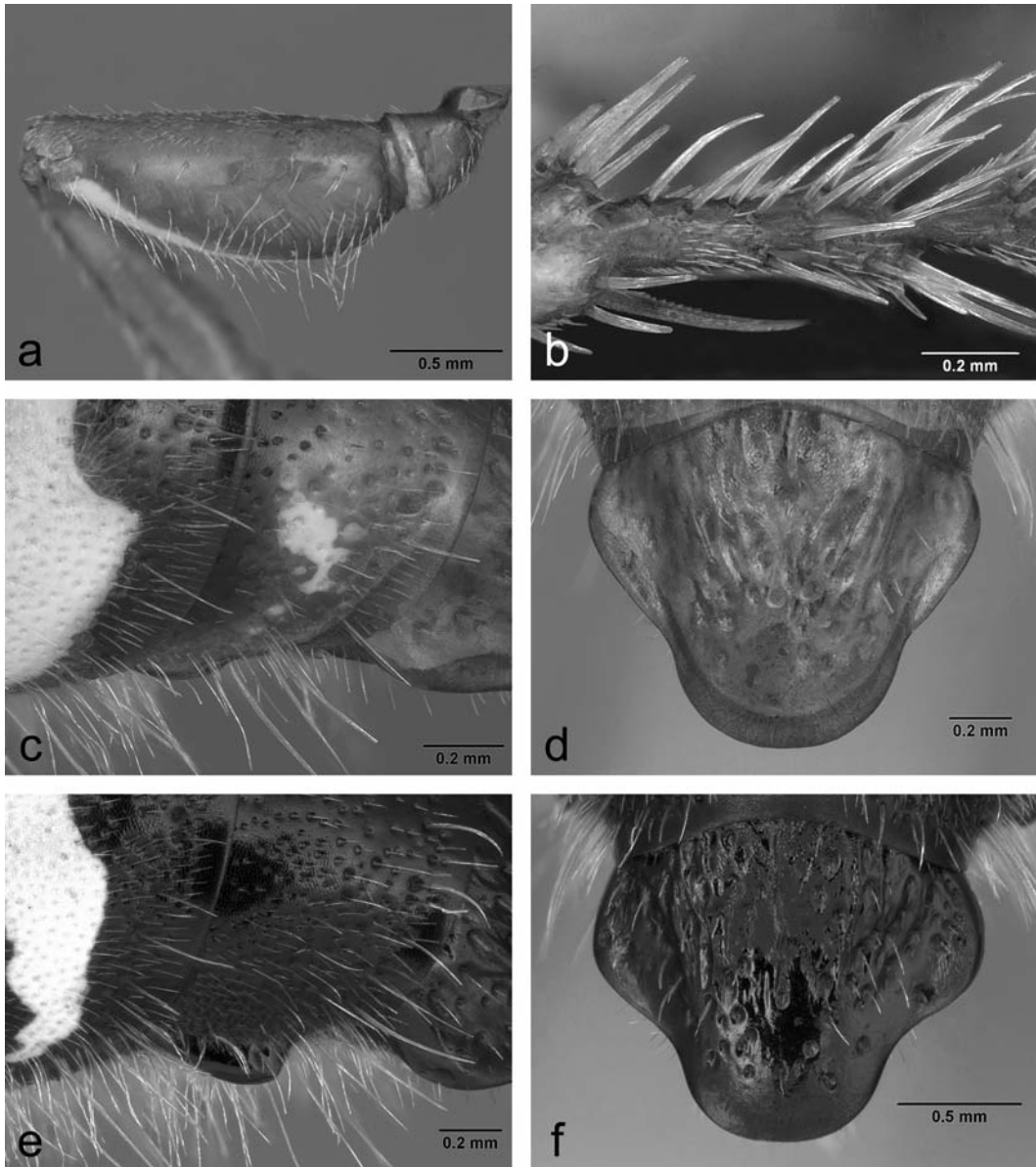


FIGURE 18. *Palarus maculatus* Dahlbom: a – female midfemur; b – female midbasitarsus; c – adlateral carina of male tergum VI of *maculatus maculatus*; d – male tergum VI of *maculatus maculatus* in dorsal view; e – adlateral carina of male tergum VI of *maculatus nigrior*; f – male tergum VI of *maculatus nigrior* in dorsal view.

**JUSTIFICATION OF NEW SYNONYMY.**— Dahlbom (1845) gives “Cap. bor. sp.” as the country of origin of *Palarus maculatus*, no doubt a variant spelling or a *lapsus calami* for the “Cap. B. sp.”, an abbreviation for Cape Bonae Spei (= Latin for Cape of Good Hoop) used for other new species from that area, e.g., *Cerceris lunigera* and *Philanthus schoenherri*. The Cape of Good Hope of that time was variously defined: it extended for 13 leagues [= 63 km] WNW from Point Agulhas and up to about 30°S according to Brookes (1844), but between 29°50' and 35°S and 15° and 26°E

(i.e., as far east as Port Elizabeth and Bloemfontein) according to Domenyi de Rienzi (1840).

Dahlbom's original description is extremely succinct: "Abdomen nigro-fuscum, flavo-maculatum. Pedes fulvi", i.e., gaster dark brown, with yellow spots, legs yellowish brown. Nevertheless, it allows recognition of the species. The important points are that the gaster is maculate rather than fasciate, that it is dark brown between the maculae, and that the gastral maculae are not the same color as the legs. Of the five species of *Palarus* occurring in the Cape Province as defined above, only *handlirschi* meets these criteria (although the gaster is fasciate rather than maculate in many specimens), and we synonymize these two names. In *latifrons*, *oneili*, and *pentheri*, the gaster is black between the maculae, fasciate in *latifrons* and *turneri*, and all black in the Cape populations of *oneili*. Also, in *latifrons* the female legs are predominantly black, and the male tibiae are yellow ("flavi" rather than "fulvi").

**DESCRIPTION.**— Clypeus about 2.5-2.6 × as wide as long or less in female, about 2.35-2.5 × in male. Postocellar area without obtuse crest. Hindocellus convex, nearly circular, not sunken along admedian edge. Least interocular distance about 0.1-0.2 × midocellar width. Area between mid- and hindocellus setose, punctate, and dull, like adjacent areas. Occipital carina separated from eye outer orbit at vertex by less than length of hindocellus. Pronotal collar without groove-like median depression. Scutal punctures about 1-3 diameters apart near center, setae suberect near center, length about 0.5 × midocellar width to slightly more. Width of impunctate median area of propodeal dorsum (measured at one midocellar width before dorsal hindmargin) smaller than length of propodeal dorsum along midline. Longest setae of midfemoral venter (near femoral base) sinuous, slightly shorter to slightly longer than midocellar width in most specimens (Fig. 18a), markedly longer than midocellar width in most males of *maculatus nigrior*. Erect setae of tergum I present both laterally and mesally.

Frons, in most specimens, with small macula above antennal socket (macula yellowish white in *maculatus maculatus*, yellow in *maculatus nigrior*). Thorax and propodeum all black in some specimens (largely dark reddish brown in one male from Vanwyksvlei, South Africa) except tegula and anterior half of humeral plate maculate; also the following maculate in most specimens: minimal lateral area on pronotal collar (some *maculatus maculatus*), preepisternum dorsally (most Namibian and some South African *maculatus maculatus*); a male from Vanwyksvlei, South Africa, has traces of yellow on scutellum, including minimal anteromedian macula. Coxae reddish to black, maculate anteriorly in some *maculatus maculatus*; femora reddish to black; forefemur with posteroventral macula of varying length; midfemur with minute outer, apical macula (possibly absent in some specimens) and (except basally) with ventral macula of varying length (ventral macula absent in many *maculatus nigrior*); hindfemur with outer, apical macula; tibiae reddish to dark brown, fore- and midtibiae maculate dorsally, hindtibiae immaculate (most specimens) or irregularly maculate; foretarsus brown in female, yellowish brown to yellow in male; midtarsus brown, partly yellow in some males; hindtarsus brown. Gaster (see also Status of *Palarus maculatus* and *nigrior* below): terga reddish to black, terga II-V (female) or II-VI (male) fasciate, fasciae broad in *maculatus maculatus* (uninterrupted in some), narrower and more broadly interrupted in *maculatus nigrior*. Sterna reddish to dark brown.

♀.— Postocellar area without median, impunctate strip. Lateroclypeal notch separated from lateroclypeal sulcus by about 0.5 × midocellar width. Dorsal length of flagellomere I 2.6-2.8 × apical width. Foretarsomere IV with single rake spine or (some specimens) with additional, smaller spine. Inner platform of pygidial plate with longitudinal, nearly parallel ridges. Length 7.5-11.5 mm.

♂.— Dorsal length of flagellomere I 2.6-2.8 × apical width. Precoxal mesopleural declivity delimited by swelling anterolaterally, without sharp tubercle laterally. Mesopleural setae behind

episternal sulcus sinuous, about as long as midocellar width. Midcoxa without anteroventral tubercle. Midbasitarsus with row of spines in distal half ventrally. Adlateral carina of tergum VI: see Status of *Palarus maculatus* and *nigrrior* below. Tergum VII: pygidial plate broad, extending over adlateral carina (thus appearing as tergal margin in dorsal view), roundly expanded basally (see also Status of *Palarus maculatus* and *nigrrior* below). Sternum II without V-shaped ridge before elevation, posterior surface of elevation tall (height greater than midocellar width), without sinuous setae or with a few such setae. Sterna III-VI densely punctate (most punctures of sternum VI more than one diameter apart), with dense, erect, sinuous setae before apical depression; sterna III-VII with a few, stiff setae bordering apical depression. Length 8.2-12.5 mm.

**STATUS OF *PALARUS MACULATUS* AND *NIGRRIOR*.**— Although described as an individual variety of *maculatus*, *Palarus nigrrior* appears to be either a subspecies of the latter or a vicariant sister species. So far we have not observed full intergradation. In *maculatus*, tergum I has a pair of large maculae (maculae evanescent in a female from Hentiesbaai, Namibia), and in the male the adlateral carina of tergum VI is slightly prominent (Fig. 18c), the adlateral carina of sternum VI is dull and not raised, and the pygidial plate is less expanded laterally (Fig. 18d). In *nigrrior*, tergum I is all black in the female and some males or (most males) has a pair of small, lateral maculae; in the male, the adlateral carina of tergum VI is prominent (Fig. 18e), the adlateral carina of sternum VI is sharp and somewhat raised, and the pygidial plate is markedly expanded laterally (Fig. 18f) except in the male from Kenya. Overall, *nigrrior* is darker than *maculatus*, and the punctuation on the scutum and scutellum is denser than in *maculatus*, although this latter difference is difficult to quantify. Their ranges are mutually exclusive, and we are not aware of sympatric populations. As defined here, *maculatus* occurs in most of South Africa and most of Namibia, whereas *nigrrior* is found in the Northern Province and Kwazulu Natal Province of South Africa, in northern and central Namibia (Rundu and Gobabis Districts), in Botswana, Mozambique, and Zimbabwe. The morphological differences and lack of intermediates suggest full species status. On the other hand, these *maculatus* that occur closer to the range of *nigrrior* resemble the latter more than those from more distant areas, suggesting an intergradation. Additional material from intermediate areas is necessary to ascertain the status of the two phena. Provisionally, we treat them as conspecific subspecies.

Other significant characters of the two subspecies are:

Color of antennal flagellum. The flagellum is reddish to brown (except black basally) in *maculatus maculatus* and black in *maculatus nigrrior*, but dark brown in some *maculatus maculatus*, including those from Olifantshoek and Sevilla, South Africa, and 18 km SE Stampriet, Namibia.

Color of mandible. The mandibular base is dark brown to black with well-defined macula in *maculatus nigrrior*, whereas in *maculatus maculatus* the base is all maculate except in specimens from Sandveld Nature Reserve, South Africa, and Seeis and Windhoek Districts, Namibia, in which the mandible is as in *maculatus nigrrior*.

Color of legs. In most *maculatus maculatus*, the non-yellow parts of the femora and tibiae are red, and the midfemoral venter is maculate (except basally). In *maculatus nigrrior*, the non-yellow parts are black and the midfemoral macula is absent in most specimens. Some *maculatus maculatus*, however, are intermediate: the non-yellow parts of femora are all black in the female from Mata Mata area and one of the males from Okahandja, Namibia; the non-yellow parts of the femora and most of the fore- and midtibiae are black, while the hindtibia is reddish brown in specimens from Olifantshoek and Velddrif, South Africa, and in males from Seeis and 17 km W Okahandja, Namibia. Males from Sandveld Nature Reserve, South Africa, are also similar, but the non-yellow parts of the fore and midtibiae are partly red and partly black. The non-yellow parts of the femora and tibiae are all black in the male from Sevilla, South Africa. The females from Seeis area have

the non-yellow parts of the femora either black or red, although one is intermediate.

Maculae of tergum I. In the male, the gap between the maculae on tergum I is smaller than either macula in most *maculatus maculatus*, but larger than either macula in *maculatus nigrior* (if the tergum is maculate). The gap is as large as either macula or nearly so in the males from Sandveld Nature Reserve, Seeis, and 17 km W Okahandja, and larger than either macula in females from the Mata Mata and Seeis areas.

Color of preapical terga. The terga are dark reddish between the maculae in most *maculatus maculatus* and all black in *maculatus nigrior*. In the *maculatus maculatus* from Mata Mata, 11 km W Clanwilliam, Olifantshoek, and Sevilla, however, the terga are also black between the maculae in the female and largely so in the male, all black in the male from Okahandja and Sevilla.

Color of apical tergum (VI in female, VII in male). The apical tergum is reddish in most *maculatus maculatus* and black in *maculatus nigrior*. In the female from Mata Mata and two males of *maculatus maculatus* from Namibia (Seeis and 17 km W Okahandja), the basal half of the apical tergum is black, whereas the apical half is reddish, and all tergum VII is black in the male from Sevilla.

Adlateral carina of male tergum VI. In most *maculatus maculatus*, the carina is rounded posteriorly, whereas it is angulate posteriorly in *maculatus nigrior* (only slightly so in some). However, in the males of *maculatus maculatus* from the Gibeon area, Namibia, the carina is about the same shape as in *maculatus nigrior* (although markedly lower), and somewhat similar in a male from Willowmore.

**COLLECTING PERIOD.**—Kenya: 29 May; Namibia: 5 October through 26 March; South Africa: 6 November through 29 January; Zimbabwe: 29 November through 31 March.

**GEOGRAPHIC DISTRIBUTION** (Fig. 19).—Kenya, Zimbabwe, Mozambique, Botswana, Namibia, and South Africa.

**RECORDS.**—*Palarus maculatus maculatus*: **ANGOLA:** Curoca River 7 mi NE Porto Alexandre (1 ♀, BMNH). **NAMIBIA:** **Bethanien District:** 45 km W Seeheim (1 ♂, ZMUC). **Gobabis District:** Dordabis (1 ♀, BALDOCK), 40 km W Witvlei (1 ♂, MS). **Karasburg District:** Karasburg (1 ♂, AMG), near Onseepkans (1 ♀, BMNH). **Karibib District:**

15 km W Karibib (1 ♀, MS), Khan River 5 mi N Usakos (1 ♂, BMNH), Khan River 23 km N Karibib at 21°47'S 15°57'E (5 ♀, 3 ♂, CAS; 2 ♀, 1 ♂, MS). **Keetmanshoop District:** Aroab (1 ♂, AMG), Welverdiend Farm 1 km W Mata Mata at 25°47'S 19°59'E (1 ♀, LACM). **Khorixas District:** 4 km E Khorixas at 20°22'S 15°00'E (2 ♀, CAS). **Maltahöhe District:** Aandster Farm (3 ♀, ZMUC), no specific locality (2 ♀, 1 ♂, UCD). **Mariental District:** 41 km SW Gibeon at 25°20'S 17°29'E (1 ♀, 8 ♂, AMG; 2 ♂, CAS), 50 km W Mariental at 24°42'S 17°33'E (1 ♂, PPRD), 18 km SE Stampriet at 24°28'S 18°30'E (1 ♀, AMG). **Okahandja District:** Leeu River 9 km W Okahandja at 21°58'S 16°50'E (1 ♂, UCD), Okahandja (1 ♀, 1 ♂, AMG; 8 ♀, 4 ♂, BMNH), 27 km S Okahandja (1 ♀, MS), 17 km W Okahandja (4 ♂, CAS; 1 ♀, 10 ♂, MS), 37 km N Windhoek (5 ♀, 2 ♂, CAS; 9 ♀, MS). **Rehoboth District:** 7 km N Rehoboth (1 ♂, MS), 23 km N Rehoboth (1 ♀, CAS), 9 km S Rehoboth (1 ♀, 1 ♂, MS). **Swakopmund District:** Gaub Pass at 23°30'S 15°46'E (1 ♀, 2 ♂, AMG), Gobabeb (3 ♀, 5 ♂, ZMUC), Gobabeb: Namib Desert Research Station at 23°33.7'S 15°02.6'E (2 ♀, 2 ♂, CAS; 12 ♀, 8 ♂, CSE; 2 ♀, 2 ♂, UCD; 1 ♀, USU), Hentiesbaai (1 ♀, CAS; 1 ♀, ZMUC), SE corner of Namib Desert Park (1 ♀, UCD), Namib Desert Research Station at 23°33'45"S 15°02'38"E (1 ♀, CSE), Swakopmund

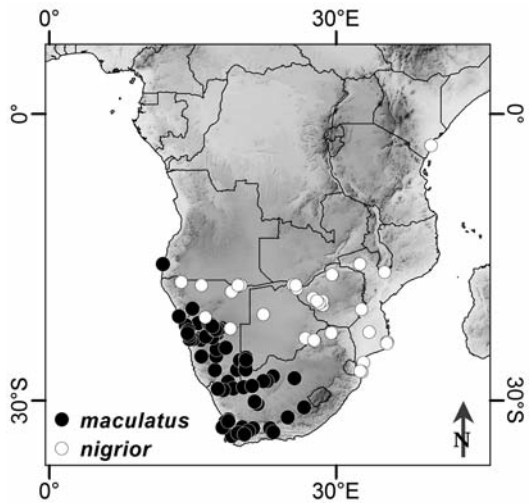


FIGURE 19. Collecting localities of the subspecies of *Palarus maculatus* Dahlbom.



(4 ♀, 4 ♂, AMG; 1 ♀, 1 ♂, BMNH; 1 ♂, CAS; 1 ♀, 2 ♂, ZMUC), 5 km E Swakopmund (1 ♀, 4 ♂, ZMUC), Swartrand 20 mi W Gobabeb (1 ♀, CAS), Ugab River mouth (1 ♂, ZMUC). **Walvis Bay District:** Rooibank (5 ♀, 8 ♂, AMG), Walvis Bay (1 ♀, 4 ♂, BMNH). **Windhoek District:** Hakos and Weissenfels farms at 23°18'S 16°23'E (1 ♂, AMG), Rechthoven (1 ♂, SAM), Seeis (1 ♂, CAS), 20 km ESE Seeis (3 ♀, AMNH), 22 km ESE Seeis (1 ♀, AMNH), 30 km E Windhoek (1 ♀, MS), 36 km E Windhoek (1 ♀, 3 ♂, MS). **SOUTH AFRICA: Eastern Cape Province:** Aliwal North (2 ♀, PPRI), Rietbron (1 ♀, AMG), Willowmore (1 ♀, AMG; 2 ♀, 1 ♂, CAS; 4 ♀, 3 ♂, SAM; 1 ♀, 1 ♂, lectotype and paralectotype of *handlirschi*, TMP; 1 ♀, UCD; 1 ♀, USNM, paralectotype of *handlirschi*). **Free State:** Sandveld Nature Reserve ca 5 air km E Bloemhof at 27°40'S 25°41'E (1 ♀, 2 ♂, CAS). **Northern Cape Province:** Augrabies Falls National Park at 28°36'S 20°21'E (3 ♂, AMG), Breekkerie at 30°07'S 21°33'E (1 ♀, SAM), Goodhouse (3 ♂, SAM), Kuruman (1 ♂, AMG), Nossob in Kalahari Gemsbok National Park (1 ♂, MS), Olifantshoek (7 ♀, 2 ♂, AMG; 1 ♂, PPRI), 40 km W Olifantshoek (1 ♂, USNM; 1 ♂, USU), 2 km S Twee Rivieren in Kalahari Gemsbok National Park at 26°30'S 20°36'E (1 ♂, PPRI), 38 km S Twee Rivieren in Kalahari Gemsbok National Park at 26°45'S 20°36'E (1 ♂, PPRI), 78 km N Twee Rivieren in Kalahari Gemsbok National Park (1 ♂, MS), Upington (1 ♀, AMG), Vanwyksvlei (1 ♂, AMG; 1 ♂, CAS), Vioolsdrif (1 ♂, AMG; 1 ♂, SAM). **Western Cape Province:** Bulshoek between Klawer and Clanwilliam (3 ♂, SAM), 60 km ENE Ceres on road to Sutherland (1 ♀, AMG), 15 km W Clanwilliam at 32°09.3'S 18°45.0'E (1 ♀, USU), Dikbome between Merweville and Koup (1 ♂, SAM), Du Toits Kloof (2 ♀, 1 ♂, SAM), Hex River (1 ♀, 1 ♂, SAM), Laingsburg at 33°12'S 20°51'E (1 ♀, CAS), Leipoldtville (2 ♀, SAM), Olifantsvlei Farm at 30°07'S 21°32'E (1 ♀, SAM), Rooinek in Laingsburg District (7 ♂, SAM), 18 mi E Touwsrivier towards Hondewater (1 ♀, SAM), Velddrif (1 ♀, AMNH), Ysterfontein Farm 11 km W Clanwilliam at 32°10'S 18°47'E (2 ♀, USU, as Willie Nel Farm on the specimen labels).

***Palarus maculatus nigrior*: BOTSWANA:** Kuke Pan at 20°59'S 22°25'E (1 ♀, 1 ♂, BMNH), 42 km S Mahalapye (1 ♂, USNM). **KENYA: Coast Province:** Arabuko-Sokoke Forest at 3.29°S 39.98°E (1 ♂, LACM). **MALAWI:** Chiromo (1 ♀, BMNH). **MOZAMBIQUE:** Chiqubo (1 ♂, USNM), Inhaca Island (1 ♀, AMG), Inhambane (1 ♂, SAM), Nyaka (1 ♂, SAM), 15 km SE Seve in Inhambane Province (1 ♂, OÖLM). **NAMIBIA: Gobabis District:** Gobabis (1 ♂, AMG). **Omaruru District:** Otjikoko Deinap (1 ♂, SAM). **Opuwo District:** Erichson's Drift on Kunene River (1 ♂, SAM). **Oshakati District:** Ondangua (1 ♀, SAM). **Rundu District:** Rundu (1 ♀, 1 ♂, CAS; 8 ♀, 9 ♂, MS; 4 ♀, 4 ♂, OÖLM), 25 km E Rundu at 17°57'S 19°57'E (3 ♂, CAS; 1 ♀, OÖLM); 30 km E Rundu (1 ♂, OÖLM); 100 km SW Rundu (1 ♀, 1 ♂, OÖLM). **SOUTH AFRICA: Kwazulu Natal:** Manguzi River (1 ♂, AMG), Tembe Elephant Park (3 ♂, OÖLM). **Northern Province:** D'Nyala Nature Reserve at 23°45'S 27°49'E (5 ♀, 5 ♂, PPRI), Ellisras (7 ♀, 5 ♂, AMG; 2 ♀, 1 ♂, CAS), near Vivo at 22°56'S 29°33'E (1 ♀, PPRI). **ZAMBIA:** 30 km W Livingstone (1 ♀, 1 ♂, OÖLM). **ZIMBABWE:** Bulawayo airport at 20°00'S 28°38'E (1 ♂, UCD), 60 km N Bulawayo on Maraposa Rd. (1 ♂, OÖLM), Gwaai (5 ♀, 1 ♂, SAM), Igusi 1 ♀, SAM), Karoi (1 ♂, AMG), Matetsi (1 ♀, SAM), 11 km NE Nyamandhlovu at 19°48'S 28°16'E (5 ♀, 5 ♂, CAS), Mt. Selinda (1 ♂, AMG), Sawmills (1 ♀, 3 ♂, SAM; 1 ♂, USNM), Victoria Falls at 17°56'S 25°50'E (2 ♂, AMG; 6 ♀, 15 ♂, CAS; 4 ♀, 6 ♂, SAM; 1 ♀, paratype of var. *nigrior*, TMP; 6 ♂, USNM).

### ***Palarus nama* Pulawski and Prentice, sp. nov.**

Figures 20, 21.

**DERIVATION OF NAME.**—*Nama*, the original inhabitants of central Namibia, also with reference to Nama Karoo biome where the holotype was collected.

**RECOGNITION.**—Like *comberi* and *obesus*, *nama* has an obtuse crest on the postocellar area (as in Fig. 12), a feature that separates these three species from other *Palarus*. The species differs from *comberi* and *obesus* in having the hindocellus nearly circular, convex, and not sunken (rather than oblong, somewhat flattened, and partly sunken), a small macula above each antennal socket and a large, anterolateral scutal macula (frontal and scutal maculae absent in the other two species), tergum I with erect, sinuous setae only behind the spiracle (present both laterally and mesally), and female midbasitarsus with fewer than 20 dorsal spines (about 30 spines in *comberi* and *obesus*).

Unlike *obesus* and many *comberi*, the scutal setae of *nama* are erect.

**DESCRIPTION.**— Clypeus  $2.8 \times$  as wide as long. Postocellar area with longitudinal crest that barely extends onto interocellar area. Hindocellus markedly convex, nearly circular, not sunken along admedian edge. Least interocular distance about  $0.1-0.2 \times$  midocellar width. Area between mid- and hindocellus setose, punctate, and dull, like adjacent areas. Occipital carina separated from eye outer orbit at vertex by less than hindocellar diameter. Pronotal collar without groove-like median depression. Scutal punctures about six diameters apart away from center, about 1-3 diameters apart near center; setae near center suberect, anteriorly longer than  $0.5 \times$  midocellar width. Width of impunctate median area of propodeal dorsum (measured at one midocellar width before dorsal hindmargin) greater than length of propodeal dorsum along midline. Longest setae of mid-femoral venter slightly sinuous, as long as midocellar width in female, slightly longer in male. Erect setae of tergum I present only laterally.

Maculae yellow. Admedian macula above antennal socket small, possibly disappearing in some specimens; flagellum black, brown ventrally. Pronotum all black. Scutum with anterolateral macula that is larger than tegula. Scutellum with pair of maculae on disk, maculae rudimentary, ill-defined in male. Metanotum brown along posterolateral edge. Preepisternal area maculate dorsally. Humeral plate all yellow. Coxae brown or forecoxa black, (mid- and hindcoxae partly yellowish). Female forefemur dark brown dorsally, reddish brown anteroventrally, with ventral macula except basally; midfemur mostly red, maculate ventrally in distal half or so, dark brown basodorsally; hindfemur red, maculate apically; tibiae red, maculate dorsally; tarsi red. Male forefemur maculate ventrally in distal half or so, macula extending to apex of dorsum; midfemur black, maculate apically; hindfemur predominantly red, partly black, maculate apically. Gaster: terga I-V red, each with broad, yellow, uninterrupted fascia and brownish posterolateral spot; segment VI red, without yellow markings; sterna I and II red and brown, following sterna dark brown to light brown.

♀.— Postocellar area without punctures along edge of crest, without impunctate strip. Lateroclypeal notch separated from lateroclypeal sulcus by about  $0.13-0.2 \times$  midocellar width. Dorsal length of flagellomere I  $2.4-2.5 \times$  apical width. Foretarsomere IV with one or two rake spines. Inner platform of pygidial plate irregularly rugose. Length 10.7-11.8 mm.

♂.— Dorsal length of flagellomere I  $2.4 \times$  apical width. Precoxal mesopleural declivity delimited by swelling anterolaterally, without sharp tubercle laterally. Mesopleural setae behind episternal sulcus slightly sinuous, most slightly shorter than midocellar width. Midcoxa without anteroventral tubercle. Midbasitarsus at most with a few thin spines in distal half ventrally. Venters

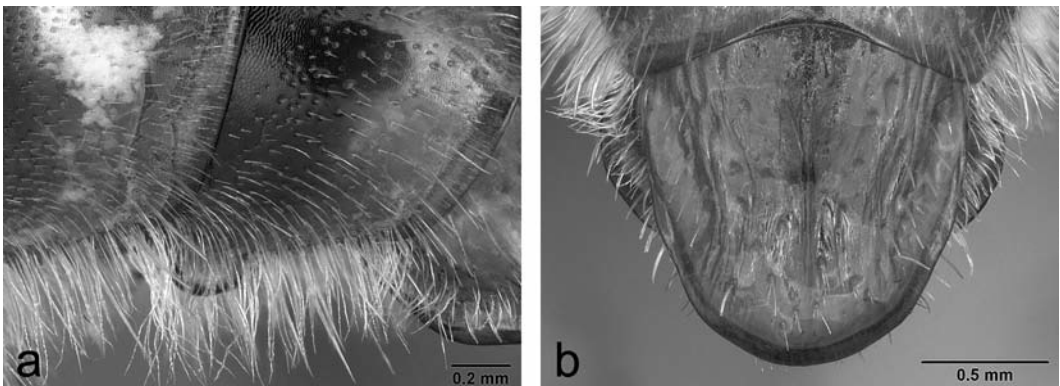


FIGURE 20. *Palarus nama* Pulawski and Prentice, sp. nov. ♂: a – adlateral carina of tergum VI; b – tergum VII in dorsal view.



of mid- and hindtibiae (except basally) and of mid- and hindbasitarsi with dense, erect setae. Adlateral carina of tergum VI roundly expanded, not angulate posteriorly (Fig. 20a). Tergum VII: pygidial plate unusually broad, with lateral margins slightly convex (Fig. 20b), well separated from adlateral carina, which is roundly expanded except near apex. Sternum II uniformly concave before elevation, height of posterior surface of elevation slightly greater than midocellar width, without row of sinuous setae along dorsal edge. Sterna III-VI with erect, sinuous setae; sterna III-V markedly concave on large basomedian area; punctures of sternum II several diameters apart, basomedian and lateral punctures of sterna III-V about one diameter apart; sterna III-VII laterally with a few stiff setae bordering apical depressions. Length about 13.0 mm.

**GEOGRAPHIC DISTRIBUTION** (Fig. 21).—South-central Namibia to western South Africa.

**RECORDS.**—**HOLOTYPE:** ♂, South Africa: Northern Cape Province: 21 km S Kenhardt, 19 Feb 1980, V.B. Whitehead (SAM). **PARATYPES: NAMIBIA: Maltahöhe District:** Sesriem Farm, 19-20 Jan 1972, [BMNH] Southern African Expedition (1 ♂, BMNH; 1 ♂, CAS). **District unknown:** Namal[and]: no specific locality, 30 Jan 1974, M.E. Irwin (1 ♀, UCD). **SOUTH AFRICA:** same data as holotype (1 ♀, SAM).

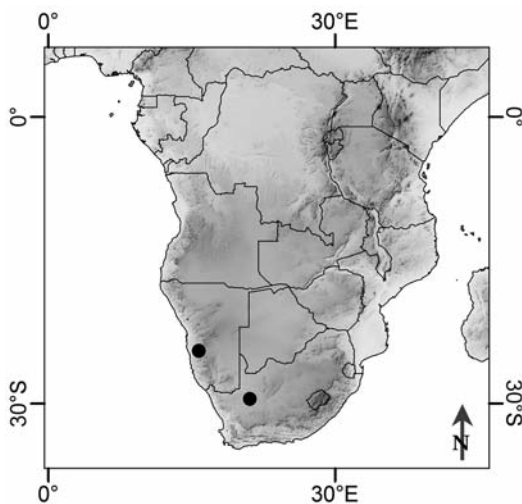


FIGURE 21 (left). Collecting localities of *Palarus nama* Pulawski and Prentice, sp. nov.

### *Palarus obesus* Arnold

Figures 22–24.

*Palarus obesus* Arnold, 1951:161, ♀. Lectotype: ♀, Senegal: Podor, given as Mauritania in original description (BMNH), **present designation**, examined.—Bohart and Menke, 1976:291 (listed).

**RECOGNITION.**— See *comberi*, p. 340.

**DESCRIPTION.**— Clypeus about  $2.5 \times$  as wide as long in female, about  $2.3\text{--}2.4 \times$  in male. Postocellar area with longitudinal, obtuse crest that extends far onto interocellar area (as in Fig. 12). Hindocellus somewhat flattened, oblong, slightly sunken along admedian edge. Least interocular distance about  $0.1\text{--}0.2 \times$  midocellar width. Area between mid- and hindocellus asetose, impunctate, shiny, contrasting with adjacent areas. Occipital carina separated from eye outer orbit at vertex by less than length of hindocellus. Pronotal collar with groove-like median depression except next to hindmargin. Scutal punctures about 1-3 diameters apart near center, about 6 diameters apart on very midline; setae appressed except erect anterolaterally, conspicuously silvery, length about  $0.7 \times$  midocellar width. Width of impunctate median area of propodeal dorsum (measured at one midocellar width before dorsal hindmargin) greater than length of propodeal dorsum along midline. Longest setae of midfemoral venter (near femoral base) not sinuous, shorter than midocellar width in female, in male sinuous, slightly longer than midocellar width. Erect setae of tergum I dense laterally, sparse mesally.

Maculae yellow; frons all black or (one male from Gao, Mali) with evanescent macula above each antennal socket; flagellum brown to black. Thorax and propodeum black, except the following maculate: pronotal collar laterally (macula slightly smaller than tegula), preepisternum dorsally, scutellar flange, metanotum except anterolaterally, tegula, essentially all of humeral plate, and,

in some specimens, part of scutellar disk (typically posterolaterally). Forecoxa black, mid- and hindcoxae brown, partly reddish brown; anteroventral midcoxal tubercle yellow; forefemur dark brown, with large posteroventral macula in apical two thirds, in some specimens with some red ventrally; midfemur brown, partly red in most specimens, with large posteroventral macula for entire femoral length in male and for apical two thirds in female; hindfemur red, with apical macula that in some specimens continues basad as ventral strip; fore- and midtibiae of female red with large macula on dorsum, in male brown with large macula on dorsum, hindtibia red, in most specimens with ill-defined trace of macula on dorsum; tarsi red. Gaster: female terga red, male terga red and brown; preapical terga each with broad, uninterrupted fascia before apical depression (some terga with narrowly interrupted macula in some males); female tergum VI with broad dorsal macula; male tergum VII yellow except brown basolaterally; at least sternum II all or partly reddish brown.

♀.— Vertex impunctate along edge of crest, but without median impunctate strip. Lateroclypeal notch almost in-line with lateroclypeal sulcus, separated by less than  $0.1 \times$  midocellar width. Dorsal length of flagellomere I  $2.5\text{--}2.7 \times$  apical width. Foretarsomere IV with two fully developed rake spines. Longest setae of midfemoral venter markedly shorter than midocellar width, not sinuous or barely sinuous. Midbasitarsus with about 30 dorsal spines (Fig. 22). Tergum I with inconspicuous adlateral carina. Inner margin of pygidial plate with sinuous, longitudinal ridges. Length 8.9–11.9 mm.

♂.— Dorsal length of flagellomere I  $2.8\text{--}3.0 \times$  apical width. Precoxal mesopleural declivity with sharp, elongate tubercle laterally, not delimited by swelling anteriorly. Mesopleural setae behind episternal sulcus sinuous, most slightly shorter than midocellar width. Midcoxa with conspicuous, oblong anteroventral tubercle (Fig. 23a). Midbasitarsus without row of spines ventrally. Venters of mid- and hindtibiae (except basally) and of mid- and hindbasitarsi with dense, erect setae (Fig. 23b, c). Tergum I with obtuse, adlateral carina that is expanded apically into conspicuous tubercle. Adlateral carina of tergum VI sharp but not angulate posteriorly (Fig. 23e). Tergum VII: pygidial plate constricted before apex, with lateral margins well separated from adlateral carina, which is roundly expanded basally (Fig. 23f). Sternum II with posteriorly pointed V-shaped ridge before elevation, fusing mesally with latter, posterior surface of elevation short (height smaller than midocellar width), with row of sinuous setae along dorsal edge (Fig. 23d). Sterna III–VI densely punctate (most punctures on sternum VI one diameter or less apart), with erect, sinuous setae (as in Fig. 13c); sterna III–VII without stiff setae bordering apical depressions. Length 10.5–12.2 mm.

**COLLECTING PERIOD.**— Mali: 12–18 August; Mauritania: September (Arnold 1951) and 19 October through 7 November; Niger: 3 August through 15 September.

**GEOGRAPHIC DISTRIBUTION** (Fig. 24).— Mauritania to Niger.

**RECORDS.**— **MALI:** Gao (1 ♂, CAS; 1 ♀, 3 ♂, MS), Hombori (5 ♀, 3 ♂, MS), 10 km E Hombori (1 ♀, MS), 25 km E Hombori (2 ♂, CAS), 30 km NE Hombori (1 ♀, MS). **MAURITANIA:** 30 km S Nouakchott (1 ♀, CAS), 60 km SE Nouakchott (1 ♀, CAS; 1 ♀, USNM), Oued Tayart 30 air km NW Atar (2 ♀, CAS), Tamouret Naadj ca 30 air km NE Moujéria (13 ♀, 4 ♂, CAS), Tayart 7 km W Atar (1 ♀, CAS).

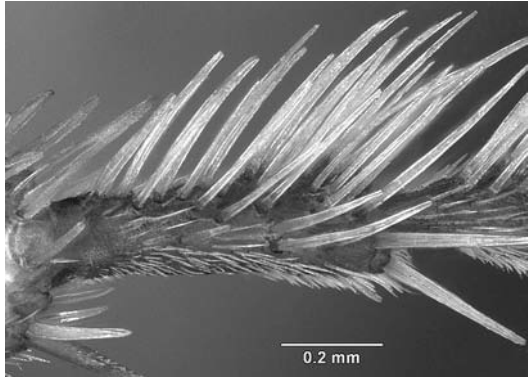


FIGURE 22. *Palarus obesus* Arnold ♀: midbasitarsus in lateral view.

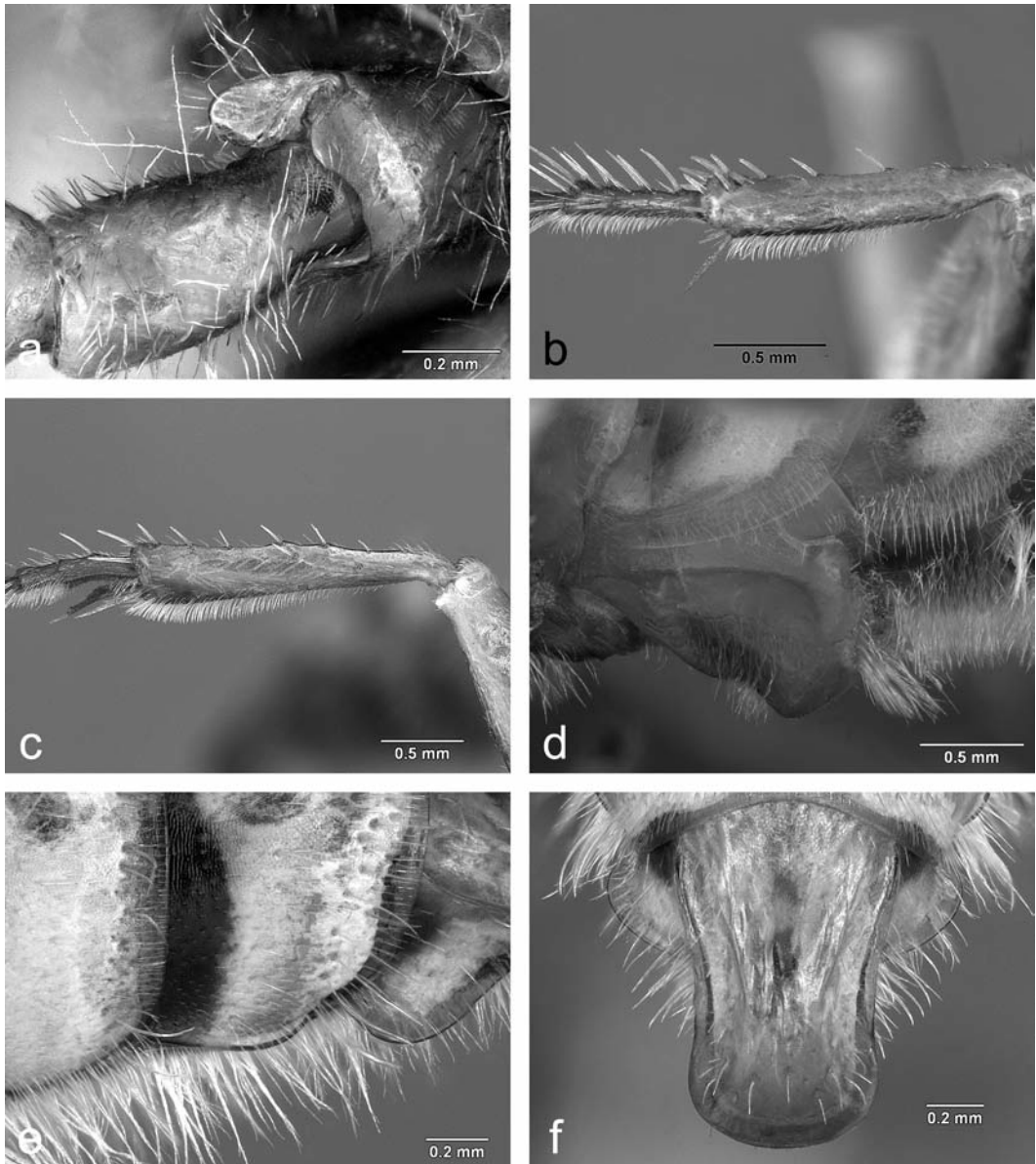


FIGURE 23. *Palarus obesus* Arnold  $\sigma$ : a – midcoxa with anteroventral tubercle; b – midtibia and midbasitarsus in lateral view; c – hindtibia and part of hindbasitarsus in lateral view; d – sternum II in lateral view; e – tergum VI in lateral oblique view showing adlateral carina; f – tergum VII in dorsal view.

**NIGER: Agadez Region:** 30 km S Agadez at 16°39.0'N 7°56.9'E (2 ♀, 4 ♂, CAS), 0.5 km SE Aderbissinat at 15°36.9'N 7°54.0'E (1 ♀, CAS). **Diffa Region:** 8 km ENE Nguigmi at 14°17.2'N 13°10.1'E (2 ♀, 1 ♂, CAS), 3 km NNE Nguigmi at 14°16.5'N 13°06.9'E (1 ♀, 6 ♂, CAS). **Maradi Region:** 8 km W Guidan-Roumji at 13°38.2'N 6°38.2'E (1 ♂, CAS). **Niamey Region:** 8 km NW Niamey at 13°35.8'N 1°59.9'E (9 ♂, CAS), 12 km NW Niamey at 13°35.9'N 1°59.2'E (2 ♂, CAS). **Tillabéri Region:** 3 km N Ayorou at 14°45.7'N 0°54.0'E (3 ♂, CAS), 5 km NW Kollo at 13°21.6'N 2°16.4'E (2 ♂, CAS), 21 km N Niamey at 13°33.2'N 2°21.5'E (1 ♀, CAS), 25 km N Niamey at 13°33.2'N 2°23.6'E (1 ♂, CAS), 82 km ESE Téra at 13°51.1'N 1°31.3'E (2 ♂, CAS). **Zinder Region:** 2 km N Gouré at 14°00.2'N 10°15.0'E (1 ♀, CAS), 10 km W Gouré at 13°55.5'N 10°12.5'E (1 ♀, CAS), 17 km W Gouré at 13°52.5'N 10°09.3'E (2 ♂, CAS), 27 km W Guidiguir at 13°40.9'N 9°39.1'E (1 ♀, 3 ♂, CAS). **SENEGAL:** Podor (1 ♀, BMNH, lectotype of *Palarus obesus*), given as Mauritania in original description.

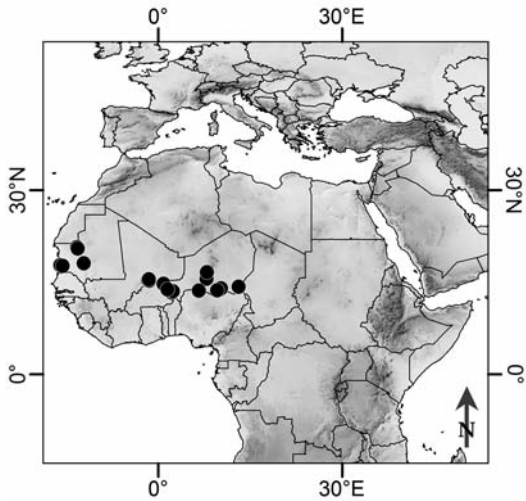


FIGURE 24. Collecting localities of *Palarus obesus* Arnold.

### *Palarus occidentalis* Arnold, new status

Figures 25, 26.

*Palarus handlirschii* race *occidentalis* Arnold, 1929:398, ♀, ♂. Lectotype: ♂, Namibia: Outjo District: Kaross Farm at 19°23'S 14°40'E (SAM), **present designation**, examined.— Arnold, 1930:7 (in checklist of Afrotropical Sphecidae).— **As *Palarus handlirschi occidentalis***: Bohart and Menke, 1976:291 (new status, listed).

**RECOGNITION.**— *Palarus occidentalis* shares the following unique character combination with *maculatus* and *furtivus*: postocellar area simple (without longitudinal crest or unsculptured line), scutellum and metanotum black, female lateroclypeal notch separated from lateroclypeal sulcus by about  $0.5 \times$  midocellar width, male tergum VII with simple adlateral carina, and male pygidial plate contrastingly, roundly expanded basally. Unlike *maculatus*, *occidentalis* has a wide median impunctate area of the propodeal dorsum (the depression's width, measured at one midocellar width before the dorsal hindmargin is greater than the dorsum's midlength, rather than smaller, Fig. 25a), the midfemoral setae not sinuous and markedly shorter than midocellar width (rather than sinuous and nearly as long as midocellar width or longer), and male sterna III-VI impunctate and asetose or with a few punctures and associated erect setae (rather than densely setose). It also has an all black female scutum and no erect setae or only a few such setae on male sterna III-VI, whereas in *furtivus* the female scutum is maculate anteriorly and male sterna III-VI are densely, conspicuously setose.

**DESCRIPTION.**— Clypeus about  $2.8 \times$  as wide as long in female,  $2.6\text{-}2.8 \times$  in male. Postocellar area without obtuse crest. Hindocellus convex, nearly circular, not sunken along admedian edge. Least interocular distance about  $0.1\text{-}0.2 \times$  midocellar width. Area between mid- and hindocellus setose, punctate, and dull, like adjacent areas. Occipital carina separated from eye outer orbit at vertex by less than length of hindocellus. Pronotal collar with median depression that is about as wide as ocellar width (depression effaced next to pronotal posterior margin). Scutal punctures near cen-



ter about 1-4 diameters apart; setae near center suberect, short (about  $0.3 \times$  midocellar width). Width of impunctate median area of propodeal dorsum (measured at one midocellar width before dorsal hindmargin) greater than length of propodeal dorsum along midline (Fig. 25a). Longest setae of midfemoral venter not sinuous, markedly shorter than midocellar width. Erect setae of tergum I present both laterally and mesally.

Maculae whitish. Mandibular macula small, well-defined; flagellum all black or brown apically. Pronotal collar, scutum, scutellum, metanotum, and mesopleuron immaculate. Humeral plate dark brown to black in posterior half or so. Legs: coxae dark brown to black; femora dark brown to black, fore- and midfemora with ventral macula except near base, mid- and hindfemora also with small outer, apical macula (hindfemur also with narrow ventral macula in one male); female tibiae reddish, fore- and midtibiae with traces of macula basodorsally; male tibiae brown, foretibial dorsum with large macula, midtibial dorsum with small macula basally; female tarsi reddish; male foretarsus light yellowish brown, mid- and hindtarsi brown. Gaster: terga and sterna dark brown to black; terga I-V fasciate before each apical depression; fasciae broad in female (that of tergum I narrowly interrupted, in some specimens also that of tergum V), in male narrower, interrupted; apical tergum immaculate in both sexes.

♀.— Postocellar area without median, impunctate strip. Lateroclypeal notch separated from lateroclypeal sulcus by more than  $0.5 \times$  midocellar width. Dorsal length of flagellomere I  $2.6\text{--}2.7 \times$  apical width. Foretarsomere IV with single rake spine or, in some specimens, with additional, smaller spine. Inner margin of pygidial plate with longitudinal, nearly parallel ridges. Length 11.5-13.5 mm.

♂.— Dorsal length of flagellomere I  $2.5\text{--}2.8 \times$  apical width. Precoxal mesopleural declivity delimited by swelling anterolaterally, without sharp tubercle laterally. Mesopleural setae behind episternal sulcus varying from sinuous, as long as midocellar width, to not sinuous, shorter than midocellar width. Midcoxa without anteroventral tubercle. Midbasitarsus with a few spines in distal half ventrally. Hindfemur not flattened anterobasally. Tergum I without adlateral carina. Adlat-

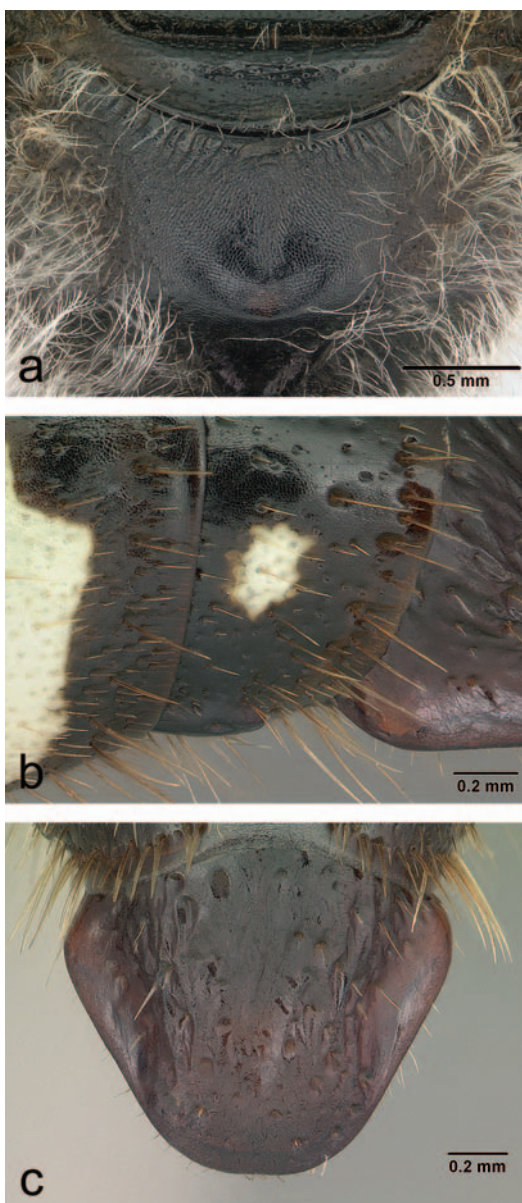


FIGURE 25. *Palarus occidentalis* Arnold: a – propodeal dorsum of female; b – male tergum VI in lateral oblique view showing adlateral carina; c – male tergum VII in dorsal view.



eral carina of tergum VI not prominent, not angulate posteriorly (Fig. 25b). Tergum VII: pygidial plate broad, extending over adlateral carina (thus appearing as tergal margin in dorsal view), roundly expanded basally (Fig. 25c). Sternum II without V-shaped ridge before elevation, posterior surface of elevation tall (height about equal to or greater than midocellar width), without sinuous setae. Sterna III-VI with a few punctures (punctures on sternum VI several to many diameters apart), with a few stiff setae bordering apical depressions, in most specimens with a few long erect, sinuous setae anterad of apical depressions. Length 10.0-13.5 mm.

**PREY.**— The female from Aroab is pinned with a bee, presumably her prey. Connal Eardley identified it as *Tetraloniella abrochia* Eardley (Apinae: Eucerini).

**COLLECTING PERIOD.**— 16 February through 11 April.

**GEOGRAPHIC DISTRIBUTION** (Fig. 26).— Namibia.

**RECORDS.**— **NAMIBIA:** **Karibib District:** 15 km W Karibib (2 ♀, 1 ♂, CAS; 1 ♀, MS), 46 km W Usakos (1 ♂, AMNH). **Keetmanshoop District:** Aroab (1 ♀, SAM). **Maltahöhe District:** Aandster Farm (1 ♂, CAS; 1 ♂, UCD; 2 ♂, ZMUC), road D804 SE Maltahöhe at 25°11'S 17°25'E (2 ♂, AMG), no specific locality (1 ♂, CAS; 1 ♂, UCD). **Mariental District:** 13 km E Stampriet at 24°16'S 18°30'E (1 ♀, AMG; 1 ♀, CAS). **Outjo District:** 24 km S Kamanjab (1 ♂, CAS; 2 ♀, MS), Kaross Farm at 19°23'S 14°40'E (1 ♀, 1 ♂, SAM, lectotype ♂ and paralectotype of *occidentalis*). **Rehoboth District:** 23 km N Rehoboth (1 ♂, MS). **Swakopmund District:** SE corner of Namib Desert Park (2 ♂, UCD).

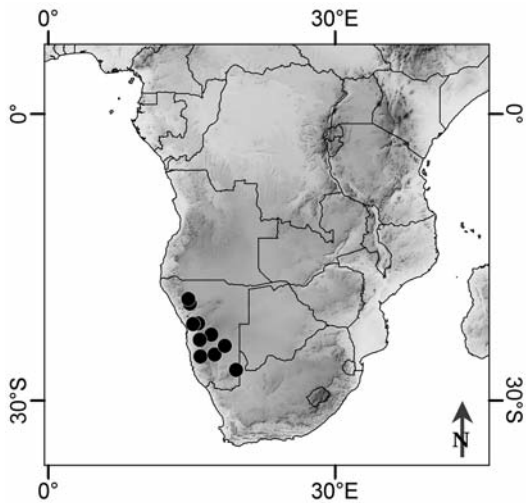


FIGURE 26. Collecting localities of *Palarus occidentalis* Arnold.

### *Palarus turneri* Brauns

Figures 27, 28.

*Palarus turneri* Brauns, 1912:655, ♀. Holotype: ♀, South Africa: Cape Province: Willowmore (TMP), examined.—Arnold, 1923:8 (in revision of Afrotropical *Palarus*), 1930:7 (in checklist of Afrotropical Sphecidae); Bohart and Menke, 1976:291 (listed).

**RECOGNITION.**— *Palarus turneri* differs from the other members of the *maculatus* group in having the minimal distance between the occipital carina and the eye orbit at least equal to the hindocellar length (smaller in the other species). The female of *turneri* is unique within the group in being distinctly dichoptic (the least interocular distance is 0.8-1.2 × midocellar width (at most 0.3 × midocellar width in the other species) and in having a postocellar area with an impunctate median strip (Fig. 27a) that becomes an impression at the level of the eye hindmargin. The male is unique in having both the adlateral carina of tergum VII and the basal portion of the pygidial plate not expanded (Fig. 27d). Subsidiary recognition features of *turneri* include: midfemoral venter without erect setae, female tergum I with continuous macula (not interrupted mesally), male mesopleuron with short setae (setal length behind episternal sulcus mostly smaller than half midocellar width), and male sterna III-VI impunctate and asetose or nearly so anterad of apical depression. The scutum of *turneri* is also markedly less setose and shinier than in the other species of the group.

**DESCRIPTION.**— Clypeus about 2.6-2.7 × as wide as long. Postocellar area without crest.

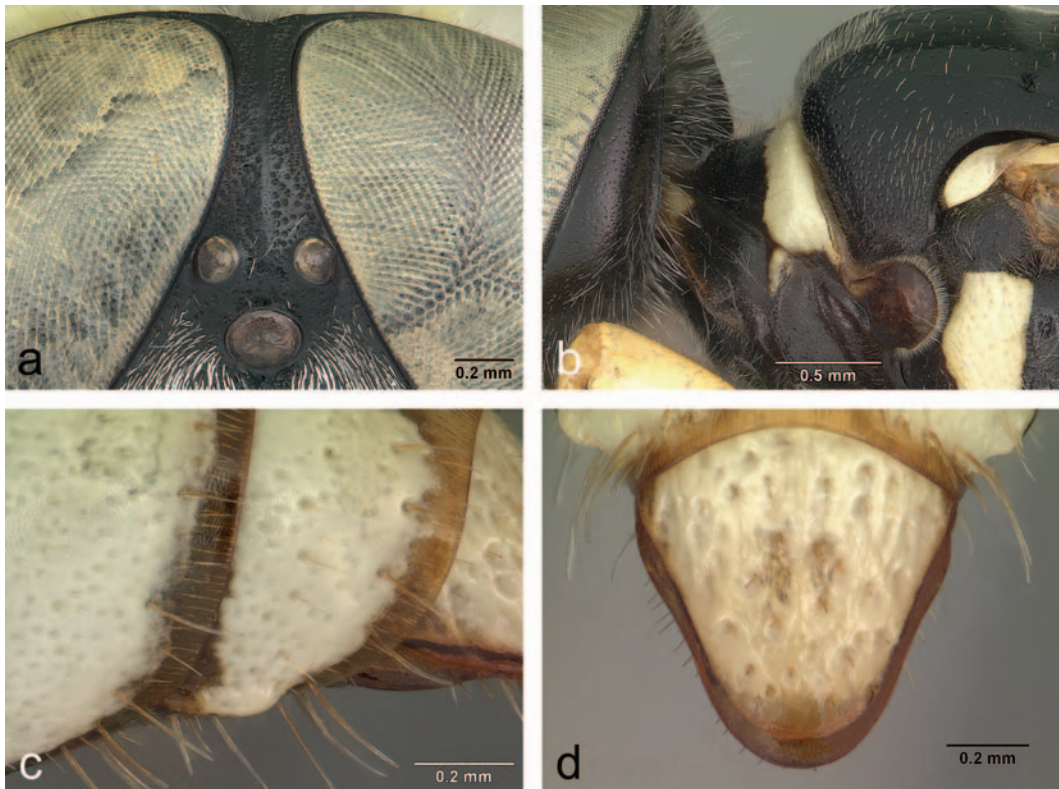


FIGURE 27. *Palarus turneri* Brauns: a – female vertex showing impunctate line; b – pronotum in lateral view; c – male tergum VI in lateral oblique view showing adlateral carina; d – male tergum VII in dorsal view.

Hindocellus convex, nearly circular, not sunken along admedian line. Least interocular distance  $0.8\text{--}1.2 \times$  midocellar width in female,  $0.4 \times$  in male. Area between mid- and hindocellus setose, punctate, and dull, like adjacent areas. Occipital carina separated from eye outer orbit at vertex by at least length of hindocellus. Pronotal collar without groove-like median depression. Scutal punctures about five or more diameters apart near center; setae suberect near center, very short (about  $0.15 \times$  midocellar width), elsewhere longer and more numerous. Width of impunctate median area of propodeal dorsum (measured at one midocellar width before dorsal hindmargin) greater than length of propodeal dorsum midline. Longest setae of midfemoral venter not sinuous, very short (about  $0.25\text{--}0.4 \times$  midocellar width). Erect setae of tergum I varying: present both laterally and mesally, or only behind spiracle, or absent.

Maculae yellowish white. Frons in some specimens with small macula on midline between antennal sockets; flagellum brown. Dorsal edge of pronotal collar maculate, all black in some specimens; scutum immaculate, scutellum black except edge of flange maculate, in female also broad posterior portion of disk; metanotum yellowish white on disk and along posterolateral margin; preepisternum yellowish white dorsally; humeral plate all yellowish white or with minute brown spots. Coxae partly to predominantly brown, partly yellow in some specimens; femora either black or reddish or brown basally, remainder pale yellow (yellow portions longer ventrally than dorsally); tibiae and tarsi pale yellow. Terga and sterna red to brown, anterior surface of tergum I brown to nearly black; terga I-V (I-VI in male) with yellowish white fasciae before apical depressions

(fasciae broad, continuous in female, interrupted in many males); female tergum VI yellowish white anteriorly, tergum VII of most males with yellowish white area

♀.— Postocellar area with impunctate median strip (Fig. 27a). Lateroclypeal notch separated from lateroclypeal sulcus by about  $0.25 \times$  midocellar width. Dorsal length of flagellomere I  $2.3\text{--}2.4 \times$  apical width. Foretarsomere IV with single rake spine or (some specimens) with additional, smaller spine. Inner margin of pygidial plate with longitudinal, sinuous ridges. Length 8.3–10.5 mm. Posterior half or more of scutellar disk yellowish white.

♂.— Dorsal length of flagellomere I  $2.4\text{--}2.6 \times$  apical width. Precoxal mesopleural declivity delimited by ill-defined swelling anterolaterally, without sharp tubercle laterally. Mesopleural setae not sinuous, those immediately behind episternal sulcus short, mostly shorter than half midocellar width. Midcoxa without anteroventral tubercle. Midbasitarsus with a few spines in distal half ventrally. Tergum I without adlateral carina. Adlateral carina of tergum VI not prominent, ending posteriorly in obtuse angle (Fig. 27c). Tergum VII: pygidial plate broad, extending over adlateral carina (thus appearing as tergal margin in dorsal view), not expanded basally (Fig. 27d). Sternum II without V-shaped ridge before elevation, posterior surface of elevation short (height smaller than midocellar width), without sinuous setae. Sterna III–VI impunctate and asetose or nearly so anterad of apical depressions (a few very short, erect setae exceptionally present near midline), with a few stiff setae bordering apical depressions. Length 7.8–11.5 mm.

**COLLECTING PERIOD.**— Namibia: 12 December through 29 March; South Africa: 11 December through 28 March.

**GEOGRAPHIC DISTRIBUTION** (Fig. 28).— Namibia and South Africa.

**RECORDS.**— **NAMIBIA:** **Bethanien District:** 96 km E Aus at  $26^{\circ}42'S$   $17^{\circ}11'E$  (1 ♀, AMG), no specific locality (1 ♀, 1 ♂, UCD). **Gobabis District:** Gobabis (2 ♀, 6 ♂, AMG). **Karasburg District:** Karasburg (1 ♂, AMG). **Karibib District:** 13 km E Karibib (1 ♂, AMNH), 20 km N Karibib (1 ♂, OÖLM), 15 km W Karibib (2 ♂, CAS; 2 ♀, MS), 55 km SW Usakos (1 ♀, CAS), 65 km SW Usakos (1 ♂, CAS; 1 ♀, MS). **Keetmanshoop District:** Goibib Farm 96 103 km N Keetmanshoop (1 ♂, CSE), Keetmanshoop (1 ♂, AMG), 29 km NE Koes at  $25^{\circ}45'S$   $19^{\circ}15'E$  (1 ♀, AMG), Koes to Gochas on road C17 at  $25^{\circ}40'S$   $19^{\circ}22'E$  (1 ♂, AMG). **Khorixas District:** 20 km W Khorixas (1 ♀, CAS). **Lüderitz District:** Klein-Aus Vista at  $26^{\circ}39'S$   $16^{\circ}15'E$  (1 ♀, 1 ♂, AMG). **Maltahöhe District:** 76 km on road Helmeringhausen to Spes Bona at  $25^{\circ}35'S$   $16^{\circ}20'E$  (1 ♀, AMG), SE Maltahöhe on road D804 at  $25^{\circ}11'S$   $17^{\circ}25'E$  (1 ♀, AMG), Nomtsas at  $24^{\circ}25'S$   $16^{\circ}51'E$  (1 ♂, AMG), Sesriem Farm (4 ♂, BMNH). **Mariental District:** 7 km S Gibeon Station at  $25^{\circ}17'S$   $17^{\circ}50'E$  (1 ♂, AMG), 41 km SW Gibeon on road 1089 at  $25^{\circ}20'S$   $17^{\circ}29'E$  (1 ♂, AMG), 5 km S Mariental at  $24^{\circ}40'S$   $17^{\circ}57'E$  (3 ♀, AMG), 18 km SE Stampriet on road C15 at  $24^{\circ}28'S$   $18^{\circ}30'E$  (1 ♂, AMG). **Rehoboth District:** 15 km N Kalkrand (3 ♂, CAS; 1 ♀, 1 ♂, MS), 23 km N Rehoboth (1 ♂, CAS; 1 ♀, 2 ♂, MS), 9 km S Rehoboth (2 ♀, CAS), 49 km S Rehoboth (1 ♂, MS). **Swakopmund District:** Gaub Pass at  $23^{\circ}30'S$   $15^{\circ}46'E$  (4 ♂, AMG), between Gaub and Kuiseb Passes at  $23^{\circ}27'S$   $15^{\circ}46'E$  (1 ♀, AMG). **SOUTH AFRICA:** **Eastern Cape Province:** Rietbron [spelled Reitbron on the label] (1 ♂, AMG), Willowmore (1 ♀, TMP, holotype of *turneri*). **Northern Cape Province:** Augrabies Falls National Park at  $28^{\circ}36'S$   $20^{\circ}21'E$  (2 ♀, 4 ♂, AMG), Marydale at  $29^{\circ}29'S$   $22^{\circ}06'E$  (1 ♀, PPRI), 40 km W Olifantshoek (3 ♂, USNM), Prieska (1 ♂, AMG), 30–50 km N Twee Rivieren in Kalahari Gemsbok National Park (2 ♂, CAS),

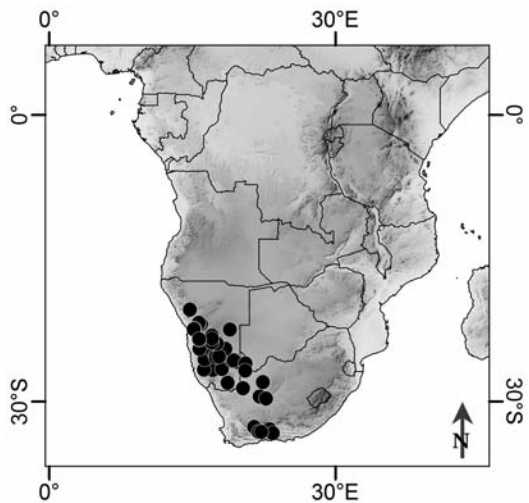


FIGURE 28. Collecting localities of *Palarus turneri* Brauns

38 km S Twee Rivieren in Kalahari Gemsbok National Park at 26°45'S 20°36'E (1 ♀, PPRI). **Western Cape Province:** Merweville District (3 ♀, SAM), Swartrivier 7 km NW Prince Albert at 33°10'S 21°59'E (2 ♀, 1 ♂, CAS), Tierberg Farm 23 km NE Prince Albert at 33°10'S 22°15'E (1 ♂, CAS).

### *interruptus* group

**RECOGNITION.**—Members of this group differ from other *Palarus* in having a broad vertex (much wider than the ocellar triangle, hindocellus separated from the inner eye orbit by more than its shortest axis, Figs. 32c, d, 35c, d, 38c, d); no supraantennal impression; frons with paracocular macula (Figs. 29a, 32c, d, 35c, d, 38c, d); frontal swelling delimited laterally by oblique sulcus that extends dorsad from lateral margin of antennal socket; presence of a transverse sulcus connecting hindocellar hindmargins; metapleuron punctate and with conspicuous setae; propodeal dorsum without adlateral depression or at most with a rudimentary depression, thus evenly convex laterally, and also conspicuously punctate except for ridged or rugose median depression that is about as wide as 1.0-1.5 midocellar widths (Fig. 29f); propodeal side punctate throughout. In the female, the pygidial plate is unique in being conspicuously ridged longitudinally and having no inner platform (Fig. 30b). In the male, the lateral pygidial process is more basal than in the other groups (Figs. 30e, 32f, 35e, f), and the adlateral carina is reduced to an inconspicuous tubercle or is absent. The penis valves in the *interruptus* group are unique in bearing a series of dorsal, preapical ridges (Fig. 39).

**DESCRIPTION.**—Other characters shared by the three included species are: Clypeal posterior surface adjacent to free margin with row of long, externally obvious setae. Clypeus convex, free margin produced anteriorly between lateroclypeal notches. Lateroclypeal notch present, in-line with lateroclypeal sulcus. Interantennal area with median crest that extends to about frons mid-height. Hindocellus slightly elongate, not markedly convex. Area between mid- and hindocellus punctate, setose, dull, like adjacent areas. Postocellar area without impression or crest. Vertex not swollen between midocellus and hindocelli. Midocellus separated from hindocellus by about one midocellar width (Figs. 32c, d, 35c, d, 38c, d). Gena well developed behind eyes, occipital carina separated from eye orbit at vertex by markedly more than midocellar width. Posteroventral mandibular notch well defined. Labrum convex, length roughly half width, without apicolateral expansion (Fig. 29c), visible between fully closed mandible and clypeus (Fig. 29b), in female with transverse carina arcuate, exposed, and apical portion with median carina. Length of scapal setae smaller than scapal width. Pronotal collar raised as narrow wedge (Fig. 29d), at most with rudimentary median depression. Streptaulus separated from anterior pronotal groove (Fig. 29e). Mesosternal and metasternal posterior margin expanded into flange overlying respective coxal articulation (Fig. 30a). Propodeal dorsum conspicuously punctate laterad of median impression (Fig. 29f), delimited by narrow lateral groove; side punctate; admarginal carina broadly interrupted mesally. First recurrent vein inserting on second submarginal cell or (some specimens) interstitial with first intersubmarginal vein. Outer and inner apical spines of hindtarsomeres II and III equal in length. Flagellum all black except tip of apical flagellomere brown or yellowish in some specimens. Hindfemur without apical lobe. Scapal setae shorter than scapal width except longer in female of *gynaecotrichus*. Hindtarsomere III without apicoadlateral dorsal spines. Terga minutely truncate apically or with apical transverse carina creating double-edged margin. Tergum I without adlateral carina, its apical depression impunctate except punctate in female of *gynaecotrichus*. Genal setae varying in shape and length between species. Wing membrane nearly hyaline to slightly infumate. Male: tergum VII without adlateral carina, only in *latifrons* with adlateral, oblong, basal tubercle; gonocoxite all sclerotized.

Non-maculate areas of head, thorax, and propodeum black; clypeus and frons maculate, mac-



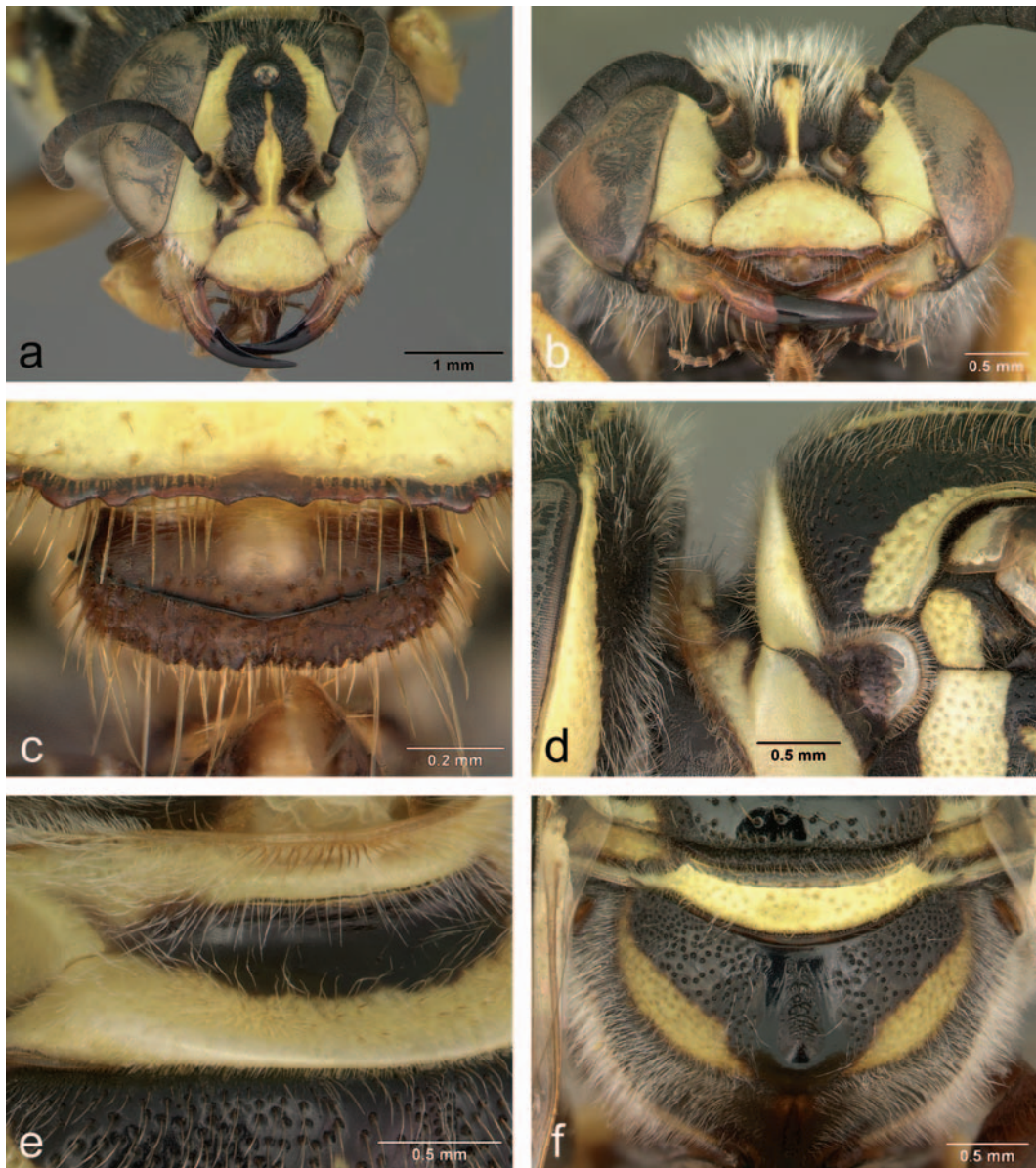


FIGURE 29. *Palarus interruptus* species group exemplified by *Palarus latifrons* Kohl ♀: a – head in frontal view showing maculation; b – head obliquely from below showing exposed labrum; c – labrum; d – pronotum in profile; e – pronotum showing streptaulus well separated from anterior pronotal groove; f – propodeal dorsum.

ula extending on vertex to hindocellar margin (Figs. 29a, 32a, 35c, d), frons with pair of black admedian longitudinal bands that extend from antennal socket to midocellus, fusing there (black also present below antennal socket in some specimens); gena with narrow macula along outer orbit that may extend to hypostoma and dorsally to near midline; mandible maculate on basal half, reddish brown to dark brown apically; antenna dark brown to black; the following are yellow on thorax: pronotal collar, pronotal side (black in some males of *latifrons*), small marginal spot before



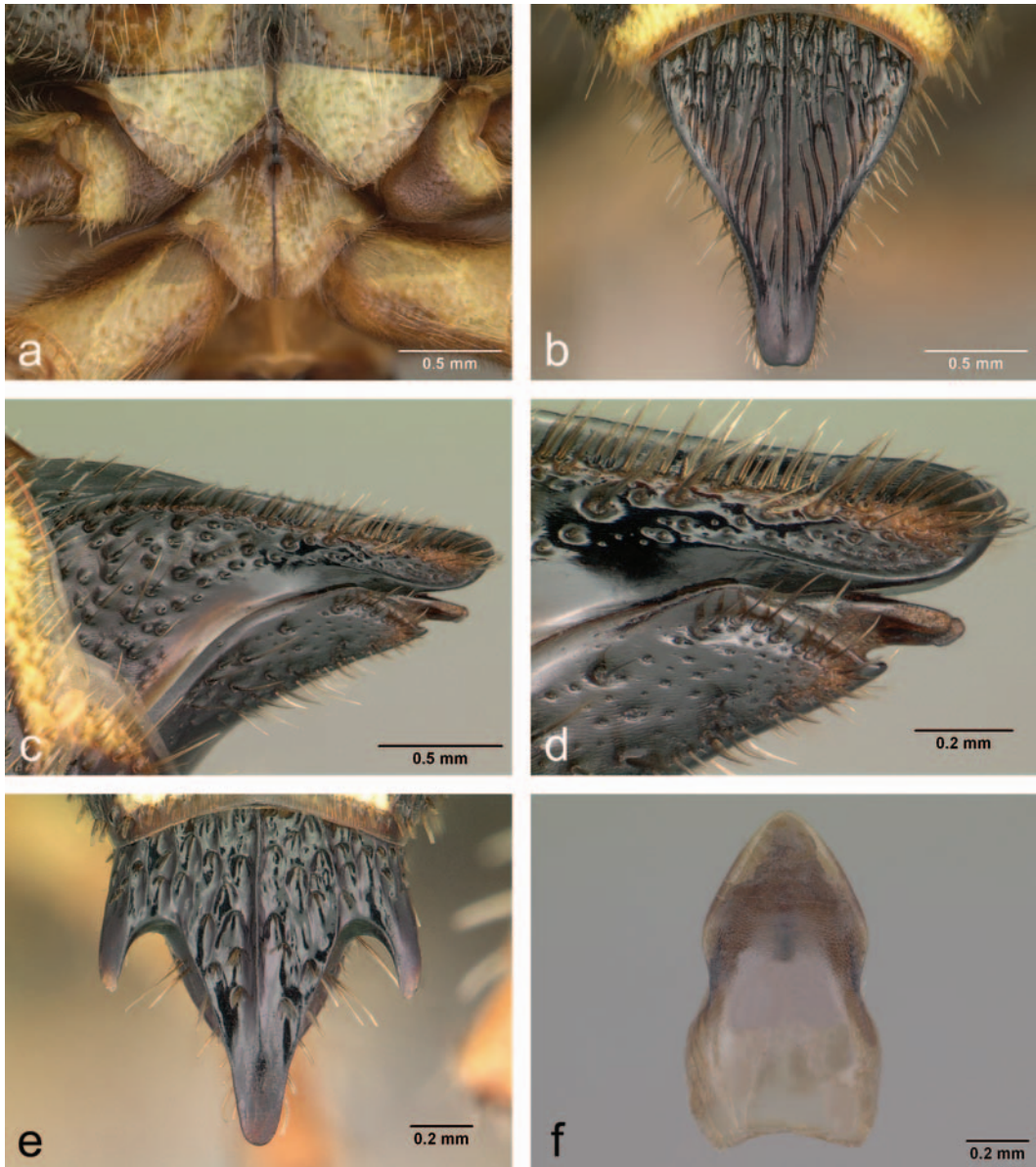


FIGURE 30. *Palarus interruptus* species group exemplified by *Palarus latifrons* Kohl: a – female mesocoxal and meta-coxal area showing mesosternal and metasternal free margin expanded into flange (respective coxal articulations concealed); b – female pygidial plate in dorsal view; c – female tergum VI laterally showing carina beneath pygidial plate; d – apex of female gastral segment VI showing sternal flange; e – male tergum VII; f – male sternum VIII, ventral surface.

midcoxa (absent in some males of *latifrons*), scutellar flange, axilla mesally, and metanotum posterolaterally (black in male and some females of *latifrons*). See descriptions of individual species for additional details. Wing membrane hyaline.

♀.— Midcoxal ventral surface without preapical tubercle. Hindtibia somewhat expanded in height, slightly curved longitudinally, flattened on dorsal half or so of inner surface. Pygidial cari-

na conspicuously raised above plate's plane on apical half. Pygidial plate with prominent, somewhat irregular, apically divergent ridges (Figs. 30b, 32f). Sides of tergum VI (Fig. 30c, d) fused preapically (resulting in tergal apex thickened dorsoventrally), tergum protruding well beyond sternal apex (Fig. 30c, d), protrusion with smooth apicoventral area; tergal side with longitudinal carina parallel to margin of pygidial plate in distal half of so (Fig. 30d), with ventral portion (ventrad of carina) reduced in size, barely visible; sternum VI with small flange overlapping ventral edge of tergum VI and sliding along smooth tergal surface below tergal carina (Fig. 30d). Sternum II simple.

♂.— Midtibial spur not shortened, about  $0.5 \times$  length of midbasitarsus. Midbasitarsus with row of minute ventral spines on outer side. Terga I and VI without adlateral carina; tergum VII with median, longitudinal carina. Sternum I without paired preapical swellings. Sternum II with preapical, transverse elevation in large specimens (posterior surface of elevation exceeding midocellar width), elevation absent in small ones. Sternum VIII rounded to acutely rounded apically, constricted preapically, its dorsal (= inner) surface with preapical, obtuse, median ridge (Fig. 30f), its venter with preapical row of setigerous punctures, asetose between row and apex, with several to many punctures anterad of row. Gonocoxite markedly expanded at apex (Fig. 31), with dense brush of long setae ventrally (Figs. 33, 36, 42b), without membranous ventral area near midlength. Penis valves dorsally fused for less than half their length (Fig. 31), longitudinally ridged before apex (Fig. 39), not angulate at ventral base of apical expansion.



FIGURE 31. *Palarus interruptus* species group exemplified by *Palarus latifrons* Kohl  
♂: genitalia dorsally.

***Palarus gynaecotrichus* Pulawski and Prentice, sp. nov.**

Figures 32-34.

**DERIVATION OF NAME.**— The name *gynaecotrichus*, derived from the Greek words *gyne* (*gynaikos*), female, and *trichos*, a hair, refers to the abundant body setae in the female.

**RECOGNITION.**— *Palarus gynaecotrichus* differs from all of its congeners in having an unusually wide vertex (the ocellocular distance is greater than the midocellar width, Fig. 32c, d). The vertex is also wide in *interruptus* and *latifrons*, but the ocellocular distance is equal to or slightly shorter than the midocellar width. Also, the hindocellus of *gynaecotrichus* is slightly more acute at the posterior admedian end than in the other two species (Fig. 32c, d), and the entire pronotal lobe is maculate (rather than maculate only along margin); the female has an unusually wide frons (antenna-ocular distance more than twice diameter of antennal socket, Fig. 32a), abundant, erect setae on the entire body (femoral setae longer than midocellar width), only three hindtibial spine rows, as opposed to four in the other two species, punctate apical depressions of terga I and II, and pygidial plate with non-concave lateral margin (Fig. 32e); the male maculae are intense yellow. In the other two species, the female face is narrower (antenna-ocular distance markedly smaller than twice diameter of antennal socket), the setae are appressed on the tibiae and gaster, the apical depressions of terga I and II is impunctate, the lateral margin of the pygidial plate is concave (Fig. 30b), and the male maculae are whitish.

**DESCRIPTION.**— Hindocellus slightly elongate, slightly more acute at posteromedian end than in *interruptus* and *latifrons*, separated from orbit by more than midocellar width (Fig. 32c, d). Least interocular distance  $6.0 \times$  midocellar width in female,  $4.8-4.9 \times$  in male. Genal setae sinuous, longer than basal mandibular width (about twice midocellar width). Scutum uniformly, densely punctate in female (most punctures less than one diameter apart), sparser posteromesally than on



FIGURE 32. *Palarus gynaecotrichus* Pulawski and Prentice, sp. nov.: a – female head in frontal view; b – female gaster in lateral view; c – female vertex in dorsal view; d – male vertex in dorsal view; e – female pygidial plate in dorsal view; f – male tergum VII in dorsal view.

remaining surface in male (mostly 1-3 diameters apart). Propodeal posterolateral setae sinuous, longer than one midocellar width in female, about as long as midocellar width in male. Terga I-IV evenly, minutely punctate in female, punctures of tergum V large.

Supraantennal swelling delimited laterally by dark sulcus; in male, hindocellus and macula below it separated by at least greatest hindocellar width; mandible in male dark brown to black with well-defined macula basally; scape yellow ventrally, flagellomere I with some yellow in some



males, remainder black. Thorax and propodeum black except the following are yellow: anterior pronotal rim, pronotal lobe, most of mesopleuron (black near posterior and ventral margins and below pronotal lobe), precoxal lobe, pair of submedian lines and streak along lateral margin on scutum (lateral streak minimal in some males from Ivory Coast), scutellar disk anteriorly (females and some males) to nearly all (most males), metanotum (lateral depression black, in some specimens also area anterad of it), most of metasternum, all metapleuron (females) or small spot above hindcoxa and around metapleural flange (males), and propodeum laterally and posterolaterally (females from Togo) or posterolaterally only (females from Ivory Coast). Female femora yellow except darkened ventrally or hindfemur darkened ventrally and apically; male fore- and midfemora yellow ventrally and dorsoapically, hindfemur black except yellow dorsoapically; female tibiae yellow or darkened apically, foretibial venter and mid- and hindtibial inner surface darkened; male tibiae yellow or foretibial venter and midtibial inner surface with black strip. Tergal fasciae yellowish brown in female, yellow in male, continuous on female terga I-III, in male continuous on terga I and II, but interrupted at least on terga V and VI.

♀.— Face unusually wide, antenno-ocular distance more than twice antennal socket diameter (Fig. 32a). Dorsal length of flagellomere I 1.9-2.0 × apical width. Foretarsomere IV with single rake spine or with additional, smaller spine. Outer surface of hindfemur without preapical spines. Hindtibia with three spine rows. Apical depression of tergum I punctate. Lateral margin of pygidial plate nearly straight. Setae erect on entire body, on scape and femora longer than midocellar diameter, dense on gaster (Fig. 32b). Length 12.0-14.3 mm.

♂.— Dorsal length of flagellomere I 1.7-2.0 × apical width. Setae shorter than midocellar diameter on scape, femora, and tibiae, suberect but markedly shorter than midocellar width on



FIGURE 33. *Palarus gynaeotrichus* Pulawski and Prentice, sp. nov. ♂: genitalia in lateral view.

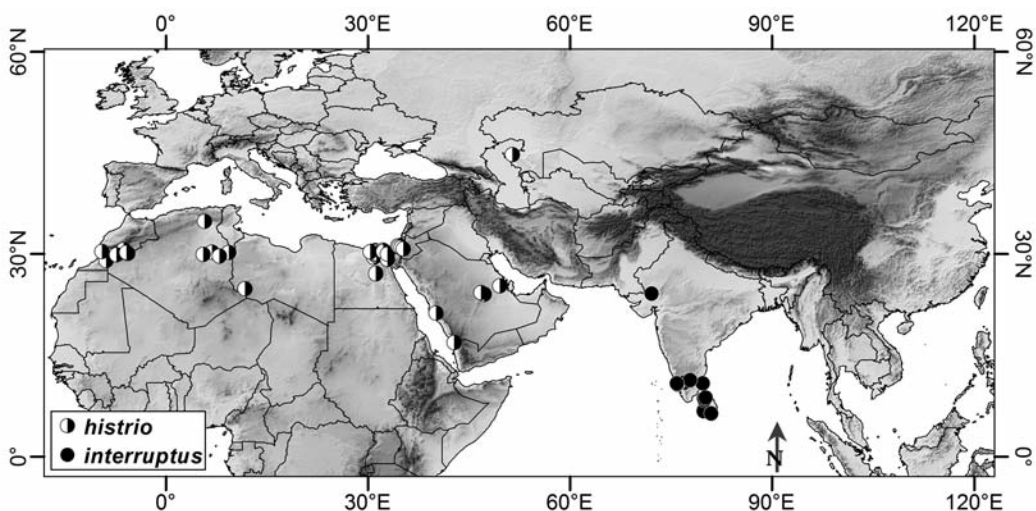


FIGURE 34. Collecting localities of *Palarus histrio* Spinola and *Palarus interruptus* (Fabricius).

laterotergite I, appressed on remaining gaster. Sternum VIII conspicuously setose on dorsal (= inner) surface. Gonocoxite with single brush of ventral setae (Fig. 33). Maculae intense yellow. Length 8.8-11.5 mm.

**GEOGRAPHIC DISTRIBUTION** (Fig. 34).— Burkina Faso, Ivory Coast, and Togo.

**RECORDS**.— **HOLOTYPE**: ♀, Togo: 5 km W Sokodé, 20 Feb 1991, W.J. Pulawski (CAS). **PARATYPES**: **BURKINA FASO**: Nasso at 11°13'N 04°26'W, January 1963, R.P. M. Terrible (1 ♂, CAS; 1 ♂, FSAG). **IVORY COAST** (all collected by W.J. Pulawski in 1991): 56 km N Niakaramandougou, 11 Jan (1 ♂, CAS); Toumodi, 7 Jan (1 ♀, 1 ♂, CAS); 40 km S Toumodi, 21 Jan (2 ♂, CAS). **TOGO** (all collected by W.J. Pulawski in 1991): 12 km S Sokodé, 15 and 21 Feb (4 ♂, CAS); 5 km W Sokodé, 17 and 20 Feb (1 ♀, 7 ♂, CAS).

### *Palarus interruptus* (Fabricius)

Figures 35-37.

*Bembix interrupta* Fabricius, 1787:286, sex not indicated. Lectotype: ♀, India: no specific locality (ZMUC), **here designated**, examined.— Lichtenstein, 1796:206 (in auction catalog); Olivier, 1789:289 (in review of world *Bembix*); Fabricius, 1793:252 (original description copied).— **As *Liris interrupta***: Fabricius, 1804:230 (new combination, redescription).— **As *Stizus interruptus***: Handlirsch, 1892:181 (new combination, original description copied); Dalla Torre, 1897:526 (in catalog of world Sphecidae).— **As *Palarus interruptus***: Dahlbom, 1845:XXIII (study of type material, new combination); Kohl, 1885:425 (authorship attributed to Dahlbom, his description copied), 428 (in checklist of world *Palarus*); van der Vecht, 1961:24 (study of type).

*Crabro interrupta* Fabricius, 1787:295, sex not indicated. Lectotype ♀, India: no specific locality (ZMUC), **here designated**, examined. Synonymized with *Liris interrupta* by Fabricius, 1804:230.— **As *Vespa interrupta***: Gmelin, 1790:2762 (new combination).— **As *Palarus interruptus***: Dahlbom, 1845:468 (new combination, listed); Kohl, 1885:425 (Dahlbom's description copied), 428 (in checklist of world *Palarus*); Cameron, 1889:148 (listed from India); Dalla Torre, 1897:658 (in catalog of world Sphecidae); Schulz, 1912:95 (Dahlbom's voucher specimen not found in Lund); Bohart and Menke, 1976:291 (listed).

*Vespa indica* Gmelin, 1790:2769. Substitute name for *Vespa interrupta* (Fabricius, 1787:286) Gmelin, 1790:2769, secondary homonym of *Vespa interrupta* (Fabricius, 1787:295) Gmelin, 1790:2762.

*Palarus orientalis* Kohl, 1885:422, ♂. Holotype: ♂, Sri Lanka: no specific locality (NHMW), examined. Synonymized with *Palarus interruptus* by van der Vecht, 1961:24.— Kohl, 1885:428 (in checklist of world *Palarus*); Cameron, 1889:148 (listed from Sri Lanka); Bingham, 1896:444 (bibliographic references), 1897:214 (original description translated into English); Dalla Torre, 1897:659 (in catalog of world Sphecidae); Schulz, 1911b:186 (description of ♀); Turner, 1911:483 (India: Disa); Cherian and Mahadevan, 1937:65 (apicultural pest in Tamil Nadu State, India); Dollfuss, 1989:11 (type material in NHMW).

**RECOGNITION**.— *Palarus interruptus* and *latifrons* are unique within the genus in having the ocellocular distance equal to the midocellar width or slightly shorter (Figs. 35c, d, 38c, d), the female pygidial plate markedly narrowing apically, with the lateral margin concave preapically (Fig. 30b), and in most females the antenno-ocular distance smaller than twice diameter of antennal socket and the hindfemoral outer surface with one or two preapical spines. The two species also have four hindtibial spine rows in the female, a feature that is lacking in *gynaecotrichus* and is not so clearly developed in other *Palarus*.

Unlike *latifrons*, the genal setae of *interruptus* (Fig. 35a) are shorter than the basal mandibular width (rather than longer) and most are not sinuous (rather than sinuous), flagellomere I is short (dorsal length 1.2-1.4 × apical width, rather than 1.7-2.0), punctures of terga I and II are minute to evanescent mesally (Fig. 35b), contrastingly smaller than lateral punctures (rather than well defined and conspicuous throughout), the distance between the hindocelli, in the female, is about equal to the ocellocular distance (Fig. 35c) rather than clearly less, male tergum VII is truncate api-





FIGURE 35. *Palarus interruptus* (Fabricius): a – female head in lateral view; b – female terga I and II in dorsal view; c – female vertex in dorsal view; d – male vertex in dorsal view; e – male tergum VII in dorsal view; f – tergum VII of a dwarf male from Disa, India, in dorsal view.

cally (Fig. 35e, f) rather than roundly pointed, and male propodeal side is maculate posterolaterally (rather than all black). The male genitalia are unique in the tribe in bearing, on each side, two well-defined brushes of ventral setae (Fig. 36).

**LECTOTYPE SELECTION.**— Four specimens of *Palarus interruptus*, part of the original syntype series, are present in the Zoological Museum, Copenhagen. All are females. Two belong to the Copenhagen collection, coming from “Dom[inus]. Lund”, i.e., from O.R. Sehested and N. Tønder

Lund collection, and are obviously syntypes of *Bembex interrupta*. Van der Vecht (1961) examined them, but did not select a lectotype. We have designated as the lectotype the specimen bearing the labels “*L. interrupta*, ex Ind. Or.” and “*Palarus*” in Fabricius’ handwriting (*L.* obviously stands for *Liris*, since Fabricius transferred the species to that genus in 1804).

The other two females come from the Kiel collection, i.e., from Fabricius’s own collection, and appear to correspond to his *Crabro interruptus*. According to the original description, specimens of *Crabro interruptus* were collected by “D[ominus]. Pflug”, who subsequently passed his material to Fabricius according to Horn et al. (1990:303). We have designated as lectotype of *Crabro interruptus* the specimen bearing the label “*interruptus*” in Fabricius’ handwriting.

**DESCRIPTION.**— Hindocellus slightly less acute at posteromedian end than in *gynaecotrichus*, separated from orbit by midocellar width or less (Fig. 35c, d). Least interocular distance  $3.6 \times$  midocellar width in female,  $3.3\text{--}3.7 \times$  in male. Genal setae shorter than basal mandibular width (about one midocellar width), most of them not sinuous (Fig. 35a). Scutal punctures sparser posteromesally than on remaining surface (mostly 1-2 diameters apart). Punctures inconspicuous or evanescent on terga I and II mesally (Fig. 35b), conspicuous on tergum V (V and VI in male). Propodeal posterolateral setae not sinuous, shorter than midocellar width.

Supraantennal swelling delimited laterally by pale sulcus; flagellum brown or black, yellowish ventrally in specimen from Disa, India. Thorax and propodeum black, except the following are pale yellow: anterior pronotal rim mesally, marginal portion of pronotal lobe, preepisternum dorsally (larger than tegula), in some specimens extending onto subalar area and behind episternal sulcus, precoxal lobe and metasternum in specimen from Disa, India, scutum submesally as line and anterolaterally, disk of scutellum anterolaterally, metanotum except depressed lateral area and (some specimens) anterolaterally, anterior portion or more of metapleuron, ventral metapleural flange, and propodeum posterolaterally (macula small in some males). Femora predominantly black and at least mid- and hindtibiae partly dark brown or black in specimens from Sri Lanka, but femora nearly all and tibiae all yellow in single male from Disa, India. Pale tergal fasciae interrupted mesally.

♀.— Face narrower than in *gynaecotrichus*, antenno-ocular distance markedly smaller than twice diameter of antennal socket. Dorsal length of flagellomere I  $1.2\text{--}1.4 \times$  apical width. Foretarsomere IV with single rake spine. Hindfemoral outer surface with one or two preapical spines (spines probably lacking in occasional specimens, as in *latifrons*). Hindtibia with four spine rows. Lateral margin of pygidial plate convex basally, concave subapically. Setae shorter than midocellar width on femora, appressed on tibiae, sparse and appressed on gaster. Length 10.0-11.5 mm.

♂.— Dorsal length of flagellomere I  $1.2\text{--}1.3 \times$  apical width. Pygidial plate truncate apically, with lateral carinae almost parallel (Fig. 35e, f). Sternum VIII conspicuously setose on dorsal (= inner) surface. Gonocoxite with two discrete brushes of ventral setae (Fig. 36). Metanotal and gastral maculae whitish. Length 7.5-8.5 mm.

**COLLECTING PERIOD.**— India: May, 4-6 June; Sri Lanka: 21 January through 25 May.



FIGURE 36. *Palarus interruptus* (Fabricius): male genitalia in lateral view.

**GEOGRAPHIC DISTRIBUTION** (Fig. 37).—  
India and Sri Lanka.

**RECORDS.**— **INDIA:** **Gujarat:** Disa = Deesa (1 ♂, CAS). **Tamil Nadu:** (Cherian and Mahadevan, 1937, or as indicated): Karikal Territory: Kurumbagarum (1 ♀, 1 ♂, UCD; 3 ♀, 2 ♂, USNM). Coimbatore District: Coimbatore (3 ♀, 1 ♂, USNM), Telungapalayam (locality of unknown location). Malabar District: Edappal, Ponnani, Tirur. Salem District: Tiruchengodu. **State and locality unknown:** 2 ♀, USNM; 1 ♀, ZMUC; 4 ♀, lectotypes and paralectotypes of *Bembex interrupta* and of *Crabro interruptus* (ZMUC). **SRI LANKA:** **Colombo District:** Colpetty 103 [km? mi?] Galle Road (1 ♀, CAS), Ratmalana (2 ♀, CAS). **Mannar District:** Kokmotte Bungalow 0.5 mi NE Wilpattu National Park (1 ♀, 3 ♂, CAS; 2 ♀, 1 ♂, USNM), Kondachchi (1 ♂, CAS; 2 ♂, USNM). **Monaragala District:** Angunakolapelessa (1 ♂, CAS; 1 ♀, 1 ♂, USNM). **Vavuniya District:** Parayanalankulam including Irrigation Canal 25 mi NW of Medawachchiya (1 ♀, CAS). **No specific locality:** 1 ♂, NHMW, holotype of *Palarus orientalis*.

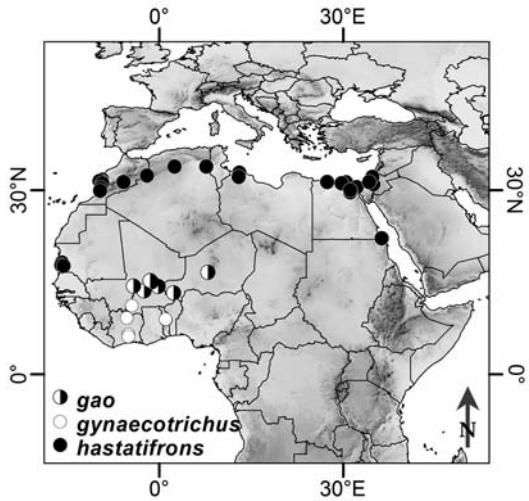


FIGURE 37. Collecting localities of *Palarus gao* Pulawski and Prentice, sp. nov., *Palarus gynaeotrichus* Pulawski and Prentice, sp. nov., and *Palarus hastatifrons* Turner.

### *Palarus latifrons* Kohl

Figures 38-40.

*Palarus latifrons* Kohl, 1884:362, ♀. Lectotype: ♀, South Africa: Cape Town (NHMW), here designated, examined.—Kohl, 1885:426 (original description copied), 428 (in checklist of world *Palarus*); Dalla Torre, 1897:659 (in catalog of world Sphecidae); Brauns, 1899:407 (description of ♂, South Africa), 1911:117 (preying on *Apis mellifera* and other aculeates, serious apicultural pest); Turner, 1912:420 (South Africa, Zambia, Malawi, Tanzania); Arnold, 1923:5 (in revision of Afrotropical *Palarus*), 1930:7 (in checklist of Afrotropical Sphecidae); Schouteden, 1930:91 (Zaire); Guiglia, 1943:76 and 1950:249 (Ethiopia); Botha, 1975:16 (damage to apiculture in South Africa); Bohart and Menke, 1976:291 (listed); Gess, 1981:20 (South Africa; nesting in friable soils), 40 (use of foretarsal rake); Clauss, 1985:157 (predation on honeybee in Botswana); Dollfuss, 1989:11 (type material in NHMW); S. Gess, 1996:282 (floral records); Wcislo, 1998:181 (proportions of antennae in relations to parasitic/non-parasitic behavior); Njau, Mpuya, and Mturi 2006 (preying on honeybee in Udzungwa Mountains, Tanzania).

*Palarus curvilineatus* Cameron, 1905:212, ♂. Holotype: ♂, South Africa: Eastern Cape Province: Steynsburg (AMG), examined. Synonymized with *Palarus latifrons* by Meade-Waldo in Meade-Waldo, Morley, and Turner, 1915:336, and by Brauns, 1917:240.

*Palarus lineatifrons* Cameron, 1905:213, ♀. Lectotype: ♀, South Africa: Eastern Cape Province: Somerset East (AMG), designated by Jacot-Guillarmod, 1961:13 (treated as holotype), examined. Synonymized with *Palarus latifrons* by Arnold, 1923:5.

**RECOGNITION.**— *Palarus latifrons* and *interruptus* have the ocellocular distance equal to the midocellar width or slightly shorter (Figs. 35c, d, 38c, d); in the female the hindfemoral outer surface has one or two preapical spines (except in occasional specimens) and the pygidial plate markedly narrowing apically, with the lateral margin concave preapically (Fig. 30b). The two species also have four hindtibial spine rows in the female, a feature that is lacking in *gynaeotrichus* and is not so clearly developed in the other *Palarus*.



Unlike *interruptus*, the genal setae of *latifrons* are sinuous and longer than the basal mandibular width (Fig. 38a), flagellomere I is long (dorsal length  $1.7\text{--}2.0 \times$  apical width, rather than  $1.2\text{--}1.4$ ), punctures of terga I and II are well defined and conspicuous throughout (Fig. 38b) rather than inconspicuous or evanescent mesally, the distance between the hindocelli in the female (Fig. 38c) is clearly smaller than the ocellular distance (rather than about equal), male tergum VII is roundly pointed apically (rather than truncate), and male propodeal side is all black (rather than maculate posteriorly).

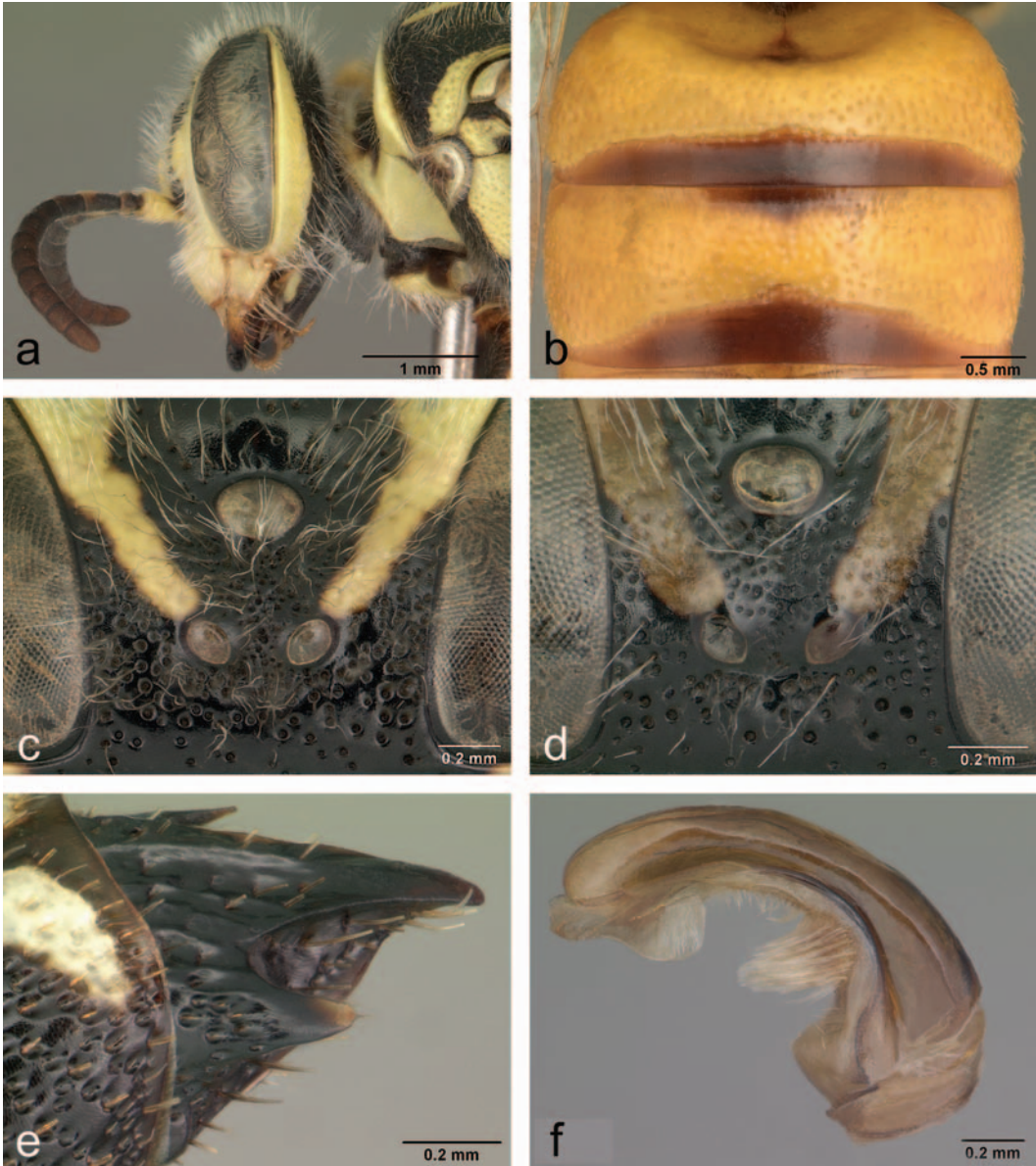


FIGURE 38. *Palarus latifrons* Kohl: a – female head in lateral view; b – female terga I and II in dorsal view; c – female vertex in dorsal view; d – male vertex in dorsal view; e – male gastral segment VII in oblique lateral view; f – male genitalia laterally.

**DESCRIPTION.**—Hindocellus minimally elongate, slightly less acute at posteromedian end than in *gynaecotrichus*, separated from orbit by slightly less than midocellar width (Fig. 38c, d). Least interocular distance  $3.4\text{--}3.5 \times$  midocellar width in female,  $3.0\text{--}3.1 \times$  in male. Genal setae sinuous (Fig. 38a), about twice midocellar width in female, slightly longer than midocellar width in male. Scutal punctures sparser centrally and posteromesally than on remaining surface (mostly 1-2 diameters apart in female, 1-4 diameters in male). Tergal punctures conspicuous. Propodeal posterolateral setae sinuous, longer than one midocellar width.

Basal half of mandible in male varying from yellow to all black; scape dark brown to black except partly to (many Kenyan specimens) predominantly yellow; flagellomere I partly yellow in some specimens, remainder black; supraantennal swelling delimited laterally by pale sulcus. Thorax and propodeum black except the following are yellow: anterior pronotal rim (females), margin of pronotal lobe, scutum anterolaterally in female and many males (may continue along scutal flange) and in many specimens also a pair of admedian lines, scutellum anteriorly (nearly all females and some males), preepisternum dorsally, subalar area and behind episternal sulcus in most females and some males (broadly so in most females), mesothoracic venter partly (some females), precoxal lobe partly to entirely (most females), metanotum except depressed lateral area and (some specimens) anterolaterally, most of metapleuron (most females) or only metapleural flange (some males), most of metasternum, propodeum posterolaterally (females only), and small spot before propodeal spiracle (females only). Fore- and midfemora black dorsally, yellow ventrally, female hindfemur varying from all black to nearly all yellow (narrowly black dorsally), male hindfemur varying from all black to largely yellow; tibiae yellow, foretibial ventral surface and mid- and hindtibial inner surface black in many females. Pale tergal fasciae continuous in females from southern Africa and Arabia, but at least bands of terga IV and V interrupted in those from Kenya, continuous or interrupted mesally in male.

♀.—Frons narrower than in *gynaecotrichus*, antenno-ocular distance markedly smaller than twice diameter of antennal socket. Dorsal length of flagellomere I  $1.8\text{--}2.0 \times$  apical width. Foretarsomere IV with single rake spine, exceptionally with additional, shorter spine. Hindfemoral outer surface with one or two preapical spines (spines lacking on one leg in occasional specimens). Hindtibia with four spine rows. Lateral margin of pygidial plate convex basally, concave subapically. Setae shorter than midocellar diameter on femora, appressed on tibiae, sparse and appressed on gaster. Length 11.0-14.2 mm.

♂.—Dorsal length of flagellomere I  $1.8\text{--}2.0 \times$  apical width. Pygidial plate averaging narrower than in *gynaecotrichus*. Tergum VII basally with tubercle above lateral margin, homologue of adlateral carina (Fig. 38e). Sternum VIII asetose on dorsal (= inner) surface. Metanotal and gastral maculae whitish. Length 7.5-14.0 mm.

**COLLECTING PERIOD.**—Angola: 15 September; Benin: 8-25 April; Botswana: 6 November through 3 December; Burkina Faso: 9-12 July; Gabon: 8 December; Kenya: 23 January, 17 April, 11 May through 29 July, 8 November through 8 December; Namibia: 2 October through 10 March; Niger: 4 August and 4 September; Saudi Arabia: 25 August and 24 September; South Africa: 17 November through February; Sudan: 24 June; Tanzania: 28-31 December; Togo: 2, 9, and 16-18 January, 22 February; Zambia: 10-22 March; Zimbabwe: 29 November through 3 April.

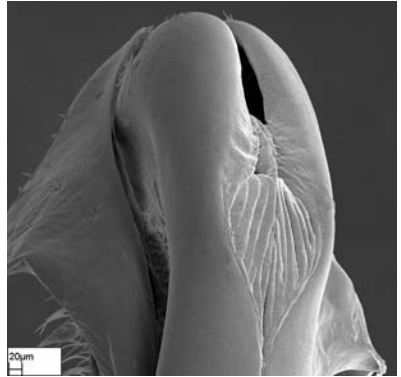


FIGURE 39. *Palarus latifrons* Kohl ♂: apical part of genitalia in lateral oblique view.



**GEOGRAPHIC DISTRIBUTION** (Fig. 40).—South Africa north to Sudan, Niger, and Mali, also Arabian Peninsula.

**RECORDS.**—**ANGOLA:** Luanda (3 ♀, USNM), Lunda: Murieje (3 ♀, 4 ♂, CAS), Lunda: Nova Chavez (1 ♀, CAS), Rocadas at Cunene River (1 ♂, BMNH), Saurimo (1 ♀, UCD). **BENIN:** 15 km SE Savé (1 ♀, 4 ♂, OÖLM), Zangnanado (1 ♂, OÖLM). **BOTSWANA:** KaGae in central Kalahari (1 ♀, PPRI), Kasane (2 ♀, OHL), Maun (1 ♀, 1 ♂, CAS; 1 ♂, OHL; 1 ♂, OÖLM), Serowe (1 ♂, CAS). **BURKINA FASO:** 4 km W Ouahigouya at 13°37.0'N 2°27.6'W (2 ♀, CAS). **ETHIOPIA:** **Gamo Gofa:** Caschei (Guiglia, 1950). **GABON:** Owendo (1 ♀, FSAG). **KENYA: Coast Province:** Mombasa (2 ♂, USU), Sokoke Forest between Kilifi and Watama (1 ♀, LACM; 1 ♂, USU), Tiwi Beaches at 4°14'S 39°36'E (1 ♀, 1 ♂, ZMUC), Voi (3 ♀, 41 ♂, OÖLM). **Eastern Province:** near Ewaso Ng'iro River opposite Archer's Post at 0°38.1'N 37°40.4'E (1 ♀, 1 ♂, CAS). **Rift Valley Province:** Eliye Springs on W shore of Lake Turkana at 3°15.2'N 36°01.3'E (2 ♀, 2 ♂, CAS), Kacheliba at 1°29'N 35° 01'E (1 ♂, AMG), Lodwar at 3°07'N 3°35'E (1 ♀, 6 ♂, CAS), Lodwar road 4 km N road to Sigor at 1°33.7'N 5°27.7'E (1 ♂, CAS), Marich Pass Field Studies Centre at 1°32.2'N 35°27.4'E (10 ♀, 8 ♂, CAS). **MALAWI:** Chikwawa 50 km SW Blantyre (1 ♂, OÖLM), SW shore of Lake Malawi (Turner, 1912). **MALI:** 60 km SW Segou (1 ♀, MS). **MOZAMBIQUE:** 30 km NW Calandica in Manicata Province (5 ♂, OÖLM), 45 km NW Chimoyo in Manicata Province (1 ♂, OÖLM), 70 km SE Chimoyo in Manicata Province (1 ♀, 4 ♂, OÖLM), Chiqubo (1 ♀, USNM), Inhambane (2 ♂, SAM), Maputo (as Lourenço Marques: 1 ♂, AMG; 2 ♀, 1 ♂, UCD), 70 km N Maputo (1 ♀, OÖLM), 25 km N Massinga in Inhambane Province (1 ♀, CAS; 1 ♀, 4 ♂, OÖLM), Nyaka (1 ♀, SAM), 110 km NW Save in Sofala Province (1 ♀, 2 ♂, OÖLM), 15 km SE Save in Inhambane Province (2 ♂, CAS; 2 ♀, 5 ♂, OÖLM). **NAMIBIA: Bethanien District:** Helmeringhausen at 22°55'S 16°49'E (1 ♂, PPRI). **Gobabis District:** Gobabis (1 ♂, AMG). **Grootfontein District:** Kombat (1 ♂, BMNH). **Karibib District:** Ameib Farm 19 mi NW Karibib (1 ♀, 1 ♂, BMNH), 23 km N Karibib (1 ♀, MS), Khan River 5 mi N Usakos (2 ♀, BMNH), 100 mi W Windhoek (1 ♂, CAS). **Keetmanshoop District:** Tses (1 ♀, USNM). **Lüderitz District:** Aus (2 ♂, MS), S Rooiberg near Orange River (3 ♂, SAM). **Maltahöhe District:** Sesriem Farm (1 ♂, BMNH). **Mariental District:** 26 km N Gochas (1 ♀, 1 ♂, UCD), Mariental (2 ♂, AMG; 1 ♂, AMNH), 65 km S Mariental (1 ♂, CAS), 13 km E Stampriet at 24°16'S 18°30'E (1 ♀, AMG). **Okahandja District:** 70 km N Okahandja (1 ♂, MS), 5 km S Okahandja (1 ♀, AMNH), 17 km W Okahandja (1 ♂, MS). **Omaruru District:** 25-50 km NW Omaruru (1 ♀, UCD). **Otjiwarongo District:** Okosongomingo Farm 50 km ESE Otjiwarongo at 20°39'S 17°05'E (1 ♂, LACM), Otjiwarongo (22 ♀, 14 ♂, PPRI), 15 km NW Otjiwarongo (2 ♂, MS). **Outjo District:** Outjo (1 ♂, SAM). **Rehoboth District:** 15 km N Kalkrand (1 ♀, 1 ♂, MS), 9 km S Rehoboth (2 ♂, CAS; 2 ♂, MS). **Rundu District:** Rundu (1 ♀, CAS; 2 ♀, 3 ♂, MS; 2 ♂, OÖLM), 100 km SW Rundu (1 ♂, OÖLM). **Swakopmund District:** Gobabeb (1 ♀, 2 ♂, ZMUC). **Tsumeb District:** 10 km SE Tsumeb (1 ♂, CAS). **Windhoek District:** Seeis (1 ♀, AMNH), Windhoek (1 ♂, AMG), 37 km N Windhoek (1 ♂, MS). **NIGER: Dosso Region:** 15 km N Gaya at 11°59.6'N 3°32.2'E (1 ♂, CAS). **Tillabéri Region:** Malalé 10 km E Niamey at 13°27.1'N 2°10.4'E (1 ♂, CAS). **SAUDI ARABIA:** Hadda 50 km E Jeddah (1 ♀, 1 ♂, CAS). **SOMALIA:** Mogadishu (1 ♀, USNM). **SOUTH AFRICA: Eastern Cape Province:** Aberdeen (6 ♀, 2 ♂, SAM), Alicedale (3 ♀, 2 ♂, AMG), NNW Bedford at 32°33'S 26°00'E (1 ♂, CAS), Belmont Valley 10 km E Grahamstown at 33°19'S 26°38'E (1 ♂, AMG), Boesmans Rivier near Grahamstown (1 ♂, SAM), Bushmans River: Letjiesbosh: Koup (4 ♂, SAM), Carlisle Bridge (1 ♀, AMG), Cradock (1 ♀, ZMUC), 7 km S Cradock (1 ♂, OÖLM), Dunbrody at 33°29'S 25°33'E (2 ♀, 4 ♂, AMG; 2 ♀, 1 ♂, SAM), Fort Beaufort: Umdala (1 ♀, 2 ♂, SAM), Fullarton E Willowmore (1 ♀, 4 ♂, AMG), Gooedeooph Farm 16 km W Steytlerville at

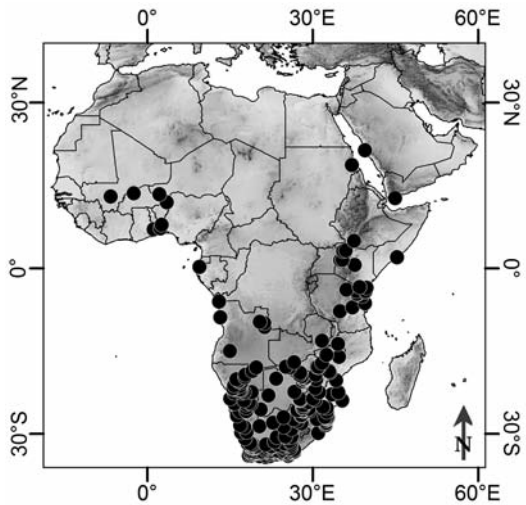


FIGURE 40. Collecting localities of *Palarus latifrons* Kohl.

33°14.7'S 24°17.3'E (2 ♂, USU), Graaff-Reinet (1 ♂, AMG), Grahamstown (1 ♀, AMG; 1 ♂, PPRI), Grahamstown: Plutos Vale (2 ♂, AMG), Hilton Farm 18 km WNW Grahamstown at 33°16'S 26°21'E (37 ♀, 8 ♂, AMG; 1 ♀, CAS), Jansenville (1 ♂, PPRI), Koonop River 17 miles from Adelaide on road to Grahamstown (1 ♀, 1 ♂, AMG), Lake Mentz at 33°12'25" S 25°08'35" E (1 ♀, DB), Middelburg (1 ♀, AMG), Pearston (1 ♂, AMG), Port Elizabeth (1 ♀, 1 ♂, PPRI), Port Elizabeth area (Brauns, 1899), Somerset East (2 ♀, AMG, lectotype and paralectotype of *lineatifrons*), Steynsburg (1 ♂, AMG, holotype of *curvilineatus*), 6 km N Steytlerville at 33°16.8'S 24°22.9'E (35 ♀, 24 ♂, USU), 37 km NW Steytlerville at 33°11'S 24°10'E (1 ♂, CSE), Strowan Farm 5 air km W Grahamstown (1 ♂, AMG), Sundays River (1 ♀, AMG; 1 ♂, CAS), Waaipoort Pass 19 km ENE Steytlerville at 33°14.8'S 24°19.8'E (3 ♀, USU), Who-Can-Tell Farm 16 mi E Cradock (1 ♀, UCD), Willowmore (1 ♀, 3 ♂, AMG; 2 ♀, 1 ♂ CAS; 1 ♀, 2 ♂, SAM; 1 ♀, 1 ♂ UCD), 9 km E Willowmore at 33°15'S 23°34'E (1 ♂, CAS), 43 km NE Willowmore at 32°59'S 23°34'E (1 ♂, CAS; 1 ♀, USU), 37 km NW Willowmore in Grootrivierberg Range at 33°11.5'S 24°09.5'E (4 ♀, USU), 28 road km SSW Willowmore at 33°27'S 24°19'E (1 ♀, CAS), 10 mi SW Willowmore (1 ♂, KU), 12 km W Willowmore at 33°16'S 23°22'E (2 ♂, CAS), Wolwekraal Farm 28 km S Steytlerville at 33°32.8'S 24°21.3'E (3 ♀, USU), Wolwekraal Farm 30 km S Steytlerville at 33°33.9'S 24°20.9'E (2 ♀, CSE; 1 ♀, USU). **Free State:** Bloemfontein (1 ♀, PPRI), Bothaville (1 ♂, AMG), Chicago (1 ♂, AMG), 30 km N Colesberg at Orange River (1 ♂, OÖLM), Kroonstad (6 ♂, AMG), Tussen Die Riviere Game Reserve at 30°30'S 26°12'E (1 ♀, PPRI). **Gauteng:** Meyerton (2 ♂, PPRI), Pretoria (4 ♀, 2 ♂, PPRI; 1 ♂, SAM), Pretoria Botanical Garden at 25°44'S 28°16'E (1 ♂, CAS), Pretoria: Nkwe (1 ♂, PPRI), Pretoria North (1 ♀, 2 ♂, AMG; 1 ♂, PPRI), 45 km N Pretoria (1 ♀, MS), Rhenosterpoort near Bronkhorstspruit at 25°45'S 28°55'E (1 ♂, PPRI), Saartjiesnek 30 km W Pretoria (1 ♀, PPRI), Vereeniging (9 ♀, 2 ♂, PPRI). **Kwazulu Natal:** Durban (1 ♂, AMNH; 2 ♀, PPRI; 1 ♀, SAM), Durban: Burman Bush (1 ♀, AMG), 20 km S Emanguzi (1 ♀, 5 ♂, OÖLM), SW Emanguzi (8 ♀, 10 ♂, OÖLM), False Bay 7 mi E of Hluhluwe Village (1 ♀, CAS), Fannies Island at 28°06'S 32°26'E (2 ♀, AMG), Kosi Bay at 26°58'S 32°48'E (2 ♀, PPRI), Lake Sibaya at 27°23'S 32°41'E (1 ♂, AMG), Manguzi River near Maputa (1 ♀, AMG), Manzengwenya Forestry at 27°16'S 32°46'E (1 ♀, 1 ♂, PPRI), Mfongosi in Zululand (1 ♂, PPRI; 1 ♂, SAM), Mkuzi Game Reserve (2 ♂, AMG), Ndumu Game Reserve (2 ♀, AMG; 2 ♀, 1 ♂, DB; 1 ♂, UCD), Santa Lucia Estuary (1 ♀, KU; 1 ♀, 1 ♂, USNM), Tembe Elephant Park (1 ♀, 1 ♂, OÖLM). **Mpumalanga:** Driefontein (1 ♀, SAM), Loskop Dam Nature Reserve at 25°25'S 29°20'E (1 ♂, PPRI), Middelburg (1 ♂, SAM), Sabie River Bungalows in Kruger National Park (3 ♂, AMG). **Northern Cape Province:** Augrabies Falls National Park at 28°36'S 20°21'E (1 ♂, AMG; 1 ♀, SAM), Britstown (1 ♀, 1 ♂, PPRI), Buffels SW Springbok (1 ♀, 1 ♂, OÖLM), Fraserburg area (1 ♂, SAM), 40 km SW Garies (1 ♀, OÖLM), Goegap (= Hester Malan) Nature Reserve (6 ♂, BMNH), Kimberley (1 ♀, SAM), Nossob River bed in Kalahari Gemsbok National Park ca 20 km S Nossob Rest Camp (1 ♀, AMG), Olifantshoek 1 ♂, AMG), Richtersveld National Park: Annisfontein (1 ♂, SAM), Tanqua-Karoo National Park (11 ♂, SAM), VanWyksfontein 8 km W Norvalspont (15 ♀, 23 ♂, AMG), Victoria West (2 ♀, 1 ♂, AMG), Vioolsdrif (1 ♂, AMG; 1 ♂, SAM). **Northern Province:** Afguns: Hope (1 ♂, AMG), Beacon Ranch 20 km NW Gravelotte (2 ♂, AMG; 1 ♀, 2 ♂, DB), D'Nyala Nature Reserve at 23°45'S 27°49'E (2 ♀, PPRI), Ellisras (1 ♀, AMG), Ellisras: Hope (2 ♂, CAS; 1 ♂, RMNH; 1 ♂, USNM), Mogol Nature Reserve at 23°58'S 27°45'E (2 ♀, 3 ♂, PPRI), Mooketsi (1 ♀, USNM), Pafuri in Kruger National Park: 22°26'S 31°12'E (1 ♀, 2 ♂, PPRI), Pienaarsrivier (1 ♂, AMG), Tweefontein 14 km NE Warmbad at 24°54'S 28°24'E (4 ♂, UCD), 5 mi W Warmbad (1 ♀, 8 ♂, USNM), Zebediela (10 ♀, 1 ♂, PPRI; 2 ♀, 1 ♂, ZMUC). **North-West Province:** Rustenberg (1 ♂, USNM), Vryburg (1 ♀, SAM). **Western Cape Province:** Aties Farm 11 km W Vanrhynsdorp at 31°40.6'S 18°39.4'E (5 ♂, USU), Beaufort West District (2 ♀, 1 ♂, SAM), Beaufort West: Oukloof (1 ♂, SAM), Bloutoring 30 mi E Touwsrivier (1 ♂), Bo Kouga in Uniondale District (1 ♀, SAM), Bothmasbad at 32°22'S 21°48'E (1 ♂, SAM), Bulshoek between Klawer and Clanwilliam (2 ♀, 4 ♂, SAM), Cape Peninsula (1 ♂, SAM), Cape Town (1 ♀, AMG; 10 ♀, NHMW, labeled as Capstadt, some as Plasun Capstadt 1872, also 1 ♀ with label illegible, and 3 ♀ without locality labels, lectotype and paralectotypes of *Palarus latifrons*; 1 ♀, 1 ♂, PPRI; 1 ♀, 2 ♂, USNM), Cape Town: Table Mountain (2 ♂, PPRI, as Tafelberg), Cederberg at 32°30'S 19°15'E (1 ♂, PPRI), Cederberg Mts. 15-30 km SE Clanwilliam (1 ♂, USU), 5 mi SE Cederberg (2 ♂, CAS), Ceres (1 ♀, 2 ♂, BMNH), 43 km (2 ♀, 2 ♂, AMG) and 60 km (1 ♀, AMG) ENE Ceres on road to Southerland, 20 km N Citrusdal (3 ♂, OÖLM), Citrusdal District (1 ♂, SAM), Clanwilliam: S Roundegat (1 ♂, AMG), 30 km N Clanwilliam (1 ♂, AMG), Dasklippas NE

Porterville (1 ♂, OHL), Dikbome on Koup – Merweville Road (24 ♀, 89 ♂, SAM), Doringbos (2 ♂, KU), Droerivier 11 km N Vanrhynsdorp at 31°42.6'S 18°12.5'E (1 ♂, USU), Elsenburg Experimental Farm 9 km N Stellenbosch at 33°51'S 18°50'E (1 ♂, SAM), Gamkaspoort at 33°22'S 21°38'E (1 ♂, SAM), Grootbrakrivier = Great Brak River (1 ♂, SAM), Hex River (1 ♀, 3 ♂, SAM), Karoo National Park at 32°15'S 22°32'E (2 ♀, 3 ♂, PPRI) and 32°20'S 22°30'E (2 ♂, PPRI), Laingsburg (1 ♀, SAM), Langberg (2 ♀, 11 ♂, OÖLM), Merweville (7 ♀, 26 ♂, SAM), Moorreesburg (7 ♀, 20 ♂, PPRI), Murraysburg (1 ♂, AMG), Murraysburg District (1 ♀, SAM), upper sources Olifants River (5 ♂, SAM), Oudtshoorn (2 ♂, AMG), Oudtshoorn: Onverwacht at 33°37'35"S 22°14'18"E (6 ♂, AMG), Porterville (1 ♂, UCD), Prince Albert Road at Vlakkraal Rivier at 33°00'S 21°41'E (1 ♀, CAS), 24 km SE Riversdale at 34°11.3'S 21°26.9'E (1 ♂, USU), Rooinek in Laingsburg District (2 ♂, SAM), Stellenbosch (1 ♀, 1 ♂, SAM), Swartberg Pass at 33°19'S 22°03'E (1 ♀, PPRI), Swartrivier 7 km NW Prince Albert at 33°10'S 21°59'E (1 ♂, CAS), Swellendam (1 ♂, UCD), Tierberg Farm 23 km NE Prince Albert at 33°07'42"S 22°16'24"E (1 ♀, 7 ♂, AMG) and 33°10'S 22°16'E (9 ♂, AMG; 2 ♀, 2 ♂, CAS; 3 ♂, OHL), Touwsrivier (2 ♂, AMG; 1 ♂, SAM), 18 mi SE Touwsrivier (2 ♂, AMNH; 7 ♂, KU; 2 ♂, UCD), Wellington (2 ♂, AMG), Wellington: Rosehook (3 ♂, CAS; 2 ♀, 18 ♂, RMNH; 4 ♂, UCD), Worcester (1 ♀, 1 ♂, PPRI), Ysterfontein Farm 11 km W Clanwilliam at 32°10'S 18°47'E (3 ♂, USU, as Willie Nel Farm on the specimen labels). **SUDAN: Kassala Province:** Erkowit at 18°46'N 37°07'E (1 ♀, CSE). **TANZANIA: Arusha Region:** Tarangire National Park: mouth of Ternagire River at 3°50'S 36°10'E (2 ♀, AMNH). **Iringa Region:** Ruaha River (Turner, 1912). **Kilimanjaro Region:** 16 km SE Same at 4°04.9'S 37°51.4'E (1 ♂, CAS), 20 km SE Same at 4°04.1'S 37°53.3'E (1 ♂, CAS). **Morogoro Region:** 62 road km SW Morogoro at 7°02.5'S 37°15.3'E (2 ♀, 2 ♂, CAS). **Tanga Region:** 73 km NW Korogwe at 4°40.8'S 38°06.4'E (1 ♀, CAS), 10 km WNW Mabokweni at 4°59.6'S 38°59.0'E (1 ♀, 1 ♂, CAS), 2 km NE Mkomazi at 4°37.8'S 38°05.5'E (1 ♀, CAS). **Zanzibar Region:** Unguja (= Island of Zanzibar): Jambiani (3 ♀, 24 ♂, BMNH). **TOGO:** 10 km N Wahala = 30 km S Atakpamé (1 ♀, CAS). **YEMEN:** Aden area (1 ♂, BMNH). **ZAIRE:** Boma (Schouteden, 1930). **ZAMBIA:** 22 km E Kalomo at 17°01'S 26°41'E (2 ♂, CAS), 6-18 km SW Mfuwe at 13°07'S 31°45'E (1 ♂, CAS), Nangereri, locality of unknown location (Turner, 1912). **ZIMBABWE:** Buby 80 km NE Beitbridge (2 ♀, 1 ♂, OÖLM), Bulawayo (1 ♀, 1 ♂, AMG; 1 ♂, PPRI; 5 ♀, 5 ♂, SAM; 1 ♂, USNM), Bulawayo airport at 20°00'S, 28°38'E (3 ♂, CAS), Bulawayo: Hillside (1 ♂, SAM), Dawn Mine 45 km NE Bulawayo at 19°48'S 28°45'E (1 ♂, CAS), Gwaai (1 ♀, SAM), Harare (1 ♀, USNM, as Salisbury), Igusi (1 ♀, SAM), Kami Ruins (1 ♂, PPRI; 1 ♂, SAM), Leighwoods 52 km SW Bulawayo at 20°26'S 28°15'E (1 ♂, UCD), Lion and Cheetah Park 24 km W Harare at 17°50'S 30°49'E (2 ♀, 1 ♂, CAS), Lupane (1 ♀, OÖLM), Mbizi Game Reserve (= Rocky Farm) 20 km SE Harare at 17°58'S 31°08'E (1 ♂, CAS), Mushandike Sanctuary W Masvingo (1 ♂, OÖLM), Redbank at Kami River (1 ♀, SAM), Sawmills (1 ♀, AMNH; 3 ♀, 5 ♂, SAM), 25 km NE Shamva on Nyagui River (1 ♀, OÖLM), Turk Mine (2 ♀, SAM), Umvuma (5 ♀, AMG; 1 ♀, SAM), Victoria Falls at 17°56'S 25°50'E (1 ♀, 1 ♂, AMG; 10 ♀, 15 ♂, CAS; 2 ♂, SAM). **LOCALITY ILLEGIBLE:** 1 ♀, 2 ♂, USNM.

### *histrio* group

**RECOGNITION.**— The females of the *histrio* group are recognized by a simply punctate pygidial plate (punctures may be round or elongate), without any longitudinal ridges or striation (Figs. 41c, 57a). Males of the group are recognized by the combination of a lateral pygidial process that is not raised or raised only slightly above the median process (pygidial plate appears tridentate) and presence of an adlateral carina below the plate (Figs. 41d, e, 43d, 45c, 48b, 52a, 53b, 57c, d, 59d, e, 61b). In the *variegatus* group the lateral process is prominently raised (pygidial plate appears bidentate except in *arabicus* and *pentheri* where the processes are fused) while in the *maculatus* group there is no lateral pygidial process and in the *interruptus* group no adlateral carina.

**DESCRIPTION.**— Postocellar area with well-developed depression, without crest. Midocellus separated from hindocellus by about its own width except markedly more in *laetus*. Hindocellus oblong, flat, nearly touching orbit (Figs. 41a, 49c). Frontal swelling not margined laterally by sulcus. Interantennal area with longitudinal crest. Scapal setae short, appressed or nearly so. Clypeal posterior surface adjacent to free margin with row of long, externally obvious setae. Clypeus pro-



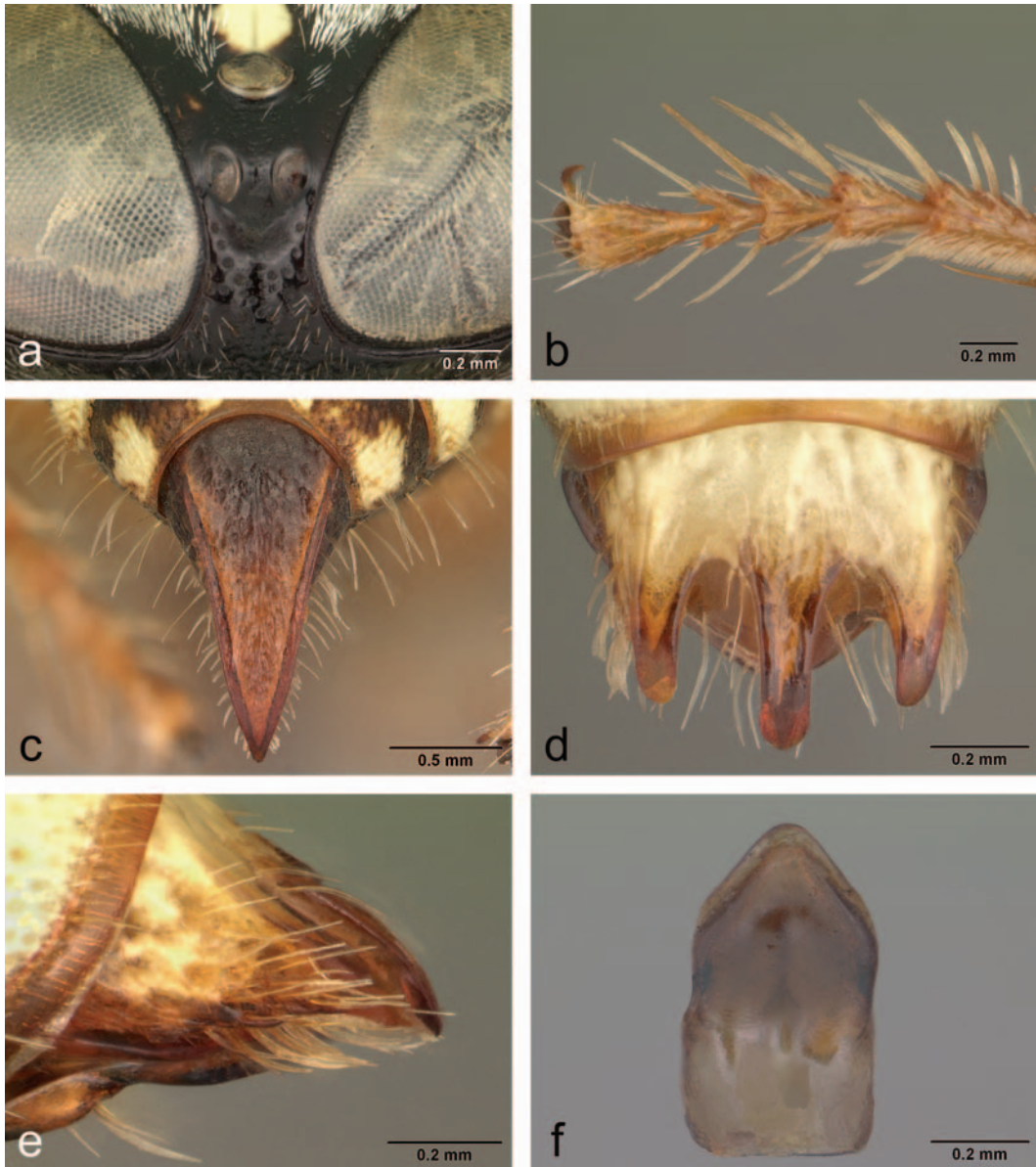


FIGURE 41. *Palarus histrio* species group exemplified by *Palarus histrio* Spinola: a – female vertex in dorsal view; b – female hindtarsus; c – female pygidial plate in dorsal view; d – male tergum VII in dorsal view; e – male segment VII in lateral view; f – male sternum VIII in ventral view.

duced anteriorly between lateroclypeal notches. Posteroventral mandibular notch varying between species. Labrum convex, length roughly half width, without apicolateral expansion, visible between fully closed mandibles, and female clypeus (Figs. 47c-e, 55e, f) with transverse carina arcuate, exposed, and apical portion with median carina. Pronotal collar raised as narrow wedge (as in Fig. 29d), at most with slight, obtuse longitudinal depression. Streptaulus separated from anterior pronotal groove (as in Fig. 29e). Metapleuron impunctate and asetose or with a few, sparse



punctures and inconspicuous setae. Mesosternal and metasternal posterior margin expanded into flange that overlays respective coxal articulation (as in Fig. 30a). Propodeal dorsum conspicuously ridged on each side of median depression (which is also ridged, width of depression several times that of midocellus), with well-defined adlateral depression; side impunctate at least anteriorly; area between side and posterior surface with sculpture and setae varying between species; admarginal propodeal carina interrupted mesally (narrowly so in *parvulus*). First recurrent vein inserting on second submarginal cell or interstitial, in small proportion of specimens inserting on first submarginal cell. Hindfemur without apical lobe. Setae of hindfemoral venter straight, markedly shorter than midocellar width. Outer apical spine of hindtarsomere II and particularly III longer and thicker than inner spine; hindtarsomere III without apicoadlateral dorsal spines. Terga minutely truncate apically or with apical transverse carina, forming double-edged margin. Tergum I with adlateral carina in male, with (*histrio* subgroup) or without (*laetus* subgroup) adlateral carina in female. Setae on gena not sinuous, subappressed to appressed, varying between species in density and length; on scape shorter than scapal width; on tergum I appressed, shorter than basal mandibular width. Medioventral area of gonocoxite membranous. Wing membrane nearly hyaline to slightly infumate.

♀.— Midcoxal ventral surface with preapical tubercle. Foretarsomere IV with single rake spine. Sides of tergum VI fused preapically (resulting in tergal apex thickened dorsoventrally), tergum protruding well beyond sternal apex (Figs. 43c, 48a, 51f, 53a, 57b, 59c), protrusion with smooth apicoventral area; tergal side with longitudinal carina parallel to margin of pygidial plate in distal half of so, its ventral portion (ventrad of carina) curved inwards, invisible externally; sternum VI with small flange overlapping ventral edge of tergum VI and sliding along tergal carina. Pygidial plate without inner platform, not raised above plate's plane on apical half. Sternum II without conspicuous swellings nor transverse carina or row of teeth.

♂.— Tergum I with conspicuous adlateral carina. Tergum VII with adlateral carina. Sternum I mesally with paired preapical swellings or single median swelling. Sternum II with transverse, preapical elevation (posterior surface of elevation exceeding midocellar width), disproportionately smaller or absent in smaller specimens. Sternum VIII minimally constricted preapically, its venter with preapical row of setigerous punctures, asetose posterad of row, at most with a few such punctures anterad of row (Fig. 41f). Gonocoxite without dense brush of long setae ventrally (Fig. 42b), with ventral membranous area near midlength. Penis valves dorsally fused for more than half their length, without series of longitudinal ridges before apex (Fig. 42a), not angulate at ventral base of apical expansion. Paraocular macula absent on both frons and gena.

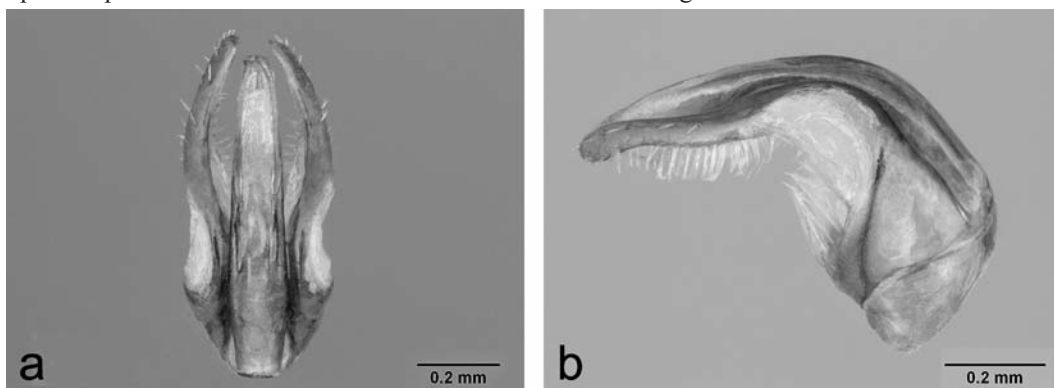


FIGURE 42. *Palarus histrio* species group exemplified by *Palarus histrio* Spinola ♂: a – genitalia in dorsal view; b – genitalia in lateral view.

*histrío* subgroup

**RECOGNITION.**— Unlike the *laetus* subgroup, the medioclypeal flange is uniform, not differentiated into admedian and adlateral portions (Figs. 47c, d, 49a, b), female tergum I has an adlateral carina, and the clypeal free margin in the male is not produced into a median lobe (Figs. 47d, 49b).

**DESCRIPTION.**— Medioclypeal flange uniform, not differentiated into admedian and adlateral portions (Figs. 47c, d, 49a, b). Lateroclypeal notch present, in-line with lateroclypeal sulcus. Least interocular distance about as wide as ocellar triangle, wider than ocellar triangle in some males of *ambustus*. Vertex not swollen between mid- and hindocelli. Occipital carina separated from eye outer orbit at vertex by more than hindocellar length (by about twice midocellar length in *histrío*). Apical depression of tergum I punctate (but with only basal, sparse punctures in some *hastatifrons* from Morocco).

Non-maculate areas of head, thorax, and propodeum black; head overall black except clypeus and in most specimens paraocular area adjacent to clypeus yellow (clypeal corner adjacent to anterior tentorial pit black); mandible yellow on basal half, reddish brown to dark brown apically; antenna dark brown to black, dorsolateral flagellar surface yellow (maculate area larger toward antennal apex). See descriptions of individual species for additional details.

♀.— Tergum I with adlateral carina.

♂.— Clypeal free margin without lobe (Figs. 47d, 49b). Midtibial spur not shortened, about 0.5 length of midbasitarsus. Venters of mid- and hindtibiae without short, erect setae, venter of mid-basitarsus with apical patch of dense setae. Tergum VI without adlateral carina, at most with obtuse swelling in *ambustus* and some *histrío*. Lateral pygidial process not raised above median process as seen in lateral view (Fig. 41e).

*Palarus ambustus* Klug

Figures 43, 44.

*Palarus ambustus* Klug, 1845:[27], pl. 47, fig. 6, ♂. Lectotype: ♂, Egypt: Saqqara (ZMHU), **present designation**, examined.— F. Smith, 1856:358 (in catalog of Hymenoptera in British Museum); Kohl, 1885:424 (original description copied), 427 (in checklist of world *Palarus*); Dalla Torre, 1897:657 (in catalog of world Sphecidae); Honoré, 1941:199 (in revision of Egyptian *Palarus*), 1942:59 (in catalog of Egyptian Sphecidae); de Beaumont, 1949:662 (in revision of Mediterranean *Palarus*), 664 (as *ambustus ambustus*), 1950:409 (Algeria), 1957:140 (Morocco); de Beaumont, Bytinski-Salz, and Pulawski, 1973:17 (Israel); Bohart and Menke, 1976:290 (listed); D. Baker, 1997:189 (in catalog of insects described by Klug, 1845).

*Palarus almeriensis* Gayubo, Asis, and Tormos, 1992:27, ♀, ♂. Holotype: ♂, Spain: Almería Province: Rioja (Univ. Salamanca).— K. Schmidt and Bitsch in Bitsch et al., 2001:288 (in Sphecid Fauna of Western Europe).

As *Palarus lepidus*: Honoré, 1941:200 (in revision of Egyptian *Palarus*) and 1942:59 (in catalog of Egyptian Sphecidae), corrected to *Palarus ambustus* by de Beaumont, 1949:662.

**LECTOTYPE SELECTION.**— Klug (1845) did not specify the number of specimens of *ambustus* he studied. We have designated as lectotype the single surviving original specimen.

**RECOGNITION.**— *Palarus ambustus* and *confusus* differ from *hastatifrons* and *histrío* by the presence of a well-defined posteroventral mandibular tooth and associated notch, lack of a median frontal macula (rudimentary frontal macula present in some *confusus* according to de Beaumont, 1949), the apically rounded ventral margin of female tergum VI (Fig. 43c), and lack of swelling before the elevation of male sternum II. In *hastatifrons* and *histrío*, the posteroventral mandibular

notch is rudimentary (Fig. 47e), the frons has a median macula, the ventral margin of female tergum VI is straight (Fig. 48a), and male sternum II is swollen before the elevation.

*Palarus ambustus* differs from *confusus* in having the preepisternal area of the mesopleuron sparsely punctate (all or many punctures several to many diameters apart, Fig. 43a, b), and the area beneath the scrobe unsculptured or with rudimentary microsculpture between punctures; also, the middle pygidial process in the male is somewhat shorter (compare Figs. 43d and 45c) than in *confusus*. In *confusus*, the preepisternal area is densely punctate (punctures less than one diameter apart or a few punctures about one diameter apart, Fig. 45a, b) and the area beneath the scrobe is microsculptured between punctures.

**DESCRIPTION.**— Least interocular distance  $0.9\text{--}1.2 \times$  midocellar width in female,  $1.8\text{--}2.2 \times$  in male (respectively  $0.8 \times$  and  $1.5 \times$  in Spanish specimens). Clypeus short, distance between condyles about  $3.2 \times$  length along midline in female,  $2.9\text{--}3.0$  in male. Mandible with well-defined posteroventral tooth and associated notch. Preepisternal area of mesopleuron with all or most punctures several to many diameters apart (with a few, sparse punctures in most specimens, but with numerous, close punctures subdorsally in some specimens from Israel and Jordan, and in one male from Kerdaseh, Egypt, Fig. 43a, b); area beneath scrobe aciculate or unsculptured between punctures. Propodeal side punctatorugose to irregularly rugose, in most specimens microsculptured anteriorly.

Gena with irregular yellow spot adjacent to mandible base in some specimens; flagellum yellow posterodorsally, remainder darkened. Thorax and propodeum all black in some males except



FIGURE 43. *Palarus ambustus* Klug: a – meso- and metapleuron of *ambustus ambustus*; b – meso- and metapleuron of *ambustus almeriensis* Gayubo, Asís, and Tormos; c – female tergum VI in lateral view; d – male tergum VII in dorsal view.

scutellar and metanotal flanges yellow; in most specimens black (reddish brown ventrally in some) with the following yellow: pronotal collar except mesally, pronotal lobe (at least marginally), preepisternum dorsally, extending onto most of subalar area in many specimens, scutum anterolaterally (larger than tegula to rudimentary) and scutellar flange, metanotum and metanotal flange, metapleural flange in most specimens, and in most specimens small lateral spot on propodeal dorsum (also posteroadmedian pair of spots in Spanish specimens). Fore- and midfemora yellow ventrally and apically (except near base), hindfemur yellow apically, remainder either reddish or dorsum black; tibiae yellow or hindtibia reddish; tarsi yellow or reddish. Gastral ground color varying from black to red; terga with yellow fasciae anterad of apical depressions (fasciae reduced to lateral spots on first terga in some males).

♀.— Dorsal length of flagellomere I  $1.7\text{--}2.0 \times$  apical width. Clypeal free margin convex mesally. Length 7.3–10.0 mm.

♂.— Dorsal length of flagellomere I  $1.6\text{--}1.8 \times$  apical width. Midbasitarsus with row of small spines ventrally. Sternum II without lateral, transverse swelling anterad of elevation. Lateral carinae of pygidial plate convex in dorsal view (converging posterad) in most specimens (Fig. 43d), but parallel in some. Lateral pygidial process without ventral carina. Length 6.3–8.2 mm.

**STATUS OF *PALARUS AMBUSTUS* AND *ALMERIENSIS*.**— Of the seven characters used by Gayubo, Asís, and Tormos (1992) to distinguish *almeriensis* from *ambustus* and *confusus*, most do not stand scrutiny when larger series of specimens are examined. Specifically, the punctation of the interantennal carina is individually variable, as is the sculpture of the interocellar area and the longitudinal, obtuse carina on the pygidial plate (the carina is ill defined in some *confusus*). In no male of *ambustus* that we have examined is the middle pygidial process shorter than the lateral one (contrary to Gayubo, Asís, and Tormos, 1992), and in one male of *ambustus* from 40 km SW Guelmim, Morocco, the lateral pygidial carinae are parallel, not convex. We cannot confirm the difference in the length of the apical flagellomere, and flagellomere I of *ambustus* is actually as long as  $1.3\text{--}1.4 \times$  II. The only reliable difference is the presence, in *almeriensis*, of 6–15 fine punctures (Fig. 43b) on the upper metapleuron (the punctures lack in *ambustus* and *confusus*). Also, the mesopleural punctures are finer than in *ambustus*, although this difference is difficult to quantify.

Because the morphological differences between *ambustus* and *almeriensis* are so small, and because the two taxa are allopatric, we prefer to treat them as subspecies of one species.

**COLLECTING PERIOD.**— Algeria: 29 May; Egypt: 2 May; Israel: 10 May through 6 June; Jordan: 15 April; Morocco: 9 April through 3 June; Spain: 3 May through 22 June; Tunisia: 20 May.

**GEOGRAPHIC DISTRIBUTION** (Fig. 44).— Southern Spain, North Africa, Israel, and Jordan.

**RECORDS.**— *Palarus ambustus almeriensis*: **SPAIN:** Almería: 20 km N Almería (1 ♀, OÖLM), Cabo de Gata (1 ♀, 1 ♂, CAS), Rioja (Gayubo, Asís, and Tormos, 1992).

*Palarus ambustus ambustus*: **ALGERIA** (de Beaumont, 1949 or as indicated): Aïn Madhi, Biskra (1 ♀, RMNH; 1 ♀, UCD), Laghouat, Tadjemout. **EGYPT** (de Beaumont, 1949, or as indicated): Abu

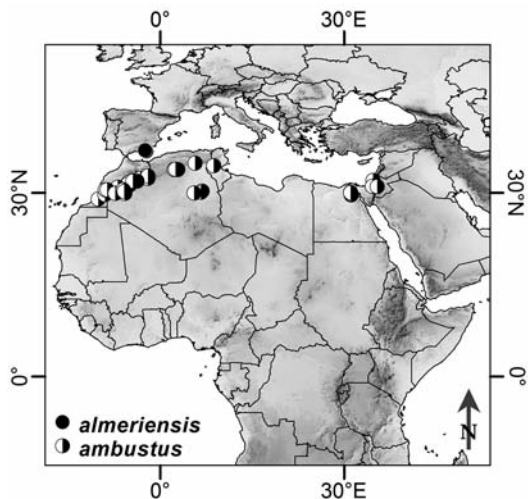


FIGURE 44. Collecting localities of the subspecies of *Palarus ambustus* Klug.



Rawash, Dahshur (1 ♂, CAS), Kafr Hakim, Kerdasah (1 ♀, MS, 1 ♂, USNM), Saqqara, also Ben Yussef and Birkade, two localities of unknown location. **ISRAEL** (de Beaumont, Bytinski-Salz, and Pulawski, 1973, or as indicated): Bat Yam, 32 km SE Beersheba = 5 km E Yeroham (1 ♀, OÖLM), Revivim. **JORDAN**: Safi 50 km from Karak (1 ♂, CAS; 1 ♂, OÖLM). **MOROCCO**: 20 km E Agdz (4 ♀, 3 ♂, OÖLM), Beni Bassia 60 km NE Boudnib (1 ♀, 4 ♂, OÖLM), 30 km N Bouarfa (1 ♀, OÖLM), 10 km S Bouarfa (10 ♀, 8 ♂, CAS; 1 ♂, CSE; 27 ♀, 20 ♂, OÖLM), 20 km W Boudnib (1 ♀, OÖLM), 20 km N Foug-Zguid (1 ♀, 4 ♂, CAS; 12 ♀, 21 ♂, OÖLM), 20 km W Foug-Zguid (3 ♀, OÖLM), 25 km S Goulmima (1 ♂, ZMUC), 10 km E Guelmim (2 ♀, CAS; 6 ♀, 10 ♂, OÖLM), 40 km SW Guelmim (2 ♂, CAS; 3 ♀, 11 ♂, OÖLM), Goulmine (de Beaumont, 1949), Ksar-es-Souk (de Beaumont, 1949), 10 km N Mhamid (3 ♂, OÖLM), Ouarzazate (1 ♂, AMNH), Tafraout (1 ♂, UCD; 1 ♀, 1 ♂, USNM), Tagounite 60 km S Zagora (1 ♂, CAS; 1 ♂, OÖLM), Talmest (1 ♂, CSE; 2 OÖLM), Taroudant (1 ♂, OÖLM), 30 km E Taroudant (1 ♀, 1 ♂, OÖLM), Tissint (3 ♀, OÖLM), 30 km NW Zagora (1 ♀, OÖLM), 5 km S Zagora (2 ♀, OÖLM). **TUNISIA**: oued 8 km SE Gafsa (1 ♀, OÖLM).

### *Palarus confusus* Turner

Figures 45, 46.

*Astata histrio* Lepeletier de Saint Fargeau, 1845:257, ♀, junior secondary homonym of *Palarus histrio* Spinola, 1839. Holotype or syntypes: ♀, Algeria: Oran (depository?).—Lucas, 1849:260 (Algeria: Oran; original description copied with modifications); F. Smith. 1856:310 (in catalog of Hymenoptera in British Museum); Acloque, 1897:94 (in Sphecidae Fauna of France and Algeria); Dalla Torre, 1897:653 (in catalog of world Sphecidae); de Beaumont, 1949:666 (as senior invalid synonym of *Palarus ambustus confusus*); Bohart and Menke, 1976:212 (listed as valid name in *Astata*).—**As *Palarus histrio***: Ferton, 1912:365 (Algeria: La Calle; nesting habits); E. Nielsen, 1933:290 (Ferton's observations reported).

*Palarus confusus* Turner, 1911:482, ♀, ♂. Syntypes: Algeria: no specific locality and Aine Kriar (OXUM, coll. Saunders), not examined. Synonymized with *Astata histrio* Lepeletier de Saint Fargeau by de Beaumont, 1949:665.—Guiglia, 1939:186 (Libya), 1942:232 (Libya); de Beaumont, 1950:409 (raised to species status, south Algeria); Gayubo, Asís, and Tormos, 1992:27 (diagnostic characters).—**As *Palarus ambustus confusus***: de Beaumont, 1949:665 (new status, in revision of Mediterranean *Palarus*), 1957:140 (Morocco); Bohart and Menke, 1976:290 (listed).

As *Palarus lepidus*: Morice, 1911:107 (Algeria), corrected to *Palarus ambustus confusus* by de Beaumont, 1949:665.

**RECOGNITION.**—*Palarus confusus* differs from *ambustus* in having the upper preepisternal area of the mesopleuron densely punctate, with punctures less than one diameter apart or some punctures about one diameter apart (Fig. 45a, b), and in having the area below the scrobe microsculptured between punctures; in the male, the median pygidial process is somewhat longer than in *ambustus* (compare Figs. 45c and 43d). In *ambustus*, all or many punctures of the preepisternal area of the mesopleuron are several to many diameters apart, and the area below the scrobe is unsculptured or slightly microsculptured between punctures. See *ambustus* for differences between *confusus*, *hastatifrons*, and *histrio*.

**TAXONOMIC HISTORY.**—*Palarus confusus* was described as a species, but treated as a subspecies of *ambustus* by de Beaumont (1949). It was restored to the species status by de Beaumont (1950) and by Gayubo, Asís, and Tormos (1992). We agree with their interpretation as we could not demonstrate intergradation to *ambustus*.

**DESCRIPTION.**—Least interocular distance 0.9-1.0 × midocellar width in female, 1.7-1.8 × in male. Mandible with well-defined posteroventral tooth and associated notch. Upper prepisternal area of mesopleuron densely punctate, punctures less than one diameter apart or some punctures about one diameter apart (Fig. 45a, b); area beneath scrobe with well-defined microsculpture between punctures. Propodeal side varying from finely, irregularly rugose to uniformly

microsculptured.

Flagellum yellowish brown dorsally or dorsolaterally, remainder brown. Thorax and propodeum black with the following yellow: pronotal collar except mesally, pronotal lobe marginally, scutum anterolaterally (area larger to smaller than tegula), scutellum anterolaterally in some specimens, scutellar flange, preepisternal area dorsally and in some specimens episcrobal area, metanotal disk, metanotal flange, metapleural flange, and in female two pairs of spots on propodeum. Fore- and midfemora yellow ventrally and apically (except near base), hindfemur yellow apically, remainder reddish to black; tibiae reddish or foretibia yellow; tarsi reddish. Gaster black, with yellow fasciae on terga I-V anterad of apical depression; apical depressions brown; pygidial plate red in female.

♀.— Dorsal length of flagellomere I  $1.5-1.7 \times$  apical width. Clypeal free margin convex mesally. Length 7.4-8.5 mm.

♂.— Dorsal length of flagellomere I  $1.5-1.6 \times$  apical width. Midbasitarsus with row of small spines ventrally. Sternum II without lateral, transverse swelling anterad of elevation. Lateral carinae of pygidial plate in dorsal view straight and parallel to slightly convex and slightly converging posterad (Fig. 45c). Lateral pygidial process without ventral carina. Length 7.0 mm.

**COLLECTING PERIOD.**— Algeria: 12 May through 6 August; Mauritania: 15 September; Morocco: 30 April through 19-21 June; Tunisia: 5-19 May.

**GEOGRAPHIC DISTRIBUTION** (Fig. 46).— Libya to Morocco, Mauritania.

**RECORDS.**— **ALGERIA:** Aflou (de Beaumont, 1949), Aïn Kriar (Turner, 1911), Annaba (Gayubo, Asís, and Tormos, 1992, as Bône), El Asnam (de Beaumont, 1949, as Orléansville), El Kala (Ferton, 1912; de Beaumont, 1949, as La Calle), Nemours (Gayubo, Asís, and Tormos, 1992), Oran (Lepelletier de Saint Fargeau, 1845), 7 km NE Tania-Le Cap Blanc (1 ♂, RMNH), Taouiala (de Beaumont, 1949). **LIBYA:** Fezzan: Til Alcun (Guiglia, 1939, 1942). **MAURITANIA:** Aleg (1 ♂, BMNH). **MOROCCO:** Ben Guérir (de Beaumont, 1949), Kenitra (1 ♀, 1 ♂, CAS; 1 ♂, OÖLM), Marrakech (1 ♂, RMNH), Sid-et-Taib 20 km N Rabat (1 ♀, OÖLM), Sidi Talbi near Kenitra (de Beaumont, 1949). **TUNISIA:** Hammamet (1 ♂, OÖLM), 3 km E Nabeul (1 ♀, CAS; 2 ♀, OHL), Tabarka area (1 ♀, ZMUC), near Tunis (de Beaumont, 1949).

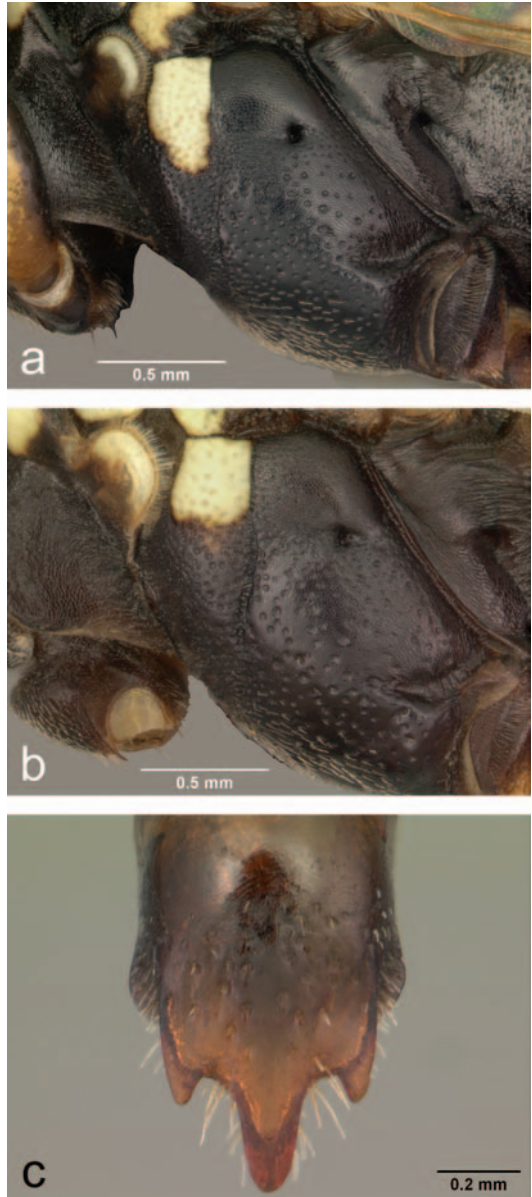


FIGURE 45. *Palarus confusus* Turner: a – meso- and metapleuron of average specimen; b – meso- and metapleuron of specimen from Mauritania; c – male tergum VII in dorsal view.

***Palarus hastatifrons* Turner**

Figures 34, 47, 48.

*Palarus hastatifrons* Turner, 1919:70, ♀, ♂. Lectotype: ♂, Palestine: Khan Yunnus 12 mi SW Ghaza (BMNH), **present designation**, examined.— de Beaumont, 1949:658 (in revision of Mediterranean *Palarus*), 659 (Israel, as *hastatifrons hastatifrons*); de Beaumont, Bytinski-Salz, and Pulawski, 1973:17 (Israel); de Beaumont, 1966:211 (Egypt), 212 (Egypt); Bohart and Menke, 1976:291 (listed).

*Palarus hastatifrons africanus* de Beaumont, 1949:660, ♀, ♂. Holotype: ♀, Morocco: Imiter SW Ksar-es-Souk (LAUSANNE), examined. **New synonym**.— de Beaumont, 1950:409 (s. Algeria), 1956:204 (Libya: n. Tripolitania), 1957:139 (Morocco); Bohart and Menke, 1976:291 (listed).

*Palarus hastatifrons oceanicus* de Beaumont, 1949:661, ♀, ♂. Holotype: ♀, Morocco: Oued Massa N Tiznit (LAUSANNE), examined. **New synonym**.— de Beaumont, 1957:140 (Morocco); Bohart and Menke, 1976:291 (listed).

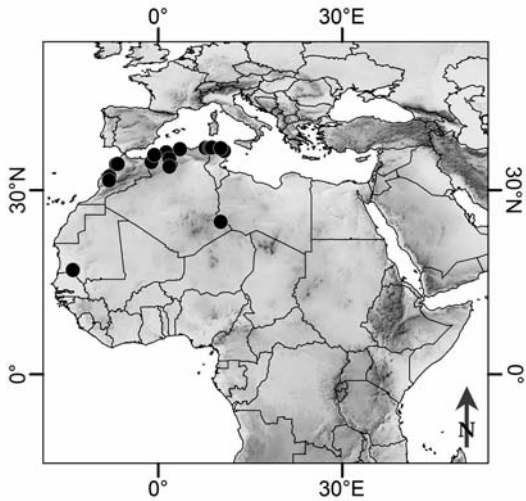


FIGURE 46. Collecting localities of *Palarus confusus* Turner.

**RECOGNITION.**— *Palarus hastatifrons* shares with *histrion* a mandible with practically non-emarginate posteroventral margin (Fig. 47e), frons maculate along the midline (Fig. 47a), ventral margin of female tergum VI straight apically in profile (Fig. 48a), and male sternum II with a lateral, transverse swelling anterad of the elevation (in contrast with *ambustus* and *confusus*, in which the mandible is emarginate posteroventrally, the frons is all black or has a trace of yellow along the midline, female tergum VI is rounded apically in profile, and male sternum II has no swelling anterad of the elevation).

The species is unique in having a strip-like extension on the glossal lobe (Fig. 47f). It also differs from *histrion* in having the minimal length of the gena in dorsal view smaller than the midocellar width (Fig. 47b), a narrower postocellar area (least interocular distance about  $0.5\text{--}1.0 \times$  midocellar width in female, about  $0.8\text{--}1.4 \times$  in male), an elongate clypeus (distance between condyles about  $2.1\text{--}2.2 \times$  length along midline in female, about  $1.9\text{--}2.0 \times$  in male, Fig. 47c, d), and the midfrontal macula separated from the paraocular macula (Fig. 47a). In *histrion*, the minimal length of the gena in dorsal view is greater than the midocellar width (Fig. 49c), the postocellar area is broader (least interocular distance is  $1.2\text{--}1.5 \times$  midocellar width in female,  $1.4\text{--}1.7 \times$  in male), the clypeus is not elongate (distance between condyles about  $2.7\text{--}2.9 \times$  length along midline in female,  $2.3\text{--}2.5 \times$  in male, Fig. 49a, b), and in most specimens the midfrontal macula is fused with the paraorbital macula (Fig. 49a, b).

**JUSTIFICATION OF NEW SYNONYMY.**— De Beaumont (1949) recognized three subspecies within *hastatifrons*: *hastatifrons hastatifrons* (Israel), *hastatifrons africanus* (North Africa), and *hastatifrons oceanicus* (coastal southern Morocco). The first two were supposed to differ by the color of the mesopleuron and gaster: well maculate in *hastatifrons africanus*, but immaculate or with reduced maculation in *hastatifrons hastatifrons*. Both subspecies, however, fully integrate at Bat Yam, Israel.

Unlike *hastatifrons africanus*, *hastatifrons oceanicus* has a yellow pronotal collar and a red-



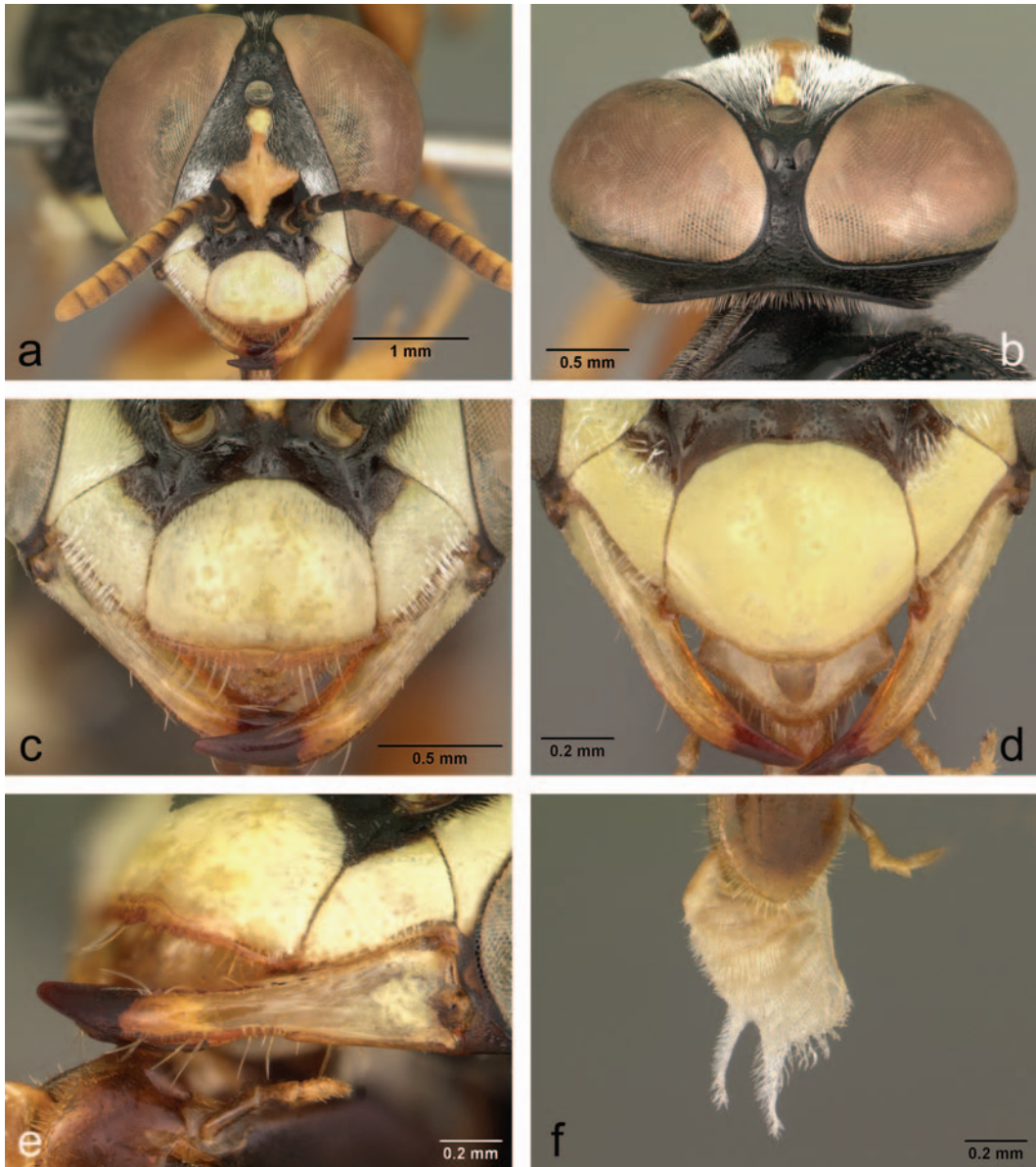


FIGURE 47. *Palarus hastatifrons* Turner: a – female head in frontal view; b – female head in dorsal view; c – female clypeus; d – male clypeus; e – female mandible; f – female glossal lobe with strip-like extension.

dish mesothoracic venter. Most specimens from Mauritania, however, are intermediate, having all black or partly yellow pronotal collar and black mesothoracic venter. Additionally, a male paratype of *oceanicus* has the mesothoracic venter practically black, with only a tinge of reddish.

Based on these observations, we feel that the subspecies of *hastatifrons* blend into each other and their recognition is not justified. Consequently, we synonymize *hastatifrons africanus* and *hastatifrons oceanicus* with *hastatifrons*.



**DESCRIPTION.**— Least interocular distance about  $0.5\text{--}1.0 \times$  midocellar width in female, about  $0.8\text{--}1.4 \times$  in male. Clypeus elongate, distance between condyles about  $2.1\text{--}2.2 \times$  length along midline in female, about  $1.9\text{--}2.0 \times$  in male (Fig. 47c, d). Mandibular posteroventral margin practically nonemarginate (Fig. 47e). Glossal lobe with strip-like extension (Fig. 47f). Minimal length of gena, in dorsal view, smaller than midocellar width (Fig. 47b). Most or many punctures of preepisternal area of mesopleuron several to many diameters apart; area below scrobe aciculate or unsculptured between punctures. Propodeal side ridged.

Frons with median macula, widest at one third of distance from antennal socket to midocellus, separated from both clypeal and paraocular maculae (Fig. 47a); gena with irregular traces of yellow ventrally and on hypostoma in some specimens; flagellum yellow posterodorsally, remainder darkened (black basally). Thorax and propodeum black (mesothoracic venter reddish in specimens from southern coastal Morocco), with the following yellow: pronotal collar in specimens from Morocco and many from Mauritania (black mesally in some), pronotal lobe (reddish in some specimens from Israel), preepisternal area dorsally in most specimens, scutum anterolaterally, scutellar flange (also scutellum posteriorly in most specimens from Mauritania), and postscutellum and metanotal flange; propodeal dorsum yellowish-reddish laterally in some specimens from Israel. Fore- and in some specimens midfemora yellow ventrally and apically (except near base) and hindfemur yellow apically, remainder reddish, femoral dorsum black in many specimens; tibiae varying from all yellow (some specimens from Mauritania) to partly or all reddish; tarsi reddish, yellowish in some specimens from Mauritania. Gastral ground color red, but red all or partly replaced by black on tergum II and following; terga, anterad of apical depression with yellow fasciae that may be ill defined and partly reduced, immaculate in some specimens from Israel.

♀.— Dorsal length of flagellomere I  $1.9\text{--}2.1 \times$  apical width. Clypeal free margin straight or with median emargination. Ventral margin of tergum VI straight apically in profile. Length 8.5–11.0 mm.

♂.— Dorsal length of flagellomere I  $2.0 \times$  apical width. Midbasitarsus with a few, thin setae ventrally. Sternum II in most specimens with lateral, transverse swelling anterad of elevation. Lateral carinae of pygidial plate in dorsal view parallel to slightly divergent posterad. Lateral pygidial process with irregular ventral carina in most specimens. Length 7.0–9.0 mm.

**COLLECTING PERIOD.**— Egypt: 30 April through 30 May, June and July; Israel: 5–21 May, 3–20 June, 5 July, and 1 October; Mauritania: 17 October through 7 November; Morocco: 22 March through 6 June; Tunisia: 8 June.

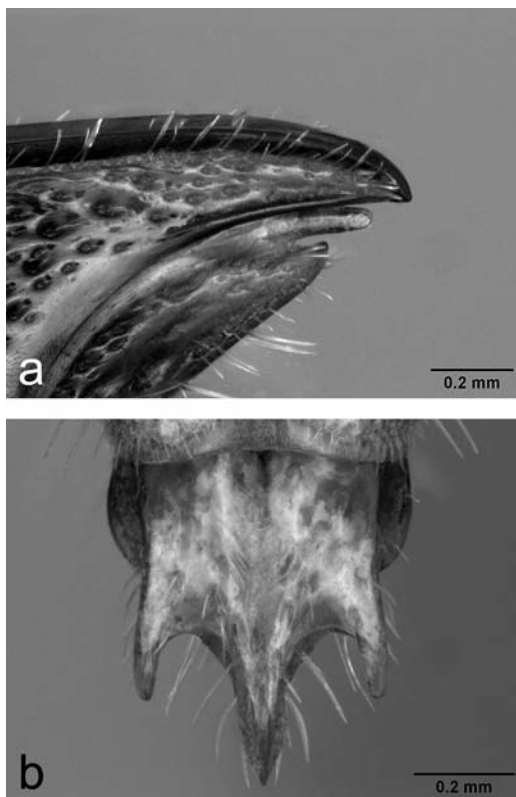


FIGURE 48. *Palarus hastatifrons* Turner: a – female tergum VI in lateral view; b – male tergum VII in dorsal view.

**GEOGRAPHIC DISTRIBUTION** (Fig. 34).— Israel to Morocco and Mauritania.

**RECORDS.**— **ALGERIA:** Tadjemount (de Beaumont, 1949). **EGYPT** (de Beaumont, 1966, or as indicated): **Al Bahr-al-Ahmar:** Gebel Elba (1 ♂, MS). **Al Iskanderiyah:** Abukir, Agmi. **Al Ismailiyah:** 8 km S Ismailia (1 ♀, USNM). **Al Jizah** (= Ghiza): Abu Rawash (1 ♀, USNM), Ghiza (1 ♀, 1 ♂, CAS). **Matruh:** 20 km E Marsa Matruh (2 ♀, CAS). **ISRAEL** (de Beaumont, Bytinski-Salz, and Pulawski, 1973 or as indicated): Bat Yam (4 ♀, 1 ♂, CAS; 4 ♂, RMNH), 13-14 km S Beersheba, Herzliya. **LIBYA: Tripolitania** (de Beaumont, 1956): Gargarese, Garian. **MAURITANIA:** Nouakchott near beach (1 ♂, CAS), 16 km NE Nouakchott (1 ♀, CAS), 32 km S Nouakchott (1 ♀, CAS), 60 km SE Nouakchott (5 ♂, CAS; 1 ♂, USNM). **MOROCCO:** Agadir (1 ♀, 1 ♂, CAS; 1 ♀, 1 ♂, CSE; 1 ♂, OÖLM; 1 ♀, 1 ♂, RMNH), 40 km S Agadir (1 ♀, CSE; 1 ♀, UCD), 10 km S Bouarfa (1 ♂, CSE; 1 ♂, OÖLM), 1 km E Essaouira at 31°30'N 9°44'W (1 ♂, CSE), Imiter (3 ♀, 1 ♂, LAUSANNE, holotype and paratypes of *hastatifrons africanus*), Sidi Rbat 60 km S Agadir (1 ♀, CSE), Talmest (1 ♂, CAS), Taroudant (1 ♂, CAS; 1 ♂, OÖLM), Tiznit: oued Massa (1 ♀, 1 ♂, CAS; 6 ♀, 6 ♂, LAUSANNE, holotype and paratypes of *hastatifrons oceanicus*; 1 ♂, RMNH; 1 ♀, USNM). **PALESTINE:** Khan Yunnus 12 mi SW Ghaza (1 ♂, BMNH, lectotype of *Palarus hastatifrons*). **TUNISIA:** 15 km W Nefta at 33°50'N 7°43'E (1 ♀, CSE).

***Palarus histrio* Spinola**

Figures 37, 49.

*Palarus histrio* Spinola, 1839:474, ♀, ♂. Lectotype: ♀, Egypt: no specific locality (MNHN), **present designation**, examined.— Lepeletier de Saint Fargeau, 1845:233 (revision); Klug, 1845:pl.47, figs. 3 and 4 (color illustrations of female and male); de Saussure, 1854:13 (discrepancy in original description); F. Smith, 1856:358 (in catalog of Hymenoptera in British Museum); Radoszkowski, 1877:25 (Uzbekistan: Kyzil Kum Desert); Kohl, 1885:425 (original description copied), 428 (in checklist of world *Palarus*); Dalla Torre, 1897:658 (in catalog of world Sphecidae); W. Schulz, 1911:185 (type material not found in Spinola collection); Ferton, 1912:365 (Algeria, prey); Honoré, 1941:199 (in revision of Egyptian *Palarus*), 1942:59 (in catalog of Egyptian Sphecidae); de Beaumont, 1949:654 (in revision of Mediterranean *Palarus*), 1952:47 (syntypes in Paris, not Torino), 1956:204 (Libya); de Beaumont, Bytinski-Salz, and Pulawski, 1973:17 (Israel); Bohart and Menke, 1976:291 (listed); Casolari and Casolari Moreno, 1980:124 (specimens in M. Spinola collection, as *istrio*); Guichard, 1988:135 (Arabian Peninsula), 1991:339 (Jordan); Kazenas, 2001:32 (in checklist of Sphecidae of Kazakhstan and Central Asia), 2002:80 (geographic distribution, Kazakhstan).

*Palarus histrio* Dahlbom, 1845:468, ♀, junior primary homonym of *Palarus histrio* Spinola, 1839. Holotype: ♀, Egypt: no specific locality (NRS), not examined. Synonymized with *Palarus histrio* Spinola by Dalla Torre, 1897:658, synonymy confirmed by de Beaumont, 1949:654, 657.

*Palarus lepidus* Klug, 1845:[25], pl. 47, fig. 3, ♀. Holotype or syntypes: ♀, Egypt: Saqqara (ZMHU), not examined. Synonymized with *Palarus histrio* by de Beaumont, 1949:658.— F. Smith, 1856:358 (in catalog of Hymenoptera in British Museum); Kohl, 1885:426 (original description copied), 428 (in checklist of world *Palarus*); Radoszkowski, 1893:69 (Turkmenistan: Serax); Dalla Torre, 1897:659 (in catalog of world Sphecidae); nec Morice, 1911:107 (= *Palarus confusus*); Maidl, 1924:239 (Sudan); Roth, 1930:82 (Algeria), 1934:189 (Algeria); nec Honoré, 1941:199 and 1942:59 (= *Palarus ambustus*); D. Baker, 1997:189 (in catalog of insects described by Klug, 1845).— **As *Larrada lepida*:** Taschenberg, 1870:6 (new combination, Egypt).

**RECOGNITION**— See *hastatifrons*, p. 383.

**LECTOTYPE OF *PALARUS HISTRIO* SPINOLA.**— The Spinola collection is housed at the Museo Regionale di Scienze Naturali, Torino, Italy, but specimens of *Palarus histrio* are not there (de Beaumont, 1952; Casolari and Casolari Moreno, 1980). A pair of Spinola's specimens, however, is present at the MNHN in Paris. The female bears a handwritten label that reads "*Palarus histrio* m." in the first line, and in the second "— Egypte, M<sup>r</sup> Waltl". The male has simply a label "♂", but the paper and the ink are identical as in the female label. Each specimen also bears a label that reads "Muséum Paris, Egypte, coll. O. Sichel 1867". Clearly they are the syntypes of *histrio* Spinola, as

noted by de Beaumont, 1952, and we select the female as the lectotype and the male as the paralectotype.

**DESCRIPTION.**—Gena in dorsal view longer than midocellar width (Fig. 49c). Least interocular distance  $1.2\text{--}1.5 \times$  midocellar width in female,  $1.4\text{--}1.7 \times$  in male. Occipital carina separated from eye outer orbit at the vertex by about twice hindocellar length. Clypeus not elongate (Fig. 49a, b), distance between condyles about  $2.6\text{--}2.9 \times$  length along midline in female,  $2.3\text{--}2.5 \times$  in male. Mandibular posteroventral margin practically nonemarginate (as in Fig. 47e), minimally emarginate in some specimens. Most or many punctures of preepisternal area of mesopleuron several to many diameters apart; area below scrobe aciculate or unsculptured between punctures. Propodeal side ridged, microsculptured anteriorly in some specimens.

Frons with linear macula mesally, widest at one third of distance from antennal socket to midocellus, in most specimens continuous with both clypeal and paraocular maculae; interocular area in some specimens with small macula anterad of hindocellus; gena in some specimens with irregular macula on ventral half or third; flagellum yellow anteriorly, darkened to black posteriorly. Thorax and propodeum black, with the following pale yellow: pronotal collar, pronotal rim in most specimens, pronotal lobe (at least along margin), scutum anterolaterally, scutellum in many specimens, scutellar flange, postscutellum, metanotal flange, upper preepisternal area, a pair of spots on propodeal dorsum in most specimens, and in Moroccan females mesopleuron, upper metapleuron, and propodeum, all extensively. Fore- and in many specimens midfemora yellow ventrally and apically (except near base) and hindfemur yellow apically, remainder reddish, femoral dorsum in many specimens black; tibiae largely yellow (remainder reddish) or hindtibiae all reddish; tarsi yellow to reddish. Gastral ground color red (most females) to black (many males), terga with yellow fasciae anterad of apical depressions (female pygidial plate basally and male tergum VII yellow in many specimens).

♀.—Clypeal free margin straight or with median emargination. Dorsal length of flagellomere I  $1.8\text{--}1.9 \times$  apical width. Ventral margin of tergum VI straight apically in profile. Length 7.2–12.0 mm.

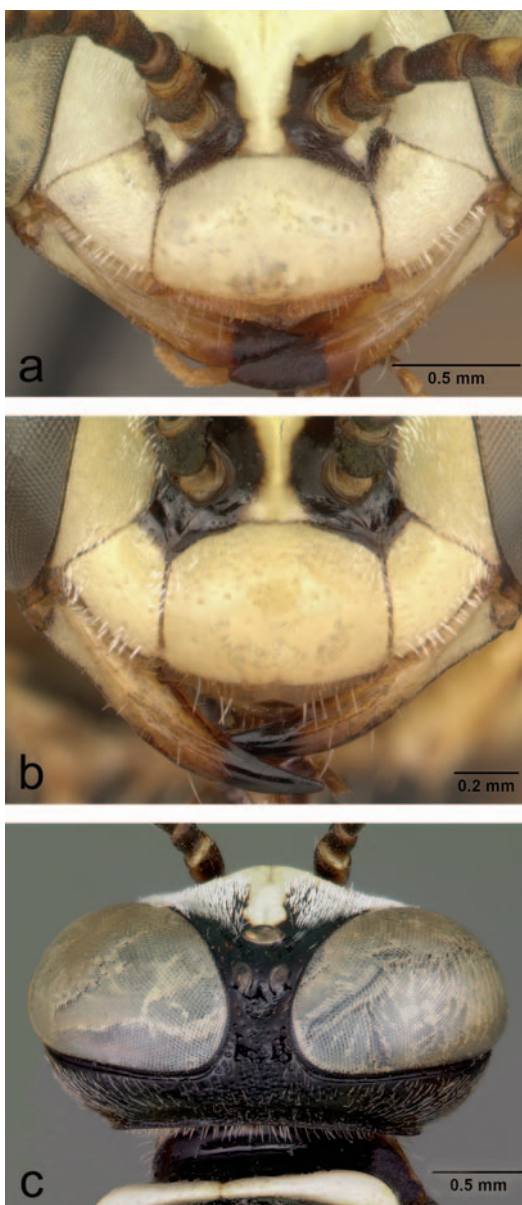


FIGURE 49. *Palarus histrio* Spinola: a – female clypeus; b – male clypeus; c – female head in dorsal view.

♂.— Dorsal length of flagellomere I  $1.6-1.8 \times$  apical width. Midbasitarsus with row of sparse spines ventrally. Sternum II with lateral, transverse swelling anterod of elevation. Lateral carinae of pygidial plate in dorsal view varying from nearly straight and essentially parallel to convex and converging posterad. Lateral pygidial process with irregular ventral carina. Length 7.5-10.2 mm.

**COLLECTING PERIOD.**— Egypt: 13 April through 22 May; Israel: 11 May through 23 June; Morocco: 20 April through 10 May; Saudi Arabia: 28 January through April.

**GEOGRAPHIC DISTRIBUTION** (Fig. 37).— North Africa, Jordan and Israel, Arabian Peninsula, and Kazakhstan.

**RECORDS.**— **ALGERIA** (de Beaumont, 1949): Biskra, Tinikert (locality of unknown location). **EGYPT: Al Buhayrah:** Wadi Natrun: Bir Hooker (1 ♀, USNM). **Al Fayyum:** Kom Osheim (1 ♀, 2 ♂, CAS). **Al Ismailiyah:** Ismailiah (1 ♂, USNM). **Al Jizah** (= Ghiza): Dahshur (5 ♀, 3 ♂, CAS), Serapeum (1 ♀, CAS). **Al Qahirah** (= Cairo): Abbasiyeh (de Beaumont, 1949), Maadi (1 ♂, CAS), Zeitoun (de Beaumont, 1949). **Asyut:** Asyut (1 ♂, SAM). **Sina** (= Sinai): Wadi Gharandal 30 km NW Abu Zenima (1 ♀, 2 ♂, CAS), Wadi Mitla (1 ♀, USNM). **No specific locality:** 1 ♀, 1 ♂, MNHN, lectotype and paralectotype of *histrion* Spinola. **ISRAEL:** Arava 4 km W Hazeva (1 ♂, RMNH), Beersheba (1 ♀, RMNH), 32 km SE Beersheba at 30°58'N 34°58'E (1 ♀, CSE), Gvulot (de Beaumont, Bytinski-Salz, and Pulawski, 1973), Revivim (1 ♀, CAS), Yeroham (de Beaumont, Bytinski-Salz, and Pulawski, 1973). **JORDAN:** Fidan 125 km N Aqaba (Guichard, 1991). **KAZAKHSTAN: South Kazakhstan:** Kyzyl-Kum Desert (Kazenas, 2002). **LIBYA: Fezzan:** In Aramas (de Beaumont, 1956). **MOROCCO:** 20 km E Agdz (2 ♀, OÖLM), between Agdz and Zagora (1 ♂, CSE), Biougra (1 ♀, CSE), 20 km N Foun-Zguid (3 ♀, 5 ♂, CAS; 5 ♀, 9 ♂, OÖLM), Icht 100 km E Bouzakame (2 ♀, 1 ♂, OÖLM), Tagounite 60 km S Zagora (1 ♂, OÖLM), Talmest (1 ♂, CSE; 2 ♀, 1 ♂, OÖLM), Taroudant (1 ♂, OÖLM), 5 km S Tata (2 ♀, CAS; 3 ♀, OÖLM), Tissint 70 km E Tata (1 ♂, OÖLM), 5 km S Zagora (2 ♂, CAS; 1 ♀, 3 ♂, OÖLM), 30 km SE Zagora (1 ♀, CSE). **SAUDI ARABIA** (Guichard, 1988): Abu Arish, Al Hair near El Riyadh, Al Kharj, Hofuf, Wadi Majarish below Taif.

### *laetus* subgroup

**RECOGNITION.**— Members of this subgroup have a unique medioclypeal flange, differentiated into an admedian and an adlateral portion that are separated by a narrowing or discontinuity (Figs. 50a-c, 51 a, b, 55c-f). In addition, the lateroclypeal notch is either absent (vast majority of specimens) or ill defined (many females of *funerarius*), while present in all other *Palarus*. Female tergum I has no adlateral carina (at most a linear swelling in some specimens), unlike the *histrion* subgroup. In the male, the clypeal free margin is produced mesally into a lobe (Figs. 50b, 51b, 55d, f), unlike the *histrion* subgroup where it is not.

**DESCRIPTION.**— Medioclypeal flange differentiated into admedian and adlateral portions that are separated by narrowing or discontinuity (Figs. 50a-c, 51 a, b, 55c-f). Lateroclypeal notch absent (present but ill defined in many females of *funerarius*). Least interocular distance smaller than width of ocellar triangle except equal to or greater in male of *laetus*, some *bisignatus* and some *piciventris*. Vertex between mid- and hindocelli differing in convexity and length among species. Occipital carina separated from eye orbit by less than half midocellar width (most *parvulus*) to about midocellar width. Apical depression of tergum I impunctate except punctate at least laterally in some *funerarius*.

Non-maculate areas of head, thorax, and propodeum black, partly red on thorax in some specimens; head overall black except clypeus and paraocular area adjacent to clypeus yellow; mandible yellow on basal half, reddish brown to dark brown apically; antenna dark brown to black, dorsolateral flagellar surface yellow (maculate area larger toward antennal apex). See descriptions of individual species for additional details.

♀.— Tergum I without adlateral carina (but with linear swelling in some specimens).



♂.— Width of clypeal free margin smaller than half width of medioclypeus. Midtibial spur varying between species. Venters of mid- and hindtibiae and of midbasitarsus without short erect setae, midbasitarsus with row of spines ventrally. Tergum VI with or without adlateral carina.

***Palarus bisignatus* F. Morawitz**

Figures 14, 50.

*Palarus bisignatus* F. Morawitz, 1890:587, ♂. Holotype: ♂, Transcaspia: no specific locality (ZIN), not examined.— F. Morawitz, 1897:150 (description of ♀); Dalla Torre, 1897:657 (in catalog of world Sphecidae); Kazenas, 1972:160 (Kazakhstan); Myartseva, 1972a:81 (Turkmenistan); Bohart and Menke, 1976:290 (listed); Kazenas, 2001:32 (in checklist of Sphecidae of Kazakhstan and Central Asia), 2002:80 (Kazakhstan); Nemkov, 2005:246 (in revision of *Palarus* of Russia and adjacent countries).

*Palarus rochei* Guichard, 1988:135, ♀, ♂. Holotype: ♀, United Arab Emirates: Al Saad at 24°25'N 55°50'E (BMNH), examined. **New synonym.**

**RECOGNITION.**— *Palarus bisignatus* shares with *funerarius* a sparsely punctate and sparsely setose mesopleuron, a propodeal enclosure that is coarsely ridged both mesally and laterally and is inconspicuously setose, and a raised lateral pygidial process in the male. Unlike that species, however, the medioclypeus of *bisignatus* is somewhat elongate (length 0.75–0.88 × maximum width, rather than 0.66–0.75 × maximum width) and, in the female, the medioclypeal flange has no small tooth and longitudinal ridge next to the lateroclypeal sulcus (tooth and ridge present in *funerarius*). In the male, the pygidial plate is narrower than in *funerarius*: the distance between the apices of the lateral processes is 1.25 × the distance from the apex of the median pygidial process to the midpoint of a line drawn between the apices of the lateral processes, whereas it is 1.65–2.5 × in *funerarius*. Additionally, the posteroventral mandibular tooth is straight or slightly rounded, hence the mandibular notch is not sharply defined basally. The notch is well defined in most *funerarius* (ill defined basally in *funerarius* from Pakistan).

**JUSTIFICATION OF NEW SYNONYMY.**— We have examined the holotype of *rochei* and found it to be conspecific with *bisignatus*, so we synonymize the two names.

**DESCRIPTION.**— Midocellus separated from hindocellus by 1.1 × midocellar width. Vertex not markedly swollen between mid- and hindocellus. Least interocular distance about 0.9–1.1 × midocellar width in both sexes. Medioclypeus somewhat elongate: length at least 0.75 × maximum width. Genal setae sparse, their length smaller than half midocellar width. Admedian and adlateral portions of medioclypeal flange not continuous in female, continuous in most males. Medioclypeal flange without small tooth or longitudinal ridge next to lateroclypeal sulcus. Posteroventral mandibular tooth straight or slightly rounded, adductor ridge swelling well developed, thus notch ill defined basally and well defined apically (Fig. 50c) except nearly reduced in specimens from Saudi Arabia. Mesopleuron smooth, with punctures several to many diameters apart and associated few, nonreflective setae. Propodeal enclosure coarsely ridged both mesally and laterally, with inconspicuous, nonreflective setae; side impunctate, unridged except ridged in some males. Hindtarsomere III varying from symmetrical to markedly expanded posterolaterally.

Frons all maculate except, in some specimens, dark lateral patch below midocellus extending to eye orbit; vertex below hindocellus with macula that extends to midocellus, and with at least rudimentary macula on postocellar area; gena all maculate or at least with irregular macula that extends to vertex; scape and pedicel all yellow, with some dark in male from United Arab Emirates; most or all of flagellomere I and most of remaining flagellum yellow. Thorax and propodeum all yellow except the following black: small median area on pronotum behind streptaulus, three scutal strips (one median, one sublateral), depressed lateral portion of scutellum, small mesopleural

area behind and largely concealed by pronotal lobe (absent in most specimens), triangular area on metanotum (reduced or absent in some specimens), triangular median area on propodeal dorsum in most specimens, and small triangular area on propodeal posterior surface in some specimens. Femora, tibiae, and tarsi yellow, femora partly red in some specimens (occasionally femoral dorsum black), tarsal apex reddish. Terga all yellow with reddish apical depressions in most specimens, but middle terga all or largely black in some males.

♀.— Clypeal free margin shallowly emarginate mesally (Fig. 50a), in some specimens produced into minute, irregular tooth on each side of emargination. Dorsal length of flagellomere I  $2.0 \times$  apical width. Tergum VI in profile with ventral margin insignificantly angled dorsad apically, apex without discontinuity between dorsal and ventral margins. Length 9.7-10.7 mm.

♂.— Dorsal length of flagellomere I  $1.9-2.0 \times$  apical width. Midtibial spur about  $0.3 \times$  length of midbasitarsus in Turkmenian specimens, but  $0.5 \times$  in Arabian male. Tergum VI with obtuse adlateral swelling. Adlateral carina of tergum VII moderately expanded basally and preapically. Lateral carinae of pygidial plate concave in dorsal view, not diverging posterad. Lateral pygidial process narrower than median process, raised above plane of median process, without ventral carina, ending posterad of apex of adlateral carina; angle between apices of lateral and median processes smaller than  $90^\circ$ . Length 8.9-9.2 mm.

**COLLECTING PERIOD.**— Oman: 19 June; Pakistan: 24 April; Saudi Arabia: 17 and 28 June; Turkmenistan: 17 May, 6-30 June, 1 July; United Arab Emirates: 3 and 20 March, 3-13 April, 15 and 31 May, 5 June, 4 July.

**GEOGRAPHIC DISTRIBUTION** (Fig. 14).— Arabian Peninsula to Kazakhstan, Uzbekistan, Turkmenistan and Pakistan.

**RECORDS.**— **KAZAKHSTAN:** Qyzylorda: 20 km S Yany-Kurgan (Kazenas, 2002). **OMAN:** Sayh Huwayyah near Bureimi (Guichard, 1988). **PAKISTAN:** **Baluchistan:** Kharan (1 ♀, BMNH, paratype of *rochei*). **SAUDI ARABIA:** Al Khardj S El Riyadh (1 ♂, BMNH, paratype of *rochei*), El Riyadh (1 ♀, 1 ♂, CAS). **TURKMENISTAN** (M = Myartseva, 1972a; N = Nemkov, 2005): Akhcha-Kuyma (N), Askhabad (2 ♀, 1 ♂, ZIN; 1 ♂, ZMMU), Djebel (1 ♀, CAS; 1 ♀, 6 ♂, ZIN), Kara Bogaz 40 km N Kizil-Arvat (1 ♀,

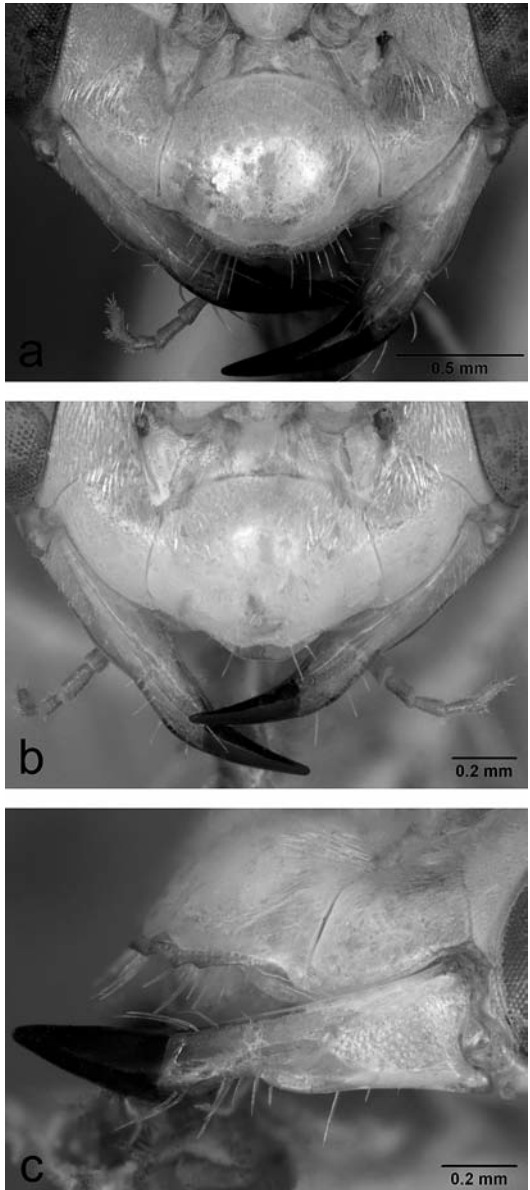


FIGURE 50. *Palarus bisignatus* F. Morawitz: a – female clypeus; b – male clypeus; c – male mandible

1 ♂, CAS; 1 ♀, ZIN), Kizyl-Arvat (N), Krasnovodsk (1 ♀, ZIN), Kushka (1 ♂, CAS; 4 ♀, ZIN), lower Mur-gab River (M), Repetek (1 ♀, 2 ♂, CAS; 4 ♀, ZIN; 6 ♀, 2 ♂, ZMMU), Takhta-Bazar (2 ♂, ZIN), lower Ted-jen River (M), Uzun Ada (M, N). **UNITED ARAB EMIRATES:** Abu Dhabi at 24°27'N 54°23'E (Guichard, 1988), Al Saad at 24°25'N 55°50'E (2 ♀, 2 ♂, BMNH, holotype and paratypes of *rochei*), Bidy al Ajam (1 ♀, BMNH, paratype of *rochei*). **UZBEKISTAN** (Nemkov, 2005): Khiva, Novyi Urgench.

***Palarus funerarius* F. Morawitz**

Figures 51-54.

*Palarus funerarius* F. Morawitz, 1889:136, ♀. Holotype: ♀, China: Inner Mongolian Autonomous Region: Tsagan Buryuk at about 42°N 100.6°E (ZIN), examined.— Dalla Torre, 1897:658 (in catalog of world Sphecidae); F. Morawitz, 1897:150 (redescription of ♀, description of ♂); Turner, 1911:480 (India); Ramakrishna Aiyar, 1916:553 (in catalog of Indian aculeates described after Bingham, 1897); Turner, 1917:194 (Pakistan); Gussakovskij, 1935:433 (Tajikistan); Bohart and Menke, 1976:291 (listed); Myartseva, 1976:81 (nesting habits); Kazenas, 1978:139 (in key to Sphecidae of Kazakhstan and Central Asia); Pulawski, 1978:229 (in key to Sphecidae of European part of former USSR); Islamov, 1986:527 (Uzbekistan); Wu and Zhou, 1996:93 (in Economic Insect Fauna of China); Nazarova, 1998:41 (Tajikistan); Kazenas, 2001:32 (in checklist of Sphecidae of Kazakhstan and Central Asia), 165 (nesting habits); Nazarova, 2005:94 (alfalfa fields in southwestern Tajikistan); Nemkov, 2005:247 (in revision of *Palarus* of Russia and adjacent countries); Ljubomirov and Uildirim, 2008:190 (in catalog of Crabronidae of Turkey).

*Palarus gracilis* Kohl in Kohl and Handlirsch, 1889:277, ♂. Holotype or syntypes: ♂, Turkmenistan: Pulikhatum S Serax near Iranian border (STATE MUSEUM OF GEORGIA, TBILISI [?]), not examined. Synonymized with *Palarus funerarius* by de Beaumont, 1949:652 (who attributed synonymy to Turner).— Dalla Torre, 1897:658 (in catalog of world Sphecidae).

*Palarus seraxensis* Radoszkowski, 1893:69, ♀, ♂. Lectotype: ♀, Turkmenistan: Serax (ZMHU), **here designated**, examined. Synonymized with *Palarus funerarius* by Nemkov, 2005:247.— Dalla Torre, 1897:659 (in catalog of world Sphecidae); Bohart and Menke, 1976:291 (listed); Kazenas, 2001:33 (in checklist of Sphecidae of Kazakhstan and Central Asia).

*Palarus incertus* Radoszkowski, 1893:70, ♀. Lectotype: ♀, Turkmenistan: Serax (ZMHU), **here designated**, examined. **New synonym.**— Dalla Torre, 1897:658 (in catalog of world Sphecidae); Bohart and Menke, 1976:291 (listed); Nemkov, 2005:246 (in revision of *Palarus* of Russia and adjacent countries, as new synonym of *Palarus bisignatus*).

As *Palarus lepidus*: Radoszkowski, 1893:69 (Turkmenistan: Serax), **present correction.**

*Palarus quiescens* Nurse, 1903:5, ♀, ♂. Syntypes: India: Gujarat: Disa = Deesa (OXUM? Not in BMNH), not examined. Synonymized with *Palarus funerarius* by Turner, 1911:480.

*Palarus nursei* Turner, 1911:481, ♂, ♀. Lectotype: ♂, Pakistan: Quetta (BMNH), **present designation**, examined. Synonymized with *Palarus funerarius* by Kazenas, 2000:51.— Ramakrishna Aiyar, 1916:553 (in catalog of Indian aculeates described after Bingham, 1897); Bohart and Menke, 1976:291 (listed); Guichard, 1988:136 (Arabian Peninsula).

*Palarus beaumonti* Bytinski-Salz, 1957:166, ♀, ♂. Holotype: ♂, Turkey: Malatya Province: Kizil Irmak River near Balaban at 38°29'N 37°34'E (originally H. Bytinski-Salz coll., now Tel Aviv Univ.), not examined (paratypes examined). **New synonym.**— de Beaumont, 1960:20 (Greece: Isle of Rhodes), 1967:337 (Turkey; possibly a synonym of *funerarius*); Bohart and Menke, 1976:290 (listed); K. Schmidt and Bitsch in Bitsch et al., 2001:289 (in Sphecidae Fauna of Western Europe); Ljubomirov and Uildirim, 2008:188 (in catalog of Crabronidae of Turkey).

**LECTOTYPE SELECTION.**— Radoszkowski (1893) did not indicate the number of specimens examined in the original description of *incertus* and *seraxensis* (both based on the female sex only). A female with Radoszkowski's handwritten label *incertus* (ZMHU) and another with Radoszkowski's handwritten label *seraxensis* (both ZMHU) may be the holotypes or the only surviving syntypes of the respective species. We have designated them as the lectotypes of *incertus* and *seraxensis*, respectively.

**JUSTIFICATION OF NEW SYNONYMY.**— We have not examined the holotype of *Palarus beaumonti*, but studied three paratypes of this species. They are clearly conspecific with *Palarus funerarius*. We also synonymize *incertus*, although with certain doubts.

**INTERPRETATION OF *PALARUS GRACILIS*.**— *Palarus gracilis* was described from a single male collected in Turkmenistan and may be deposited in Tbilisi, Georgia (and not in NHMW, as Nemkov, 2005, claimed). We were unable to obtain it for study (our request to borrow it remained unanswered), but Kohl's description suggests that it is identical to *funerarius*. The only *Palarus* that occur in Turkmenistan and have male tergum VII tridentate as in Kohl's Figure 14 are *funerarius* and *pictiventris*. Kohl says that the coloration of *gracilis* is similar to that of *variegatus* except for the four yellow spots on the propodeum, implying that the area around the midocellus is black and the terga are black with yellow bands. This color pattern is found in most *funerarius*, but clearly excludes *pictiventris*, in which the propodeum is black and the gaster is red with yellow bands. In addition, many *funerarius* have the carinae of the lateral tooth of tergum VII nearly parallel, as in Kohl's figure, whereas these carinae are divergent in the other species. We accept the synonymy of *gracilis* and *funerarius*, proposed by de Beaumont and suspected by Kohl himself.

**RECOGNITION.**— Like *bisignatus*, *funerarius* has a sparsely punctate and sparsely setose mesopleuron, a propodeal enclosure that is coarsely ridged both mesally and laterally and is inconspicuously setose, and a raised lateral pygidial process in the male. Unlike *bisignatus*, the medioclypeus of *funerarius* is not elongate (length about  $0.66\text{--}0.75 \times$  maximum width, rather than  $0.75\text{--}0.88$ ) and the posteroventral mandibular tooth of most specimens is nearly straight to rounded distally but well defined, the mandibular notch thus being sharply defined basally (in contrast with *bisignatus*, in which the posteroventral tooth gradually lowers toward the mandibular apex and the notch is unsharply defined basally). In females of *funerarius* from Pakistan, however, the posteroventral tooth and notch approach the condition found in *bisignatus*. The vast majority of females differ from *bisignatus* in having the venter of tergum VI angled apically in profile (Fig. 51f) rather than straight. In the female, the medioclypeal flange has a small tooth and ridge next to the lateroclypeal sulcus (inconspicuous in some specimens), whereas the tooth and ridge are absent in *bisignatus*. In the male, the pygidial plate is broader than in *bisignatus*: the distance between apices of lateral pygidial processes is equal to  $1.65\text{--}2.5 \times$  distance from apex of median process to midpoint of line drawn between apices of lateral processes (rather than  $1.25 \times$ ).

**STATUS OF *PALARUS INCERTUS*.**— The typical *incertus* differs from average *funerarius* in having the following: 1. tergum I reddish or reddish brown outside the macula (rather than black), 2. apex of female tergum VI straight ventrally in profile (Fig. 53a) rather than angulate (Fig. 51f), 3. median process of male pygidial plate bent down, slightly but clearly below the lateral processes in profile (Fig. 53b) rather than bent down only slightly, placed almost in the same plane as the lateral processes in profile (Fig. 52a), 4. posterior end of the adlateral carina of male tergum VII roundly produced (rather than produced into angular flange), and 5. posteroventral surface of male tergum VII with a comparatively wide emargination on tergal edge (Fig. 53c) rather than nearly reduced (Fig. 52b). None of these differences is constant, however. For example tergum I is reddish outside the macula in some specimens from Turkey and some from Kazakhstan that are otherwise typical *funerarius*; the apicoventral portion of female tergum VI is straight in profile in a female from Rhodes which otherwise is a typical *funerarius*; and details of male tergum VII are intermediate in several specimens. We conclude that *incertus* is just an individual form of *funerarius*.

**DESCRIPTION.**— Midocellus separated from hindocellus by  $1.1 \times$  midocellar width. Vertex not markedly swollen between mid- and hindocellus. Least interocular distance about  $0.8\text{--}0.9 \times$  midocellar width in female,  $0.9\text{--}1.5 \times$  in male. Genal setae sparse, shorter than midocellar width. Adme-



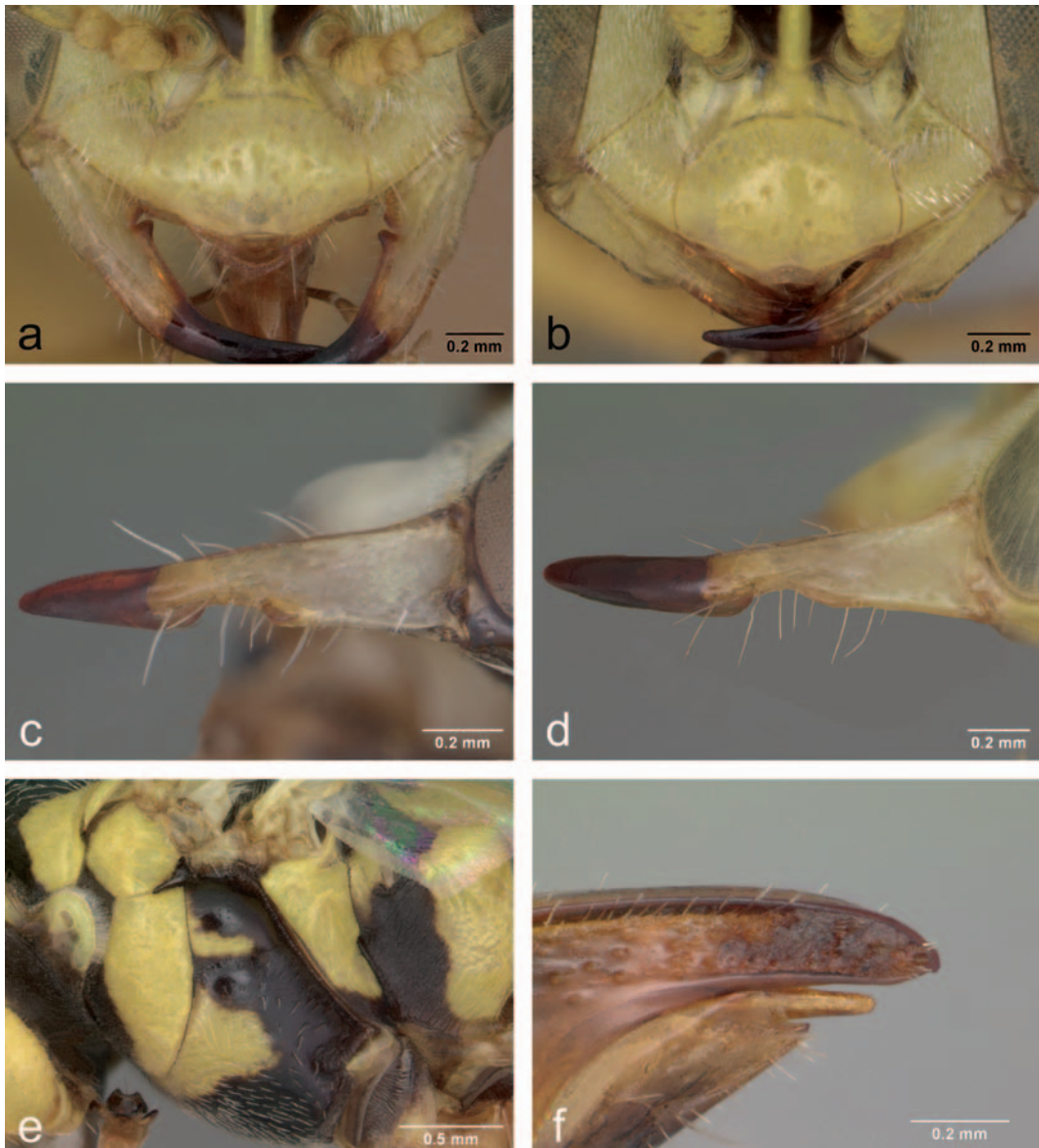


FIGURE 51. *Palarus funerarius* F. Morawitz: a – female clypeus; b – male clypeus; c – mandible of female from Turkmenistan; d – mandible of female from Pakistan; e – female thorax and propodeum in lateral view; f – female tergum VI in lateral view.

dian and adlateral portions of clypeal flange not continuous (discontinuity inconspicuous in male). Lateroclypeal notch absent or rudimentary in female, poorly defined in male; medioclypeal flange with small tooth and ridge next to lateroclypeal sulcus in female, with poorly defined obtuse tooth and small or no ridge in male. Posteroventral mandibular tooth and adductor ridge swelling well developed in most specimens, with notch well indicated basally and apically (Fig. 51c), but tooth obtusely angulate and notch more open in Pakistani males, and tooth reduced and notch shallow in Pakistani females (Fig. 51d). Mesopleuron aciculate, its punctures several to many diameters apart,

setae nonreflective, sparse. Propodeal enclosure coarsely ridged both mesally and laterally, with inconspicuous, nonreflective setae; side irregularly microsculptured in female, ridged in male.

Clypeus in some specimens black adjacent to anterior tentorial pit; frons all black except for paraorbital macula in a female from Turkey, in most specimens with at least supraantennal macula that may extend to paraocular macula and/or is continuous mesally with its opposite and with linear macula on frontal line below frontal midheight; in many specimens with maculae below antennal socket; in some specimens (including those from Pakistan) with macula along midline above frontal midheight and macula below hindocellus; gena in most specimens immaculate or with small macula adjacent to mandibular base, in some with macula extending to above genal midheight; scape and flagellomere I in some specimens maculate ventrally, in Pakistani specimens most of scape, pedicel and flagellomere I maculate, and more apical flagellomeres may lack maculae typical of the group. Thorax and propodeum black except the following are yellow: pronotum anteriorly in most specimens, pronotal collar, pronotal lobe (at least posteriorly), scutum anterolaterally (narrowly so in specimens from Turkey), a pair of strips or at least dots on scutum (absent in female from Turkey), scutellar flange, scutellum except in some specimens from Turkey and Kazakhstan, metanotum including flange, preepisternal area dorsally, in many specimens most of mesopleuron and of metasternum, propodeal dorsum varying from all black to extensively yellow (with yellow spot posterolaterally in many specimens). Fore- and midfemora in some specimens yellow ventrally and apically, hindfemur yellow apically, and remainder black, but all femora yellow in other specimens except dorsum partly black; tibiae yellow or partly darkened; tarsi yellow to reddish. Gastral ground color black, red or reddish brown in exceptional specimens, terga with yellow fasciae anterad of apical depressions (fasciae extending to tergal foremargin on terga II-VI in most males and on terga II-V in many females, narrow fascia present on tergum I only in one male from Urda, Kazakhstan, pygidial plate yellow in male and some females); apical depressions brown.

♀.—Clypeal free margin emarginate mesally, produced into modest tooth on each side of emargination (Fig. 51a). Lateroclypeal notch, when present, in line with lateroclypeal sulcus. Dorsal length of flagellomere I  $1.8-1.9 \times$  apical width. Tergum VI in profile with ventral margin angled dorsad apically in vast majority of specimens (Fig. 51f), straight in some. Length 7.8-10.2 mm.

♂.—Dorsal length of flagellomere I  $1.9-2.1 \times$  apical width. Midtibial spur not shortened, about  $0.5 \times$  length of midbasitarsus. Adlateral carina of tergum VI absent. Adlateral carina of tergum VII produced into angulate process posteriorly in most specimens, narrowed posteriorly in smaller ones. Lateral carinae of pygidial plate slightly concave in dorsal view, slightly to clearly diverging apicad. Lateral pygidial process narrower than or as broad as median process, raised above plane of median process, without ventral carina, ending posterad of apex of adlateral carina; angle between apices of lateral and median processes slightly less to more than  $90^\circ$ ; gap between lateral and median processes, in profile, insignificant in most specimen, but well defined in one of the smallest males (from 4 km N Bakanas, Kazakhstan). Length 5.0-9.7 mm.

**VARIATION.**—*Palorus funerarius* is sexually dichromatic in Kazakhstan (the male being more yellow), but apparently not elsewhere, as in Turkmenistan.

**COLLECTING PERIOD.**—Greece (Isle of Rhodes): 12 August, 11-25 September; India: 11 August; Iran: 29 June through 1 July; Kazakhstan: 7-30 June and 10-19 July; Pakistan: 26-29 June and 14-20 July; Saudi Arabia: 18 March through 30 April; Tajikistan: 1 June and 19-29 July, 12 August; Turkey: 27 May, 3-7 June, 26 July, and 3-13 August; Turkmenistan: 3-8 and 15-31 May, 3-14 June, 21 June, 28 July, 20-24 August; Uzbekistan: 18 and 29 June, 29 August.

**GEOGRAPHIC DISTRIBUTION** (Fig. 54).—Turkey to western China, Arabian Peninsula, north to southeastern European Russia, Kazakhstan and Mongolia, south to India.

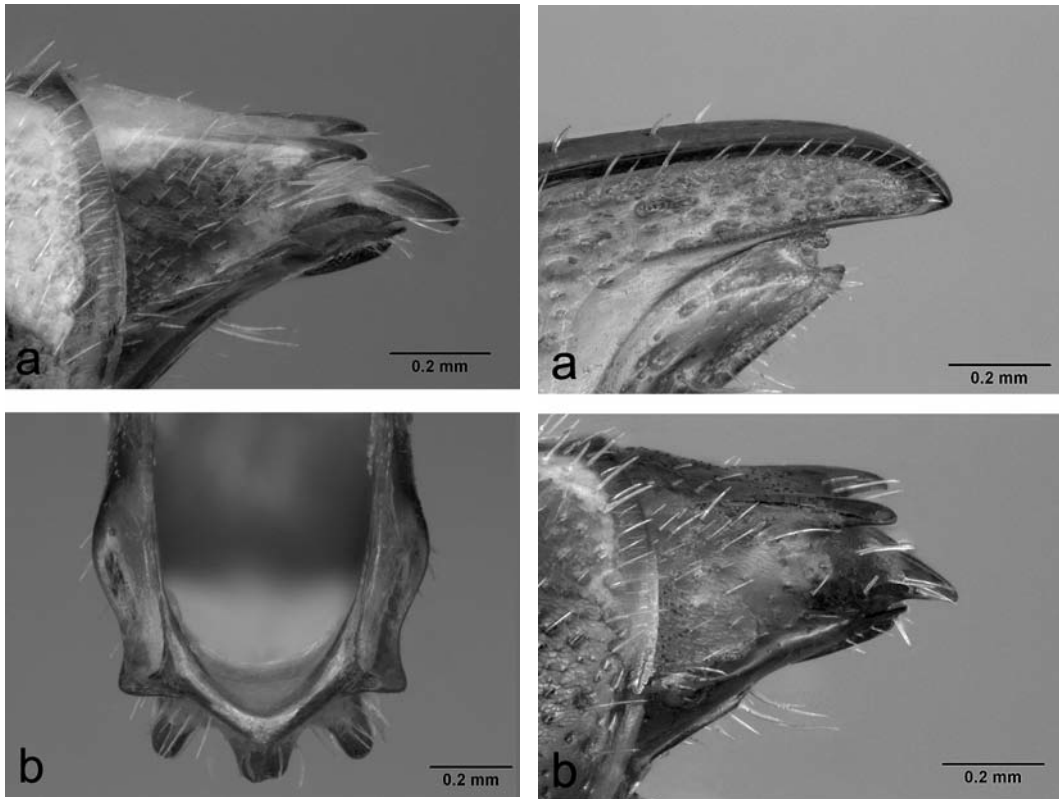


FIGURE 52. *Palarus funerarius* F. Morawitz ♂: a – tergum VII in lateral view; b – sternum VIII in ventral view.

**RECORDS.**— **ARMENIA:** Ordubad (Nemkov, 2005). **CHINA: Inner Mongolian Autonomous Region:** Tsagan Buryuk at about 42°N 100.6°E (1 ♀, ZIN, holotype of *funerarius*). **GREECE:** Isle of Rhodes: Ixia (1 ♂, RMNH), Tsambika beach at 36°13'3"N 28°08'3"E (1 ♀, 1 ♂, CAS). **INDIA: Gujarat:** Disa = Deesa (Nurse, 1903). **Rajasthan:** Bilara 70 km E Jaisalmer (1 ♂, STUTTGART). **IRAN: Khuzestan:** Haft Tapeh 300 km N Abadan (1 ♂, CAS). **KAZAKHSTAN** (K = Kazenas, 2002, N = Nemkov, 2005): **Almaty:** Aidarly on Ili River (5 ♀, 34 ♂, OÖLM), Aksuek 250 km NW Almaty at about 44.5°N 74.5°E (N), 15 km E Ayak-Kalkan (K), 4 km N Bakanas on Ili River (2 ♀, 4 ♂, OÖLM), 17 km NW Bakanas village on Ili River (2 ♀, 1 ♂, CAS), Boguty Mts. (K), Chilik (K), Chingildy (K), Dubun' on Ili River 80 km E Chilik (K), Ili (2 ♂, USNM), Iliysk (1 ♀, 1 ♂, CAS; 1 ♂, UCD), 3 km S Issyk (7 ♂, OÖLM), Kapchagai 75 km N Alma-Ata (1 ♀, 4 ♂, CAS; 1 ♂, OÖLM; 7 ♂, USNM), 400 m W bridge between Khundja and Panfilov at 43°58'N 79°33'E (1 ♂, CSE), Koktal (1 ♂, OÖLM), Kolshengel (N), Kuygan (K), Lepsi at 46.4°S 78.8°E (29 ♀, 49 ♂, OÖLM), 25 km N Lepsi (N), 6 km SE Lepsi (1 ♀, 2 ♂, OÖLM), Matai desert at 46°N 78.6°E (1 ♀, 6 ♂, OÖLM), 41 km E village Nurly (K), Panfilov (K), 100 km N Taldy

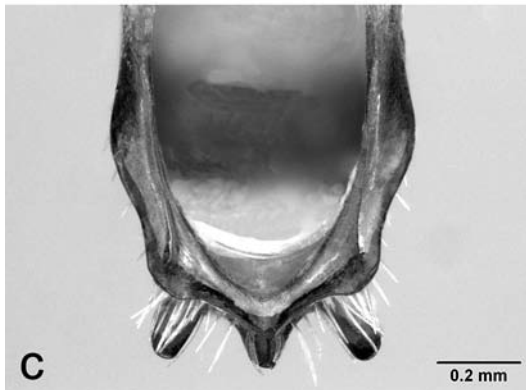
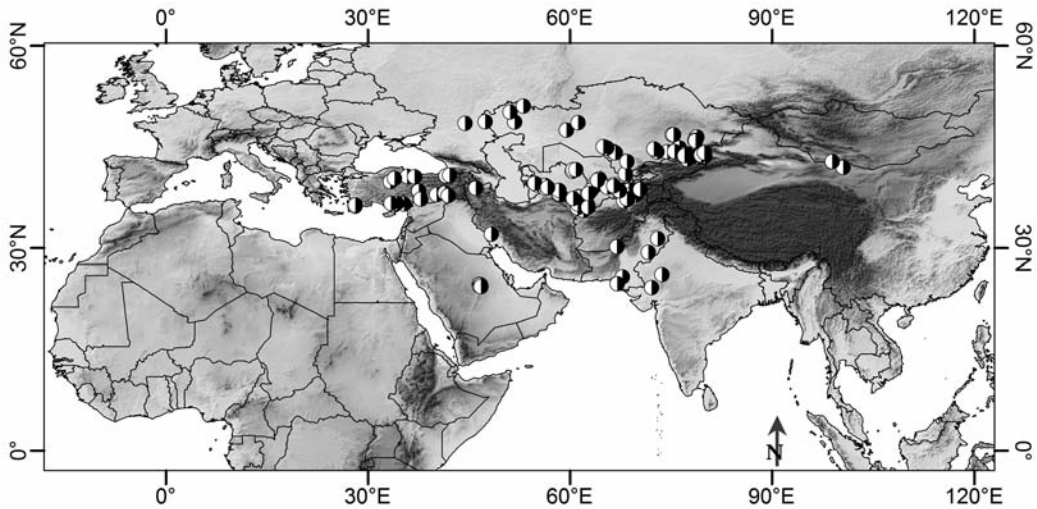


FIGURE 53. *Palarus funerarius* F. Morawitz, specimens corresponding to *incertus* Radoszkowski: a – female tergum VI in lateral view; b – male tergum VII in lateral view; c – male sternum VIII in ventral view.

FIGURE 54. Collecting localities of *Palarus funerarius* F. Morawitz.

Kurgan at 45°54'N 78°43'E (1 ♂, CSE). **Aqtöbe:** Bolshie Barsuki sands near Chelkar (K), Chelkar (N), Irghiz (K). **Atyraū:** Kharkin 180 km N Atyraū (N). **Oral** (= Ural'sk): Urda (1 ♀, 9 ♂, ZMMU). **Qaragandy:** 25 km E Balkhash (N), 50 km E Balkhash on Lake Balkhash (12 ♀, 139 ♂, OÖLM). **Qyzylorda:** Baigakum near Djulek = Chiili (1 ♀, CAS; 1 ♂, ZIN; 1 ♂, ZMMU), Djulek = Chiili (1 ♀, CAS; 5 ♂, ZIN), Qyzylorda (1 ♀, ZIN, as Perovsk), Teren-Uzyak (1 ♀, ZMMU). **South Kazakhstan:** 45 km SE Chardara (K), Timur railway station ca 42°50'N 68°30'E (1 ♀, KRAKÓW). **West Kazakhstan:** 20 km SE Aksay (1 ♂, OÖLM), Lbishchensk, now Chapaev (1 ♀, ZIN), Urda (1 ♀, 1 ♂, CAS; 1 ♀, UCD). **Zhambyl:** 60 km NW Furmanovka (1 ♂, CAS), 70 km NW Furmanovka (1 ♀, 2 ♂, CAS), 2 km S Furmanovka (1 ♀, CAS). **MONGOLIA:** Tsagan-Bogdo-Ula mountain in Bayanhongor Aymag (Nemkov, 2005). **PAKISTAN:** **Baluchistan:** Quetta (1 ♂, BMNH, lectotype of *Palarus nursei*). **Punjab:** Bahawalpur (1 ♀, 2 ♂, CAS), Faisalabad (Turner, 1917). **Sind:** Karachi (1 ♂, BMNH), Kirthar National Park 150 km NE Karachi, 25°10'–26°05'N 67°10'–67°55'E (2 ♀, 6 ♂, CAS), Malir River 5 km ESE Karachi International Airport (4 ♀, 6 ♂, CAS). **RUSSIA:** Krasnoarmeysk (1 ♂, ZIN, as Sarepta). **SAUDI ARABIA** (Guichard, 1988): Ad Diriyah near El Riyadh, Al Hair near El Riyadh, El Riyadh (1 ♀, 1 ♂, CAS), Dirab Agricultural Station. **TAJIKISTAN** (N = Nemkov, 2005): Aivaj at mouth of Kafirnigan River (1 ♀, 1 ♂, CAS; 2 ♀, ZIN), Dushanbe (2 ♂, CAS; 1 ♀, OÖLM; 1 ♂, ZIN), Kondara (1 ♀, ZIN), Kulab (1 ♀, ZIN), Kurgan-Tyube (N), Nizhniy Pyandj (N), Tigrovaya Balka Nature Reserve (Nazarova, 1998), Tovil-Dora 140 km E Dushanbe (1 ♀, ZMMU). **TURKEY:** **Adana:** Karataş (2 ♀, 2 ♂, CAS). **Amasya:** Amasya (de Beaumont, 1967). **Ankara:** 16 km W Kirikkale (de Beaumont, 1967). **Artvin:** 20 km Yusufeli – Tortum Road (de Beaumont, 1967). **Çankiri:** Kizil Irmak (1 ♂, RMNH). **Diyarbakir:** Diyarbakir on Tigris shore (1 ♂, CSE; 1 ♂, OÖLM; 1 ♂, RMNH). **Erzurum:** between Olur and Sungabayiri (1 ♂, AMNH). **İçel:** Eksiler: Silifke (2 ♀, OÖLM). **Malatya:** Balaban Bridge at 38°29'S 37°34'E (1 ♀, paratype of *Palarus beaumonti*, CAS; 1 ♀, 1 ♂, ZMHU, paratypes of *Palarus beaumonti*). **Mersin** (de Beaumont, 1967): Alata, Mut. **Tokat:** Niksar area (de Beaumont, 1967). **Siirt:** Kozluk (1 ♀, OÖLM), 15 km S Siirt (1 ♀, 1 ♂, OÖLM). **Urfa:** Halfeti (1 ♂, RMNH). **TURKMENISTAN** (N = Nemkov, 2005): Akhcha-Kuyma (N), Anau 20 km E Ashgabat (3 ♂, CAS; 4 ♀, 4 ♂, OÖLM), Ashgabat (1 ♀, OÖLM; 1 ♀, UCD; 1 ♀, 2 ♂, ZIN), 15 km N Ashgabat (3 ♀, 9 ♂, OÖLM), Badhyz (6 ♀, ZMMU), Bayram-Ali (1 ♀, ZMMU), Bazyr near Ashgabat (1 ♂, ZMMU), 40 km N Chardjow (1 ♀, OÖLM), Dort-Kuyu (1 ♀, 2 ♂, ZIN), Farab (1 ♀, ZIN), Gasan-Kuli (1 ♂, ZIN), Imam-Baba (1 ♂, CAS; 7 ♀, 15 ♂, ZIN), Karabata (3 ♂, ZMMU), Kara Kala (1 ♀, 1 ♂, CAS), Kary-Kul 65 km N Ashgabat (1 ♀, 3 ♂, CAS; 3 ♂, USNM), 200 km W Kerki at 37°50'N 62°55'E (3 ♀, 9 ♂, ZMMU), Kizil-Arvat (1 ♂, ZMMU), 40 km N Kizil-Arvat (N), Kushka (1 ♀, 1 ♂, CAS; 2 ♂, ZIN; 1 ♂, ZMMU), Mary (1 ♀, 2 ♂, ZIN; 1 ♀, 3 ♂, ZMMU, as Merv), Morgunovka near Kushka (1 ♀, 1 ♂, CAS), 60 km E Nebit-Dag (N), Pulikhatum S Serax near Iranian bor-



der (Kohl in Kohl and Handlirsch, 1889), Repetek (1 ♂, ZIN; 3 ♀, 3 ♂, ZMMU), Sara-Yazy (1 ♂, ZMMU), Serax (2 ♀, 6 ♂, KRAKÓW; 1 ♂, ZIN; 1 ♀, ZMHU, lectotype of *Palarus seraxensis*; 1 ♀, 3 ♂, ZMHU, including lectotype of *incertus*, one ♂ with Radoszkowski's handwritten label *lepidus*), Serax area (1 ♀, ZMMU), 15 km E Sharlouk at 38°13'N 55°50'E (1 ♂, ZMMU), Sumbar 45 km N Kara-Kala (1 ♂, ZIN), Tash-Kepri (4 ♂, CAS), Tedjen (3 ♀, CAS; 1 ♀, RMNH; 1 ♂, ZIN; 1 ♀, ZMMU), Uch-Adzhi (1 ♂, ZIN). **UZBEKISTAN:** Bag-Abzal 50 km N Bukhara (1 ♂, UCD), 25 km SE Kagan (1 ♂, ZMMU), Kasan District (1 ♀, ZMMU), Khiva (8 ♀, 3 ♂, ZIN), Khiva: Karmysh (1 ♀, ZIN), Khiva: Ravat (3 ♀, ZIN), Kyzyl-Kyr in Kyzyl-Kum Desert (1 ♂, OÖLM), Mubarek (1 ♀, ZMMU), Surkhandarya Oblast': Baisuntau Range at River Kholkadjar (Islamov, 1986), Yargak near Khatyrchi (1 ♀, ZIN).

### *Palarus laetus* Klug

Figures 55-58.

*Palarus laetus* Klug, 1845:[26], pl. 47, fig. 4 and 5, ♀, ♂. Lectotype: ♀, Egypt: Ghiza Province: Saqqara (ZMHU), **here designated**, examined.—Kohl, 1885:425 (original description copied); Dalla Torre, 1897:658 (in catalog of world Sphecidae); Turner, 1911:481 (synonymy); von Schulthess, 1926:215 (Tunisia, determination tentative); Nadig, 1933:85 (Morocco); Honoré, 1941:200 (in revision of Egyptian *Palarus*), 1942:59 (in catalog of Egyptian Sphecidae); Giner Mari, 1945:362 (Morocco: Western Sahara); de Beaumont, 1949:667 (in revision of Mediterranean *Palarus*); Pulawski, 1964:112 (Egypt); de Beaumont, Bytinski-Salz, and Pulawski, 1973:17 (Israel); Bohart and Menke, 1976:291 (listed); Guichard, 1980:228 (Oman); 1988:135 (Arabian Peninsula); Roche and Zalut, 1994:115 (Egypt: Sinai Peninsula); Baker, 1997:189 (in catalog of insects described by Klug, 1845).

*Larra annulata* Walker, 1871:26, ♂, junior primary homonym of *Larra annulata* Klug, 1845. Lectotype: ♂, Djibouti: Tajura (BMNH), **present designation**, examined. Synonymized with *Palarus laetus* by Turner, 1911:481.

*Stizus walkeri* Handlirsch, 1892:177, ♂ (as *Walkeri*, incorrect original capitalization). Substitute name for *Larra annulata* Walker.—Dalla Torre, 1897:534 (in catalog of world Sphecidae).

*Palarus fabius* Nurse, 1903:6, ♀, ♂. Lectotype: ♀, India: Gujarat: Disa = Deesa (BMNH), **here designated**, examined. **New synonym.**—Turner, 1911:481 (diagnostic characters); Ramakrishna Aiyar, 1916:553 (in catalog of Indian aculeates described after Bingham, 1897); Morice, 1921:823 (Iraq); de Beaumont, 1970:16 (Iran: Baluchistan); Al-Ali, 1977:92 (Iraq).—**As *Palarus laetus fabius*:** de Beaumont, 1949:652 (new status); Bohart and Menke, 1976:291 (listed).

As *Palarus* sp.?: Morice, 1911:107 (Algeria, ♀), corrected to *Palarus laetus disputabilis* by de Beaumont, 1949:670.

*Palarus eximius* Honoré, 1941:201, ♂. Holotype: ♂, Egypt: Hawamdieh (Entomol. Soc. Egypt, Cairo?), not examined (a ♂ labeled co-type examined). Tentatively synonymized with *Palarus laetus* by de Beaumont, 1949:669.—Honoré, 1942:59 (in catalog of Egyptian Sphecidae).

*Palarus disputabilis* Morice, 1911:108, ♂. Holotype: Algeria: Biskra (OXUM), not examined. **New synonym.**—**As *Palarus laetus disputabilis*:** de Beaumont, 1949:670 (new status, in revision of Mediterranean *Palarus*); Bohart and Menke, 1976:291 (listed).

**RECOGNITION.**—*Palarus laetus* is unique in the group in having the area between the mid- and hindocellus swollen and as long as 1.8-1.9 × midocellar width (Fig. 55a), whereas it is not swollen and 1.1 × or less in the other species. It is also unique in that the lateral pygidial process in the male ends anterad of the apex of the adlateral carina, rather than posterad of that point (Fig. 57c, d); also, unlike *parvulus* and *pictiventris*, lateral pygidial carinae are slightly converging toward the apex rather than being parallel or diverging (Fig. 57c). Like *parvulus* and *pictiventris*, the mesopleuron of *laetus* is densely setose beneath the scrobal sulcus, but unlike those species most genal setae are conspicuously dense and reflective, and in most specimens the episcrobal area is largely asetose, sharply contrasting with the densely setose area beneath the scrobe (Fig. 56d). The median, asetose area on the propodeal dorsum is markedly wider than the midocellar width

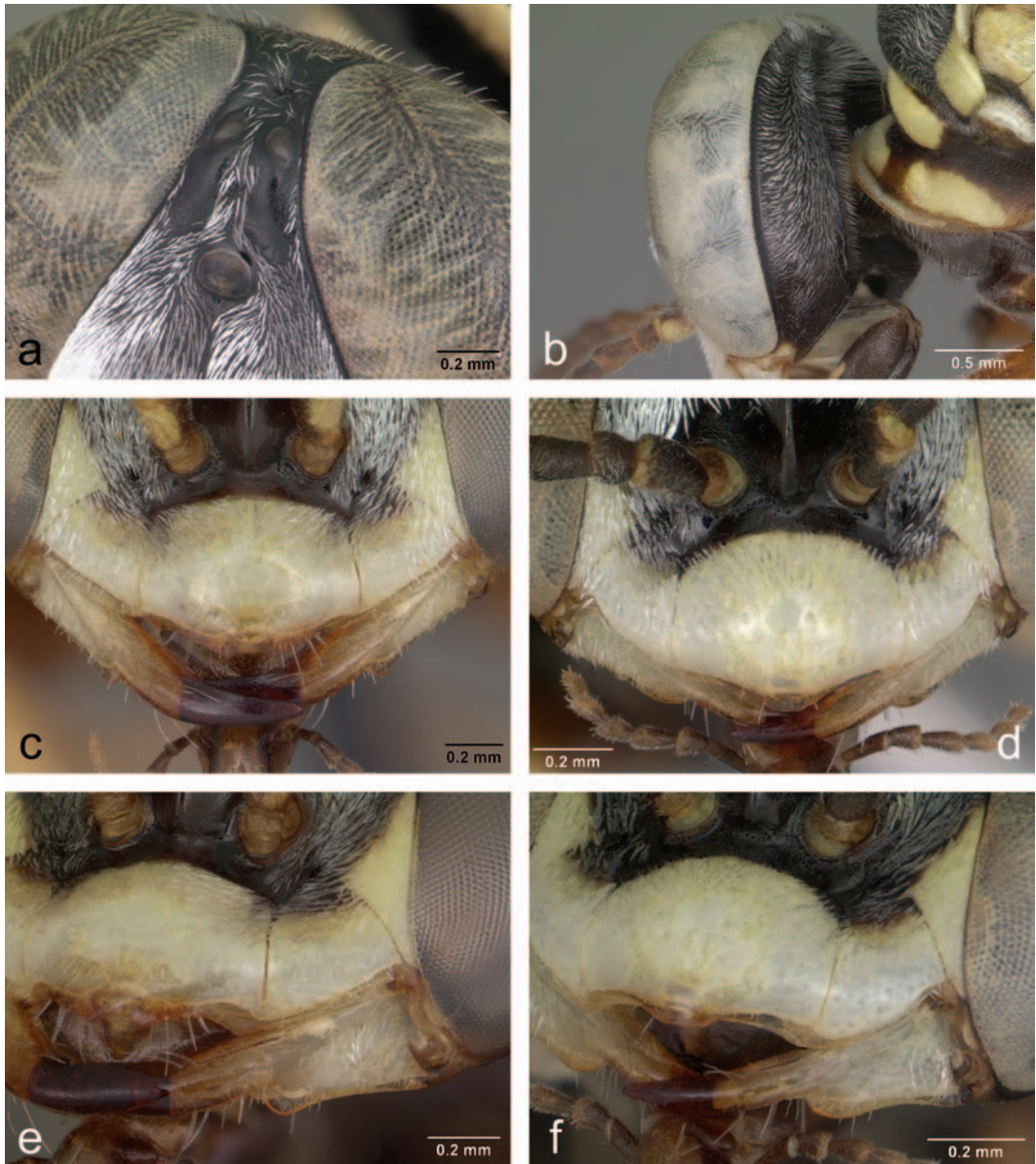


FIGURE 55. *Palarus laetus* Klug: a – ocellar area of female in dorsal oblique view; b – female gena showing reflective setae; c – female clypeus in frontal view; d – male clypeus in frontal view; e – female clypeus in lateral oblique view; f – male clypeus in lateral oblique view.

(Fig. 56e), while about equal anteriorly to midocellar width in *pictiventris*(Fig. 61a). In the African populations of *laetus*, the posteroventral mandibular notch is well defined (Fig. 56a, b), whereas it is absent or rudimentary in those of *parvulus*. The female of *laetus* also differs from those of the other two species in having the apex of tergum VI evenly rounded in profile, without a discontinuity between dorsal and ventral margins (Fig. 57b) rather than with discontinuity).

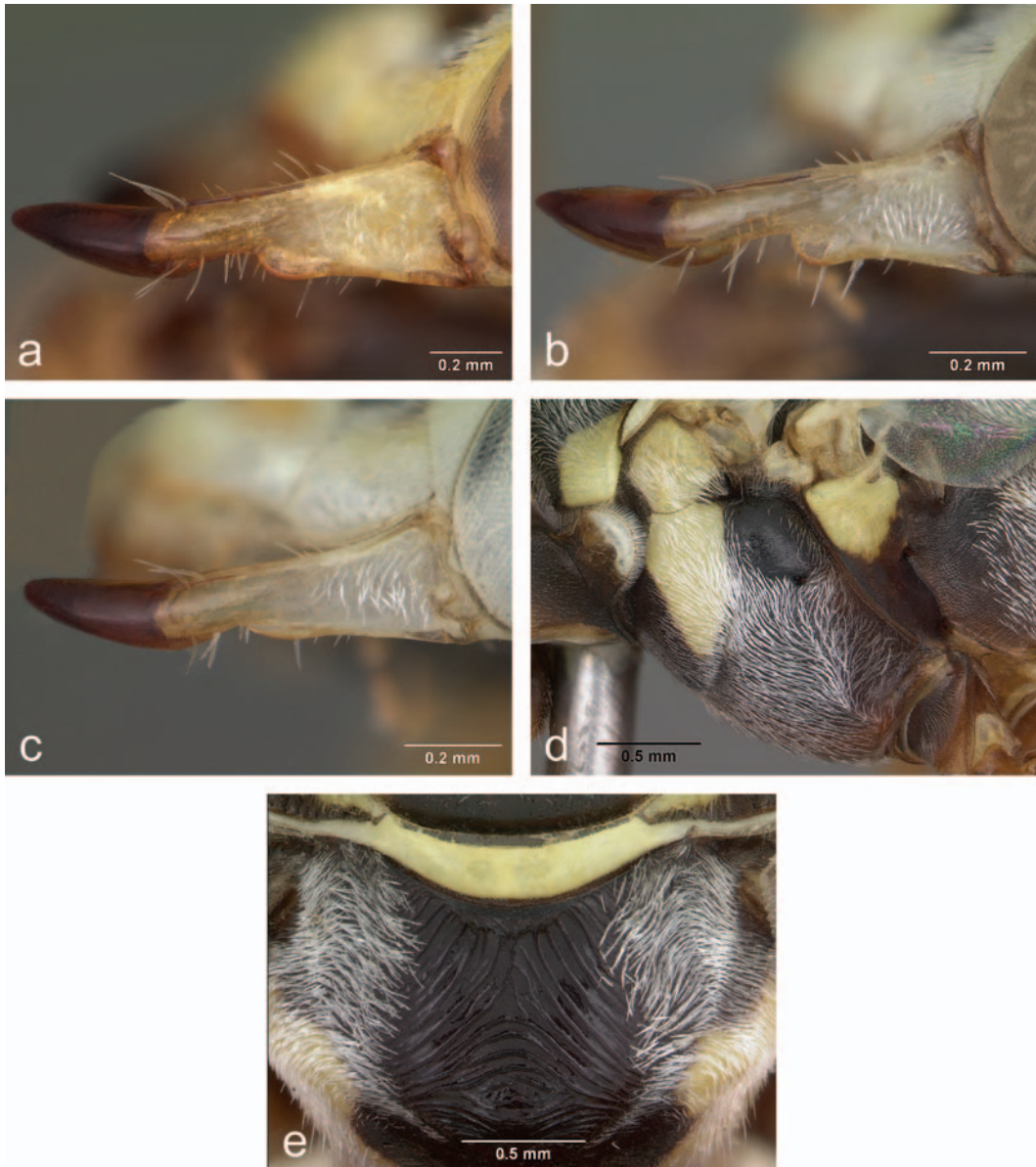


FIGURE 56. *Palarus laetus* Klug ♀: a – mandible of specimen from Mauritania; b – mandible of specimen from Egypt; c – mandible of specimen from Pakistan; d – meso- and metapleuron; e – propodeal dorsum.

**LECTOTYPE SELECTION.**— Of the two syntypes of *laetus* now in existence, we have designated the female as the lectotype and the male as the paralectotype.

**JUSTIFICATION OF NEW SYNONYMY.**— Morice (1911) described *Palarus disputabilis* from Biskra, Algeria. De Beaumont (1949) treated it as a subspecies of *laetus* and characterized it by the replacement of black by red on the thorax, propodeum, legs, and gaster, a slightly more pronounced posteroventral mandibular tooth and notch, flagellum slightly thicker, adlateral carina of tergum





FIGURE 57. *Palarus laetus* Klug: a – female tergum VI in lateral oblique view; b – female tergum VI in lateral view; c – male tergum VII in dorsal view; d – male tergum VII in lateral oblique view.

VII almost simple, carinae of sternum I rounded apically, and the transverse swelling of sternum II lower. These differences were based on two males from Biskra, Algeria, and do not withstand scrutiny when larger series are compared. First, the black and red forms occur within the same populations in other parts of the species range. Second, the differences in the shape of the adlateral carina of tergum VII, the carinae of sternum I, and the transverse swelling of sternum II, clearly represent individual and populational variation. The enlargement of the posteroventral mandibular tooth and notch is also a minor difference compared with the range of variation in this structure in the species (e.g., the posteroventral tooth and notch are distinctly reduced in Asian populations of *laetus*). Also, the flagellum appears to be thicker in another male from Biskra (CAS), but not in any other specimens. In our opinion, *Palarus disputabilis* should be synonymized with *Palarus laetus*.

*Palarus fabius* is clearly conspecific with *laetus*. These names therefore are also synonyms.

**DESCRIPTION.**— Area between mid- and hindocellus swollen, as long as  $1.8-1.9 \times$  midocellar width (Fig. 55a). Admedian and adlateral portions of clypeal flange either continuous or not continuous. Lateroclypeal notch absent; medioclypeal flange without small longitudinal tooth and ridge next to lateroclypeal sulcus. Least interocular distance about  $1.0-1.4 \times$  midocellar width in female,  $1.3-1.6 \times$  in male. Genal setae numerous, mostly appressed and reflective, shorter than midocellar width (Fig. 55b). Posteroventral mandibular tooth and adductor ridge swelling variable (see Geographic Variation below). Mesopleuron microsculptured, dull, densely punctate (punctures 1-3 diameters apart), associated setae partly concealing integument; episcrobal area largely



glabrous in most specimens (Fig. 56d), but largely setose (glabrous only next to scrobal sulcus) in one male from Agdz, Morocco, and single male from Hudeiba, Sudan. Propodeal enclosure with sculpture markedly finer laterally than mesally in most specimens, laterally with conspicuous, clearly reflective setae; side varying from ridged to unridged.

Head black except the following are yellow: clypeus (black adjacent to anterior tentorial pit), lower frons next to clypeus adjacent to orbit, and basal half of mandible, in some specimens also frons below antennal socket, gena adjacent to mandibular base (yellow extending to one third genal height in lightest specimens), and scape ventrally; flagellum yellowish brown posterodorsally, remainder darkened (only apical flagellomeres yellowish brown in some specimens). Thorax and propodeum black or partly red except the following are yellow: pronotum anteriorly and posteriorly (anterior macula divided in three parts in some specimens), pronotal lobe at least posteriorly, scutum anterolaterally, scutellar flange, postnotum including flange, preepisternum dorsally, in many specimens also scutellum, upper metapleuron, a pair of spots near apex of propodeal dorsum, and propodeum between side and posterior surface. Fore- and midfemora black or red dorsally, yellow ventrally and apically (midfemur only apically in some specimens), hindfemur black to red except apically; tibiae yellow, darkened ventrally, hindtibia partly dark in some females; tarsi yellow or yellowish brown. Terga I-V in female, I-VI in male, with yellow, preapical band.

♀.—Clypeal free margin shallowly emarginate mesally, not produced into tooth on each side of emargination (Fig. 55c, e). Dorsal length of flagellomere I  $1.4-1.6 \times$  apical width. Apex of tergum VI with ventral margin straight, without angulation or discontinuity between dorsal and ventral margins (Fig. 57b). Length 6.4-10.2 mm.

♂.—Dorsal length of flagellomere I  $1.3-1.5 \times$  apical width. Midtibial spur not shortened, about 0.5 length of midbasitarsus. Adlateral carina of tergum VI present in most specimens (reduced in smallest ones). Adlateral carina of tergum VII produced into angulate process posteriorly (Fig. 57c, d). Lateral carinae of pygidial plate convex in dorsal view, slightly converging toward apex. Lateral pygidial process slightly narrower than median process, raised above plane of median process, without ventral carina, ending anterad of apex of adlateral carina (Fig. 57c, d); angle between apices of lateral and median processes markedly smaller than  $90^\circ$  (Fig. 57c); lateral pygidial carinae converging toward apex (Fig. 57c). Length 5.0-9.2 mm.

**GEOGRAPHIC VARIATION.**—*Palarus laetus* varies in the shape of the posteroventral mandibular notch and in coloration (black versus red). Details are given below.

Mandibular posteroventral notch. The notch is well defined in specimens from Africa (Fig. 56a, b) except somewhat reduced in those from Egypt including Sinai, and markedly reduced in specimens from the Arabian Peninsula, Iran, Pakistan, and India (Fig. 56c). It is variable in specimens from Dubai: most specimens have the notch reduced, but it is well defined in one female from Awir.

Color. The red may replace black on the thoracic venter, part of mesopleuron, legs, and gaster. Specimens with red coloration occur in Morocco, Algeria, Tunisia, Upper Egypt, Iraq, and, together with typical specimens, in Mauritania, Lower Egypt, and Sinai Peninsula. A specimen with red and yellow pattern was described as *disputabilis* from Biskra, Algeria, by Morice (1911). Both color forms are found in several localities, e.g., in Dahshur, Egypt, and Wadi Gharandal, Sinai, and intermediates occur. The red coloration tends to occur in larger specimens.

**COLLECTING PERIOD.**—Algeria: 30 May and 23 August; Burkina Faso: 9 July through 7 August; Egypt: 15 April through 11 October; Ethiopia: 21 June; India: 4-6 and 12-15 June, 11 and 22-25 August; Iran: 7 May, 22 May, and 29 June – 1 July; Iraq: 5 September; Israel: 9 May and 9 July; Jordan: 15 April; Mali: 20-31 July, 7-20 August; Mauritania: 15 October through 7 November; Morocco: 27-29 May; Niger: 3 August through 14 September; Pakistan: 29 June, 13-20 July;

Saudi Arabia: 9 May and 4 July; Senegal: 27 July through 3 August; Togo: 17 February; Tunisia: 8 June and 1 July; United Arab Emirates: 15-18 April, 2-5 and 22 May, 26 June.

**GEOGRAPHIC DISTRIBUTION** (Fig. 58).—North Africa south to Benin, Togo, and Ethiopia, Middle East, Arabian Peninsula, Pakistan, India.

**RECORDS.**—**ALGERIA:** Biskra (1 ♂, CAS; 6 ♀, 3 ♂, OÖLM), Djanet (de Beaumont, 1949), Ghardaia (de Beaumont, 1949), 50 km S El Goléa (1 ♂, FSAG). **BENIN:** 15 km SE Savé (1 ♂, OÖLM). **BURKINA FASO:** 25 km E Dori at 13°57.2'N 0°09.9'E (1 ♀, CAS), 39 km E Dori at 13°58.1'N 0°17.5'E (3 ♀, CAS), 4 km NE Dori at 14°03.8'N 0°03.1'W (7 ♀, 29 ♂, CAS), 30 km SE Dori at 13°50.3'N 0°08.0'E (1 ♂, CAS), 7 km WNW Dori at 14°03.7'N 0°06.6'W (4 ♀, 8 ♂, CAS), 15 km SE Gorom Gorom at 14°21.4'N 0°07.9'W (13 ♂, CAS), 4 km NW Ouahigouya at 13°37.0'N 2°27.6'W (3 ♀, 6 ♂, CAS), Oursi at 14°40.5'N 0°27.2'W (4 ♂, CAS). **DJIBOUTI:** Tajura (1 ♂, BMNH, lectotype of *Larra annulata* Walker). **EGYPT:** **Al Buhayrah:** Bir Hooker in Wadi Natrun (1 ♂). **Al Fayyum:** Kom Osheim (3 ♀, CAS; 2 ♂, OÖLM; 1 ♂, SAM, as Fayum). **Al Jizah** (= Ghiza): Abu Rawash (11 ♀, 6 ♂, CAS), Dahshur (6 ♀, 5 ♂, CAS; 1 ♂, USNM), Ghiza Pyramids (11 ♀, 21 ♂, CAS; 1 ♂, MS; 2 ♂, RMNH; 3 ♀, 2 ♂, SAM; 1 ♀, 1 ♂, UCD; 1 ♀, USNM), Hawamdieh (2 ♂, USNM, one labeled "*Palarus eximius* co-type"), Saqqara (1 ♂, CAS, as Serapeum; 1 ♂, SAM; 1 ♂, USNM; 1 ♀, 1 ♂, ZMHU, lectotype and paralectotype of *laetus*). **Al Qahirah** (= Cairo): Gebel Asfar (1 ♀, SAM), Maadi (1 ♀, 1 ♂, CAS). **Al-Uksur** (= Luxor): Luxor (1 ♀, USU). **As Sahra al Janubiah:** El Kharga in Kharga oasis (2 ♂, CAS; 1 ♀, 4 ♂, USNM). **Aswan:** Aswan (1 ♀, CAS), near Kom Ombo temple (1 ♀, CAS). **Sina** (= Sinai): Wadi Gharandal 30 km NW Abu Zenima (3 ♀, 7 ♂, CAS). **Location unknown:** Beni Yussef (1 ♀, SAM). **ETHIOPIA:** **Harerge Province:** Errer Gota W Dire Dawa (1 ♀, USNM). **INDIA:** **Gujarat:** Disa = Deesa (1 ♀, 2 ♂, BMNH, including lectotype and paralectotype ♂ of *fabius*; 19 ♂, CAS). **Rajasthan:** Bilara 70 km E Jaisalmer (1 ♂, OHL), 30 km SW Jaisalmer = 8 km W Kundhara (1 ♂, STUTTGART). **IRAN:** **Baluchistan:** SW Iranshar at Bampur River (de Beaumont, 1970). **Bandar-Abbas:** 50 km NW Jask (1 ♂, CSE). **Khuzestan:** Haft Tapeh 300 km N Abadan: Choca Zambil (1 ♀, CAS). **IRAQ:** Amara (Morice, 1921), Baiji (1 ♀, CSE). **ISRAEL:** Hazewa in Arawa Valley (1 ♀, 1 ♂, UCD), Iddan in Arawa Valley (1 ♀, UCD), 45 km N Elat E Qetura at 29°58'N 35°06'E (2 ♂, CSE), Wadi Ruth 5 km E Nizzana (de Beaumont, Bytinski-Salz, and Pulawski, 1973). **JORDAN:** Safi 50 km N Karak (1 ♂, CSE; 2 ♂, OÖLM). **LIBYA:** **Fezzan:** Brak (de Beaumont, 1949). **MALI:** Dogo (1 ♂, FSAG), Douentza (3 ♂, CAS; 5 ♂, MS), 180 km SW Gao (1 ♀, 1 ♂, MS), 30 km W Gao (1 ♂, MS), Hombori (1 ♀, 4 ♂, CAS, 2 ♀, 4 ♂, MS), 10 km E Hombori (1 ♂, MS), 25 km E Hombori (1 ♀, 5 ♂, CAS), 10 km S Mopti (2 ♀, 1 ♂, CAS, 6 ♀, 3 ♂, MS). **MAURITANIA:** 20 km NE Aleg (1 ♀, CAS), 25 km SW Moujéria (2 ♀, 1 ♂, CAS), Nouakchott near beach (2 ♂, CAS), 16 km NE Nouakchott (1 ♂, CAS), 153 km NE Nouakchott (1 ♀, CAS), 30 km S Nouakchott (1 ♀, CAS), 22 km SE Nouakchott (2 ♀, 1 ♂, CAS), 60 km SE Nouakchott (1 ♂, CAS), 70 km SE Nouakchott (1 ♀, 2 ♂, CAS), 130 km SE Nouakchott (4 ♀, 1 ♂, CAS), Oued Henné ca 50 air km NE Moujéria (2 ♀, 1 ♂, CAS), Oued Segellit 25 km S Atar (1 ♀, CAS), Oued Tayart 30 air km NW Atar (1 ♂, USNM), Rachid 40 km NW Tijikja (2 ♀, 1 ♂, CAS; 1 ♂, USNM), Tamouret Naaj ca 30 air km NE Moujéria (5 ♀, 3 ♂, CAS; 2 ♀, USNM), 25 km SW Tijikja (1 ♀, CAS). **MOROCCO:** Agdz (7 ♂, OÖLM), Beni Bassia 60 km NE Boudnib (2 ♂, OÖLM), Mhamid 80 km S Zagora in Draa Valley (2 ♀, 4 ♂, CSE; 1 ♂, OÖLM), Mhamid 100 km S Zagora (2 ♀, OÖLM), 30 km NW Zagora in Draa Valley (2 ♀, 5 ♂, CSE), 30 km SE Zagora in Draa Valley (3 ♂, CSE). **NIGER:** **Agadez Region:** 3 km W Aderbissinat at 15°34.9'N 7°53.6'E (1 ♂, CAS), 30 km

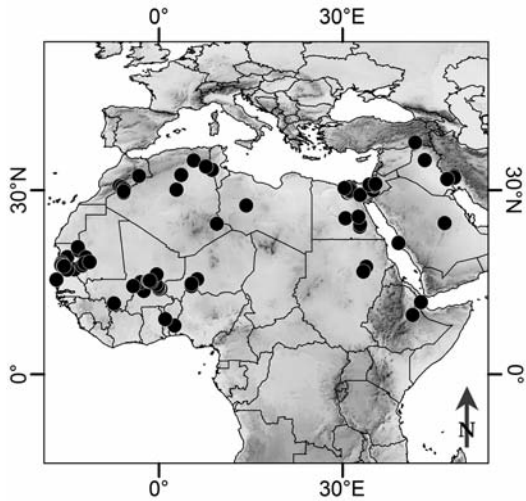


FIGURE 58. Collecting localities of *Palarus laetus* Klug.

S Agadez at 16°39.0'N 7°56.9'E (1 ♂, CAS). **Diffa Region:** 53 km SW Diffa at 13°11.7'N 12°06.7'E (1 ♂, CAS), 12 km ENE Nguigmi at 14°18.9'N 13°13.2'E (2 ♀, CAS), 3 km NNE Nguigmi at 14°16.5'N 13°06.9'E (2 ♂, CAS), 13 km NNE Nguigmi at 14°23.0'N 13°08.0'E (1 ♀, CAS). **Dozzo Region:** 5 km E Birnin Gauré at 13°05.6'N 2°57.1'E (1 ♀, CAS). **Maradi Region:** 17 km NNW Maradi at 13°38.7'N 7°02.6'E (1 ♂, CAS). **Niamey Region:** 8 km NW Niamey at 13°35.8'N 1°59.9'E (1 ♀, CAS). **Tahoua Region:** Abalak at 15°28'N 6°16'E (1 ♀, 5 ♂, FSAG), Badeguichéry at 14°31'N 5°22'E (2 ♀, 10 ♂, FSAG), Moujia at 14°22'N 5°22'E (1 ♀, FSAG), 20 km S Tahoua at 14°45'N 5°20'E (2 ♂, CAS; 6 ♂, FSAG). **Tillabéri Region:** 3 km N Ayorou at 14°45.7'N 0°54.0'E (4 ♂, CAS), 11 km N Ayorou at 14°49.3'N 0°52.2'E (1 ♂, CAS), 13 km N Ayorou at 14°50.1'N 0°52.4'E (2 ♂, CAS), 5 km NW Kollo at 13°21.6'N 2°16.4'E (1 ♀, CAS), 13 km N Niamey at 13°32.6'N 2°16.4'E (3 ♂, CAS), 25 km N Niamey at 13°33.2'N 2°23.6'E (2 ♂, CAS), 82 km ESE Téra at 13°51.1'N 1°31.3'E (2 ♂, CAS), 84 km ESE Téra at 13°51.2'N 1°32.7'E (1 ♀, 1 ♂, CAS), 18 km NW Tillabéri at 14°18.2'N 1°19.0'E (1 ♀, CAS), 7 km SSW Torodi at 13°03.2'N 1°46.7'E (2 ♂, CAS). **Zinder Region:** 50 km E Gouré at 13°45.9'N 10°40.7'E (3 ♂, CAS), 2 km N Gouré at 14°00.2'N 10°15.0'E (1 ♂, CAS), 7 km N Gouré at 14°03.0'N 10°13.9'E (1 ♀, CAS), 15 km N Gouré at 14°07.0'N 10°12.4'E (1 ♀, 1 ♂, CAS), 17 km W Gouré at 13°52.5'N (2 ♀, 5 ♂, CAS), 27 km W Guidiguir at 13°40.9'N 9°39.1'E (2 ♀, 1 ♂, CAS), 49 km NW Tanout at 15°11.7'N 8°27.1'E (1 ♂, CAS), 80 km NW Tanout at 15°20.8'N 8°15.1'E (3 ♂, CAS), 37 km S Tanout at 14°38.2'N 8°42.6'E (4 ♂, CAS), 45 km S Tanout at 14°37.4'N 8°44.3'E (1 ♂, CAS), 55 km S Tanout at 14°31.2'N 8°44.3'E (3 ♂, CAS), 37 km S Zinder at 14°13.3'N 9°00.5'E (1 ♀, 1 ♂, CAS), 45 km S Zinder at 13°27.3'N 9°00.5'E (1 ♀, 3 ♂, CAS). **OMAN** (Guichard, 1980 or as indicated): Al Wafi, Hail al Ghaf at 23°09.7'N 58°55.5'E (1 ♀, 2 ♂, CAS; 1 ♀, OHL), Huwayyah (2 ♂, OÖLM), Masirah Island, Qurum, Sayh Huwayyah near Buraimi (1 ♂, RMNH). **PAKISTAN:** Bahawalpur (6 ♀, 4 ♂, CAS), Chenab River 27 km SW Multan (1 ♂, CAS), Lal Suhandra National Park 34 km SE Bahawalpur (3 ♀, CAS), Malir River 5 km ESE Karachi International Airport (3 ♂, CAS). **SAUDI ARABIA:** El Riyadh (1 ♂, CAS), Jeddah (1 ♂, CAS), S Jeddah (2 ♀, CSE). **SENEGAL:** Tiougoune (5 ♀, 5 ♂, CAS; 42 ♀, 61 ♂, FSAG). **SUDAN:** Ed Damer: Hudeiba (1 ♂, CAS), Musayab (1 ♀, USNM). **TOGO:** 5 km W Sokodé (1 ♂, CAS). **TUNISIA:** El Fauar at 33°21'N 8°42'E (2 ♂, CSE), 15 km W Nefta at 33°50'N 7°43'E (4 ♂, CSE). **TURKEY:** Siirt: 15 km S Siirt (1 ♀, OÖLM). **UNITED ARAB EMIRATES:** Al Ain (1 ♀, OÖLM), Al Ain: Al Towwaya (1 ♀, OÖLM), Dubai (1 ♀, UCD), Dubai: Al Awir (2 ♀, CAS; 6 ♀, 1 ♂, UCD; 1 ♀, USU), Dubai: Nakhali (3 ♀, UCD; 1 ♀, USU), Schweib – Madam road (1 ♂, RMNH), Sharjah (1 ♀, ZMMU).

### *Palarus parvulus* de Beaumont

Figures 59, 60.

*Palarus parvulus* de Beaumont, 1949:672, ♀, ♂. Holotype: ♂, Algeria: Ghardaia (MNHN, coll. P. Roth), not examined.— de Beaumont, 1950:409 (Algeria); de Beaumont, Bytinski-Salz, and Pulawski, 1973:17 (Israel); Bohart and Menke, 1976:291 (listed); Guichard, 1988:135 (Arabian Peninsula).

**RECOGNITION.**— *Palarus parvulus*, a North African species that extends to Sinai Peninsula and Jordan, shares a densely setose mesopleuron with *laetus* and *pictiventris*. Unlike *laetus*, the vertex of *parvulus* is not swollen, the genal setae are sparse and not reflective, the episcrobal area is all setose or nearly so but asetose in exceptional specimens (nearly all asetose in most *laetus*), and, in the male, the lateral pygidial process ends behind the adlateral carina. Unlike *pictiventris*, the median, asetose gap of the propodeal dorsum in *parvulus* is markedly wider than the midocellar width (rather than not wider). Additionally, the posteroventral mandibular notch in African specimens is nearly completely reduced, practically absent (Fig. 59a), a condition approached by the Indian and Pakistani populations of *laetus* (notch well defined in *pictiventris* and in African *laetus*). The notch is also reduced in *histrion* and *hastatifrons*, two species of the *histrion* subgroup.

**DESCRIPTION.**— Midocellus separated from hindocellus by about 0.8-0.9 × midocellar width. Vertex not markedly swollen between mid- and hindocellus. Admedian and adlateral portions of medioclypeal flange continuous in most specimens, minutely discontinuous in some. Lateroclypeal

notch absent; medioclypeal flange without longitudinal tooth and ridge next to lateroclypeal sulcus. Least interocular distance about  $0.5-0.9 \times$  midocellar width in female,  $0.8-1.0 \times$  in male. Genal setae sparse, not reflective, length smaller than midocellar width. Posteroventral mandibular tooth in most specimens absent or vestigial and adductor ridge swelling poorly developed, notch rudimentary or absent (Fig. 59a), but minimal notch present in specimens from Jordan and one from Sinai. Mesopleuron microsculptured, dull, densely punctate (punctures 1-2 diameters apart), setae largely concealing integument (Fig. 59b) except episcrobal area asetose in one female from Mau-

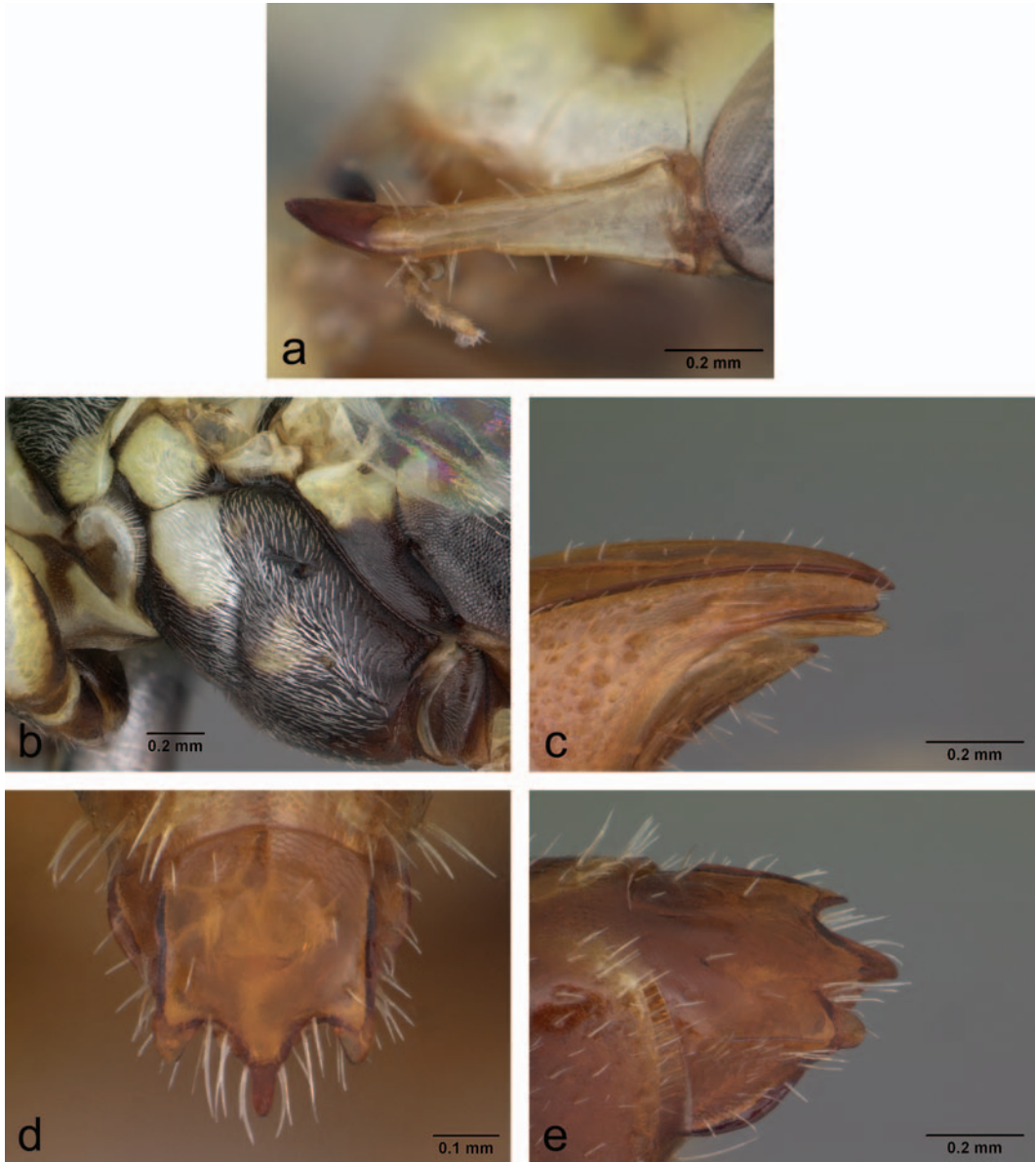


FIGURE 59. *Palarus parvulus* de Beaumont: a – female mandible; b – female meso- and metapleuron; c – female tergum VI in lateral view; d – male tergum VII in dorsal view; e – male tergum VII in lateral oblique view.



ritania. Propodeal enclosure with sculpture markedly finer laterally than mesally, laterally with conspicuous, clearly reflective setae; side unridged.

Frons in most specimens largely yellow between frontoclypeal sulcus and antennal socket, with narrow yellow median line below frontal midheight, exceptionally with yellow below hindocellus; gena in some specimens with small macula adjacent to mandibular base; scape maculate ventrolaterally in some specimens; flagellomeres partly yellow dorsally, apical flagellomeres all yellow dorsally. Non-maculate thoracic areas black except red in some specimens (scutum and part of propodeal dorsum black); pronotum varying from mostly yellow (only median spot behind streptaulus black and pronotal lobe dark mesally) to mostly black (only pronotal lobe yellow apically); scutum all black or (most specimens) yellow anterolaterally; scutellum yellow to black, scutellar flange yellow; postscutellum and metanotal flange yellow; mesopleuron mostly black (only preepisternal area yellow dorsally) to largely yellow; metapleuron black or largely yellow; propodeum black or with pair of yellow spots at apex of dorsum and yellow posterolaterally. Femora red or black, fore- and midfemora yellow ventrally and apically (yellow does not extend to femur base), hindfemur yellow apically; tibiae and tarsi yellow or tibiae black or red ventrally. Ground color of gaster red (black on segments IV-VI in some males); terga I-III each with yellow fascia before apical depression, terga IV and V either with continuous fascia, or a pair of yellow spots, or immaculate.

♀.— Clypeal free margin inconspicuously, shallowly emarginate mesally, not produced into tooth on each side of emargination. Dorsal length of flagellomere I  $1.7-2.0 \times$  apical width. Tergum VI with ventral margin in profile sharply angled dorsad at apex, apex with discontinuity between dorsal and ventral margins (Fig. 59d). Length 5.0-7.5 mm.

♂.— Dorsal length of flagellomere I  $1.6-1.8 \times$  apical width. Midtibial spur not shortened, about  $0.5 \times$  length of midbasitarsus. Adlateral carina of tergum VI present. Adlateral carina of tergum VII not forming tooth or angulate process posteriorly (Fig. 59d, e). Lateral carinae of pygidial plate straight in dorsal view (apically convex), parallel except converging apically. Lateral pygidial process slightly to markedly wider than median process, not raised above plane of median process, with apex ending behind apex of adlateral carina (Fig. 59d, e), with ventral carina that in most specimens extends to adlateral carina; angle between apices of lateral and median processes more than  $90^\circ$  (Fig. 59d). Length 4.5-7.1 mm.

**COLLECTING PERIOD.**— Algeria: 19-29 May and 23 August; Egypt: 14-22 May; Israel: 22 May and 3 July; Jordan: 4-5 May; Mauritania: 14 October through 7 November; Morocco: 23 April, 20-29 May; United Arab Emirates: 15 May through 19 June.

**GEOGRAPHIC DISTRIBUTION** (Fig. 60).— North Africa south to Mauritania, Sinai Peninsula, Israel, Jordan, Arabian Peninsula.

**RECORDS.**— **ALGERIA:** Biskra (1 ♀, CAS), Djanet (1 ♀, 1 ♂, OÖLM), Ghardaia (de Beaumont, 1949), 50 km S El Goléa (1 ♀, CAS; 1 ♀, FSAG), Laghouat (de Beaumont, 1949). **EGYPT:** Sina (= Sinai): Kadesh Barnea (de Beaumont, Bytinski-Salz, and Pulawski, 1973), Wadi Gharandal 30 km NW Abu Zenima (8 ♂, CAS). **ISRAEL:** 14 km S

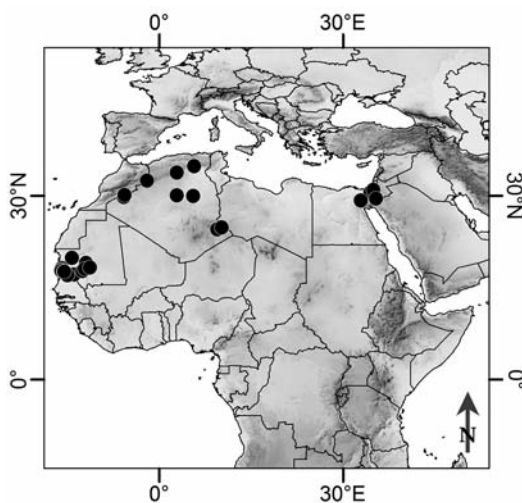


FIGURE 60. Collecting localities of *Palarus parvulus* de Beaumont.

Beersheba (de Beaumont, Bytinski-Salz, and Pulawski, 1973). **JORDAN**: Wadi Rum (1 ♂, CAS; 1 ♀, 3 ♂, OÖLM). **LIBYA**: **Fezzan**: Tin Alacun: Wadi Iseien (de Beaumont, 1949). **MAURITANIA**: 20 km NE Akjoujt (1 ♀, CAS), 20 km N Aleg (1 ♀, CAS), 25 km SW Moujéria (3 ♀, 1 ♂, CAS), Nouakchott near beach (2 ♀, 1 ♂, CAS), 16 km NE Nouakchott (11 ♀, 4 ♂, CAS), 30 km S Nouakchott (24 ♀, 3 ♂, CAS; 1 ♂, USNM), 32 km S Nouakchott (7 ♀, 3 ♂, CAS), 22 km SE Nouakchott (6 ♀, 8 ♂, CAS), 60 km SE Nouakchott (2 ♀, 2 ♂, CAS), 70 km SE Nouakchott (3 ♀, 1 ♂, CAS), 130 km SE Nouakchott (16 ♀, 4 ♂, CAS), Oued Henné ca 50 km air km NE Moujéria (3 ♀, 2 ♂), Rachid 40 km NW Tijikja (8 ♀, 4 ♂, CAS; 2 ♀, 2 ♂, ZMMU), Tamouret Naaj 30 air km NE Moujéria (11 ♀, 7 ♂, CAS), 25 km SW Tijikja (2 ♀, CAS). **MOROCCO**: 10 km S Bouarfa (1 ♂, OÖLM), Mhamid 80 km S Zagora in Draa Valley (2 ♀, 3 ♂, CSE), Tagounite (3 ♂, OÖLM), 30 km SE Zagora in Draa Valley (1 ♀, 2 ♂, CSE). **OMAN**: Sayh Huwayyah near Buraimi (Guichard, 1988). **UNITED ARAB EMIRATES** (Guichard, 1988): Al Saad, Schweib-Madam road.

***Palarus pictiventris* F. Morawitz**

Figures 61, 62.

*Palarus pictiventris* F. Morawitz, 1890:589, ♀. Syntypes: ♀, Transcaspia: no specific locality (ZIN), not examined.—Dalla Torre, 1897:659 (in catalog of world Sphecidae); Myartseva, 1963:61 (Turkmenistan), 1965:80 (Turkmenistan), 1972a:81 (Turkmenistan); Bohart and Menke, 1976:291 (listed); Kazenas, 1994:115 (prey), 2001:33 (in checklist of Sphecidae of Kazakhstan and Central Asia), 2002:80 (geographic distribution, collecting localities in Kazakhstan); Nemkov, 2005:248 (in revision of *Palarus* of Russia and adjacent countries).

**RECOGNITION.**—*Palarus pictiventris* is easily recognized by its unique propodeal vestiture: the dorsal setae are conspicuously reflective and separated by an asetose, longitudinal gap whose minimum width is no more than midocellar width (Fig. 61a). Its mesopleuron is conspicuously setose, as in *laetus* and *parvulus*, in which the gap between the setae of the propodeal dorsum is several times the midocellar width. Also, unlike most *laetus*, the episcrobal area of *laetus* is all setose or nearly so and the genal setae are sparse; and unlike *parvulus* the posteroventral mandibular notch is well defined. The free margin of the female clypeus is emarginate mesally, the emargination flanked by a tooth (emargination inconspicuous, not flanked by tooth, in the other two species). Unlike male *laetus*, the lateral pygidial process ends behind the end of the adlateral carina (Fig. 61b).

**DESCRIPTION.**—Midocellus separated from hindocellus by  $1.1 \times$  midocellar width. Vertex not markedly swollen between mid- and hindocellus. Admedian and adlateral portions of clypeal lip continuous. Lateroclypeal notch absent; medioclypeal flange without longitudinal ridge and tooth next to lateroclypeal sulcus. Least interocular distance about  $0.8\text{--}1.1 \times$  midocellar width in female,  $0.9\text{--}1.1 \times$  in male. Genal setae numerous (but less so than in *laetus*), length smaller than midocellar width. Posteroventral mandibular notch shallow but well defined basally and apically. Mesopleuron conspicuously microsculptured, dull, densely punctate (punctures 1-3 diameters apart), setae partly concealing integument. Propodeal enclosure with sculpture markedly finer laterally than mesally, laterally with conspicuous, clearly reflective setae; minimum gap between setose areas no more than midocellar width (Fig. 61a); side unridged or with fine ridges in many males.

Clypeus black adjacent to anterior tentorial pit; gena in some specimens with small macula adjacent to mandibular base; scape maculate ventrolaterally in some specimens; flagellum yellow dorsally (apical flagellomeres brown in some specimens). Ground color of thorax and propodeum black, but partly red in some specimens, with the following yellow: pronotum anteriorly, pronotal collar, pronotal lobe, dorsal portion of pronotal side, minute yellow spot anterad of tegula on scutum in many specimens, scutellum anterolaterally (macula extending laterally to hindmargin in some specimens), scutellar flange, postscutellum and metanotal flange, preepisternal area dorsal-

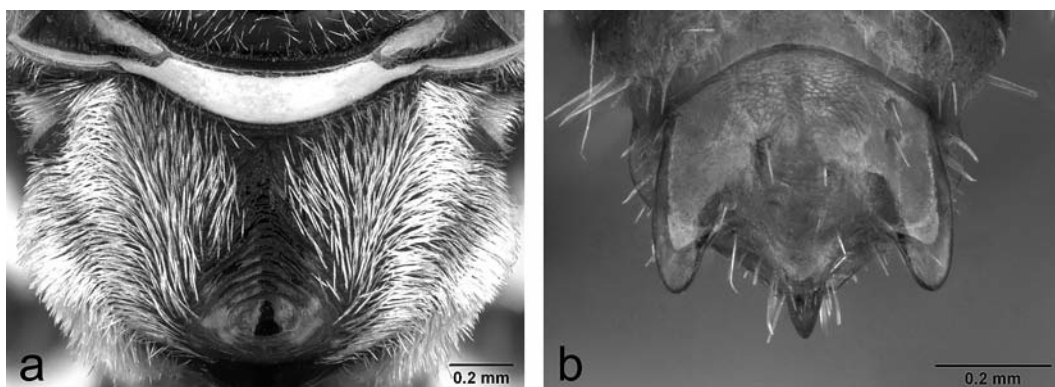


FIGURE 61. *Palarus pictiventris* F. Morawitz: a – propodeal dorsum of female; b – male tergum VII in dorsal view.

ly; propodeum all black. Forefemur yellow ventrally and apically (except near base), remainder black or basoventrally red; midfemur yellow ventrally (except near base) and apically (only apex yellow in some specimens), remainder red to black; hindfemur red or black except yellow apically; fore- and midtibiae yellow, reddish to black ventrally; hindtibia yellow to largely red or black; foretarsus yellow, mid- and hindtarsi yellow to brown. Gaster red, terga I-III each with yellow fascia anterad of apical depression, tergum IV in some specimens with mesally interrupted fascia (fasciae in most specimens not extending to lateral margin of terga).

♀.— Clypeal free margin emarginate mesally, emargination flanked by tooth. Dorsal length of flagellomere I  $1.7\text{--}1.8 \times$  apical width. Tergum VI in profile with ventral margin slightly angled dorsad at apex, apex with or without discontinuity between dorsal and ventral margins. Length 6.0–8.3 mm.

♂.— Dorsal length of flagellomere I  $1.7\text{--}1.8 \times$  apical width. Midtibial spur not shortened, about  $0.5 \times$  length of midbasitarsus. Adlateral carina of tergum VI present. Adlateral carina of tergum VII not forming tooth or angulate process posteriorly (Fig. 61b). Lateral carinae of pygidial plate convex in dorsal view, diverging apicad (Fig. 61b). Lateral pygidial process slightly to markedly broader than median process, slightly raised above median process, without ventral carina, ending behind apex of adlateral carina (Fig. 61b); angle between apices of lateral and median processes markedly more than  $90^\circ$  (Fig. 61b). Length 6.0–8.0 mm.

**COLLECTING PERIOD.**— Kazakhstan: 25 May, 2–29 June, 12–27 July; Turkmenistan: 12–28 May, 1–11 June, 21 June, 4–12 July; Uzbekistan: 13 May, 26 June, 15 September.

**GEOGRAPHIC DISTRIBUTION** (Fig. 62).— Kazakhstan, Uzbekistan, Turkmenistan.

**RECORDS.**— **KAZAKHSTAN** (K = Kazenas, 2002): **Almaty**: 20 km N Aydarly in Sarytaukum Desert (1 ♀, 2 ♂, CAS), 65 km W Bakanas on Ili River (1 ♀, 1 ♂, CAS), 35 km N Chilik on Ili River (1 ♀, 2 ♂, CAS), Dubun' on Ili River 80 km E Chi-

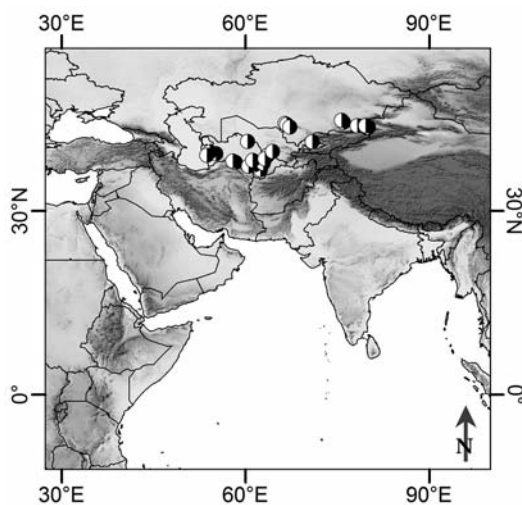


FIGURE 62. Collecting localities of *Palarus pictiventris* F. Morawitz.

lik (K), 30 km SSW Koktal on Ili River (K). **Qyzylorda:** Baigakum near Chiili (1 ♂, ZIN), Djulek, now Chiili (1 ♂, CAS; 3 ♂, ZIN), 20 km S Yany-Kurgan (1 ♀, UCD). **TURKMENISTAN** (M = Myartseva, 1972a; N = Nemkov, 2005): Akhcha-Kuyma (N), Askhabad (1 ♀, 1 ♂, CAS; 9 ♂, ZIN; 1 ♂, ZMMU), Baga Abzal (1 ♂, ZIN), Bayram-Ali (1 ♀, ZMMU), Charjow (M), Djebel (1 ♂, ZIN), Farab (1 ♀, 1 ♂, CAS; 3 ♂, ZIN), Gheok-Tepe (M), Imam-Baba near Mary (1 ♀, 1 ♂, CAS; 1 ♂, ZIN), Karabata (1 ♀, 1 ♂, ZMMU), Kerki (1 ♂, ZMMU), 200 km W Kerki at 37°50'N 62°55'E (1 ♀, 2 ♂, ZMMU), Mary (1 ♂, ZIN, as Merv), Mollakara near Djebel (1 ♀, CAS; 5 ♂, ZIN), lower Murgab River (M), Repetek (1 ♂, UCD; 3 ♂, ZMMU), Takhtabazar (2 ♂, ZIN), lower Tedjen River (M), Uzun-Ada (M, N). **UZBEKISTAN:** Baga-Abzal 15 km N Bukhara (1 ♂, ZMMU), Khiva (10 ♂, ZIN; 1 ♀, 1 ♂, ZMMU), Khiva: Ravat (1 ♂, ZIN), Navbakhor 30 km N Kokand at 41.3°N 70.9°E (1 ♂, OÖLM).

### *variegatus* group

**RECOGNITION.**— The females of this group are recognized by a finely, longitudinally ridged pygidial plate (Figs. 65d, 79c, 98a). In the male, the lateral pygidial process is markedly raised above the tergal apex so that the tergal apex appears bifid, except in *arabicus* and *petheri*, where the lateral processes are fused (Figs. 63b, 87e).

**DESCRIPTION.**— In addition to the characters described above, members of the *variegatus* group share the following. Postocellar area without obtuse crest. Clypeal posterior surface adjacent to free margin with row of long, externally obvious setae. Clypeus produced anteriorly between lateroclypeal notches. Lateroclypeal notch present. Interantennal area with obtuse, longitudinal crest (crest rudimentary in *gao* and most *saundersi*). Frontal swelling not margined laterally by sulcus. Least interocular distance varying from about as wide as ocellar triangle to about 0.5 of triangle. Hindocellus oblong, flat, nearly touching orbit. Vertex not markedly swollen between mid- and hindocellus. Postocellar area with well-developed depression, without crest. Midocellus separated from hindocellus by 1.0-1.3 × midocellar width. Area between mid- and hindocellus setose, punctate, dull, like adjacent areas. Gena well developed, occipital carina separated from eye orbit at vertex by slightly less to slightly more than midocellar width, except in males of *bernardi*, *dongalensis*, and *saundersi*, in which separation is slightly more than 0.5 × midocellar width. Labrum convex, length roughly half width, without apicolateral expansion, visible between fully closed mandibles and clypeus (as in Fig. 29b), in female with transverse carina arcuate, exposed, and apical portion with median carina. Posteroventral mandibular notch present, well defined. Scapal setae appressed (a few may be suberect), markedly shorter than midocellar width. Pronotal collar raised as narrow wedge (as in Fig. 29d), without longitudinal depression. Streptaulus separated from anterior pronotal groove (as in Fig. 29e). Scutum shiny, with punctures several to many diameters apart at center. Metapleuron impunctate and asetose or with inconspicuous setae and a few, sparse punctures. Propodeal dorsum coarsely ridged or rugose on each side of median depression (which is also ridged, several midocellar widths wide), with well-defined adlateral depression; side impunctate at least anteriorly; admarginal carina complete mesally, except in some *oneili*. Mesosternal and metasternal posterior margin expanded into flange that overlays respective coxal articulation (as in Fig. 30a). First recurrent vein varying within species, inserting on first submarginal cell, or interstitial with first intersubmarginal vein, or inserting on second submarginal cell. Hindfemur without apical lobe. Setae of hindfemoral venter straight, markedly shorter than midocellar width. Outer and inner apical spines of hindtarsomeres II and III equal in length or nearly so in female, varying in male. Hindtarsomere III without apicoadlateral dorsal spines (exceptionally one such spine present on one leg). Terga minutely truncate apically or with apical transverse carina creating double-edged margin. Tergum I without erect setae, its apical depression punctate. Medioventral area of gonocoxite membranous. Thoracic and gastral setae shorter than basal mandibular width (except for preapical sternal setae), appressed on tergum I.



Clypeus all yellow (except *oneili* and *variegatus*); mandible yellow on basal half, reddish brown to dark brown apically. Paraocular macula absent from both frons and gena. Wing membrane varying in color between species.

♀.— Lateroclypeal notch in line with lateroclypeal suture. Forebasitarsus IV with single rake spine except with additional partly developed spine in many *rufipes*. Midcoxal ventral surface with preapical tubercle. Outer apical spine of hindtarsomeres II and III as long and thick or slightly longer than inner apical spine. Pygidial plate without inner platform. Lateroclypeal notch in-line with lateroclypeal sulcus. Tergum I with adlateral carina or swelling. Pygidial carina not raised above plate's plane on apical half. Sides of tergum VI fused preapically (resulting in tergal apex thickened dorsoventrally), tergum protruding well beyond sternal apex (as in Fig. 30d), protrusion with smooth apicoventral area; tergal side with longitudinal carina parallel to margin of pygidial plate in distal half of so, its ventral portion (ventrad of carina) curved inwards and invisible externally; sternum VI with small flange overlapping ventral edge of tergum VI and sliding along smooth tergal surface below tergal carina. Sternum II with transverse crest that is either straight or arching anterad.

♂.— Clypeal free margin without median lobe except ill-defined lobe present in *bernardi*. Midtibial spur varying: not shortened, shortened, or absent. Hindcoxal venter with a few, sparse punctures. Tergum I with conspicuous adlateral carina. Tergum VII with adlateral carina. Venters of mid and hindtibiae and of midbasitarsus without short, erect setae. Sternum I mesally with paired preapical swelling except swelling essentially single in some *jaxartes*. Sternum II with transverse, preapical elevation whose anterior margin is either rounded or carinate and posterior margin is carinate; posterior surface of elevation at least as high as midocellar width (higher in most specimens), asetose or with a few, inconspicuous setae except with numerous setae in *dongalensis*. Sternum VIII at least slightly constricted preapically, its venter with preapical row of setigerous punctures, asetose posterad of row, at most with a few such punctures anterad of row except conspicuously punctate and setose anterad of row (row ill defined) in *saundersi*. Gonocoxite without dense brush of long setae ventrally, with membranous ventral area extending from near gonocoxite basis to about midlength. Penis valves dorsally fused for more than half their length, without longitudinal ridges before apex, not angulate at ventral base of apical expansion.

***Palarus arabicus* Pulawski, sp. nov.**

Figures 63, 64.

**DERIVATION OF NAME.**— *Arabicus*, masculine Latin adjective derived from Arabia, the country of origin of the species.

**RECOGNITION.**— The male of *arabicus* (the female is unknown) is unique within the *variegatus* group in having the pygidial plate a single, apically nonmarginate platform, with evenly arcuate lateral margin (Fig. 63).

**DESCRIPTION** (based on single male).— Least interocular distance about  $0.9 \times$  midocellar width. Occipital carina separated from eye orbit at vertex by about  $1.1 \times$  midocellar width. Anterior margin of precoxal mesopleural declivity with angulate prominence. Propodeal side largely impunctate and unridged, punctate posterodorsally.

Frons yellow up to above midheight (less than that mesally), black below antennal socket; gena with elongate macula subdorsally; antenna black (apical flagellomere brown posteriorly). Thorax with the following pale yellow: pronotum anteriorly, pronotal collar except mesally and laterally, pronotal lobe, scutum anterolaterally, scutellar flange, postscutellum, metanotal flange, and preepisternal area dorsally. Wing membrane slightly infumate.

♀.— Unknown.

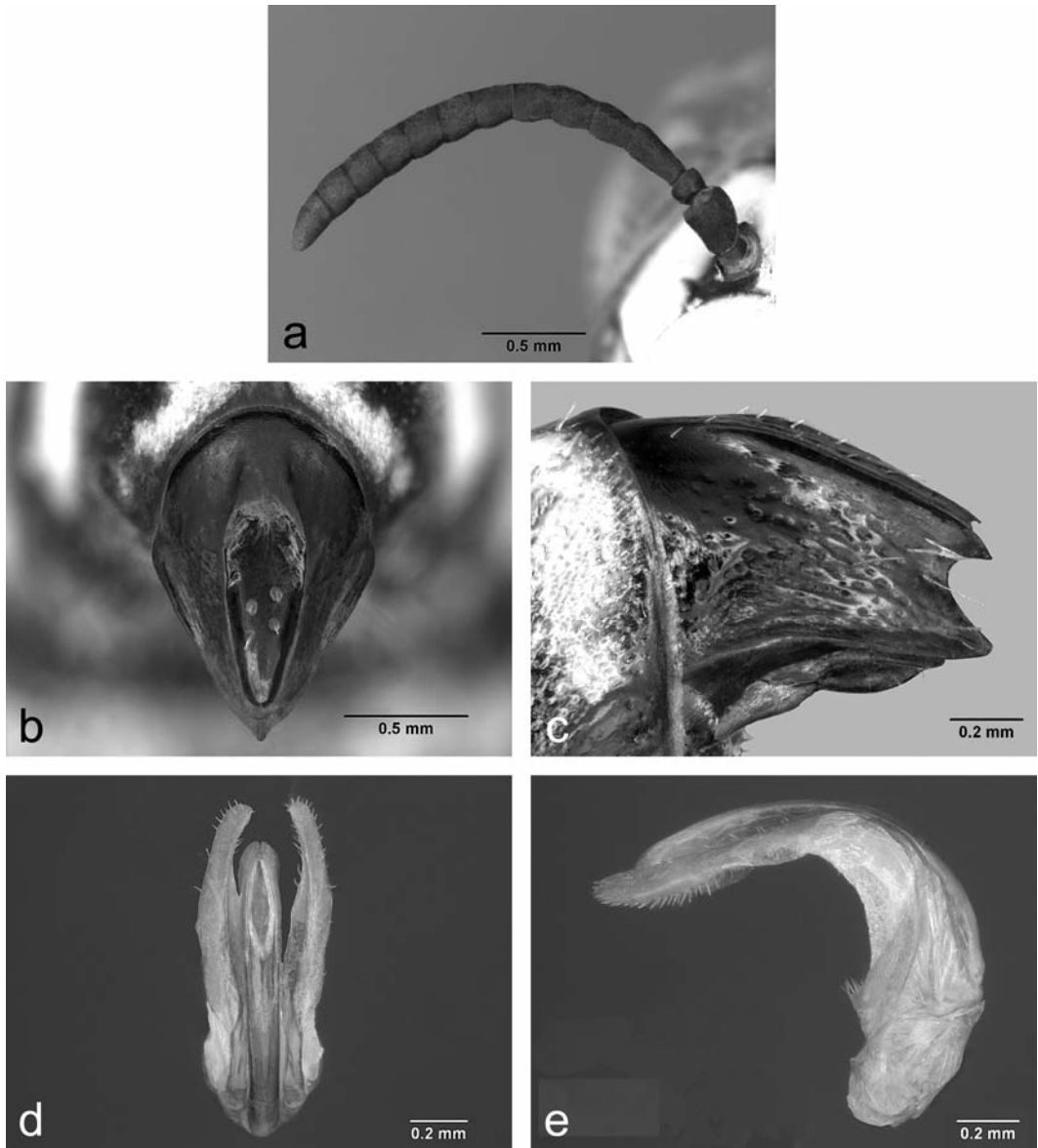


FIGURE 63. *Palarus arabicus* Pulawski, sp. nov. ♂: a – antenna; b – tergum VII in dorsal view; c – tergum VII in lateral view; d – genitalia in dorsal view, e – genitalia in lateral view.

♂.—Free margin of medioclypeus slightly arcuate. Genal setae not sinuous, shorter than midocellar width. Longest setae between mandibular condyle and notch equal to midocellar width. Dorsal length of flagellomere I  $2.2 \times$  apical width; flagellomeres II-VII minimally convex ventrally, practically cylindrical (Fig. 63a). Mesothoracic venter, before precoxal sulcus, with most punctures several diameters apart and setae shorter than those on ventral portion of preepisternum. Metasternum setose. Forecoxa without apicomedian platform, apicomedian setae slightly denser than on remaining surface. Forebasitarsus with oblong, black, preapical tubercle on venter. Mid-

coxal venter unsculptured except for a few, sparse punctures, with preapical tubercle and posteroventral, obtuse carina. Midtibial spur about  $0.3 \times$  length of midbasitarsus. Midbasitarsus neither curved nor flattened, with several spines ventrally; midtarsomeres II and III each with translucent, apicoventral pad. Tergum V without adlateral tooth or tubercle. Tergum VI with adlateral carina. Tergum VII (Fig. 63b, c): pygidial plate a single, nonmarginate platform, raised above tergal apex, with evenly arcuate lateral margin; side not markedly concave; adlateral carina not expanded basally; ventral margin of tergium visible in lateral view; setae not denser than those on tergium VI, longest on sides and ventral apex of lateral pygidial process, not upcurved at tergal apex. Sternum II without transverse carina before elevation, anterior margin of elevation obtuse, posterior margin simple carina. Sterna V and VI, on disk, with punctures that average many diameters apart; associated setae inconspicuous; adlateral carina of sterna V and VI obtuse, raised relative to ventral margin of respective terga, that of sternum VI pointed posteriorly. Gonocoxite basoventrally with sclerotized lobe adjacent basoventrally to membranous area (Fig. 63e), apically with conspicuous setae (Fig. 63d, e). Length about 14.3 mm.

**GEOGRAPHIC DISTRIBUTION** (Fig. 64).—Saudi Arabia.

**RECORD.**—HOLOTYPE: ♂, SAUDI ARABIA: Al Hotah [= Al Hawtah near El Riyadh], 24 Apr 1981, D.H. Walker (BMNH).

### *Palarus bernardi* de Beaumont

Figures 64–68.

As *Palarus dongalensis* var.—Klug, 1845: pl. 47, fig 2, corrected to *Palarus bernardi* by de Beaumont, 1949:644.

*Palarus bernardi* de Beaumont, 1949:644, ♀, ♂. Holotype: ♂, Libya: Fezzan: Brak (MNHN), examined.—Bohart and Menke, 1976:290 (listed).

**RECOGNITION.**—*Palarus bernardi* has sinuous genal setae (Fig. 65b) that in the *variegatus* group also occur in *dongalensis*, *jaxartes*, and the male of *rufipes*.

The female differs from *jaxartes* in the shape of sternum II that has a long, semicircular platform posterad of the transverse crest (Fig. 65d); the platform's length is markedly greater than the midocellar width, and the sternum apical depression is markedly shorter than the midocellar width (the platform in *jaxartes* is transverse, markedly shorter than the midocellar width, and the apical depression is about as long as the midocellar width). It closely resembles *dongalensis*, but has flagellomere I about  $1.4 \times$  as long dorsally as wide apically (Fig. 65a), as long as flagellomere II (rather than  $1.7 \times$  as long dorsally as wide apically and clearly longer than flagellomere II), the posteroventral mandibular tooth angulate (Fig. 65c) rather than rounded, and the gena with only a few punctures next to hypostomal carina (rather than many punctures).

The male of *bernardi* is unique in having the midbasitarsus flattened dorsoventrally (Fig. 67a, b), although a similar condition is found in *dongalensis*, and an oblique carina of tergium VII (above

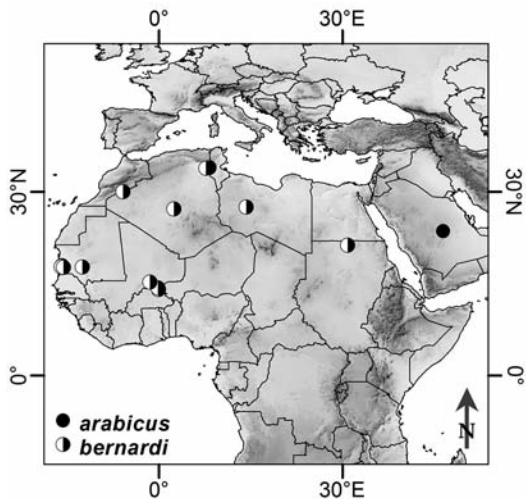


FIGURE 64. Collecting localities of *Palarus arabicus* Pulawski, sp. nov., and *Palarus bernardi* de Beaumont.

the adlateral carina) extending to the tergal foremargin (Fig. 67f). Also, the mesothoracic venter is concave, a condition approached in *rufipes*. As in *dongalensis* and *rufipes*, the forebasitarsus is conspicuously broadened, with spatulate rake spines (Fig. 66e), and the side of tergum VII is concave (Fig. 67f); as in *dongalensis*, the forefemoral anteroventral surface has a well-defined concavity (Fig. 66c), the hindbasitarsus is flattened dorsoventrally (Fig. 67c, d), and sterna V and VI have dense, erect, slightly sinuous setae. See the key for differences between *bernardi* and *dongalensis*.

**DESCRIPTION.**— Least interocular distance about  $0.9\text{--}1.0 \times$  midocellar width in female,  $0.7 \times$

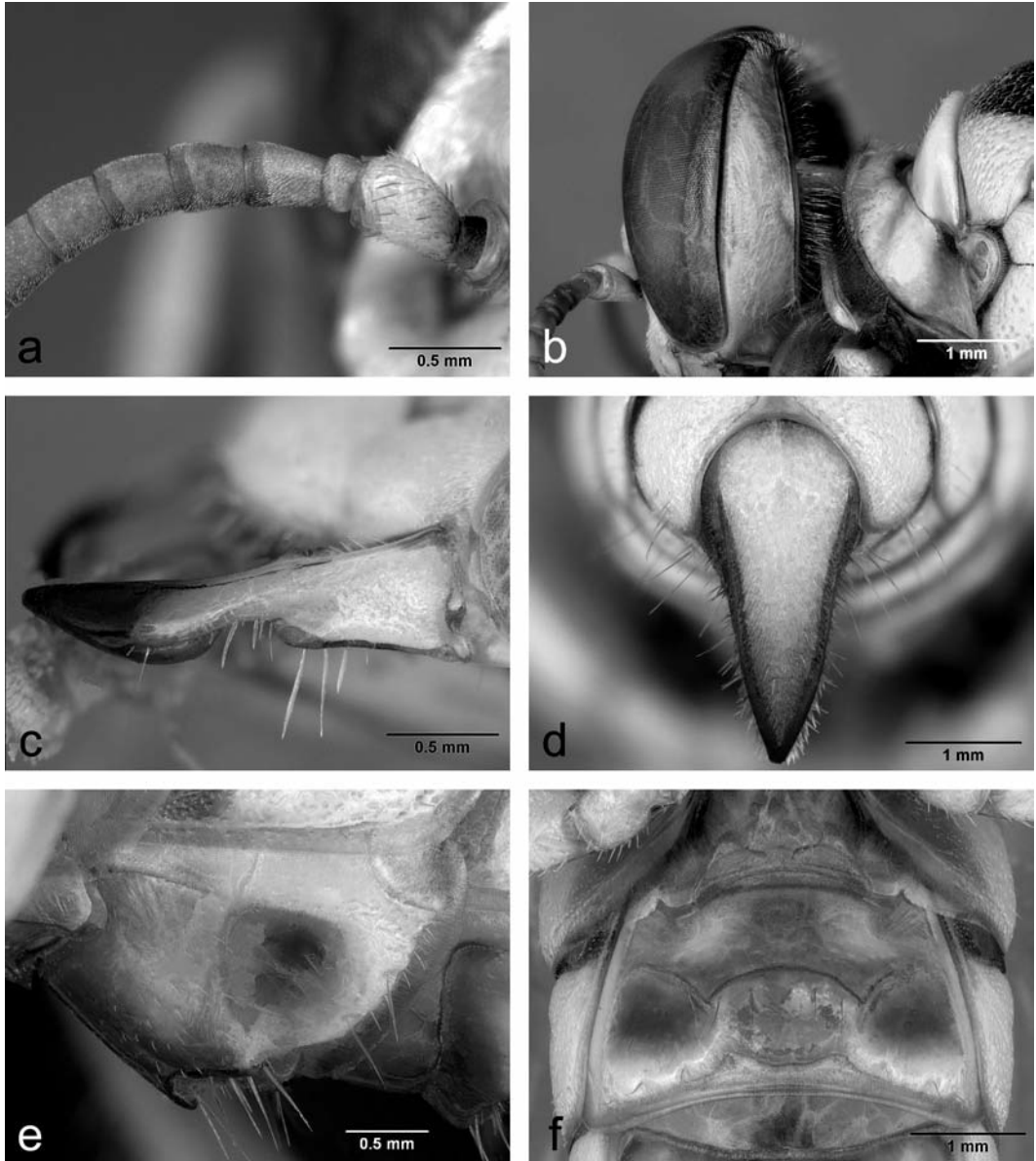


FIGURE 65. *Palarus bernardi* de Beaumont ♀: a – basal portion of antenna; b – head in posterolateral oblique view showing genal setae; c – mandible; d – pygidial plate in dorsal view; e – sternum II in lateral view; f – sternum II in ventral view.



in male. Occipital carina separated from eye outer orbit at vertex by hindocellar length in female, less than hindocellar length in male. Anterior margin of precoxal mesopleural declivity with minimal angular prominence in some males. Propodeal side aciculate anteriorly, in many specimens ridged posteriorly (contrary to de Beaumont, 1949).

Frons all yellow except with some brown below antennal socket in some specimens, in single specimen from Mali with black area below midocellus; vertex yellow to black; gena largely or entirely yellow; mandible yellow except apically, brown basomesally in some specimens; scape

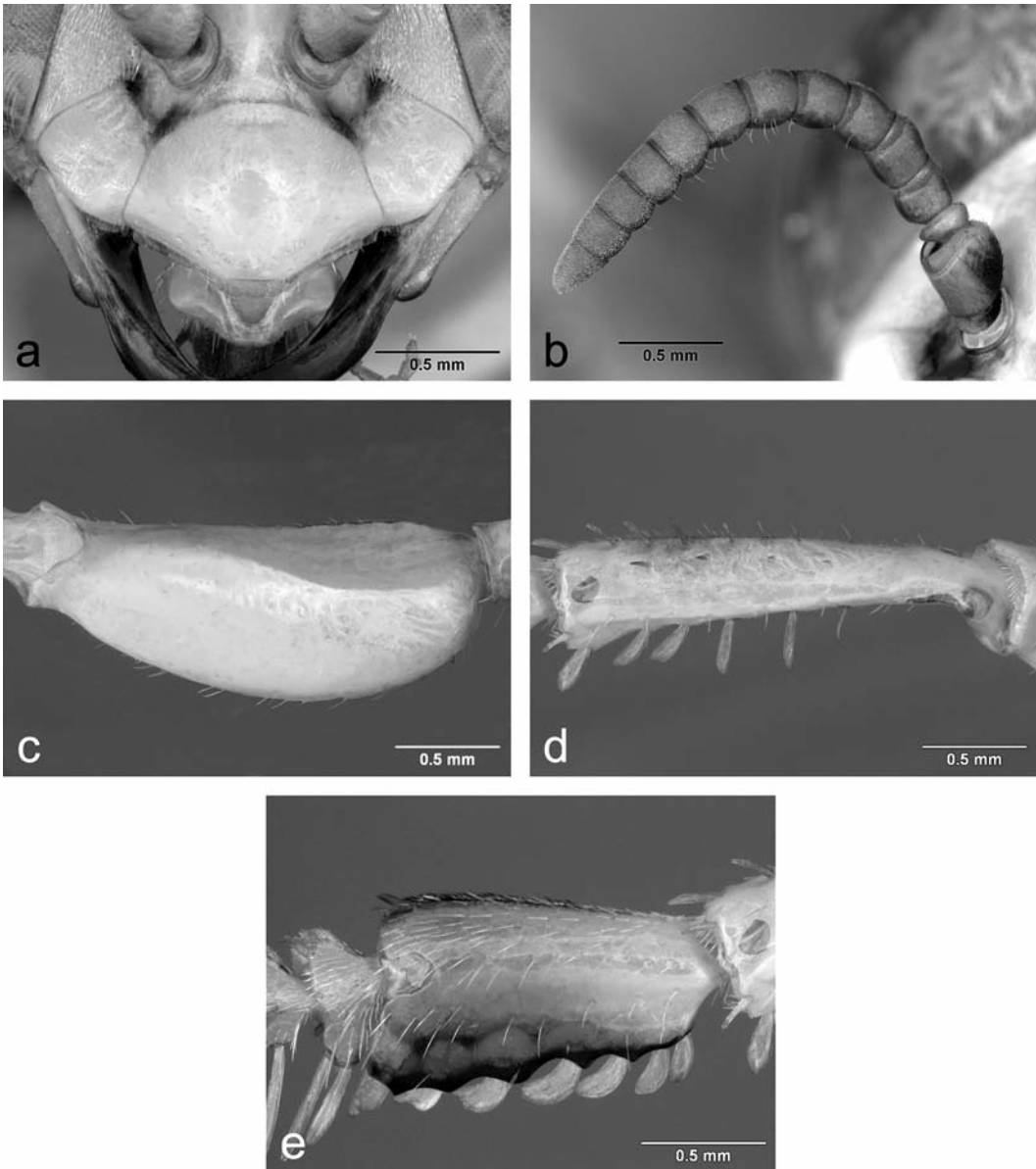


FIGURE 66. *Palarus bernardi* de Beaumont ♂: a – clypeus; b – antenna; c – forefemur in ventral view; d – foretibia; e – forebasitarsus.

and pedicel yellow in most specimens, scape partly brown ventrally in some males; flagellum yellow-orange, in male brown ventrally. Thorax and propodeum varying from all yellow to partly black or reddish (black or reddish are: central spot on pronotum, scutum largely, mesopleuron posteriorly, metapleuron, propodeal dorsum mesally, propodeal side and posterior surface). Wing membrane hyaline, but marginal, submarginal, and discoidal cells infumate in many males. Legs all yellow except mid- and hindtarsi brown or femoral dorsum darkened; forebasitarsal outer margin black in male, venter with several black stripes. Gaster all yellow (some females) or the following are black: basal declivity of tergum I, narrow basal zone of terga II-V, side of female tergum VI, side of male terga VI and VII (also of tergum V in some specimens); male tergum VII all black in some specimens.

♀.— Genal setae sinuous, some longer than midocellar width (Fig. 65b). Dorsal length of flagellomere I  $1.3\text{--}1.4 \times$  apical width (Fig. 65a). Adlateral carina of tergum I gradually effacing posterad. Fine ridges of pygidial plate somewhat irregular, clearly diverging from midline (Fig. 65d). Sternum II (Fig. 65e, f): with transverse crest simple or slightly irregular; posterad of transverse crest (and associated row of setae) with semicircular platform delimited by obtuse swelling, apex of platform separated from setae by more than midocellar width; apical depression of sternum II shorter than midocellar width; swelling that borders apical depression not extending to each lateromedian angle of crest, without sharp tubercle. Length 13.7–16.6 mm.

♂.— Clypeus markedly convex on each side of lateroclypeal notch about midway from frontoclypeal suture to free margin (Fig. 66a), markedly more so than in other *Palarus*; free margin of medioclypeus produced into obtuse lobe, slightly concave on each side of lobe; lateroclypeus asetose (except adjacent to tentorial pit), contrasting with adjacent frons. Genal setae sinuous, longest setae more than midocellar width. Longest setae between mandibular condyle and notch about half midocellar width. Occipital carina separated from eye orbit at vertex by slightly more than half midocellar width. Dorsal length of flagellomere I  $1.0\text{--}1.2 \times$  apical width, ventral length smaller than apical width; flagellomeres I-VIII convex ventrally, VII-IX with row of erect, sparse setae (Fig. 66b). Mesopleural setae behind episternal sulcus straight, markedly shorter than midocellar width. Mesothoracic venter noticeably concave, with few punctures before precoxal sulcus (most punctures many diameters apart), with setae markedly shorter than those on ventral portion of preepisternum. Metasternum largely asetose (setae present only laterally). Forecoxa without apicomedian platform, with apicomedian brush of long setae; forecoxal setae varying from straight to sinuous. Forefemoral anteroventral surface concave (Fig. 66c). Foretibial outer surface with row of spatulate spines (Fig. 66d). Forebasitarsus conspicuously widened (Fig. 66e), with discrete black markings along edges and on venter, with row of dark, appressed setae on venter; rake spines short, spatulate (Fig. 66e). Midcoxal venter flattened, unsculptured except for a few, sparse punctures, at most with evanescent preapical tubercle, with oblong, posteroventral tubercle. Midtibial spur absent. Midbasitarsus flattened dorsoventrally (Fig. 67a, b), ventrally with short, somewhat irregularly distributed spines (including basal half). Hindbasitarsus flattened dorsoventrally (Fig. 67c, d). Tergum V with adlateral tubercle near hindmargin. Tergum VI with adlateral carina. Tergum VII: pygidial plate (Fig. 67e, f) slightly concave in basal half, markedly raised above tergal apex (lateral pygidial process separated from tergal apex by more than midocellar width), conspicuously emarginate posteriorly, with emarginate portion markedly broader than basal part (greatest width of plate about  $0.4 \times$  length), lateral pygidial process widest anteriorly, processes not connected ventrally by V-shaped carina; pygidial carina sinuous, separated from lateral edge of lateral process. Side of tergum VII in anterior half with oblique carina that extends to tergal foremargin and ends there as round tumescence, conspicuously concave above carina; adlateral carina straight, not expanded; ventral margin of tergum concealed in lateral view. Setae of tergum VII erect basally,

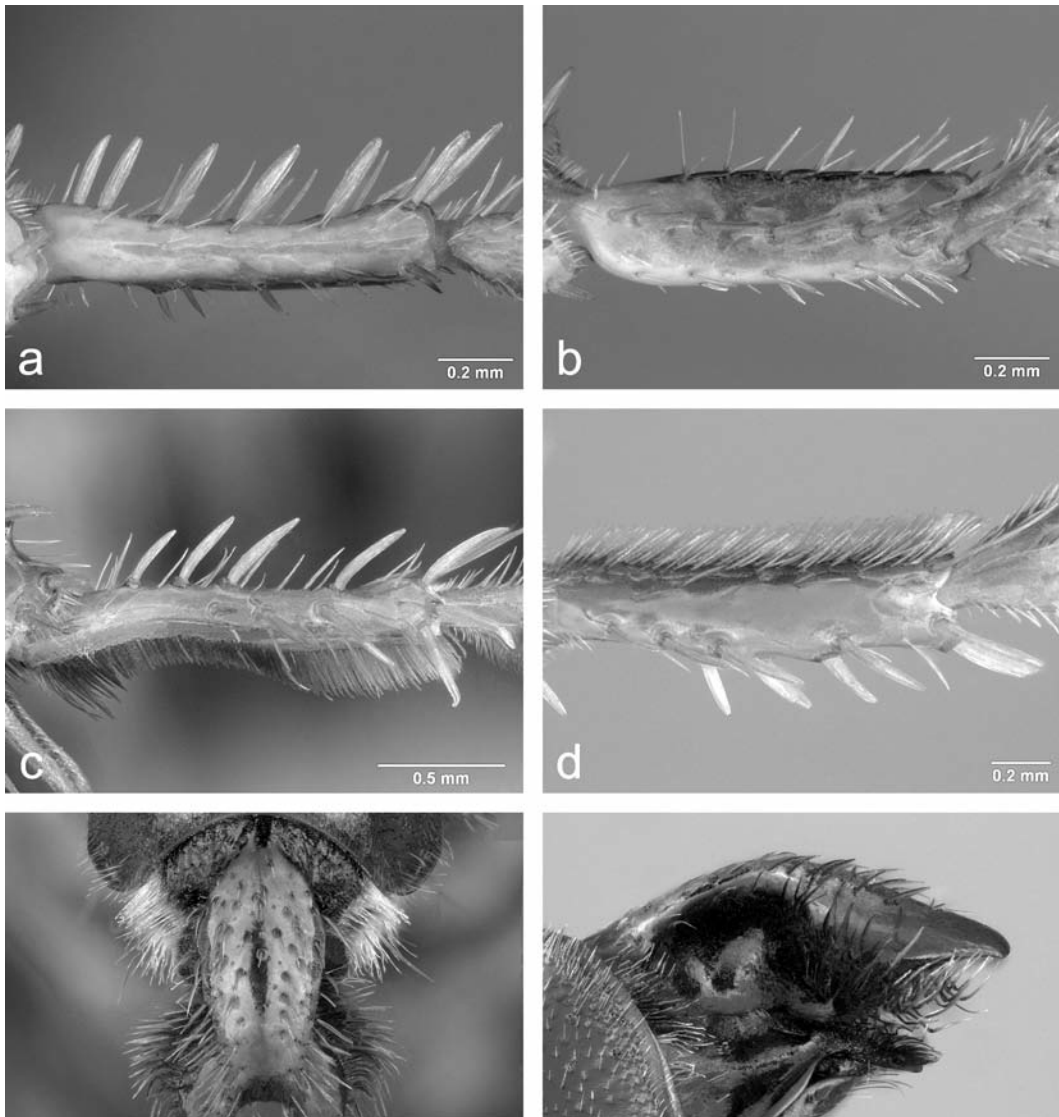


FIGURE 67. *Palarus bernardi* de Beaumont ♂: a – midbasitarsus in lateral view; b – midbasitarsus in dorsal view; c – hindbasitarsus in lateral view; d – hindbasitarsus in dorsal view; e – tergum VII in dorsal view; f – tergum VII in lateral view.

not obscuring integument (concavity asetose); erect, markedly shorter and denser on edge of oblique carina; numerous, long, upcurved on ventral surface of lateral pygidial process; conspicuously dense (but shorter than those of process) near tergal apex. Sternum II with transverse ridge before elevation, anterior margin of elevation obtuse, posterior margin with a few, obtuse teeth. Sternum V with most punctures about 1-3 diameters apart, associated setae fine, erect, slightly sinuous. Sternum VI with most punctures about 1-2 diameters apart, associated setae fine, erect, slightly sinuous; adlateral carina sharply defined adjacent to ventral margin of tergum VI but not elevated relative to it, not pointed posteriorly. Gonocoxite basoventrally with sclerotized lobe adja-

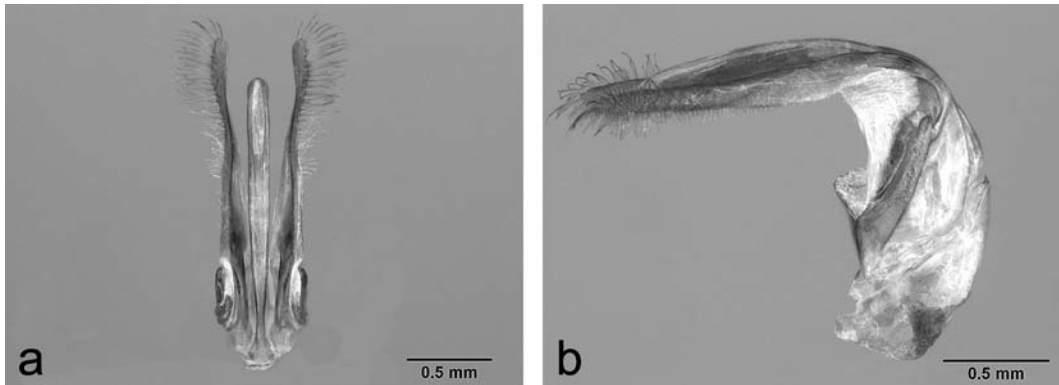


FIGURE 68. *Palarus bernardi* de Beaumont ♂: a – genitalia in dorsal view; b – genitalia in lateral view.

cent basoventrally to membranous area (Fig. 68b), apically with conspicuous setae (Fig. 68a, b). Length 14.2–16.6 mm.

**COLLECTING PERIOD.**— Burkina Faso: 24–28 July; Libya: 27–30 May; Mali: 18 August; Mauritania: 15 October through 7 November; Morocco: 28 May; Tunisia: 8 June and 2 September.

**GEOGRAPHIC DISTRIBUTION** (Fig. 64).— Northwest Africa to Mauritania, Burkina Faso, and Sudan.

**RECORDS.**— **ALGERIA:** In-Salah (de Beaumont, 1949). **BURKINA FASO:** 4 km NE Dori at 14°03.8'N 0°03.1'W (2 ♀, 2 ♂, CAS), 15 km SE Gorom Gorom at 14°21.4'N 0°07.9'W (4 ♂, CAS). **LIBYA:** **Fezzan:** Brak (1 ♂, MNHN, holotype of *bernardi*; 1 ♂, LAUSANNE, paratype of *bernardi*). **MALI:** 25 km E Hombori (1 ♂, CAS). **MAURITANIA:** 25 km SW Moujéria (1 ♀, CAS), 30 km S Nouakchott (1 ♂, CAS), 22 km SE Nouakchott (1 ♀, CAS), 60 km SE Nouakchott (5 ♀, 1 ♂, CAS). **MOROCCO:** 30 km S Zagora (1 ♂, CSE). **SUDAN:** Ambukohl, now Ambikol (de Beaumont, 1949). **TUNISIA:** Degache (1 ♂, CSE), 15 km W Nefta at 33°50'N 7°43'E (1 ♀, 2 ♂, CSE).

### *Palarus dongalensis* Klug

Figures 69–71.

As *Palarus rufipes* Olivier: Spinola, 1839:475 (Egypt), corrected to *Palarus dongalensis* by de Beaumont, 1952:47; de Saussure, 1854:14 (variation).

*Palarus dongalensis* Klug, 1845:[25], pl. 47, figs. 1, 2, ♀. Lectotype: ♀, Sudan: Ambukohl, now Ambikol (ZMHU), **here designated**, examined.— F. Smith, 1856:358 (in catalog of Hymenoptera in British Museum); Kohl, 1885:424 (original description copied), 427 (in checklist of world *Palarus*); Dalla Torre, 1897:657 (in catalog of world Sphecidae); de Beaumont, 1949:642 (in revision of Mediterranean *Palarus*), 1962:223 (Saudi Arabia); de Beaumont, Bytinski-Salz, and Pulawski, 1973:17 (Israel); Bohart and Menke, 1976:291 (listed); Nascimento and Overal, 1980:8 (Chile, record obviously erroneous); Guichard, 1988:134 (Arabian Peninsula); D. Baker, 1997:189 (in catalog of insects described by Klug, 1845).

*Palarus decipiens* Honoré, 1941:197, ♀, ♂. Lectotype: ♀, Egypt: Sokhna on Red Sea coast (USNM), examined. Synonymized with *Palarus dongalensis* by de Beaumont, 1949:642.— Honoré, 1942:59 (in catalog of Egyptian Sphecidae).

**RECOGNITION.**— *Palarus dongalensis* closely resembles *bernardi* (see the latter species, p. 411, for recognition). The species is unique within the group in having the posteroventral mandibular tooth rounded rather than angulate (Fig. 69b). The male is unique in having the occipital carina effaced dorsolaterally (but not dorsally, Fig. 69d). As in *fulviventris*, the male midbasitar-



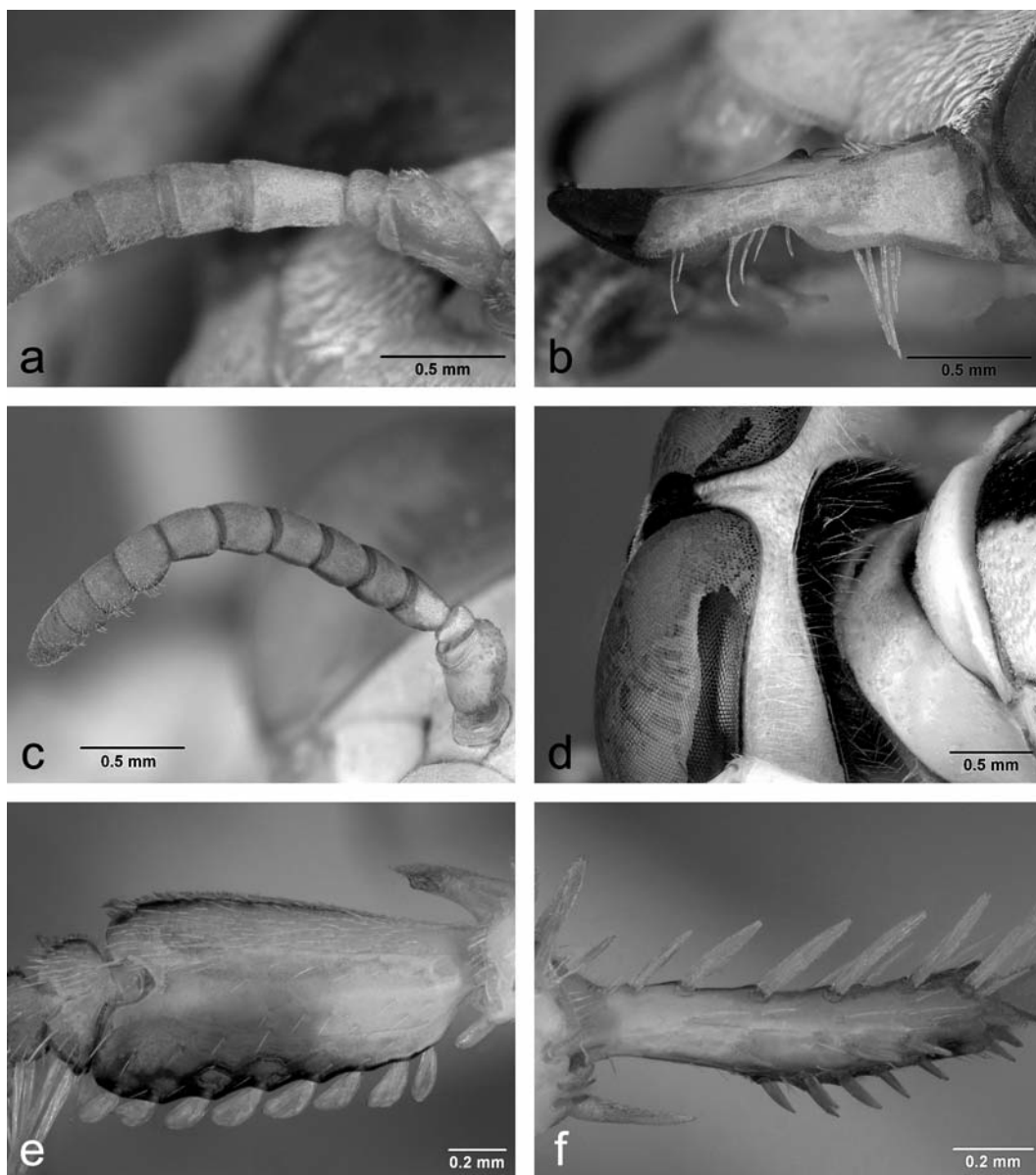


FIGURE 69. *Palarus dongalensis* Klug: a – basal portion of female antenna; b – female mandible; c – male antenna; d – male head in dorsal oblique view showing occipital carina effaced subdorsally; e – male forebasitarsus; f – male midbasitarsus in lateral view.

sus lacks basoventral spines (Fig. 69f), but unlike that species the forebasitarsus is markedly broadened (Fig. 69e), among other characters.

**DESCRIPTION.**— Least interocular distance about  $1.0 \times$  midocellar width in both sexes. Occipital carina separated from eye outer margin by hindocellar length in female, slightly more than half hindocellar length to slightly less than hindocellar length in male. Posteroventral mandibular tooth more rounded than in the other species of the *variegatus* group (Fig. 69b). Anterior margin of pre-

coxal mesopleural declivity without angulate prominence. Propodeal side aciculate anteriorly, ridged posteriorly.

Frons all yellow; vertex yellow (black next to hindocelli); most of postocellar area yellow; gena all yellow or nearly so; scape and pedicel all yellow, flagellum orange-yellow, in male partly brown ventrally. Pronotum all yellow except black or red mesally behind streptaulus. Scutum yellow, in most specimens with three longitudinal black strips (area between strips may be yellow or red); remaining thorax and propodeum all yellow in some specimens, reddish to partly black in others (propodeal dorsum yellow on each side of median depression, posterior surface black mesally, metapleuron black in some specimens). Wing membrane hyaline. Femora all yellow or fore- and midfemora reddish dorsally and hindfemur reddish except apically; tibiae and tarsi yellow. Terga yellow except tergum I red or black on basal declivity, following terga narrowly brown basally, and male tergum VII black laterally.

♀.— Dorsal length of flagellomere I  $1.7 \times$  apical width (Fig. 69a). Genal setae sinuous, some longer than midocellar width. Adlateral carina of tergum I gradually effacing posterad. Fine ridges of pygidial plate somewhat irregular, clearly diverging from midline (as in Fig. 65d). Sternum II as in *bernardi* (as in Fig. 65e, f): transverse crest simple; posterad of transverse crest (and associated row of setae) with semicircular platform delimited by obtuse swelling, apex of swelling separated from setae by more than midocellar width; apical depression shorter than midocellar width; swelling that borders apical depression not extending to each lateromedian angle of crest, without sharp tubercle. Length 14.0-18.0 mm.

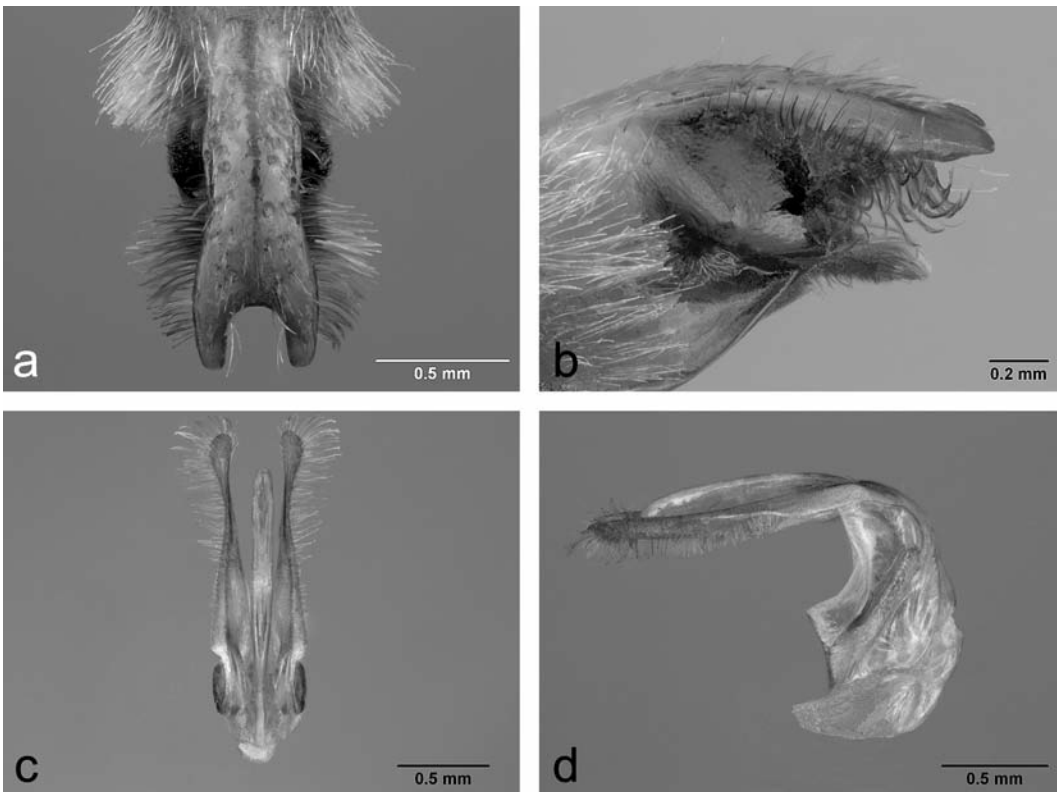


FIGURE 70. *Palarus dongalensis* Klug ♂: a – tergum VII in dorsal view; b – tergum VII in lateral view; c – genitalia in dorsal view; d – genitalia in lateral view.

♂.—Free margin of medioclypeus arcuate. Genal setae sinuous, longest ones (near hypostoma) about twice midocellar width (Fig. 69d). Longest setae between mandibular condyle and notch almost twice midocellar width. Occipital carina effaced subdorsally (Fig. 69d). Dorsal length of flagellomere I  $1.4 \times$  apical width; flagellomeres I-X somewhat convex ventrally, VII and VIII slightly more than others, VII-X with a few erect setae (Fig. 69c). Mesopleural setae behind episternal sulcus straight, markedly shorter than midocellar width. Mesothoracic venter, before precoxal sulcus, with some punctures many diameters apart, with setae shorter than those on ventral portion of preepisternum. Metasternum largely asetose (setae present only laterally). Forecoxa without apicomedian platform, with apicomedian brush of long setae (most setae sinuous). Forefemoral anteroventral surface concave. Forebasitarsus conspicuously widened, with discrete black markings along edges (Fig. 69e) and on venter, with row of dark, appressed setae on venter. Foretarsal rake spines spatulate (Fig. 69e). Midcoxal venter flattened, unsculptured except for a few, sparse punctures, with evanescent preapical tubercle and oblong posteroventral tubercle. Midtibial spur shortened (about  $0.25 \times$  length of midbasitarsus). Midbasitarsus somewhat flattened dorsoventrally, curved in profile (Fig. 69f), ventrally with row of short spines (spines absent on basal third or so). Hindbasitarsus flattened dorsoventrally (as in Fig. 67 c, d). Tergum V without adlateral tooth or tubercle. Tergum VI with adlateral carina. Tergum VII: pygidial plate (Fig. 70a) slightly concave, emarginate apically, markedly raised above tergal apex (lateral pygidial process separated from tergal apex by more than midocellar width, Fig. 70b); pygidial carinae slightly diverging posteriorly; greatest width of plate about  $0.4 \times$  length; lateral pygidial process widest anteriorly (Fig. 70a), processes not connected ventrally by V-shaped carina; side of tergal plate conspicuously concave, in anterior half with oblique, densely setose carina that does not extend to tergal foremargin (Fig. 70b); adlateral carina curved, not expanded; ventral margin of tergal plate concealed in lateral view; setae erect basally, not obscuring integument (concavity asetose); erect, markedly denser and shorter on edge of oblique ridge; numerous, long, upcurved on ventral surface of lateral pygidial process; conspicuously dense (but shorter than those of process) near tergal apex. Sternum II with transverse ridge before elevation, anterior margin of elevation obtuse, posterior margin with a few, obtuse teeth; posterior surface of elevation with numerous setae to almost glabrous. Sternum V: most punctures 1-2 diameters apart, associated setae erect, conspicuous, partly sinuous. Sternum VI: most punctures about one diameter apart, associated setae erect, conspicuous, mostly sinuous; adlateral carina sharp adjacent to ventral margin of tergal plate, not elevated relative to that margin, not pointed posteriorly. Gonocoxite with small sclerotized lobe adjacent basoventrally to membranous area (Fig. 70d), apically with conspicuous setae (Fig. 70c, d). Length 14.3-15.0 mm.

**COLLECTING PERIOD.**—Egypt: May, 29 June, early July; Israel: 9 June; Oman: 5 April; Pakistan: 24 April; Saudi Arabia: 1-15 July and 18 August; United Arab Emirates: 18 April through 28 June, July and 9-18 September.

**GEOGRAPHIC DISTRIBUTION** (Fig. 71).—Egypt, Sudan, Israel and Arabian Peninsula, Pakistan, also central Sahara.

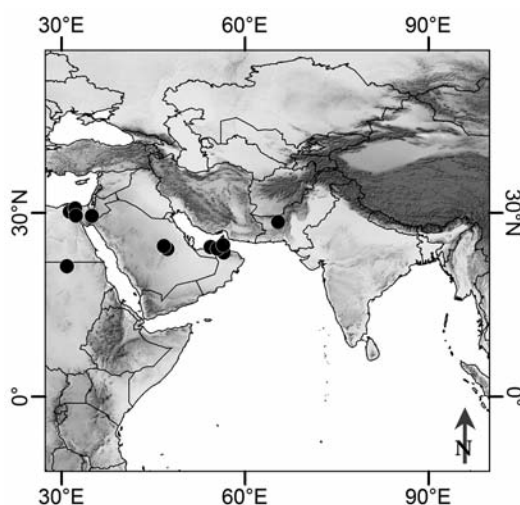


FIGURE 71. Collecting localities of *Palarus dongalensis* Klug.

**RECORDS.**— **EGYPT:** Abu Zabal, Ismailia (de Beaumont, 1949), 20 km N Ismailia (1 ♂, CSE), Sokhna on Red Sea coast (1 ♀, 1 ♂, USNM, lectotype and paralectotype of *decipiens*). **ISRAEL:** Elat (de Beaumont, Bytinski-Salz, and Pulawski, 1973). **OMAN:** NW Yanqul (Guichard, 1988). **PAKISTAN:** **Baluchistan:** Kharan (Guichard, 1988). **SAUDI ARABIA:** Al Kharj (Guichard, 1988), El Riyadh (de Beaumont, 1962). **SUDAN:** Ambikol on Nile (spelling according to Baker, 1997; 1 ♀, ZMHU, lectotype of *dongalensis*). **UNITED ARAB EMIRATES:** Abu Dhabi (1 ♂, CAS), Al Saad (Guichard, 1988), Hatta (Guichard, 1988). **COUNTRY UNKNOWN:** Central Sahara: Ahmet (de Beaumont, 1949).

### *Palarus fulviventris* Latreille

Figures 72-76.

*Palarus fulviventris* Latreille, 1812:651, ♂. Holotype or syntypes: ♂, Arabia according to original description, but actually Syria or Iraq; no specific locality (lost), not examined. Tentatively synonymized with *Palarus spinolae* by de Beaumont, 1949:639.—Kohl, 1885:424 (original description copied), 428 (in checklist of world *Palarus*); Dalla Torre, 1897:658 (in catalog of world Sphecidae).

*Palarus spinolae* de Saussure, 1854:14, ♀, ♂ (as *Spinolae*, incorrect original capitalization). Syntypes: Egypt: no specific locality (lost?), not examined. **New synonym.**—F. Smith, 1856:358 (in catalog of Hymenoptera in British Museum); Kohl, 1885:427 (original description copied), 428 (in checklist of world *Palarus*); Dalla Torre, 1897:659 (in catalog of world Sphecidae); Honoré, 1941:197 (in revision of Egyptian *Palarus*), 1942:59 (in catalog of Egyptian Sphecidae); de Beaumont, 1949:639 (in revision of Mediterranean *Palarus*), 640 (Egypt), 1962:223 (Saudi Arabia); de Beaumont, Bytinski-Salz, and Pulawski, 1973:17 (Israel); Bohart and Menke, 1976:291 (listed); Guichard, 1980:228 (Oman), 1988:134 (Arabian Peninsula, as *spinolae spinolae*).

*Palarus aurantiacus* Radoszkowski, 1893:68, ♀. Lectotype: ♀, Turkmenistan: Serax (ZMHU), **here designated**, examined. **New synonym.**—F. Morawitz, 1897:151 (redescription); Dalla Torre, 1897:657 (in catalog of world Sphecidae); Myartseva, 1972a:81 (Turkmenistan), 1972b:108 (parasite: *Asiometopia* sp.), 1976:80 (nesting habits); Bohart and Menke, 1976:290 (listed); Kazenas, 1978:139 (in key to Sphecidae of Kazakhstan and Central Asia); Nazarova, 1998:41 (Tajikistan); Kazenas, 2001:32 (in checklist of Sphecidae of Kazakhstan and Central Asia), 165 (review of known biology), 2002:80 (geographic distribution, Kazakhstan); Nazarova, 2005:94 (alfalfa fields in southwestern Tajikistan); Nemkov, 2005:243 (in revision of *Palarus* of Russia and adjacent countries).

*Palarus spinolae niger* de Beaumont, 1949:642, ♀, ♂. Holotype: ♂, Libya: Tripolitania: Gat (MILANO), not examined. **New synonym.**—de Beaumont, 1958:63 (Algeria: Tassili des Ajjer).—Bohart and Menke, 1976:291 (listed).

*Palarus leleji* Nemkov, 2005:243, ♀, ♂. Holotype: ♀, Iran: Ardabil: Unghyut Mugan (ZIN), paratypes examined. **New synonym.**

As *Palarus* sp.: Guiglia, 1939:187 (Libya), corrected to *Palarus spinolae niger* by de Beaumont, 1949:642.

**RECOGNITION.**—The female of *fulviventris* shares with *klugi* and *variegatus* the short genal setae (markedly shorter than the midocellar width), sternum II posterad of the crest and the associated row of setae with a semicircular platform (delimited by obtuse swelling), and the sternum's apical depression shorter than the midocellar width. Unlike *klugi*, the posteroventral mandibular tooth of *fulviventris* is rounded (Fig. 73a) rather than sharp, and the forecoxa has an apicomedian process (Fig. 73b) that is absent in *klugi*. Unlike *variegatus*, the flagellum of *fulviventris* is all or largely yellow or reddish (rather than all or predominantly black). *Palarus rufipes* is also similar, but in *fulviventris* the foretibia is simple and the forebasitarsus is not widened. In *rufipes*, the foretibia is specialized (apicoventral margin emarginate posterad of spur socket, cuticle dark adjacent to emargination, ventral surface, basad of spur, in most specimens with conspicuous, falciform seta, Fig. 90c) and the forebasitarsus is slightly widened (Fig. 90d).

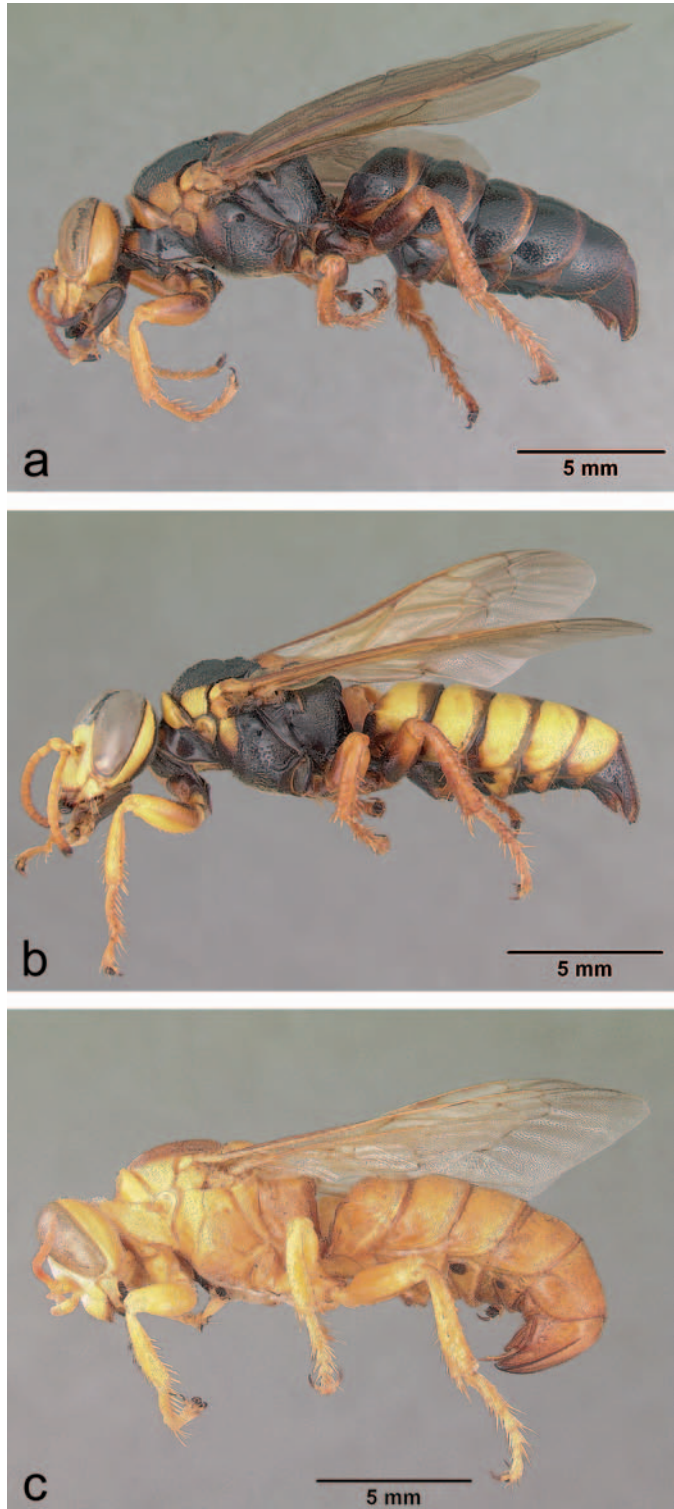
The males of *fulviventris* and the Indian *klugi* share the following characters: a unique mid-basitarsus that is flattened laterally (i.e., markedly higher than wide), with inner surface asetose, slightly concave (Fig. 74c, d); a unique adlateral carina of tergum VII that is broadened and curved



ventrad in basal half (Fig. 75d, e, 82f); and a black, apicoventral spot or series of spots on the foretibial venter (Fig. 74b). The male of *fulviventris* has the flagellar venter more distinctly serrate than *klugi*, flagellomeres II-IX more convex preapically (compare Figs. 74a and 82d), the posteroventral mandibular tooth the usual shape, not produced into a point, apicomedian forecoxal process conspicuous (Fig. 73d) versus short in *klugi* (Fig. 82b), and the lateral pygidial process conspicuous, separated from its opposite by at least the midocellar width (Fig. 75b, d), whereas inconspicuous, separated from its opposite by much less than midocellar width in *klugi* (Fig. 82e).

**TYPE LOCALITY.**—In the original description of *Palarus fulviventris*, Latreille says on the origin of species: “M. Olivier l’a trouvé dans les déserts d’Arabie”. What he called Arabia, however, cannot correspond to the modern Arabian Peninsula. In his detailed report of his travels, Olivier (1801-1807) never mentioned Arabia, but described his visits to Egypt (between Alexandria and Cairo through the Nile), to Syria (Latakia to Aleppo), to Iraq (between Kirkuk and Baghdad), and to Iran (many areas). The species must have been collected in one of these four countries (probably Syria or Iraq), but not in Arabia.

FIGURE 72. *Palarus fulviventris* Latreille: a – female from Algeria in lateral view; b – female from Egypt in lateral view; c – female from Turkmenistan in lateral view.



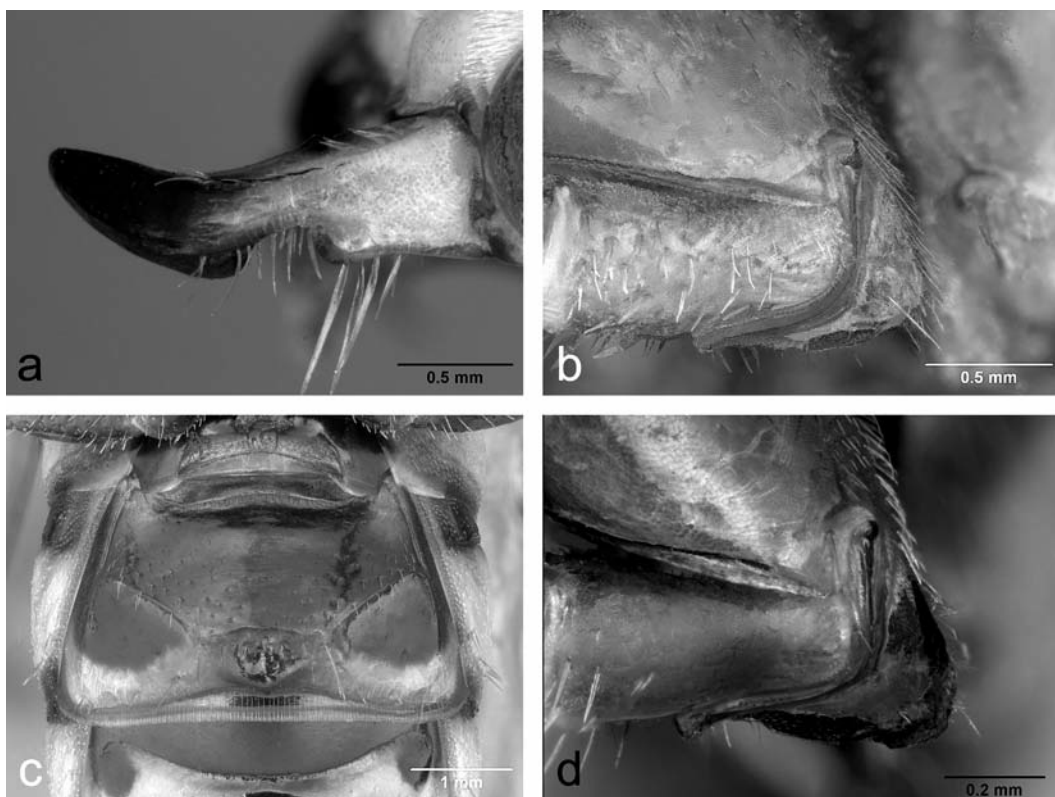


FIGURE 73. *Palarus fulviventris* Latreille: a – female mandible; b – female forecoxal apex; c – female sternum II in ventral view; d – male forecoxal apex.

**JUSTIFICATION OF NEW SYNONYMY.**—*Palarus fulviventris* was described from an unspecified number of males. The type material is apparently lost, but the original description allows unequivocal recognition. Of all *Palarus* occurring in Egypt and the Middle East, only the species currently known as *spinolae* has a combination of a yellowish red antenna with the two apical flagellomeres dark, the male flagellomeres serrate ventrally, and what may be described as a bifid apical gastral segment. These characteristics fit well the original description of *fulviventris* (“les antennes sont comprimées, un peu dentelées en scie à leur arête inférieur, d’un fauve-pâle, avec les deux derniers articles noirâtres”, “le dernier segment est fourchu”). Also, the body length given by Latreille (“un peu plus de six lignes”, i.e., slightly more than 13.5 mm) is within the variation range of this species. We conclude that these two nominal species are conspecific, and we synonymize them. Latreille noted that the metathorax (he probably meant the propodeum) has several maculae, two above and two or three on each side. The specimens from North Africa and Israel have the propodeum all black, whereas the Central Asian specimens have it mostly yellow, while the type or types of *fulviventris* seem to be intermediate in color.

*Palarus aurantiacus* and *leleji* are clearly conspecific with *fulviventris*, as defined above, and are therefore synonyms. Nemkov (2005) thought that *leleji* differed from *aurantiacus* in having a slightly concave lateral side of the female pygidial plate, the posterior margin of male sternum I slightly emarginate (rather than bidentate), and the lateral sides of male pygidial plate diverging posterad (rather than nearly parallel). We have found, however, that both the shape of the female

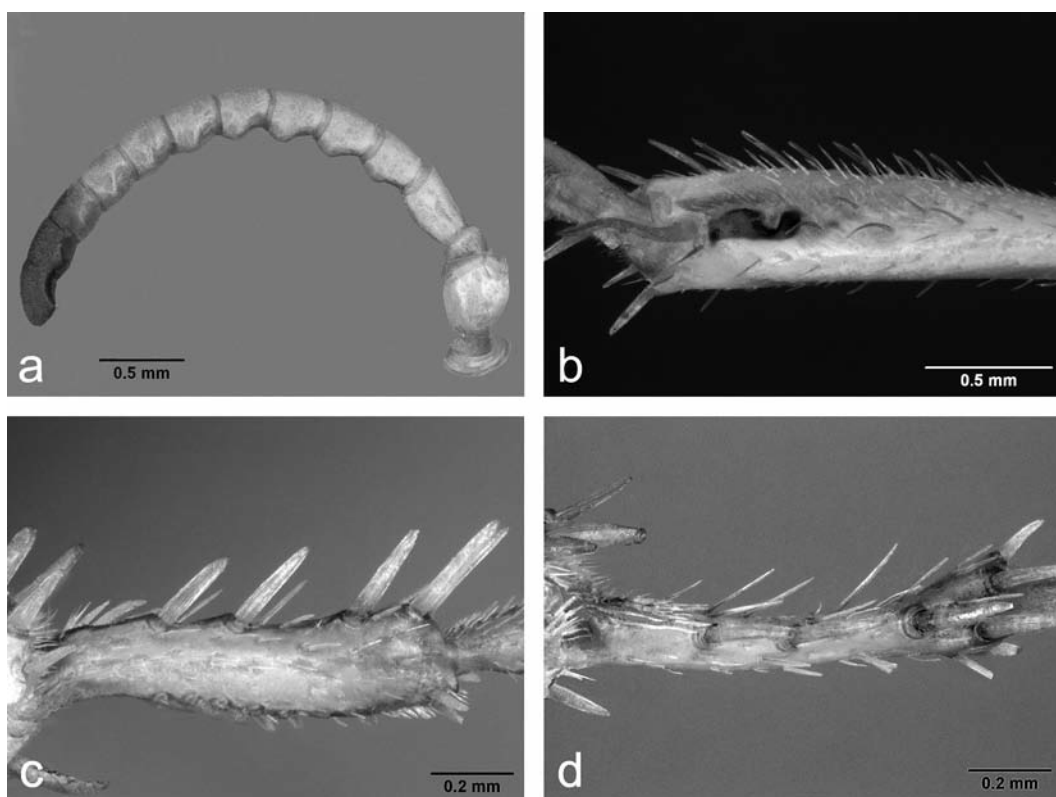


FIGURE 74. *Palarus fulviventris* Latreille ♂: a – antenna; b – foretibial venter; c – midbasitarsus in lateral view; d – midbasitarsus in dorsal view.

pygidial plate and of male sternum I are individually variable. For example, sternum I varies from slightly emarginate to markedly emarginate (bidentate) in Egyptian specimens. The lateral margins of the male pygidial plate are indeed slightly less divergent in specimens from Central Asia than in these from other regions, but we regard it as geographic variation.

*Palarus spinolae niger* was described for a dark form of *fulviventris*. Given the amount of color variation in *fulviventris*, we expect this form to be connected by intermediates to the typical form, and we synonymize these names as well.

**LECTOTYPE SELECTION.**— The original description of *aurantiacus* does not indicate the number of the specimens studied. The only original specimen now in existence may therefore be the holotype or one of the syntypes. We have designated it as the lectotype.

**TYPE DEPOSITORY OF PALARUS SPINOLAE.**— The type specimens of *Palarus spinolae* are probably lost. They are not represented in de Saussure collection in Geneva, Switzerland (Bernhard Merz's e-mail of 3 May 2006), nor are they listed in the catalog of Spinola collection in Torino, Italy, by Casolari and Casolari Moreno (1980).

**DESCRIPTION.**— Least interocular distance about  $1.3\text{--}1.5 \times$  midocellar width in female,  $1.3\text{--}1.6 \times$  in male. Occipital carina separated from eye outer margin by more than hindocellus length. Anterior margin of precoxal mesopleural declivity with angulate prominence (prominence rudimentary in some specimens). Propodeal side aciculate anteriorly in many specimens, remainder ridged (ridges inconspicuous in some specimens).

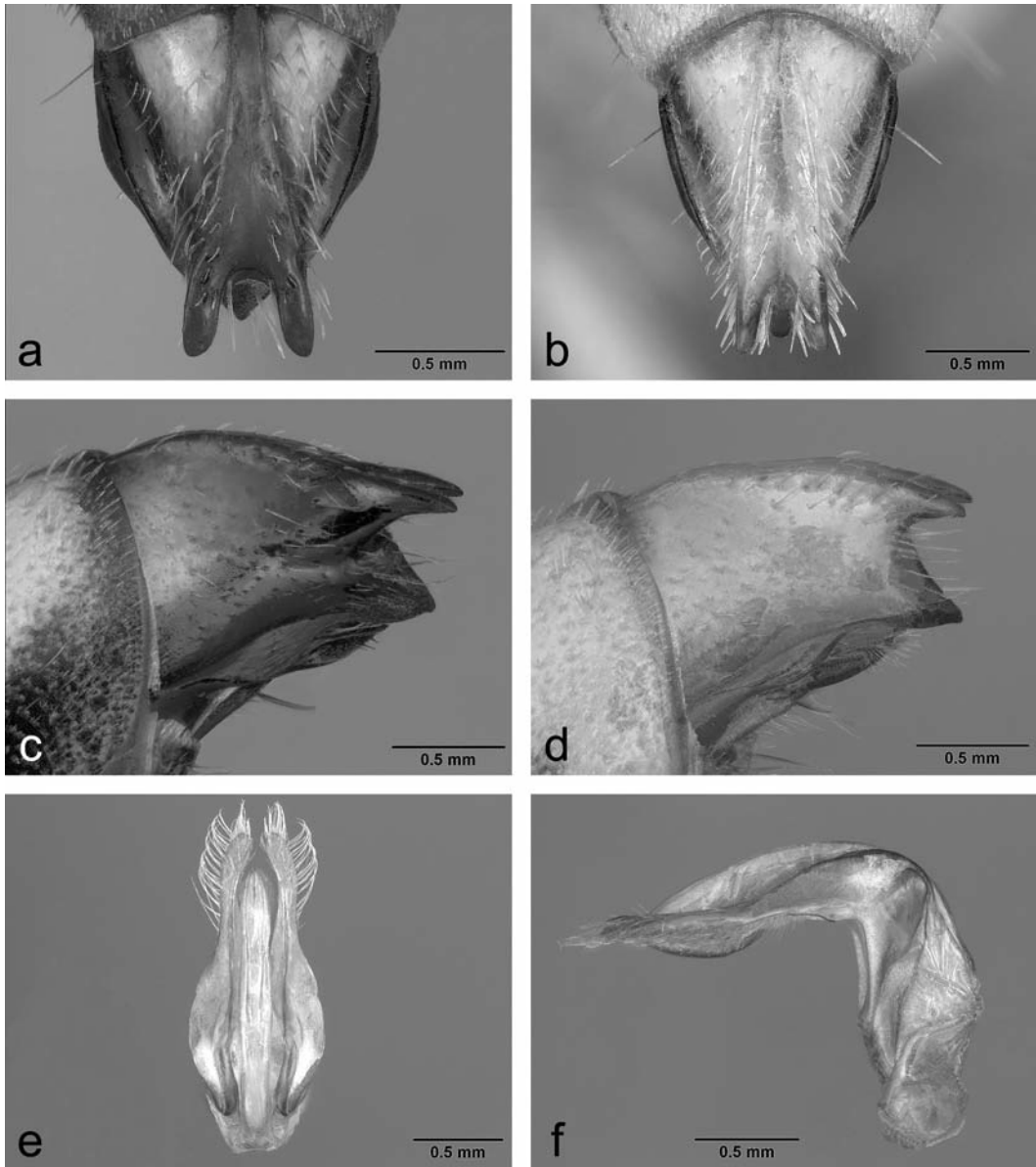


FIGURE 75. *Palarus fulviventris* Latreille ♂: a – tergum VII in dorsal view, specimen from Egypt; b – tergum VII in dorsal view, specimen from Uzbekistan; c – tergum VII in lateral view, specimen from Egypt; d – tergum VII in lateral view, specimen from Uzbekistan; e – genitalia in dorsal view; f – genitalia in lateral view.

Clypeus and at least ventral half of frons yellow, remaining body parts markedly varying in color (see Color Variation below). Male foretibia with black apicoventral spot or a series of spots.

♀.— Genal setae not sinuous, markedly shorter than midocellar width. Dorsal length of flagellomere I  $1.9\text{--}2.2 \times$  apical width. Forecoxa with apicomedian process. Adlateral carina of tergum I gradually effaced posterad. Fine ridges of pygidial plate somewhat irregular to irregular, clearly diverging from midline. Sternum II (Fig. 73c): transverse crest simple (most specimens) or serrate;



posterad of transverse crest (and associated row of setae) with semicircular platform delimited by obtuse swelling, apex of swelling separated from setae by more than midocellar width; apical depression shorter than midocellar width; swelling that borders apical depression extending to each lateromedian angle of crest, without sharp tubercle. Length 14.6-20.0 mm.

♂.—Free margin of medioclypeus almost straight. Genal setae not sinuous, longest ones about equal to midocellar width. Longest setae between mandibular condyle and notch more than midocellar width. Dorsal length of flagellomere I  $2.0-2.2\times$  apical width; venter of flagellomere I convex preapically, of flagellomeres II-X concave and unsculptured basally and convex preapically, with some erect setae on preapical flagellomeres (Fig. 74a); venter of flagellomeres II and III with small, glabrous area between setal patch and apical margin. Venter of apical flagellomere basally concave and unsculptured. Mesopleural setae behind episternal sulcus straight, markedly shorter than midocellar width. Mesothoracic venter, before precoxal sulcus, with most punctures many diameters apart, with setae shorter than those on ventral portion of preepisternum. Metasternum largely asetose (setae present only laterally). Forecoxa apicomeresally expanded into narrow platform that is delimited by carina and largely glabrous on outer surface, apicomedian setae not denser than on remaining surface. Foretibia with black, elongate apicoventral spot on venter (Fig. 74b), spot broken into several spots in many specimens. Midcoxal venter flattened, densely to sparsely punctate. Midtibial spur curved, short (about  $0.25\times$  length of midbasitarsus or less). Midbasitarsus flattened laterally, curved in dorsal view, ventrally with row of spines that are closely spaced in basal half (Fig. 74c, d). Midtarsomeres II and III ventrally each with inconspicuous, transverse, glabrous area between setal patch and apical margin. Tergum V without adlateral tooth or tubercle. Tergum VI with adlateral swelling that in some specimens is modified into adlateral carina. Tergum VII: pygidial plate (Fig. 75a, b) largely flat (slightly concave in Central Asian specimens), emarginate apically, markedly raised above tergal apex: lateral pygidial process separated from tergal apex by more than midocellar width (Fig. 75a, b); pygidial carinae diverging posterad (greatest width of plate  $0.3-0.4\times$  length); lateral pygidial process widest anteriorly, processes not connected medioventrally by V-shaped carina; adlateral carina, in anterior half, with ventrally oriented flange (Fig. 75c, d); ventral margin concealed in lateral view (except anteriorly); setae sparse, longest and densest ventrad of lateral pygidial process (Fig. 75c, d), not upcurved at tergal apex. Sternum II with transverse ridge before elevation, anterior margin of elevation obtuse and posterior margin either simple or with rudimentary, obtuse teeth. Sternum V with punctures that are several to many diameters apart, associated setae inconspicuous. Sternum VI with punctures that are approximately 2-4 diameters apart, with setae straight, suberect to erect; adlateral carina well raised relative to ventral margin of tergal VI, obtusely to acutely pointed posteriorly in some specimens. Gonocoxite without sclerotized lobe adjacent basoventrally to membranous area (Fig. 75f), apically with conspicuous setae (Fig. 75e). Length 13.6-20.4 mm.

**COLOR VARIATION** (Fig. 72a-c).—*Palarus fulviventris* varies significantly in color, most variation being geographic. Details are given below:

The darkest specimens (Fig. 72a) occur in Morocco (Mhamid), Algeria (Djanet), and southwestern Libya (Ghat). These populations represent the western portion of the species range and were recognized as the subspecies *spinolae niger* de Beaumont, 1949. Here, the flagellum is reddish yellow, with a varying number (minimum two) of apical flagellomeres darkened. The rest of the head is black except for yellow lower half of the frons and anterior gena. The thorax and propodeum are all black except the following are reddish yellow: pronotal lobe, scutum anterolaterally, and upper preepisternal area of the mesopleuron, in the male also the pronotal collar (all or only laterally), and in most males the scutellum is reddish. The wings are conspicuously infumate in the cellular area, the mid- and hindfemora are black (except apically); also part of the forefemur

is black; and the tibiae are yellow to brown. The terga are black except dark reddish apical depressions.

Egyptian and Israeli specimens (Fig. 72b), and those from northern Iran (including the type series of *leleji*), are significantly lighter. The antennae are reddish yellow, with the apical two flagellomeres dark, almost black. The rest of the head is black except for yellow lower half of the frons and anterior gena. The following are yellow on the thorax and propodeum: pronotal lobe and collar, scutum anterolaterally, scutellum, and metanotum (scutellum and metanotum reddish yellow to black in some specimens), and in some specimens a pair of reddish lateral spots on the propodeal dorsum. The wings are moderately infumate, the mid- and hindfemora are yellow or with darkened dorsum, and the tibiae are yellow. The terga are yellow except brownish apical depressions.

The lightest specimens occur in Tunisia, southern Iran, Central Asia, and western China (Fig. 72c). In some of these, the entire body (including the flagellum) is yellow except for the black ocellar triangle and some reddish brown, but in some others most of the scutum and the propodeal dorsum mesally are red or black, the occiput, part of the pronotum, and anterior part of terga are black, and some sterna have black spots. The wings are almost hyaline. In the single female from Tunisia, the entire body (including the flagellum) is yellow, except the following are black: ocellar triangle, scutum anteromesally and posteroadlaterally (part of scutum reddish), mesothoracic side along metapleural sulcus, and propodeal side anteriorly and propodeal posterior surface mesoventrally.

**PREY.** — The specimen from Talimarjan, Uzbekistan, is labeled (in Russian): “captured with paralyzed *Anthidium*”.

**COLLECTING PERIOD.**— Algeria: 19-29 May and June; Egypt: 20 April through 18 May and 13 October; Iran: 29 June through 1 July; Israel 10 May – 23 June; Libya: September; Morocco: 16 May; Oman: 30 March; Saudi Arabia: January and March through 19 August; Tajikistan: 22-26 May; Turkmenistan: 17 and 23 May, 1-29 June, 8-11 July; United Arab Emirates: March through May and July; Uzbekistan: 12-16 June, 17 July, and 30 August.

**GEOGRAPHIC DISTRIBUTION** (Fig. 76).— North Africa, Israel, Arabian Peninsula, Iran, Central Asia (southern Kazakhstan, Tajikistan, Turkmenistan, Uzbekistan), western China.

**RECORDS.**— **ALGERIA:** Djanet (3 ♀, 6 ♂, CAS; 8 ♀, 12 ♂, OÖLM). **CHINA:** Xinjiang: Bugas near

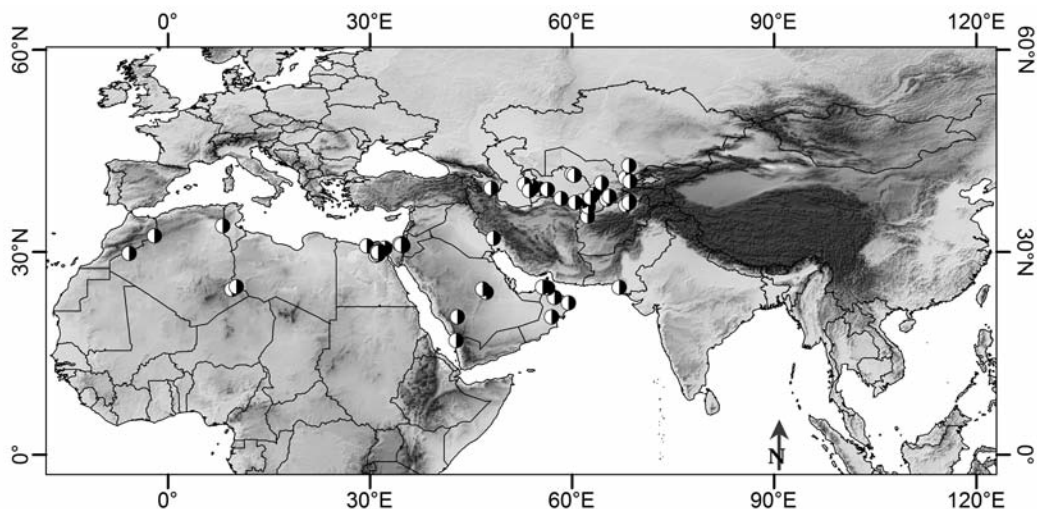


FIGURE 76. Collecting localities of *Palarus fulviventris* Latreille.

Hami which is about 42.5°N 93°E (1 ♀, ZIN). **EGYPT: Al Fayyum:** Kom Osheim (1 ♀, 3 ♂, CAS). **Al Iskanderiyah** (= Alexandria): Burg-el-Arab (1 ♂, USU). **Al Ismailiyah:** Ismailiah (de Beaumont, 1949). **Al Jizah** (= Ghiza): Abu Rawash (1 ♂, CAS; 3 ♂, USNM), Ghiza (2 ♀, 17 ♂, CAS; 1 ♂, RMNH), Hawamdieh (Honoré, 1941), Kafr Farouk = Ein Shams (3 ♂, USNM), Kafr Hakim (1 ♀, AMNH). **Al Qahirah** (= Cairo): Abbasiyah (de Beaumont, 1949), Gebel Asfar (1 ♀, 2 ♂, SAM), Kerdasah (de Beaumont, 1949), Maadi (1 ♂, CAS; 1 ♂, MS; 1 ♂, SAM; 1 ♀, USNM). **IRAN:** Haft Tapeh 300 km N Abadan (1 ♀, CAS), Unghyut Mugan in Ardabil Province (1 ♀, 1 ♂, ZIN, paratypes of *leleji*). **ISRAEL** (de Beaumont, Bytinski-Salz, and Pulawski, 1973, or as indicated): Beersheba, Gvulut, Revivim (1 ♂, CAS), Kfar Yeroham (1 ♂, CAS; 1 ♂, RMNH, as Bir Rehme). **KAZAKHSTAN: South Kazakhstan:** 30 km S Chardara (Kazenas, 2002), Timur railway station ca 42°50'N 68°30'E (1 ♀, KRAKÓW). **LIBYA: Fezzan:** Ghat (Guiglia, 1939; de Beaumont, 1949, as Gat). **MOROCCO:** 10 km S Bouarfa (1 ♂, OÖLM), Mhamid (1 ♂, OÖLM). **OMAN:** Al Minjal al Film 350 km S Muscat (1 ♂, CSE), Rostaq (Guichard, 1980), Sur (Guichard, 1980). **PAKISTAN:** Karachi (1 ♀, BMNH). **SAUDI ARABIA:** Abu Arish (Guichard, 1988), Al Kharj (Guichard, 1988), Beish (Guichard, 1988), El Riyadh (de Beaumont, 1960; Guichard, 1988). **TAJIKISTAN:** Ayvadj (2 ♀, ZIN), 10 km NE Garavuty on Vakhsh River (1 ♂, CAS), Djilikul (3 ♂, ZIN), Tigrovaya Balka Nature Reserve (Nazarova, 1998), near Yanghiabad on Vakhsh River (1 ♂, CAS). **TUNISIA:** Tozeur (1 ♀, MS). **TURKMENISTAN** (M = Myartseva, 1972a; N = Nemkov, 2005): Akhcha Kuyma (1 ♀, CAS), Askhabad (1 ♂, OÖLM; 1 ♀, ZIN; 1 ♀, 1 ♂, ZMMU), Badhyz Nature Reserve (1 ♂, CAS; 1 ♂, ZMMU), Bederkent in Takhta-Bazar District (1 ♀, 3 ♂, ZIN), Djebel (1 ♀, CAS; 2 ♀, ZIN), Farab (1 ♀, ZIN), Imam Baba (1 ♂, ZIN), Karabata (1 ♂, ZMMU), Kara Bogaz 40km N Kizil Arvat (1 ♀, 1 ♂, ZIN), Kerki (N), Krasnovodsk (6 ♂, ZIN), Repetek (3 ♀, ZIN; 2 ♀, 1 ♂, ZMMU), lower Tedjen River (M), Uch-Adji (1 ♀, ZIN), Uzun-Ada (M). **UNITED ARAB EMIRATES** (Guichard, 1988): Hatta, Shweib-Madam Road. **UZBEKISTAN:** Bag Abzal 50 km N Bukhara (2 ♂, CAS), Golodnaya Step' railway station [later renamed Mirzachel' and then Gulistan] ca 40°30'N 68°40'E (2 ♂, KRAKÓW), Khiva (2 ♂, CAS; 1 ♀, 6 ♂, ZIN)), Khiva: Ravat (1 ♂, ZIN), near Talimarjan (1 ♀, ZMMU).

### *Palarus gao* Pulawski and Prentice, sp. nov.

Figures 34, 77, 78.

**DERIVATION OF NAME.**— *Gao*, a medieval town on the southern outskirts of Sahara in Mali; a noun in apposition to the generic name.

**RECOGNITION.**— The female of *gao* has a distinctive sternum II (Fig. 77a-c): the crest has three well-defined teeth, the platform behind crest is not delimited basally, and its apex is narrower than in *fulviventris* and *variegatus* (compare Fig. 77a with 73c and 98c, d).

The male has genal setae straight (rather than sinuous) and markedly shorter than the midocellar width, the pygidial plate markedly emarginate apically (fig. 77e), midtibial spur present, and the midbasitarsus not flattened (about as wide as high). Like *fulviventris* and unlike *variegatus*, it has an acute apicomedian forecoxal prominence. Other features of *gao* that differentiate it from *variegatus* are: midcoxa with posteroventral carina or well-developed tubercle (lacking in *variegatus*); midtarsomere II with cluster of posteroventral spines (cluster lacking); adlateral carina of tergum VII double-edged in posterior half (rather than simple), microridged between edges (Fig. 77f); adlateral carina of sternum VI not pointed posteriorly whereas pointed in most *variegatus*, and antenna all or predominantly yellow or orange-yellow dorsally (Fig. 77d) rather than all or predominantly black.

**DESCRIPTION.**— Least interocular distance about 1.7-1.9 midocellar width in female, 1.4 × in male. Occipital carina separated from eye outer margin by more than hindocellus length. Anterior margin of precoxal mesopleural declivity with angulate prominence. Propodeal side microareolate or unsculptured anteriorly, remainder ridged. Forewing slightly infumate.

Figures yellow in ventral half, yellow extending mesally to midocellus in female; gena all yellow in female (black behind postocellar area in specimen from Niger), with macula above mid-height in male; scape and pedicel yellow in female, brown to black ventrally in male (scape with

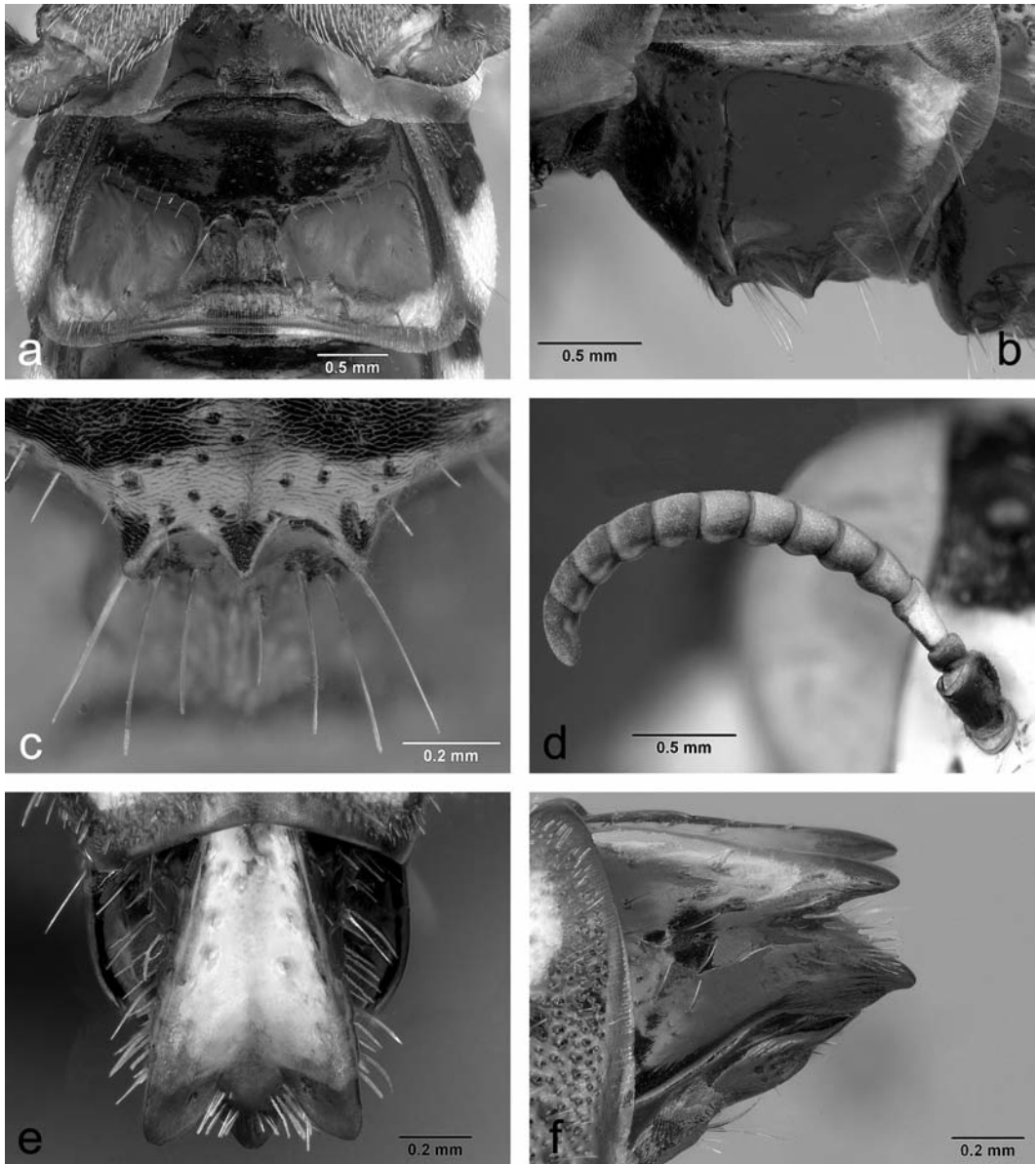


FIGURE 77. *Palarus gao* Pulawski and Prentice, sp. nov.: a – female sternum II in ventral view; b – female sternum II in lateral view; c – center of female sternum II in ventral view; d – male antenna; e – male tergum VII in dorsal view; f – male tergum VII in lateral view.

some yellow in some specimens); flagellum yellow or orange-yellow dorsally, brown ventrally, except flagellomere I yellow (only partly so in male). Pronotal collar and lobe yellow, also pronotum anteriorly in female. Thorax and propodeum black except the following are yellow: scutum anterolaterally, scutellum and scutellar flange, axilla, metanotum, mesopleuron largely in female, preepisternal area dorsally in male (also episcrobal area in some specimens), in female also propodeal dorsum (black mesally in some specimens). Wing membrane nearly hyaline basally,



infumate apically. Femora largely yellow, but forefemur black dorsally (except apex) and in most specimens reddish anteriorly, midfemur black dorsally (except apex) and reddish anteriorly, hindfemur red or black basally, yellow apically; tibiae yellow; tarsi brown. Terga nearly all yellow (black basally, including basal declivity of tergum I), but side of tergum VI in male and most females and male tergum VII black.

♀.— Genal setae sparse, shorter than midocellar width. Dorsal length of flagellomere I  $1.8-2.0 \times$  apical width. Adlateral carina of tergum I low, gradually effaced posterad. Fine ridges of pygidial plate uniform, diverging posterad near margin. Sternum II: transverse crest with three teeth (Fig. 77a-c); posteromedian concavity (posterad of crest and associated row of setae) with median platform that is not delimited basally; swelling that borders apical depression ill defined, without sharp tubercle laterally (Fig. 77a). Length 13.0-14.2 mm.

♂.— Free margin of medioclypeus slightly arcuate. Genal setae markedly shorter than midocellar width. Longest setae between mandibular condyle and notch about equal to midocellar width. Dorsal length of flagellomere I  $1.8-1.9 \times$  apical width; venter of flagellomeres II-X convex preapically (Fig. 77d), apical flagellomeres with some short, erect setae. Mesopleural setae behind episternal sulcus not sinuous, markedly shorter than midocellar width. Mesothoracic venter, before precoxal sulcus, with most punctures 2-3 diameters apart and setae as long as those on ventral portion of preepisternum. Metasternum setose. Forecoxa apicomesally expanded into narrow platform that is delimited by carina, apicomedian setae not denser than on remaining surface. Midtibial spur short (about  $0.25 \times$  length of midbasitarsus), slightly curved. Midbasitarsus not curved nor flattened, ventrally with row of widely spaced spines; midtarsomere II in some specimens with cluster of posteroventral spines. Tergum V without adlateral tooth or tubercle. Tergum VI without adlateral carina or swelling. Tergum VII: pygidial plate (Fig. 77e) somewhat concave, emarginate apically, markedly raised above tergal apex (lateral pygidial process separated from tergal apex by more than midocellar width); pygidial carinae diverging posteriorly (plate's greatest width about  $0.5 \times$  length); lateral pygidial process widest anteriorly, processes not connected medioventrally by V-shaped carina; adlateral carina expanded anteriorly, double-edged in posterior half, integument ridged between edges (Fig. 77f); ventral edge of tergum concealed in lateral view; setae sparse, longest and densest (but not upcurved) ventrad of lateral pygidial process, not upcurved at tergal apex. Sternum II with transverse ridge before elevation, anterior margin of elevation obtuse, posterior margin a simple carina. Sternum V with punctures averaging several to many diameters apart (a few punctures may be about one diameter apart); associated setae inconspicuous. Sternum VI with punctures that are approximately 2-4 diameters apart; setae straight, suberect to erect; adlat-

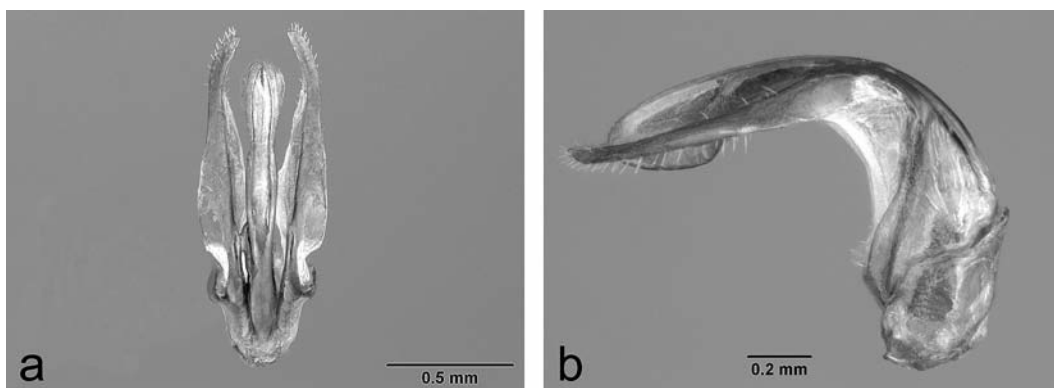


FIGURE 78. *Palarus gao* Pulawski and Prentice, sp. nov. ♂: a – genitalia in dorsal view; b – genitalia in lateral view.

eral carina somewhat raised relative to ventral margin of tergum VI, not sharply pointed posteriorly. Gonocoxite with narrow, sclerotized lobe adjacent basoventrally to membranous area (Fig. 78b), apically with short, inconspicuous setae (Fig. 78a). Length 11.0-11.7 mm.

**GEOGRAPHIC DISTRIBUTION** (Fig. 34).— Burkina Faso, Mali.

**RECORDS.**— **HOLOTYPE:** ♂, Mali: 25 km E Hombori, 18 Aug 1991, W.J. Pulawski (CAS). **PARATYPES:** **BURKINA FASO:** 15 km SE Gorom Gorom at 14°21.4'N 0°07.9'W, 28 July 2004, Sidiki Konaté and W.J. Pulawski (1 ♀, 1 ♂, CAS); 4 km NW Ouahigouya at 13°37.0'N 2°27.6'W, 9 July 2004, M.H. Bourbin and W.J. Pulawski (1 ♀, BMHN; 1 ♀, CAS; 1 ♂, OHL); same locality, 6-7 Aug 2004, Sidiki Konaté and W.J. Pulawski (2 ♀, 2 ♂, CAS). **MALI:** 180 km SW Gao, 13 Aug 1991, M. Schwarz (1 ♂, MS), 10 km S Mopti, 7 Aug 1991, W.J. Pulawski (1 ♂, CAS). **NIGER: Agadez Region:** 30 km S Agadez at 16°39.0'N 7°56.9'E, 7 Aug 2005, Madougou Garba and W.J. Pulawski (2 ♀, CAS). **Tillabéri Region:** 8 km SE Kollo at 13°16.4'N 2°22.0'E, Madougou Garba and W.J. Pulawski (1 ♀, CAS).

***Palarus jaxartes* Pulawski and Prentice, sp. nov.**

Figures 79-81.

**DERIVATION OF NAME.**— *Jaxartes* (ὁ Ἰαξάρτης), the ancient Greek name of Syr Darya River, near which the first specimen was collected; a noun in apposition to the generic name.

**RECOGNITION.**— Like *bernardi* and *dongalensis*, *jaxartes* has sinuous genal setae, many of which are longer than the midocellar width.

In the female, sternum II has a short, transverse platform posterad of transverse crest and associated row of setae (the platform is ill defined in several specimens from Repetek, Turkmenistan); the platform's length is markedly smaller than midocellar width; also, the apical depression of the sternum is about as long as the midocellar width (Fig. 80a, b). A similar sternum occurs elsewhere only in *saundersi* in which the genal setae are straight, shorter than one midocellar width. In addition, the least interocular distance is almost equal to midocellar width in *jaxartes* and 0.6-0.7 × midocellar width in *saundersi*.

The male of *jaxartes* shares with *saundersi* the forebasitarsal venter with a black preapical, longitudinal spot; the midtibia without spur (also absent in *bernardi*); a lamellar, translucent, circular pad on the venter of midtarsomeres II and III (pad also present in *arabicus*, *oneili*, and *saundersi*); and the adlateral carina of tergum VII not expanded, the tergum thus appearing double-edged (Fig. 79f). The male of *jaxartes* differs from that of *saundersi* in the following (in addition to having sinuous genal setae): the punctures of the mesothoracic venter are 1-4 diameters apart (many diameters apart in *saundersi*), the adlateral carina of tergum V is present only posteriorly (extends over nearly the entire exposed length of the tergum in *saundersi*), the pygidial plate is broadly emarginate apically (Fig. 79e) whereas narrowly emarginate in *saundersi*, and the elevation of sternum II is not carinate and not serrate, whereas sharply carinate anteriorly and serrate posteriorly in *saundersi* (Fig. 95a, b).

**DESCRIPTION.**— Least interocular distance about 0.9 × midocellar width in both sexes. Occipital carina separated from eye orbit at vertex by more than hindocellar length in female, by hindocellar length or slightly more in male. Anterior margin of precoxal mesopleural declivity without angulate prominence. Propodeal side unridged, punctate except anteriorly.

Frons yellow to above midheight, gena yellow adjacent to orbit to above midheight or more in female, black in male; mandibular posterior margin dark basally in male; scape yellow, pedicel brown or yellow, flagellum yellow dorsally, darkened ventrally. Pronotum yellow except black mesally behind streptaulus in female, in male black except anterior rim, collar, and pronotal lobe yellow; scutum yellow laterally in female, anterolaterally in male; scutellum, scutellar flange, and metanotum yellow; mesopleuron, metapleuron, and propodeum largely yellow in female, in male

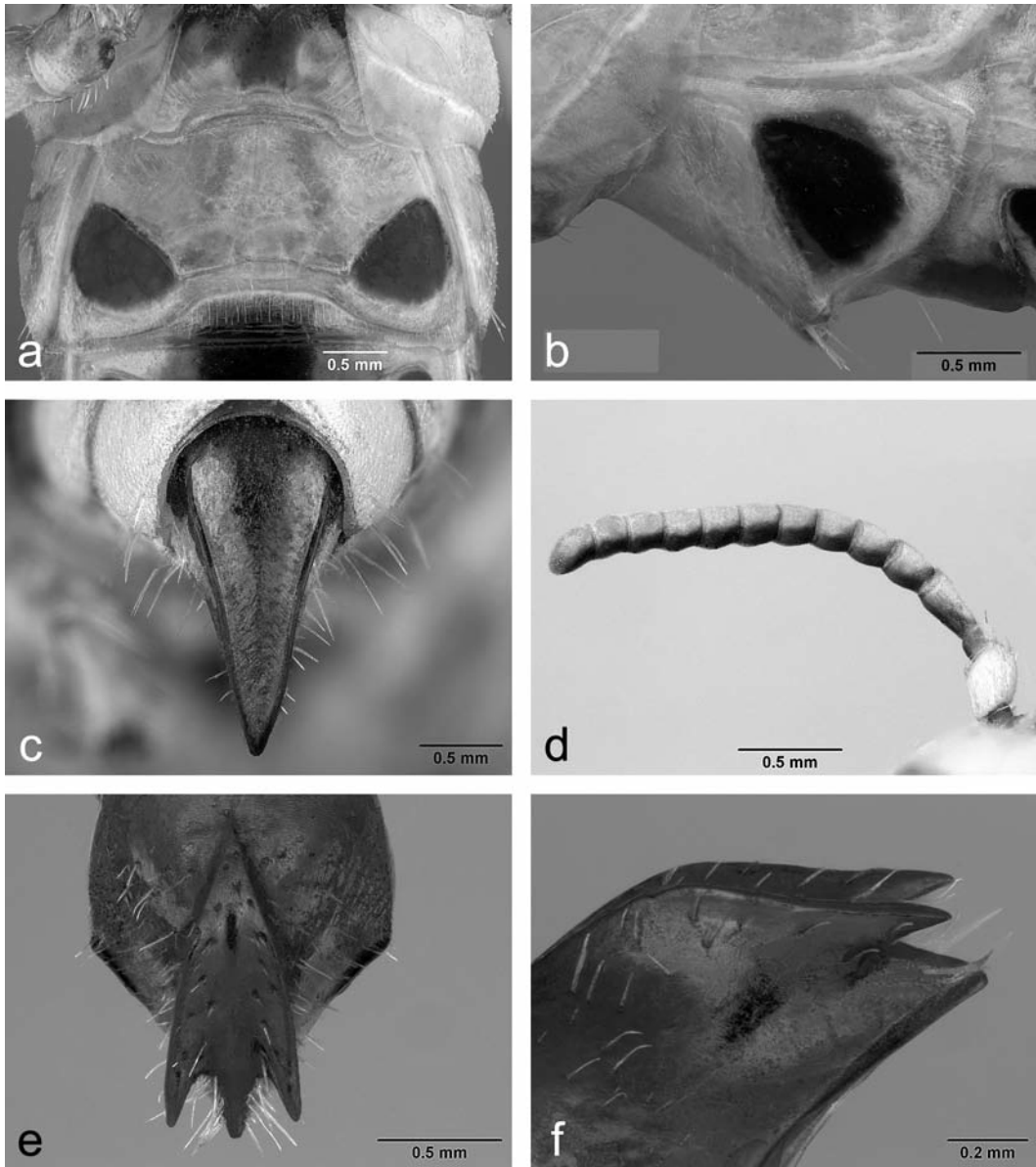


FIGURE 79. *Palarus jaxartes* Pulawski and Prentice, sp. nov.: a – female sternum II in ventral view; b – female sternum II in lateral view; c – female pygidial plate in dorsal view; d – male antenna; e – male tergum VII in dorsal view; f – male tergum VII in lateral view.

mesopleuron varying from mostly black (only preepisternal area dorsally yellow) to all yellow, and side of propodeal dorsum yellow (also propodeal side largely in one specimen from Repetek). Wing membrane nearly hyaline. Femora, tibiae, and tarsi yellow (female femora yellowish brown). Terga yellow except apical tergum black in both sexes.

♀.— Genal setae sinuous, some longer than midocellar width. Dorsal length of flagellomere I  $2.1 \times$  apical width. Adlateral carina of tergum I gradually effaced posterad. Lateral margin of

pygidial plate slightly concave at about midlength, but practically straight in specimens from Uch-Adzhi. Ridges of pygidial plate irregular, markedly diverging posterad from midline (Fig. 79c). Sternum II (Fig. 79a, b): transverse crest simple; posterad of transverse crest (and associated row of setae) with short, transverse platform whose posterior margin is linear, obtuse laterally, sharp in mesal third or more; distance between crest and platform's posterior margin markedly smaller than midocellar width; apical depression longer than midocellar width; swelling that borders apical depression extending to lateromedian angle of crest, without sharp tubercle. Length 12.0-13.5 mm.

♂.— Free margin of medioclypeus slightly arcuate. Genal setae sinuous, some longer than midocellar width. Longest setae between mandibular condyle and notch about equal to midocellar width. Dorsal length of flagellomere I  $2.4 \times$  apical width; venter of flagellomeres I and II inconspicuously convex preapically, of flagellomeres III-IX slightly convex (Fig. 79d). Mesopleural setae behind episternal sulcus sinuous, about as long as midocellar width. Mesothoracic venter, before precoxal sulcus, with most punctures two to three diameters apart, with setae about as long as those on ventral portion of preepisternum. Metasternum largely asetose (setae present only laterally). Forecoxa without apicomedian platform, without dense apicomedian setae. Forebasitarsal venter with small black, preapical spot, in specimen from Karak with row of a few erect setae adjacent to posterior margin on about apical third. Midcoxal venter flattened, unsculptured except for a few, sparse punctures, with inconspicuous preapical tubercle, posteroventral carina reduced to ill-defined swelling. Midtibial spur absent. Midbasitarsus neither curved nor flattened, ventrally with somewhat irregular row of spines. Midtarsomeres II and III with apicoventral, translucent, circular pad (as in Fig. 84e). Tergum V with short, obtuse, posteriorly situated adlateral carina. Tergum VI with long adlateral swelling (extending over most of exposed tergal length). Tergum VII: pygidial plate (Fig. 79e) concave, emarginate apically, raised above tergal apex (lateral pygidial process separated from tergal apex by more than midocellar width); pygidial carinae diverging posterad (greatest width of plate about  $0.5 \times$  length); lateral pygidial process widest anteriorly, processes not connected ventrally by V-shaped carina; side of tergum not markedly concave; adlateral carina evenly curved, not expanded (Fig. 79f); ventral margin of tergum close to adlateral carina, but largely visible in lateral view; carina in posterior half produced into minimal, ventrally oriented flange; setae longest on sides and ventral apex of lateral pygidial process, not upcurved at tergal apex (Fig. 79f). Sternum II without transverse ridge before elevation, anterior margin of elevation obtuse and posterior margin undulating, with inconspicuous, obtuse teeth in specimen from Karak. Sternum V with a few inconspicuous punctures and setae. Sternum VI, on disk, with minute punctures that are many diameters apart; associated setae inconspicuous, straight; adlateral carina short, somewhat

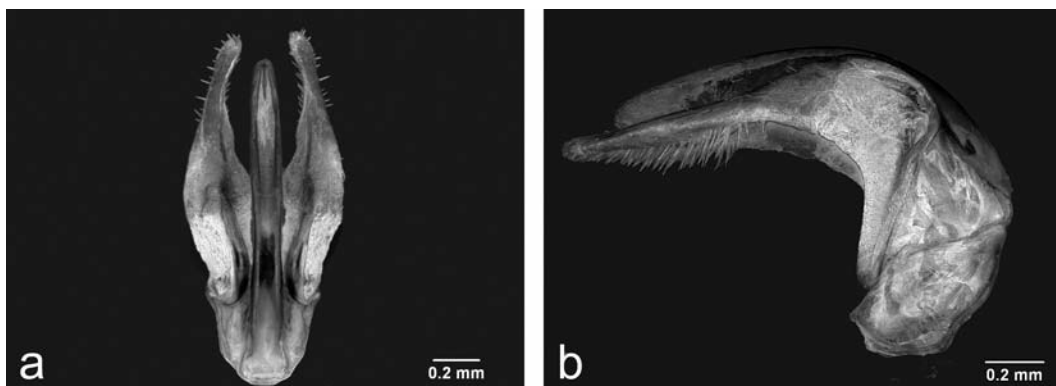


FIGURE 80. *Palarus jaxartes* Pulawski and Prentice, sp. nov. ♂: a – genitalia in lateral view; b – genitalia in dorsal view.



raised relative to ventral margin of tergum VI, not acutely pointed posteriorly. Gonocoxite with narrow sclerotized lobe adjacent basoventrally to membranous area (Fig. 80a), apically with short but conspicuous setae (Fig. 80b). Length 12.5-12.8 mm.

**GEOGRAPHIC DISTRIBUTION** (Fig. 81).—Kazakhstan, Turkmenistan.

**RECORDS.**—**HOLOTYPE:** ♀, Kazakhstan: Chardara (1 ♀, KRAKÓW, ex coll. Radoszkowski). **PARATYPES:** **KAZAKHSTAN: South Kazakhstan:** Karak (= Karak Tau or Karak Hill) ca 120 km N Chardara (1 ♂, KRAKOW, ex coll. Radoszkowski). The labels of the two specimens from Kazakhstan are typical of A.P. Fedtchenko material. He visited Chardara on 25 April 1871, and Karak on 6-7 May 1871 of the Julian calendar (Fedtchenko, 1871). **TURKMENISTAN:** Charjow, no date, G. von Rennekampff (1 ♀, RMNH, as Tschardschui); Repetek, 14 May 1990, A. Shatalkin (1 ♂, CAS; 1 ♀, 1 ♂, ZMMU); 3 km SE Repetek, 13 May 1990, V.L. Kazenas (1 ♀, 1 ♂, CAS); Uch-Adzhi, 1-3 May 1929, A. Shestakov (1 ♀, CAS; 3 ♀, ZIN); same locality, 10 May 1908, V. Sovinskiy (1 ♀, ZIN).

### *Palarus klugi* Menke

Figures 81-83.

*Palarus indicus* Nurse, 1903:4, ♂, junior secondary homonym of *Palarus indicus* (Gmelin, 1790). Holotype: ♂, India: Gujarat: Disa = Deesa (BMNH), examined. **New synonym.**—Turner, 1911:480 (probably a subspecies of *Palarus dongalensis*); Ramakrishna Aiyar, 1916:553 (in catalog of Indian aculeates described after Bingham, 1897); Turner, 1917:194 (India: Disa, Pusa).

*Palarus klugi* Menke in Bohart and Menke, 1976:291. Substitute name for *Palarus indicus* Nurse, 1903.

**RECOGNITION.**—The female of *klugi* shares with *fulviventris* the short genal setae (markedly shorter than the midocellar width), sternum II posterad of the crest and associated row of setae with a semicircular platform (delimited by obtuse swelling), the sternum's apical depression shorter than the midocellar width, and the flagellum yellow basally, orange yellow apically. Unlike *fulviventris*, the posteroventral mandibular tooth of *klugi* is sharp (Fig. 82a), rather than rounded, and the forecoxa has no apicomedian process (process present in *fulviventris*). Also, *klugi* occurs in southern Pakistan and India, whereas *fulviventris* ranges from North Africa to Kazakhstan and Tajikistan.

The male of *klugi* and that of *fulviventris* share the following unique characters: the midbasitarsus flattened laterally (i.e., markedly higher than wide), with the inner surface asetose, slightly concave (as in Fig. 74c, d), the adlateral carina of tergum VII broadened and bent ventrad in its basal half (Fig. 82d), and the foretibia with a black apicoventral mark (a series of such marks may be present in *fulviventris*). The male of *klugi* differs from *fulviventris* in having the flagellar venter less distinctly serrate, flagellomeres II-IX less convex preapically (compare Figs. 74a and 82d), the posteroventral mandibular tooth produced into a ventrally (= posteriorly) directed point, apparently unique among the apoid wasps (Fig. 82c), apicomedian forecoxal process short (conspicuous in *fulviventris*), the lateral pygidial process inconspicuous, separated from its opposite by much less than midocellar width (Fig. 82e), whereas in *fulviventris* the lateral process are conspicuous, separated from its opposite by at least midocellar width.

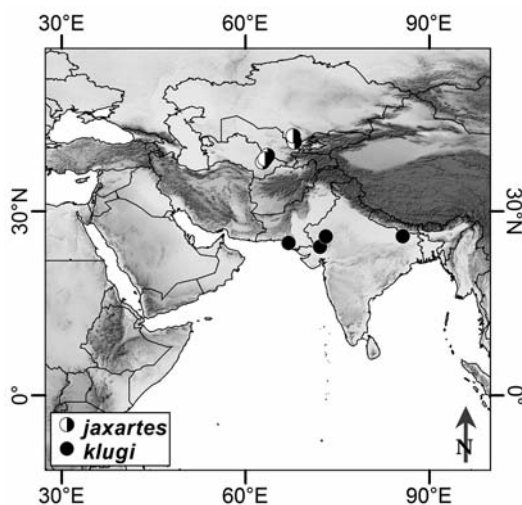


FIGURE 81. Collecting localities of *Palarus jaxartes* Pulawski and Prentice, sp. nov., and *Palarus klugi* Menke.

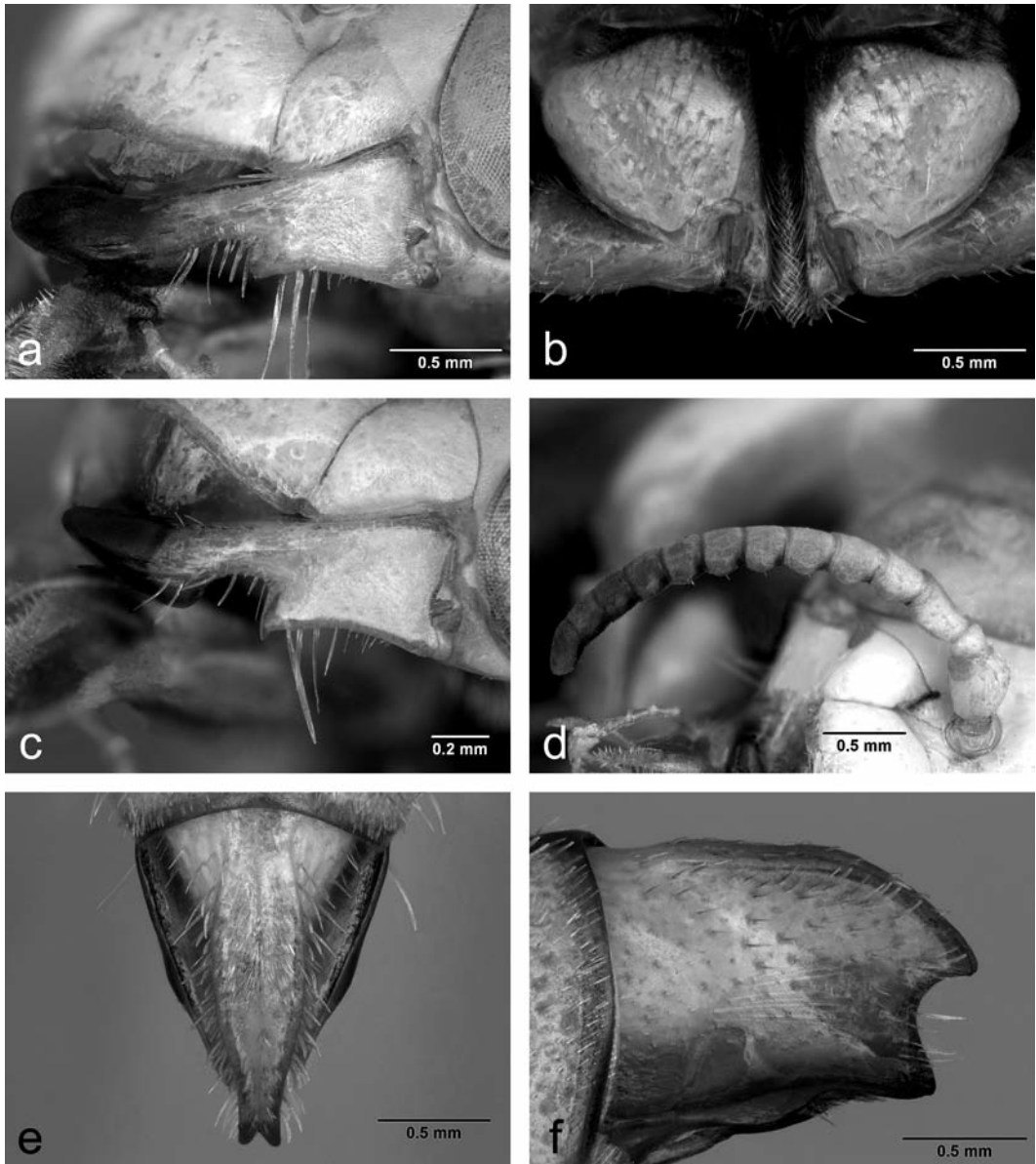


FIGURE 82. *Palarus klugi* Menke: a – female mandible; b – male forecoxae and foretrochanters; c – male mandible; d – male antenna; e – male tergum VII in dorsal view; f – male tergum VII in lateral view.

**DESCRIPTION.**— Least interocular distance about  $1.6 \times$  midocellar width in female,  $1.4 \times$  in male. Occipital carina separated from eye outer margin by more than hindocellar length. Anterior margin of precoxal mesopleural declivity with angulate prominence. Propodeal side ridged (conspicuously so in male) except unsculptured anteriorly.

Frons maculate to above midheight in holotype male and another male from Jodhpur area, to midocellus in remaining specimens; vertex yellow in most specimens (except interocellar area

black in some) but all black in male from Jodhpur area, with narrow, orange brown macula laterad of hindocellus in holotype; gena all yellow in female, yellow along anterior half in male (black dorsally in holotype); scape and pedicel all yellow; flagellum yellow basally, orange-yellow apically, with some brown ventrally. Pronotal collar and lobe yellow, also pronotum anteriorly. Thorax and propodeum black except the following are yellow: scutum anterolaterally (remaining scutum all red in one female), scutellum and scutellar flange, axilla, metanotum and metanotal flange, preepisternal area dorsally in male, in female all mesopleuron (including venter), metapleuron, propodeal side in most specimens (all black in male from Jodhpur area) and side of propodeal dorsum. Wing membrane yellowish. Femora reddish except forefemur yellow ventrally and apically; foretibia and tarsus yellow (male foretibia with black, oblong apicoventral spot), mid- and hindtibiae and tarsi reddish. Terga nearly all yellow except basal declivity of tergum I black (only mesoventrally so in male from Jodhpur area).

♀.— Genal setae not sinuous, markedly shorter than midocellar width. Posteroventral mandibular tooth sharp (Fig. 82a). Dorsal length of flagellomere I  $1.8 \times$  apical width. Forecoxa without apicomedian process. Adlateral carina of tergum I gradually effaced posterad. Fine ridges of pygidial plate somewhat irregular, clearly diverging from midline. Sternum II as in *fulviventris* (as in Fig. 73c): with transverse crest simple; posterad of transverse crest (and associated row of setae) with semicircular platform delimited by obtuse swelling, apex of swelling separated from setae by more than midocellar width; swelling that borders apical depression extending to each latromedian angle of crest, without sharp tubercle. Length 16.0 mm.

♂.— Free margin of medioclypeus almost straight. Genal setae not sinuous, longest ones about equal to midocellar width. Posteroventral mandibular tooth produced into a ventrally (= posteriorly) directed point (Fig. 82c). Longest setae between mandibular condyle and notch slightly more than midocellar width. Dorsal length of flagellomere I  $1.8 \times$  apical width; venter of flagellomere I convex preapically, of flagellomeres II-X concave and unsculptured basally and convex preapically, with some erect setae on preapical flagellomeres (Fig. 82d). Mesothoracic venter, before precoxal sulcus, with most punctures many diameters apart and setae shorter than those on ventral portion of preepisternum. Metasternum setose. Forecoxa apicomesally with short, narrow platform that is delimited by carina and largely glabrous on outer surface (Fig. 82b), apicomedian setae denser than on remaining surface. Mesopleural setae behind episternal sulcus simple, markedly shorter than midocellar width. Midcoxal venter flattened, unsculptured except for a few, sparse punctures, with evanescent, elongate, preapical tubercle, with posteroventral carina. Midtibial spur short (about  $0.4 \times$  length of midbasitarsus). Midbasitarsus flattened laterally, curved in dorsal view, ventrally with row of spines that are closely spaced in basal half (as in Fig. 74c, d); inner surface concave, glabrous. Tergum V without adlateral tooth or tubercle. Tergum VI without adlateral swelling or carina. Tergum VII: pygidial plate (Fig. 82e) slightly concave, narrowly emarginate apically (emargination markedly shorter and narrower than midocellar width), markedly raised above apex of tergum VII (lateral pygidial process separated from tergal apex by about  $1.5 \times$  midocellar width); pygidial carinae diverging in basal half, convergent preapically (greatest width of plate  $0.4 \times$  length); lateral pygidial process widest at base, in holotype and male from Jodhpur connected by longitudinal carina with tergal apex; adlateral carina, in anterior half, with ventrally oriented flange (Fig. 82f), as in *fulviventris*; ventral margin visible anteriorly and posteriorly in profile; setae sparse, not upcurved, longest ventrally of lateral pygidial process. Sternum II with transverse ridge before elevation, anterior margin of elevation obtuse and posterior margin somewhat undulating carina. Sternum V impunctate and asetose except laterally in most specimens, sparsely punctate in that from Jodhpur. Sternum VI with minute punctures that average many diameters apart and inconspicuous associated setae; adlateral carina well raised relative to ventral margin of

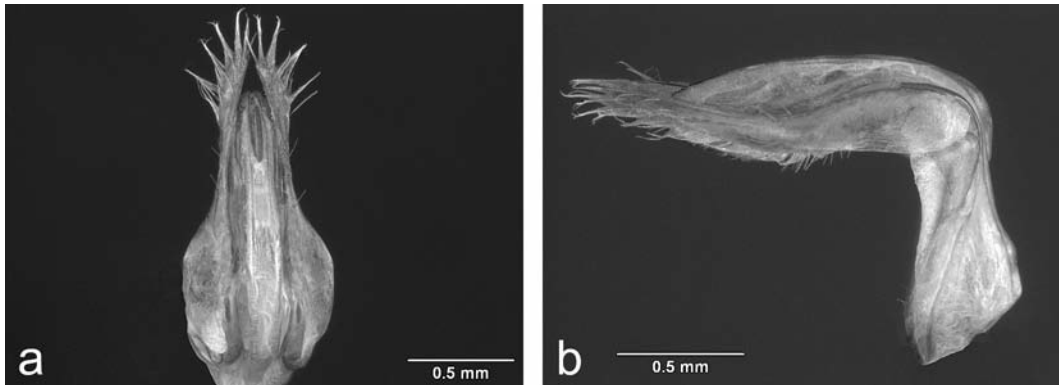


FIGURE 83. *Palarus klugi* Menke ♂: a – genitalia in dorsal view; b – genitalia in lateral view.

tergum VI. Gonocoxite with sclerotized lobe adjacent basoventrally to membranous area (Fig. 83b), apically with conspicuous setae (Fig. 83a). Length 15.5-17.3 mm.

**COLLECTING PERIOD.**—India: April (Pusa), 15 August (Jodhpur area,), September (Disa); Pakistan: October.

**GEOGRAPHIC DISTRIBUTION** (Fig. 81).—India, Pakistan.

**RECORDS.**—**INDIA:** Bihar: Pusa (Turner, 1917). Gujarat: Disa = Deesa (1 ♂, BMNH, holotype of *indicus* Nurse). Rajasthan: 40 km S Jodhpur (1 ♂, CAS). **PAKISTAN:** Sind: Karachi (1 ♀, 1 ♂, BMNH; 1 ♀, CAS).

### *Palarus oneili* Brauns

Figures 84-86.

*Palarus oneili* Brauns, 1899:408, ♀, ♂ (as *O'Neili*, incorrect original capitalization and apostrophe). Lectotype: ♀, South Africa: Eastern Cape Province: Sunday River near Port Elisabeth (TMP), **present designation**, examined.—Bingham, 1902:210 (South Africa); Brauns, 1911:117 (preying on *Myzine* and small bees); Arnold, 1923:11 (in revision of Afrotropical *Palarus*), 1930:7 (in checklist of Afrotropical Sphecidae); Bohart and Menke, 1976:291 (listed); Gess, 1981:20 (South Africa, nesting in friable soils).

*Palarus rothschildi* Magretti, 1908:190, ♂ (as *Rothschildi*, incorrect original capitalization). Holotype or syntypes: ♂, Ethiopia: Endessa in upper Awash River area (MNHN), examined. **New synonym.**—Arnold, 1923:12 (original description copied), 1930:7 (in checklist of Afrotropical Sphecidae); Scott in Arnold, 1933:369 (known from Ethiopia); Bohart and Menke, 1976:291 (listed).

*Palarus rothschildi croesus* Arnold, 1951:160, ♀, ♂. Lectotype: ♂, Ethiopia: Ufdem, now Afdem (BMNH), **present designation**, examined. **New synonym.** Not listed by Bohart and Menke (1976).

*Palarus multiguttatus* Arnold, 1960:472, ♂. Lectotype: ♂, Kenya: Kacheliba: Suk (SAM, specimen labeled as Type by G. Arnold), **here designated**, examined. **New synonym.**—Bohart and Menke, 1976:291 (listed).

**RECOGNITION.**—Like *pentheri*, the female of *oneili* has a transverse, serrate crest on sternum II, with no additional carina or platform posterad of it (Fig. 84a). They differ in the thoracic coloration: in *oneili*, the pronotum and the scutum anterolaterally are yellow or black, in many specimens also the scutellum and the metanotum are yellow (reddish in some). These areas are all reddish in *pentheri*. Also, the least interocular distance is slightly greater in *oneili* (about 0.7-0.85 × midocellar width, versus 0.6 × in *pentheri*).

The male of *oneili* may be recognized by the combination of a lamellar, translucent, circular



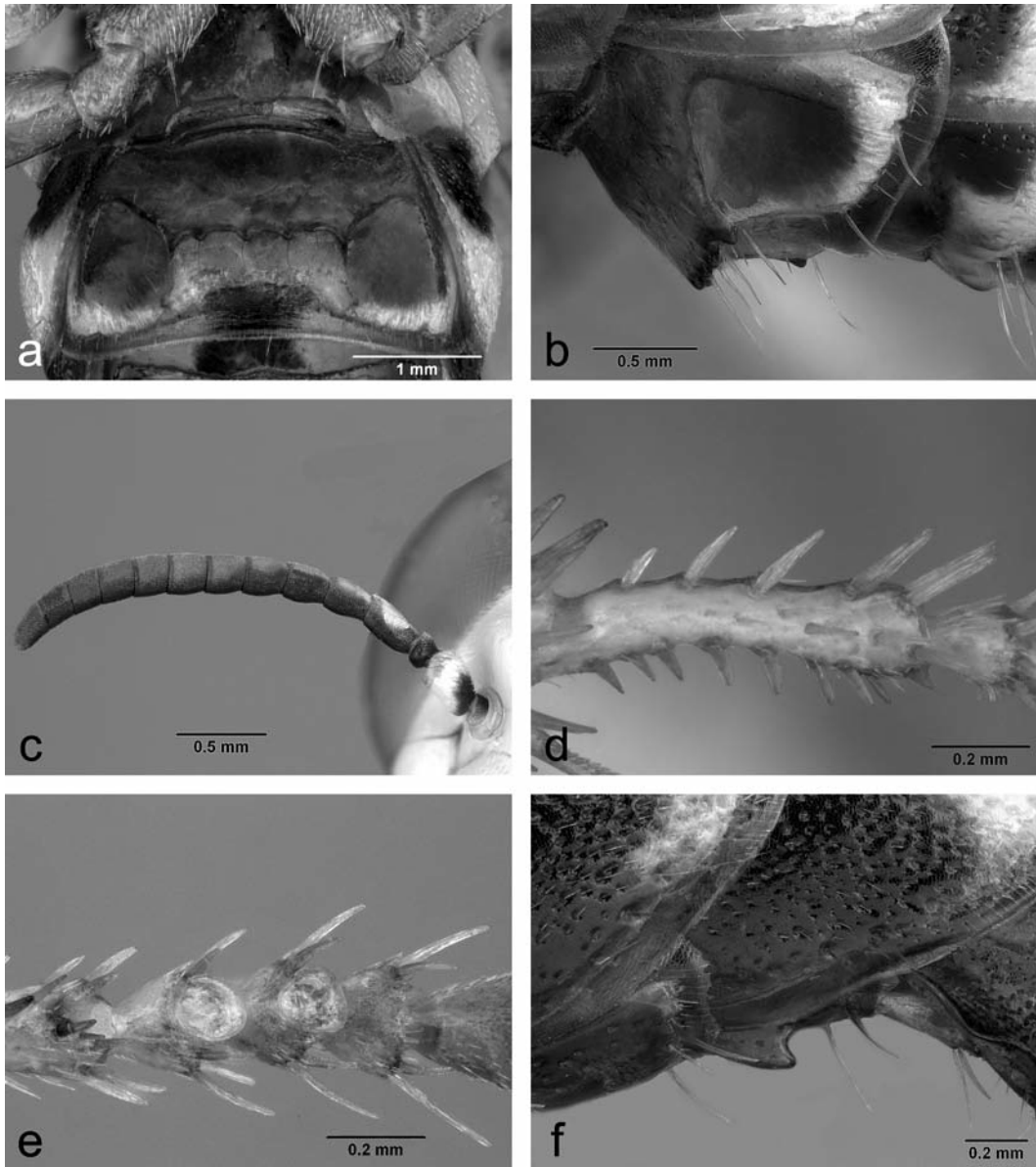


FIGURE 84. *Palarus oneili* Brauns: a – female sternum II in ventral view; b – female sternum II in lateral view; c – male antenna; d – male midbasitarsus in lateral view; e – male midtarsomeres II and III in ventral view; f – adlateral carina of sternum VI in lateral oblique view.

pad on the venter of both midtarsomeres II and III (Fig. 84e) and a longitudinal basal carina on tergum VII between the dorsal elevation and adlateral carina (Fig. 85b). Only the pads are present in *arabicus*, *jaxartes* and *saundersi*, and only the tergal carina in *pentheri*. Also, unlike the other four species, tergum VI of *oneili* lacks both an adlateral carina and a tooth.

**JUSTIFICATION OF NEW SYNONYMY.**— *Palarus multiguttatus*, *oneili*, *rothschildi*, and *rothschildi*

*di* var. *croesus* are just forms of one widely distributed species that varies significantly in color. We could not detect any significant differences between the populations, and we synonymize these names.

**DESCRIPTION.**—Least interocular distance about 0.7-0.9 × midocellar width in female, 0.5-0.8 × in male. Occipital carina separated from eye outer margin by more than hindocellar length (slightly so in male). Anterior margin of precoxal mesopleural declivity with modest angulate prominence (prominence rudimentary or absent in some specimens). Propodeal side aciculate anteriorly, remainder punctate, unridged (punctures nearly reduced in some specimens). Maculae yellow except gastral maculae whitish in specimens from Ethiopia.

Coloration of *oneili* varies extensively, both within and between populations. For example, the pronotum, scutum anterolaterally, scutellum, metanotum, and terga are yellow in most females from Tierberg Farm, South Africa, but all black in others. Males tend to be darker than females, and in many southern African populations nearly all black males are predominant. Gastral maculae yellow in most populations, but yellowish white in those from Ethiopia.

Clypeus largely brown or black in many South African males, especially medioclypeus; frons all yellow to midocellus or slightly below or with small black area ventrad and laterad of antennal socket (in some males also black between and above antennal sockets); vertex black, occasionally with minute macula between mid- and hindocellus; gena black, yellow along orbit (macula small, centered above genal midheight in specimens from South Africa and males from Namibia); mandible dark basomesally in some specimens; scape varying from all yellow to all black; pedicel and flagellum yellowish brown to black, dorsum in many specimens light brown to reddish (except basally); flagellum yellow to dark orange dorsally, more broadly so toward apex; remaining flagellum largely brown in female, black in male. Thorax and propodeum all black in some males, in female at least preepisternal area yellow (also in many males); macula of varying size present in many specimens on pronotal collar, pronotal lobe, pronotal side, propleural side, scutum anterolaterally, almost all metanotum, behind episternal sulcus (mesopleuron and mesothoracic venter almost all yellow or reddish in some females), on scutellum (all or part), metanotum, propodeal dorsum laterally, propleuron, and in some females also on small area before metapleural pit or more irregular metapleural spots; scutellum in some specimens partly reddish, in female contrasting with yellow metanotum; precoxal lobes and metasternum brown to reddish brown. Wing membrane nearly hyaline to minimally infumate. Coxae dark brown to reddish, largely yellowish or reddish in most females, forecoxa yellow laterally in some specimens; mid- and hindcoxae with small apical macula in some specimens; femora largely yellow to reddish, with contrasting reddish, brown, or dark brown areas that do not extend to apex: posterodorsal on fore- and midfemora, dorsal, posterior, and ventral on hindfemur; tibiae and tarsi yellow to yellowish red (more reddish in female). Terga either all dark brown to black (apical depressions dark brown) or terga I-V (I-VI in male) each with yellow or yellowish white macula; maculae continuous to broadly interrupted; female tergum VI reddish, immaculate (dark brown ventrally in darkest specimens); male tergum VII varying from black to dark brown, yellowish or reddish dorsally (including all of pygidial plate); all sterna in female, sterna I, III-VII in male, dark brown to reddish, becoming lighter toward gastral apex, either all immaculate or sterna II-IV (female) or III-V (male) with lateral yellow or yellowish white maculae of varying size; male sternum II lighter than other sterna, in lighter specimens partly yellow, including entire posterior surface of platform.

♀.—Genal setae straight, shorter than midocellar width. Dorsal length of flagellomere I 1.9-2.1 × apical width. Adlateral carina of tergum I ending abruptly (its posterior apex simply rounded, angulate, or a sharp process). Fine ridges of pygidial plate comparatively uniform, slightly diverging posterad except on median area. Sternum II (Fig. 84a, b): transverse crest dentate; pos-

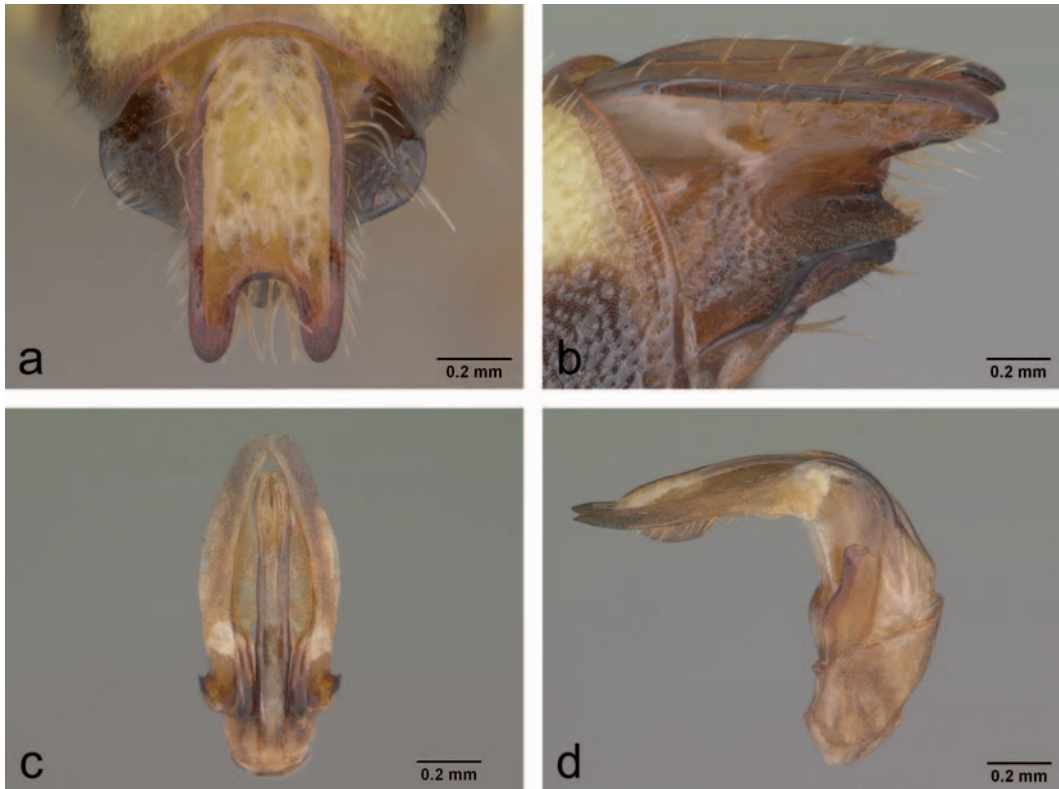


FIGURE 85. *Palarus oneili* Brauns G: a – tergum VII in dorsal view; b – tergum VII in lateral view, c – genitalia in dorsal view; d – genitalia in lateral view.

teromedian concavity (posterad of crest and associated row of setae) without additional carina or platform, much longer than midocellar width; swelling that borders apical depression extending to each posteromedian angle of crest, in most specimens with sharp tubercle posterad of posteromedian angle of crest. Length 9.3-11.9 mm.

♂.— Free margin of medioclypeus slightly arcuate to almost straight. Genal setae straight, shorter than midocellar width. Longest setae between mandibular condyle and notch equal to midocellar width. Dorsal length of flagellomere I  $1.8-2.0 \times$  apical width; venter of flagellomeres II-VI slightly convex, almost straight on remaining flagellomeres; flagellomeres without erect setae (Fig. 84c). Mesopleural setae behind episternal sulcus not sinuous, markedly shorter than midocellar width. Mesothoracic venter, before precoxal sulcus, with most punctures 1-3 diameters apart and setae about as long as those on ventral portion of preepisternum. Metasternum largely asetose (setae present only laterally). Forecoxa without apicomedian platform, with dense, apicomedian setae. Forebasitarsus with oblong, black, preapical tubercle on venter. Midcoxal venter somewhat flattened, unsculptured except for a few, sparse punctures, at most with evanescent preapical tubercle, posteroventral carina or tubercle present. Midtibial spur not shortened, about  $0.6-0.7 \times$  length of midbasitarsus. Midbasitarsus slightly curved in profile, not flattened, ventrally with row of short spines (Fig. 84d). Midtarsomeres II and III ventrally with lamellate, translucent, circular pad (Fig. 84e). Hindcoxal venter with ill-defined posteroventral carina, its adlateral surface flat, shiny, with a few, sparse punctures and associated setae. Tergum V without adlateral tooth or tubercle.

Tergum VI without adlateral carina, at most with rudimentary adlateral swelling in some specimens. Tergum VII with short longitudinal carina between base of pygidial plate and adlateral carina (Fig. 85b); pygidial plate (Fig. 85a) slightly concave, emarginate apically, markedly raised above tergal apex (lateral pygidial process separated from tergal apex by more than midocellar width); pygidial carinae diverging posteriorly in basal half, parallel in apical half (plate's greatest width  $0.3-0.5 \times$  length); lateral pygidial process widest at base, processes connected medioventrally by V-shaped carina (carina obtuse or evanescent in some specimens); adlateral carina not curving ventrad, expanded in basal half (Fig. 85b); ventral tergal margin concealed in lateral view; setae numerous and erect apicolaterally; not upcurved near tergal apex. Sternum II with transverse ridge before elevation, anterior margin of elevation obtuse and posterior margin simple carina, either straight or somewhat uneven. Sternum V, on disk, with punctures averaging several to many diameters apart; associated setae inconspicuous. Sternum VI, on disk, with punctures that vary from about two to many diameters apart (almost impunctate in some specimens); setae appressed to suberect, fine; adlateral carina obtuse, raised relative to ventral margin of tergum VI, acutely pointed posteriorly (Fig. 84f). Gonocoxite with large sclerotized lobe adjacent basoventrally to membranous area (Fig. 85d), apically with short setae on ventral surface only (Fig. 85c, d). Length 9.5-11.4 mm.

**PREY.**—Two females were collected with prey at Hilton Farm, South Africa, one by A.J. Weaving with a female of *Bembecinus cinguliger* (Handlirsch), the other by R.W. and S.K. Gess with a female of *Bembecinus haemorrhoidalis* (Handlirsch), both prey determined by Friedrich W. Gess. Another female was collected 70 km E Port Nolloth, South Africa, by J.G. and B.L. Rozen with a female bee *Meliturgula braunsi* Friese (determination by John S. Ascher), and another at Marich Pass, Kenya, by W.J. Pulawski with a male nomiine bee *Macronomia borrieriae* Pauly (determination by Alain Pauly).

**COLLECTING PERIOD.**—Ethiopia: 27 August; Kenya 11 May through 14 June, 20-21 November through 2 December; Namibia: 12 December through 24 March; Niger: 4 August and 12 September; South Africa: 9 October through 14 February; Tanzania: 3-15 January.

**GEOGRAPHIC DISTRIBUTION** (Fig. 86).—Mali, Niger, and Ethiopia to South Africa.

**RECORDS.**—**ANGOLA:** Rocadas at Cunene River (1 ♂, BMNH). **ETHIOPIA:** Afdem (1 ♀, 1 ♂, BMNH, lectotype and paralectotype of *Palarus rothschildi croesus*, as Ufdem), Endessa in upper Awash River area (1 ♂, MNHN, holotype of *rothschildi*). **Harerge Province:** 37 km SE Jijiga at  $9^{\circ}11'N$   $43^{\circ}05'E$  (1 ♀, 2 ♂, CAS). **KENYA: Coast Province:** Voi (2 ♂, OÖLM). **Rift Valley Province:** Kacheliba (2 ♂, SAM, lectotype and paralectotype of *Palarus multiguttatus*), Lodwar road 4 km N road to Sigor at  $1^{\circ}33.7'N$   $35^{\circ}27.7'E$  (1 ♀, 4 ♂, CAS), Marich Pass Field Studies Centre at  $1^{\circ}32.2'N$   $35^{\circ}27.4'E$  (9 ♀, 5 ♂, CAS). **MALI:** 40 km W Mopti (1 ♀, MS). **NAMIBIA: Gobabis District:** Gobabis (6 ♂, AMG), vicinity of Gobabis (1 ♂, AMNH), 40 km W Witvlei (6 ♀, 2 ♂, CAS; 3 ♀, 7 ♂, MS). **Karibib District:** 50 km E Karibib (1 ♂, MS), 20 km N Karibib (1 ♀, MS; 1 ♀, OÖLM), Khan River 23 km N Karibib at  $21^{\circ}47'S$   $15^{\circ}57'E$  (1 ♂, CAS), 11 km W Usakos (2 ♀, AMNH). **Maltahöhe District:** road D804 SE Maltahöhe at  $25^{\circ}11'S$   $17^{\circ}25'E$  (1 ♀, AMG). **Okahandja District:** Oka-

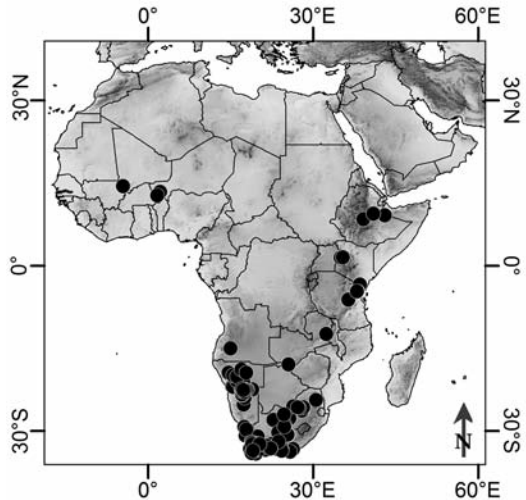


FIGURE 86. Collecting localities of *Palarus oneili* Brauns.



handja (2 ♀, AMG; 1 ♀, 4 ♂, BMNH; 1 ♀, MS), 27 km S Okahandja (1 ♀, 1 ♂, CAS; 1 ♀, MS). **Otjiwarongo District:** 3 km NE Kalkfeld (1 ♀, MS), 18 km NE Kalkfeld at 20°45'S 16°16'E (1 ♂, CAS), Osire (1 ♂, AMG). **Outjo District:** Kaross Farm at 19°23'S 14°40'E (1 ♀, SAM), Otjikondo (1 ♀, 1 ♂, SAM), Outjo (1 ♂, SAM). **Rehoboth District:** 15 km N Kalkrand (1 ♂, CAS; 2 ♂, MS), 7 km N Rehoboth (1 ♀, CAS; 1 ♂, MS), 23 km N Rehoboth (1 ♀, 1 ♂, CAS), 9 km S Rehoboth (1 ♀, 3 ♂, MS), 74 and 84 km S Windhoek (2 ♂, SAM). **Tsumeb District:** Namutoni (2 ♀, 10 ♂, AMG), 10 km SE Tsumeb (1 ♂, MS), 25 km SE Tsumeb (1 ♀, OÖLM). **Windhoek District:** 2 km S Aris at 22°46'S 17°08'E (1 ♂, CAS), Seeis (1 ♀, AMNH), 9 km ESE Seeis (1 ♀, AMNH), 29 km ESE Seeis (2 ♀, AMNH), 36 km ESE Seeis (2 ♀, AMNH), 44 km ESE Seeis (1 ♂, AMNH), 45 km S Seeis (2 ♀, AMNH), 30 km E Windhoek (1 ♀, MS), 29 km N Windhoek (1 ♂, MS). **District unknown:** Steinhausen in NE Namibia (4 ♀, 4 ♂, AMG). **NIGER: Tillabéri Region:** Malalé 10 km E Niamey at 13°27.1'N 2°10.4'E (2 ♂, CAS), 30 km SSW Torodi at 12°49.5'N 1°41.6'E (1 ♀, CAS). **SOUTH AFRICA: Eastern Cape Province:** Aberdeen (1 ♀, 1 ♂, SAM), Dunbrody at 33°29'S 25°33'E (2 ♀, AMG; 5 ♀, SAM; 1 ♀, ZMUC), 18 km WNW Grahamstown: Hilton Farm at 33°16'S 26°21'E (3 ♀, 1 ♂, AMG), Sunday River (3 ♀, AMG; 1 ♀, SAM; 1 ♀, 1 ♂, TMP, lectotype and paralectotype of *Palarus oneili*), Waaipoot Pass 19 km ENE Steytlerville at 33°14.8'S 24°19.8'E (1 ♀, USU), Willowmore (2 ♀, 3 ♂, AMG; 1 ♂, CAS; 4 ♀, 5 ♂, SAM; 1 ♂, UCD; 1 ♀, 1 ♂, USNM), 9 km E Willowmore at 33°15'S 23°34'E (1 ♂, CAS), Wolwekraal Farm 28 km S Steytlerville at 33°32.8'S 24°21.3'E (1 ♂, USU). **Free State:** Hendrik Verwoerd Dam (1 ♀, PPRI), Sandveld Nature Reserve ca 5 air km E Bloemhof at 27°40'S 25°45'E (1 ♀, PPRI). **Gauteng:** Johannesburg: Chrisville (1 ♂, RMNH), Johannesburg: Robertsham (1 ♀, RMNH), Pretoria (1 ♀, ZMUC). **Northern Cape Province:** Garies (3 ♂, OÖLM), 40 km SW Garies (2 ♂, OÖLM), Goegap (= Hester Malan) Nature Reserve (1 ♂, BMNH), Kimberley (1 ♂, AMG; 2 ♂, SAM), 60 km S Loeriesfontein (1 ♀, OÖLM), 60 km W Loeriesfontein (1 ♀, OÖLM), Mogol Nature Reserve at 23°58'S 27°45'E (1 ♂, PPRI), Olifantshoek (1 ♀, 1 ♂, MS), 70 km E Port Nolloth (2 ♀, AMNH), SW Springbok (1 ♀, 1 ♂, OÖLM), 27 km S Strydenburg (1 ♂, OÖLM), Tanqua-Karoo National Park (1 ♂, SAM), VanWyksfontein 8 km W Norvalspont (2 ♀, 7 ♂, AMG). **Northern Province:** Buffelspoort Dam (1 ♂, AMG), 30 km W Hoedspruit which is at 24°21'S 30°51'E (1 ♂, DB), Mogol Nature Reserve at 23°58'S 27°45'E (1 ♂, PPRI). **North-West Province:** 50 km S Kimberley (1 ♀, 1 ♂, OÖLM), Marico (1 ♂, SAM), Rustenburg (Bingham, 1902), Vryburg (2 ♀, 1 ♂, AMG). **Western Cape Province:** Beaufort West: Oukloof (1 ♀, SAM), Bulshoek between Klawer and Clanwilliam (1 ♀, 1 ♂, SAM), 20 km N Citrusdal (7 ♂, OÖLM), 5 km N Clanwilliam on road R363 to Klawer (1 ♂, AMG), Dikbome between Merweville and Koup (1 ♂, SAM), Greyton (1 ♂, OÖLM), Hex River (1 ♂, SAM), 20 km SE Hopefield (1 ♂, AMNH), Konstabel Farm 30 km WSW Matjiesfontein at 33°16'S 20°17'E (1 ♀, 1 ♂, CAS; 2 ♀, 3 ♂, SAM), Merweville District (3 ♀, 4 ♂, SAM), Murraysburg (1 ♂, AMG), Olifantsriver between Citrusdal and Clanwilliam (1 ♀, 1 ♂, SAM), upper sources Olifants River (1 ♀, SAM), Stellenbosch (2 ♀, 1 ♂, SAM), Tierberg Farm 23 km NE Prince Albert at 33°07'42"S 22°16'24"E (8 ♀, 3 ♂, AMG), 33°10'00"S 22°16'24"E (2 ♂, AMG), and 33°08'S 22°16'E (1 ♂, CAS), Touwsrivier: Ouberg Pass (1 ♀, SAM), Wellington: Roosehoek (1 ♀, 7 ♂, RMNH). **TANZANIA: Dodoma Region:** 74 km E Dodoma at 6°05.6'S 36°27.2'E (1 ♀, CAS). **Tanga Region:** 73 km NW Korogwe: 4°40.8'S 38°06.4'E (1 ♀, 2 ♂, CAS), 2 km NE Mkomazi at 4°37.8'S 38°05.5'E (2 ♂, CAS), Pangani River Camp 86 km NW Korogwe at 4°37.3'S 38°00.7'E (1 ♂, CAS). **ZAMBIA:** 30 km NW Kazangula [the borderpost of Zambia, Namibia, Botswana and Zimbabwe] (1 ♂, OÖLM), 30 km W Livingstone (1 ♂, OÖLM).

### *Palarus pentheri* Brauns

Figures 87-89.

*Palarus pentheri* Brauns, 1899:403, ♂ (as *Pentheri*, incorrect original capitalization). Holotype or syntypes: ♂, South Africa: Cape Province: "Tamatsetse in territorio Khamâs" (TMP), examined.—Brauns, 1911:117 (South Africa); Arnold, 1923:9 (in revision of Afrotropical *Palarus*), 1930:7 (in checklist of Afrotropical Sphecidae); Bohart and Menke, 1976:291 (listed).

**RECOGNITION.**— See *oneili* for recognition of the female (p. 436). The male is unique within the genus in having a prominent, lateral tooth on each side of tergum V (Fig. 87d) and the pygidi-

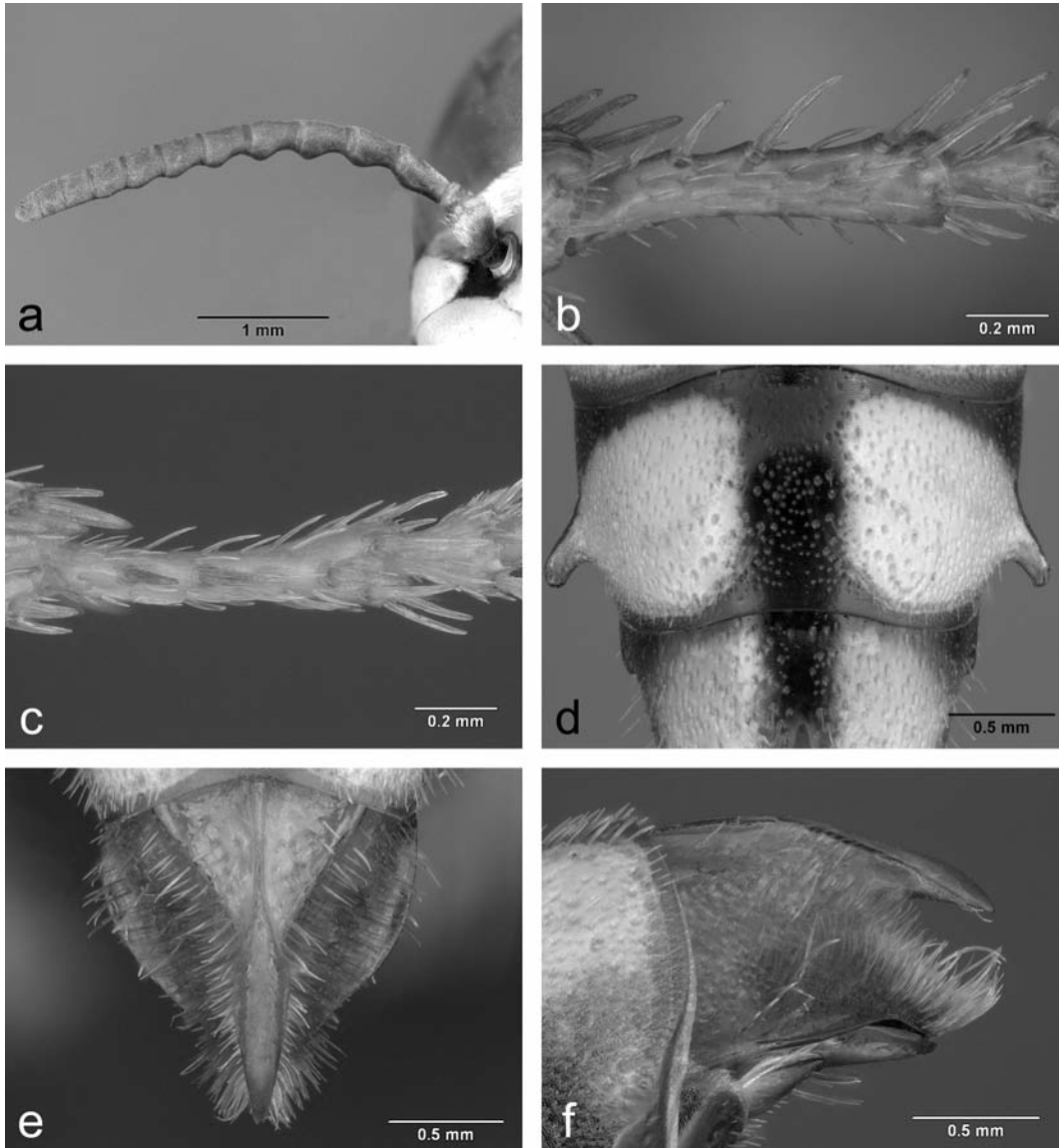


FIGURE 87. *Palarus pentheri* Brauns G: a – antenna; b – midbasitarsus in lateral view; c – midbasitarsus in dorsal view; d – tergum V in dorsal view; e – tergum VII in dorsal view; f – tergum VII in lateral view.

al plate unusually narrow (especially in basal half), not emarginate apically (Fig. 87e).

**DESCRIPTION.**— Least interocular distance about  $0.6 \times$  midocellar width in female,  $0.35\text{--}0.7 \times$  in male. Occipital carina separated from eye orbit at vertex by more than hindocellar length in female, slightly less than hindocellar length in male. Anterior margin of precoxal mesopleural declivity with modest angulate prominence. Propodeal side aciculate anteriorly, remainder punctate, unridged.

Frons and clypeus all yellow except brown between anterior tentorial pit and antennal socket in many females, black ventrolaterad of antennal socket in male; postocellar area orange brown in

most females and some males; gena yellow in female except (most specimens) brown adjacent to occipital carina, in male yellow on anterior half, in some specimens macula not extending to vertex and hypostoma; mandible yellow, with dark brown apex; scape yellow or (some specimens) partly brown; pedicel and flagellum yellow orange, in many males partly brown ventrally. Thorax and propodeum black to overall reddish, with reddish on most of pronotum, scutum anterolaterally, and in most specimens on scutellum and metanotum (largely red in one female from Igusi, Zimbabwe); preepisternal area with yellow or reddish spot; humeral plate brown to reddish; tegula brown to reddish, yellow anteriorly in some specimens. Wing membrane infumate basally (at least slightly so), in most specimens hyaline or nearly so apically. Coxae reddish with some brown in most females, dark brown with some reddish in most males; ventral forecoxal surface yellowish in some specimens; femora reddish in female, reddish to dark brown in male; forefemur with large posteroventral macula; mid- and hindfemora maculate apically; tibiae and tarsi yellow except yellowish red in some females. Gastral terga I-V (I-VI in male) black, each with broadly interrupted yellow fascia (fasciae largely reduced, ill formed on terga III and IV to I-V in some specimens); female tergum VI reddish, immaculate; male tergum VII immaculate, reddish in most specimens, yellowish red dorsally in some; sterna black to reddish, becoming lighter toward gastral apex, immaculate except for trace of yellow laterally on sterna II-V in some specimens.

♀.— Genal setae not sinuous, shorter than midocellar width. Dorsal length of flagellomere I  $2.0\text{--}2.1 \times$  apical width. Adlateral carina of tergum I ending abruptly as rounded tubercle, angular tubercle (most specimens), or prominent spine. Fine ridges of pygidial plate comparatively uniform, slightly diverging from midline except on median area. Sternum II as in *oneili* (as in Fig. 84a, b): with transverse crest dentate; posteromedian concavity (posterad of crest and associated row of setae) without additional carina or platform, much longer than midocellar width; swelling that borders apical depression extending to each lateromedian angle of crest, with sharp tubercle posterad of lateromedian angle of crest in some specimens. Length 13.1–16.8 mm.

♂.— Free margin of medioclypeus arcuate. Some genal setae sinuous in most specimens, longest ones smaller than midocellar width (only slightly so in some specimens). Longest setae between mandibular condyle and notch slightly more than midocellar width. Dorsal length of flagellomere I  $1.9\text{--}2.1 \times$  apical width; flagellomeres without obvious setation, I and VIII slightly concave ventrally, convex preapically, II–VII conspicuously so (Fig. 87a). Mesopleural setae behind episternal sulcus not sinuous, markedly shorter than midocellar width. Mesothoracic venter, before precoxal sulcus, with most punctures 1–2 diameters apart, with setae suberect and longer than those on ventral portion of preepisternum (some apically sinuous). Metasternum largely asetose (setae present only laterally). Forecoxa without apicomedian platform, with apicomedian brush of long setae. Forebasitarsus with raised apicoventral brush of setae. Midcoxal venter flattened, unsculptured except for a few, sparse punctures, without preapical tubercle, with posteroventral carina. Midtibial spur not shortened, about  $0.5\text{--}0.7 \times$  length of midbasitarsus. Midbasitarsus flattened laterally, i.e., with height greater than width (Fig. 87b, c), slightly curved in profile basally, with row of spines ventrally (Fig. 87b). Hindcoxal venter somewhat flattened, its posteroventral carina ill defined in some specimens. Tergum V with prominent, posterolaterally oriented, dorsoventrally flattened adlateral tooth (Fig. 87d). Tergum VI with adlateral carina, tubercle, or inconspicuous swelling. Tergum VII with basal carina between pygidial plate and adlateral carina; pygidial plate markedly raised above tergal apex (Fig. 87f): apex of plate separated from tergal apex by more than midocellar width, pointed (not emarginate) apically; pygidial carinae very closely spaced or fused into single carina in basal half or so, slightly diverging then converging in distal half (Fig. 87e); greatest width of plate about  $0.1 \times$  length; median pygidial process without ventral V-shaped carina; adlateral carina somewhat expanded, not flattened into distinct, elevated area; ventral margin

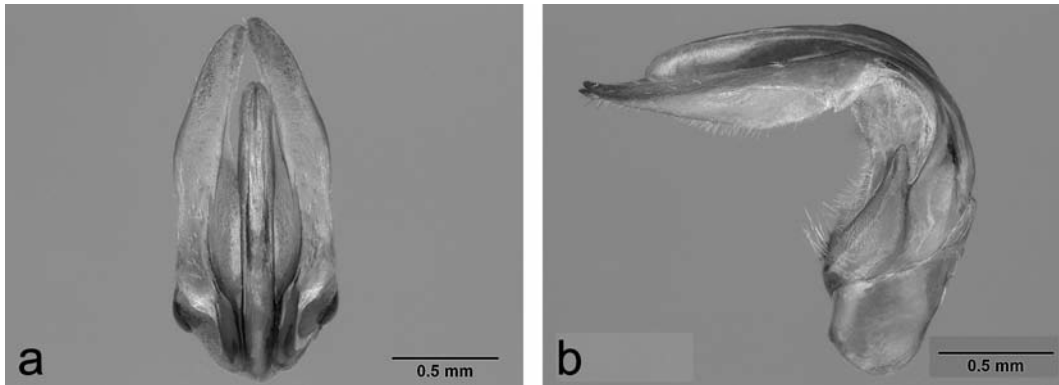


FIGURE 88. *Palarus pentheri* Brauns ♂: a – genitalia in dorsal view; b – genitalia in lateral view.

of tergum concealed in lateral view; setae, ventrad of pygidial carina, conspicuous, erect, densest toward apex, directed up toward tergal apex (Fig. 87f). Sternum II with transverse ridge before elevation, with anterior margin of elevation obtuse and posterior margin simple, obtuse, nondentate carina. Sternum V, on disk, with punctures averaging several to many diameters apart, associated setae inconspicuous. Sternum VI, on disk, with punctures that vary from about 2-4 to many diameters apart; setae appressed to suberect; its adlateral carina in form of posteriorly pointed tubercle, raised relative to ventral margin of tergum VI. Gonocoxite with large sclerotized lobe adjacent basoventrally to membranous area (Fig. 88b), apically setose on ventral surface only (Fig. 88a, b). Length 10.9-17.8 mm.

**PREY.**— Two females examined are pinned with other wasps, presumably their prey: a female from Sawmills, Zimbabwe (AMG) with a male of the mutillid *Pseudocephalotilla multicarinata* (André, 1908), det. D. Brothers, and a female from Dondo, Mozambique, with a male of the eumeline *Antodynerus oogaster* (Gribodo), det. J. Gusenleitner.

**COLLECTING PERIOD.**— Botswana: 28 February – 27 March; Namibia: 17-31 January, 13-22 February, 2-14 March, 27 October; South Africa: 17 November through 1 December, 14 January; Tanzania: 18 September; Zimbabwe: 29-30 November, 8-23 December, 23 January, 1-8 February, 9 March, 1 April.

**GEOGRAPHIC DISTRIBUTION** (Fig. 89).— Southern Tanzania, Malawi, Mozambique, Zimbabwe, Namibia, Botswana, South Africa.

**RECORDS.**— **BOTSWANA:** Kalahari Gemsbok National Park 1.5 km E Chelaka (1 ♀, CAS), 20 mi W Kalkfontein (1 ♀, 4 ♂, CAS). **MALAWI:** Lake Malawi (as Lake Nyasa): Grand Beach (1 ♀, SAM). **MOZAMBIQUE:** Dondo (1 ♀, SAM). **NAMIBIA:** **Grootfontein District:** Grootfontein (1 ♀, PPRI), 80 km N Grootfontein (1 ♂, OHL). **Karasburg District:** road 201 at 27°09'S 19°01'E (1 ♀, AMG). **Maltahöhe District:** no specific locality (1 ♀, UCD). **Mariental District:** Gross Nabas 24 km SE Stampriet at 24°30'S 18°32'E (2 ♂, AMG). **Okahandja District:** Okahandja (1 ♂, AMG). **Otjinene District:** 2 km S Otjisume Farm at 21°18'42"S 19°19'20"E (1 ♀, CSE). **Otjiwarongo District:** 18 km NE Kalkfeld at 20°45'S 16°16'E (1 ♂, CAS), Osire (1 ♀, 1 ♂, AMG), Otjiwarongo (1 ♂, PPRI), Waterberg at 20.5°S 17.3°E (1 ♀, CSE). **Outjo District:** Outjo (3 ♀, 1 ♂, SAM). **Rehoboth District:** 15 km N Kalkrand (1 ♂, CAS; 3 ♂, MS), 23 km N Rehoboth (2 ♂, CAS; 5 ♂, MS). **Rundu District:** Kuring Kuru on Okavango River (1 ♀, SAM), Rundu (4 ♀, CAS; 2 ♀, 1 ♂, MS; 1 ♀, 1 ♂, OHL; 1 ♀, 4 ♂, OÖLM), 25 km E Rundu at 17°57'S 19°57'E (1 ♂, CAS; 1 ♂, MS), 40 km E Rundu (2 ♂, OÖLM), 100 km SW Rundu (1 ♀, MS), 130 km SW Rundu (1 ♀, CSE). **Swakopmund District:** 29 km SE Gobabeb at 23°43'S 15°14'E (1 ♂, PPRI). **Tsumeb District:** Namutoni (1 ♀, 1 ♂, AMG), 10 km SE Tsumeb (2 ♂, CAS; 2 ♂, MS). **Tsumkwe District:** 19°47'S 20°35'E (1 ♂, USNM). **Windhoek District:** Arnhem Farm 110 km E Windhoek at 22°41'S 18°08'E (1 ♂, LACM), 22 km



ESE Seeis (1 ♂, AMNH). **SOUTH AFRICA:** **Eastern Cape Province:** Middelburg (1 ♂, AMG). **Gauteng:** Johannesburg (1 ♀, PPRI), Johannesburg: Robertsham (1 ♂, CAS), Pretoria (1 ♂, SAM; 1 ♀, ZMUC), Pretoria North (1 ♂, AMG). **Kwazulu-Natal:** Fannies Island in Santa Lucia Lake at 28°06'S 32°26'E (1 ♀, 6 ♂, AMG), Mfongosi in Zululand (4 ♂, SAM), Umfolozi River bridge 7 km SW Mtu-tubata (1 ♂, AMG; 1 ♀, 1 ♂, DB). **Mpumalanga:** Barberton (1 ♂, UCD), Sabie River Bungalow in Kruger National Park (2 ♀, 1 ♂, AMG; 1 ♀, RMNH). **Northern Cape Province:** Koopan-Suid at 27°20'S 20°21'E (1 ♀, SAM), Narugas at approximately 29°36'S 19°17'E (1 ♀, 2 ♂, SAM), Nossob (2 ♂, MS), Nossob River bed 11 km NNE Twee Rivieren in Kalahari Gemsbok National Park (1 ♀, 1 ♂, AMG). **Northern Province:** Afguns: Hope (1 ♂, AMG), Beacon Ranch 20 km NW Gravelotte (1 ♀, 1 ♂, DB), Ellisras (3 ♀, 2 ♂, AMG; 2 ♂, DB), Gravelotte (1 ♀, 2 ♂, AMG), Langjan Nature Reserve at 22°52'S 29°14' E (2 ♀, PPRI), Moorddrift (1 ♂, AMG), Rust de Winter (1 ♂, AMG), 5 mi W Warmbad (1 ♂, USNM). **North-West Province:** Marico (1 ♀, TMP, labeled by H. Brauns as a type of *Palarus oneili*). **Province unknown:** Tamatsetse in territorio Khamâs (1 ♂, TMP, holotype of *Palarus pentheri*). **TANZANIA:** Dar es Salaam (1 ♂, CSE), Rukwa Valley (1 ♀, 1 ♂, UCD). **ZIMBABWE:** Bubi 80 km NE Beitbridge (1 ♂, OÖLM), Bulawayo (1 ♂, AMG; 2 ♀, 1 ♂, SAM; 1 ♀, USNM), Bulawayo: Hillside (1 ♀, USNM), Fig Tree at 20°22'S 28°00'E (1 ♀, 1 ♂, SAM), Filabusi: Druid Mine (1 ♂, SAM), Gwaai River (1 ♀, USNM), Igusi (1 ♀, AMG; 1 ♂, ZMUC), Kami Ruins at 20°09'S 28°26'E (1 ♂, CAS; 1 ♀, SAM), Mount Selinda (1 ♂, SAM), Nantwich (1 ♀, SAM), 11 km NE Nyamandhlovu at 19°48'S 28°16'E (4 ♀, 3 ♂, CAS), Redbank at Kami River at 20°00'S 28°22'E (1 ♂, CAS), 25 km NE Samva on Nyagui River (1 ♂, OÖLM), Sawmills (2 ♀, AMG; 2 ♂, DB; 1 ♀, 1 ♂, PPRI; 4 ♀, 11 ♂, SAM), Victoria Falls at 17°56'S 25°50'E (6 ♀, 13 ♂, CAS; 1 ♀, 4 ♂, SAM; 1 ♂, USNM).

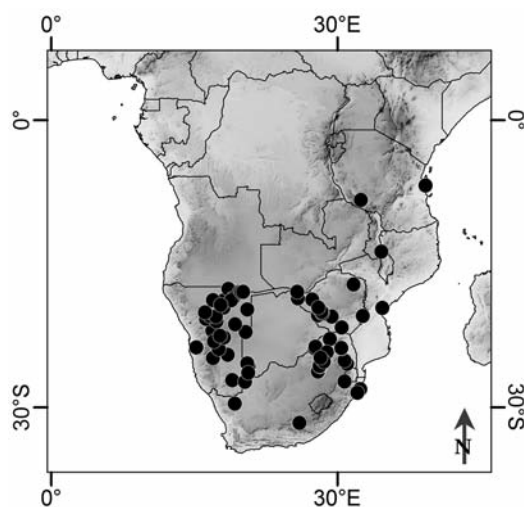


FIGURE 89. Collecting localities of *Palarus pentheri* Brauns.

### *Palarus rufipes* Latreille

Figures 90-93.

*Tiphia flavipes* Fabricius, 1793:224, ♀, junior secondary homonym of *Palarus flavipes* (Fabricius, 1781), Article 58.4. Holotype or syntypes: Barbaria, now NW Africa: no specific locality (depository?), not examined.—Coquebert, 1801:53 (redescription), pl. XIII, Fig 1 (illustration of Fabrician type); Fabricius, 1804:232 (redescription); de Beaumont, 1949:649 (the name is a junior secondary homonym in *Palarus*).

*Palarus rufipes* Latreille, 1812:651, ♀. Substitute name for *Palarus flavipes* (Fabricius).—nec Spinola, 1839:475 (= *Palarus dongalensis*); de Saussure, 1854:13 (listed), 14 (variation); F. Smith, 1856:358 (in catalog of Hymenoptera in British Museum); Kohl, 1885:426 (original description copied), 428 (in checklist of world *Palarus*); Dalla Torre, 1897:659 (in catalog of world Sphecidae); W. Schulz, 1905:66 (taxonomic history, redescription); Honoré, 1941:202 (in revision of Egyptian *Palarus*: unrecognizable species); de Beaumont, 1949:647 (in revision of Mediterranean *Palarus*), 1950:409 (Algeria, Morocco), 1957:139 (Morocco); Casolari and Casolari Moreno, 1980:124 (specimens in M. Spinola collection).

*Palarus humeralis* Dufour, 1854:379, ♀, ♂. Lectotype: ♂, Algeria: Pontéba, now Oumm ed Drou (MNHN), **present designation**, examined. Synonymized with *Palarus rufipes* by W. Schulz, 1905:66.—de Saussure, 1854:13 (listed); F. Smith, 1856:358 ((in catalog of Hymenoptera in British Museum); Walker, 1871:26 (Egypt); Kohl, 1885:422 (in revision of Larrinae), 425 (original description copied), 428 (in checklist of world *Palarus*); Schmiedeknecht, 1896:163 (Algeria); Dalla Torre, 1897:658 (in catalog

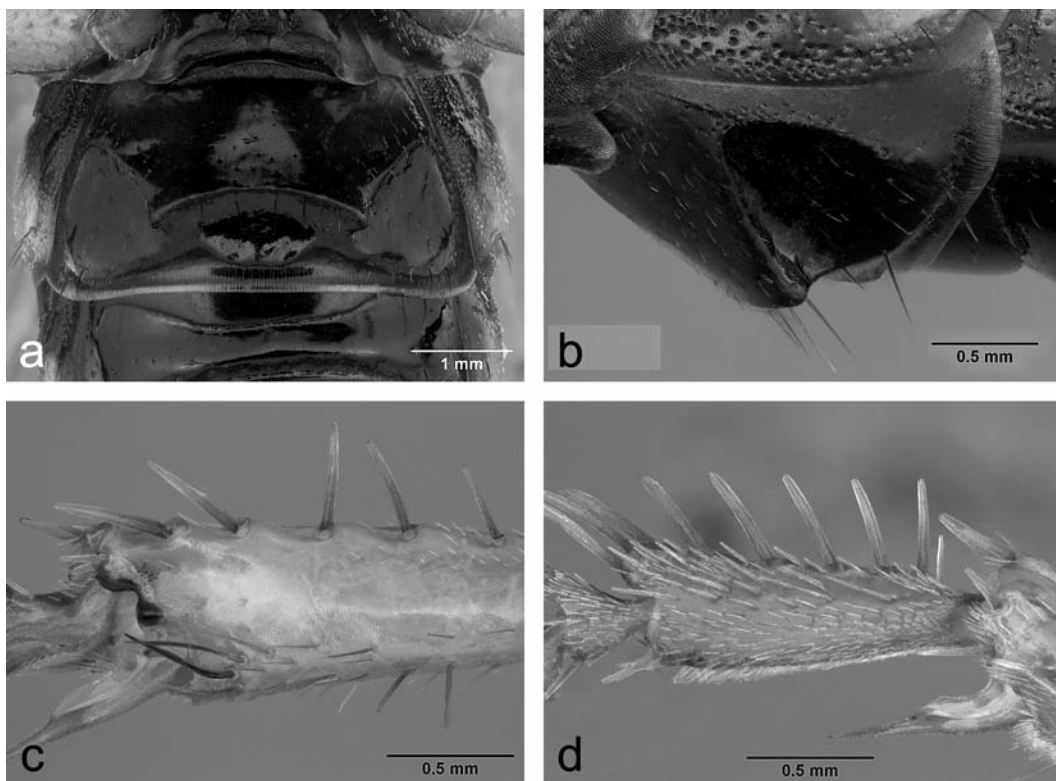


FIGURE 90. *Palarus rufipes* Latreille ♀: a – sternum II in ventral view; b – sternum II in lateral view; c – apex of foretibia in ventral view; d – forebasitarsus.

of world Sphecidae); Morice, 1911:107 (Algeria); Ferton, 1912:365 (Algeria, prey); Innes Bey, 1912:112 (specimens recorded by Walker, 1871, now destroyed by dermestids, came from unknown locality); von Schulthess, 1926:215 (Tunisia); Nadig, 1933:85 (Morocco); E. Nielsen, 1933:299 (Ferton's observations reported); Guiglia, 1940:288 (Libya), 1942:232 (Libya).

**RECOGNITION.**—*Palarus rufipes* has a unique foretibia, with the apicoventral margin emarginate posterad of spur socket (cuticle dark adjacent to emargination), and with one or two falciform setae on the ventral surface proximad of spur (Fig. 90c). The female forebasitarsus is wider than in all other congeners (Fig. 90d).

The male has several unique features: apical flagellomere curved in profile and concave ventrally (Fig. 91a), triangularly broadened foretibia (Fig. 91b), elongate hindbasitarsus (Fig. 91e), with length about twice that of posterior hindtibial spur, and anterolateral portion of tergum VII with dense setae that fully conceal integument (Fig. 92a, b). As in *bernardi* and *dongalensis*, the forebasitarsus is conspicuously broadened (Fig. 91c), but unlike these species the foretibia has no spatulate setae (see Key for other differences). As in *bernardi*, the mesothoracic venter of *rufipes* is more concave than in other *Palarus*. The predominantly black body is a subsidiary recognition feature (antenna and gaster black, thorax and propodeum largely black, wings black except apically).

**DESCRIPTION.**—Least interocular distance about 1.1-1.2 × midocellar width in both sexes. Occipital carina separated from eye orbit at vertex by more than hindocellar length in female, by about hindocellar length in male. Anterior margin of precoxal mesopleural declivity with angulate

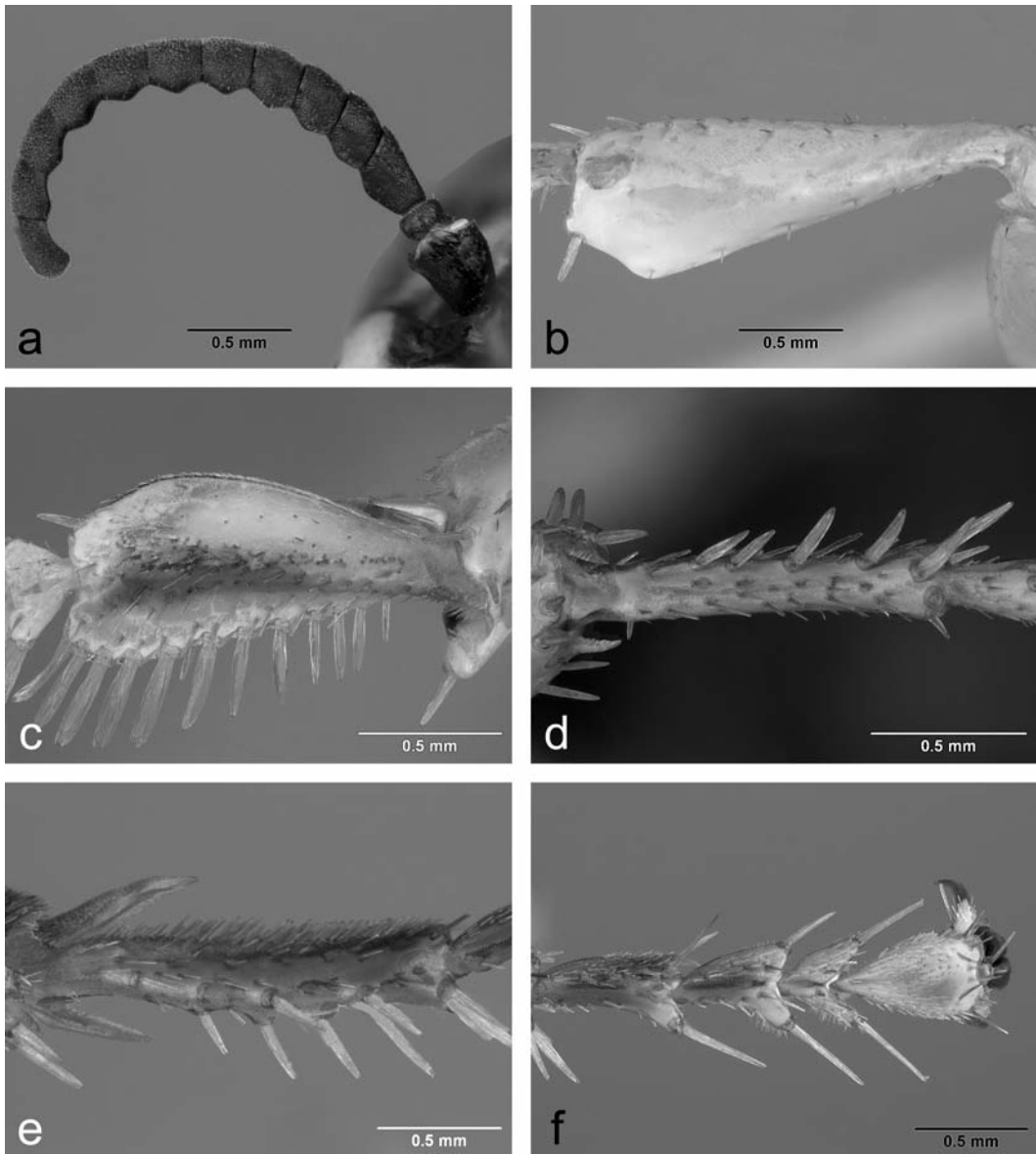


FIGURE 91. *Palarus rufipes* Latreille  $\sigma$ : a – antenna; b – foretibia in posterior view; c – forebasitarsus; d – midbasitarsus in lateral view; e – hindbasitarsus in dorsal view; f – hindtarsomeres II-IV.

prominence (prominence rudimentary in some females). Propodeal side ridged except microsculptured anteriorly in some specimens. Apicoventral foretibial margin emarginate posterad of spur socket, cuticle dark adjacent to emargination; ventral surface of foretibia, basad of spur, with conspicuous, falciform seta (Fig. 90c), with two such setae in many females.

Clypeus dark brown adjacent to anterior tentorial pit; lateroclypeus black dorsally in male; frons in female with ventral paraocular macula and median macula between and above antennal sockets that extends to frontal midheight in some specimens, all black in male; gena in female with

small macula above midheight and another one adjacent to mandibular base, all black in male; mandible yellow basally, dark apically; scape and pedicel brown orange in female, dark brown in male; flagellum dark brown in female, black in male. Thorax and propodeum: pronotal collar and scutum anterolaterally yellowish brown, in female also pronotum anteriorly, pronotal lobe, scutellum and scutellar flange, metanotum and metanotal flange, upper mesopleuron, and in some specimens pair of spots on propodeal dorsum. Wing membrane yellowish in female except brownish along outer margin, markedly infumate in male. Coxae and trochanters black, femora, tibiae, and tarsi reddish, male foretarsus pale yellow, male forebasitarsus with dark longitudinal strip. Terga I-V (except tergum I basally) yellowish brown in female, also pygidial plate in some specimens, and maculae broadly interrupted on terga IV and V in some others; gaster all black in male.

♀.— Genal setae not sinuous, shorter than midocellar width. Dorsal length of flagellomere I  $1.6-1.7 \times$  apical width. Forebasitarsus widened (Fig. 90d). Forebasitarsus IV either with single rake spine or with two spines. Dorsal end of adlateral carina of tergum I gradually effaced posterad. Fine ridges of pygidial plate somewhat irregular, clearly diverging from midline. Sternum II (Fig. 90a, b): transverse crest simple; posterad of transverse crest (and associated row of setae) with semicircular platform delimited by obtuse swelling, apex of swelling separated from setae by more than midocellar width; apical depression shorter than midocellar width; swelling that borders apical depression extending to each lateromedian angle of crest, without sharp tubercle. Length 12.7-16.1 mm.

♂.— Free margin of medioclypeus arcuate to nearly straight. Genal setae sinuous (nearly

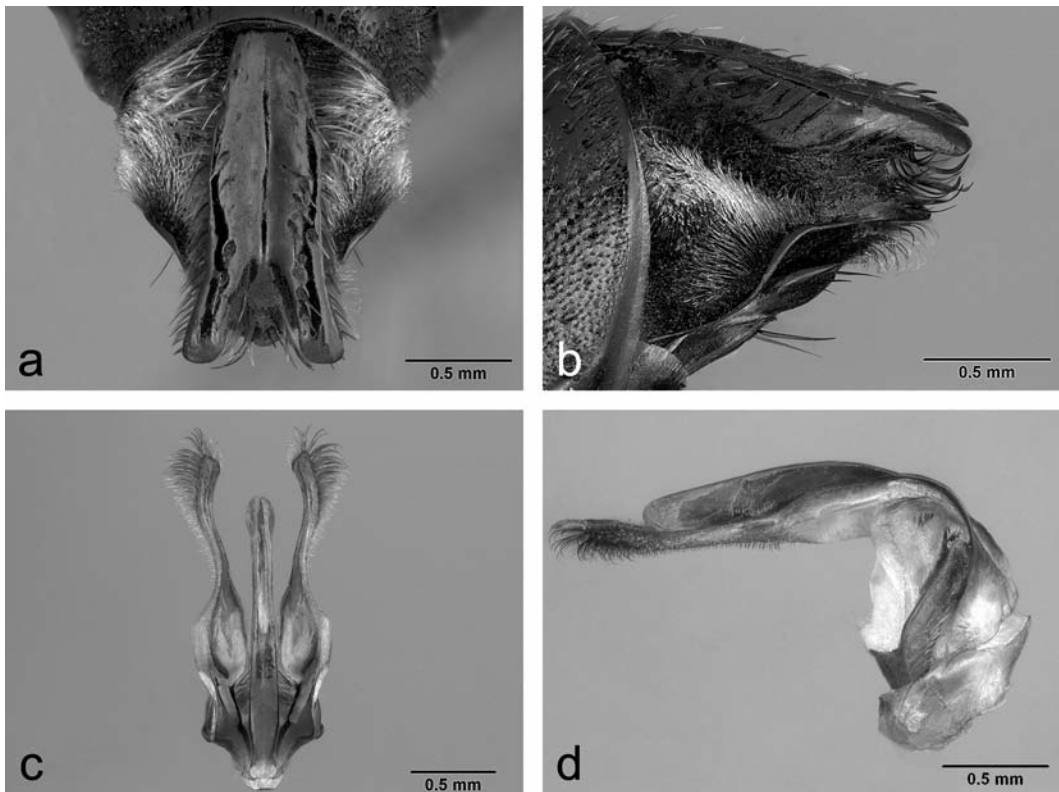


FIGURE 92. *Palarus rufipes* Latreille ♂: a – tergum VII in dorsal view; b – tergum VII in lateral view; c – genitalia in dorsal view; d – genitalia in lateral view.



straight in some specimens), longest setae equal to or longer than midocellar width. Longest setae between mandibular articulation and posteroventral notch shorter than half midocellar width. Dorsal length of flagellomere I  $1.7 \times$  apical width; venter of flagellomeres I-VIII convex near midlength, with a few short, erect setae; venter of flagellomeres IX and X convex preapically; apical flagellomere markedly curved, concave ventrally (Fig. 91a). Mesopleural setae behind episternal sulcus not sinuous, shorter than midocellar width. Mesothoracic venter, before precoxal sulcus, concave, largely impunctate and unsculptured, with setae shorter than those on ventral portion of preepisternum. Metasternum largely asetose. Forecoxa without apicomedian platform, apicomedian setae not denser than on remaining surface. Foretibia markedly triangular as seen in posterior view (Fig. 91b). Forebasitarsus conspicuously widened (Fig. 91c), with black apicoventral marking and long, dark brown dorsal marking, with row of appressed setae apically on venter. Foretarsal rake spines broadened (Fig. 91c). Midcoxal venter flattened, densely punctate basally, with ill-defined, oblong tubercle, posteroventral carina present. Midtibial outer surface concave, spur shorter than  $0.2 \times$  length of midbasitarsus. Midbasitarsus unusually long (Fig. 91d), longer than midtarsomeres II-V combined, not flattened or curved, without row of ventral spines (but spines present along inner margin). Hindbasitarsus elongate (Fig. 91e), length about twice that of posterior hindtibial spur; hindtarsomere II more than twice as long as wide apically; hindtarsomeres II-IV asymmetrical, somewhat expanded apicolaterally (Fig. 91f), with dense, erect setae ventrally. Tergum V without adlateral tooth or tubercle. Tergum VI with adlateral swelling. Tergum VII: pygidial plate (Fig. 92a) somewhat concave, emarginate apically, markedly raised above tergal apex (apex of lateral pygidial process separated from tergal apex by more than midocellar width); pygidial carinae diverging posteriorly in dorsal view (greatest width of plate about  $0.4-0.5 \times$  length); lateral pygidial process widest beyond base, processes not connected ventrally by V-shaped carina; side of tergum markedly obliquely concave; adlateral carina curved, not expanded (Fig. 92b); ventral margin concealed in lateral view; setae, anterad of concavity, appressed, dense, concealing integument, sparse, erect posterad of concavity, upcurved on ventral surface of lateral pygidial process (Fig. 92d). Sternum II with transverse ridge before elevation, with anterior margin of elevation obtuse and posterior margin somewhat undulating. Sternum V, on posterior part of disk, with inconspicuous punctures that average several to many diameters apart, associated setae inconspicuous. Sternum VI with punctures that vary from about 2-4 to many diameters apart; associated setae suberect; adlateral carina in form of obtuse tubercle, somewhat raised relative to ventral margin of tergum VI, not pointed posteriorly. Gonocoxite with small sclerotized lobe adjacent basoventrally to membranous area (Fig. 92d), apically with conspicuous setae (Fig. 92c). Length 13.5-16.2 mm.

**COLLECTING PERIOD.**— Algeria: 30 May; Morocco: 15 April through 20 June; Tunisia: 5-31 May through 4 July.

**GEOGRAPHIC DISTRIBUTION** (Fig. 93).— Morocco to Tunisia.

**RECORDS.**— **ALGERIA** (de Beaumont, 1949, or as indicated): Aïn Cherichira, Annaba (as Bône), Biskra (1 ♀, SAM), Boghari, Bou Hanifia, El Kala (as La Calle), Médeä, Oumm ed Drou (as Pontéba,

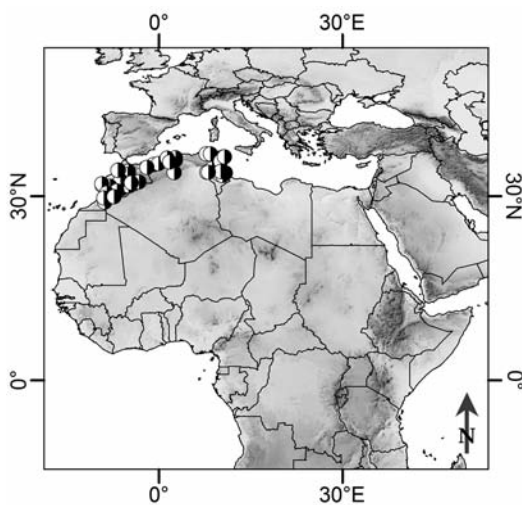


FIGURE 93. Collecting localities of *Palarus rufipes* Latreille.

2 ♀, 2 ♂, MNHN, lectotype and paralectotypes of *humeralis*), Tadjemout, Vialar, no specific locality (2 ♀, 4 ♂, ZMUC). **MOROCCO**: 5 km N Agadir (1 ♀, OÖLM), Amouguer 50 km N Rich (1 ♀, OÖLM), Aoulouz 40 km E Taroudant (1 ♀, CAS; 1 ♀, OÖLM), Asni to Arraround (1 ♂, UCD), Beni Bassia 60 km NE Boudnib (1 ♂, CAS; 1 ♀, 1 ♂, OÖLM), Beni Mellal, El Kelaa, Fès (de Beaumont, 1957), 10 km E Guelmime (1 ♂, OÖLM), N Guelmime (1 ♂, OÖLM), Icht 100 km E Bouzakame (1 ♂, CAS; 1 ♂, OÖLM), Ifrane (1 ♀, UCD), Kasba Tadla (de Beaumont, 1949, 1950), Kenitra (de Beaumont, 1949, as Port-Lyautey), Marrakech (5 ♀, 10 ♂, RMNH; 1 ♂, ZMUC), Marrakech: oued Tensift (2 ♀, CAS; 1 ♀, OÖLM), Mehdiya (de Beaumont, 1957), 10 km SE Ouarzazate (1 ♂, CSE), Oudja, Oulad-Berrehil in Haut Atlas (1 ♀, OÖLM), 10 km S Rich (1 ♂, CAS; 1 ♀, 1 ♂, OÖLM), Taфраout (1 ♂, OÖLM), Tissint 70 km E Tata (1 ♂, OÖLM). **TUNISIA** (de Beaumont, 1949, or as indicated): Djerba: Sidi Magrès (1 ♀, CAS; 1 ♀, OÖLM), Gafsa, Hammamet (1 ♂, OÖLM), Kairouan, 3 km SW Matmata (1 ♂, CSE), Médenine, Metouia 17 km N Gabès (1 ♀, CSE), 3 km E Nabeul (1 ♀, CAS; 3 ♀, 1 ♂, OHL); Nefta (1 ♂, CAS; 1 ♂, OÖLM), Tozeur.

### *Palarus saundersi* Morice

Figures 94-97.

*Palarus saundersi* Morice, 1897:310, ♂. Holotype: ♂, Egypt: Koubbeh near Cairo (OXUM), not examined.— Honoré, 1941:198 (in revision of Egyptian *Palarus*), 1942:59 (in catalog of Egyptian Sphecidae); de Beaumont, 1949:649 (in revision of Mediterranean *Palarus*, description of ♀), 1957:139 (Morocco), 1960:246 (Libya); de Beaumont, Bytinski-Salz, and Pulawski, 1973:17 (Israel); Bohart and Menke, 1976:291 (listed); Guichard, 1988:134 (Saudi Arabia); Nemkov, 2005:243 (in revision of *Palarus* of Russia and adjacent countries).

**RECOGNITION.**— The female of *saundersi* has a distinctive sternum II (Fig. 94a, b), with a short transverse platform posterad of the transverse crest (and associate row of setae); the posterior margin of platform is separated from the setal row by less than midocellar width; also, the apical depression is about as long mesally as the midocellar width. A similar platform, although partly obtuse and nonprominent occurs in *jaxartes*. Unlike *jaxartes*, the genal setae of *saundersi* are straight, shorter than midocellar width (rather than sinuous, longer than midocellar width), and the least interocular distance is  $0.6\text{--}0.7 \times$  midocellar width, averaging less than in the other species of the *variegatus* group (about equal to midocellar width in *jaxartes*).

The male of *saundersi* has a unique pygidial plate whose apex is closer to the tergal apex than in the other species of the *variegatus* group and is shallowly emarginate apically (Fig. 95a, b). Also sternum II is unique within the group in having the anterior margin of elevation sharply carinate, and so is sternum VIII in having the apical, exposed part densely setose (Fig. 96a). Additional recognition features are: as in the male of *jaxartes*, the forebasitarsus has a black or dark preapical, longitudinal tubercle on the venter (less conspicuous in *jaxartes*) and the adlateral carina of tergum VII not expanded (Fig. 95e), the tergum thus appearing double-edged. Furthermore, the males of the two species lack a midtibial spur (also absent in *bernardi*) and have a lamellar, translucent, circular pad on the venter of midtarsomeres II and III (pad also present in *arabicus* and *oneili*). The male of *saundersi* differs from that of *jaxartes* in the following (in addition to the pygidial and sternal characters): the genal setae are shorter than the midocellar width and not sinuous (some setae as long as midocellar width and sinuous in *jaxartes*), the punctures of the mesothoracic venter are many diameters apart (1-4 diameters apart in *jaxartes*), the adlateral carina of tergum V extends over nearly the entire exposed length of the tergum (short, posterior in *jaxartes*), and the elevation of sternum II is sharply carinate anteriorly and serrate posteriorly (Fig. 95a), whereas not sharply carinate and not serrate in *jaxartes*.

**DESCRIPTION.**— Least interocular distance about  $0.6\text{--}0.8 \times$  midocellar width in female,  $0.5 \times$  in male. Occipital carina separated from eye orbit at vertex by about hindocellar length in female,

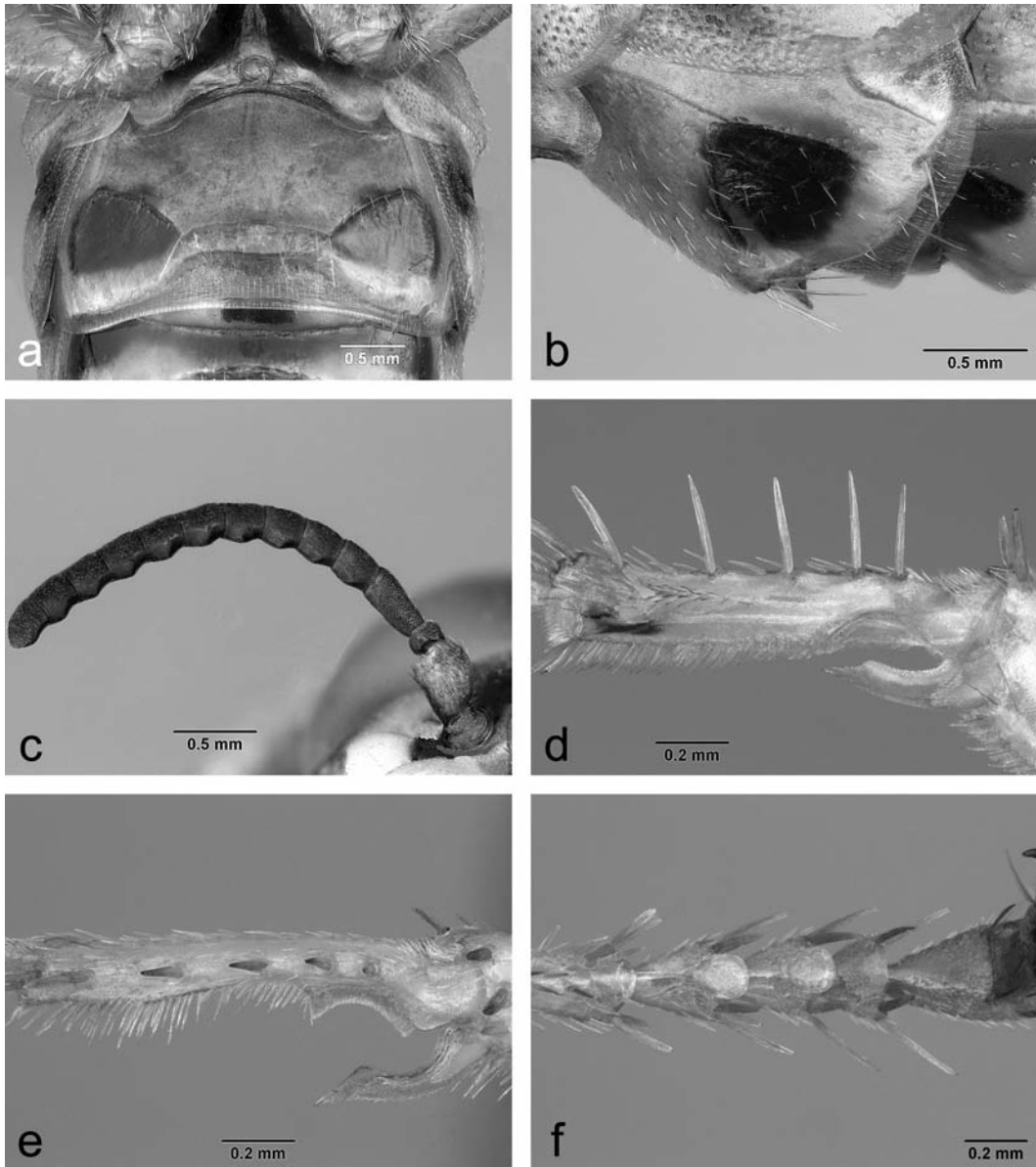


FIGURE 94. *Palarus saundersi* Morice: a – female sternum II in ventral view; b – female sternum II in lateral view; c – male antenna; d – male forebasitarsus in ventral view; e – male forebasitarsus in profile showing row of erect setae; f – male midtarsomeres II and III in ventral view.

about half hindocellar length in male. Anterior margin of precoxal mesopleural declivity without angulate prominence. Propodeal side varying from punctate, unridged to finely ridged except microareolate or unsculptured anteriorly in many specimens.

Frons with ventral paraocular macula, yellow between frontoclypeal sulcus and antennal sockets (extending just above sockets); gena with at most small macula adjacent to mandibular base; antenna all dark brown except scape yellow medioventrally; in many specimens small maculae

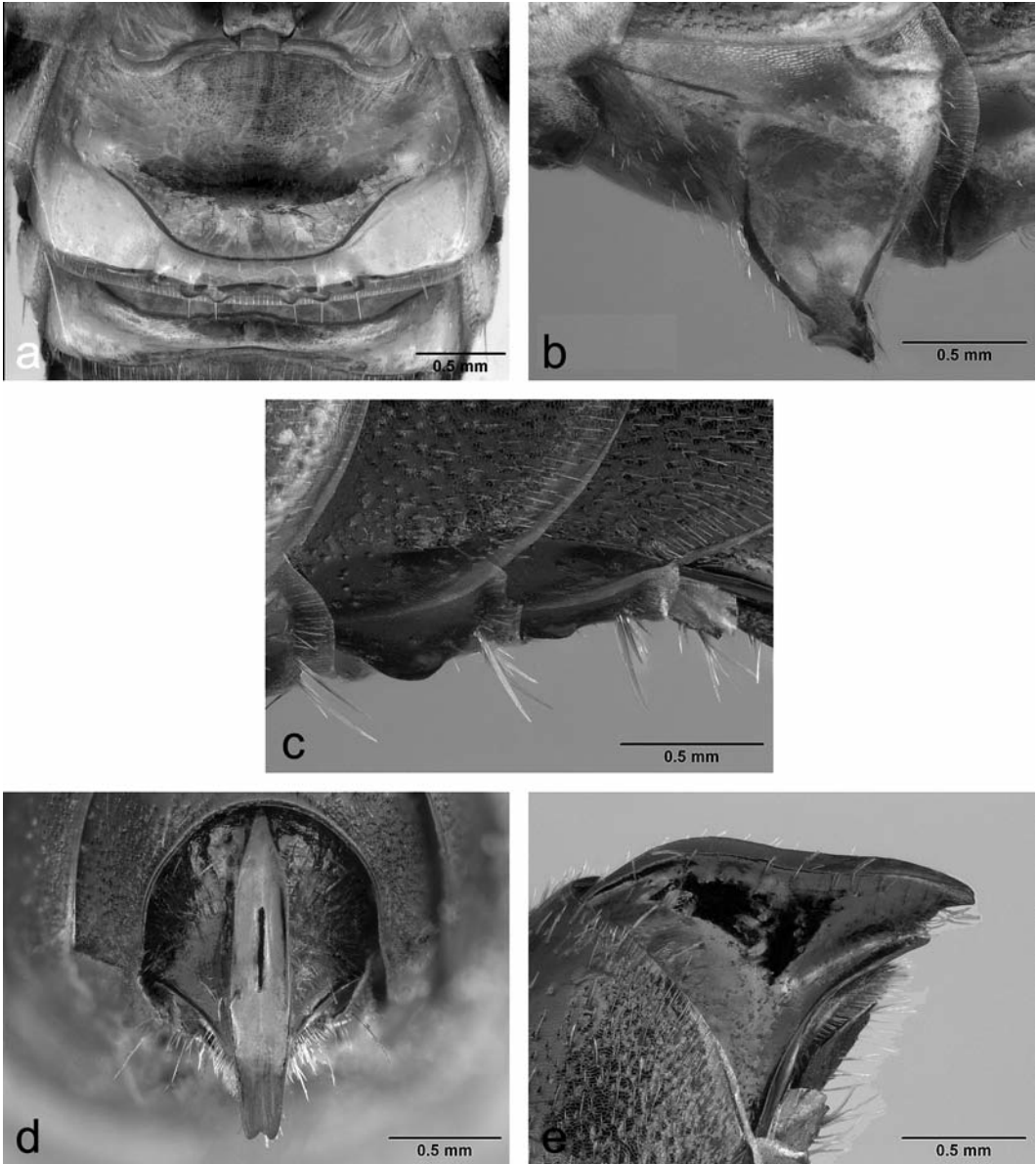


FIGURE 95. *Palarus saundersi* Morice ♂: a – sternum II in ventral view; b – sternum II in lateral view; c – lateral portions of terga IV and V and sterna IV and V in oblique lateral view showing adlateral sternal carinae; d – tergum VII in dorsal view; e – tergum VII in lateral view.

present on pedicel, flagellomeres I and II, and in some on more apical flagellomeres. Thorax with the following yellowish brown: pronotal collar laterally in most specimens, scutum anterolaterally, scutellum and scutellar flange, postscutellum and metanotal flange. Wing membrane minimally infumate apically in female, basally in male. Legs yellowish brown in female, partly yellow in male. Terga yellowish brown except apical tergum black; also tergum V (also VI in male) black in some specimens.



♀.— Genal setae not sinuous, shorter than midocellar width. Dorsal length of flagellomere I  $2.1 \times$  apical width. Adlateral carina of tergum I gradually effaced posterad. Fine ridges of pygidial plate irregular, markedly diverging from midline. Sternum II (Fig. 94a, b) with transverse crest simple; posterad of transverse crest (and associated row of setae) with short, transverse platform that is separated from setae by less than midocellar width; apical depression about as long as midocellar width; swelling that borders apical depression extending almost to each lateromedian angle of crest, without sharp tubercle. Length 12.8-13.6 mm.

♂.— Free margin of medioclypeus slightly arcuate. Genal setae not sinuous, shorter than midocellar width. Longest setae between mandibular condyle and notch slightly more than midocellar width. Dorsal length of flagellomere I  $1.9-2.1 \times$  apical width; venter of flagellomeres II-X convex near midlength, with basal and apical concavities creating uniformly serrate ventral flagellar surface (Fig. 94c); some flagellomeres with a few short, erect setae on venter. Mesopleural setae behind episternal sulcus not sinuous, shorter than midocellar width. Mesothoracic venter, before precoxal sulcus, with most punctures four or more diameters apart, with setae about as long as those on ventral portion of preepisternum. Metasternum largely setose. Forecoxa without apicomedian platform, apicomedian setae dense. Forebasitarsus with oblong, black preapical tubercle, with ventral row of erect setae adjacent to outer margin on at least apical third of tarsomere (Fig. 94d, e). Midcoxal venter not flattened, punctate except apically, with inconspicuous preapical tubercle, posteroventral carina reduced to ill-defined swelling. Midtibial spur absent. Midbasitarsus in profile slightly curved basally, ventrally with somewhat irregular row of spines. Midtarsomeres II and

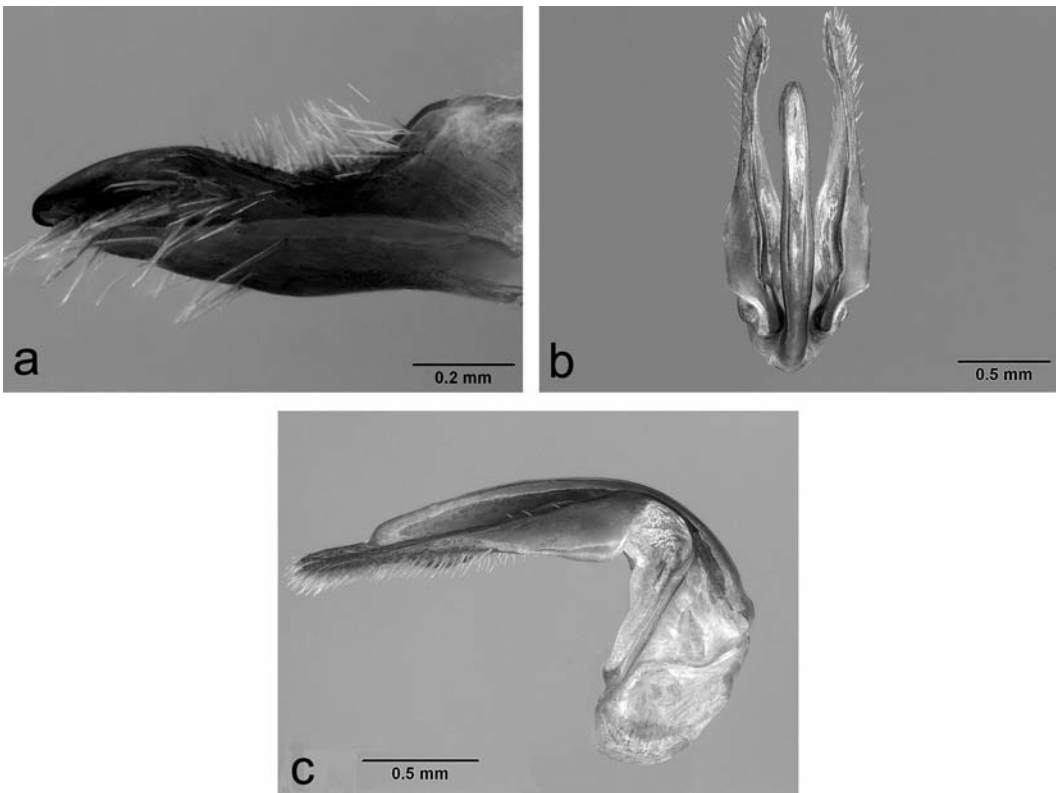


FIGURE 96. *Palarus saundersi* Morice ♂: a – sternum VIII in lateral view; b – genitalia in dorsal view; c – genitalia in lateral view.

III ventrally with translucent, circular pad (Fig. 94f). Tergum IV with adlateral swelling, terga V and VI each with long adlateral carina (extending over most of exposed tergal length). Tergum VII: pygidial plate (Fig. 95d) markedly concave, narrowly emarginate apically, somewhat raised above apex of tergum VII: apex of lateral pygidial process separated from tergal apex by less than mid-cellular width (Fig. 95e); pygidial carinae diverging anteriorly in dorsal view, converging posteriorly (greatest width of plate about  $0.25 \times$  length); lateral pygidial process widest basally, processes not connected ventrally by V-shaped carina; adlateral carina evenly curved, not expanded (Fig. 95e); ventral margin of tergum narrowly visible in lateral view; setae sparser than those on tergum VI, longest and densest ventrad of lateral pygidial process, not upcurved at tergal apex (Fig. 95e). Sternum II without transverse carina before elevation, anterior margin of elevation sharply carinate and posterior margin with series of teeth (Fig. 95a, b). Sternum V impunctate or with a few, inconspicuous punctures, associated setae inconspicuous. Sternum VI, on disk, with minute punctures that are many diameters apart; setae inconspicuous, straight; adlateral carina short, somewhat raised relative to ventral margin of tergum VI, not acutely pointed posteriorly (Fig. 95c). Ventral surface of sternum VIII largely punctate and setose: most or all exposed portion setose (Fig. 96a). Gonocoxite with minimal sclerotized lobe adjacent basoventrally to membranous area (Fig. 96b), apically setose (Fig. 96a, b). Length 12.6-13.9 mm.

**COLLECTING PERIOD.**— Algeria: June; Israel: 15-30 May; Morocco: 19-20 May and 6 and 7 June; Saudi Arabia: March; Tunisia: 22 May.

**GEOGRAPHIC DISTRIBUTION** (Fig. 97).— North Africa, Israel, Arabian Peninsula, Turkmenistan.

**RECORDS.**— **ALGERIA** (de Beaumont, 1949, or as indicated): Aïn Sefra, Djanet (1 ♂, OÖLM), Sidi bou Zid in Djebel Amour, Touggourt. **EGYPT:** **Al Jizah** (= Ghiza): Abu Rawash (Honoré, 1941). **Al Qahira** (= Cairo): Gebel Asfar (de Beaumont, 1949), Koubbah (Morice, 1897), Wadi Digla (1 ♀, MS). **ISRAEL** (de Beaumont, Bytinski-Salz, and Pulawski, 1973, or as indicated): Gvulot (1 ♂, RMNH), Mamshit, Urim, Yeroham. **MOROCCO:** 10 km S Bouarfa (1 ♀, 2 ♂, CAS; 1 ♀, CSE; 2 ♀, 5 ♂, OÖLM), 30 km N Bouarfa (1 ♂, CAS), Boumalne (de Beaumont, 1949), Imiter (de Beaumont, 1949). **SAUDI ARABIA:** Umm Laj (Guichard, 1988). **TUNISIA:** W Matmata at  $33^{\circ}34.65'N$   $09^{\circ}39.35'E$  (1 ♀, CSE), Sfax (de Beaumont, 1949), Tozeur (de Beaumont, 1949). **TURKMENISTAN:** Uch-Adji (Nemkov, 2005).

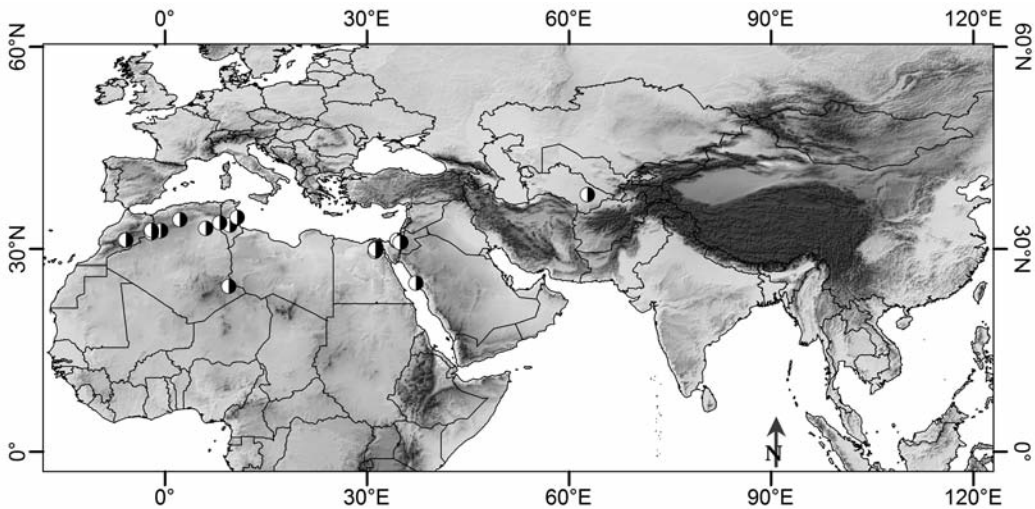


FIGURE 97. Collecting localities of *Palarus saundersi* Morice.

***Palarus variegatus* (Fabricius)**

Figures 98-100.

[N.B. There are no fewer than 150 literature citations of *Palarus variegatus* and its synonym *flavipes*, mostly locality records from Europe. Only the essential nomenclatural citations are presented for these two names].

*Tiphia variegata* Fabricius, 1781:451, sex not indicated. Holotype: ♀, Russia: Siberia: no specific locality (BMNH, Banks coll.), not examined.— As *Palarus variegatus*: Girard, 1879:951 (new combination, morphology and habits); van der Vecht, 1961:24 (discussion of type material).— As *Larra variegatus*: Casolari and Casolari Moreno, 1980:113 (specimens in M. Spinola collection).

*Crabro flauipes* Fabricius, 1781:470, sex not indicated. Holotype: ♀, Italy: no specific locality (ZMUC). Synonymized with *Palarus variegatus* by Turner, 1909:484 (first reviser).— As *Philanthus flauipes*: Fabricius, 1790:255 (new combination, erroneously “in Daniae floribus”).— As *Crabro flavipes*: Olivier, 1792:513 (new combination, redescription).— As *Gonius flavipes*: Panzer, 1806:178 (new combination, redescription).— As *Palarus flavipes*: Latreille, 1805:296 (new combination).

*Palarus auriginosus* Eversmann, 1849:384, ♀, ♂ (authorship attributed to Pallas). Lectotype: ♀, Russia: Orenburg (ZIN), **here designated**, examined. Synonymized with *Palarus flavipes* by Kohl, 1885:420.— Becker, 1880:153 (Russia: Sarepta, now Krasnoarmeysk S Volgograd); Radoszkowski, 1890:507 (Armenia: Mount Ararat), 1892:591 (male genitalia).

*Palarus affinis* F. Morawitz, 1893:414, ♂. Holotype: ♂, Tajikistan: Takfan in Yagnob valley (ZIN), examined before 1965. Synonymized with *Palarus variegatus* by Nemkov, 2005:245.— F. Morawitz, 1894:344 (Turkmenistan: Koshlagar, description of ♀); Dalla Torre, 1897:657 (in catalog of world Sphecidae); Gussakovskij, 1935:433 (Tajikistan: Kulab); Myartseva, 1972a:81 (Turkmenistan).— **As *Palarus variegatus affinis***: Pulawski, 1965:575 (study of type, new status); Bohart and Menke, 1976:291 (listed); Nazarova, 1998:41 (Tajikistan: Tigrovaya Balka Nature Reserve); Kazenas, 2001:32 (in checklist of Sphecidae of Kazakhstan and Central Asia).

*Palarus flavipes* var. *varius* Sickmann, 1894:215, ♀, ♂. Syntypes: China: Hopei Province: Tientsin (MÜNSTER), not examined.— Dalla Torre, 1897:657 (in catalog of world Sphecidae).— **As *Palarus variegatus varius***: Tsuneki 1964:61 (in key), 1969:17 (nesting habits), 1971:34 (China: Beijing: Tiendang); Kazenas, 1980:89 (Russia: Far East); Tsuneki, 1982:15 (known from Korea); Nemkov, 1992:245 (Russian Far East); Nemkov *in* Nemkov, Kazenas, Budrys, et Antropov, 1995:413 (in key to Sphecidae of Russian Far East); Wu and Zhou, 1996:93 (in Economic Insect Fauna of China); Nemkov, 2005:246 (in revision of *Palarus* of Russia and adjacent countries).

*Palarus fortistriolatus* Cameron, 1907:91, ♀. Lectotype: ♀, Pakistan: Baluchistan: Quetta (BMNH), **here designated**, examined. **New synonym**.— Turner, 1911:480 (diagnostic characters); Ramakrishna Aiyar, 1916:553 (listed); Bohart and Menke, 1976:291 (listed).

*Palarus saishiuensis* Okamoto, 1924:202, ♀. Holotype: ♀, South Korea: Quelpart Island, now Jeju Island: no specific locality (depository?), not examined. Synonymized with *Palarus variegatus varius* by Tsuneki, 1971:34.— Sato, 1926:36-39 (nesting habits), corrected to *Palarus variegatus varius* by Tsuneki, 1971:34.

**LECTOTYPE SELECTION.**— Cameron (1907) did not specify the number of specimens examined in his description of *fortistriolatus*. We received for study two females with handwritten labels “*Palarus fortistriolatus* Cameron” (presumably in Cameron’s own handwriting), and we selected one as the lectotype of this species.

W. Pulawski examined the syntype series of *Palarus auriginosus* Eversmann on 15 June 2006. He designated as the lectotype the only female bearing Eversmann’s original label “*Palarus auriginosus* Pall.”. The specimen is also labeled “Orb.” (= Orenburg). The remaining 7 ♀ 5 ♂ with various, difficult to read labels of origin, were labeled paralectotypes.

**RECOGNITION.**— In both sexes, the genal setae are markedly shorter than the midocellar

width. In the female, sternum II has a semicircular or elliptical platform (Fig. 98c, d) delimited by an obtuse swelling posterad of the transverse crest and associated row of setae (crest not dentate), and the sternum's apical depression is shorter than the midocellar width. *Palarus fulviventris* is similar, but in *variegatus* the flagellum is either all black or (some specimens) yellow basally and the swelling that borders the apical depression of sternum II laterally in most specimens extends to the lateromedian angle of the crest. In *fulviventris*, the flagellum is all or largely yellow or reddish, and the preapical swelling of sternum II does not extend to the crest.

In the male, the forebasitarsus is not broadened, the midtibial spur is present, the midbasitarsus is not flattened (either dorsoventrally or laterally), tergum VII lacks an additional carina between the pygidial plate and adlateral carinae, and the antenna is all black, except with small macula on the scape and on flagellomere I in some specimens. The Saharan *gao* is similar, but differs by the antenna all or predominantly yellowish red dorsally and by other characters given in the key (p. 00). In most males of *variegatus*, the adlateral carina of sternum VII is pointed posteriorly (Fig. 99b), as in *oneili*, *pentheri*, and some *fulviventris*.

**JUSTIFICATION OF NEW SYNONYMY.**—*Palarus fortistriolatus* Cameron, from Pakistan, was described from specimens with an all yellow scutellum, metanotum, and apical tergum (as in *Palarus affinis*), but otherwise identical to European *variegatus*. As the extent of yellow is variable, as described below, and as both color types occur in many localities, we see no need to recognize this name either at the specific or subspecific level.

**DESCRIPTION.**—Least interocular distance about 1.1-1.4 × midocellar width in both sexes.

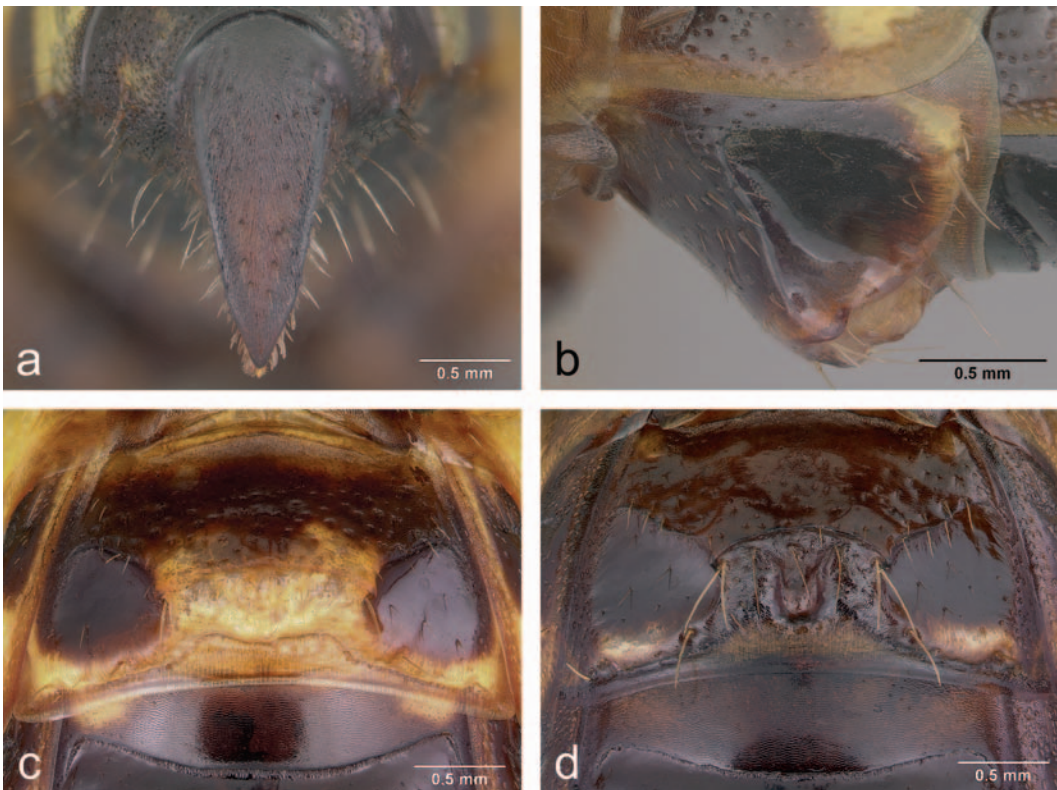


FIGURE 98. *Palarus variegatus* (Fabricius) ♀: a – pygidial plate in dorsal view; b – sternum II in lateral view; c – central portion of sternum II, *variegatus variegatus* (Fabricius); d – same, *variegatus varius* Sickmann.



Occipital carina separated from eye orbit at vertex by more than length of hindocellus. Clypeus about 2.5-2.6  $\times$  as wide as long or less in female, about 2.35-2.5  $\times$  as wide as long in male. Anterior margin of precoxal mesopleural declivity with angulate prominence. Propodeal side irregularly ridged or rugose, microsculptured anteriorly in some specimens.

Clypeus black adjacent to anterior tentorial pit (minimally in specimens from Turkmenistan and single one from Tajikistan) and also below frontoclypeal sulcus in subspecies *varius*; frons with at least ventral paraocular macula (subspecies *varius*), maculate in lower half in other specimens; antenna all black except with small macula on scape and on flagellomere I in some specimens, including many from Turkmenistan. Wing membrane nearly hyaline to slightly infumate apically. At least terga I-IV fasciate (only I-III in a male from Monan, China), and gaster all black in a female from Biysk area, Russia (fasciae interrupted in subspecies *varius*). See Color Variation and Subspecies in *Palarus variegatus* below for further details.

♀.— Genal setae not sinuous, markedly shorter than midocellar width. Dorsal length of flagellomere I 2.1-2.2  $\times$  apical width. Adlateral carina of tergum I gradually effaced posterad. Fine ridges of pygidial plate slightly irregular, clearly diverging from midline (Fig. 98a). Sternum II with transverse crest simple (most specimens) or serrate; posterad of crest (and associated row of setae) with semicircular or elliptical platform (Fig. 98c, d) delimited by obtuse swelling and in most specimens with paired, posteriorly converging carinae; apex of platform separated from setae by more than midocellar width; apical depression of sternum II shorter than midocellar width; swelling that borders apical depression in most specimens extending to each lateromedian angle of crest, without sharp tubercle. Length 10.6-14.3 mm.

♂.— Free margin of medioclypeus slightly arcuate to almost straight. Genal setae not sinuous, markedly shorter than midocellar width. Longest setae between mandibular articulation and posteroventral notch about equal to midocellar width. Dorsal length of flagellomere I 1.9-2.1  $\times$  apical width; venter of flagellomeres II-VIII somewhat convex preapically (all venter slightly convex on flagellomeres I and IX); flagellomeres without obvious setation (Fig. 99a). Mesopleural setae behind episternal sulcus not sinuous, shorter than midocellar width. Mesothoracic venter, before precoxal sulcus, with most punctures 2-4 diameters apart, with setae slightly shorter than those on ventral portion of preepisternal area. Metasternum setose. Forecoxa apicomesally without platform, with setae not conspicuously denser than on remaining surface. Midcoxal venter flattened, punctate except apically, with inconspicuous preapical tubercle (tubercle absent in small specimens), with posteroventral carina obtuse, ill defined. Midtibial spur about 0.4-0.5  $\times$  length of midbasitarsus in most specimens, but about 0.3  $\times$  in many from Central Asia. Midbasitarsus neither curved nor flattened, with row of widely spaced spines ventrally. Tergum V without adlateral tooth or tubercle. Tergum VI with small adlateral swelling in some specimens. Tergum VII: pygidial plate (Fig. 99c) somewhat concave, emarginate apically, raised above tergal apex (lateral pygidial process separated from tergal apex by more than midocellar width); pygidial carinae diverging posteriorly in dorsal view (greatest width of plate about 0.5  $\times$  length); lateral pygidial process widest anteriorly, processes not connected ventrally by V-shaped carina; side not markedly concave; adlateral carina expanded basally (Fig. 99d); ventral edge of tergum concealed in lateral view; setae not denser than those on tergum VI, longest on sides and ventral apex of lateral pygidial process, not upcurved at tergal apex. Sternum II with transverse carina before elevation, anterior margin of elevation obtuse, posterior margin a simple carina. Sterna V and VI, on disk, with punctures that average many diameters apart; associated setae inconspicuous; adlateral carina of sternum VI obtuse, raised relative to ventral margin of tergum VI, markedly pointed posteriorly in most specimens (Fig. 99b), but blunt in many males from Turkey. Gonocoxite without sclerotized lobe adjacent basoventrally to membranous area (Fig. 99e), setose apically (Fig. 99e, f). Length 9.1-12.4 mm.

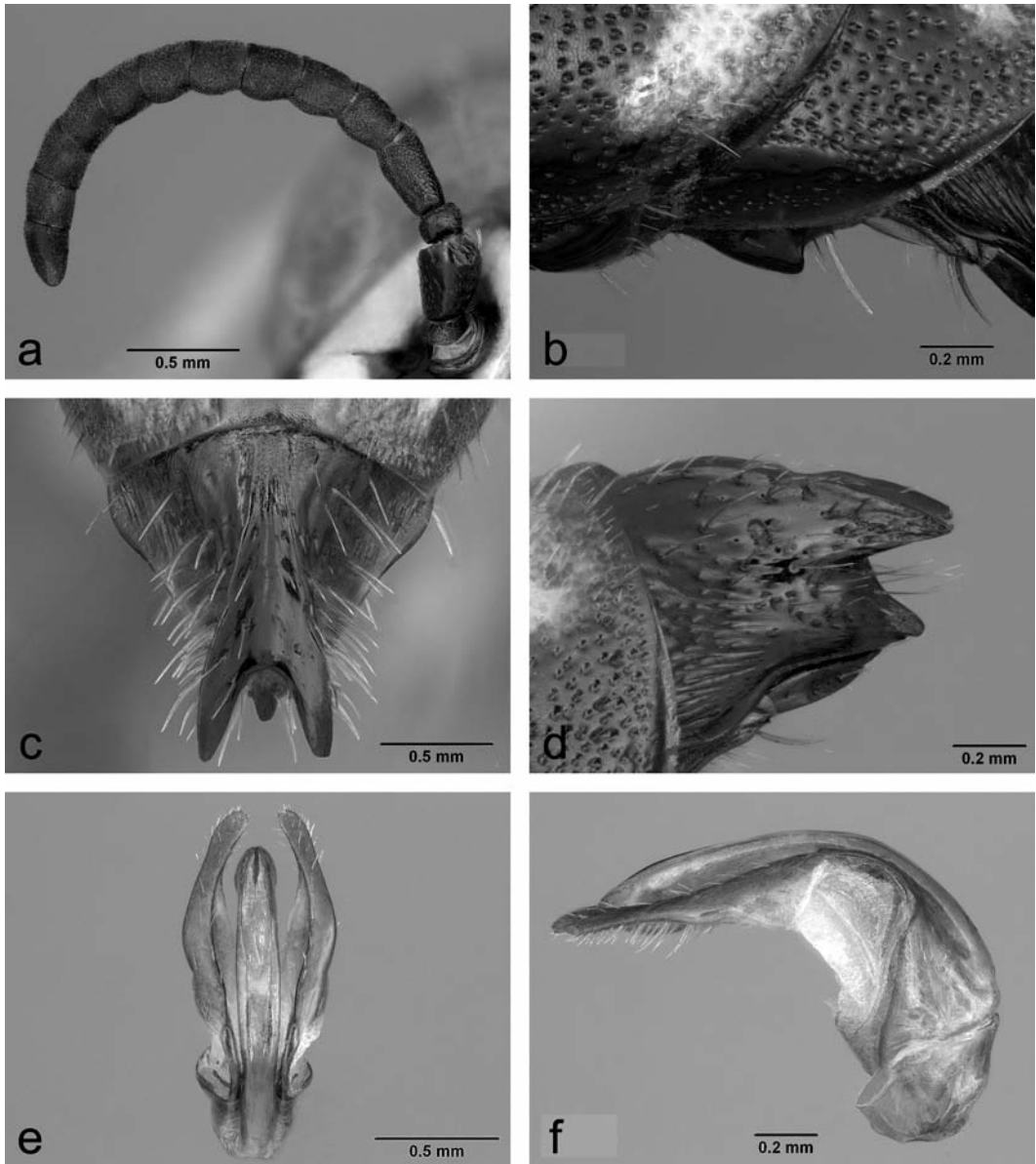


FIGURE 99. *Palarus variegatus* (Fabricius) ♂: a – antenna; b – adlateral carina of sternum VI; c – tergum VII in dorsal view; d – tergum VII in lateral view; e – genitalia in dorsal view; f – genitalia in lateral view.

**COLOR VARIATION.**—Frons: except for the area below antennal socket, the frons is all maculate in ventral half in most specimens (with large black area around antennal sockets in specimens from Europe and some from Turkey), and all black above antennal sockets in specimens from central and eastern China, Korea, and Russian Far East. The amount of frontal black is least in specimens from Turkmenistan and Pakistan.

Gena: all black except maculate in some females from Spain and in most specimens from

Turkmenistan and Tajikistan (in females up to three-quarters genal height, in males only above genal midheight).

Pronotum: all black in many specimens from Italy, Hungary, Bulgaria, and the Far East, but the collar is mostly yellow (at least laterally); also the pronotal rim is yellow anteriorly in specimens from Central Asia.

Scutum: all black in many specimens from Italy, Hungary, Bulgaria, but yellow anterolaterally in most. It is all black in specimens from the Far East.

Scutellum (excluding scutellar crest): all black in specimens from central and eastern China, Korea, and Russian Far East, all black or yellow only along the hindmargin in specimens from Italy, Hungary, Slovakia, Bulgaria, and in many from Spain, European Russia, and Turkey. It is nearly or all yellow in most specimens from European Russia, Turkey, Kazakhstan, Kyrgyzstan, Pakistan, Turkmenistan, Tajikistan, and Mongolia (specimens from the latter three countries were previously assigned to the subspecies *affinis* Morawitz), and some from Spain, but yellow only posteriorly in some specimens. The scutellum may vary in specimens from the same locality, e.g., it is all black or yellow posteriorly in specimens from Gbelce, Slovakia, and mostly or nearly all black to all yellow in those from Koktuma, Kazakhstan, Djebel, Turkmenistan, and Quetta, Pakistan.

Mesopleuron: all black in some males from Italy and Hungary and in specimens from the Far East, but in most the preepisternal area is yellow at least dorsally; the mesopleuron is partly yellow behind the episternal sulcus in specimens from Turkmenistan and some from Pakistan.

Thoracic venter and propodeum: these areas are all black in most specimens, but partly yellow in individuals from Turkmenistan and some from Pakistan (i. e., most *variegatus* previously assigned to subspecies *affinis*).

Legs: the femora, tibiae, and tarsi of most populations are either all yellow or the femora are partly black basally (e.g., in specimens from Italy and Hungary, and western China), but all red in those from central and eastern China, Korea, and Russian Far East.

Apical tergum: the apical tergum is all black in most populations, but with some yellow on each side in females from Spain, and all or largely yellow in most specimens from Kyrgyzstan, Turkmenistan, Tajikistan, and Pakistan.

**SUBSPECIES IN *PALARUS VARIEGATUS*.**— There are two sharply differentiated subspecies of this species: *variegatus variegatus* and *variegatus varius*. In the nominotypical subspecies, the frons is maculate above the antennal sockets, the pronotal lobe, femora, tibiae, and tarsi are yellow or the femora are partly black basally, the tergal fasciae are continuous (interrupted on terga II-IV in one male from Hungary), and the body maculae are yellow (somewhat orange in specimens from Kazakhstan, Mongolia, and some from Toskool-Ata, Kyrgyzstan); in the female, the platform of sternum II (posterad of transverse crest) is semicircular (Fig. 98c) in western European specimens, but elliptical to a various degree in many from eastern Europe and Asia. In *variegatus varius*, the frons is black between the antennal sockets and the midocellus, the pronotal lobe is black, the femora, tibiae, and tarsi are red, the tergal fasciae are interrupted (gaster all black in a female from Buryatya, Russia), and the body maculae are whitish; in the female, the platform of sternum II is elliptical (Fig. 98d).

**COLLECTING PERIOD.**— Armenia: 7 May; Austria: 21 August; Azerbaijan: 7 and 11 July; Bulgaria: 26 June through 29 August; China: 21-30 May; France: 24 June, 1-3 August, 23-27 August; Greece: 31 May; Hungary: 27 June through 27 July; Iran: 1-9 June; Italy: 10 June through 3 August; Kazakhstan: 24 May through 30 July; Korea: 9 July; Kyrgyzstan: 1 June through 29 July, 19 and 31 August; Macedonia: 17 July; Mongolia: 1 July through 31 August; Pakistan: 12 May through August; Romania: 20 May through 20 August; Russia (European): 10 June through 16 July,

15 August; Russia (Tyva): 1 and 2 August; Russia (Altayskiy Kray): 10 June; Russia (Buryatya): 19 August; Russia (Amurskaya Oblast'): 13 July; Slovakia: 25 April through 19 August; Spain: 9 June through 12 September; Tajikistan: 12 May through 24 July; Turkey: 3 June through 16 July; Turkmenistan: 28 April through 31 May, 13 and 24 June, 8 July; Ukraine: 1, 2 and 17 August; Uzbekistan: 12 May through 15 June, 2, 20 and 28 July.

**GEOGRAPHIC DISTRIBUTION** (Fig. 100).— Spain, southern France, Italy, eastern Europe north to Austria, Czech Republic, Ukraine, and Bryansk Oblast' in Russia, Armenia, Turkey, Kazakhstan, Uzbekistan, Turkmenistan, Tajikistan, Afghanistan, Pakistan, Mongolia, Russian Far East (southern part), South Korea, and northern China. The following old records have not been confirmed by subsequent authors and are obviously erroneous: Germany (Vander Linden, 1829; Schenck, 1857, 1867; Taschenberg, 1858), Sweden (Billberg, 1820), Switzerland (Kohl, 1883), and Tunisia (Smits van Burgst, 1913).

**RECORDS.**— *Palarus variegatus variegatus*: **AFGHANISTAN**: Gulbahar (de Beaumont, 1961). **ARMENIA**: Mount Ararat (Radoszkowski, 1890), Yerevan (1 ♂, UCD; 2 ♀, 2 ♂, ZMMU). **AUSTRIA**: **Burgenland**: Neusiedl: Kalvarienberg (Dollfuss, 1987), Neusiedl: Tabor (5 ♀, 1 ♂, MS). **Niederösterreich**: Guntamsdorf (3 ♀, 7 ♂, MS), Oberweiden at 48°17'N 16°50'E (1 ♀, MS). **Wien**: Donau-Auen (Zettel, Gross, and Mazzucco, 2001), Marchfeld (1 ♂, CAS), Teiritzberg (1 ♂, CAS), Türkenschanze (1 ♀, ZMUC), Wien (1 ♀, USNM). **No specific locality**: 2 ♂, USNM. **AZERBAIJAN**: Sabirabad (1 ♀, ZMMU), Samur River on Baku-Derbent road (1 ♀, 1 ♂, ZMMU). **BULGARIA**: Ichtiman (Ljubomirov, 2000), Ivanski near Shumen (Jacobs, 2005), Kulata (1 ♂, OÖLM), Nesebar (1 ♂, CAS), Pancharevo (Ljubomirov, 2000), Plovdiv (5 ♀, 9 ♂, OÖLM), Sandanski (1 ♀, CAS; 1 ♀, 1 ♂, OÖLM), Slanchev Bryag (2 ♂, OÖLM), Sozopol (1 ♀, 1 ♂, CAS), western Stara Planina Mts. (Atanassov, 1972), Varna (5 ♀, 6 ♂, CAS; 2 ♂, USNM), Varvara (1 ♀, OÖLM). **CHINA**: **Nei Monggol** (= Inner Mongolia): Alashan Range (Nemkov, 2005): Bainkhuluk and Khohtyn-Gol, also Apaka (4 ♀, 10 ♂, USNM), Beidzumiao near Apaka (Tsuneki, 1969, 1971), Dan-Yuan-In (1 ♀, ZIN). **Gansu**: Dunhuang (1 ♀, ZIN, as Sachzhou). **Xinjiang**: Yining (1 ♂, ZMMU, as Kuldza). **CROATIA** (Vogrin, 1955): Đurđevac, Osijek. **CZECH REPUBLIC** (Zavadil, Šustera, and Bat'a, 1937): Písek, Rohatec, also Bzenec (Balthasar, 1941). **FRANCE**: **Alpes-de-Haute-Provence** (Maldès et al., 1993): Digne, Valensole. **Ardèche**: La Voulte (Maldès et al., 1993). **Bas-Rhin**: Haguenau (Schmid-Egger and Bitsch, 2001). **Bouches-du-Rhône**: Arles (Maldès et al., 1993), Marseille (Kohl, 1885). **Drôme**: Nyons (Berland, 1925). **Gard** (Maldès et al., 1993, or as indicated): Bellegarde, Grau-du-Roi, Saint-Chaptes. **Hautes-Alpes**: Serres (Berland, 1925). **Hérault**: Montpellier (1 ♀, USNM), Sète (Marquet, 1875, as Cette; Maldès et al., 1993).

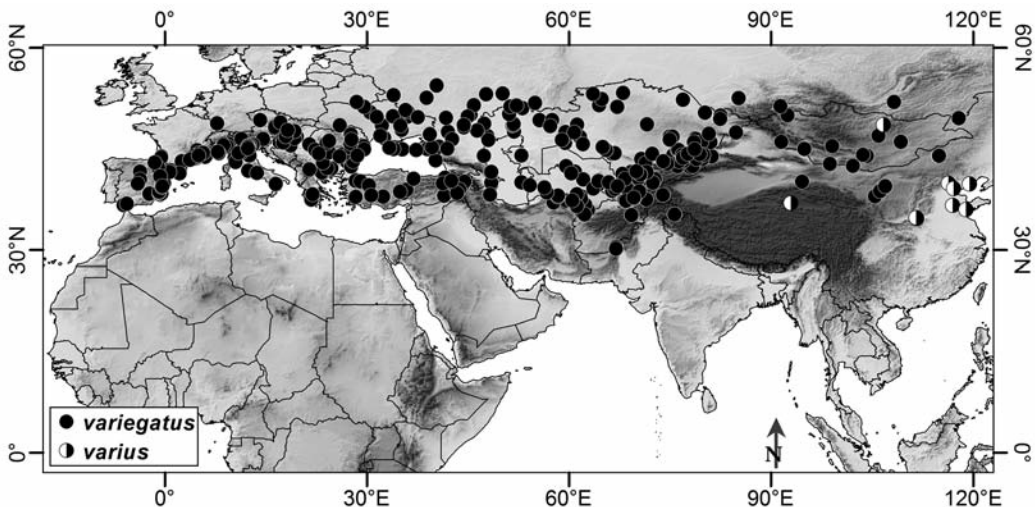


FIGURE 100. Collecting localities of *Palarus variegatus* (Fabricius).



**Landes:** Mont-de-Marsan (Maldès et al., 1993), Saint-Sever (Dufour, 1841; Schmid-Egger and Bitsch, 2001). **Lot-et-Garonne:** Campet (Simon Thomas, 1976; Maldès et al., 1993), Durance (Simon Thomas, 1972). **Vaucluse:** Avignon (Fabre, 1856), pont d'Avignon (1 ♂, RMNH), Carpentras (1 ♀, RMNH), Sorgues (Maldès et al., 1993). **No specific locality:** 1 ♀, USNM; 1 ♀, ZMUC. **GEORGIA:** Ermolovskoye near Gagra (1 ♀, 1 ♂, ZMMU), Voshlovanskiy Nature Reserve (Nemkov, 2005). **GREECE: Pelopónnisos:** Olympia (1 ♂, MS). **Sterea Ellás** (= Central Greece): Evinohori 11 km E Missolonghi (1 ♀, OHL), Lidorikion (de Beaumont, 1965), Rentina (de Beaumont, 1965), Thessaloniki (de Beaumont, 1965). **HUNGARY** (J = Józán, 1985): Balatonalmádi (Benedek, 1979), Balatonboglár (J), between Balatonszépplak and Zamardi (Móczár, 1952), Barcs (Józán, 1983), Bátorliget (Benedek, 1969), Boronka-melléki Protected Area (Józán, 1992), Budapest (1 ♀, ZMUC), Bugac Pusztá: Herkető (1 ♀, CAS), Bugaszeg (J), Csepel (Scobiola-Palade, 1967), Dárany (J), Debreczen (Scobiola-Palade, 1967), Duna-Dráva National Park (Józán, 1995), Dunaharasti (1 ♂, CAS), Félegyháza (Vángel, 1905), Kalocsa (Mocsáry, 1897, as Calocsa), 15 km SW Kecskemét (1 ♂, CAS), Kiskunság National Park (Józán, 1986; Karsai, 1988), Kisujszallás (Mocsáry, 1897), Kömlöd (Vángel, 1905), Makhegy (J), Rómahegy (J), Somogytúr (J), Szabolcsfalú (J), Szatymaz (Mocsáry, 1897), Szomotor (Schulz, 1904), Tetye (J), Veresegyház (Benedek, 1969), Zamardi (2 ♀, 4 ♂, CAS), no specific locality (5 ♂, USNM; 1 ♀, 2 ♂, ZMUC). **IRAN: Ardabil:** Mugan (1 ♀, ZMMU). **Khorasan:** 90 km W Quchan (7 ♂, USNM). **ITALY: Calabria:** Villapiano (Pagliano, 1980). **Campania:** no specific localities (Pagliano and Negrisolto, 2005). **Emilia-Romagna** (de Beaumont, 1954, or as indicated): Cervia (Grandi, 1931), Grizzana and Ronzano in Bologna Province, Modena area (Baldini, 1894), Rastignano in Bologna Province (Guiglia, 1944), Riccione in Forlì Province (Grandi, 1954), Rimini in Forlì Province, Valle delle Pozze in Modena Province, Viserbella (Grandi, 1928). **Lazio:** Acilia in Roma Province (de Beaumont, 1959), Pontecorvo in Frosinone Province (de Beaumont, 1954). **Lombardia** (Guiglia, 1944): Calolzio, Mercallo, Milano (1 ♂, CAS), Turbigio (1 ♀, CAS). **Piemonte:** Ceva (Pagliano, 1990), Narzole (Pagliano, 1980), no specific locality (2 ♂, ZMUC). **Toscana:** Pisa area (Rossi, 1792), San Vincenzo in Livorno Province (de Beaumont, 1954). **Trentino–Alto Adige:** Bolzano (Kohl, 1888, as Bozen). **Veneto:** Bibione at 45°38'N 13°03'E (2 ♂, OÖLM), Cavazuccherina (Gayubo, Borsato, and Osella, 1991), Lido di Venezia (de Beaumont, 1959; Giordani Soika, 1932; Guiglia, 1944), Lido: Alberoni at 45°20'52"N 12°19'23"E (1 ♀, CAS), Porto Caleri (Negrisolto, 1995), no specific locality (1 ♂, CAS). **Location unknown:** C. d'Adda (1 ♀, USNM, can be Castiglione d'Adda or Crespi d'Adda). **KAZAKHSTAN** (K = Kazenas, 2002, N = Nemkov, 2005): **Almaty Oblast':** Aidarly on Ili River at 44.1°N 75.5°E (1 ♂, OÖLM), Almaty (1 ♀, 12 ♂, OÖLM), 4 km N Bakanas (2 ♀, 7 ♂, OÖLM), 17 km NW Bakanas (N), W Chunja at 43°37'N 79°21'E (3 ♀, 4 ♂, CSE), 20 km WSW Dobyň at 43°35.23'N 79°52.15'E (1 ♀, OHL), Fabrichnyi 40 km E Almaty (1 ♀, OÖLM), Ili (Kzenas, 1972), Ilyysk (1 ♀, CAS; 1 ♀, 1 ♂, ZMMU), Kapchagay 100 km N Almaty at 43.9°N 76.8°E (1 ♂, CAS; 3 ♀, 8 ♂, OÖLM, 3 ♂, USNM), 35 km NW Kapchagay (1 ♀, CAS), Kaskelen River 50 km N Almaty (2 ♀, 3 ♂, CAS; 16 ♂, USNM), Keytebek Valley (Dzhungaria) in Katutau Mts. (1 ♀, 1 ♂, CAS), Koktuma at Lake Alakol at 46°0'N 81°04'E (8 ♀, 21 ♂, OÖLM), Koybynskoe Valley in Katu-Tau Mts. (Kzenas, 1972), Kurtagoy on Charyn River (Kzenas, 1972), Lepsi at 46.4°N 78.8°E (1 ♀, 3 ♂, OÖLM), 25 km N Lepsi (N), 6 km SE Lepsi (14 ♂, OÖLM), 70 km SE Lepsi at 46°01'N 79°42'E (1 ♀, CSE), Malaysary 144 km N Almaty (2 ♀, 3 ♂, OÖLM), Matai at 46.0°N 78.6°E (4 ♀, 2 ♂, OÖLM), Panfilov area (Kzenas, 1972), 40 km W Panfilov at 44°14'N 79°28'E (2 ♂, CSE), Taldy-Kurgan area (Kzenas, 1972). **Aqtöbe:** 5-10 km NE Aqtöbe (K), Babatay (K), Berchogur (K), Bol'shiye Barsuki (K), Chelkar (2 ♀, ZIN), Dzhurun (1 ♂, UCD), Irghiz (K), Malyie Barsuki (1 ♀, ZIN). **Atyraū:** 50 km N Atyraū (K, N, as Guryev), Grebenschchikov (K), Inder (1 ♀, ZIN), Inderborskiy (K), Kharkin 180 km N Atyraū (N). **East Kazakhstan:** Öskemen (1 ♀, ZIN, as Ust' Kamenogorsk), Semey (6 ♀, ZIN, as Semipalatinsk), 5 km N Tashkesken in Tarbagatai Mts. at 47°16'N 80°49'E (1 ♀, OHL), Zaisan (4 ♂, ZMMU). **North Kazakhstan:** Kökshetaū near Terisakkan River (1 ♀, ZIN). **Oral** (= Ural'sk): Oral (2 ♀, ZIN, as Ural'sk), Urda (1 ♀, 1 ♂, CAS; 2 ♂, UCD; 1 ♀, 4 ♂, ZMMU), Yanvartsevo 65 km N Oral (N). **Pavlodar:** Pavlodar (1 ♀, ZIN). **Qaragandy:** Atasuskiy = Zhana-Arka (1 ♀, 1 ♂, CAS), Balkhash (1 ♀, CSE; 1 ♂, OÖLM), 50 km E Balkhash (7 ♂, OÖLM), 50 km S Balkhash (2 ♂, OÖLM). **Qostanay:** Aman-Karagay (K), Naurzum (1 ♀, 1 ♂, ZMMU), Qostanay (K). **Qyzylorda:** Aral'sk (K), Baigakum near Djulek (1 ♀, ZIN); Bal-amurun near Djulek (1 ♀, ZIN), Djulek = Chiili (8 ♀, ZIN), Karashokat (N), Kazalinsk (1 ♀, UCD), Kulandy peninsula (3 ♀, 1 ♂, ZMMU), Qyzylorda (1 ♂, ZMMU, as Perovsk), 70 km NW Qyzylorda (N). **South Kazakhstan:** Akkul 115 km NW Djambul (5 ♀, 1 ♂, OÖLM), Chardara (Radoszkowski, 1877), 10 km E Djambul

(1 ♀, 5 ♂, OÖLM), 60 km W Furmanovka (1 ♂, CAS). **West Kazakhstan:** 20 km SE Aksay (1 ♀, 1 ♂, OÖLM), Lbishchensk, now Chapaevo (K), Oral (K). **Location unknown:** Kok-Djida (K), Volodarskoye (K). **KYRGHYZSTAN:** Afleatum at 41.6°N 71.6°E (1 ♂, CSE; 2 ♀, 1 ♂, OÖLM), Berk-Su river in Zaalayskiy Alatau Range (1 ♂, OÖLM), Bishkek (1 ♂, OÖLM, as Frunze), Chong-Kyzylysu at 42°18'00"N 78°04'00"E (2 ♂, ZMMU), Kok Maynak at 42°27'05"N 76°07'56"E (1 ♀, ZMMU), Osh (1 ♀, ZMMU), Przheval'sk (1 ♂, ZMMU), 35 km SW Shurab (4 ♀, ZMMU), 10 km NNE Tebek at 43°10'N 74°03'E (1 ♀, CSE), Toskool-Ata in Fergana Mountain Range (1 ♀, OÖLM). **MACEDONIA:** Skopje (1 ♂, OÖLM). **MONGOLIA** (N = Nemkov, 2005, T = Tsuneki, 1972): **Bayanhongor Aymag:** 15 km S Bon-Tsagan-Noor (4 ♀, ZMMU), Tsagan Bogd uul: Tooroin-bulag = 13 km E border post Tsaganbulag (T). **Dornogovi Aymag:** 40 km NW Khara-Eireg (T), Naran Bulak (1 ♀, 1 ♂, CAS). **Govi Altay Aymag:** Adzh Bogd uul approximately at 45°N 95°E (N). **Khovd Aymag:** 10 km SSW Somon Bulgan (T). **Ömnögovi Aymag:** Bayanzag 100 km SW Dalanzadgad at 44°09'N 103°43'E (1 ♀, AMNH; 1 ♀, OÖLM), 30 km S Maidal-Obo (2 ♀, ZMMU), 70 km S Noyon (N). **Tov Aymag:** Tsorgol Khairkan (1 ♀, ZIN). **Uvs:** Ubsu-Nur lake 50 km E Ulaangom (N). **PAKISTAN:** **Baluchistan:** Kushlagh 27 km N Quetta (1 ♂, USNM), Quetta (2 ♀, AMNH; 6 ♀, 4 ♂, BMNH), including lectotype and paralectotype ♀ of *fortistriolatus*; 2 ♀, 3 ♂, USNM). **Northern Areas:** Shrigartar Valley near Skardu W Indus Valley (Gayubo, Borsato, and Osella, 1992). **ROMANIA:** Agigea (1 ♂, RMNH; 1 ♂, USNM), Budești (1 ♀, 1 ♂, UCD), Caraorman (Scobiola-Palade, 1972, 1985), C.A. Rosetti in Danube delta (Scobiola-Palade, 1966, 1985), Făurei-Brăila (Scobiola, 1950), Frătești-Vlașca (Scobiola, 1950; Scobiola-Palade, 1968b), Giurgiu (Scobiola, 1950; Scobiola-Palade, 1968a, b), Iași (Lehrer, 1955), Mehadia (Kohl, 1885), Ocna Sibiului (Scobiola-Palade, 1967), Periprava (Scobiola-Palade, 1966, 1968a, 1985), Piscu-Covurlui (Scobiola, 1950), Recea (Lehrer, 1955), Sărăturile in Danube delta (Scobiola-Palade, 1974, 1989), Techirghiol (Scobiola-Palade, 1967), Ulea-Tutova (Scobiola, 1950), Valea Lungă in Mediaș District (Scobiola-Palade, 1967). **Dobrogea:** locality illegible (1 ♀, OÖLM). **RUSSIA** (N = Nemkov, 2005): **Astrakhan Oblast':** Astrakhan (1 ♂, KRAKÓW; 1 ♂, OÖLM; 1 ♀, ZIN), near Dosang stanitsa (2 ♀, 1 ♂, ZMMU), Nikol'skoye (N). **Bryansk Oblast':** no specific locality (Kolesnikov, 1977). **Chita Oblast':** Abagaitui (N). **Daghestan:** Kraynovka Region (2 ♂, BMNH), Magaramkent (1 ♀, ZMMU). **Krasnodarskiy Krai:** Anapa at 44°52'N 37°22'E (1 ♂, ZMMU), Ashshe in Tuapse District (1 ♀, ZIN), Gul'kevichi (Romanova, 1969), Krasnodar (1 ♀, 2 ♂, ZMMU, as Yekaterinodar), Ust'-Labinsk (Romanova, 1969). **Kursk Oblast':** Borisovka (1 ♀, ZIN), Gotnya (Ahrens, 1925). **Orenburg Oblast':** Orenburg (2 ♂, KRAKÓW). **Rostov Oblast':** delta of Don River (Shkuratov, 2001), Nedvigovka and Rogozhkino (Minoranskiy and Shkuratov, 1996), Romanovskaya at 47°33'N 42°02'E (1 ♂, ZMMU), Rostovskiy Nature Reserve at 46°27'N 42°41'E (Shkuratov, 2002), Vëshenskaya village area at 49°37'N 41°45'E (Shkuratov, 2000). **Ryazan' Oblast':** Gremyachka (N), Spassk District (1 ♀, ZMMU). **Samara Oblast':** Sotsgorod (Chinin, 1991). **Saratov Oblast':** Kamyshin at 50°06'N 45°24'E (5 ♀, ZMMU), Saratov (1 ♂, KRAKÓW, as Sartw.). **Stavropol'skiy Krai:** Stavropol' (N), Zimnyaya Stavka on lower Kuma River (1 ♀, ZIN). **Tyva** (= Tuva): Teve-Khaya at 51.36°N 91.45°E (6 ♀, ZMMU). **Ul'yanovsk Oblast':** Novospasskoye (Blagoveshchenskaya, 1994). **Volgograd Oblast':** Kamyshin (2 ♂, CAS; 2 ♂, ZMMU), Krasnoarmeysk (2 ♀, ZIN, as Sarepta), Tinguta at 48°12'44"N 44°25'09"E (1 ♀, 5 ♂, ZMMU), Volgograd: Beketovka (1 ♀, 1 ♂ KRAKÓW; 1 ♀, UCD; 1 ♀, 1 ♂, ZMMU). **Voronezh Oblast':** Galich'ya Gora Nature Reserve (Kuznetzova, 1990). **SERBIA:** Deliblato (Mocsáry, 1897, as Deliblát), Grebenac (Mocsáry, 1897, Frivaldszky, 1877, as Grebenác), Kovin (Mocsáry, 1897, as Kubin), Pali (Mocsáry, 1897, as Palics), Subotica (Vogrin, 1955). **SLOVAKIA:** Čenkov (1 ♂, OÖLM; 1 ♂, RMNH), Chlumec (Zavadil, Šustera, and Bat'a, 1937), Chotín (4 ♀, 5 ♂, OÖLM), Gbelce (26 ♀, 48 ♂, OÖLM), Kovačov (Balthasar, 1948), Král (Zavadil, Šustera, and Bat'a, 1937), Královský Chlmec (8 ♀, 18 ♂, OÖLM; 1 ♀, RMNH), Parkan (1 ♀, RMNH), Plav (Zavadil, Šustera, and Bat'a, 1937), Seleška (Zavadil, 1934), Somotor (9 ♀, 15 ♂, OÖLM), Streda (25 ♀, 6 ♂, OÖLM), Štúrovo (10 ♀, 9 ♂, OÖLM; 1 ♂, RMNH), Štvrtok (Zavadil, Šustera, and Bat'a, 1937), Vel'ký Kamenec (18 ♀, 13 ♂, OÖLM), Vinický (Mocsáry, 1897; Chyzer, 1902; as Szöllóske). **SPAIN:** **Albacete** (Tormos, Asís, and Gayubo, 1994): Graya, Yeste. **Alicante** (Torregrasa et al., 1993): Elche, Monnegre, Muchamiel, Novelda, San Vicente del Raspeig, Villena. **Barcelona** (Antiga y Suner and Bofill y Pichot, 1904, or as indicated): Barcelona (1 ♀, UCD; 1 ♀, ZIN), Besòs, Can Tunis, Castelldefels, Gavà, La Garriga, Monistrol, Papiol. **Burgos:** Fuentespina (Gayubo and Sanza, 1986). **Cádiz:** Jerez de la Frontera (4 ♀, 4 ♂, CAS; 2 ♀, 7 ♂, RMNH; 3 ♀, 5 ♂, UCD), Villamartin (1 ♂, RMNH). **Castellón de la Plana** (Asís and Jiménez, 1988; Gayubo and Tormos, 1986): Moncófar, Villafranca del Cid,

Villahermosa del Río, Villarreal. **Lerida**: 10 km E Lerida (1 ♀, 2 ♂, USU), Pobra de Segur (Bischoff, 1931). **Madrid**: no specific locality (1 ♀, USNM). **Navarra**: no specific locality (Ceballos, 1949). **Segovia**: Segovia (2 ♀, RMNH). **Teruel**: Oliete (Dusmet, 1915). **Toledo**: Toledo (2 ♀, 1 ♂, RMNH). **Valencia** (Gayubo and Tormos, 1984; Giner Mari, 1934; Tormos and Jiménez, 1987a, b): Alcira, Cañada, Dehesa de El Saler, El Plá, Picasent, Ribarroja, Valencia. **Valladolid**: Montemayor de Pililla (Gayubo and Heras, 1986). **TAJIKISTAN**: Bulbulchashma in Babatag Range (1 ♂, OÖLM), Chil-Dara at 38°57'40"N 70°17'35"E (1 ♀, ZMMU), Dushanbe (1 ♂, CAS; 3 ♂, OÖLM; 1 ♀, ZIN), Dzihilikul (1 ♀, ZIN), Kabadian (1 ♀, ZIN), Khorog (Nemkov, 2005), Kondara (1 ♀, ZMMU), Kulab (1 ♀, ZIN), Nurek dam (1 ♀, OÖLM), Pamir: no specific locality (1 ♂, KRAKÓW), Shaydan (1 ♂, OÖLM), Takfan (F. Morawitz, 1893, Nemkov, 2005); Tavildara in Darvaz Range (2 ♂, OÖLM), Tigrovaya Balka Nature Reserve (Nazarova, 1998), Vose 120 km SE Dushanbe (1 ♂, OÖLM). **TURKEY**: **Artvin**: 20 km Yusufeli – Tortum road (de Beaumont, 1967). **Aydin**: Karadut in Nemrut Dag at 40°17'N 28°20'E (1 ♂, OÖLM), Nazili (de Beaumont, 1967). **Bayburt**: Demirözü (Gayubo, Hikmet, and Yildirim, 2003). **Bitlis**: Ahlat (1 ♂, RMNH). **Bursa**: Bursa (Kohl, 1885, as Brussa). **Erzurum**: Çahyazi (Gayubo, Hikmet, and Yildirim, 2003); Erzurum (Yildirim and Ljubomirov, 2005:1799), Köprükoy: Yağan (Yildirim and Ljubomirov, 2005), Pasinler (Gayubo, Hikmet, and Yildirim, 2003), Porsuk Baraji: Sebran at 39°37'N 30°19'E (1 ♀, OÖLM). **Kars**: Sarikamiş: Karakurt ((Gayubo, Hikmet, and Yildirim, 2003; Yildirim and Ljubomirov, 2005). **Kayseri**: Erciyas Dagı (1 ♂, CAS), Sultanhanı. **Konya**: Sille (1 ♀, 2 ♂, MS). **Nevşehir**: Göreme at 38°07'N 30°39'E (1 ♂, OÖLM), Ürgüp (1 ♂, RMNH). **Siirt**: Kozluk at 38°11'N 41°29'E (1 ♀, OÖLM), Tuzlagozu at 38.1°N 41.47°E (4 ♀, 5 ♂, OÖLM). **Tokat**: Nicksar area (de Beaumont, 1967). **Van**: Muradye (1 ♀, CSE), Van (1 ♂, RMNH). **TURKMENISTAN** (M = Myartseva, 1972a, N = Nemkov, 2005): Akibay in Bayram-Ali District (Myartseva, 1965), Ashkhabad (1 ♂ CAS; 1 ♀, ZIN; 1 ♂, ZMMU), 15 km N Ashkhabad (3 ♂, OÖLM;), Badhyz (1 ♂, IZKNAS; 2 ♀, ZMMU), Bukharden (N), Dargan Ata (M), Djebel 25 km NW Nebit Dag (2 ♀, 17 ♂), Dort Kuyu (M), Farab (4 ♀, ZIN), Imam Baba (M), Kaakhka (1 ♀, ZIN), Karabata (1 ♀, 2 ♂, ZMMU), Kara-Kala (2 ♀, ZIN; 2 ♀, 1 ♂, ZMMU), 40 km N Kizyl-Arvat (N), Koshlagar (F. Morawitz, 1894), Krasnovodsk (4 ♀, ZIN), Kushka (3 ♀, ZIN), Mary (1 ♀, ZMMU, as Merv), lower Murgab River (Myartseva, 1963, 1972a), Nebit Dag (1 ♀, 6 ♂, OÖLM), Seraks (4 ♀, 11 ♂, KRAKÓW), Takhta Bazar (1 ♀, ZIN), Tedjen (5 ♀, 4 ♂, CAS; 1 ♀, 3 ♂ ZMMU). **UKRAINE**: **Cherkasy Oblast'**: Kanev Nature Reserve (Gorobchishin, 1993, 1995, 1996). **Dnepropetrovsk Oblast'**: Dnepropetrovsk (Kohl, 1885, as Yekaterinoslav). **Khar'kiv Oblast'**: Kupyansk (Ivanov, 1872), Merefa (2 ♀, 4 ♂, ZMMU), no specific locality (Faussek, 1906). **Kherson Oblast'**: Kherson (1 ♀, ZIN). **Kiev Oblast'**: Kiev (3 ♀, ZIN), Kiev: Lukianovka (2 ♀, ZIN). **Kirovohrad Oblast'**: Kirovohrad (1 ♀, ZIN, as Elisavetgrad). **Krym Oblast'**: Eupatoria (1 ♀, ZIN), Koktebel (4 ♀, 1 ♂, ZMMU), Yenishar Golf near Koktebel (1 ♀, 2 ♂, ZMMU), no specific locality (1 ♀, ZMUC, as Tauria). **Mykolaiv Oblast'**: Mykolaiv (1 ♀, ZIN, as Nikolayev). **Poltava Oblast'**: Poltava (5 ♀, ZIN), Yares'ki in Mirgorod District (2 ♀, ZIN; 1 ♂, ZMMU). **Ternopol' Oblast'**: Synkiv (Wierzejski, 1874, as Sinków). **Zaporozhye Oblast'**: Zaporozhye (1 ♂, ZMMU). **Also**: Polesye Region (Voblenko et al., 1996). **UZBEKISTAN**: Baga-Abzal 15 km N Bukhara (2 ♀, ZIN; 1 ♂, ZMMU), Fergana (1 ♀, ZIN; 1 ♀, ZMMU, as Skobelev), Iskander (1 ♂, ZMMU), Kamashi (Nemkov, 2005), Khiva (1 ♀, 1 ♂, BMNH; 23 ♀, ZIN), Khiva: Karmysh (1 ♀, ZIN), Khiva: Ravat (6 ♀, ZIN), Kitab (1 ♀, 1 ♂, ZMMU), Nukus (1 ♀, ZMMU), Obburden (1 ♂, ZMMU), Papngan at 41.2°N 70.6'E 20 km NW Kokand (1 ♀, OÖLM), Shakhriyabz (4 ♀, 2 ♂, ZMMU), Sidjak village in Ugamskiy mountain range in Tashkent Oblast' (Islamov, 1986), Staraya Bukhara (1 ♀, ZIN), Stepnoye 30 km N Tashkent (1 ♀, ZMMU), Yargak 30 km WNW Khatta-Kurgan (1 ♀), Zeravshan Valley (1 ♂, KRAKÓW). **LOCALITY ILLEGIBLE** (4 ♂, KRAKÓW).

**Palarus variegatus varius**: **CHINA**: **Beijing Shi**: Beijing (1 ♂, CAS; 1 ♀, RMNH; 4 ♀, 11 ♂, USNM). **Hebei** (= Hopeh): Beidaihehaibin (1 ♀, ZMUC, as Peitaiho Beach), Tientsin (2 ♀, ZIN). **Heilongjiang**: no specific locality (Wu and Zhou, 1996). **Henan** (= Honan): Monan at Huang-he at 34.7°N 111.7°E (1 ♂, CAS; 12 ♂, CSE; 2 ♂, OÖLM), Xiexian in Zhongtiao Shan Mts. at 34.8°N 111.6°E (1 ♂, OÖLM), Zhaoyi in Zhongtiao Shan Mts. at 34.8°S 111.6°E (1 ♂, OÖLM). **Shandong**: Jinan (2 ♀, USNM, as Tsinan), no specific locality (Wu and Zhou, 1996). **Tianjin Shi**: Tianjin (Sickmann, 1894, as Tientsin). **Tsinghai**: Tsaidam Region: no specific locality (1 ♂, KRAKÓW). **Province unknown**: Chili: Chao Yang (3 ♀, 1 ♂, USNM). **MONGOLIA**: Mandal 80 km N Ulan Bator (1 ♂, OÖLM). **RUSSIA**: **Altayskiy Krai**: Katun' River near Biysk (1 ♀, ZMMU). **Amur Oblast'**: Blagoveshchensk (Nemkov, 1992), Glukhari (Nemkov, 2005), Lenin-

skiy (Nemkov, 2005), Natalino area (1 ♀, 1 ♂, CAS), Saskal (Nemkov, 2005). **Buryatya:** Uda River downstream from railroad station Kurba in Zaigraevo District (1 ♀, ZMMU). **SOUTH KOREA:** Jeju = Cheju Island (Okamoto, 1924, as Quelpart Island), Keikido Shoyo (1 ♂, USNM), Koryo = Korea, no specific locality (2 ♀, RMNH; 2 ♀, USNM), Seoul (1 ♀, USNM, as Suigen), Shoyo-zan Mountain in Kangwon-do Province (1 ♂, CAS).

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