

**PHYLOGENY OF THE AMMOBATINI
AND REVISION OF THE AFROTROPICAL GENERA
(HYMENOPTERA: ANTHOPHORIDAE: NOMADINAE)**

by

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ABSTRACT

The phylogeny of the Ammobatini was studied, with regard to the principles of cladistics using parsimony, and the classification is revised. It is concluded that the tribe forms a monophyletic group that comprises six distinct monophyletic genera: *Pasite* Jurine, *Sphecodopsis* Bischoff, *Ammobates* Latreille, *Melanempis* Saussure, *Spinopasites* Warncke and *Oreopasites* Cockerell, of which *Pasites*, *Sphecodopsis*, *Ammobates* and *Melanempis* occur in the Afrotropical Region.

The Afrotropical species of these four genera are revised. *Pseudopasites* Bischoff and *Pseudodichroa* Bischoff are synonymized with *Sphecodopsis*. *Pasites* includes 17 Afrotropical species, *Sphecodopsis* 10 species, and *Ammobates* and *Melanempis* are each known from a single Afrotropical species. Ten new species are described: *Pasites nilssoni*, *P. paulyi*, *P. humecta*, *P. gnoma*, *P. namibiensis*, *P. somalica*, *Sphecodopsis vespericena*, *S. longipygidium*, *S. namaquensis* and *Ammobates auster*. Thirty-three names are synonymized: they are *P. nigerrima* (Fries), *P. argentata* (Baker) (= *P. barkeri* (Cockerell)); *P. chubbi* Cockerell, *P. nigritula* Bischoff, *P. peratra* Cockerell (= *P. atra* Fries); *P. nigripes* (Fries), *P. fortis* Cockerell, *P. subfortis* Cockerell, *P. stordyi* Cockerell, *P. voiensis* Cockerell, *P. altior* Cockerell (= *P. carnifex* (Gerstaecker)); *P. natalensis* (Cockerell), *P. alboguttatus* (Fries), *P. ogilviei* (Cockerell) (= *P. jenseni* (Fries)); *P. alivalensis* (Cockerell), *P. rufitarsis* (Cockerell) (= *P. histrio* (Gerstaecker)); *P. marshalli* (Cockerell) (= *P. jonesi* (Cockerell)); *P. abessinica* (Fries), *P. fulviventrif* (Bischoff), *P. rhodesiana* (Bischoff), *P. apicalis* (Bischoff), *P. turneri* (Cockerell), *P. politula* (Cockerell), *P. indecisa* (Cockerell), *P. nudicauda* (Cockerell), *P. bechuanica* (Cockerell), *P. breviceps* (Cockerell) (= *P. appletoni* (Cockerell)); *S. rufula* (Cockerell) (= *S. minutissima* (Cockerell)); *S. pygmaea* (Fries), *S. rufescens* Bischoff, *S. algoensis* Bischoff, *S. perpunctata* Cockerell (= *S. aculeata* (Fries)); *S. leonis* (Cockerell) (= *S. semirufa* (Cockerell)). Keys to the genera and species are provided.

PREFACE

The work described in this thesis was carried out at the Biosystematics Division, Plant Protection Research Institute, Pretoria, from February 1988 to December 1994, the last two years under the supervision of Professor Denis J. Brothers, of the University of Natal, Pietermaritzburg.

These studies represent original work of the author and have not otherwise been submitted in any form for any degree or diploma to any University. Where use has been made of the work of others it is duly acknowledged in the text.

CONTENTS

1 INTRODUCTION	1
2 HISTORICAL REVIEW OF THE AMMOBATINI	3
3 MATERIALS AND METHODS	5
3.1 INTRODUCTION	5
3.2 MORPHOLOGICAL TERMS AND DESCRIPTIONS	5
3.3 CLADISTIC METHODS	6
3.4 MATERIAL EXAMINED	9
4 PHYLOGENY OF THE AMMOBATINI	11
4.1 INTRODUCTION	11
4.2 ANALYSIS OF ADULT CHARACTERS	11
4.2.1 SPECIES AND SPECIES GROUPS	11
4.2.2 GENERIC GROUND PLANS	13
4.2.3 GENERIC RELATIONSHIPS	13
4.2.4 TRIBAL RELATIONSHIPS	15
4.3 LARVAL CHARACTERS	15
4.4 ZOOGEOGRAPHY	15
4.5 CONCLUSION	17
5 REVISION OF THE AFROTROPICAL AMMOBATINI	18
5.1 INTRODUCTION	18
5.2 GENUS <i>PASITES</i> JURINE	19
5.3 GENUS <i>SPHECODOPSIS</i> BISCHOFF	68
5.4 GENUS <i>AMMOBATES</i> LATREILLE	88
5.5 GENUS <i>MELANEMPIS</i> SAUSSURE	90
6 ACKNOWLEDGEMENTS	91
7 REFERENCES	92
8 INDEX	97

1 INTRODUCTION

The purpose of this study was to provide a comprehensive revision of the systematics of the Afrotropical Ammobatini (Anthophoridae; Nomadinae). To attain this objective three main aspects were investigated. The first was to establish whether the Ammobatini is a monophyletic taxon and, in so doing, establish its validity. The second was to review the generic classification of the Ammobatini and gain an understanding of the relationships between the genera. The third was to acquire a sound knowledge of the identity of the Afrotropical species and the relationships between species.

The Ammobatini are cleptoparasitic bees, also known as cuckoo-bees. They lay their eggs in the nests of pollen-collecting bees that provision their larval cells with sufficient food for the larva to develop to maturity. The cleptoparasite kills the host larva and utilizes its provisions.

Pollinating bees are one of the most important groups of beneficial insects. It is therefore important to study the systematics and biology of their cleptoparasites because they affect the population dynamics of pollen-collecting bees. Bees of the ammobatine genus *Sphecodopsis* Bischoff, for example, are known to parasitise species of *Scrapper* Lepageletier & Serville (Rozen & Michener 1968). Both of these genera are endemic to southern Africa. *Scrapper* pollinates indigenous plants and is potentially important in the pollination of agricultural crops. It is prevalent in the semi-arid regions of southern Africa where insect-pollinated indigenous plants form an important component of the ground cover and pasture.

The cuckoo-bee subfamily Nomadinae, to which the Ammobatini belongs, is the largest and most diverse lineage of cleptoparasitic bees. The Nomadinae comprise ten distinct tribes (Roig-Alsina 1991) and about 1200 described species (Alexander 1990). This subfamily has its greatest diversity in the Nearctic and Neotropical Regions, is fairly well represented in the Afrotropical and Palaearctic Regions and is poorly known from the Oriental and Australian Regions.

In the Afrotropical Region, the subfamily comprises four tribes: Nomadini, Epeolini, Ammobatoidini and Ammobatini. The Nomadini, Epeolini and Ammobatoidini are

represented there only by their nominate genera. The Nomadini and the Epeolini were revised by Eardley & Schwarz (1991) and Eardley (1991), respectively. The Ammobatoidini is known from the Afrotropical Region from a single female specimen described as *Ammobatoides braunsi* Bischoff. The Ammobatini is the largest and most diverse tribe of Afrotropical nomadine bees.

The Ammobatini occur mainly in the Nearctic, Palaearctic and Afrotropical Regions. Although they have not been recorded from the Oriental Region, several Palaearctic species are known from areas that border the Oriental Region and these species possibly extend into that region. They do not occur in the Neotropical and Australian Regions. The Nearctic and Palaearctic faunas have been well studied and the Afrotropical fauna is revised here.

The tribal classification of the subfamily has been extensively reviewed (Alexander 1990; Roig-Alsina 1991). Current knowledge of the systematics of the Nomadinae makes the Ammobatini well suited for phylogenetic research and such a study is needed before the systematics of the subfamily can be properly understood.

Most of the previous work on the systematics of the Afrotropical Ammobatini consists of descriptions of new species and distribution records. The original descriptions are generally vague, without illustrations and inadequate for the recognition of the species. Bischoff (1923) provided a comprehensive revision of the Afrotropical Ammobatini, but his work has several shortcomings, such as that he did not study much of the type material, and it has subsequently become outdated. The present study is the first treatment of these bees that included an examination of nearly all the type material and a study of male and female terminalia.

The research was based mainly on adult morphology as only sufficient material of the adult stage was available for such a study. In spite of the excellent work on ammobatine larvae by Rozen (1954, 1966), Rozen & McGinley (1974) and Rozen & Roig-Alsina (1991), Rozen & McGinley (1974) clearly stated that insufficient data were available on ammobatine larvae for a phylogenetic analysis of the tribe, and little additional information has subsequently accrued. Nevertheless, a preliminary investigation into the phylogeny of ammobatine larvae

was undertaken, but proved to be of little value in the interpretation of the relationships between the genera.

2 HISTORICAL REVIEW OF THE AMMOBATINI

The history of the classification of this group of closely-related bees may be outlined as follows. Recent literature, e.g. Alexander (1990) and Roig-Alsina (1991), considers them to belong to the Anthophoridae. The current familial placement of these bees, a topic that is beyond the scope of the study, has been accepted.

The first significant attempt to arrange the bees into a system of higher classification was by Dalla Torre (1896). He placed all bees in the family Apidae and placed the genera that are currently considered to belong to the Ammobatini, namely *Ammobates* Latreille, *Pasites* Jurine and *Omachthes* Gerstaecker, together with several other genera, in the subfamily Coelioxyna. Ashmead (1899) divided the Apidae into several families and transferred the Coelioxyna to the family Stelidae, which included most of the parasitic bees.

Michener (1944) provided the first comprehensive study in which bees were assigned to tribes. He placed *Oreopasites* Cockerell, *Ammobates*, *Morgania* Smith, *Omachthes* and *Pasites* in the Ammobatini (Anthophorinae; Apidae). Michener (1944) also suggested that *Caesarea* Friese, *Melanempis* Saussure, *Parammobatodes* Friese, *Pasitomachtes* Bischoff, *Pseudodichroa* Bischoff and *Sphecodopsis* Bischoff may belong in the Ammobatini.

Popov (1951) divided Michener's (1944) Ammobatini into two distinct tribes, the Ammobatini and the Pasitini, of the subfamily Anthophorinae, family Anthophoridae. According to Popov (1951) the Ammobatini contained the genera *Ammobates* (for which he described two new subgenera, *Xerammobates* Popov and *Euphileremus* Popov), *Caesarea*, *Parammobatodes* Popov and *Oreopasites*. On the other hand, *Pasites*, *Morgania*, *Omachthes*, *Pseudopasites*, *Sphecodopsis*, *Pasitomachtes* and *Pseudodichroa* constituted the Pasitini. Popov (1951) made no mention of *Melanempis*.

Sûstera (1958) placed the Nomadini, Ammobatini and Pasitini in the Andrenidae. Baker

(1971), in his discussion on *Pasitomachtes*, supported Popov's (1951) classification. Rozen & McGinley (1974), however, in their study on the systematics and phylogeny of the larvae of these bees, refuted this classification. Warncke (1983), in a revision of the Palaearctic fauna, subsequently took a completely different approach and placed almost the entire Palaearctic and Afrotropical faunas of ammobatine bees (*sensu* Michener) into the genus *Pasites*, which he subdivided into six subgenera: *Parammobatodes*, *Spinopasites* Warncke, *Micropasites* Warncke, *Euphileremus*, *Ammobates* and *Pasites*. He considered *Morgania*, *Omachthes*, *Pasitomachtes*, *Pseudopasites* and *Sphecodopsis* to be junior synonyms of *Pasites* (*sensu stricto*). Warncke (1983) did not give a detailed explanation for his actions and made no mention of *Oreopasites* and *Melanempis*.

Subsequent to Warncke's (1983) study, the tribal classification of the Nomadinae, based on adult morphology, was studied by Roig-Alsina (1987, 1991) and Alexander (1990), neither of whom adopted Warncke's (1983) classification. Roig-Alsina (1987), in his discussion on the phylogenetic relationship between the Caenoprosopidini, Biastini and Ammobatini, defined the Ammobatini in the 'sense of Michener (1944)'. Alexander (1990), in his table on the distribution and host records of the Nomadinae, did not use Warncke's (1983) classification because he had not studied the group in sufficient detail. Roig-Alsina (1987, 1991) and Alexander (1990) demonstrated that the Caenoprosopidini is the sister-group of the Ammobatini. In the Ammobatini the sixth metasomal sternite (S6) of the female is bifurcate, or secondarily simple, posteriorly and in the Caenoprosopidini this structure is bilaterally separate. The inference, by the above mentioned authors, that the bifurcate female S6 in the Ammobatini gave rise to the bilaterally separated condition in the Caenoprosopidini implies that the Caenoprosopidini is a monophyletic group. The monophyly of the Ammobatini, however, was not demonstrated by either Roig-Alsina (1987, 1991) or Alexander (1990).

In his studies on the phylogeny of the Nomadinae, Roig-Alsina (1987) demonstrated the sister taxon of the (Ammobatini+Caenoprosopidini) clade to be the Biastini. Alexander (1990), however, indicated that the Neolarrini was possibly the sister-group of this group. Subsequently Roig-Alsina (1991), using different characters, came to the same conclusion as Alexander (1990). The absence of a pygidial plate, as mentioned by Roig-Alsina (1987) is not a synapomorphy of the ((Ammobatini+Caenoprosopidini)+Biastini), as several species of *Pasites* have well-developed pygidial plates.

3 MATERIALS AND METHODS

3.1 INTRODUCTION

In an attempt to demonstrate the monophyly of the Ammobatini and elucidate the generic classification of the Afrotropical Ammobatini, all the known Afrotropical species and all the available extra-African representatives of the tribe were studied. As ammobatine bees are fairly rare, this thesis is the result of more than ten years of study. During this time there were long periods when research was hampered because of insufficient material or difficulty in borrowing important specimens from abroad. The study included the examination of over 800 specimens of Afrotropical ammobatine bees and 183 specimens from the Palaearctic and Nearctic Regions.

All the available type material of the Afrotropical species was examined during the course of the study. The type material of eight species was not studied: *Pasitomachthes argentatus* Baker, *Pasites atratula* Friese, *Omachthes gabonensis* Vachal, *Morgania rotundiceps* Bischoff and *Morgania tropica* Cockerell could not be obtained, and *Omachthes capensis* Friese, *Pseudodichroa fumipennis* Bischoff and *Phileremus (Melanempis) uter* Saussure were reliably identified from authentically determined material. The study of extra-African material was based mostly on authentically determined material. Information on the labels of type specimens is recorded verbatim from the labels. For other material the locality, date, collector and host plant are given in this sequence.

The distribution maps have been simplified to eliminate overlapping of symbols and ambiguous localities omitted to give a clear impression of the species distribution. Those distribution records that have not been confirmed by the examination of material are listed in the discussion under each species.

3.2 MORPHOLOGICAL TERMS

The terminology mainly follows that of Michener (1944). Sexual dimorphism in adult Ammobatini is slight and, apart from *Sphecodopsis*, *Oreopasites*, *Melanempis* and *Spinopasites* in which males have eleven flagellar segments, is largely confined to the distal region of the metasoma. A single detailed description for both sexes of each species has therefore been given, with the diagnostic sex-limited characters of each sex explicitly

described. The abbreviations T and S are used for the metasomal terga and sterna, respectively (e.g. T1 and S1 refer to the first metasomal tergum and sternum, respectively).

Pubescence refers to the downy vestiture that comprises finely branched hairs. The sixth metasomal tergum of the female of some species has a brush posteriorly (located below the pygidial plate when this structure is present). This brush has been referred to as the subpygidial brush. When the subpygidial brush has thick hairs dorsally and fine vestiture ventrally it has been referred to as differentiated. In certain taxa the posteromedian region of the fifth metasomal sternum of the female, when viewed from behind, forms a distinct furrow. Rozen's (1968a) terminology has been used for this structure which he referred to as being 'gutter-like'.

3.3 CLADISTIC METHODS

The study of the phylogeny of the Ammobatini was done in a stepwise series of analyses. This approach enabled the information on the character states of each species to be used systematically to derive ground plans of states for each species group and genus.

Adults of each species that were available for study were thoroughly examined and the different states of each character were coded. Polarization of characters was based strictly on out-group comparison and the putative sister-group was taken as the out-group. In an attempt to demonstrate the monophyly of the Ammobatini the sister-group of the Ammobatini, the Caenoprosopidini, (Roig-Alsina 1987, 1991) was included in the in-group. The Neolarrini (represented by *Neolarra vigilans* (Cockerell)), which is the sister-group of (Ammobatini+Caenoprosopidini) (Roig-Alsina 1991), was taken as the out-group, except where the state that occurred in the Neolarrini was different from that which occurred in the (Ammobatini+Caenoprosopidini) (character 50). In character 50 the sister-group of the (Neolarrini+ (Ammobatini+Caenoprosopidini)), the Townsendiellini, (represented by *Townsendiella californica* Michener) (Roig-Alsina 1991) was taken as the out-group. The state of each character that occurs in the out-group was coded as primitive and the different state/states that occur in the in-group were coded as derived. Where a possible evolutionary progression could be determined between different states of the character within the in-group successive derived states were defined (0 = primitive; 1, 2 & 3 = successive derived states).

The out-group, therefore, represents a hypothetical ancestor in which all the character states are primitive. A question mark (?) was used where the state in a species could not be studied, such as sex-limited characters for species in which the appropriate sex is unknown or was not available for study.

The different states of each character were incorporated in data matrices. The first matrix (Table 1) gives all the relevant information on each species. In the formation of the second data matrix (Table 2) some species were grouped into species groups (reasons given below), each of which is represented by a ground plan of that group. The third matrix (Table 4) includes only ground plans of the genera and was derived from the second matrix. The fourth matrix (Table 5) deals with the larvae, and only one species is included for each genus. The cladograms were generated using Hennig86, version 1.5 (Farris 1988). The first, second, fourth and fifth cladograms originate from the analysis of the information in Tables 1, 2, 4 & 5, respectively, without using character weighting (commands m*; bb*) (Fig. 1, 2, 4 & 5). The third cladogram resulted from the use of successive approximations character weighting (repeated application of m*; bb*; xs w) in the analysis of the information in Table 2 (Fig. 3). Character weighting was applied to give an indication of which cladogram derived without weighting might be preferred. For each of the fourth and fifth analyses, using the data in Tables 4 & 5, respectively, only one most parsimonious tree was obtained (Fig. 4-5), making successive approximations character weighting unnecessary. Plotting of characters on the cladograms was done manually using accelerated transformation, the criterion of Farris (1970) in which reversals are maximised and parallelism minimized. On theoretical grounds this approach was preferred by Pinna (1991). Each homoplastic state was considered individually to determine whether the homoplasy could be more appropriately explained by a parallelism rather than by a reversal, but no such state was found.

During the characterization of the species and species groups only morphological characters were taken into account. The reason for not including zoogeographical information is that it is not genetic but historical, and therefore should not be included in the analysis of the genealogy. It was, however, used to evaluate the results of the study.

The initial analysis resulted in over 1588 equally parsimonious cladograms, and the strict consensus tree had several polytomies, some of which contained numerous branches (Fig. 1). The polytomies made it difficult to analyze the result and the large amount of time taken by the computer to derive the cladogram hindered the formation of a ground plan for each genus by the method described below.

A study of the species data matrix (Table 1) indicated that the absence of data, such as the sex-limited characters for species only known from one sex, contributed significantly to the poor resolution of the cladogram. The missing data apparently resulted in that character being treated as if it potentially had each state, therefore proliferating the number of cladograms that were produced and the time taken to generate these cladograms. This problem was overcome to a large extent by grouping morphologically similar species into species groups. Appendix 1 is a list of the species that were studied and their groupings. As most of the missing data was among the sex-limited characters of species of which only one sex was available, the assumption was made that species that closely resembled one another in one sex would be similar in the opposite sex. Because the grouping was done primarily to overcome the problem of missing data, it was done conservatively to minimise the possibility of grouping species for which the states of the opposite sex were different. Known intra-group differences represent states that have little significance in grouping species in this tribe.

The grouping of species required the development of a ground plan of character states for each species group. To achieve the most parsimonious cladogram, the ground plan for each species group that gave the most parsimonious unweighted cladogram was chosen. The determination of the appropriate ground plan for each species group was done by first developing a ground plan comprising the most primitive state of each character that occurs in a species group. The resultant data matrix was analyzed (command used: m*) and the tree length recorded. Then, for each character for which more than one state occurs within a species group the matrix was systematically altered, taking one character at a time, by replacing the primitive state with the derived state (for characters represented by more than two states in a single species group, the matrix was altered in a stepwise manner from the most primitive to the most derived state). After each alteration the resultant matrix was re-analyzed and the tree length compared with that of the former analyses. The data set that

gave the shortest tree was chosen. Where the different states provided cladograms of similar length, each state was studied for evidence suggesting which state was primitive for the group. In the absence of such evidence the more primitive state was chosen. This procedure was repeated for each species group. The result provided a ground plan for each species group. In both the *A. rostratus* and *A. punctatus* groups the more derived state for character 31 (i.e., state 1) and in the *A. rostratus* group for character 52 (i.e., state 2) gave a shorter tree and was therefore preferred. In the *A. punctatus* group character 57 is represented by three different states (i.e., states 0, 1 & 2), of which state 1 gave the shortest tree. The same approach was adopted in the development of ground plans for the genera (Table 4), which resulted in the more derived state (i.e., state 1) being preferred for two characters in *Ammobates*. For character 1 states 0 and 1 gave trees of similar length. State 1 was preferred because it is apparently more primitive for the group, being reversed in *A. rostratus*. In *Ammobates* state 1 is more common and this state also occurs in *Spinopasites* and *Oreopasites*, whereas state 2 occurs in (*Melanempis*+*Sphecodopsis*). For character 31 the derived state (i.e., state 1) gave the shortest tree.

The identification of the larval characters was largely based on a comparison of the bee larvae that were described and illustrated by Rozen and his collaborators (*Oreopasites vanduzeei* by Rozen (1954 & 1966); *Neolarra pruinosa* Ashmead (Rozen 1966); *Specodopsis fumipennis* Bischoff, *Ammobates muticus* Spinola and *Morgania histrio* by Rozen & McGinley (1974); and *Caenoprosopis crabronina* Holmberg and *C. holmbergi* Roig-Alsina (Rozen & Roig-Alsina 1991)). The standard of these researchers' work is high and it appeared unlikely that the examination of the material on which they worked would reveal any significant characters in addition to those they had described and illustrated. The methodology for the interpretation of the polarity of these characters was similar to that used for the adult characters. Certain larval characters, such as the position of the posterior tentorial pit, could not be used in the analysis because the state that occurred in the out-group did not occur in the in-group and the larva of *Townsendiella* is unknown. The larval characters that were studied and their states are given in Appendix 3. The coding of the states for each genus is given in Table 5.

3.4 MATERIAL EXAMINED

The material on which the study was based is in the institutions recorded below. They have been referred to in the text by the accompanying acronyms, which have mostly been taken from Arnett *et al.* (1986).

AMNH - American Museum of Natural History, New York, U.S.A.

AMGS - Albany Museum, Grahamstown, South Africa

BCOB - D. Baker's private collection, Oxford, Great Britain

BCSA - D.J. Brothers' private collection, Pietermaritzburg,
South Africa

BLCU - Bee Biology & Systematics Laboratory, Utah State
University, Logan, U.S.A.

CASC - California Academy of Sciences, San Francisco, U.S.A.

DMSA - Durban Natural Science Museum, Durban, South Africa

ICCM - Carnegie Museum of Natural History, Pittsburgh, U.S.A.

MNHN - Muséum National d'Histoire Naturelle, Paris, France

MRAC - Musée Royal d'Afrique Centrale, Tervuren, Belgium

SANC - Biosystematics Division, Plant Protection Research
Institute, Pretoria, South Africa

NCUS - L. Nilsson's private collection, Uppsala University,
Uppsala, Sweden

NHML - The Natural History Museum, London, Great Britain

NHRS - Naturhistoriska Riksmuseet, Stockholm, Sweden

PCGB - A. Pauly's private collection, Gembloux, Belgium

SAMC - South African Museum, Cape Town, South Africa

SCAA - M. Schwarz's private collection, Ansfelden, Austria

SEMK - Snow Entomological Museum, University of Kansas,
Lawrence, U.S.A.

SKNP - Skukuza, Kruger National Park, South Africa

SMWH - State Museum, Windhoek, Namibia

TMSA - Transvaal Museum, Pretoria, South Africa

ZMHB - Museum für Naturkunde der Humboldt-Universität,
Berlin, Germany

4 PHYLOGENY OF THE AMMOBATINI

4.1 INTRODUCTION

Bees generally feed their progeny on pollen and nectar that they collect from flowers. Cleptoparasitism among bees is a derived trait and it has evolved independently several times within the bees (Alexander 1990). The features that are unique to cleptoparasitic bees are derived, although they may resemble the primitive state for the bees as a whole, such as the loss of the scopa. Other features that separate cleptoparasitic bees from pollen-collecting bees are the thickened integument and the more robust sting (Alexander 1990). Many aculeate wasps that parasitize other Aculeata also have a thickened integument, which protects them from their hosts, and a well-developed sting, used for protection and to paralyse their hosts. There are many other convergent traits in the cleptoparasitic bees which, as indicated by Alexander (1990), complicate attempts to trace their phylogeny.

In spite of the difficulties involved in the study of the phylogeny of cleptoparasitic bees, the *Nomadinae sensu lato* has been relatively well studied by Rozen (1966, 1974, 1977), Rozen *et al.* (1978), Roig-Alsina (1987, 1991) and Alexander (1990). Although the *Nomadinae sensu lato* do not form a monophyletic group, the *Nomadinae sensu stricto*, which includes the Ammobatini, are monophyletic (Roig-Alsina 1991). Roig-Alsina (1991) defined the *Nomadinae sensu stricto* as comprising the groups Ammobatini, Ammobatoidini, Biastini, Caenoprosopidini, Epeolini, Neolarrini, Townsendiellini, *Hexepeolus* Linsley & Michener, *Nomada* Scopoli and the *Brachynomada* group. The *Nomadinae sensu lato* includes, in addition to the above mentioned taxa, Isepeolini, Protepeolini, Epeoloidini, Osirini, Holcopositini, *Parepeolus* Ducke and *Coelioxoides* Cresson.

4.2 ANALYSIS OF ADULT CHARACTERS

4.2.1 SPECIES AND SPECIES GROUPS

The analysis of adult character states (Appendix 2) of the species and species groups (Table 2), resulted in 48 most parsimonious cladograms (trees), each with a length of 154 evolutionary events (steps). The study of each of these 48 trees indicated a consistent pattern of seven major clades (branches) (Fig 2). The basal branch consistently represented the Caenoprosopidini, which was included in an attempt to demonstrate the monophyly of the

Ammobatini, while the other six major clades more or less represent the ammobatine genera as defined by Michener (1944). The consistency in the composition of the six clades that comprise the Ammobatini in all of the most parsimonious cladograms, led to these clades being considered here to constitute genera (*Pasites*, *Spinopasites*, *Oreopasites*, *Ammobates*, *Sphecodopsis* and *Melanempis*, Fig. 1). Most of the trees differ only in the position of the species and species groups within each clade.

Analysis of the data using successive approximations character weighting resulted in 12 most parsimonious trees, each with a raw length of 156 steps. The differences in the lengths of the trees produced with and without character weighting apparently resulted from the different configurations of the species and species groups within each genus and not from differences in the configuration of the genera. The final weight assigned to each character in the weighted analysis is recorded in Table 3.

The only difference in the relationships between the genera in the 48 most parsimonious unweighted cladograms was the relative position of *Oreopasites*. In some of the cladograms it formed the sister-group of *Ammobates*, with (*Sphecodopsis*+ *Melanempis*) as the sister-group of (*Ammobates*+*Oreopasites*) (Fig. 3), while in the other cladograms it formed the sister-group of (*Sphecodopsis*+*Melanempis*), with *Ammobates* as the sister-group of (*Oreopasites*+(*Sphecodopsis*+*Melanempis*)). This resulted in a polytomy for *Oreopasites*, *Ammobates* and (*Sphecodopsis*+*Melanempis*) in the consensus tree (Fig. 2). The position of *Oreopasites* in the consensus tree, produced using successive approximations character weighting (Fig. 3) was the same as that which occurred most frequently among the trees produced without character weighting and was accepted as the most probable phylogeny. Evidence supporting this choice is the reduction in the male pygidial plate (state 52.1), which associates *Ammobates* and *Oreopasites* and was given a weight of 5 in the analysis using successive approximations character weighting (Table 3). The posterolaterally directed mandibles, in repose, (18.0) and the undifferentiated vestiture on the ventrolateral region of the mesepisternum (27.0), which group *Oreopasites* with (*Melanempis*+*Sphecodopsis*), have weights of 1 and 0 respectively (Table 3). The grouping of *Oreopasites* with *Ammobates* can also be more easily explained when considering the biogeography of these bees.

4.2.2 GENERIC GROUND PLANS

The analysis of generic ground plans, without character weighting, gave a single most parsimonious tree (Fig. 4). The configuration of the tree differs from that produced by the former analyses (Fig. 1-3) only in the placement of *Spinopasites*. The reason for the change is that in the generic ground plans of *Spinopasites*, *Oreopasites* and *Ammobates* the hind tibia has thick setae (32.1) and the posteromedian region of the female S5 has a distinct protuberance (48.2). In *Sphecodopsis* and *Melanempis* the hind tibia has fine vestiture (32.0). *Sphecodopsis* has a small posteromedian protuberance on the female S5 (48.1) and *Melanempis* has a large, gutter-like protuberance (48.3), making the derivation of the posteromedian protuberance on the female S5 dichotomous.

4.2.3 GENERIC RELATIONSHIPS

Discussion of the generic relationships is based mainly on the cladogram of the species and species groups derived without weighting of characters (Fig. 2). Reference is made to the cladograms obtained using successive approximations character weighting (Fig. 3) and the generic ground plans (Fig. 4). Emphasis has not been placed on the generic analysis because the formation of generic ground plans for the more diverse genera, such as *Ammobates*, resulted in the loss of information. The loss of information in the formation of ground plans for species groups was minimal.

Pasites forms the first major clade of the Ammobatini (Fig. 1-4) and is monophyletic. Its monophyly is demonstrated by three unique synapomorphies, the presence of a subpygidial brush (state 42.1), fine vestiture and the structure of the posteromedian region of the female S5 (43.1, 46.1). Supporting character states are: 10-segmented male antennal flagellum (9.1); spatulate labrum (13.1); position of the mandibles when in repose (19.0) and presence of a pygidial plate in the female T6 (40.0).

The remaining ammobatine genera together form a distinct clade which is the sister-group of *Pasites* and monophyletic. The monophyly of this clade is demonstrated by the unique structure of the female S5, which is concave posteromedially (47.1) and has a naked posteromedian protuberance (44.1 & 48.2).

Spinopasites is apparently monotypic and forms the sister-group of the clade

((*Sphecodopsis*+*Melanempis*)+(Oreopasites+ *Ammobates*)) in the species and species groups analysis. The distinguishing features are the gently curved propodeum (36.0) and the single posterior spine on the female S6 (51.2), neither of which are unique to this genus. In the generic analysis *Spinopasites* forms the sister-group of (Oreopasites+*Ammobates*), with (*Melanempis*+*Sphecodopsis*) as the sister-group of (*Spinopasites*+(Oreopasites+*Ammobates*)) (Fig. 4). The discovery of the male of this genus may unambiguously demonstrate its monophyly and relationship to the other genera in the tribe.

The remaining four genera form two separate clades, (*Ammobates*+*Oreopasites*) and (*Melanempis*+*Sphecodopsis*). In the accepted cladogram of the species and species groups these two clades form sister-groups (Fig. 3) (in the same analysis some cladograms have *Ammobates* as the sister-group of (Oreopasites+(*Melanempis*+*Sphecodopsis*)) and in the generic analysis *Spinopasites* is the sister-group of (*Ammobates*+*Oreopasites*)). *Ammobates* and *Oreopasites* form a monophyletic group defined by the absence of the male pygidial plate (52.1), which is peculiar to these two genera, and by the strongly appressed scutal vestiture (24.0). Each of these two genera is apparently monophyletic. In *Ammobates* the structure of the posterior margin of the female S5 (45.1) is unique. Other states that help to define *Ammobates* are the short, unmodified, naked posterior margin of the female S5 (44.0) and the posterior region of the male S8 that is at least as wide as the anterior region (57.1). A unique synapomorphy was not found for *Oreopasites*. *Oreopasites* is largely defined by the presence of an occipital carina (17.1), crossing of the mandibles when in repose (18.0) and undifferentiated vestiture on the lower region of the mesepisternum (27.0).

(*Melanempis*+*Sphecodopsis*) is not defined by a unique synapomorphy. The combination of character states that defines this clade is as follows: the lateral region of the vertex is flat (1.2); facial vestiture is generally simple (6.1), erect (7.1) and fairly sparse (8.1); scutal vestiture is mostly erect (24.2) and fairly sparse (25.1); vestiture on the ventrolateral region of the mesepisternum is not obviously different from that on the upper region (27.0); setation on the hind tibia is more or less uniform (32.0) and the male pygidial plate is well developed (52.0). *Melanempis* is clearly monophyletic, defined primarily by the truncate female T6 which is naked and surrounded by a small carina (39.1). Of the other states that define this genus the most significant are the absence of a maxillary palp (14.1), mediolongitudinal

carina on the dorsal surface of the female T6 (37.1) and the gutter-like structure on the posteromedian region of the female S5 (48.3). *Sphecodopsis* is defined by a combination of several states, the most important being the quadrate, apically pointed labrum (10.0, 11.0, 12.1, 13.1), mandibles which cross each other behind the labrum when in repose (18.0, 19.0), simple scutal vestiture (23.1) and the extension of the pre-epistomal groove below the scrobal groove (28.1).

4.2.4 TRIBAL RELATIONSHIPS

The Caenoprosopidini is the sister-group of the Ammobatini, as was demonstrated by Roig-Alsina (1987, 1991) who adequately discussed the relationships between these two tribes. Roig-Alsina (1987, 1991) clearly demonstrated the Caenoprosopidini to be monophyletic by the presence of several unique synapomorphies, but was unable to demonstrate the monophyly of the Ammobatini in this way. By including *C. crabronina* in this study, to represent the Caenoprosopidini, the monophyly of the Ammobatini was demonstrated by the presence of several unique, unreversed, synapomorphies. They are the presence of antennal sockets in the middle of the face and the associated relatively long subantennal suture (4.1, 5.1), presence of the paraocular carina (16.1) and the declivous, gently concave, glabrous anterior surface of the pronotum (20.1). The modification of the posteromedian region of the female S5 as a whole is also unique to the Ammobatini, but it forms two separate characters within the tribe. In *Pasites* the posterior margin is clothed with fine vestiture and is not lengthened (44.1, 46.1 & 2), whereas in the other Ammobatini the posterior is naked and elongate (44.0, 47.1 & 2).

4.3 LARVAL CHARACTERS

Analysis of the larvae produced a single most parsimonious cladogram that was totally unresolved (Fig. 5). There were insufficient suitable characters to produce a structured tree, since all the genera (except *Pasites*) have unique states not shared by any others (Table 3).

4.4 ZOOGEOGRAPHY

Five of the ammobatine genera are confined to the Old World: *Sphecodopsis* (southern Africa) and *Melanempis* (Madagascar) are Afrotropical; *Pasites* is widespread in the Afrotropical Region and includes one Palearctic species (*P. muculata* Jurine); *Spinopasites*

is known only from Tunisia (Palearctic), and *Ammobates* is predominantly Mediterranean, a few species occur in eastern Europe and Iran, and one occurs in southern Africa. *Oreopasites* is the only New World genus and it occurs in the southwest of the Nearctic Region. The sister-group of the Ammobatini, the Caenoprosopidini (Roig-Alsina 1987, 1991), is Neotropical and its species occur mainly in the Patagonian Subregion of South America (Roig-Alsina 1987; Kuschel 1969). This suggests that the common ancestor of the (Caenoprosopidini+Ammobatini) occurred in that part of Gondwanaland which today forms southern Africa and the southern part of South America. It also suggests that the Ammobatini evolved subsequent to the separation of South America from southern Africa, during the breakup of Gondwanaland, about 120 million years ago (Smith *et al.* 1981). The common ancestor of the (Caenoprosopidini+ Ammobatini) must, however, have occurred before that time. Therefore, it may be assumed that the Ammobatini originated in the Old World, and most probably in the Afrotropical Region because *Pasites*, which forms the basal clade of the Ammobatini, is primarily Afrotropical (*P. maculata* is one of the most derived species in the genus). The Ammobatini are assumed to have spread from the Afrotropical into the Palearctic Region. *Ammobates* and *Oreopasites* are evidently sister-groups, and the colonization of the Nearctic by the Ammobatini apparently took place from the Palearctic Region. There is no evidence to indicate the route through which Nearctic Region was colonized.

Our knowledge of the paleovegetation in Africa is inadequate to facilitate a detailed hypothesis on the vegetation types that the ancestors of the extant ammobatine genera inhabited. The ideas that follow are, therefore, speculative. Preliminary ideas on this topic may nevertheless illicit explanations from other sources that will help resolve the question. Soon after the breakup of Gondwanaland the vegetation in Africa was vastly different from that of today (Axelrod & Raven 1978). It consisted largely of rain forest and woodland. Although most of the extant Ammobatini live in the semi-deserts of southern Africa and the Mediterranean Region, *Pasites* inhabits a variety of different vegetation types, and occurs in rain forest, woodland and desert. This supports the conclusion that *Pasites* is the oldest ammobatine genus and suggests that the habitation of arid areas is derived for the tribe.

Of significance is the occurrence of *Ammobates auster* spec. nov. in the arid areas of southern Africa, whereas the rest of the genus occurs in the Palaearctic Region (primarily in the Mediterranean and Eremic regions). *Ammobates auster* closely resembles certain of the Palaearctic species. This suggests that *Ammobates* was previously more widely distributed in Africa.

4.5 CONCLUSION

The classification of Michener (1944) is compatible with the results of the current study. The only difference is that some of his genera have been synonymized. Popov's (1951) division of the current Ammobatini into two distinct tribes (Ammobatini = *Ammobates* & *Oreopasites*; and Pasitini = *Pasites* & *Sphecodopsis*) is incompatible with the results of this study as *Sphecodopsis* and *Pasites* belong to separate monophyletic clades, but does associate *Ammobates* and *Oreopasites* together. The inclusion of all the Ammobatini into a single genus (Warncke 1983) obscured the fact that the tribe can be divided into definite groups which facilitates the understanding and study of these bees. The differences between the genera, as delimited above, appear to be more consistent with the differences used to define genera in other groups of bees, and a subgeneric classification could even be gainfully applied in certain of the ammobatine genera, especially *Pasites* and *Ammobates*.

Insufficient material of certain important species of *Pasites*, such as *P. gnoma* spec. nov., is available for the application of a subgeneric classification to this genus and the revision of *Ammobates* is beyond the scope of this study.

A study of larval characters was used in an attempt to support the phylogeny of the Ammobatini, as determined using adult characters. The result of the analysis of these characters was of no value for this purpose. This opinion is in accordance with that of Rozen & McGinley (1974), who stated that there was insufficient material of ammobatine larvae available for the study of their phylogeny.

5 REVISION OF THE AFROTROPICAL AMMOBATINI

5.1 INTRODUCTION

The Ammobatini is a small tribe comprising six genera. *Oreopasites* is Nearctic and is known from 11 species. *Sphecodopsis* comprises nine species, all of which are endemic to southern Africa. *Melanempis* is Madagascan and is known from one described species and one that awaits description (R.W. Brooks, 1991, personal communications, SEMC). *Spinopasites* is monotypic and occurs in Tunisia. *Pasites* is principally Afrotropical, having 23 Afrotropical species and one from the Palaearctic Region. Finally, *Ammobates* has its centre of diversity around the Mediterranean Sea. It comprises 47 Palaearctic species and a single southern African species.

Ammobatine bees are small to medium sized (2,3 - 12,5 mm long) and cleptoparasitic. They are mostly black to reddish with short, densely plumose, appressed vestiture and the metasoma is strongly convex dorsally. Most species of *Sphecodopsis*, however, have long, weakly plumose, semi-erect vestiture and the metasoma is flattish. The principal diagnostic features of the Ammobatini are: paraocular carina well developed on lower half of face; pronotal collar carinate laterally; female S5 concave posteromedially, when viewed from behind, ranging from weakly to strongly concave; apex of concavity of female S5 extended into a protuberance that may be gutter-like in all genera except *Pasites*; female S6 reduced and largely internal, visible externally as one or two sclerotized spines, not bilaterally separated.

KEY TO THE GENERA

(males and females)

1. Distal ends of mandibles cross in repose 2
- Distal ends of mandibles overlap in repose 3
2. Labrum short and pointed apicomediaally, mandibles close behind labrum
(Afrotropical) *Sphecodopsis*
- Labrum long and truncate distally, mandibles traverse labrum so that distal end of
labrum is visible posterior to mandibles (Nearctic) *Oreopasites*
3. Female S5 with posteromedian region naked (often entire posterior margin naked),

- and with a small protuberance or a weak to well-developed gutter; male antenna 13-segmented (except *Melanempis* which has 12 antennal segments and posterior end of male T7 concave) 4
- Female always with entire posterior margin of S5 clothed with fine vestiture, and devoid of any modifications as described above; male antenna 12-segmented *Pasites*
4. Female with S6 forming a single spine posteriorly (North Africa) (male unknown) *Spinopasites*
- Female with S6 bifurcate posteriorly 5
5. Female with posterior end of T6 naked and circumscribed by a carina; male T7 spatulate, devoid of a pygidial plate and concave posteriorly (Madagascan) *Melanempis*
- Female with posterior end of T6 setose, without a peripheral carina; male T7 usually with a pygidial plate, never concave posteriorly (southern African and Palaearctic) *Ammobates*

Many of the species are dealt with in groups (Appendix 1). The purpose of the species groups is to facilitate the description and discussion of closely related species, and should facilitate the recognition of the species. The species groups are not entities suitable for description as distinct taxa, but rather represent conglomerations of morphologically similar, closely related, species.

5.2 GENUS *PASITES* JURINE

Pasites Jurine, 1807: 224. Type species *Pasites maculata* Jurine, 1807 (original designation).

Morgania Smith, 1854: 253; Cockerell 1933c: 106; Warncke 1983: 261-347. Type species:

Pasites dichroa Smith, 1854 (monobasic).

Morgania (*Morgania*) Smith: Bischoff 1923: 586.

Omachthes Gerstaecker, 1869: 154. syn. nov. Type species: *Omachthes carnifex* Gerstaecker, 1869 (designated by Sandhouse 1943).

Homachthes Gerstaecker: Dalla Torre 1896: 499 [unjustified emendation *pro Omachthes*].

Morgania (*Omachthes*) Gerstaecker: Bischoff 1923: 586.

Omachtes [*sic.*] Gerstaecker: Sandhouse 1943: 580 [*lapsus pro Omachthes*].

Pasitomachthes Bischoff, 1923: 596. syn. nov. Type species: *Pasites nigerrima* Friese, 1922 (original designation).

Pasitomachtes [sic.] Bischoff: Sandhouse 1943: 586 [*lapsus pro Pasitomachthes*].

The name *Pasites* could be of either gender, but Jurine (1807) gave the specific epithet of the type species a feminine ending, thereby making it feminine. The emendation by Gerstaecker (1869), who changed the gender of the type species, is unjustified in accordance with the International Code of Zoological Nomenclature (1985), Article 30.

Smith (1854), subsequent to the original description of *P. dichroa*, stated that 'It is very probable that the present species may be separated from *Pasites* by a monographer of these parasitic genera, in which case we would propose the name of *Morgania*'. The original description of *P. dichroa* dealt mainly with the unusual colour of the species. Subsequently, Gerstaecker (1869) described the genus *Omachthes* for *P. carnifex*, a species that closely resembles *P. dichroa* in all respects. Thereafter the names *Pasites*, *Morgania* and *Omachthes* were commonly applied, in an inconsistent manner, to the group of bees that is today known as *Pasites*.

Bischoff (1923) provided the first monographic study of the Afrotropical cuckoo bees, and clearly stated that *Pasites* does not occur in the Afrotropical Region. He placed the Afrotropical species that had previously been placed in *Pasites* into *Morgania* (which he divided into two subgenera, namely *Morgania sensu stricto* and *Omachthes*) except for two species that were previously assigned to *Pasites* for which he described the genus *Pasitomachthes*. The two species are *P. nigerrima* (Friese) (= *P. barkeri* (Cockerell)) and *P. bicolor* Friese. The only information that Bischoff (1923) provided on his interpretation of *Pasites*, *Morgania*, *Omachthes* and *Pasitomachthes* was in a key to the ammobatine genera. The characters referred to in the key were either poorly described, and do not allow for an accurate interpretation of his ideas, or unreliable (Cockerell 1933c). Bischoff (1923) did not state whether he had studied the type species of *Morgania* and *Omachthes*, namely *Pasites dichroa* Smith and *Omachthes carnifex* Gerstaecker, respectively, which are clearly more closely related to one another than to any of the other species that he placed in either *Morgania sensu stricto* or *Omachthes*.

The characters that Bischoff (1923) used to identify *Pasites* are clearly evident in some of the Afrotropical species. It is, therefore, inexplicable as to why he stated that *Pasites* does not occur in Africa. It is also not clear why he described the genus *Pasitomachthes* for two species that apparently conform with his interpretation of *Morgania*. The current study, during which the type species of *Pasites*, *Morgania*, *Omachthes* and *Pasitomachthes* were studied, demonstrated that these four taxa are synonymous.

Pasites is primarily Afrotropical. *Pasites maculata* Jurine, which is Palaearctic, is the only species in the genus that does not occur in the Afrotropical Region. There are fifteen subsaharan species, namely: *P. barkeri* Cockerell, *P. atra* Cockerell, *P. paulyi* spec. nov., *P. braunsi* Bischoff, *P. humecta* spec. nov., *P. gnoma* spec. nov., *P. carnifex* (Gerstaecker), *P. dichroa* (Smith), *P. jenseni* (Fries), *P. namibiensis* spec. nov., *P. histrio* (Gerstaecker), *P. jonesi* (Cockerell), *P. rufipes* (Fries), *P. appletoni* (Cockerell) and *P. somalica* spec. nov. Three species are endemic to Madagascar: *P. nilssoni* spec. nov., *P. tegularis* Fries and *P. bicolor*.

The species of *Pasites*, in subsaharan Africa, are very small to large (3,9-12,5 mm long) and their colour varies from completely black to almost entirely reddish-orange. The diagnostic features of the genus are as follows: vertex, frontal view, distinctly convex (Fig. 6, 46), except that of *P. rufipes* in which vertex is flat laterally and raised between lateral ocelli (cf. Fig. 64); face with short brown to white or whitish vestiture, that on lower half of face densely pubescent and that on upper half relatively sparse and mostly simple (Fig. 6, 46), except *P. rufipes* in which entire face is sparsely clothed with long, black, weakly pubescent, vestiture (cf. Fig. 64); antenna 12-segmented in both sexes; labrum variable in length and shape, ranging from a little shorter to distinctly longer than its maximum width and from pointed apicomediaally to more or less truncate distally (Fig. 15); mandibles behind labrum in repose; scutellum gently and evenly curved mediolongitudinally and gently swollen mediolaterally; last exposed metasomal tergum (T6 female, T7 male) either with or without a pygidial plate; female S5 with a strong conical or elliptical concavity, without a posteromedian protuberance, border of concavity clothed with fine vestiture; female S6 bifurcate posteriorly.

The diagnostic characters of the species are diverse, ranging from their general colour, sculpture and vestiture to the structure of the maxillary palp, pygidium and fifth metasomal sternum of the female, and the terminalia of the male, as described below. Males are difficult to identify, but can usually be associated with conspecific females, taken from the same area, by their colour and sculpture. This, together with the fact that the males of three species are unknown, has made it difficult to produce a reliable key to the males.

The genus has been divided into four species-groups. Three species have not been grouped (Appendix 1).

KEY TO SPECIES OF *PASITES*

(males and females)

1. Upper paraocular area distinctly swollen, face strongly incurved above antennal sockets and gently incurved dorsomedially; occurring in the Palaearctic Region (*P. maculata* group) *P. maculata*
- Upper paraocular area flat to slightly swollen, gently incurved above antennal sockets and flat dorsomedially; Afrotropical 2
2. Occurring in subsaharan Africa 3
- Madagascan (*P. atra* group, part) 22
3. Head, viewed perpendicular to lower region of clypeus, with upper margin of vertex between eye and lateral ocellus straight (*cf.* Fig. 64); facial vestiture weakly pubescent and black; metasoma black; pygidial plate absent (male unknown) (*P. rufipes* group) *P. rufipes*
- Vertex convex (Fig. 6, 46); facial vestiture densely pubescent near antennal sockets and usually whitish, if brown or black then metasoma orange; metasoma black, reddish black or orange; female with a well-developed pygidial plate 4
4. Very small, 2,3-2,5 mm long; pygidial plate absent in both sexes, female with subpygidium well-developed posteriorly, about half as long as its maximum width and densely clothed with fine brownish-yellow vestiture (Fig. 31); male S8 with two well-developed anterior lobes (Fig. 33); gonocoxite of genitalia broadly rounded posteriorly (Fig. 34) (*P. gnoma* group) *P. gnoma*
- Small to large, 3,7-12,5 mm long; pygidial plate always present, but sometimes

- reduced; females with subpygidial brush short, distinctly less than half as long as its maximum width; male terminalia otherwise 5
5. Metasoma orange and largely naked, with a little orange vestiture; vestiture on head and mesosoma brown to white (large 7,0-12,5 mm long) (*P. carnifex* group) . . . 6
- Metasoma usually black or blackish, sometimes reddish to orange, always with white pubescence; vestiture on head and mesosoma always pallid (small to large, 3,7-8,8 mm long) (Males are difficult to identify and for some species are unknown, females are usually required for a positive identification) 7
6. First flagellomere 1,2X as long as second flagellomere; female subpygidial brush expanded dorsally (Fig. 41); male S8 parallel sided posteriorly and weakly concave posteromedially (Fig. 42) *P. dichroa*
- First flagellomere 2,5X as long as second flagellomere; female subpygidial brush not expanded dorsally (Fig. 37); male S8 tapering posteriorly and with posterior end distinctly emarginate (Fig. 39) *P. carnifex*
7. Female with posteromedian concavity on S5 conical (Fig. 7, 16, 21, 22, 26, 30); male usually completely black to blackish, legs always black; pygidial plate of male tapering posteriorly when viewed from above 8
- Female with posteromedian concavity on S5 elliptical (Fig. 47, 51, 54, 55, 58, 62); males black to orangish; pygidial plate with posterior end more or less parallel-sided in dorsal view, except *P. appletoni* in which legs and metasoma are orangish . . 12
8. Female with pygidial plate well developed laterally and posteriorly (Fig. 7); vestiture on posterior margin of T2-T4 directed laterally (*P. barkeri* group) *P. barkeri*
- Female pygidial plate either well developed laterally and notched posteriorly or entire plate strongly reduced; vestiture on posterior margin of T2-T4 directed posteriorly (*P. atra* group, part) 9
9. Female with entire pygidial plate strongly reduced, virtually absent, laterally; male S7 tapering evenly towards posterior end, which is distinctly emarginate (Fig. 23) *P. humecta*
- Female pygidial plate well developed laterally, notched posteriorly; male S7 otherwise 10
10. Maxillary palp five-segmented *P. paulyi*
- Maxillary palp two or three-segmented 11
11. Maxillary palp two-segmented *P. atra*

- Maxillary palp three-segmented (male unknown) *P. braunsi*
- 12. Metasoma with six exposed terga and five exposed sterna, excluding highly modified S6; terminal tergum (T6) with a well-developed subpygidial brush; terminal sternum (S5) strongly concave posteromedially (female) 13
- Metasoma with seven exposed terga and six exposed sterna; terminal tergum without a subpygidial brush; terminal sternum entire (male) 18
- 13. Pygidial plate distinct laterally, either notched or absent posteriorly (Fig. 58, 62) (*P. appletoni* group, part) 14
- Pygidial plate never notched posteriorly, sometimes reduced laterally (Fig. 47, 51, 54) (*P. jenseni* group, part) 15
- 14. Pygidial plate fully developed, except for a small notch posteromedially *P. appletoni*
- Pygidial plate only visible laterally, without a distinct posterior margin (male unknown) *P. somalica*
- 15. Propodeum with mediolongitudinal region punctate and clothed with fine vestiture 16
- Propodeum with mediolongitudinal region glabrous and naked 17
- 16. Pygidial plate well developed both laterally and distally (Fig. 47); labrum tuberculate apicomediaally *P. jenseni*
- Pygidial plate reduced laterally so that it exists only as a distinct carina on posterior end of T6 (Fig. 54); labrum with a transverse carina apically *P. jonesi*
- 17. Labrum relatively long, 1,2-1,3X as long as its maximum width *P. namibiensis*
- Labrum quadrate *P. histrio*
- 18. Head and mesosoma mostly black, with mandible, labrum, antenna, pronotal lobe, tegula and legs orangish, and metasoma orange; scutum fairly densely covered with small, well-separated punctures; propodeum with a broad, naked, glabrous mediolongitudinal band; male S8 strongly expanded laterally (Fig. 60) (*P. appletoni* group, part) *P. appletoni*
- Generally with head, mesosoma and metasoma mostly black; specimens with orange coloration, similar to that described above, have large, widely spaced scutal punctures, and mediolongitudinal region of propodeum either pubescent or with glabrous area greatly expanded dorsally; S8 weakly expanded laterally (Fig. 49, 53) (*P. jenseni* group, part) 19
- 19. Propodeum with mediolongitudinal region punctate and clothed with fine vestiture

.....	20
- Propodeum with mediolongitudinal region glabrous and naked	21
20. Labrum tuberculate apicomediaally	<i>P. jenseni</i>
- Labrum with a transverse carina apically	<i>P. jonesi</i>
21. Labrum relatively long, 1,2-1,3X as long as its maximum width ...	<i>P. namibiensis</i>
- Labrum quadrate	<i>P. histrio</i>
22. Integument of head and mesosoma mostly reddish; S7 acutely pointed posteriorly and carinate posteroventrally (Fig. 12) (female unknown)	<i>P. nilssoni</i>
- Integument of head and mesosoma black; male S7 parallel sided posterolaterally with posterior end emarginate (Fig. 27), without a posteroventral carina (males of the following two species are indistinguishable)	23
23. Female without a pygidial plate (Fig. 26)	<i>P. bicolor</i>
- Female pygidial plate well developed laterally and notched posteriorly (Fig. 30)	<i>P. tegularis</i>

THE *PASITES BARKERI* SPECIES GROUP

This species group comprises only *P. barkeri*.

Pasites barkeri (Cockerell) **comb. nov.**, Fig. 6-11, 20

Morgania barkeri Cockerell, 1919: 189-190 (♀ holotype, DMSA).

Pasites nigerrimus [sic.] Friese, 1922: 39; Cockerell 1932: 115 (♀ lectotype, ZMHB) [*lapsus pro nigerrima*]. syn. nov.

Pasitomachthes nigerrimus (Friese): Bischoff 1923: 596-598 [referred to as *Morgania* (*Omachthes*) *nigerrimus* [sic.] on p. 588].

Morgania nigerrimus [sic.] (Friese): Cockerell 1933c: 108 [*lapsus pro nigerrima*].

Pasitomachthes argentatus Baker, 1971: 3-8 (♀ holotype, BCOB). syn. nov.

Pasites nigerrima was described from two female specimens, one from Durban (South Africa) and the other from Kigonsera (Tanzania). The syntype from Durban was studied and is here designated as the lectotype of the species. The other syntype was not traced. The types of *barkeri* and *nigerrima* closely resemble one another, which suggests that Friese (1922) was not aware that the species had been described by Cockerell (1919). Baker (1971)

described *argentata* in detail, and compared *argentata* with *nigerrima*, as defined in the original description (he did not examine the type material of *nigerrima*). Although the type material of *argentata* was not available for study, comparison of the detailed original description of *argentata* with the holotype of *barkeri* and the lectotype of *nigerrima* led to the opinion that *argentata*, *barkeri* and *nigerrima* are synonyms.

DESCRIPTION

Length of head 1,6-2,0 mm; scutum 1,3-1,7 mm; fore wing 6,4-7,9 mm; body 6,3-8,8 mm.

Integument black to reddish-black.

Vestiture mostly white, scutal vestiture brownish-yellow; ventral surfaces of tarsi yellowish; T5 of female with a yellowish tinge and distal region of S5 brownish-yellow; T6 with subpygidial brush brownish-orange. Vestiture on head mostly short, dense and pubescent, vertex moderately dense and simple (Fig. 6); mesosomal vestiture dense, short and simple on scutum, moderately sparse on ventrolateral region of mesepisternum, very sparse on trochanters and femora, and very dense on ventral surfaces of tarsi; T1 with anterior surface and posterolateral regions densely pubescent, vestiture on remainder of T1 sparse; T2-T4 with anterior regions sparsely pubescent and distal regions with moderately dense fringes of laterally directed vestiture; female T5 and male T5-T6 with vestiture of distal fringes directed posteriorly; female T6 with a subpygidial brush (Fig. 7); metasomal venter moderately sparsely to densely pubescent, and with velutinous vestiture surrounding distal concavity of S6.

Labrum quadrate, apex carinate with carina strongly tuberculate medially, and rounded apicolaterally; maxillary palp 5-segmented and about twice as long as pedicel of antenna; scutum densely punctate, punctures small and distinctly separate; scutellum strongly convex, but only slightly swollen mediolaterally; mesopleuron generally moderately densely punctate, punctures fairly large and separate; propodeum largely punctate, narrowly glabrous medioposteriorly; pygidial plate broad and well developed in both sexes; female with subpygidial brush short and devoid of a ventral tuft (Fig. 7); female S5 with a deep, conical concavity (Fig. 7) and S6 narrowly bifid (Fig. 8); male S7 gradually tapering towards the

posterior end, truncate posteriorly (Fig. 9); S8 more or less rounded posteriorly, anterior end moderately expanded anterolaterally (Fig. 10); genitalia with gonocoxite curved gently inwards posteriorly (Fig. 11).

DISTRIBUTION (Fig. 20)

This species inhabits the tropical and subtropical regions of Africa. It is known from Zaire, Uganda, Burundi, Tanzania, Zimbabwe and from the east coast of South Africa.

DISCUSSION

This is the only species that is black or blackish with short simple vestiture on the scutum, laterally directed vestiture on T2-T4 and a well-developed pygidial plate in the female.

It resembles certain of its congeners, namely the *P. atra* species group, *P. gnoma* and the *P. carnifex* species group, in that the posteromedian concavity of the female S5 is conically emarginate (Fig. 7, 16, 31, 37). The structure of the male gonocoxite (Fig. 11) resemble that of *P. paulyi* and *P. nilssoni* (Fig. 14), both of which belong to the *P. atra* group, more closely than to any other species in the genus. In the cladistic analysis (Fig. 2) it is demonstrated as being most closely related to the clade that comprises the *P. appletoni* group, *P. carnifex* group, *P. jenseni* group, *P. rufipes* and *P. maculata*.

Cockerell (1933c) recorded the host of this species as possibly being *Nomia garua* Strand (Halictidae).

Other published distribution records: Kigonsera in Tanzania (Fries 1922); Dilolo & 50 km S. Bukavu in Zaire (Cockerell 1932); Monrovia in Liberia, Aburi in Ghana, Kampala in Uganda & Uvira in Tanzania (Cockerell 1933c); Cameroon & Ghana (Medler 1980) and Bulawayo in Zimbabwe (Baker 1971).

MATERIAL EXAMINED

TYPE MATERIAL. *Morgania barkeri*, ♀ holotype: 'Durban, Natal, 9.iii.1918, C.N. Barker, *Morgania barkeri* Ckll. Type, TYPE', DMSA.

Pasites nigerrima, ♀ lectotype: 'Durban 10.3.1, Hayar 1219 [on reverse side of label],

Pasitomachthes nigerrimus Bisch. Typ. ♀, War Cotype des *Omachthes nigerrimus* Fr.!, Coll. Frieze, Typus, Zool Mus Berlin', ZMHB.

ADDITIONAL MATERIAL. 17♀ 11♂: ZAIRE: 'SL Edourd, Bitshumbi (925m), Parc Nat. Albert', 22.iv.1936, L. Lippens, 1♂ MRAC. ZIMBABWE: Victoria Falls, 20.i.1927, 1♀ 5♂ SAMC 1♂ SANC. SOUTH AFRICA: Kosi Bay, 26.58S 32.48E, 10-11.ii.1990, C.D. Eardley, 1♂ SANC; Mfongosi, iv & xii.1916 & iii.1917, W.E. Jones, 9♀ SAMC 1♀ SANC; Charters Creek, St Lucia, 28.12S 32.25E, 14-16.i.1981, R. Oberprieler, 1♀ SANC; Durban, Bluff, 26.ii.1921, C.N. Barker, 1♂ DMSA; Burman Bush, 8-18.iii.1963, H. Empey, 2♀ 2♂ SANC; Mont Clair, Durban, 25.iii.1945, 1♀ DMSA 1♀ SAMC; Port St. John, 19.iii.1969, L.C. Starke, 1♀ SANC.

THE *PASITES ATRA* SPECIES GROUP

The *P. atra* species group comprises the following seven species: *P. nilssoni*, *P. atra*, *P. paulyi*, *P. braunsi*, *P. humecta*, *P. bicolor* and *P. tegularis*. In most of these species the head and mesosoma are black and the metasoma ranges from black to reddish. In *P. nilssoni* the head, mesosoma and metasoma are reddish. The most useful diagnostic characters of the group are the conical posteromedian concavity of the female S5 in combination with the female subpygidial brush which is undifferentiated and either longer than wide or quadrate. The female of *P. nilssoni* is unknown. The females are generally more distinctive and can be separated more easily than the males.

This species group has been called the *P. atra* group because *P. atra* is the most common species in the group. *Pasites nilssoni* has been dealt with first because of its unique coloration and because it has certain affinities, in the structure of the male terminalia, with *P. barkeri*. In general *P. nilssoni* resembles the species that comprise the *P. atra* species group more closely than *P. barkeri*.

Pasites nilssoni spec. nov., Fig. 12-14, 35

This species is named for the collector, Prof. L.A. Nilsson, of Uppsala University, Sweden, who recognized it as being new.

DESCRIPTION

MALE (female unknown). Lengths: head 1,4 mm; scutum 1,1 mm; fore wing 4,8 mm; body 5,3 mm.

Integument of head mostly orange with upper region of face and posterior region of gena partly black; mesosoma orange with mediolongitudinal region of scutum, anterior and ventral areas of pleuron, venter and propodeum black to orangish-black; legs more or less with ventral surface of femora, most of tibia and entire tarsi black or blackish; metasoma mostly orangish-black anteriorly and blackish-orange posteriorly.

Vestiture mostly white to whitish, scutum with a pale yellow tinge, ventral surfaces of tarsi pale yellow, and S6 yellowish. Vestiture generally ranges from strongly to weakly plumose, and fairly dense; upper region of face, vertex, most of scutum and scutellum, lower region of mesopleuron, trochanters and femora mostly with simple vestiture; propodeum with lateral surface and mediolongitudinal region of posterior surface naked; T1 mostly pubescent, distal margin naked; T2-T6 mostly with fine vestiture anteriorly and a dense pubescent cross-bands posteriorly; T7 with a little simple vestiture on pygidial plate; metasomal venter largely densely pubescent, S6 with simple vestiture.

Structure similar to *P. barkeri* except as follows: labrum without a distinct carina or tubercle; maxillary palp a little longer than pedicel of antenna (1,4: 1); scutellum strongly convex with a distinct mediolongitudinal cleft; propodeum with naked areas laterally and glabrous posteriorly; pygidial plate weakly pointed posteriorly; apex of S7 pointed in ventral view (Fig. 12) and distinctly keeled; S8 more or less truncate posteriorly and not expanded anterolaterally (Fig. 13); genitalia with posterior end of gonocoxite distinctly differentiated and relatively long, about 0,7X as long as anterior region of gonocoxite (Fig. 14).

DISTRIBUTION (Fig. 35)

This species is known from Morondava, on the west coast of Madagascar.

DISCUSSION

Within the group, this species can be easily recognized by the unique orangish integument of

the male head and mesosoma. A more precise determination of the relationship between this and the other species in the group must await the discovery of the female.

MATERIAL EXAMINED

TYPE MATERIAL. ♂ holotype: 'MADAGASCAR: OUEST: Toliary Morondava, Florêt de Kirindy, 25.xi.1989, PL. REPR. ECOL. PRO.', NCUS.

Pasites atra Friese, Fig. 15-20

Pasites ater [sic.] Friese, 1909b: 148 (♀ holotype, NHRS) [*lapsus pro P. atra*].

Morgania (Omachthes) ater [sic.] (Friese): Bischoff 1923: 588 [*lapsus pro M. atra*].

Pasites friesei Cockerell, 1910: 217 [*nom. nov. pro Pasites atra* Friese nec Fabricius].

Morgania friesei (Cockerell): Cockerell 1933c: 109-110.

Morgania chubbi Cockerell, 1919: 189-190 (♀ holotype, DMSA). syn. nov.

Morgania (Omachthes) nigracula Bischoff, 1923: 588 (♀ lectotype, TMSA). syn. nov.

Omachthes nigratulus (Bischoff): Anonymous 1958: 32.

Morgania peratra Cockerell, 1933c: 109-110 (♂ holotype, NHML). syn. nov.

Cockerell's (1910) renaming of this species as *P. friesei* was unjustified. Although *P. atra* Friese is a junior secondary homonym of *P. atra* (described as *Nomada atrata* by Fabricius 1804 and first referred to as *P. atra* by Spinola 1806), Fabricius' species was synonymized with the Palearctic species *Biastes brevicornis* (Panzer 1798) by Dalla Torre (1896) and *brevicornis* is the older name. When Bischoff (1923) dealt with this species he placed the name *P. friesei* in parentheses.

Cockerell (1919) described *P. chubbi* from a single female from Durban. He did not give a comparison between this species and any of its congeners. Bischoff (1923) separated *atra* and *nigracula* primarily on the structure of the distal fringe on the female T5, and he did not refer to *P. chubbi*. As *nigracula* closely resembles *chubbi*, it appears as if Bischoff (1923) was not aware of Cockerell's (1919) paper. During the course of this study much material of this species, from numerous localities, was studied and the species was found to be widely distributed and the extent of the vestiture variable. The study, which included the examination of the type material, revealed that *atra*, *chubbi* and *nigracula* are synonyms.

Pasites nigrītula was described from two females, from Sunday's River and Plat River (eastern Cape, South Africa). The Sunday's River specimen is the only syntype that was traced, and it is here designated as the lectotype.

The male of this species was first described by Cockerell (1933c) as *P. peratra*. The association of the sexes, by the study of specimens of both sexes taken together that closely resemble one another, resulted in the synonymy of *atra* and *peratra*.

DESCRIPTION

Length of head 1,3-2,0 mm; scutum 0,8-1,8 mm; fore wing 4,4-6,9 mm; body 4,5-7,1 mm.

Integument black, except tegula, legs and metasoma sometimes reddish.

Vestiture mostly white, ventral surfaces of tarsi, female T5 and S5 and male T6 and S6 with a pale yellow tinge; female subpygidial brush brownish-orange. Head mostly densely pubescent, upper region of face and vertex with sparse vestiture (*cf.* Fig. 6); mesosoma with pronotal collar, most of pronotal lobe, lateral regions of mesopleuron (excluding lower hypoepimeral area) and posterolateral regions of propodeum densely pubescent; remainder of mesosomal vestiture sparse; vestiture on legs dense, except trochanters and femora sparse to very sparse and ventral surfaces of tarsi very dense; T1 with anterior surface and posterolateral region densely pubescent, remainder of T1 with sparse, simple vestiture; T2 and sometimes T3 with dense, posterolaterally directed, vestiture posterolaterally, anterior regions of each tergum with sparse, simple vestiture; female T3/T4-T5 and male T3/T4-T6 with moderately dense distal fringes of laterally directed hairs (vestiture sparse and simple anteriorly); female T6 with sparsely vestiture and with a weakly developed subpygidial brush (Fig. 16); female S2-S4 with vestiture fairly sparse anteriorly and dense posteriorly, and S5 with moderately dense vestiture, distal margin velutinous; male metasomal venter moderately densely pubescent.

Labrum a little longer than wide, weakly tuberculate apicomediaally (Fig. 15); maxillary palp two-segmented and less than one-half as long as pedicel (except three-fourths as long as pedicel in one specimen); scutum consistently 1,1X as long as its narrowest width, punctures

moderately large and often confluent; scutellum strongly convex but only slightly swollen mediolaterally; propodeum distinctly glabrous mediolongitudinal; mesopleuron mostly densely punctate, hypoepimeral and ventral regions sparsely punctate; female T6 without a distinct pygidial plate, but with a weak carina posterolaterally (Fig. 16), pygidial brush short and devoid of a ventral tuft, shallowly concave ventrally (Fig. 16); male with a well-developed, broadly rounded pygidial plate; female S5 with a deep conical concavity (Fig. 16), and S6 narrowly bifurcate (*cf.* Fig. 8); male S7 tapering posteriorly (Fig. 17), with posterior end gently rounded; S8 generally rounded posteriorly, with a small protuberance posteromedially, and not strongly expanded anterolaterally (Fig. 18); genitalia with gonocoxite slender, the basal part gently curved (Fig. 19).

DISTRIBUTION (Fig. 20)

This species is wide spread throughout the greater part of subsaharan Africa, occurring in a variety of different biotypes.

DISCUSSION

Pasites atra differs from the other species in the group by the two-segmented maxillary palp, female pygidial plate which is well developed laterally and notched posteriorly and subpygidial brush which is completely brownish-orange. In *P. atra* the male S7 tapers gradually towards the gently rounded posterior end.

The known host plants of *P. atra* are: *Ageratum* sp., *Aspilia africana* (Pers.) C.D. Adams, *Aspilia helianthoides* Benth. & Hook. f. Gsn., *Emilia coccinea* Sweet and *Mikania natalensis* DC. (family Asteraceae), *Stachytarpheta angustifolia* Vahl (family Verbenaceae), *Spermacoce verticillata* L. (family Rubiaceae) and *Harungana madagascariensis* Lam. ex Pair. (family Hypericaceae).

The only other published distribution record is Kampala in Uganda (Cockerell 1933c).

MATERIAL EXAMINED

TYPE MATERIAL. *Pasites ater*, ♀ holotype: 'Kilimandjaro, 6 Sept., Typus, *Pasites ater* ♀ Fr. 1908 Friese det.', NHRS.

Morgania chubbi, ♀ holotype: `Natal, Bellair, E.C. Chubb, 13 Jan. 1919, *Morgania chubbi* Ckll. Type, TYPE', DMSA.

Morgania nigrigula, ♀ lectotype: `Sunday's River, Dr Brauns, Cape Colony, 27.xii.1897, *O. nigrigulus* Bisch. Typ. ♀., *Omachthes nigrigulus* TYPE Bischoff, *Omachthes nigrigulus* ♀ Type No. 564', TMSA.

Morgania peratra, ♂ holotype: `NATAL, Weenen, iii.iv.1924, H.P. Thomasset, *Morgania peratra* Ckll TYPE, Pres. by Imp. Inst. Ent. B.M. 1933-582, B.M. TYPE HYM. 17B 81', NHML.

ADDITIONAL MATERIAL. 54♀ 48♂: SENEGAL: Ziguinchor, viii.1979, A. Pauly, 1♂ PCGB; BURKINA FASO: Sources du Kou, 13.x.1979, A. Pauly, 3♀ PCGB; River Lahissa S., 5.x.1979, A. Pauly, on *Aspilid helianthoides*, 1♀ PCGB. LIBERIA: Bakratown, x.1926, 1♀ MCZC 1♀ MRAC. IVORY COAST: Grand-Béréby, 18.xii.1979, A. Pauly, 1♂ PCGB; Tabou, 21.xii.1979, A. Pauly, 1♀ PCGB. TOGO: Sokodé, xii.1982, A. Pauly, 1♀ PCGB. CAMEROON: Wum, maquis d'altitude, 6.24N 10.03E, 20.viii.1987, A. Pauly, on *Emilia coccinea*, 2♀ PCGB, on *Aspilid africana* 1♀ 2♂ PCGB, on *Ageratum* sp. 1♂ PCGB; Kriegschiffsha, 15.iii.1892, Dr Brauns, 1♂ TMSA. CENTRAL AFRICAN REPUBLIC: Kembe, 4.29N 21.53E, 13.viii.1985, Dollfuss, 1♀ SCAA. EQUATORIAL GUINEA: Bioko, Sa. Jsabel, 25.iii.1900, L. Conradt S., 1♀ TMSA. GABON: Og. Lolo., Paris, 1.19S 12.30E, 29.i.1986, A. Pauly, 1♀ 3♂ PCGB; Og. Lolo., Pana, 700m, 29.i.1986, A. Pauly, on *Mikania cordata* 1♂ PCGB; Og. Iv., Sassamongo, 2.v.1986, A. Pauly, 2♂ PCGB 2♂ SANC; same data plus, on *Stachytarpheta angustifolia*, 1♂ PCGB 1♂ SANC; Botouala, 2.v.1986, A. Pauly, on *Stachytarpheta angustifolia*, 1♂ PCGB; Cap, Santa Clara, 29.ix.1985, A. Pauly, 2♀ 1♂ PCGB 1♀ SANC; Sindara, riv. Ngounié, 29.xii.1985, A. Pauly, on *Spermacoce verticillata*, 1♀ PCGB; Kango, 22.ix.1985, A. Pauly, on *Harungana madagascariensis*, 1♀ PCGB; Ayem W., 25.xii.1985, A. Pauly, on *Aspilid africana*, 1♂ PCGB; Forêt des Abeilles, 00,22S 11.52E, 1.ii.1986, A. Pauly, on *Harungana madagascariensis*, 1♂ PCGB; W. NT., Bilé-Mélen, 21.iii.1987, A. Pauly, 1♂ PCGB. ZAIRE: Tshuapa, Bokuma, i-iii.1954, R.P. Lootens, 3♀ MRAC; Equateur, Bokuma, ii & vii.1952, R.P. Lootens, 1♀ 1♂ MRAC; Urundi, t. Bururi, 900m, Nyamurembe, 7.iii.1953, P. Basilewsky, 1♂ PCGB; Ubangi, Nouvelle Anvers, 9.xii.1952, P. Basilewsky, 1♀ PCGB; Kivu, Uvira, 25-26.xii.1952, P. Basilewsky, 1♀ 1♂ MRAC; Kivu, Mulungu, 5.iv.1937, H.J. Brédo, 1♀ MRAC; Kivu, Bukavu, 26.vii.1931, J. Ogilvie, 1♂ MRAC; Terr. de Kasongo, riv. Lumami, i.1960, P.L.G. Benoit, 1♂ MRAC;

Kisangani [= Stanleyville] 9.iv.1928, A. Collart, 1♂ MRAC; Kisangani, 16.iv.1932, J. Vrydag, 2♂ MRAC; Kunzulu, ix.1917, R. Mayné, 1♂ MRAC; Boma, vii.1920, H. Schouteden, 1♀ MRAC; Kisantu, 1932, R.P. Vanderyst, 1♀ MRAC; 'District de Fanovana, Madag. Region orientale Forets humides, ix-x, 1938, Charles Lambeton', 1♀ 1♂ AMNH.

KENYA: Karen, Nairobi, 20.v.1967, C.D. Michener, 1♀ SEMK. RWANDA: Gitarama, 1850m., terr. Nyanza, i.1953, P. Basilewsky, 1♀ MRAC. ZIMBABWE: Victoria Falls, 4.i.1920, 1♀ TMSA; Bulawayo, 15.ii.1926, R.H.R. Stevenson, 1♀ TMSA. BOTSWANA: Kugana, 19.03S 23.02E, 22-26.xi.1979, B. Lamoral, 1♂ BCSA. NAMIBIA: 24 km S.E. Outjo, 23.ii.1977, J.G. & B.L. Rozen, 1♂ AMNH; Gobabis, 21.xii.1974, H. Empey, 1♂ SANC. SOUTH AFRICA: Entabeni Forest Reserve, 33.00S 30.16E, 7-11.i.1987, C.D. Eardley, 1♀ SANC; Mogoto Nature Reserve, Zebediela, 24.15S 29.13E, 22-25.x.1979, C.D. Eardley, 1♀ SANC; Nylsvley Nature Reserve, 24.39S 28.42E, 10-11.xii.1979, C.G. Moolman, 1♀ SANC; Lydenburg district, 1896, P.A. Krantz, 1♀ SANC; O.T.K. Reserve, near Loskop Dam, 25.27S 29.24E, 9-11.xii.1985, C.D. Eardley, 1♀ 2♂ SANC; Weltevreden, 25.34S 31.10E, 24.i.1990, G.L. Prinsloo, 1♂ SANC; Mogol Nature Reserve, Ellisras district, 23.58S 27.45E, 25-26.i.1982 & 27-29.ii.1984, C.D. Eardley, 2♀ SANC; D'Nyala Nature Reserve, 23.45S 27.49E, 8-12.xii.1989, C.D. Eardley, 1♀ 1♂ SANC; Hope, near Ellisras, 17.xi.1962, H. Empey, 1♂ SANC; Ben Alberts Nature Reserve, near Thabazimbi, 24.37S 27.23E, 24-28.xi.1980, C.D. Eardley, 1♂ SANC; Schoongeleen, between Bulgeriver & Matlabas, 24.12S 27.45E, 14.i.1991, V.M. Uys, 1♂ SANC; Rustenburg, 6.xii.1969, L.C. Starke, 1♂ SANC; Botanical Gardens, Pretoria, 25.45S 28.17E, 6.iv.1989, C.D. Eardley, 1♀ SANC; Johannesburg, i.1908, G. Kobrow, 1♂ TMSA; Strubens Valley, 31.xii.1965, H. Empey, 1♀ SANC; Potchefstroom, T. Ayrs, 1♀ SAMC; Mfongosi, iii.1916, W.E. Jones, 1♂ SAMC; Umlaas Road, 19 km S.E. Pietermaritzburg, 23.i.1967, C.D. Michener, D.J. Brothers, 1♀ SAMK; Nagle Dam, 27 km E. Pietermaritzburg, 5.i.1967, C.D. Michener, D.J. Brothers, 1♀ SEMK; Weenen, iii.1924, H.P. Thomasset, 1♂ SANC; Tongaat Beach, 10-11.iv.1971, F.L. Farquharson, 1♂ DMSA; Umgeni River, near Table Mountain, 4.ii.1940, L. Bevis, 1♀ AMGS; Amanzimtoti, 10.iv.1952, C. Jacot-Guillarmod, 2♀ AMGS; Drakensberg Botanic Gardens, near Harrismith, 28.17S 29.09E, 27.xii.1986, C.D. Eardley, 1♂ SANC; Cookhouse, 14.i.1965, H. Empey, 1♂ SANC; Hilton, Grahamstown, 3-16.xi.1977, F.W. Gess, 3♀ 1♂ AMGS; Boesmans River, near Grahamstown, iii.1954, 1♂ SAMC; Hunts Drift, Fish River,

11.xii.1960, C. Jacot-Guillarmod, 1♀ AMGS.

Pasites paulyi spec. nov., Fig. 20-21

This species is named for the collector, Dr A. Pauly, PCGB.

DESCRIPTION

Similar to *P. atra*. Length of head 1,5-1,6 mm; scutum 1,1-1,3 mm; fore wing 4,5-5,5 mm; body 5,0-6,4 mm.

Integument black, except tegula, legs and metasoma sometimes reddish.

Vestiture mostly white, ventral surfaces of tarsi, female T5 and S5 and male T6 and S6 with a pale yellow tinge; female T6 with subpygidial brush black medially, circumscribed by brownish-orange (cf. Fig. 17, dense central region black and relatively sparse peripheral area brownish-orange). Head mostly densely pubescent, upper region of face and vertex with sparse vestiture (cf. Fig. 6); mesosoma with pronotal collar, most of pronotal lobe, lateral regions of mesopleuron (excluding lower hypoepimeral area) and posterolateral regions of propodeum densely pubescent; remainder of mesosomal vestiture sparse; vestiture on legs dense, except trochanters and femora sparse to very sparse and ventral surfaces of tarsi very dense; T1 with anterior surface and posterolateral region densely pubescent, remainder of T1 with sparse, simple vestiture; T2 and sometimes T3 with dense, posterolaterally directed, vestiture posterolaterally, anterior regions of each tergum with sparse, simple vestiture; female T3/T4-T5 and male T3/T4-T6 with moderately dense distal fringes of posteriorly directed hairs (vestiture sparse and simple anteriorly); female T6 with sparse vestiture and with a weakly developed subpygidial brush (Fig. 16); female S2-S4 with vestiture fairly sparse anteriorly and dense posteriorly, and S5 with moderately dense vestiture, distal margin velutinous; male metasomal venter moderately densely pubescent.

Labrum a little longer than wide, labrum with a small tubercle apicomediaally; maxillary palp two-segmented and subequal in length to antennal pedicel; scutum consistently 1,1X as long as its narrowest width, punctures moderately large and often confluent; scutellum evenly convex, devoid of any pronounced mediolateral swelling; propodeum distinctly glabrous

mediolongitudinal; mesopleuron mostly densely punctate, hypoepimeral and ventral regions sparsely punctate; female pygidial plate with posterolateral carina more strongly developed than in *P. atra* (cf. Fig. 16), subpygidial brush quadrate (Fig. 21), S5 deeply emarginate posteromedially (Fig. 21) and S6 narrowly bifid; male with a well-developed, broadly rounded pygidial plate (cf. Fig. 8); male S7 and genitalia as in *P. barkeri* (cf. Fig. 9-11); male S8 similar to that of *P. atra*, except a little more truncate distally (cf. Fig. 18).

DISTRIBUTION (Fig. 20)

This species is known from the woodland of northern Cameroon.

DISCUSSION

In this species the maxillary palp is five-segmented, female pygidial plate notched posteriorly and subpygidial brush brownish-orange with a black centre. The male S7 with lateral margins are gently concave and posterior end more or less gently rounded (cf. Fig. 9).

MATERIAL EXAMINED

TYPE MATERIAL. ♂ holotype 3 ♀ paratypes: CAMEROON: Parc Nat. Waza, 11.21N 14.35E, 5.viii.1987, A. Pauly, ♂ holotype PCGB 1 ♀ paratype PCGB 1 ♀ paratype SANC; Maga, 10.50N 14.59E, 3.viii.1987, A. Pauly, Fl. No. 374, 1 ♀ paratype PCGB.

Pasites braunsi (Bischoff) **comb. nov.**, Fig. 56

Morgania (*Omachthes*) *braunsi* Bischoff, 1923: 587 (♀ holotype, TMSA).

Omachthes braunsi (Bischoff): Anonymous 1958: 31.

DESCRIPTION

FEMALE (male unknown). Length of head 1,4-1,9 mm; scutum 1,2-1,6 mm; fore wing 4,7-5,8 mm; body 5,0-6,5 mm.

Similar to *P. atra* except as follows: subpygidial brush black medially, circumscribed by brownish-orange; labrum pointed and very weakly tuberculate apicomediaally; maxillary palp three-segmented and subequal in length to antennal pedicel; pygidial plate with posterolateral carina more strongly developed; subpygidial brush quadrate.

DISTRIBUTION (Fig. 56)

The habitat of *P. braunsi* ranges from bushveld, in Zimbabwe, Namibia and parts of South Africa, to montane grassland in Lesotho.

DISCUSSION

This species closely resembles *P. paulyi* in the notched pygidial plate and black central spot in the subpygidial brush. It differs from *P. paulyi* in that the maxillary palp is three-segmented.

MATERIAL EXAMINED

TYPE MATERIAL. *Omachthes braunsi*, ♀ holotype: 'Bothaville, Oranje Fr. Sta., 13.xi.1898, Dr Brauns, *Omachthes braunsi* Bisch. Typ., Typus Bischoff, *Omachthes braunsi* Biss. Type No. 566', TMSA.

ADDITIONAL MATERIAL. 31♀: ZIMBABWE: Bulawayo, 21.xii.1919, 1♀ SANC. NAMIBIA: Regenstein 32, 2217 CA, 12.xii.1973, 2♀ SMWH. 5 km S. Okahandja, 30.iii-1.iv.1979, J.G. Rozen, 3♀ AMNH; 3 km S. Windhoek, 11.iii.1976, J.G. & B.L. Rozen, 1♀ AMNH. LESOTHO: Mamathes, ii.1946 & i.1961, C. Jacot-Guillarmod, 3♀ AMGS; Hensley's Dam Leribe, 29.ii.1948, C. Jacot-Guillarmod, 1♀ AMGS. SOUTH AFRICA: Kruger National Park, Skukuza, 24.59S 31.55E, 292m, 19.i.1984, C.D. Eardley, 2♀ SANC; same locality, 14-17.i.1985, G.L. Prinsloo, 3♀ SANC; Ben Alberts Nature Reserve, Thabazimbi, 24.37S 27.32E, 24-28.xi.1980, M.W. Mansell, 1♀ SANC; Johannesburg, 4.ii.1978, H.R. Hepburn, 1♀ SEMC; Queenstown, 16.xii.1979, H. Empey, 1♀ SANC; Whittlesea, i.1979, C.D. Eardley, 1♀ SANC; Hilton, Grahamstown, 28.ii-17.iii.1978, F.W. & S.K. Gess, 7♀ AMGS; Willow Glen, Grahamstown, 24.xi.1982, D.W. Gess, 1♀ AMGS; Belmont Valley, Grahamstown, 24.xi.1982, F.W. & S.K. Gess, 24.xi.1982, 2♀ AMGS; Strowan, W. Grahamstown, i.1980, D.J. Brothers, P. Hulley & C. Jacot-Guillarmod, 1♀ BCSEA.

***Pasites humecta* spec. nov.**, Fig. 20, 22-25

This species is apparently endemic to the humid regions of tropical Africa, hence the name *humecta*.

DESCRIPTION

Length of head 1,1-1,5 mm; scutum 0,8-1,2 mm; fore wing 4,0-5,6 mm; body 3,7-4,5 mm.

Integument of head and mesosoma black, except labrum, mandible, antennal flagellum, tegula, pronotal lobe and legs (coxae excluded) which are mostly reddish-black; metasoma black to reddish-black.

Vestiture mostly white, ventral surfaces of tarsi pale yellowish and terminal segment of metasoma brownish-orange. Head mostly moderately densely pubescent, lower half very densely pubescent (*cf.* Fig. 6); mesosoma with scutum and ventrolateral region of mesepisternum sparsely pubescent, remainder of mesosoma very densely pubescent; legs densely pubescent, except trochanters and femora sparsely pubescent; metasoma naked to very sparsely pubescent, except T1 with anterior (subvertical) surface mostly densely pubescent and with a dense posterolateral tuft; T2-T3 with broadly medially interrupted distal fringes; female T4-T5 and male T4-T6 with well-developed distal fringes; female T6 with distal end densely clothed with velutinous vestiture (Fig. 22), with a weakly developed subpygidial brush (Fig. 22); male T7 largely naked; metasomal venter with sparse vestiture, except distal ends of S2-S4, in female, and S2-S5, in male, with dense distal fringes; S5 and S6 in female and male, respectively, velutinous.

Labrum a little longer than wide (1,1: 1), flattish with a weakly developed tubercle apicomediaally and angulate apicolaterally (*cf.* Fig. 15); maxillary puplus two-segmented and half as long as pedicel; scutum moderately densely punctate, punctures large and sometimes convergent; scutellum gently curved with mediolateral region gently swollen; propodeum with mediolongitudinal region broadly glabrous; female T6 virtually devoid of a pygidial plate, but with a small carina distally (Fig. 22); female S5 broadly emarginate (Fig. 22), S6 narrowly bifid; male S7 tapering evenly posteriorly with posterior end emarginate (Fig. 23); male S8 generally rounded posteriorly, with a posteromedian prominence, and not strongly expanded anterolaterally (Fig. 24); genitalia with gonocoxite slender and bowed outward (Fig. 25).

DISTRIBUTION (Fig. 20)

This species is known from wooded areas in tropical Africa, from Nigeria to Tanzania.

DISCUSSION

The pygidial plate of the female of *P. humecta* is strongly reduced, almost absent (Fig. 22).

The male S7 tapers gradually towards the gently concave posterior end (Fig. 23).

MATERIAL EXAMINED

TYPE MATERIAL. ♀ holotype, 17♀ 8♂ paratypes: ZAIRE: Malela, 6.00S 12.40E, 8.vii.1915, Lang & Chapin, ♀ holotype AMNH; Kisangani, 25.10E 0.30N, ii & iv.1915, 1♀ 1♂ paratypes AMNH. NIGERIA: Lagos, 18.viii.1966, C.D. Michener, 2♂ SEMK. CAMEROON: Bambui, near Bamenda, 41500 m, 9 & 20.vii.1966, C.D. Michener, 12♀ SEMK 2♀ SANC 1♂ SEMK; Tingch, Menchin, River, near Wum, 21000 m, 14.viii.1966, C.D. Michener, 1♂ SEMK; Lolodorf, 10.viii.1920, A.I. Good, 1♂ paratype ICCM (Acc 6552); same data except, 6.vii.1926, 1♀ paratype ICCM. GABON: 4.xii.1909, A.I. Good, 1♂ paratype SANC (Acc 4189); same data except, 23.xi.1909, 1♀ paratype SANC. TANZANIA, Morogoro, 19.x.1956, W.E. Kerr, 1♂ SEMK.

Pasites bicolor Friese, Fig. 26-29, 35

Pasites bicolor Friese, 1900: 262 (♀ lectotype, ZMHB).

Pasitomachthes bicolor (Friese): Bischoff 1923: 597-598.

Friese (1900, 1922) attributed the authorship of this species to 'de Saussure *in litt.*', but the article was clearly written by Friese. The name should therefore be attributed to Friese.

Bischoff (1923) proposed the generic name *Pasitomachthes* for *Pasites nigerrima* and *Pasites bicolor*, and clearly stated that the former was the type species of *Pasitomachthes*. He also redescribed each of these two species. In each of the redescrptions he placed the term 'n.sp.' behind the species name. This was clearly an error, as they were not new species but new combinations. The species was described from two females from Nossi-Bé in Madagascar, only one of which was available for study and is here designated as the lectotype.

DESCRIPTION

Length of head 1,5-1,9 mm; scutum 1,3-1,7 mm; fore wing 5,9-7,3 mm; body 5,9-7,6 mm.

Integument of head, mesosoma and legs entirely black to mostly black or blackish with labrum, mandible, pronotal lobe and tegula orange to orangish, and legs blackish-orange to orange; metasoma completely orange to reddish-black (latter with a mottled appearance).

Vestiture mostly white, anteromedian region of scutum with a slight yellow tinge, ventral surfaces of tarsi pale yellow and T6 and S5 mostly pale yellowish, subpygidial brush reddish. Vestiture on lower region of face and gena pubescent, upper region of face and vertex simple (*cf.* Fig. 6); mesosoma mostly pubescent, dorsum and ventral region of mesopleuron with simple to weakly plumose vestiture; vestiture on coxae pubescent, remainder of legs simple; propodeum densely pubescent, except propodeal triangle which is naked; T1 with anterior surface sparsely pubescent, remainder of vestiture fine and simple, except posterolateral region which ranges from naked to sparsely clothed with simple to weakly plumose vestiture (never densely pubescent); distal margin of T1 naked and glabrous; T2 with sparse fine vestiture, except posterolaterally where it is densely pubescent; female T3 and male T3-T4 similar to T2, except vestiture on posteromedial region ranges from sparse and simple to dense and plumose (where latter occurs, vestiture forms a dense cross-band); female T4-T5 and male T5-T6 with vestiture sparse and simple anteriorly, and dense and pubescent posteriorly; female T6 with sparse, erect, simple hairs, except subpygidial brush which is fairly dense (Fig. 26), male T7 sparsely pubescent; metasomal venter fairly sparsely clothed with fine, simple vestiture, except distal margin of female S5 with fine dense vestiture.

Labrum quadrate, apex strongly tuberculate, and rounded apicolaterally; maxillary palp three-segmented and half as long as pedicel of antenna; scutum densely punctate, punctures small and distinctly separate; tegula weakly convex, giving the impression that it is proportionately larger than in its congeners; scutellum strongly convex with a deep mediolongitudinal cleft, so that it appears strongly swollen mediolaterally; propodeal triangle glabrous and weakly striated in places; mesopleuron fairly densely punctate, punctures separate; female T6 devoid of a pygidial plate (Fig. 26), male pygidial plate well-developed and broadly rounded distally; female subpygidial brush weakly defined (Fig. 26); female S5 distinctly concave (Fig. 26); S6 narrowly bifid (*cf.* Fig. 8); male S7 more or less parallel sides posterolaterally, gently emarginate posteriorly (Fig. 27); S8 gently rounded posteriorly with two apical protuberances posteromedially, not strongly expanded anterolaterally (Fig.

28); genitalia with gonocoxite slender and bowed near base (Fig. 29).

DISTRIBUTION (Fig. 35)

This species is endemic to Madagascar.

DISCUSSION

The females of the two Madagascan species, *P. bicolor* and *P. tegularis*, are similar, and the males are indistinguishable. The most salient diagnostic feature of the females is the complete loss of the pygidial plate in the former, as opposed to the reduced pygidial plate in the female of *P. tegularis*. Associated with the loss of the pygidial plate the T6 is distinctly more rounded in *P. bicolor*, the remnants of the pygidial plate in *P. tegularis* form two dorsolateral carinae which give the T6 a more angulate appearance. The males of *P. bicolor* and *P. tegularis*, can be separated from the other species in the group by the S7 which is more or less parallel-sided posterolaterally and emarginate posteriorly (Fig. 27).

MATERIAL EXAMINED

TYPE MATERIAL. ♀ lectotype: 'Madagasc, Annatarivo [label almost illegible], *Pasites bicolor* Sau. ♀. Madagascar, Typus, *Pasitomachthes bicolor* Bisch. Typ. ♀, Zool. Mus. Berlin'. ZMHB.

ADDITIONAL MATERIAL. 8♀ 4♂: MADAGASCAR: N.E., Fampanambo, iv.1959, J. Vadon, 2♀ MRAC; Centre Province: Antananarivo, Angavokely, 17.ii.1992, 18.56S 47.45E, PL. REPR. ECOL. PROI., 5♀ 3♂ NCUS; Centre Province, Angavokely, 17.iii.1988, L.A. Nilsson, 1♀ 1♂ NCUS.

Pasites tegularis Friese, Fig. 30, 35

Pasites tegularis Friese, 1922: 38-39 (♀ holotype, ZMHB).

Morgania (Omachthes) tegularis (Friese): Bischoff 1923: 589.

This species is most closely related to *P. bicolor*, which Bischoff (1923) placed in the genus *Pasitomachthes*.

DESCRIPTION

Length of head 1,3-1,6 mm; scutum 1,0-1,4 mm; fore wing 4,2-6,1 mm; body 5,2-6,9 mm.

Integument of head and mesosoma mostly black or blackish with labrum, mandible, pronotal lobe and tegula orange to orangish; legs blackish-orange to orange; metasoma completely orange to reddish-black (latter with a mottled appearance).

Vestiture similar to *P. bicolor* in colour except as follows: scutum mostly pale yellow, sometimes white; pygidial brush brownish; propodeum densely pubescent, except mediolongitudinal region which is naked; T1 with posterolateral region densely pubescent; female T6 with sparse, erect, simple vestiture, except with a dense subpygidial brush.

Structure similar to *P. bicolor* except as follows: maxillary palp three-fourths as long as pedicel of antenna; mediolongitudinal region of propodeum glabrous (dorsolateral region of propodeal triangle pubescent, and glabrous area not confined to propodeal triangle mediolongitudinally), and without any striations; female pygidial plate reduced to a weakly developed dorsolateral carina on T6 (Fig. 30).

DISTRIBUTION (Fig. 35)

Pasites tegularis is a Madagascan endemic.

DISCUSSION

The pygidial plate of *P. tegularis* is weakly developed laterally and absent posteriorly. It is the only known Madagascan species in which a pygidial plate occurs in the female. The male is indistinguishable from that of *P. bicolor*.

MATERIAL EXAMINED

TYPE MATERIAL. ♀ holotype: 'Nossi-Bé, *Pasites bicolor* ♀ var., *Pasites tegularis* ♀ Fr. 1904 Friese det., Type, *Omachthes tegularis* (Fr.) ♂ Typ., Coll. Friese, Zool. Mus. Berlin', ZMHB.

ADDITIONAL MATERIAL. 12♀ 7♂: MADAGASCAR: N.E., Fampanambo, iv.1959, J.

Vadon, 3♀ 5♂ MRAC; same data except, vi.1960, 1♀ MRAC; same data except, xii.1962, 1♀ MRAC; same data except, 1962, 1♀ MRAC; Tamatave Province, 6 km N. Tamatave, 15.i.1985, J.W. Wenzel, 2♀ SEMK; Tulear Province, 45 km S. Mahabo, 20.42S 44.38E, 24-26.xi.1986, J.W. Wenzel, 2♀ SEMK; Tananarive Province, 17 km W. Ambatolampy, 19.24S 47.25E, 1650m, 30.i.1985, J.W. Wenzel, 1♂ SEMK; Rogez, vii.1937, A. Seyrig, 1♂ MRAC; Est. Neaux Nottes, S. St. Marie, 6.xii.1983, L.A. Nilsson, L. Jonsson, 1♀ NCUS; Est. Soanierana Ivongo S, 27.x.1987, L.A. Nilsson, 1♀ NCUS.

THE *PASITES GNOMA* SPECIES GROUP

The *P. gnoma* group is monotypic.

Pasites gnoma spec. nov., Fig. 20, 31-34

The specific epithet of the name of this tiny species is Latin and refers to its small size.

DESCRIPTION

Length of head 0,7-0,8 mm; scutum 0,4-0,5 mm; fore wing 2,0-2,2 mm; body 2,3-2,5 mm.

Integument generally black to blackish-orange, with mandible, antenna, distal ends of tibiae, tarsi, basal region of T1 and metasomal venter orange to orangish (female more extensively orange coloured than male).

Vestiture mostly white; ventral surfaces of tarsi and female T6 and S5 pale yellow. Scutal vestiture largely simple; trochanters and femora sparsely pubescent; metasoma with anterior and posterolateral regions of T1 densely pubescent; T2 with a broadly interrupted distal fringe, and female T3-T4 and male T3-T5 with continuous distal fringes; female T6 densely pubescent posteriorly (Fig. 31), with short and long vestiture (distal end of male metasoma damaged and cannot be accurately described); S1-S4 sparsely pubescent, female S5 with sparse vestiture which comprises a mixture of short and long hairs.

Labrum quadrate, generally flat and distinctly pointed apically; maxillary palp absent; scutum moderately densely punctate, punctures small, shallow and separate; scutellum gently and evenly convex, devoid of any exaggerated swelling mediolaterally; propodeum devoid of

mediolongitudinal glabrous area; punctation on propodeum and mesopleuron similar to scutum; pygidial plate absent in both sexes; female T6 flattened posteromedially, this area densely clothed with short, fine vestiture, that on subpygidial area very short, subpygidial brush weakly developed (Fig. 31); female S5 conically emarginate (Fig. 31), S6 narrowly bifid; male S7-S8 acutely pointed posteriorly, S8 with two anterior lobes (Fig. 32-33); male genitalia with gonocoxite broadly rounded posteriorly (Fig. 34).

DISTRIBUTION (Fig. 20)

The species is known only from the type locality in Niger, which is grassland wooded with *Acacia* and deciduous shrubs.

DISCUSSION

Pasites gnoma is distinct from its congeners. It can be easily recognised by its small size, absence of a pygidial plate in both sexes, truncate and finely hirsute posteromedian region of the female T6, acute apices of the male S7 & S8 and two anterior lobes of the male S8 (Fig. 31-33). In the cladistic analysis it is grouped with *P. atra* by the loss of the anteromedian lobe on the male S8 (Fig. 2).

MATERIAL EXAMINED

TYPE MATERIAL. ♀ holotype & 1♂ paratype: NIGER: 20km S. Tahoua, 14.45N 5.20E, 13.viii.1987, A. Pauly, ♀ holotype 1♂ paratype PCGB.

THE *PASITES CARNIFEX* SPECIES GROUP

Two species have been placed in the *P. carnifex* species group, namely: *P. carnifex* and *P. dichroa*. These two species are large (7,0-12,5 mm) with the head and mesosoma black and metasoma orange. The distal fasciae of T2-T4 are sparse, with posteriorly directed vestiture. The female pygidial plate and subpygidial brush are well developed, and the S5 is conically emarginate posteromedially. Males resemble females in colour, but do not have any other obvious unique features.

Pasites carnifex (Gerstaecker) comb. nov., Fig. 36-40, 44

Omachthes carnifex Gerstaecker, 1869: 155 (♀ holotype, ZMHB).

Omachthes nigripes Friese, 1915: 276, 296, 298 (♀ lectotype, ZMHB). syn. nov.

Morgania nigripes (Friese): Cockerell 1919: 190.

Morgania (*Omachthes*) *nigripes* (Friese): Bischoff 1923: 591.

Morgania fortis Cockerell, 1921: 207-208 (♀ holotype, SAMC) syn. nov.

Pasites magnificus [sic.] Brauns, 1926: 207-208 (♀ holotype, TMSA) [*lapsus pro P. magnifica*].

Morgania magnificus [sic.] (Brauns): Cockerell 1933b: 130 [*lapsus pro M. magnifica*].

Morgania subfortis Cockerell, 1933c: 107 (♀ holotype, MRAC) syn. nov.

Morgania (*Omachthes*) *stordyi* Cockerell, 1933a: 377 (♂ holotype, NHML). syn. nov.

Morgania (*Omachthes*) *voiensis* Cockerell, 1937a: 155 (♂ holotype, NHML). syn. nov.

Morgania (*Omachthes*) *altior* Cockerell, 1937a: 155 (♂ holotype, NHML). syn. nov.

Small differences in size, colour and wing venation of this striking species led to the description of several synonyms. *Pasites magnifica* was synonymized with *fortis* by Cockerell (1933b), and *nigripes*, *fortis*, *subfortis*, *stordyi*, *voiensis* and *altior* are here synonymised with *carnifex*. The synonymy of these six species follows the study of the type material of each species, which was found to be within the range of variation established for this species during the study. *Pasites nigripes* was described from a male and female from Eritrea, neither of which could be obtained for study, and a female from Usambara, Tanzania, which was studied and is designated here as the lectotype.

DESCRIPTION

Habitus, dorsal aspect, as in Fig. 36. Length of head 2,4-2,7 mm; scutum 2,3-2,5 mm; fore wing 8,6-10,0 mm; body 11,1-12,5 mm.

Colour of integument, dorsal aspect, as in Fig. 36 (darkly shaded areas illustrate black integument and light shading orange areas); head and mesosoma mostly black, distal region of mandible and sometimes antenna and labrum reddish, legs completely black to blackish proximally and orange distally; metasoma orange to reddish-orange.

Vestiture on head brown to white; mesosoma mostly brownish, ventral surface of hind tarsus always orange; metasoma mostly orange, subpygidial brush mostly black, except ventral region sometimes orange or orangish. Middle and lower regions of face and gena, and entire labrum densely pubescent; upper region of face and vertex with moderately dense, largely simple, vestiture; mesosoma generally densely clothed with short vestiture, peripheral fringe of pronotal lobe and coxae, tibiae and tarsi densely clothed with long pubescent; metasoma largely clothed with short, fine, simple vestiture; subpygidial brush well developed, not expanded dorsally, and differentiated, dorsal region with thick hairs and ventral region with fine vestiture (Fig. 37); S5 velutinous.

Labrum more or less quadrate, distal end generally rounded, sometimes slightly pointed apicomediaally; maxillary palp four-segmented and 1,4-1,7X as long as pedicel; scutum mostly very densely punctate, punctures very small and separate; scutellum weakly to moderately tuberculate mediolaterally; punctation on pleural and ventral regions of mesosoma and entire propodeum moderately dense to very dense; pygidial plate well developed in both sexes (female pygidial plate, as in Fig. 37); female S6 broadly bifurcate; male S7 as illustrated (Fig. 38); males S8 tapering posteriorly, with posterior end strongly concave, weakly expanded anterolaterally (Fig. 39); genitalia with gonocoxite curved distinctly inwards posteriorly (Fig. 40), and more elongate than that of *P. dichroa*.

DISTRIBUTION (Fig. 44)

This species apparently occurs throughout East and South-East Africa, and is known from a single locality in West Africa.

DISCUSSION

In *P. carnifex* the subpygidial brush is gently concave ventrally, but not distinctly bilobed as in *P. dichroa* (Fig. 37). The males of these two species differ in the shape of the S8, in *P. carnifex* it tapers towards the distinctly concave posterior end, whereas in *P. dichroa* the posterior region is parallel sided and the posterior end more or less entire (notched medially) (cf. Fig. 39, 42).

Other published distribution records: Eritrea (Friese 1909b); Semliki plain in Uganda

(Cockerell 1933a); Laikipia escarpment in Kenya and Sanje in Tanzania (Cockerell 1933c); Busongora in Uganda and Mulanje & Blantyre in Malawi (Cockerell 1937b).

MATERIAL EXAMINED

TYPE MATERIAL. *Omachthes carnifex*, ♀ holotype: 'Capland, Drége S., 639, Type, *carnifex* Gerst. *dichrous* Klug i.l., *Omachthes carnifex* Gerst. 1907 Friese det., *Omachthes dichrous* Spin., Zool. Mus. Berlin', ZMHB.

Omachthes nigripes, ♀ lectotype: 'D.O.-Africa, Usambara, 6.1903, *Omachthes nigripes* ♀ Fr. 1914 Friese det., Type, *Omachthes nigripes* Fr. i.l. Type Bischoff ♀, Zool. Mus. Berlin', ZMHB.

Morgania fortis, ♀ holotype: 'F.J. Kroeger, Moboki, Lydenb. Transv., *Morgania fortis* Ckll. TYPE', SAMC.

Pasites magnifica, ♀ holotype: 'Sawmills S.R., 22.3.1919, Rhodesia Museum, *Pasites magnificus* ♀ Type No. 571', TMSA.

Morgania subfortis, ♀ holotype: 'Musée du Congo, Ituri: Blukwa, 3/4.xii.1928, A. Collart, *Morgania subfortis* Ckll. TYPE', MRAC.

Morgania stordyi, ♂ holotype: 'Brit E. Africa, R.J. Stordy, 1912-329, *Morgania stordyi* Ckll. TYPE, B.M. TYPE HYM. 17B 80', NHML.

Morgania voiensis, ♂ holotype: 'Brit E. Afr., Voi., 1 800 ft. Mch. 21-23, 1911, S.A. Neave, 1911-177, *Morgania voiensis* Ckll. TYPE, B.M. TYPE HYM. 17B 77', NHML.

Morgania altior, ♂ holotype: 'Brit E. Afr., S.E. Slopes of Kenya, 6 000 to 7 000 ft., Feb. 3-12.1911, S.A. Neave, 1911-177, *Morgania altior* Ckll. TYPE, B.M. TYPE HYM. 17B 78', NHML.

ADDITIONAL MATERIAL. 10♀ 2♂: BURKINA FASO: riv. Volta Rouge, 15 Km Kokhologo, 22.x.1979, A. Pauly, 1♀ PCGB. ZAIRE: 'P.N.A. vers Rweru (Volc. Mikeno) 2400 m., (Bambous), 26 au 27.vii.1934, G.F. de Witte: 501', 1♀ MRAC. ZIMBABWE: Umtali, 26.ii.1942, 1♀ SAMC; Chimanimani, 1050 m, 25.iv.1985, J. Gusenleitner, 1♀ SCAA; Sawmills, 24.ii.1925, R.H.R. Stevenson, 1♀ TMSA 1♀ SANC; Bulawayo, 16.iii.1919, 1♀ SAMC. SOUTH AFRICA: Umhlali, 14.iv.1946, R.F. Smith, 1♀ AMGS; Waterval Boven, 18.ii.1969, L.C. Starke, 2♀ SANC; Magoebaskloof, 23.58S 30.00E, 5.ii.1986, J.S. Donaldson, 1♂ SANC; Schoemanville, 26.xii.1959, H. Empey, 1♂ SANC.

Pasites dichroa Smith, Fig. 41-44

Pasites dichroa Smith, 1854: 253 (♂ holotype, NHML).

Homachthes dichrous (Smith): Dalla Torre 1896: 499.

Morgania dichroa (Smith): Cockerell 1904: 207.

Omachthes dichroa [sic.] (Smith): Friese 1909a: 437 [*lapsus pro O. dichrous*].

Homachthes gerstaeckeri Schulz, 1906: 267 [unjustified replacement name for *Pasites dichroa* Smith nec Spinola].

Morgania gerstaeckeri (Schulz): Cockerell 1910: 217.

Morgania (*Morgania*) *gerstaeckeri* (Schulz): Bischoff 1923: 592.

Morgania nigrithorax Strand, 1912: 310-311 (♀ lectotype, ZMHB).

Morgania (*Morgania*) *nigrithorax* Strand: Bischoff 1923: 593.

Smith (1854) described this species as *Pasites dichroa*. When he described the species he suggested that it was probably generically distinct, and recommended the generic named *Morgania* for the taxon. Prior to the description of the species, Spinola (1843) mentioned that there was a specimen in 'Mus, Berol' (= ZMHB) that had been labelled *Ammobates dichrous*. The latter name, however, has no standing in zoological nomenclature, because the species was not described (International Code Zoological Nomenclature (1985), Article 11). Schulz (1906) established that Spinola's (1843) *Ammobates dichrous* and Smith's (1854) *Pasites dichroa* were congeneric, but not synonymous. He disregarded the fact that Spinola's (1843) *Ammobates dichrous* had neither been described nor placed in the same genus as Smith's (1854) species, and unjustifiably renamed Smith's (1854) species, which he considered to be a junior homonym, as *P. gerstaeckeri*.

Strand (1912), in the original description of *P. nigrithorax*, indicated that the type series comprised three females. In reality the type series consists of two females and a male (Bischoff 1923), of which one female and the male were studied. The female that was studied is here designated as the lectotype of this species.

DESCRIPTION

Length of head 1,8-2,0 mm; scutum 1,5-1,6 mm; fore wing 7,1-8,0 mm; body 7,0-8,6 mm.

Similar to *P. carnifex* except as follows: legs with femora, tibiae and tarsi orange; vestiture on head and mesosoma mostly white, scutum yellowish-brown; subpygidial brush of female mostly brownish-orange, black dorsomedially, well developed, differentiated, expanded dorsally and bilobed ventrally (Fig. 41); flagellar segment I around 0,34X as long as scape and 1,2X as long as flagellar segments II; labrum distinctly pointed apicomediaally; maxillary palp 1,0-1,2X as long as pedicel; scutum moderately densely punctate, with small, well-separated punctures; scutellum strongly tuberculate mediolaterally; punctation of mesepimeron moderately dense; female S6 narrowly bifid posteriorly; male S8 more or less parallel sided posterolaterally and gently concave posteromedially, weakly expanded anterolaterally (Fig. 42); male genitalia more rounded in appearance (Fig. 43) (male S7 missing from specimen studied).

DISTRIBUTION (Fig. 44)

This species is known from central Zaire, Equatorial Guinea and northern Angola, where the dominant vegetation is evergreen forest.

DISCUSSION

The female of *P. dichroa* can be separated from *P. carnifex* by the dorsal expansion and two ventral lobes of the subpygidial brush (Fig. 41). The posterior region of the male S8 is parallel sided and the posterior end gently curved with a median notch (Fig. 42).

The only other published distribution records are: Kasai, Dunga & Lac Kivu in Zaire.

MATERIAL EXAMINED

TYPE MATERIAL. *Pasites dichroa*, ♂ holotype: '*dichroa* Type SM. *Morgania dichroa* TYPE Smith, B.M. TYPE HYM. 17B 79', NHML.

Morgania nigrithorax, ♀ lectotype: 'Sp. Guinea, Uelleburg, 6-8.1908, G. Tessmann S.G., *Morgania nigrithorax* Strand det. ♀ m., Type, Zool. Mus. Berlin', ZMHB.

Morgania nigrithorax, ♂ paralectotype: 'Span. Guinea, Uelleburg, G. Tessmann S.G., *Morgania nigrithorax* Strand det. ♀ m., Type, *Morgania nigrithorax* Strd. ♂ Bischoff, Lectotype', ZMHB.

ADDITIONAL MATERIAL. 2♀: ZAIRE: Kisangani (= Stanleyville), 0.30N 25.10E, 13.iv.1915, Lang & Chapin, 1♀ AMNH. ANGOLA: Dundo (Distr. Lunda), ii-iv.1958, 1♀ BLCU.

THE *PASITES JENSENI* SPECIES GROUP

This species group comprises four species, *P. jenseni*, *P. namibiensis*, *P. histrio* and *P. jonesi*. These four species all have the head, mesosoma and legs mostly black; the metasoma ranges from black to orange. The vestiture on the lower half of the face is pallid, densely plumose and appressed. The most useful diagnostic features of the females of the group are the elliptical posteromedian concavity on S5, in combination with the pygidial plate, which is at least visible posteriorly (posterior margin entire), and differentiated subpygidial brush. Males can only be identified as belonging to the group by their association with females.

Pasites jenseni (Frieze) **comb. nov.**, Fig. 45-50, 56

Omachthes graenicheri var. *jenseni* Frieze, 1915: 298 (♀ holotype, ZMHB).

Morgania graenicheri jenseni (Frieze): Cockerell 1919: 190.

Morgania (*Omachthes*) *jenseni* (Frieze): Bischoff 1923: 587.

Epeolus jenseni (Frieze): Frieze 1941: 101.

Omachthes jenseni Frieze: Anonymous 1958: 32.

Omachthes (*Ammobates*) *graenicheri* Brauns, *nomen nudum*. Frieze, 1915: 298.

Morgania graenicheri (Brauns): Cockerell 1919: 190; Bischoff, 1923: 587-588.

Omachthes graenicheri Brauns: Frieze 1922: 38.

Pasites graenicheri (Brauns): Anonymous 1958: 31.

Omachthes alboguttatus Frieze, 1922: 38 (♂ holotype, ZMHB). **syn. nov.**

Morgania (*Omachthes*) *alboguttatus* [*sic.*] (Frieze): Bischoff 1923: 588 [*lapsus pro M. alboguttata*].

Morgania alboguttata (Frieze): Cockerell 1933b: 130.

Morgania natalensis Cockerell, 1933b: 129-130 (♂ holotype, NHML). **syn. nov.**

Morgania (*Omachthes*) *ogilviei* Cockerell, 1935: 560-561 (♂ holotype, NHML). **syn. nov.**

Frieze (1915) described *jenseni* as a 'variety' of *graenicheri*, which he attributed to Brauns *in. litt.* But neither Brauns nor anybody else had described *graenicheri*, therefore the name is

invalid and *P. jenseni* becomes an available name for this species (International Code of Zoological Nomenclature (1985), Articles 11 & 23).

Intraspecific variation in the colour, vestiture and punctation of the species led Friese (1922) and Cockerell (1933b, 1935) to describe three morphological variants of *P. jenseni* as distinct species. Following the study of both the type and other material, *P. alboguttata*, *P. natalensis* and *P. ogilviei* were found to fall within the range of variation for this species and are here synonymized with *P. jenseni*.

DESCRIPTION

Habitus, lateral aspect, as in Fig. 45. Length of head 2,1-3,0 mm; scutum 1,8-2,7 mm; fore wing 7,3-9,8 mm; body 7,8-12,5 mm.

Integument, including tegula, mostly black, reddish-black in places.

Vestiture white, except mandible, ventral surfaces of tarsi and distal region of S5 pale yellow, and subpygidial brush completely black to mostly black with lateral and ventral regions orangish. Middle and lower regions of face, labrum and gena very densely pubescent, upper region of face and vertex moderately densely clothed with simple vestiture (Fig. 46); mesosomal dorsum with moderately dense to sparse, simple vestiture, except pronotal collar very densely pubescent and posterolateral regions of scutum with plumose vestiture; periphery of pronotal lobe, subvertical (posterior) region of scutellum, metanotum and propodeum (including mediolongitudinal region) densely clothed with short to long vestiture; legs generally with coxae, most of tibiae and entire tarsi densely pubescent, remainder of legs with long, simple, sparse vestiture or naked; dorsal surface of tibiae also with reddish scales; metasoma generally with anterior and anterolateral regions of T1 moderately densely pubescent and posterolateral regions very densely pubescent; T2-T3 in females and T2-T4 in males with lateral regions of distal margins densely pubescent (T4 and T5 in female and male, respectively, with distal fringe narrowly interrupted medially or continuous); female T5 and male T6 with a densely pubescent distal fringe; females with subpygidial brush well-developed, 1,1X as long as its maximum width, and differentiated, mostly thick black hairs; metasomal venter sparsely to densely clothed with simple, white vestiture, posterolateral

regions of S3-S4 sometimes plumose, and distal region of S5 velutinous.

Labrum quadrate and flattish, pointed and distinctly tuberculate mediodistally; maxillary palp five-segmented and generally 2-3X as long as antennal pedicel; scutum moderately densely punctate with large, deep punctures that occasionally merge; scutellum with a weakly developed mediolateral tubercle; pygidial plate well developed in both sexes; terminal tergum truncate in female (Fig. 47), broad and rounded posteriorly in male; female S5 with an elliptical concavity as illustrated in Fig 47; male S7 gently tapering posteriorly (Fig. 48), S8 more or less rounded posteriorly with a posteromedian tubercle, weakly expanded anterolaterally (Fig. 49); male genitalia with gonocoxite incurved posteriorly (Fig. 50).

DISTRIBUTION (Fig. 56)

The habitat in which *P. jenseni* occurs ranges from bushveld to montane grassland. It is known from numerous localities throughout South Africa, Lesotho and the central region of northern Namibia.

DISCUSSION

In this species the labrum is quadrate, propodeum completely clothed with fine vestiture and female pygidial plate fully developed.

Other published distribution records: George in South Africa (Bischoff 1923) and Morijo in Kenya (Friese 1941).

MATERIAL EXAMINED

TYPE MATERIAL. *Omachthes jenseni*, ♀ holotype: 'Transvaal, Zeerust, 1897, Jensen, *Omachthes graenicheri* v *jenseni* ♀ Fr. 1914 Friese det., type, *O. jenseni* Fr. ♀, Coll. Friese, Zool. Mus. Berlin', ZMHB.

Omachthes alboguttata, ♂ holotype: '[locality label illegible], *Omachthes alboguttatus* ♂ Fr. 1914 Friese det., type, Coll. Friese, Zool. Mus. Berlin', ZMHB.

Morgania natalensis, ♂ holotype: 'Natal: National Park, 3-15.iii.1932, A. Mackie, T.D.A. Cockerell Exp. to Africa 1931, Pres. by Imp. Inst. Ent. B.M. 1932-291, *Morgania natalensis* Ckll TYPE, B.M. TYPE HYM. 17B 98', NHML.

Morgania ogilviei, ♂ holotype: 'AFRICA: Belmont, J. Ogilviei, 23.ii.1934, B.M. 1934-157, *Morgana ogilviei* TYPE, B.M. TYPE HYM. 17B 91', NHML.

ADDITIONAL MATERIAL. 18♀ 7♂: NAMIBIA: Okozongominja, 2017CA, 6.iii.1979, V.B. Whitehead, 1♂ SAMC. LESOTHO: Mamathes, February-March in 1949-1954, C. Jacot-Guillarmod, 3♀ 2♂ AMGS; Bokong Post Office, 26.xii.1946, C. Jacot-Guillarmod, 1♂ AMGS. SOUTH AFRICA: Kruger National Park, Letaba, 2331 DC, 16.xii.1965, A., L. & H. Braack, 1♀ SKNP; Woodbush Village, xii.1918, C.J. Swierstra, 1♀ TMSA; Wolkberg, 21km S.W. Tzaneen, 11.iii.1976, R.H. Watmough, 1♀ SANC; Johannesburg, iv.1906, G. Kobrow, 1♀ ZMHB ['type' of *graenicheri*] 4♀ 1♂ TMSA 1♀ SANC; Delarey [= Delareyville], 15.i.1917, H. Brauns, 1♀ TMSA; Cathedral Peak Hotel, 45 km S. Winterton, 1450 m, 16.ii.1967, C.D. Michener, 2♀ SEMK; Modderfontein, 18.iv.1920, H. Brauns, 1♀ TMSA; Murraysburg district, iii.1931, 1♀ SAMC 1♂ SANC; Richmond district, iii.1931, 1♀ SAMC; Stellenbosch, 5.iv.1927, F. Beyers, 1♂ SANC.

Pasites namibiensis spec. nov., Fig. 51-53, 56

This new species is known to occur only in Namibia, and it takes its name from that country.

DESCRIPTION

Similar to *P. jenseni* (habitus, lateral aspect, cf. Fig. 45). Length of head 2,2-2,8 mm; scutum 1,8-2,6 mm; fore wing 7,5-8,9 mm; body 8,0-12,0 mm.

Integument mostly black, orange maculation limited to ventral region of clypeus, labrum, basal region of antenna, and middle and hind femora; metasomal venter usually orange or orangish.

Vestiture white, except mandible, ventral surfaces of tarsi and distal region of S5 pale yellow, and subpygidial brush completely black to mostly black with lateral and ventral regions orangish. Middle and lower regions of face, labrum and gena very densely pubescent, upper region of face and vertex moderately densely clothed with simple vestiture (cf. Fig. 46); mesosomal dorsum with sparse, simple vestiture, except pronotal collar very densely pubescent and posterolateral regions of scutum with plumose vestiture; periphery of pronotal

lobe, subvertical (posterior) region of scutellum and metanotum densely clothed with short to long vestiture; mediolongitudinal region of propodeum naked; legs generally with coxae, most of tibiae and entire tarsi densely pubescent, remainder of legs with long, simple, sparse vestiture or naked; dorsal surface of tibiae also with reddish scales; metasoma generally with anterior and anterolateral regions of T1 moderately densely pubescent and posterolateral regions very densely pubescent; T2-T3, in females, and T2-T4, in males, with lateral regions of distal margins densely pubescent (T4 and T5 in female and male, respectively, with distal fringe narrowly interrupted medially or continuous); female T5 and male T6 with a densely pubescent distal fringe; females with subpygidial brush well-developed, quadrate and differentiated, mostly with thick black hairs; metasomal venter sparsely to densely clothed with simple, white vestiture, posterolateral regions of S3-S4 sometimes plumose, and distal region of S5 velutinous.

Labrum 1,2-1,3X as long as wide, flattish, rounded distally and weakly tuberculate; maxillary palp five-segmented and generally 2-3X as long as antennal pedicel; scutum sparsely punctate and glabrous between punctures; scutellum with a weakly developed mediolateral tubercle; propodeum glabrous mediolongitudinally, this region distinctly wider above than below; pygidial plate well developed in both sexes; terminal tergum truncate in female, upper half of subpygidial brush with thick black hairs and lower half with fine vestiture (Fig. 51); female S5 with an elliptical concavity (Fig. 51); male S7 more or less parallel sided posterolaterally (Fig. 52), S8 truncate posteriorly and gently expanded anterolaterally (Fig. 53); male genitalia with gonocoxite incurved posteriorly (*cf.* Fig. 50).

DISTRIBUTION (Fig. 56)

This species is known from arid bushveld in Namibia.

DISCUSSION

Pasites namibiensis has the labrum a little longer than its maximum width, posterior region of propodeum glabrous and impunctate and pygidial plate fully developed.

MATERIAL EXAMINED

TYPE MATERIAL. ♀ holotype 2♂ paratypes: NAMIBIA: Spitzkoppe, 8.vii.1976, R.H.

Watmough, ♀ holotype SANC; Kaoko Otavi, iii.1926, 1♂ paratype SAMC 1♂ paratype SANC.

Pasites histrio (Gerstaecker) **comb. nov.**, Fig. 56

Omachthes histrio Gerstaecker, 1869: 155 (♀ holotype, ZMHB).

Morgania histrio (Gerstaecker): Cockerell 1904: 208.

Morgania (*Omachthes*) *histrio* (Gerstaecker): Bischoff 1923: 589.

Morgania (*Omachthes*) *histrio transvaalensis* Bischoff, 1923: 587-589; Rozen 1969: 104-106; 1974: 6-16 (♂ lectotype, TMSA). **syn. nov.**

Morgania transvaalensis Bischoff: Cockerell 1933c: 109.

Omachthes histrio transvaalensis (Bischoff): Anonymous 1958: 33.

Morgania (*Morgania*) *alivalensis* Cockerell, 1933a: 380 (♀ holotype, NHML). **syn. nov.**

Morgania (*Morgania*) *rufitarsis* Cockerell, 1937a: 155-157 (♂ lectotype, NHML). **syn. nov.**

Bischoff (1923) described *transvaalensis* from a female and two male specimens. The female and one male are from Delareyville, in the Transvaal (South Africa), and the other male is from Willowmore, in the Cape. The male from Willowmore was the only specimen examined that could be positively identified as constituting part of the type series and has here been designated as the lectotype. *Pasites rufitarsis* was described from two males and a female, all of which were taken at Swellendam (Cape). Only one male syntype was available for study and this specimen is here designated as the lectotype. The type material of *P. histrio*, *P. alivalensis*, *P. transvaalensis* and *P. rufitarsis* are almost indistinguishable and clearly conspecific.

DESCRIPTION

Similar to *P. jenseni* except as follows: integument generally with antenna, mandible, labrum, tegula and legs reddish, and metasoma reddish to orange anteriorly and black posteriorly; mesosomal dorsum sparsely pubescent and propodeum with mediolongitudinal region naked and glabrous; T3 sometimes with continuous distal cross-band; labrum quadrate, rounded distally with a laterally compressed, subapical tubercle; maxillary palp five-segmented and 2,5-3,3X as long as pedicel; scutum usually very sparsely punctate with large, deep, separate punctures, and glabrous between punctures.

DISTRIBUTION (Fig. 56)

This species is known from a few localities in Namibia and the Transvaal and numerous localities in the Cape.

DISCUSSION

In *P. histrio* the labrum is quadrate, mediolongitudinal region of the propodeum smooth and shiny, and pygidial plate well developed.

The only other published distribution record is 'near Ceres' (South Africa) (Cockerell 1933c).

MATERIAL EXAMINED

TYPE MATERIAL. *Morgania histrio*, ♀ holotype: 'Capland, Krebs S., *histrio* Gerst*. caffer N. ant., Type, *Omachthes histrio* 1907 Friese det., Zool. Mus. Berlin', ZMHB.

Morgania histrio transvaalensis, ♂ lectotype: 'Capland, Willowmore, 18.2.1904, Dr. Brauns, *O. histrio transvaalensis* Bisch. Typ., Typus Bischoff ♂, *Omachthes histrio transvaalensis* Bischoff HOLOTYPE No: 1190', TMSA.

Morgania alivalensis, ♀ holotype: 'Aliwal North, Cape Province, Dec. 1922, S. Africa, R.E. Turner, Brit. Mus., 1923-45, *Morgania alivalensis* Ckll. TYPE, B.M. TYPE HYM 17B 93', NHML.

Morgania rufitarsis, ♂ lectotype: 'Cape Province, Swellendam 17-xii.31-18.i.32, S. Africa, R.E. Turner, Brit. Mus., 1932-56, *Morgania rufitarsis* Ckll. TYPE, B.M. TYPE HYM 17B 89', NHML.

ADDITIONAL MATERIAL. 22♀ 10♂: NAMIBIA: Kaoko Otavi, iii.1926, 1♀ SANC; Gobabis, 21.xii.1974, H. Empey, 1♀ 1♂ SANC. SOUTH AFRICA: Delarey [= Delareyville], 15.i.1917, H. Brauns, 1♀ SANC; Roodeplaat, 20-25.ii.1916, Dr Breyer, 1♂ TMSA; Resolution, Albany district, 23.iii.1928, A. Walton, 2♂ TMSA; Strowan, Grahamstown, xi-xii.1966, C. Jacot-Guillarmod, 3♀ 3♂ AMGS; Grahamstown, 7.xii.1966, C.D. Michener, 2♀ AMNH; W. Grahamstown, 27.xi.1966, J.G. Rozen, D.J. Brothers, 7♀ 2♂ AMNH; Grahamstown, 6-7.xii.1966, C.D. Michener, 7♀ 1♂, SEMK.

Pasites jonesi (Cockerell) **comb. nov.**, Fig. 44, 54

Morgania jonesi Cockerell, 1921: 207 (♀ holotype, SAMC).

Morgania (*Morgania*) *marshalli* Cockerell, 1937a: 157 (♀ holotype, NHML). **syn. nov.**

As in several other cases in the genus unreliable characters, such as metasomal vestiture, were used to separate species (Cockerell 1921, 1937a). The differences between the types of *P. jonesi* and *P. marshalli* are slight and clearly fall within the range of variation for this species. *Pasites jonesi* and *marshalli* have therefore been synonymised.

DESCRIPTION

Similar to *P. jenseni* except as follows: certain specimens (those from the Karoo and Namaqualand, in the Cape) with metasoma mostly to completely orange; scutum very sparsely to moderately densely punctate; pygidial brush ranges from mostly black to mostly orange; labrum round distally with a subapical carina; pygidial plate reduced to a carina near top of pygidial brush (Fig. 54), subpygidial brush as in Fig. 54.

DISTRIBUTION (Fig. 44)

This species is known from several localities in South Africa, Namibia, Zimbabwe and Kenya. The habitats it occupies range from savanna to desert.

DISCUSSION

In *P. jonesi* the labrum is quadrate, mediolongitudinal region of the propodeum punctate and clothed with fine vestiture and pygidial plate reduced laterally, so that only the posterior end is visible.

The only other published distribution record is the Masai Reserve in Kenya (Cockerell 1933c).

MATERIAL EXAMINED

TYPE MATERIAL. *Morgania jonesi*, ♀ holotype: 'Mfongosi, Zululand, W.E. Edwards, 1914, *Morgania jonesi* Ckll. TYPE', SAMC.

Morgania marshalli, ♀ holotype: 'Mazoe, Marshonal'd, Dec. 05, G.A.K. Marshall, 1908-212,

Morgania marshalli Ckll. TYPE, B.M. TYPE HYM. 17B 90', NHML.

ADDITIONAL MATERIAL. 7♀ 1♂: KENYA: Karen, Nairobi, 3 & 20.v.1967, C.D.

Michener, 2♀ SEMK. NAMIBIA: 40 km N. Omaruru, 19.ii.1977, J.G. & B.L. Rozen, 1♀

AMNH. SOUTH AFRICA: Kruger National Park, Shipandani Picket, 2331CB, A., L. & H.

Braack, 2♀ SANC; Dikbome, Koup, Lainsburg div., iv-v.1950, H. Zinn, 2♀ SAMC;

Vogelfontein, P. Albert div., iii-iv.1929; A.J. Hesse, 1♂ SAMC.

THE *PASITES RUFIPES* SPECIES GROUP

Pasites rufipes is distinct from its congeners in several respects and has therefore been placed in a monotypic group.

Pasites rufipes (Fries) **comb. nov.**, Fig. 55-56

Omachthes rufipes Fries, 1915: 298 (♀ holotype, ZMHB).

Morgania rufipes (Fries): Cockerell 1919: 190.

Morgania (Omachthes) rufipes (Fries): Bischoff 1923: 591-592.

DESCRIPTION

FEMALE (male unknown). Length of head 2,6 mm; scutum 2,1 mm; fore wing damaged; body 10,2 mm.

Integument mostly black, scape, mandible, tegula, legs and distal end of metasoma reddish.

Vestiture mostly black, mediolongitudinal region of scutellum and metanotum partly white and subpygidial brush orange. Vestiture on head and mesosoma mostly moderately sparse, long and simple (similar to that which occurs in certain species of *Sphecodopsis*, Fig. 63-64); propodeum, including mediolongitudinal region, largely plumose; metasomal vestiture sparse and simple (Fig. 63), except subpygidial brush dense (Fig. 55); S6 pallid, velutinous distally.

Vertex flattish laterally and strongly raised between lateral ocelli (*cf.* Fig. 64); labrum about 1,3X as long as wide, flattish and gently rounded distally; maxillary palp five-segmented and 4,1X as long as pedicel; scutum quadrate and fairly densely punctate, punctures large and

often confluent; scutellum weakly tuberculate mediolaterally; punctation on mesopleuron similar to scutum; pygidial plate absent (Fig. 55); S5 with a well-developed, elliptical, concavity posteromedially (Fig. 55); S6 widely bifurcate.

DISTRIBUTION (Fig. 56)

The species is known from two widely separated localities in South Africa, namely Zeerust in the western Transvaal and Bowesdorp, near Kamieskroon in Namaqualand. Both these localities are fairly dry, but Zeerust has summer rainfall and Namaqualand has a mediterranean climate.

DISCUSSION

Pasites rufipes can be easily recognized by the long, black, erect, weakly plumose vestiture on the head and mesosoma in combination with the vertex which is more or less flat laterally (cf. Fig. 64), absence of a pygidial plate and elliptical concavity on the posteromedian region of the female S5 (Fig. 55). The structure of the vertex and vestiture on the head and mesosoma of *P. rufipes* resembles that of certain species of *Sphecodopsis*, but the elliptical concavity of the female S5 clearly resembles that of *Pasites*, and the structure of the pygidium is unique. The male of *P. rufipes* is unknown.

MATERIAL EXAMINED

TYPE MATERIAL. *Omachthes rufipes*, ♀ holotype: Transvaal, Zeerust, 1897, Jensen, *Omachthes rufipes* ♀ Fr. 1914 Friese det., Type, *Morgania rufipes* Fr. i.l.Bisch. Type ♀, Zool. Mus. Berlin', ZMHB.

ADDITIONAL MATERIAL. SOUTH AFRICA: 1♀: Bowesdorp, ix.1941, SAMC.

THE *PASITES APPLETONI* SPECIES GROUP

Pasites appletoni and *P. somalica* have been grouped. The head and mesosoma of these two species are black, as in most of their congeners, but the legs and metasoma are usually orange. The female S5 is elliptically concave posteromedially and the pygidial plate is either notched or absent posteriorly. The most conspicuous salient feature of the male of *P. appletoni* is the simple, erect, yellowish vestiture on the scutum in combination with the legs

that are usually orange. The male of *P. somalica* is unknown.

In the scutal vestiture and colour of the integument, especially the orangish legs, these two species resemble the Palaearctic species, *Pasites maculata*. In *P. maculata* the pygidial plate is absent in the female.

Pasites appletoni (Cockerell) **comb. nov.**, Fig. 44, 57-61

Morgania appletoni Cockerell, 1910: 216-217 (♀ holotype, NHML).

Omachthes abessinicus Friese, 1915: 297-298 (♀ holotype, ZMHB). **syn. nov.**

Morgania abessinica (Friese): Cockerell 1919: 190.

Morgania (Omachthes) abessinicus [sic.] (Friese): Bischoff 1923: 589-590 [*lapsus pro M. abessinica*].

Morgania (Omachthes) fulviventris Bischoff, 1923: 590 (♂ holotype, TMSA). **syn. nov.**

Morgania fulviventris Bischoff: Cockerell 1937a: 154.

Omachthes fulviventris (Bischoff): Anonymous 1958: 31.

Morgania (Omachthes) rhodesianus [sic.] Bischoff, 1923: 590 (♂ holotype, TMSA) [*lapsus pro M. rhodesiana*]. **syn. nov.**

Omachthes rhodesianus (Bischoff): Anonymous 1958: 33.

Morgania (Omachthes) apicalis Bischoff, 1923: 591 (♂ holotype, TMSA). **syn. nov.**

Morgania apicalis Bischoff: Cockerell 1933a: 379.

Omachthes apicalis (Bischoff): Anonymous 1958: 30.

Morgania (Omachthes) turneri Cockerell, 1933a: 378-379 (♀ holotype, NHML). **syn. nov.**

Morgania (Pseudopasites) politula Cockerell, 1933a: 382, 384 [incorrectly given masculine gender on p. 382] (♂ holotype, NHML). **syn. nov.**

Morgania (Omachthes) indecisa Cockerell, 1936: 31 (♀ holotype, NHML). **syn. nov.**

Morgania (Omachthes) nudicauda Cockerell, 1937a: 153 (♀ holotype, NHML). **syn. nov.**

Morgania (Omachthes) bechuanica Cockerell, 1937a: 153-154 (♀ holotype, NHML). **syn. nov.**

Morgania (Omachthes) breviceps Cockerell, 1937a: 154 (♀ holotype, NHML). **syn. nov.**

This species is widely distributed in subsaharan Africa. Throughout its range it varies greatly in size and moderately in colour. A geographic variant occurs in the Karoo and

Namaqualand, it tends to have less pilosity, especially on the metasoma, than material from localities to the north of the region. The density of the vestiture varies gradually and cannot be used to separate species. The large amount of variation that is displayed by the species together with its wide distribution has led to the description of a large number of synonyms. This was revealed by a detailed study of all the relevant type material, which was found to fall within the accepted range of variation for this species.

The placement of *politula* in the subgenus *Pseudopasites* by Cockerell (1933a) was clearly an error. *Pseudopasites* was described by Bischoff (1923) as a subgenus of *Sphecodopsis* and not of *Pasites*.

DESCRIPTION

Habitus, dorsal aspect, as in Fig. 57. Length of head 1,0-1,7 mm; scutum 0,8-1,3 mm; fore wing 3,3-5,8 mm; body 3,9-7,2 mm.

Colour of integument of head mostly black, ventral margin of clypeus sometimes orange, antenna often partly to mostly orange or orangish, labrum and mandible usually mostly orangish (distal end of mandible blackish and labrum often with mediobasal, lateral and mediodistal regions black); mesosoma ranges from almost completely black to completely orange, most commonly with scutum, scutellum, propodeum and upper region of mesopleuron black or reddish-black and lower region of mesopleuron and mesosomal venter orange; pronotal lobe usually partly orange; tegula translucent orange and legs mostly orange, coxae sometimes black or blackish, and femora, tibiae and tarsi occasionally black; metasoma generally reddish to orange, sometimes with a blackish tinge and/or black distally.

Vestiture on head white, except mandible white to yellowish; mesosoma mostly white, scutum yellowish except lateral region which is white, dorsal surface of scutellum concolorous with scutum; legs largely white, ventral surfaces of tarsi yellowish, outer surfaces of tibiae with a few reddish scales; metasomal vestiture mostly white, subpygidial brush usually black medially, circumscribed by orange; metasomal venter orange to white vestiture, except female S5 with an orange fringe surrounding posteromedian concavity.

Vestiture on head usually mostly moderately dense and plumose, that on upper region of face

and vertex sparse and simple, and occasionally lower region partly clothed with simple pubescence; mandible with a few simple hairs; pronotal collar and lobe densely pubescent; scutum with short, simple moderately dense, vestiture, except lateral region which is densely pubescent; scutellum with dorsum largely similar to scutum, posterior (subvertical) surface plumose; propodeum naked mediolongitudinally; legs with femora largely naked; metasomal with T1 naked to sparsely pubescent anteriorly (subvertical surface), and with dense posterolateral spots; female T2-T5 and males T2-T6 with sparsely to densely pubescence on posterior margins which may be interrupted medially; female T6 with a well-developed, subpygidial brush; differentiation of subpygidial brush unique in that thick hairs occur in centre and fine vestiture around edge (Fig. 58); male T7 sparsely clothed with pale vestiture; metasomal venter with sparse to dense vestiture, except female S5 with a fringe of short, simple hairs surrounding posteromedian concavity;

Labrum about quadrate, flattish with apex pointed and weakly tuberculate; maxillary palp four-segmented, 1,5-2,2X as long as antennal pedicel; scutum fairly densely covered with small well-separated punctures; scutellum gently and evenly convex to unevenly convex with mediolateral regions weakly swollen; propodeum with a broad glabrous area mediolongitudinally; mesopleuron mostly densely punctate, ventrolateral and ventral regions sparsely punctate; pygidial plate well developed and broadly rounded in both sexes, female with a distinct notch mediodistally (Fig. 58); female S5 with a elliptical concavity (Fig. 58); male S7 tapering posteriorly (Fig. 59), S8 gently concave posteriorly and very strongly expanded laterally (Fig. 60); male genitalia with gonocoxite broad anteriorly, narrow posteriorly and with posterior region gently incurved (Fig. 61).

DISTRIBUTION (Fig. 44)

This species is known from Niger and Cameroon in the north-west, Somalia in the north-east, and from much of southern Africa.

DISCUSSION

Pasites appletoni can be identified by the female terminalia. The pygidial plate is notched posteromedially, the subpygidial brush is mostly orangish with a black centre, and the S5 has an elliptical concavity posteromedially (Fig. 58). The male can be identified by the shape of

the S7 and S8 (Fig. 59-60), and in orange coloured specimens, by the colour of the legs and metasoma.

The known host plants are *Sesamum* sp. (family Pedaliaceae), and an undetermined Boraginaceae.

Other published distribution records: Lonely Mine in Zimbabwe (Cockerell 1933a) and Cash Delta in Sudan (Cockerell 1933c).

MATERIAL EXAMINED

TYPE MATERIAL. *Morgania appletoni*, ♀ holotype: 'Bohotle, Somaliland, 1903, Verty. Major A.F. Appleton, 1907-89, *Morgania appletoni* Ckll. TYPE, B.M. TYPE HYM. 17B 84', NHML.

Omachthes abessinica, ♀ holotype: 'NO.-Afrika, Eritrea, 08, *Omachthes abessinicus* Fr. ♀ 1914 Friese det., Type, Zool. Mus. Berlin', ZMHB.

Morgania fulviventris, ♂ holotype: 'Capland, Willowmore, 1.12.1904, Dr Brauns, *Omachthes fulviventris* Bisch. ♂ Typ., *Omachthes fulviventris* Biss. ♂ Type No. 569', TMSA.

Morgania rhodesiana, ♂ holotype: 'Bulawayo, S. Rhodesia, 14.12.1919, Rhodesia Museum, *Omachthes rhodesianus* Bisch. ♂ Typ., *Omachthes rhodesianus* Biss. ♂ Type No. 572', TMSA.

Morgania apicalis, ♂ holotype: 'Capland, Willomore, März 10 1919, Dr Brauns, *Omachthes apicalis* Bisch. Typ., *Omachthes apicalis* Biss. ♂ Type No. 568', TMSA.

Morgania turneri, ♀ holotype: 'S.W.Africa, R.E. Turner, Brit. Mus., 1928-61, Okahandja, 1-12.i.1928, *Morgania turneri* Ckll. TYPE, B.H. TYPE HYM. 17B 83', NHML.

Morgania politula, ♂ holotype: 'Cape Province, Little Karoo, 38 m. E. of Ceres, 17-25.xi.1924, S.Africa, R.E. Turner, Brit. Mus. 1924-518, *Morgania politula* Ckll. TYPE, B.M. TYPE HYM. 17B 97', NHML.

Morgania indecisa, ♀ holotype: 'S.W.Africa, Cape of Good Hope, Nelspoort, 5.xii.1933, J. Ogilvie, T.D.A. Cockerell, Exp. to Africa 1931, Pres. by Imp. Inst. Ent. B.M. 1932-291, *Morgania indecisa* Ckll. TYPE, B.M. TYPE HYM. 17B 92', NHML.

Morgania nudicauda, ♀ holotype: 'AFRICA, Belmont, J. Ogilvie, 23.ii.1934, B.M. 1934-157, *Morgania nudicauda*, B.M. TYPE HYM. 17B 88', NHML.

Morgania bechuanica, ♀ holotype: `AFRICA, Palapye, 5.iii.1934, J. Ogilvie, B.M. 1934-172, *Morgania bechuanica* Ckll. TYPE, B.M. TYPE HYM. 17B 86', NHML.

Morgania breviceps, ♀ holotype: `AFRICA, Upington, J. Ogilvie, 21.ii.1934, B.M. 1934-157, *Morgania breviceps* Ckll. TYPE, B.M. TYPE HYM. 17B 87', NHML.

ADDITIONAL MATERIAL. 210♀ 55♂: NIGER: 20 km S. Tahoua, 14.45N 05.20E, 13.viii.1987, A. Pauly, on Boraginaceae, 1♀ 1♂ PCGB; Tsermaoua, 13.53N 05.20E, 13.viii.1987, A. Pauly, On *Sesamum* sp., 1♂ PCGB. CAMEROON: Bambui, near Bamenda, 1400 m, 5.viii.1966, C.D. Michener, 1♀ SEMK. BOTSWANA: Serowe, 17.x.1923, R. Stevenson, 1♀ TMSA; Serowe, iii.1986, 3♀ SANC; Palapye, 18.x.1923, R. Stevenson, 1♀ SANC; V.-L. Kal. Exp. Kuke Pan, 21-30.iii.1930, 1♀ TMSA. ZIMBABWE: Sawmills, 28.xii.1919, 2♀ TMSA; Hillside, 17.ii.1923, 1♂ TMSA; Sanyati Valley, ix-x.1925, R. Stevenson, 1♀ TMSA; Bulawayo, December-March, different collectors, 9♀ 7♂ TMSA; Bulawayo, 23.xi.1924, 2♀ SEMK. SOUTH AFRICA: Kruger National Park, Pafuri, 22.26S 31.12E, 264m, 20-24.i.1985, G.L. Prinsloo, 53♀ 8♂ SANC; 40 km N. Louis Trichardt, 24.iii.1967, C.D. Michener, 2♀ SEMK; Happy Rest Nature Reserve, 22.59S 29.46E, 10.iii.1990, C.D. Eardley, 2♀ 2♂ SANC; D'Nyala Nature Reserve, Ellisras district, 23.45S 27.49E, 19.xii.1987, M.W. Mansell, G.L. Prinsloo, C.D. Eardley, 3♀ SANC; Mogol Nature Reserve, Ellisras district, 23.58S 27.45E, 27-29.ii.1984, C.D. Eardley, 1♀ 1♂ SANC; Ben Alberts Nature Reserve, Thabazimbi, 24.37S 27.23E, 24-28.xi.1980, M.W. Mansell, C.D. Eardley, 2♀ SANC; Ellisras, 7.x.1961, 3.i.1971 & 19.ii.1972, H. Empey, 1♀ 1♂ SANC; Soutpan, Pretoria district, 25.24S 28.06E, 29.i.1987, C.D. Eardley, 1♀ SANC; Scottburgh, 14.ii.1926, R.H.R. Stevenson, 1♀ SAMC; Olifantshoek, 24.iii.1990, W. Pulawski, 1♀ 2♂ CASC; Carlisle Bridge, 14.i.1965, H. Empey, 1♀ SANC; Graaff-Reinet, 3.i.1978, H. Empey, 1♂ SANC; Willowmore, i-ii.1911 & ii.1912, H. Brauns, 1♀ 1♂ TMSA 1♀ 2♂ SANC. NAMIBIA: Rundu, 10.iii.1990, W. Pulawski, 1♀ CASC; Otavi, iii.1926, 1♀ SAMC; Namakunde, ii.1922, 1♀ SAMC; 61 km W. Omaruru, 22.iii.1979, J.G. Rozen, 2♀ AMNH; 11-46 km W. Usakos, 14.iii.1979, J.G. & B.L. Rozen, 8♀ AMNH; 17-19 km E. Usakos, 18.iii.1976, J.G. & B.L. Rozen, 2♀ AMNH; 50km S.W. Usakos, 21.ii.1990, W. Pulawski, 1♀ CASC; 11 km N. Karibib, 27.ii.1990, W. Pulawski, 1♀ CSAC; 62 km E. Karibib, 20.ii.1990, W. Pulawski, 2♀ CSAC; 43 km E. Karibib, 20.ii.1990, W. Pulawski, 1♀ CSAC; Otjituo, i.1920, W. Tucker, 1♀ SAMC; 70 km N. Okahandja, 16.iii.1990, W. Pulawski, 2♀ 2♂ CASC;

5 km S. Okahandja, 13-17.iii.1979, J.G. & B.L. Rozen, 6♀ AMNH; 5 km S. Okahandja, 30.iii.-1.iv.1979, J.G. Rozen, 53♀ AMNH; 27 km S. Okahandja, 18.ii.1990, W. Pulawski, 3♀ CASC; 3 km N.E. Kalkfeld, 2.ii.1990, W. Pulawski, 2♀ CASC; 15 km N. Kalkrand, 13.ii.1990, W. Pulawski, 2♀ 1♂ CSAC; 23 km N. Rehoboth, 15.ii.1990, W. Pulawski, 1♀ 1♂ CSAC; 24 km S. Kamanjab, 5.iii.1990, W. Pulawski, 1♂ CSAC; 20km N.E. Otjiwarongo, 13.iii.1990, W. Pulawski, 3♀ 2♂ CSAC; 40 km W. Witvlei, 16.ii.1990, W. Pulawski, 4♀ 1♂ CSAC; 8 km W. Windhoek Airport, 11.iii.1979, J.G. & B.L. Rozen, 1♂ AMNH; 36 km E. Windhoek, 16.ii.1990, W.J. Pulawski, 1♀ CSAC; 20-22 km E.S.E. Seeis, 13-29.iii.1976, J.G. & B.L. Rozen, 16♀ 12♂ AMNH; 9-36 km E.S.E. Seeis 16.ii.1977, J.G. & B.L. Rozen, 5♀ 3♂ AMNH.

Pasites somalica spec. nov., Fig. 44, 62

This new species is known from a single female from Somalia, and it is named for that country.

DESCRIPTION

Similar to *P. appletoni* (cf. Fig. 57). Female (male unknown). Length of head 1,9 mm; scutum 1,7 mm; fore wing 6,5 mm; body 9,4 mm.

Colour of integument of head mostly black, antenna partly orangish, labrum orange and mandible orange, except distal end which is blackish; mesosoma black; legs orange, except middle and hind coxae which are black; metasoma orange.

Vestiture on head white, except mandible white to yellowish; mesosoma mostly white, scutum yellowish except lateral region which is white, dorsal surface of scutellum concolorous with scutum; legs largely white, ventral surfaces of tarsi yellowish, outer surfaces of tibiae with a few reddish scales; metasomal vestiture mostly white, subpygidial brush black dorsally and orange ventrally (Fig. 62); metasomal venter orange to white vestiture, except S5 with an orange fringe surrounding posteromedian concavity.

Vestiture on head dense and plumose, that on upper region of face and vertex sparse and simple; mandible with a few simple hairs; pronotal collar and lobe densely pubescent; scutum

with short, simple moderately dense, vestiture, except lateral region which is densely pubescent; scutellum with dorsum largely similar to scutum, posterior (subvertical) surface plumose; propodeum naked mediolongitudinally; legs with femora largely naked; metasomal with T1 naked to sparsely pubescent anteriorly (subvertical surface), and with dense posterolateral spots; T2 with dense white pubescence posterolaterally; female T3-T5 with dense white subapical fringes; T6 with a well-developed subpygidial brush, which has thick hairs above and fine vestiture below (Fig. 62); metasomal venter with sparse to dense vestiture, except S5 with a fringe of short, simple hairs surrounding posteromedian concavity;

Labrum about quadrate, flattish with apex pointed and weakly tuberculate; maxillary palp four-segmented, subequal in length to antennal pedicel; scutum fairly densely covered with small well-separated punctures; scutellum with mediolateral region distinctly swollen; propodeum narrowly naked mediolongitudinally; mesopleuron mostly densely punctate, ventrolateral regions sparsely punctate; pygidial plate only visible posterolaterally (Fig. 62); S5 with a elliptical concavity (Fig. 58).

DISTRIBUTION (Fig. 44)

The species is known from Somalia.

DISCUSSION

Pasites somalica closely resembles *P. appletoni*. They can be separated by the structure of the female pygidium. In *P. somalica* the pygidial plate is visible as two lateral carinae only and the subpygidial brush is black dorsally and orangish ventrally.

MATERIAL EXAMINED

TYPE MATERIAL. SOMALIA: locality illegible, 25.11.53, Desert Locust Survey. ♀ holotype, AMGS.

SPECIES OF UNCERTAIN IDENTITY

The following four species, *Pasites atratula* Friese, *Omachthes gabonensis* Vachal, *Morgania rotundiceps* Bischoff and *Morgania tropica* Cockerell, could not be identified from the literature alone and the type material was not available for study. Although *Omachthes* and

Morgania have been synonymized with *Pasites*, it could not be established whether these three species belong in *Pasites*.

***Pasites atratula* Friese**

Pasites atratulus [sic.] Friese, 1922: 36 (♂ syntype, ? & destroyed) [*lapsus pro P. atratula*].

Morgania (*Omachthes*) *atratus* [sic.] (Friese): Bischoff 1923: 588 [*lapsus pro M. atratula*].

Morgania atratulus [sic.] (Friese): Medler 1980: 483.

The type material of this species comprised three males. One was placed in the ZMHB and two in the Zoologische Institut und Zoologische Museum, Universität von Hamburg, Hamburg, Germany. The first-mentioned type is not in the ZMHB, and the other two were destroyed during World War II.

***Omachthes gabonensis* Vachal**

Omachthes gabonensis Vachal, 1903: 382-383 (♀ holotype, ?).

Morgania gabonensis (Vachal): Cockerell 1919: 190.

Morgania (*Omachthes*) *gabonensis* (Vachal): Bischoff 1923: 587-588.

Omachthes gabonensis (Vachal): Medler 1980: 483.

The holotype of this species was apparently originally deposited in Vachal's collection. Today this collection is housed in the MNHN. The holotype of *O. gabonensis* is not in this museum and could not be traced in any of the other major European museums.

***Morgania rotundiceps* Bischoff**

Morgania (*Omachthes*) *rotundiceps* Bischoff, 1923: 588 (2♂ syntypes, ?).

The species was described from two males, both of which were taken in Tanzania. Although the type material was deposited in the ZMHB, they could not be located in that museum.

Morgania tropica Cockerell

Morgania tropica Cockerell, 1933c: 106-107 (♀ holotype, MRAC).

The type material of this species is housed in the MRAC. The material was on loan during the course of the study and the museum to which it belongs was unable to retrieve it during the study period.

5.3 GENUS *SPHECODOPSIS* BISCHOFF

Sphecodopsis Bischoff, 1923: 593. Type species: *Omachthes capicola* Strand, 1911 (original designation).

Sphecodopsis (*Sphecodopsis*) Bischoff 1923: 593.

Sphecodopsis (*Pseudopasites*) Bischoff, 1923: 593. Type species: *Pasites pygmaea* Friese, 1922 (subsequent designation, Sandhouse 1943).

Pseudodichroa Bischoff, 1923: 586, 595; Rozen 1968a: 1-10. Type species: *Omachthes capensis* Friese (subsequent designation, Sandhouse 1943). syn. nov.

The following ten species comprise the genus *Sphecodopsis*: *S. capicola* (Strand), *S. vespericena* spec. nov., *S. villosa* Friese, *S. longipygidium* spec. nov., *S. namaquensis* spec. nov., *S. minutissima* (Cockerell), *S. aculeata* (Friese), *S. semirufa* (Cockerell), *S. capensis* (Friese) and *S. fumipennis* (Bischoff). Of these, *S. vespericena*, *S. longipygidium*, *S. namaquensis*, *S. capensis* and *S. fumipennis* are only known from female specimens, and *S. villosa* is only known from the male. The diagnostic characters of many of the species are sex limited, and in the absence of suitable material of these species it is impossible to associate the sexes. The unassociated and undescribed males of two species, of which material was available, were omitted from the study. As the males of most of the described species are unknown or cannot be identified, a key for the identification of the males has not been provided. The male terminalia have the most reliable diagnostic features of this sex and have been illustrated for the species of which the males are known. These illustrations, in combination with the descriptions, should enable the recognition of the males.

The genus is endemic to southern Africa. Five species (*S. vespericena*, *S. longipygidium*, *S. namaquensis*, *S. capensis* and *S. fumipennis*) are known only from Namaqualand and the

south-western region of the Cape, an additional three species (*S. capicola*, *S. aculeata* and *S. semirufa*) occur in Namaqualand and the Karoo. The distribution of one of these, namely *S. aculeata*, extends eastward to Grahamstown. The other two species (*S. villosa* and *S. minutissima*) apparently occur throughout the greater part of southern Africa.

Bischoff (1923) divided *Sphecodopsis* into two subgenera. The nominative subgenus comprised *S. capicola* and *S. villosa*, while the subgenus *Pseudopasites* comprised *S. minutissima* and *S. aculeata*. *Sphecodopsis capensis* and *S. fumipennis* were placed into the genus *Pseudodichroa* by Bischoff (1923). The cladistic analysis of these species did not reveal any characteristics that supported the subdivision of *Sphecodopsis* into subgenera, nor the placement of *S. capensis* and *S. fumipennis* into a separate genus. The only features that separate *Pseudodichroa* from *Sphecodopsis* are the gutter-like female S5 and the S6 which forms a single posterior spine. In *Sphecodopsis* the female S5 has a small protuberance (Fig. 66, 82, 84, 96) and S6 is bifid (Fig. 67). Material of males that apparently belong to either *S. capensis* or *S. fumipennis* were studied and are virtually indistinguishable from *Sphecodopsis*. The two subgenera and *Pseudodichroa* have therefore been synonymised.

Sphecodopsis are smallish (4.0-9.0 mm long), wasp-like bees in which the head and mesosoma are black and the metasoma is generally reddish and/or orangish anteriorly and black posteriorly, occasionally the entire metasoma is black. The genus is characterized as follows: vertex, frontal view, flat laterally, area between lateral ocelli distinctly raised; antenna 12-segmented in female and 13-segmented in male; labrum more or less quadrate, pointed and weakly tuberculate apicomediaally; mandibles behind labrum in repose; facial vestiture generally black (cf. Fig. 64), white in *S. aculeata* and *S. minutissima*, long and weakly pubescence, except in *S. minutissima* which has short, dense facial pubescence; scutellum gently and evenly curved; last exposed metasomal tergum (T6 female, T7 male) without a pygidial plate, but with dorsum broad and with dorsolateral region strongly incurved posteriorly, especially in male where dorsum resembles a pygidial plate; female S5 either shallowly or strongly concave distally, when viewed from behind, and with a weakly to strongly developed protuberance posteromedially, when viewed from below (Fig. 66, 79, 82, 84, 96); female S6 with distal end either simple or bifid posteriorly (Figs 67, 80, 83, 85, 97).

In the discussion that follows some of the species have been placed in two species groups, on the basis of their morphology, while three species have not been grouped. The *S. capicola* group comprises *S. capicola*, *S. vespericena*, *S. villosa*, *S. longipygidium* and *S. namaquensis*. The *S. capensis* group comprises *S. capensis* and *S. fumipennis*. The three species that have not been grouped are *S. minutissima*, *S. aculeata* and *S. semirufa*. These species groups are not clearly defined units suitable for description as distinct taxa. They have been used simply to facilitate discussion on the similarity between species.

KEY TO SPECIES

(Females)

1. Metasoma with S6 simple posteriorly (*S. capensis* group) 2
- S6 bifid posteriorly 3
2. First submarginal cell of fore wing distinctly longer than second cell; posterior region of S5 with area clothed with pallid vestiture distinctly pointed anteromedially *S. fumipennis*
- First and second submarginal cells of fore wing subequal in length; posterior region of S5 with area clothed with pallid vestiture rounded anteromedially ... *S. capensis*
3. Posterior end of T5 distinctly elongate posteromedially (Fig. 76); pygidium elongate posteriorly (Fig. 77-78) (*S. longipygidium* group, part) *S. longipygidium*
- Posterior end of T5 more or less straight (Fig. 65); pygidium short posteromedially 4
4. Facial vestiture white 5
- Facial vestiture completely to mostly black 6
5. Vestiture on lower region of face with pilosity well developed, virtually obscuring facial integument; upper region of face with integument clearly visible as a result of vestiture being short and simple; T5 with a well-developed distal fringe medially; T6 with lateral region of distal fringe long, and with vestiture curved outwards (*S. minutissima* group) *S. minutissima*

- Integument of entire face visible as a result of all facial vestiture being weakly pubescent; T5-T6 devoid of clearly discernable distal fringes (*S. aculeata* group) *S. aculeata*
- 6. Median region of T5 with a well-developed distal fringe of straight, posterior projecting, setae (*S. capicola* group, part) 7
- T5 either naked and impunctate posteriorly or with a sparse subapical fringe ... 8
- 7. Distal fringe on T5 black to brownish; legs largely orange *S. vespericena*
- Distal fringe on T5 white; legs black to blackish *S. capicola*
- 8. T5 naked and impunctate posteriorly; vestiture on anterior region long and black (*S. semirufa* group) *S. semirufa*
- T5 densely punctate and completely clothed with short white vestiture (*S. capicola* group) *S. namaquensis*

THE *SPHECODOPSIS CAPICOLA* SPECIES GROUP

This species group is made up of the following five species: *S. capicola*, *S. vespericena*, *S. villosa*, *S. longipygidium* and *S. namaquensis*. The vestiture on the head and mesosoma is black, and consists mostly of fairly long, weakly pubescent hairs, and the female T5 has a distinct apical or subapical fringe.

Sphecodopsis capicola (Strand), Fig. 63-72, 81

Omachthes capicola Strand, 1911: 224-225 (♂ holotype, ZMHB).

Morgania capicola (Strand): Cockerell 1919: 190; 1933c: 109.

Sphecodopsis (*Sphecodopsis*) *capicola* (Strand): Bischoff 1923: 593-595.

DESCRIPTION

Habitus, dorsal aspect, as in Fig. 63. Length of head 1,4-2,0 mm; scutum 1,0-1,7 mm; fore wing 4,3-7,0 mm; body 4,8-7,7 mm.

Integument of head black, except distal end of mandible orange; mesosoma black, except tegula, pronotal lobe, most of femora, tibiae and tarsi usually orangish; metasoma mostly orange, distal segments black.

Vestiture on head black; mesosoma black, except short pubescence (described below) on scutum, scutellum and surrounding pronotal lobe white; legs generally white, femora black, dorsal surfaces of tibiae and basitarsi with black setae intermixed with white vestiture and ventral surfaces of tarsi blackish-orange; metasomal vestiture pallid in areas where integument is orange and black in regions where integument is black, except posterior region of female T5 with white vestiture (median region with a well-developed white distal fringe), T6 black to brownish-orange and S5 with a brownish-orange tinge, especially posterolaterally; male T6 white distally, T7 completely white. Face densely clothed with long, weakly plumose vestiture (Fig. 64), lower region of gena with short and long pubescence intermixed; mesosoma with a mixture of long, weakly plumose vestiture and short pubescence; legs, except femora, generally clothed with very short, simple to weakly plumose, vestiture, femoral vestiture sparse, long and simple to weakly plumose; dorsal surfaces of tibiae and basitarsi with black setae intermixed with vestiture; metasomal vestiture very short, and simple, except median region of T5 with a well-developed white distal fringe.

Scutum with fine, dense punctation; propodeum largely punctate, propodeal triangle finely sculptured; female T5 straight posteriorly, except for a weakly developed notch posteromedially (Fig. 65), pygidium short and devoid of a subpygidial brush; male T7 rounded posteriorly, strongly incurved ventrolaterally (Fig. 68); female S5 broadly protuberant posteromedially, with a small prominence on each side of protuberance (Fig. 66); female S6 widely bifurcate posteriorly (Fig. 67); male S7 as in Fig. 69, S8 gently concave posteromedially and anteromedian lobe narrow (Fig. 70); male genitalia with posterior end of gonocoxite truncate and dorsolaterally flattened (Fig. 71-72).

DISTRIBUTION (Fig. 81)

Sphecodopsis capicola is known from the Karoo and Namaqualand, both of which are in the Cape.

DISCUSSION

The female of this species can be identified by the black to blackish legs in combination with

the posterior fringe of white setae on T5. The male can be identified by the truncate gonocoxite of the genitalia (Fig. 71-72). Its closest relative is *S. vespericena*, to which it is remarkably similar. In these two species the posteromedian protuberance of the female S5 is broad with very small posterolateral prominences (Fig. 66).

The only known host plant of this species is *Grielim humifusum* Thumb. (family Rosaceae).

MATERIAL EXAMINED

TYPE MATERIAL. ♂ holotype: 'Capland berg, 1774, *Morgania capicola* ♂ Strand det., Type, Zool. Mus. Berlin', ZMHB.

ADDITIONAL MATERIAL. 22♀ 2♂: SOUTH AFRICA: Willowmore, 15.viii.1920, Dr Brauns, 1♀ TMSA; Ceres district, 15-30.x.1934, M. Versfeld, 1♀ SAMC; 8 km W. Graafwater, 3218BA, 27.ix.1978, V.B. Whitehead, 3♀ TMSA 1♀ SANC; 20 km N. Clanwilliam, 9.ix.1982, V.B. Whitehead, on *Grielim humifusum*, 1♀ SANC; Sandberg Station, 32.18BC, 11.viii.1988, V.B. Whitehead, 1♀ SAMC; Biedouw Valley, Clanwilliam district, 32.08S 19.14E, 5-7.ix.1987, C.D. Eardley, 1♀ 1♂ SANC; 20 km N. Klawer, 9.ix.1983, V.B. Whitehead, 2♀ SAMC; 5 km S. Niewoudville, 3119AC, 2.viii.1984, 25.viii.1988, V.B. Whitehead, 4♀ SAMC 1♀ SANC; Vanrhynsdorp, 12.viii.1927, Dr. Brauns, 1♀ TMSA 1♀ 1♂ SANC; Hester Malan Nature Reserve, Springbok, 17.ix.1983, V.B. Whitehead, 1♀ SAMC; Springbok, 7.ix.1966, C.D. Michener, 3♀ SEMK.

Sphecodopsis vespericena spec. nov., Fig. 81

The species was only known from four specimens before Drs F.W. & S.K. Gess (AMGS) discovered that they visit flowers in the late afternoon. At this time they were collected in abundance. Their habit of feeding late in the day led to the derivation of the name *vespericena* from the latin word *vesper*, which means evening.

A large series of specimens of *S. vespericena* was collected together with several *Scapter* sp., whose host plants and foraging time were similar to those of *S. vespericena*. Parasitised nests of this species of *Scapter* have not been found and it was not possible to ascertain through other means whether it is the host of *S. vespericena*.

DESCRIPTION

Similar to *S. capicola* (cf. Fig. 63). FEMALE (male unknown). Length of head 1,9-2,2 mm; scutum 1,6-1,8 mm; fore wing 6,4-7,4 mm; body 7,3-9,0 mm.

Integument of head black, except distal end of mandible orange; mesosoma black, except tegula, pronotal lobe, most of femora, tibiae and tarsi usually orangish; metasoma mostly orange, distal segments black.

Vestiture on head black, except lower region of gena with a little short white pubescence intermixed with long black vestiture; mesosoma black, except short pubescence (described below) on scutum and scutellum white, and on pleural area, venter and propodeum white to pale grey; legs generally white, femora black, dorsal surfaces of tibiae and basitarsi with black setae intermixed with white vestiture and ventral surfaces of tarsi blackish-orange; metasomal vestiture pallid in areas where integument is orange and black in regions where integument is black, except posterior region of T5-T6 black to brownish-orange (T5 with a well-developed blackish distal fringe medially). Face densely clothed with long, weakly plumose vestiture (Fig. 64), lower region of gena with short and long pubescence intermixed; mesosoma with a mixture of long, weakly plumose vestiture and short pubescence; legs, except femora, generally clothed with very short, simple to weakly plumose, vestiture; femoral vestiture sparse, long and simple to weakly plumose; dorsal surfaces of tibiae and basitarsi with black setae intermixed with vestiture; metasomal vestiture very short, and simple, except median region of T5 with a well-developed white distal fringe.

Scutum with fine, dense punctation; propodeum largely punctate, propodeal triangle finely sculptured; T5 straight posteriorly, except for a weakly developed notch posteromedially (cf. Fig. 65), pygidium short and devoid of a subpygidial brush; S5 broadly protuberant posteromedially, with a small prominence on each side of protuberance (cf. Fig. 66); S6 widely bifurcate posteriorly (cf. Fig. 67).

DISTRIBUTION (Fig. 81)

The species is known from the southern region of Namaqualand.

DISCUSSION

In *S. vespericena* the legs are largely orange and the distal fringe of the female T5 is black to brownish. Otherwise this species is remarkably similar to *S. capicola*.

The species has been taken from the following host plants: *Grielum humifusum* (family Rosaceae), *Senecio* probably *arenarius* Thunb. and *Helichrysum* sp. (family Asteraceae), *Herrea* sp. (family Mesembryanthemaceae) and *Hemimeris montana* L.f. (family Scrophulariaceae)

MATERIAL EXAMINED

TYPE MATERIAL. ♀ holotype 67♀ paratypes: SOUTH AFRICA: 11 km W. Clanwilliam, 32.10S 18.47E, 1.x.1990, C. Eardley, ♀ holotype 24♀ SANC 2♀ MRAC 3♀ AMNH 2♀ NHML 2♀ TMSA 2♀ SAMC 3♀ SEMC 2♀ MNHN 2♀ DMSA 2♀ ZMHB 3♀ SCAA 2♀ CASC; same locality, 2-8.x.1990, F.W. & S.K. Gess, on *Grielum humifusum* (1♀), *Senecio* prob. *arenarius* (1♀), *Herrea* sp. (5♀), and *Helichrysum* sp. (1♀), 14♀ AMGS; Holfontein, 20 km S. Clanwilliam, 24.viii.1983, V.B. Whitehead, on *Hemimeris racemosa*, 1♀ SAMC; Ramskop Camp, Clanwilliam, 3218BB, 30.viii.1984, V.B. Whitehead, M. Macpherson, 1♀ SAMC; Saldanha Bay, ix.1960, 1♀ SAMC; Malmesbury Road, 20.x.1923, W.C. Eales, 1♀ SAMC.

Sphecodopsis villosa (Fries), Fig. 73-75, 81

Pasites villosus [sic.] Fries, 1909a: 438-439 (♂ holotype, ZMHB) [*lapsus pro P. villosa*].

Omachthes villosus (Fries): Fries 1915: 297.

Morgania villosa (Fries): Cockerell 1919: 190.

Sphecodopsis (*Sphecodopsis*) *villosa* (Fries): Bischoff 1923: 593-594.

DESCRIPTION

MALE (female unknown). Similar to *S. capicola* except as follows: head and mesosoma more densely punctate (punctuation difficult to quantify, refer Bischoff 1923); distal region of

metasoma with area in which integument is black, clothed with black vestiture; S8 strongly concave posteromedially and with anteromedian lobe broad (Fig. 73); genitalia with gonocoxite curved inwards and more or less pointed posteriorly (Fig. 74-75).

DISTRIBUTION (Fig. 81)

The species has been recorded from Namaqualand, in the Cape, and Zeerust, in the Transvaal.

DISCUSSION

The similarity between this species and the male of *S. capicola* suggests that they are closely related. These two species can be separated only by the structure of the male terminalia. The most distinctive difference is in the shape of the posterior end of the gonocoxite, which is truncate in *S. capicola* (Fig. 71-72) and somewhat pointed in *P. villosa*. As the males of *Sphecodopsis* have not been included in the key to species, this species should be identified by the comparison of the male S7-S8 and genitalia with the illustrations given in Fig. 73-75.

MATERIAL EXAMINED

TYPE MATERIAL. ♂ holotype: 'Transvaal, Zeerust, 1897, Jensen, *Pasites villosa* Fr. ♂ 1908 Friese det., *Omachthes villosus* Fr. ♂ 1914 Friese det., Type, Zool. Mus. Berlin', ZMHB.

ADDITIONAL MATERIAL. 1♂: SOUTH AFRICA: Vanrhynsdorp, 12.viii.1927, H. Brauns, SANC.

Sphecodopsis longipygidium spec. nov., Fig. 76-81

This new species is known from a single female specimen in which the pygidial region of S5 is elongate. It is from this unique feature that the name *longipygidium* was derived.

DESCRIPTION

Similar to *S. capicola* (cf. Fig. 63). FEMALE (male unknown). Length of head 2,3 mm; scutum 1,8 mm (fore wing damaged in holotype); body 8,1 mm.

Integument of head black, except distal end of mandible orange; mesosoma black, except tegula, pronotal lobe, most of femora, tibiae and tarsi usually orangish; metasoma mostly orange, distal segments black.

Vestiture on head black; mesosoma black with short white pubescence apparently confined to scutum (scutal pubescence damaged in holotype); legs generally white, femora black, dorsal surfaces of tibiae and basitarsi with black setae intermixed with white vestiture and ventral surfaces of tarsi blackish-orange; metasomal vestiture pallid in areas where integument is orange and black in regions where integument is blackish, posterior region of T5 with a well-developed, black distal fringe medially, T6 black to brownish-orange and S5 with a brownish-orange tinge, especially posterolaterally. Face densely clothed with long, weakly plumose vestiture (*cf.* Fig. 64), lower region of gena with short and long pubescence intermixed; mesosoma with a mixture of long, weakly plumose vestiture and short pubescence; legs, except femora, generally clothed with very short, simple to weakly plumose, vestiture; femoral vestiture sparse, long and simple to weakly plumose, dorsal surfaces of tibiae and basitarsi with black setae intermixed with vestiture; metasomal vestiture very short and simple, except median region of T5 with a well-developed white distal fringe.

Scutum with fine, dense punctation; propodeum largely punctate, propodeal triangle finely sculptured; posteromedian region of T5 elongate, i.e., fringed area (Fig. 76); pygidium of T6 much more strongly elongate posteriorly than in *S. capicola* (Fig. 77-78); S5 without apicolateral prominence (Fig. 79); S6 with a relatively short disc, elongate anterolaterally (Fig. 80).

DISTRIBUTION (Fig. 81)

The species is known from Namaqualand.

DISCUSSION

The principal diagnostic feature of *S. longipygidium* is the elongation of the terminal

segments of the female metasoma (Fig. 76-78). The T5 has a distal fringe that is similar to that of *S. capicola* and *S. vespericena*, which suggests that they are closely related. The structure of the apex of S5 is unlike that of *S. capicola* and *S. vespericena*, in that it does not have apicolateral prominences, and resembles *S. minutissima* (Fig. 84).

MATERIAL EXAMINED

TYPE MATERIAL. ♀ holotype: SOUTH AFRICA: 'Namaqualand, Knersvlakte, Niewerust [= Nuwerus], ix.1941', SAMC.

Sphecodopsis namaquensis spec. nov., Fig. 81-83

This new species takes its name from the region it inhabits, Namaqualand.

DESCRIPTION

FEMALE (male unknown). Length of head 1,5-1,7 mm; scutum 1,3-1,5 mm; fore wing 5,1-5,5 mm; body 5,6-7,9 mm.

Integument of head black, except distal end of mandible orange; mesosoma black, except tegula, distal ends of femora, tibiae and tarsi usually orangish; metasoma mostly orange, posterior margin of T2 slightly blackish, and that of T3 black; T4-T6 and S3-S5 black.

Vestiture on head black; mesosoma black, with very little of the short pubescence white (pubescence surrounding pronotal lobe white); legs generally white, femora black, dorsal surfaces of tibiae and basitarsi with black setae intermixed with white vestiture and ventral surfaces of tarsi blackish-orange; metasomal vestiture mostly white, a few black hairs occur on proximal regions of T3-T5, on S2-S5 and on pygidium. Face densely clothed with long, weakly plumose vestiture (*cf.* Fig. 64), lower region of gena with short and long pubescence intermixed; mesosoma with a mixture of long, weakly plumose vestiture and short pubescence; legs, except femora, generally clothed with very short, simple to weakly plumose, vestiture, femoral vestiture sparse, long and simple to weakly plumose, dorsal surfaces of tibiae and basitarsi with black setae intermixed with vestiture; metasomal vestiture very short and simple; distal fringe on T5 subapical and weakly developed.

Scutum with fine, dense punctation; propodeum largely punctate, propodeal triangle finely sculptured; female T5 straight posteriorly, pygidium short and devoid of a subpygidial brush; S5 narrow posteriorly, with a well-developed apicolateral prominence (Fig. 82); S6 with disc long and slender, and very narrowly bifid posteriorly (Fig. 83).

DISTRIBUTION (Fig. 81)

Namaqualand is where this species is known to occur.

DISCUSSION

This species is distinct from the other species in this group in that it does not have a distinct distal fringe on T5. It resembles the other species in the posterolateral prominences on S5. The most important diagnostic features are the white vestiture on the female S5 and the slender, narrowly bifid female S6 (Fig. 83).

MATERIAL EXAMINED

TYPE MATERIAL. ♀ holotype 2♀ paratypes: SOUTH AFRICA: Biedouw Valley, Clanwilliam district, 32.08S 19.14E, 5-7.ix.1987, C.D. Eardley, ♀ holotype SANC; Kleinberg, near Langebaanweg, 3218CC, 26.ix.1978, V.B. Whitehead, 2♀ paratypes SAMC.

THE *SPHECODOPSIS MINUTISSIMA* SPECIES GROUP

This species group comprises only *S. minutissima*.

Sphecodopsis minutissima (Cockerell) **comb. nov.**, Fig. 94, 84-89

Morgania (*Omachthes*) *minutissima* Cockerell, 1933a: 379 (♀ holotype, NHML).

Morgania (*Pseudopasites*) *rufula* Cockerell, 1933a: 382-383 (♀ holotype, NHML). **syn. nov.**

The type specimens of *minutissima* and *rufula* are remarkably similar and clearly conspecific. It is, therefore, unclear why Cockerell (1933a) described them as distinct species in different subgenera in the same article without even comparing them with one another.

The description that follows is incomplete because the metasoma is missing, except the terminal terga, sterna and genitalia, in the only known male specimen.

DESCRIPTION

Length of head 1,1-1,3 mm; scutum 0,9-1,1 mm; fore wing 3,2-4,3 mm; body 4,6-5,8 mm.

Integument of head and mesosoma black to reddish-black, antenna, mandible, pronotal lobe, tegula, most of femora, tibiae and tarsi orangish; labrum orange to black; metasoma orange.

Vestiture white, except ventral surfaces of tibiae and tarsi pale orangish, female T7 and S6 pale orangish and fringe on distal end of pygidium blackish. Lower region of face and gena very densely pubescent; upper region of face and gena, and vertex sparsely pubescent, vestiture short and simple; mesosomal vestiture sparse, except pronotal collar, anterior region of scutum, lateral regions of scutellum and metanotum, posterolateral region of propodeum and most of dorsal region of mesopleuron densely pubescent; legs generally with vestiture on coxae, tibiae and tarsi dense and trochanters and femora sparse; female with vestiture on T1-T3 sparse (T2-T3 with a little white pubescence posterolaterally), T4 sparse with a weakly developed distal fringe, T5 sparse with distal fringe well developed medially and T6 generally sparsely pubescent (distal fringe short, sometimes blackish medially).

Structurally similar to *S. capicola* except as follows: lateral region of vertex sloping upwards towards raised lateral ocelli, giving vertex a convex appearance; propodeum broadly glabrous mediolongitudinally; female S5 resembles that of *S. longipygidium* in that it does not have an apicolateral protuberance (Fig. 84); female S6 very narrowly bifid, disc fairly wide, keeled mediolongitudinally (Fig. 85); male S7 strongly incurved laterally (Fig. 86), S8 with anterior prominence narrow (Fig. 87); genitalia with gonocoxite more or less straight, narrow and pointed posteriorly (Fig. 88-89).

DISTRIBUTION (Fig. 94)

This species is known from widely separated localities in Zimbabwe and South Africa. The biotypes they inhabit range from woodland to semi-desert, with either summer or winter rainfall.

DISCUSSION

This species can be easily identified by the gently convex vertex and white, appressed,

pubescence on the head and mesosoma. These features are unique to this species, being more similar to *Pasites*, which makes it difficult to determine its closest relative. The female S5 resembles *S. longipygidium* in that it does not have posterolateral prominences (cf. Fig. 79, 84).

MATERIAL EXAMINED

TYPE MATERIAL. *Morgania minutissima*, ♀ holotype: 'Aliwal North, Cape Province, 450ft., 1-13.i.1923, S. Africa, R.E. Turner, Brit. Mus., 1923-70, *Morgania minutissima* Ckll TYPE, B.M. TYPE HYM. 17B 72', NHML.

Morgania rufula, ♀ holotype: 'Cape Province, Little Karoo, 38 km E. of Ceres, 17-25.xi.1924, S. Africa, R.E. Turner, Brit. Mus., 1924-518, *Morgania rufula* Ckll TYPE, B.M. TYPE HYM. 17B 96', NHML.

ADDITIONAL MATERIAL. 4♀ 1♂: ZIMBABWE: Victoria Falls, 3.i.1920, 1♀ SAMC. SOUTH AFRICA: Farm Arkoep, 6 km N. Kamieskroon, 30.19S 17.56E, 1-2.x.1990, C. Eardley, 1♀ SANC; Clanwilliam Dam, 32.11S 18.53E, 3-7.x.1988, F.W. & S.K. Gess, 1♀ AMGS; Vanrhynsdorp, 20.x.1968, J.G. Rozen, E. Martinez, 1♀ 1♂ AMNH.

THE *SPHECODOPSIS ACULEATA* SPECIES GROUP

This is a monotypic species group.

Sphecodopsis aculeata (Fries), Fig. 90-94

Pasites aculeatus [sic.] Fries, 1922: 37 (♀ holotype, ZMHB) [*lapsus pro P. aculeata*].

Sphecodopsis (*Pseudopasites*) *aculeata* (Fries): Bischoff 1923: 595.

Morgania aculeata (Fries): Cockerell 1933a: 383.

Pasites pygmaeus [sic.] Fries, 1922: 37 (♂ lectotype, ZMHB) [*lapsus pro P. pygmaea*]. syn. nov.

Sphecodopsis (*Pseudopasites*) *pygmaeus* [sic.] (Fries): Bischoff 1923: 595 [*lapsus pro S. pygmaea*].

Morgania pygmaea (Fries): Cockerell 1933a: 384.

Sphecodopsis (*Pseudopasites*) *rufescens* Bischoff, 1923: 593-594 (♀ holotype, ZMHB). syn. nov.

Sphecodopsis (Pseudopasites) algoensis Bischoff, 1923: 595 (♂ lectotype, TMSA). syn. nov.

Morgania algoensis (Bischoff): Cockerell 1933a: 384.

Pseudopasites algoensis (Bischoff): Anonymous 1958: 30.

Morgania (Pseudopasites) perpunctata Cockerell, 1933a: 382-384 (♂ holotype, NHML)
[specific epithet erroneously recorded as masculine on p. 382]. syn. nov.

Bischoff (1923) and Cockerell (1933a) recognized five distinct species for what is here considered to be a single species, mainly on differences in the colour of the vestiture and the metasoma. An exception is the female paralectotype of *S. algoensis*, which could not be located, that Bischoff (1923) separated from *aculeata*, *pygmaea* and *rufescens* by the relatively long vestiture on the upper region of the head and scutum. Confirmation as to whether the specimen was correctly described awaits the discovery of the paralectotype. A comparative study of the colour differences that Bischoff (1923) and Cockerell (1933a) used to separate species indicated that these differences fall within the range of variation for this species and could not be used to define distinct species.

Sphecodopsis pygmaea and *S. algoensis* were each described from a pair of specimens of opposite sexes. The type series of *S. pygmaea* was collected in Cape Town, and that of *S. algoensis* at Algoa Bay. In each case the female could not be located. The male syntypes are therefore designated as the lectotypes of these two species.

DESCRIPTION

Length of head 1,2-1,5 mm; scutum 0,9-1,2 mm; fore wing 4,0-5,0 mm; body 4,4-6,3 mm.

Integument of head and mesosoma black to blackish, except distal end of mandible orange; posterolateral region of tegula translucent; metasoma completely black to orange anteriorly and black posteriorly.

Pubescence white, except ventral surfaces of tarsi pale yellow. Head and mesosoma generally moderately densely pubescent, except femora sparsely pubescent; tibiae and tarsi densely pubescent; metasoma with sparse vestiture, except pygidium in which it is dense.

Structurally similar to *S. capicola* except as follows: scutum moderately densely punctate, punctures large and mostly separate; propodeal triangle weakly sculptured to glabrous; female S5 similar to that of *S. namaquensis*, except without black setation (cf. Fig. 82); S6 narrowly bifid (cf. Fig. 83); male S7 strongly incurved posterolaterally (Fig. 90); S8 weakly expanded anterolaterally and anterior lobe expanded laterally (Fig. 91); genitalia with gonocoxite rounded posteriorly (Fig. 92-93).

DISTRIBUTION (Fig. 94)

The species is known from several widely distributed localities in the southern region of South Africa.

DISCUSSION

Sphecodopsis aculeata closely resembles the species that comprise the *S. capicola* species group. This species can be recognized by the pallid, simple vestiture on the head and mesosoma, absence of a distal fringe on the female T5 and expansion of the anterior lobe of the male S8 (Fig. 91). The pallid, simple vestiture and the structure of the male S8 are unique, within the genus, to this species. The absence of a distal fringe on the female T5 suggests an affinity with both *S. namaquensis* and *S. semirufa*. The structure of the female S5 and S6 of *S. aculeata*, however, resembles that of *S. namaquensis*.

MATERIAL EXAMINED

TYPE MATERIAL. *Pasites aculeata*, ♀ holotype: 'Cape Town, L.C. Peringuey, 1911, *Pasites aculeatus* Fr. ♀ 1904 Friese det., Type, *Pseudopasites*, Zool. Mus. Berlin', ZMHB.
Pasites pygmaea, ♂ lectotype: 'Capland, *Pasites pygmaeus* Fr. ♂ 1904 Friese det., Coll Friese, *Pseudopasites*, Type, Zool. Mus. Berlin', ZMHB.
Sphecodopsis rufescens ♀ holotype: 'T. us Afr. *Pseudopasites rufescens*, Type, Zool. Mus. Berlin', ZMHB.
Sphecodopsis algoensis, ♂ lectotype: 'Algoa bay, Capland, Dr Brauns, 20.8.96, *Pseudopasites algoensis* Bisch. ♂ Typ., *Pseudopasites algoensis* Type ♂ Bischoff, *Pseudopasites algoensis* Biss. ♂ Type No. 567', TMSA.
Morgania perpunctata, ♂ holotype: 'Rapenburg, Cape Flats, 1-14.x.1920, S. Africa, R.E. Turner, 1920-424, *Morgania perpunctata*, B.M. TYPE HYM. 17B 95', NHML.

ADDITIONAL MATERIAL. 26♀ 21♂: SOUTH AFRICA: 19 km N.W. Grahamstown, 16.xi.1970, H.V. Daly, 1♀ SEMK; Grahamstown, Hilton, 12.x.1977 & 26.ix.1983, F.W. & S.K. Gess, 3♀ AMGS; same locality, 9.x.1972, 29.ix.1977 & 12.x.1977, F.W. Gess, 4♀ AMGS; Boknes, 33.43S 26.35E, 5.iv.1984; S.K. Gess, 1♀ AMGS; Willowmore, 11.x.1904, H. Brauns, 1♀ TMSA; Cango River, Oudtshoorn district, x.1937, 1♀ SAMC; Seven Weeks Poort, Ladismith district, 10.ix.1948, C.J. Jacot-Guillarmod, 2♀ AMGS; Pearly Beach, Bredasdorp, ix.1959, 1♀ SAMC; Cape Town, vii & ix.1913 & 1915, 1♀ 16♂ SAMC 2♂ SANC; Hout Bay, 15.ix.1966, C.D. Michener, 3♀ 1♂ SEMK; Kommetjie, 15-25.x.1972, J.G. Rozen, R. McGinley, C. Thompson, 2♀ AMNH; Kommetjie, 15.x.1966, C.D. & B.J. Michener, 4♀ SEMK; Stellenbosch, 1919, Lightfoot, 1♀ AMNH; Pakhuis Pass, ix.1961, 1♂ SANC; Kamieskroonberg, near Kamieskroon, 30.32S 18.08E, 3.x.1990, C.D. Eardley, 1♀ 1♂ SANC.

THE *SPHECODOPSIS SEMIRUFA* SPECIES GROUP

This monotypic species group comprises only *S. semirufa*.

Sphecodopsis semirufa (Cockerell) **comb. nov.**, Fig. 94-101

Morgania semirufa Cockerell, 1933a: 380-381 (♀ holotype, NHML).

Morgania (Sphecodopsis) leonis Cockerell, 1933a: 382, 384 (♂ holotype, NHML). **syn. nov.**

The type specimens of *leonis* are considerably smaller than those of *S. semirufa*. Otherwise they are almost indistinguishable from the type material of *S. semirufa*.

DESCRIPTION

Length of head 1,1-1,7 mm; scutum 0,8-1,3 mm; fore wing 3,6-5,8 mm; body 3,9-6,1 mm.

Integument of head and mesosoma mostly black, distal half of mandible, antenna and pronotal lobe sometimes orange to reddish-black; tegula always orange and legs black to reddish-black, often with femur orangish; metasoma orange anteriorly and black posteriorly.

Vestiture on head black; mesosoma with short, white and long, black vestiture intermixed; vestiture on coxae and trochanters largely white, femora generally black (posterodistal region

of hind femur white) and tibiae and tarsi pallid with a few black setae on dorsal surfaces (those on middle and hind legs thick and spinose); female metasoma generally with vestiture on orange areas short and pallid, and black regions long and black, except T6 and S5 mostly with a mixture of black and white vestiture, posterior region pale brownish; male metasomal vestiture mostly black. Vestiture on head long and moderately dense, hairs simple to weakly plumose; mesosoma with short white pubescence intermixed with long, black, weakly pubescent hairs; femora generally sparsely pubescent, dense posterodistally on hind femur; black setae on dorsal surfaces of middle and hind tibiae and tarsi thick and spinose; female metasoma generally with vestiture on areas in which integument is orange short, and on areas with integument black long; metasoma of male with vestiture mostly long.

Scutum fairly sparsely punctate, punctures small, shallow and mostly separate; propodeal triangle glabrous, mediolongitudinal region below triangle punctate; female T6 as in Fig. 95, S5 with posteromedian protuberance small and posterolateral prominence large and incurved, forming a distinct concavity posteromedially (Fig. 96); female S6 very narrowly bifid and mediolongitudinally carinate on ventral surface (Fig. 97); male S7 as illustrated (Fig. 98), S8 widely and gently concave posteriorly and without a distinct anterior lobe (Fig. 99); male genitalia with gonocoxite shorter than penis valve and curved strongly inwards. (Fig. 100-101).

DISTRIBUTION (Fig. 94)

This species is known from a few localities in the southern region of South Africa.

DISCUSSION

Sphecodopsis semirufa can be easily identified by the sparsely pubescent, glabrous face; posteromedian concavity and enlarged apicolateral prominences of the female S5 (Fig. 96), absence of a distinct anterior lobe on the males S8 (Fig. 99) and bowed gonocoxite of the male genitalia (Fig. 100). These features are all unique within the genus. The mosaic of characters that occur in *S. semirufa* makes it difficult to determine its closest relative.

MATERIAL EXAMINED

TYPE MATERIAL. *Morgania semirufa*, ♀ holotype: Worcester, Cape Province, Sept.

1928, S. Africa, R.E. Turner, Brit. Mus. 1928-457, *Morgania semirufa* Ckll TYPE, B.M. TYPE HYM. 17B 94', NHML.

Morgania leonis, ♂ holotype: `S. Africa, R.E. Turner, 1920-342, Lion's Head, Cape Town, Aug. 1920, *Morgania leonis* Ckll., TYPE, B.M. TYPE HYM. 17B 85', NHML.

ADDITIONAL MATERIAL. 7♀: SOUTH AFRICA: Grahamstown, Hilton, 12.iv.1968, C. Jacot-Guillarmod, 1♀ AMGS; Willowmore, 19.v.1903 & 5.ix.1903, H. Brauns, 1♀ TMSA 1♀ SANC; Lammerskraal, Prince Albert District, ix.1947, 1♀ SAMC 1♀ SANC; Kamieskroon, ix.1930, 1♀ SAMC; Lambert's Bay, 32.04S 18.20E, 4.x.1974, R.H. Watmough, 1♀ SANC.

THE *SPHECODOPSIS CAPENSIS* SPECIES GROUP

This species group comprises *S. capensis* and *S. fumipennis*. These two species are unique in the structure of the female terminalia. The posteromedian region of S5 is gutter-like and the posterior end of S6 forms a single spine.

Sphecodopsis capensis (Fries) comb. nov.

Omachthes capensis Fries, 1915: 296-297 (♀ holotype, ZMHB).

Morgania capensis (Fries): Cockerell 1919: 190.

Pseudodichroa capensis (Fries): Bischoff 1923: 595-596; Rozen, 1968a: 1-9; 1968b: 3-13.

The holotype of this species was not examined during the course of the study because material that was reliably identified by Dr J.G. Rozen (AMNH), who examined the holotype (Rozen 1968a), was examined together with Rozen's (1968a) outstanding redescription. As the species was thoroughly dealt with by Rozen (1968a), it has not been redescribed here.

The host of this species is *Scapter longula* (Fries) (Rozen 1968b).

MATERIAL EXAMINED

26♀: SOUTH AFRICA: Rapenburg, 1-14.x.1920, R.E. Turner, 4♀ SAMC; Kommetjie, 29.x-9.xi.1966, C.D. Michener & J.G. Rozen, 7♀ AMNH; Kommetjie, 14.x.1972, J.G. Rozen, R. McGinley & C. Thompson, 10♀ AMNH; 25 km E. Velddrif, 23.x.1972, J.G. Rozen, R. McGinley & C. Thompson, 5♀ AMNH.

Sphecodopsis fumipennis (Bischoff) **comb. nov.**

Pseudodichroa fumipennis Bischoff, 1923: 596; Rozen 1968a: 1-9; 1968b: 3-13; 1974: 6-8
(2♀ syntype, ZMHB).

Bischoff (1923) described this species from two female specimens, one from Cape Town, and the other has 'Java' on the label. Bischoff (1923) regarded the accuracy of the locality label as questionable, and Rozen (1968a); who examined the specimen (the Cape Town syntype had been lost), shared Bischoff's (1923) sentiments. During the course of the current study material of this species, which was identified by Dr J.G. Rozen, was studied and compared with his (Rozen 1968a) excellent redescription. This species was adequately dealt with by Rozen (1968a) and requires no further comment.

The host of *S. fumipennis* is *Scapter crassula* Cockerell (Rozen 1968b).

MATERIAL EXAMINED

10♀: SOUTH AFRICA: Kommetjie, 29.x-9.xi.1966, C.D. Michener & J.G. Rozen, 4♀ AMNH; Kommetjie, 14.x.1972, J.G. Rozen, R. McGinley & C. Thompson, 2♀ AMNH; Between Nieuwoudtville & top Vanrhyns Pass 29-30.ix.1990, F.W. & S.K. Gess, 3♀ AMGS; Nieuwoudtville flower reserve, 31.19 AC, V.B. Whitehead & M. Macpherson, 28.viii.1984. 1♀ SAMC.

SPECIES OF UNCERTAIN IDENTITY

Sphecodopsis argyrura (Cockerell) **comb. nov.**

Morgania argyrura Cockerell, 1933c: 108-109 (♀ holotype, NHML).

The condition of the holotype of this species was such, that it could not be determined whether it belongs in another described species or whether it is distinct. Cockerell (1933c) described it in the genus *Morgania*, but mentioned that it belonged to 'the genus or subgenus *Sphecodopsis*'. The condition of the holotype is sufficient to recognize that it belongs in *Sphecodopsis*.

5.4 GENUS *AMMOBATES* LATREILLE

Ammobates Latreille, 1809: 169. Type species *Ammobates rufiventris* Latreille, 1809
(subsequent designation, Latreille 1810, Sandhouse 1943).

A single species of *Ammobates*, namely *A. auster* spec. nov. was recently discovered in southern Africa. *Ammobates* is otherwise only known from the Palaearctic Region (Popov 1951), where it is particularly diverse in the Mediterranean basin. As *A. auster* is known only from five specimens, it is difficult to speculate on the distribution of *Ammobates* in the Region. However, several other genera of bees, including *Meliturgula* Friese and *Melitturga* Latreille, occur in southern Africa and the Eremic Region and not in the intermediate area. It is, therefore, possible that *Ammobates* does not occur in the area between southern Africa and the Mediterranean Basin.

Ammobates auster is a medium sized (7,3-9,0 mm long) bee. The head and mesosoma are mostly black and the metasoma is, at least, partly orangish (posterior region sometimes black). The generic diagnostic features are: vertex, in front view, gently convex; antenna 12-segmented in female and 13-segmented in male; labrum distinctly longer than its maximum width and truncate distally; mandibles lie over labrum and their apices overlap in repose; facial vestiture white and mostly sparse, dense pubescence occurs in vicinity of antennal sockets, and appressed; scutellum essentially gently and evenly curved; female T6 without a pygidial plate, male T7 with a pygidial plate; female with pygidial region densely setose (Fig. 103-104); female S5 shallowly concave posteriorly, with a fairly well-developed gutter posteromedially (Fig. 102, 105); female S6 bifid posteriorly (Fig. 106).

Ammobates auster spec. nov., Fig. 94, 102-110

This new species takes its name from the Latin word *auster*, which means south. It is the only species of the genus known from the southern hemisphere.

DESCRIPTION

Length of head 2,0-2,7 mm; scutum 1,5-2,2 mm; fore wing 6,1-8,6 mm; body 15,0-11,0 mm.

Integument of head and mesosoma mostly black, appendages generally reddish to orange;

metasoma either mostly reddish to orange or orangish anteriorly and black posteriorly.

Vestiture generally white, posterior surface of hind tibia and ventral surfaces of all basitarsi with dense yellow to orange setation; female T6 orangish, female pygidium with a blackish tinge; female S5 with orangish velutinous vestiture subapically, male S6 pale yellowish.

Vestiture generally sparse, often dense and pubescence around antennal sockets, on lateral region of pronotal collar, edge of pronotal lobe, anterior margin of scutum, posterior region of scutellum, entire metanotum, anterodorsal region of mesepisternum, adjacent to epimeral suture, on entire mesepimeron, dorsolateral region of propodeum, posterior regions of middle and hind tibiae and on posterolateral regions of female T1-T5 and male T1-T6; posterior surface of hind tibia and ventral surfaces of all basitarsi with dense setation; pygidial area with coarse, dense setation; female S5 with velutinous orangish vestiture subapically.

Labrum about 1.6X as long as its maximum width, strongly incurved laterally and truncate distally; maxillary palp two-segmented and subequal in length to antennal pedicel; scutum fairly sparsely punctate and glabrous between punctures; scutellum generally gently curved, slightly concave medioposteriorly; virtually entire posterior surface of propodeum naked and glabrous; female T6 truncate posteriorly and expanded posterolaterally (Fig. 102-104); male T7 with a well-developed, broadly rounded, pygidial plate; female S5 with a well-developed gutter posteromedially (Fig. 102, 105), S6 forked posteriorly (Fig. 106); male S7 slender anterolaterally and posteriorly, S8 emarginate posteriorly, with a well-developed anterior lobe which is not expanded laterally (Fig. 107-108); male genitalia with gonocoxite distinctly shorter than penis valve and curved strongly inwards (Fig. 109-110).

DISTRIBUTION (Fig. 94)

The species is known from a few localities in southern Namibia, and the south-western and south-eastern regions of South Africa.

DISCUSSION

Ammobates auster, for the purpose of the cladistic analysis, was grouped with *A. punctatus*. In spite of the geographical separation of *A. auster* from the rest of the *A. punctatus* group, it is remarkably similar to the other species in the group. The most important diagnostic feature

of the group is the structure of the female pygidium, and within the group the female of *A. auster* can be identified by the shape of this structure. The pygidium of *A. auster* is truncate and expanded laterally (Fig. 102-104). The male can be identified by the structure of the S8 which narrows posteriorly (Fig. 108).

MATERIAL EXAMINED

TYPE MATERIAL. ♀ holotype 3♀ 1♂ paratypes: NAMIBIA: 40 km S. Kolmanskop, 23.x.1974, R.H. Watmough, ♀ holotype, SANC. SOUTH AFRICA: Strowan, 27.xi.1968, F.W. Gess, 2♀ AMGS; 29 km E. Touwsrivier towards Hondewater, -xii.1962, 1♀ SAMC; 77 km E. Barrydale, 13.xi.1966, C.D. Michener, 1♂ SEMK.

5.5 THE GENUS *MELANEMPIS* SAUSSURE

Phileremus (Melanempis) Saussure, 1891: 84.

Melanempis Saussure: Michener 1944: 276. Type species *Phileremus (Melanempis) ater* Saussure, 1891 (monobasic) (Sandhouse 1943).

Melanempis is endemic to Madagascar. The name, which means black spot, is feminine. The genus is known from one described species, which is the largest known ammobatine bee. It is currently being revised by R.W. Brooks, who has material of an additional species (1991, personal communication). Consequently the genus has only been briefly dealt with here. During the course of the study only the type species was available for examination.

Melanempis atra is a large bee (11,2-15,8 mm long). The head, mesosoma and metasoma are blackish-brown in colour. The genus is characterized as follows: vertex, frontal view, weakly and unevenly convex; antenna 12-segmented in both sexes; labrum 1,4X as long as its maximum width and truncate distally; mandibles lie over labrum and their apices overlap in repose; vestiture mostly brownish-orange and sparse, fairly dense on lower region of face and distal end of metasoma; scutellum gently and evenly curved mediolongitudinally, and distinctly tuberculate mediolaterally; last exposed metasomal tergum (T6 female, T7 male) devoid of a pygidial plate; female T6 distinctly truncate, pygidial region naked and circumscribed by a small carina; male T7 abruptly curved under laterally and posterolaterally, forming a pseudopygidial plate; female S5 with a well-developed gutter posteromedially;

female S6 bifid posteriorly.

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<i>perpunctata</i> , Sphecodopsis	81
<i>politula</i> , Pasites	60
<i>Pseudodichroa</i>	68
<i>Pseudopasites</i>	68
<i>pygmaea</i> , Sphecodopsis	81
<i>rotundiceps</i> , Pasites	67
<i>rhodesiana</i> , Pasites	60
<i>rufescens</i> , Pasites	81
<i>rufipes</i> , Pasites	58
<i>rufitarsis</i> , Pasites	55
<i>rufula</i> , Pasites	79
<i>semirufa</i> , Sphecodopsis	84
<i>somalica</i> , Pasites	65
<i>Sphecodopsis</i>	68
<i>stordyi</i> , Pasites	45
<i>subfortis</i> , Pasites	45
<i>tropica</i> , Pasites	67
<i>tegularis</i> , Pasites	41
<i>transvaalensis</i> , Pasites	55
<i>turneri</i> , Pasites	60
<i>villosa</i> , Sphecodopsis	75
<i>voiensis</i> , Pasites	45
<i>vespericena</i> , Sphecodopsis	73

Appendix 1. Species studied and their groupings. Following each species name are: genera to which species were assigned before this study, for genera synonymised here; number of specimens studied; whether the holotype or lectotype was studied, indicated by a 'T'; and general distribution. The zoogeographic region in which each species occurs is indicated as follows: P = Palearctic, A = Afrotropical, Na = Nearctic and Nt = Neotropical.

Pasites barkeri group

P. barkeri (Cockerell) [19♀ 11♂; T; A: tropical & subtropical Africa]

Pasites atra group

P. atra Friese [57♀ 49♂; T; A: widespread in Africa]

P. nilssoni spec. nov. [1♂; T; A: Madagascar]

P. paulyi spec. nov. [3♀ 1♂; T; A: Cameroon]

P. braunsi (Bischoff) [32♀; A: Southern Africa]

P. humecta spec. nov. [18♀ 8♂; T; A: equatorial Africa]

P. bicolor Friese [*Pasitomachthes*; 9♀ 4♂; T; A: Madagascar]

P. tegularis Friese [13♀ 7♂; T; A: Madagascar]

Pasites gnoma group

P. gnoma spec. nov. [1♀ 1♂; T; A: Niger]

Pasites carnifex group

P. carnifex (Gerstaecker) [15♀ 5♂; T; A: East & southern Africa]

P. dichroa Smith [4♀ 2♂; T; A: equatorial West Africa]

Pasites jenseni group

P. jenseni (Friese) [19♀ 10♂; T; A: southern Africa]

P. namibiensis spec. nov. [1♀ 2♂; T; A: southern Africa]

P. histrio (Gerstaecker) [24♀ 12♂; T; A: southern Africa]

P. jonesi (Cockerell) [9♀ 1♂; T; A: East & southern Africa]

Pasites rufipes group

P. rufipes (Friese) [2♀; T; A: southern Africa]

Pasites appletoni group

P. appletoni (Cockerell) [217♀ 59♂; T; A: widespread in Africa]

P. somalica spec. nov. [1♀; T; A: somalia]

Pasites maculata group

P. maculata Jurine [5♀ 4♂; P: Morocco to Japan]

Sphecodopsis capicola group

- S. capicola* (Strand) [22 ♀ 3 ♂; T; A: southern Africa]
S. vespericena spec. nov. [68 ♀; T; A: southern Africa]
S. villosa (Fries) [2 ♂; T; A: southern Africa]
S. longipygidium spec. nov. [1 ♀; T; A: southern Africa]
S. namaquensis spec. nov. [3 ♀; T; A: southern Africa]

Sphecodopsis minutissima group

- S. minutissima* (Cockerell) [6 ♀ 1 ♂; T; A: southern Africa]

Sphecodopsis aculeata group

- S. aculeata* (Fries) [28 ♀ 24 ♂; T; A: southern Africa]

Sphecodopsis semirufa group

- S. semirufa* (Cockerell) [8 ♀ 1 ♂; T; A: southern Africa]

Sphecodopsis capensis group

- S. capensis* (Fries) [*Pseudodichroa*; 29 ♀; A: southern Africa]
S. fumipennis (Bischoff) [*Pseudodichroa*; 11 ♀; A: southern Africa]

Melanempis atra group

- M. atra* (Saussure) [2 ♀ 1 ♂; A: Madagascar]

Spinopasites spinotus group

- S. spinotus* (Warncke) [1 ♀; P: Tunisia]

Ammobates orientanus group

- A. orientanus* (Warncke) [1 ♀ 1 ♂; P: Mediterranean]
A. aegyptiacus (Warncke) [1 ♂; P: Mediterranean]

Ammobates minutus group

- A. minutus* (Mocsary) [4 ♀ 5 ♂; P: East Europe]

Ammobates muticus group

- A. muticus* Spinola [45 ♀ 28 ♂; P: North Africa]
A. oraniensis (Lepeletier) [5 ♀ 6 ♂; P: South-east Europe]
A. latitarsis Fries [2 ♀ 2 ♂; P: East Mediterranean]

Ammobates biastoides group

- A. biastoides* Fries [2 ♀ 1 ♂; P: Mediterranean]

Ammobates punctatus group

- A. punctatus* (Fabricius) [5 ♀ 4 ♂; P: Mediterranean]
A. ancylae (Warncke) [1 ♀ 1 ♂; P: Mediterranean]
A. solitarius Nurse [1 ♀ 1 ♂; P: Pakistan]

- A. vinctus* Gerstaecker [6♀ 6♂; P: Mediterranean]
A. auster spec. nov. [4♀ 1♂; A: southern Africa]
A. similis Mocsary [1♀ 1♂; P: Mediterranean]
A. rufiventris Latreille [3♀ 2♂; P: Algeria]
A. iranicus (Warncke) [1♀ 1♂; P: Iran to Turkey]
A. dubius Benoist [1♀ 1♂; P: Egypt & Sudan]
A. niveatus (Spinola) [1♀ 2♂; P: Mediterranean]
A. assimilis (Warncke) [1♂; P: Tunisia]
A. syriacus Friesse [1♀; P: Mediterranean]
A. opacus Popov [1♀; P: Bulgaria]
A. armeniacus Morawitz [1♀ 1♂; P: Turkey]
A. sanguineus Friesse [1♀ 1♂; P: Turkey & Greece]

Ammobates rostratus group

- A. rostratus* Friesse [3♀ 3♂; P: Mediterranean]
A. robustus Friesse [1♀ 1♂; P: Turkey]
A. teheranicus Mavromoustakis [1♂; P: Iran]
A. hipponensis Pérez [2♂; P: Algeria]
A. baueri (Warncke) [1♀; P: Mediterranean]
A. mavromoustakisi Popov [2♀ 2♂; P: Mediterranean]
A. handlirschi Friesse [1♂; P: Algeria]
A. depressus Friesse [1♀; P: Turkey]

Ammobates verhoeffi group

- A. verhoeffi* Mavromoustakis [1♀ 1♂; P: North Africa]

Ammobates persicus group

- A. persicus* Mavromoustakis [1♀ 1♂; P: Iran]

Oreopasites vanduzeei group

- O. vanduzeei* Cockerell [1♀ 1♂; Ne: western U.S.A.]
O. linsleyi Rozen [1♀ 1♂; Ne: western U.S.A.]

Caenoprosopis crabronina group

- C. crabronina* Holmberg [1♀ 1♂; Nt: Argentina, Paraguay & south-eastern Brazil]

APPENDIX 2. Adult morphological characters used in the cladistic analysis and their states. The states assigned to taxa are recorded in Tables 1 & 3. Characters are treated as additive. Polarity was determined with reference to Neolarrini as the out-group, except for character 50.

1. Vertex contour, when viewed perpendicular to lower region of inner eye margins: strongly convex laterally, lateral ocelli distinctly below vertex (Fig. 46) (0); gently convex, lateral ocellus slightly protuberant above vertex or a little below vertex (Fig. 6) (1); straight, lateral ocellus mostly protuberant above lateral region of vertex (Fig. 64)(2).
2. Vertex length: relatively short, less than twice diameter of lateral ocellus (0); elongate, at least twice as long as diameter of lateral ocellus (1).
3. Vertex profile: curved gently downwards to occiput (0); extending more or less straight behind lateral ocellus, curved abruptly downwards posteriorly (1).
4. Position of antennal socket: on lower half of face, closer to ventral edge of clypeus than to lateral ocellus (0); near middle of face, closer to lateral ocellus than to ventral edge of clypeus (Fig. 6) (1).
5. Length of subantennal suture: much shorter than clypeus (0); subequal in length to clypeus (Fig. 6) (1).
6. Facial vestiture, hair structure: densely plumose, at least in area surrounding antennal sockets (0); simple to weakly plumose (1).
7. Facial vestiture, hair posture: appressed (0); erect (1).
8. Facial vestiture, hair density: dense, at least on lower region of face (Fig. 6) (0); sparse over entire face (Fig. 64) (1).
9. Segmentation of male antennal flagellum: 11-segmented (0); 10-segmented (1).
10. Length of labrum: distinctly shorter than its maximum width (0); quadrate (1); clearly longer than wide, about 1,2-1,9 times as long as its basal width (2).
11. Shape of labrum, apical truncation: apex gently rounded (or pointed) (0); truncate, distal end straight to weakly concave medially (1).
12. Shape of labrum, apex pointed: apex gently rounded (or truncate) (0); pointed apicomediaally (1).
13. Shape of apex of labrum: unmodified (0); spatulate (1).
14. Maxillary palp: present (0); absent (1). The number of segments in the maxillary palp is highly variable in several bee groups, and sometimes within a single species. However, what appeared to possibly be of significance is that some species have lost the maxillary palp.

15. Length of segments of labial palp: segment 2 about twice as long as segment 3 (0); segment 2 at least four times as long as segment 3 (1).
16. Paraocular carina: absent (0); distinct (1).
17. Occipital carina: absent (0); present and short (1); long, extending down posterior edge of gena (2).
18. Angle of mandibles, in repose: directed posterolaterally so that they clearly cross one another, and their apices do not overlap (illustrated by Rozen 1968a) (0); directed mesad so that their distal ends overlap in repose (1).
19. Position of mandibles, when in repose, in relation to labrum: mandibles close behind labrum (0); close over or in front of distal edge of labrum (1).
20. Pronotum: curved distinctly upwards posteromedially, but not declivous (0); declivous with vertical surface usually gently concave and glabrous (1).
21. Lateral region of pronotal collar: rounded (0); carinate (1).
22. Lateral edge of axilla: curved gently downward to wingbase (0); carinate (1).
23. Scutal vestiture, hair structure: densely plumose (0); with weakly plumose and densely plumose vestiture intermixed (1); simple (2).
24. Scutal vestiture, hair posture: strongly appressed (0); weakly appressed (1); mostly erect (2).
25. Scutal vestiture, hair density: dense (0); sparse (1).
26. Mesepisternal vestiture, hair structure: densely plumose (0); mostly weakly plumose (1).
27. Ventrolateral region of mesepisternum: vestiture similar to remainder of sclerite (0); sparsely pubescent to naked, in strong contrast to densely pubescent upper region of mesepisternum (1).
28. Pre-episternal groove: extending from near wingbase to scrobal groove (0); extending below scrobal groove (1).
29. Mediolongitudinal region of scutellum: unmodified or weakly raised (0); strongly swollen (1).
30. Dorsolateral edge of scutellum: rounded (0); carinate (1).
31. Shape of median region of metanotum: swollen or tuberculate (0); flat (1).
32. Setae on hind tibia of female: all setae fine, not thickened and spine-like (0); fine setae mixed with greatly thickened, spine-like, setae (1).
33. Anterior region of sternum I: flat to gently curved (0); strongly swollen (1).
34. Posterior region of sternum I: more or less in same plane as sternum II (0); strongly declivous (1).

35. Mediolongitudinal region of sternum I: gently rounded (0); carinate anteriorly (1).
36. Mediolongitudinal region of propodeum: gently and evenly curved (0); declivous (1).
37. Dorsal surface of female T6: flat to gently convex (0); carinate mediolongitudinally (1).
38. Posterior end of female pygidial plate: fully developed (Fig. 7) (0); reduced, including posteromedian notch (1).
39. Female T6 truncate, following loss of pygidial plate: Pygidial plate present, fully developed or reduced (or absent with distal end of T6 spatulate) (0); absent, posterior end of T6 truncate and setose (1); absent, posterior end of T6 truncate and naked, circumscribed by a small carina (2).
40. Female T6 spatulate, following loss of pygidial plate: pygidial plate present, either fully developed or reduced (or absent with distal end of T6 truncate) (0); pygidial plate absent, posterior end of T6 spatulate (1).
41. Posterior fringe on female T6: absent (0); present (1).
42. Female subpygidial brush: absent (0); present, but not differentiated (Fig. 7) (1); well developed and differentiated dorsoventrally (Fig. 37, 41, 47, 51, 54, 55, 58, 62) (2).
43. Posterior margin of female S5: posteromedian region naked (0); clothed with fine vestiture (1).
44. Posteromedian elongation of naked posterior margin of female S5: naked posterior margin short and of uniform length (or elongate and more or less of uniform length throughout its width) (0); elongate posteromedially only, due to the apparent recession of the vestiture, more or less pointed anteromedially (1).
45. Posterior elongation of naked posterior margin of female S5: naked posterior margin short and of uniform length (or elongate posteromedially) (0); naked posterior margin widely elongate due to an apparent elongation of naked posterior margin, of uniform length (1).
46. Posteromedian concavity of female S5 in species in which the posterior margin is clothed with fine vestiture, when viewed from behind: broadly and moderately concave (or variable with posterior margin naked) (0); with a well developed, conical concavity (Fig. 7, 16, 21, 22, 30, 31, 37) (1); concavity well developed and elliptical (Fig. 47, 51, 54, 55, 58, 62) (2) (see character 47).
47. Posteromedian concavity of female S5 in species in which the posterior margin is naked, when viewed from behind: broadly and moderately concave (or strongly concave with posterior margin clothed with fine vestiture) (0); with a well-developed, conical concavity (1); concavity well developed and more or less elliptical (2). The structure of the posterior margin

of the female S5 differs between those bees in which this structure is naked and those in which it is clothed with fine vestiture. Apparently the posteromedian concavity evolved independently in these two groups of bees in response to similar requirements associated with the laying of the eggs in the cell wall of the host's nest.

48. Posteromedian protuberance of female S5: posterior edge entire or concave and without a posteromedian protuberance (0); with a very small posteromedian protuberance (Fig. 66, 79, 84) (1); protuberance distinct (Fig. 82) (2); protuberance gutter-like (illustrated by Rozen 1968a) (3).
49. Carina on female S5: absent (0); present (1).
50. Structure of female S6: external (0); mostly internal, not longitudinally separated (Fig. 8) (1); mostly internal and longitudinally separated (2). Polarity determined with *Townsendiellini* as the out-group.
51. Posterior edge or apex of female S6: entire (0); forming two sclerotized spines (Fig. 8) (1); forming a single sclerotized spine (2).
52. Reduction of male pygidial plate: pygidial plate present, sometimes reduced and confined to distal end of tergum (0); absent (1).
53. Structure of male pygidial plate: pygidial plate simple, reduced or absent (0); well developed and bilobed (illustrated by Roig-Alsina 1987) (1).
54. Loss of anteromedian lobe of male S8: anteromedian lobe short (Fig. 10) (or long) (0); lobe absent (Fig. 13) (1).
55. Elongation of anteromedian lobe of male S8: anteromedian lobe short (or absent) (Fig. 10) (0); elongate (1).
56. Anterolateral lobes of male S8: very small and unmodified or absent (Fig. 10, 13, 70) (0); well developed (Fig. 33) (1).
57. Relative width of posterior region of male S8: narrower than anterior region (Fig. 10) (0); with anterior and posterior regions of more or less of equal width (Fig. 99) (1); posterior region wider than anterior region (illustrated by Warncke 1983) (2).
58. Expansion of anterolateral region of male S8: weakly expanded (Fig. 10) (0); strongly expanded (illustrated by Roig-Alsina 1987) (1).

APPENDIX 3. Characters of larval morphology (plesiomorphy = 0; apomorphy = 1). The states assigned to taxa are recorded in Table 4. Characters are treated as additive. Polarity was determined with reference to Neolarrini as the out-group.

1. Body curvature: curved (0); straight (1).
2. Vertex curvature, in profile: evenly curved (0); swollen medially (1).
3. Epistomal suture, between anterior tentorial pit and mandible: absent (0); present (1).
4. Labial tubercle: small (0); large (1).
5. Apex of labrum: rounded and without apical swelling (0); extended apicomediaally and swollen apically (1).
6. Maxillary palp: reduced (0); large and easily discernible (1);
7. Apex of mandible: gently curved, basal region not strongly swollen (0); more or less hooked distally and strongly swollen basally (1).
8. Labiomaxillary region: recessed (0); gently swollen (1).
9. Posterolateral swelling on terminal segment: absent (0); present (1).

Table 1. Data matrix of adult characters for species (characters and coding of character states according to Appendix 2)

Out-group						
0000000000	0000000000	0000000000	0000000000	0000000000	00000000	
<i>Sphecodopsis capicola</i>						
2001111101	0110010001	0012110100	1000010001	1001001101	10000000	
<i>Sphecodopsis vespericena</i> & <i>S. longipygidium</i>						
20011111?1	0110010001	0012110110	1000010001	1001001101	1???????	
<i>Sphecodopsis villosa</i>						
2001111101	0110010001	0012110100	1?0001????	??????????	?0000000	
<i>Sphecodopsis namaquensis</i>						
20011111?1	0110010001	0012110100	1000010001	1001001101	1???????	
<i>Sphecodopsis minutissima</i>						
2001111001	0110010001	0012111100	1000010001	1001001101	10000000	
<i>Sphecodopsis aculeata</i>						
2001111101	0110010001	0012110100	1000010001	0001001101	10000000	
<i>Sphecodopsis semirufa</i>						
2001111101	0110010001	0012110100	1000010001	0001001201	10000010	
<i>Sphecodopsis capensis</i> & <i>S. fumipennis</i>						
20011111?1	0110010001	0012110100	1000010001	0001002301	2???????	
<i>Pasites barkeri</i>						
1001100011	0110010101	0021001010	1010010000	0110010001	10000000	
<i>Pasites atra</i>						
1001100011	0110010101	0021001010	1110110100	0110010001	10010000	
<i>Pasites nilssoni</i>						
1001100011	0110010101	0021001010	1?1011????	??????????	?0010000	
<i>Pasites paulyi</i>						
1001100011	0110010101	0021001000	1110110100	0210010001	10010000	
<i>Pasites braunsi</i>						
10011000?1	0110010101	0021001010	1110110100	0210010001	1???????	
<i>Pasites humecta</i>						
1001100011	0110010101	0021001000	1110110110	0110010001	10010000	
<i>Pasites bicolor</i>						
1001100011	0110010101	0021001010	1010110110	0110010001	10010000	
<i>Pasites tegularis</i>						
1001100011	0110010101	0021001010	1010110100	0110010001	10010000	
<i>Pasites gnoma</i>						
1001100011	0111010001	0021001000	1110010000	0110010001	12010100	
<i>Pasites carnifex</i>						
1001100011	0110010101	0022110110	1110010000	0210010001	10000000	
<i>Pasites dichroa</i>						
1001100011	0110010101	0022110110	1110010000	0210010001	10010010	
<i>Pasites jenseni</i> & <i>P. histrio</i>						
0011100011	0110010101	0011001010	1110010000	0210020001	10000000	
<i>Pasites namibiensis</i> & <i>P. jonesi</i>						
0111100012	0110012101	0011001010	1110010000	0210020001	10000000	

Pasites rufipes
 20011111?1 0110010101 0022110010 0111001000 0210020001 1???????

Pasites appletoni
 1001100011 0110010101 0021001010 1110010100 0210020001 10000000

Pasites somalica
 10011000?1 0110010101 0021001010 1110010100 0210020001 1???????

Pasites maculata
 1011100011 0101010101 0021001010 1111010000 0210020001 10000000

Spinopasites spinotus
 10011000?1 0100010111 0021001000 1100000001 0001001201 2???????

Melanempis atra
 2101111102 1001011111 0022110010 0000011010 0001001301 10010000

Oreopasites vanduzeei
 1001100002 1000011011 0020010000 1100010001 0001001201 11000000

Oreopasites linsleyi
 1001100002 1000021011 0020010000 1100010001 0001001201 11000000

Ammobates verhoeffi
 1001100002 1000010111 0021000000 0010010001 0000101211 11000010

Ammobates rostratus
 0111100002 1000010111 0020001000 0110000001 0000101211 11000010

Ammobates robustus
 0111100002 100??10111 0020001000 01????????? ?????????? ??????????

Ammobates teheranicus & *A. baueri*
 01111000?2 1000010111 0020001000 0110000001 0000101211 1?????????

Ammobates hipponensis
 0111100002 1000011111 0020001000 0?1000????? ?????????? ?1000010

Ammobates mavromoustakisi
 0111100002 1000010111 0020001000 1110000001 0001101211 10000010

Ammobates handlirschi
 0111100002 100??11111 0020001000 111000????? ?????????? ?1000010

Ammobates depressus
 01111000?2 1000010111 0020001000 0100000001 1000101211 11000020

Ammobates punctatus
 1011100002 1000010111 0020001000 0110010101 0000101211 11000000

Ammobates ancylae
 1111100002 100??10111 0020001000 1110010001 0000101201 11000020

Ammobates solitarius
 10111000?2 1000010111 0020001000 1110010001 0000101201 1?????????

Ammobates vinctus
 10111000?2 1000011111 0020001000 1110010001 0000101211 11000010

Ammobates auster, A. similis, A. niveatus & *A. syriacus*
 1011100002 1000010111 0020001000 1110010001 0000101201 11000010

Ammobates rufiventris
 1011100002 1000011111 0020001000 1110010001 0000101201 11000010

Ammobates iranicus
 1011100002 1000011111 0020001000 1110010001 0000101201 11000020

Ammobates dubius

1011100002 1000010111 0020001000 1110010001 0000101201 11000020

Ammobates assimilis

1011100002 1000010111 0020001000 111001???? ?????????? ?1000020

Ammobates opacus

10111000?2 100??11111 0020001000 1110010001 0000101201 1????????

Ammobates armeniacus

1011100002 100??10111 0020001000 1110010001 0000101201 11000020

Ammobates sanguineus

1011100002 1000010111 0020001000 1111010001 0000101201 11000020

Ammobates biastoides

0001100002 1000010111 0020001000 1111010001 0000101201 11000010

Ammobates persicus

1011100002 1000010111 0020001000 1010010001 0000101211 11000010

Ammobates minutus

1001100012 1000011111 0020001000 1110010001 0000101201 11001020

Ammobates orientanus

1001100012 0100010001 0020001000 1110010001 0000101201 11001020

Ammobates aegyptiacus

10011000?2 010?010001 0020001000 11???10001 00????????1 1????????

Ammobates muticus

1011100002 1000010111 0022011000 1100011001 0000101201 11000010

Ammobates oraniensis

10111000?2 1000010111 0022011000 1100011001 0000101201 1????????

Ammobates latitarsis

1011100002 1000010111 0022011000 1100011001 0000101201 110?????

Caenoprosopis crabronina

2010011001 0000101110 1110001101 0010010001 1000000002 10101001

Table 2. Data matrix of adult characters for species and species groups (characters and coding of character states according to Appendix 2)

Out-group	0000000000	0000000000	0000000000	0000000000	0000000000	00000000
<i>Sphecodopsis capicola</i> group	2001111101	0110010001	0012110100	1000010001	1001001101	10000000
<i>Sphecodopsis minutissima</i>	2001111001	0110010001	0012111100	1000010001	1001001101	10000000
<i>Sphecodopsis aculeata</i>	2001111101	0110010001	0012110100	1000010001	0001001101	10000000
<i>Sphecodopsis semirufa</i>	2001111101	0110010001	0012110100	1000010001	0001001201	10000010
<i>Sphecodopsis capensis</i> group	20011111?1	0110010001	0012110100	1000010001	0001002301	2???????
<i>Pasites barkeri</i>	1001100011	0110010101	0021001010	1010010000	0110010001	10000000
<i>Pasites atra</i> group	1001100011	0110010101	0021001000	1110110100	0110010001	10010000
<i>Pasites gnoma</i>	1001100011	0111010001	0021001000	1110010000	0110010001	12010100
<i>Pasites carnifex</i> group	1001100011	0110010101	0022110110	1110010000	0210010001	10010000
<i>Pasites jenseni</i> group	0011100011	0110010101	0011001010	1110010000	0210020001	10000000
<i>Pasites rufipes</i>	20011111?1	0110010101	0022110010	0111001000	0210020001	1???????
<i>Pasites appletoni</i> group	1001100011	0110010101	0021001010	1110010100	0210020001	10000000
<i>Pasites maculata</i>	1011100011	0101010101	0021001010	1111010000	0210020001	10000000
<i>Spinopasites spinotus</i>	10011000?1	0100010111	0021001000	1100000001	0001001201	2???????
<i>Melanempis atra</i>	2101111102	1001011111	0022110010	0000011010	0001001301	10010000
<i>Oreopasites vanduzeei</i> group	1001100002	1000011011	0020010000	1100010001	0001001201	11000000
<i>Ammobates verhoeffi</i>	1001100002	1000010111	0021000000	0010010001	0000101211	11000010
<i>Ammobates rostratus</i> group	0111100002	1000010111	0020001000	1110000001	0000101211	11000010
<i>Ammobates punctatus</i> group	1011100002	1000010111	0020001000	1110010001	0000101201	11000010
<i>Ammobates biastoides</i>	0001100002	1000010111	0020001000	1111010001	0000101201	11000010

Ammobates persicus

1011100002 1000010111 0020001000 1010010001 0000101211 11000010

Ammobates minutus

1001100012 1000011111 0020001000 1110010001 0000101201 11001020

Ammobates orientanus group

1001100012 0100010001 0020001000 1110010001 0000101201 11001020

Ammobates muticus group

1011100002 1000010111 0022011000 1100011001 0000101201 11000010

Caenoprosopis crabronina

2010011001 0000101110 1110001101 0010010001 1000000002 10101001

Table 3. Weight assigned to each character by the computer during the analysis of the information in Table 2 after successive approximations character weighting.

Character	Weight	Character	Weight	Character	Weight
1	1	20	10	39	10
2	0	21	10	40	2
3	0	22	10	41	2
4	10	23	3	42	10
5	10	24	1	43	10
6	2	25	4	44	4
7	2	26	2	45	10
8	2	27	0	46	5
9	4	28	2	47	10
10	5	29	4	48	5
11	2	30	10	49	10
12	1	31	0	50	10
13	2	32	1	51	0
14	0	33	2	52	5
15	10	34	0	53	10
16	10	35	10	54	2
17	0	36	0	55	2
18	1	37	0	56	10
19	1	38	0	57	5
				58	10

Table 4. Data matrix of adult characters for genera (characters and coding of character states according to appendix 2)

Out-group

0000000000 0000000000 0000000000 0000000000 0000000000 00000000

Sphecodopsis

2001111101 0110010001 0012110100 1000010001 0001001101 10000000

Pasites

0001100011 0100010101 0011000000 0010000000 0110010001 10000000

Spinopasites

10011000?1 0100010111 0021001000 1100000001 0001001201 1????????

Melanempis

2101111102 1001011111 0022110010 0000011010 0001001301 10010000

Oreopasites

1001100002 1000011011 0020010000 1100010001 0001001201 11000000

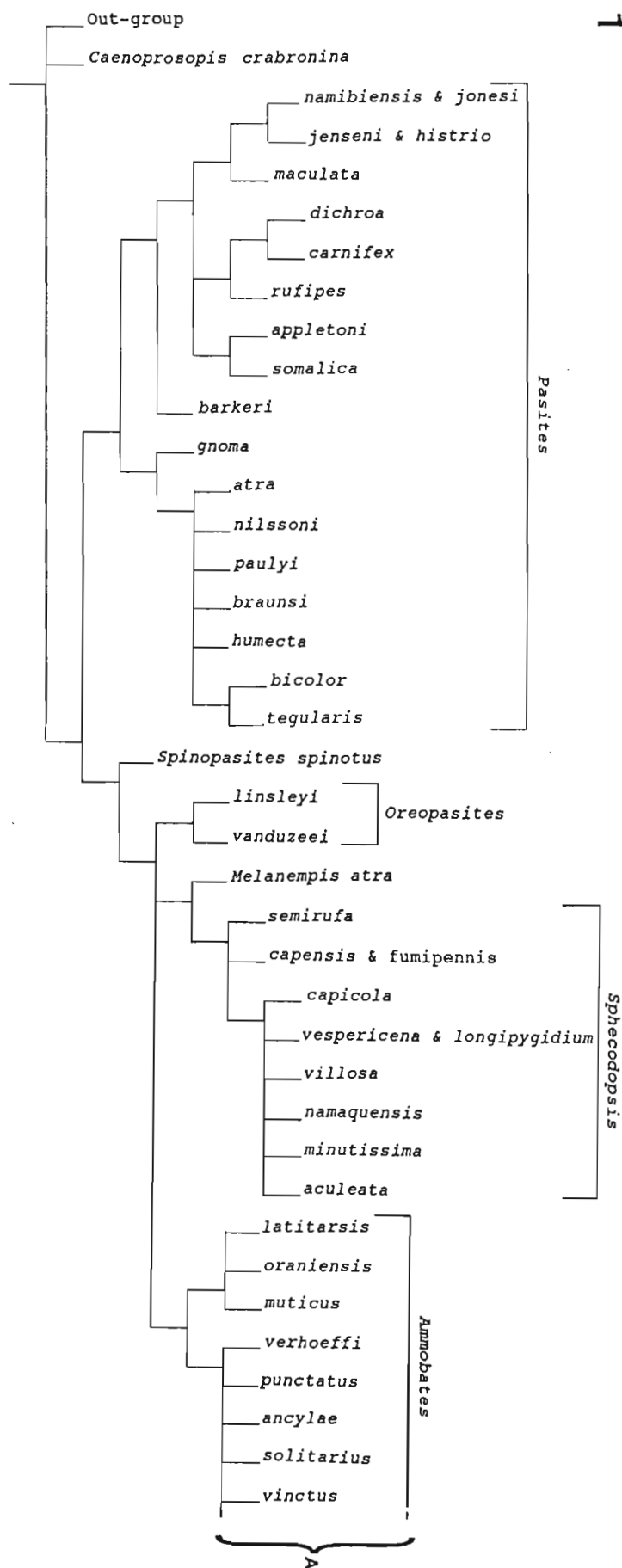
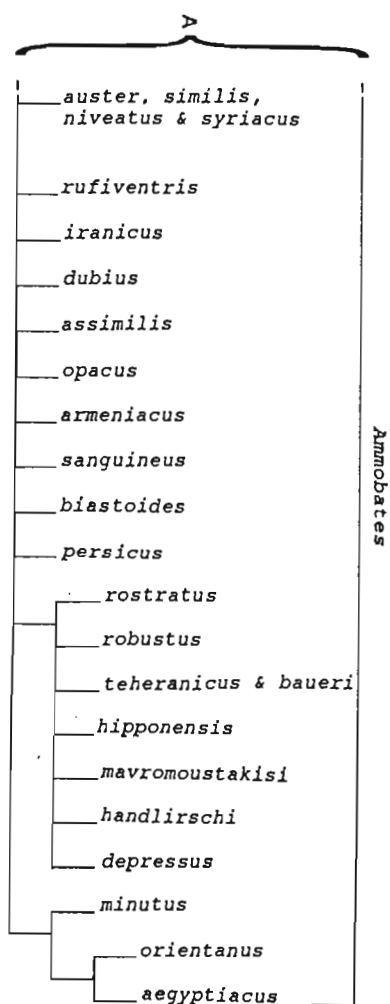
Ammobates

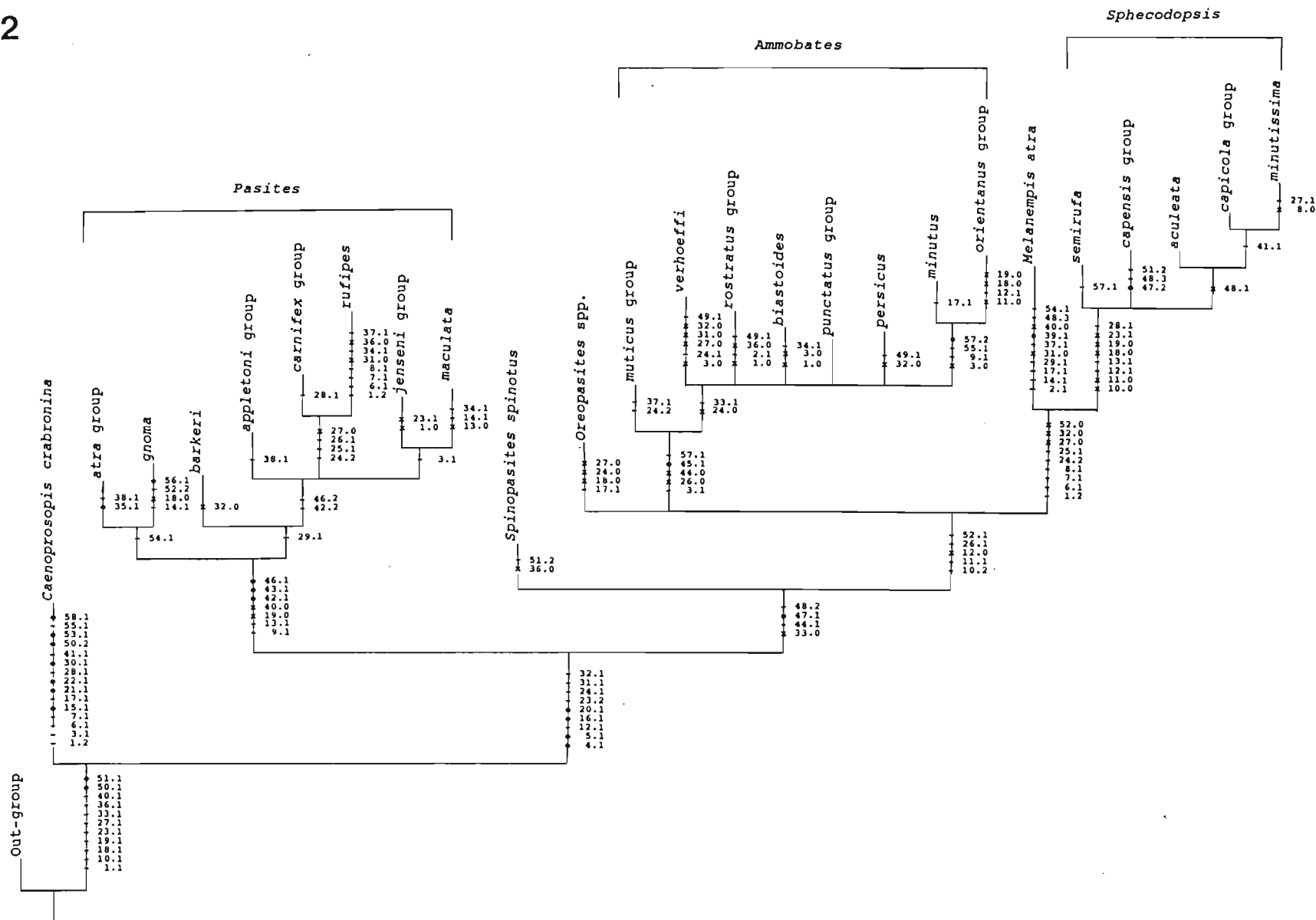
1001100002 0000010111 0020000000 1100000001 0000101201 11000000

Caenoprosopis

2010011001 0000101110 1110001101 0010010001 1000000002 10101001

TABLE 5. Data matrix for analysis of larval characters (characters and coding as in Appendix 3)*Neolarra* 000000000*Caenoprosopis* 000000010*Sphecodopsis* 100000001*Pasites* 000000000*Oreopasites* 001100000*Ammobates* 010011100





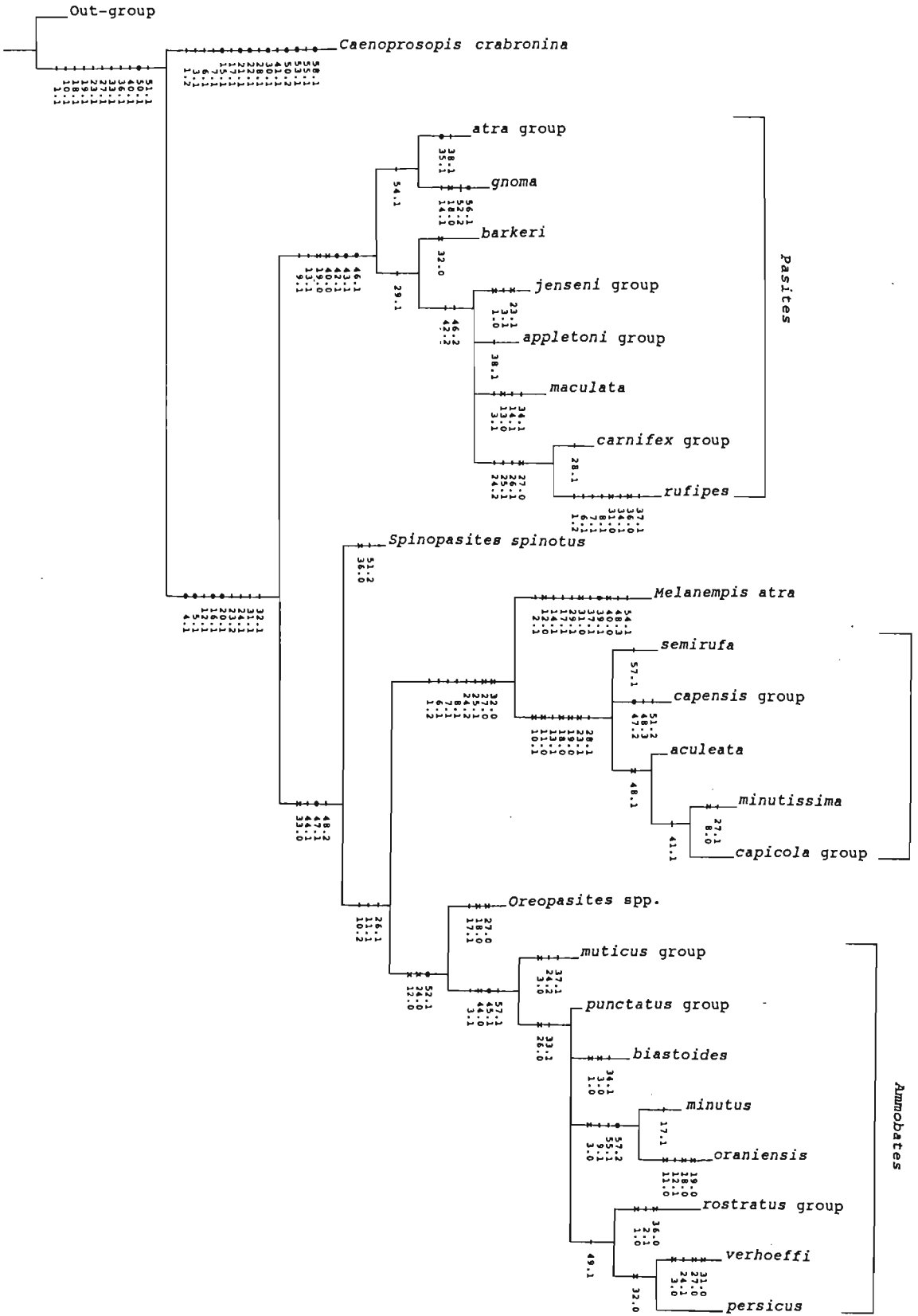
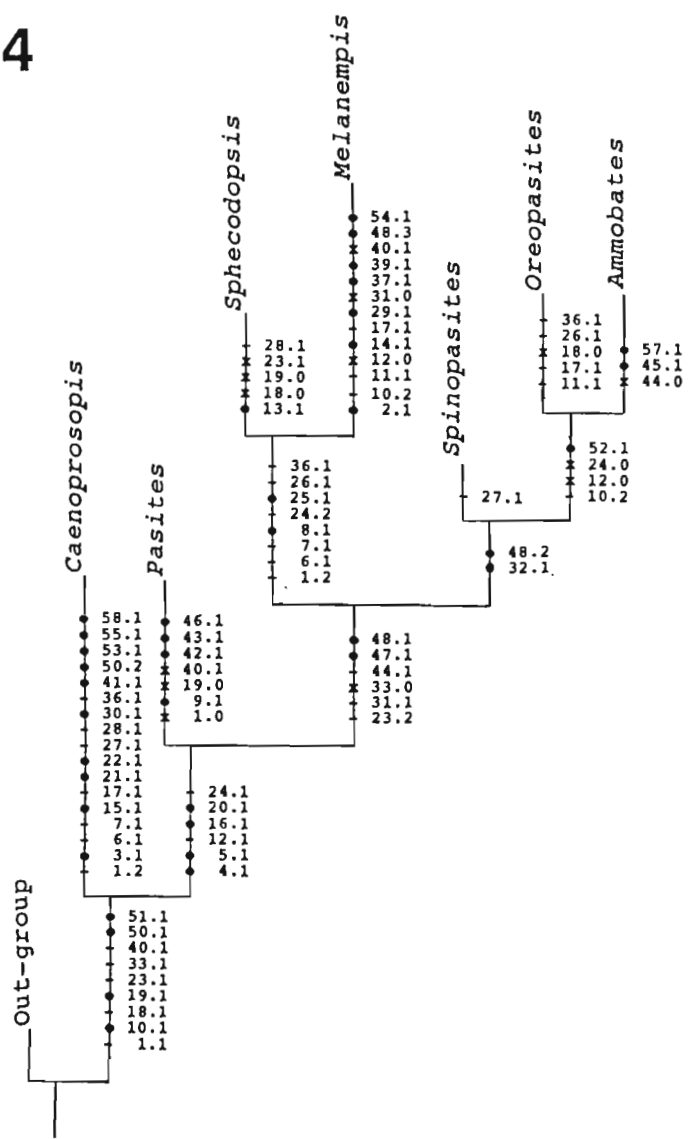


FIG. 4. Single most parsimonious cladogram from analysis of data in Table 3 (genera using adults), without character weighting (raw length 87, consistency index 68, retention index 52). For symbols see Fig. 1

FIG. 5. Single most parsimonious cladogram from analysis of data in Table 5 (genera using larvae), without character weighting (raw length 9, consistency index 100, retention index 100). For symbols see Fig. 1

4



5

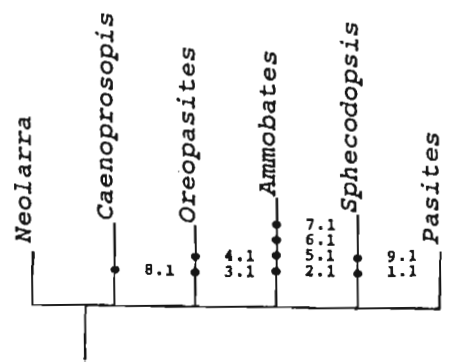
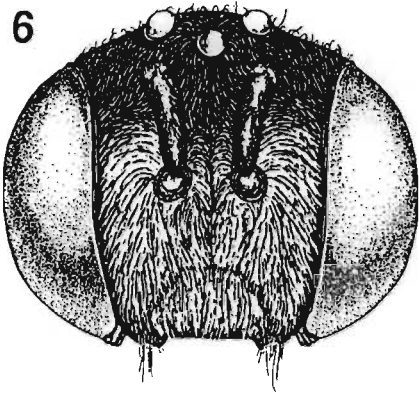
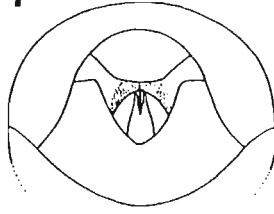


FIG. 6-19. *Pasites* spp. 6-11. *P. barkeri*. 6-8. Female. 6. Head, front view; 7. Terminalia, posterior view; 8. S6; 9-11. Male. 9-10. S7-S8, respectively; 11. Genitalia. 12-14. *P. nilssoni*, male. 12-13. S7-S8, respectively; 14. Genitalia. 15-19. *M. atra*. 15-16. Female. 15. Labrum; 16. Terminalia, posterior view; 17-19. Male. 17-18. S7-S8, respectively; 19. Genitalia

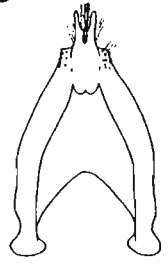
6



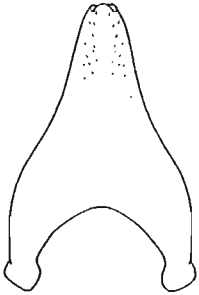
7



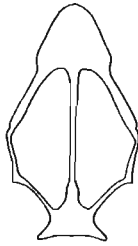
8



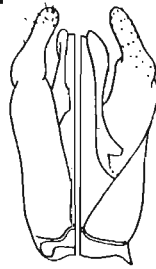
9



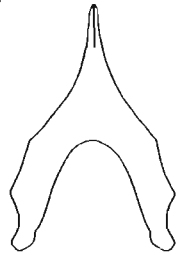
10



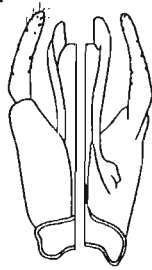
11



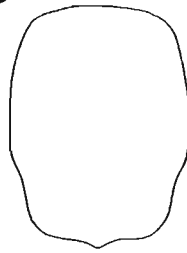
12



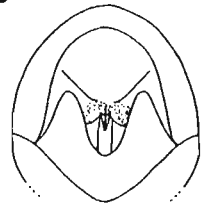
14



15



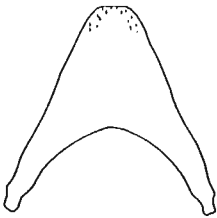
16



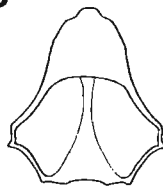
13



17



18



19

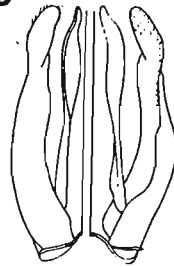


FIG. 20. Africa. The known distribution of *P. barkeri*, ■, *P. ater*, ●, *P. paulyi*, ▲, *P. gnoma*, +, and *P. humecta*, ▼

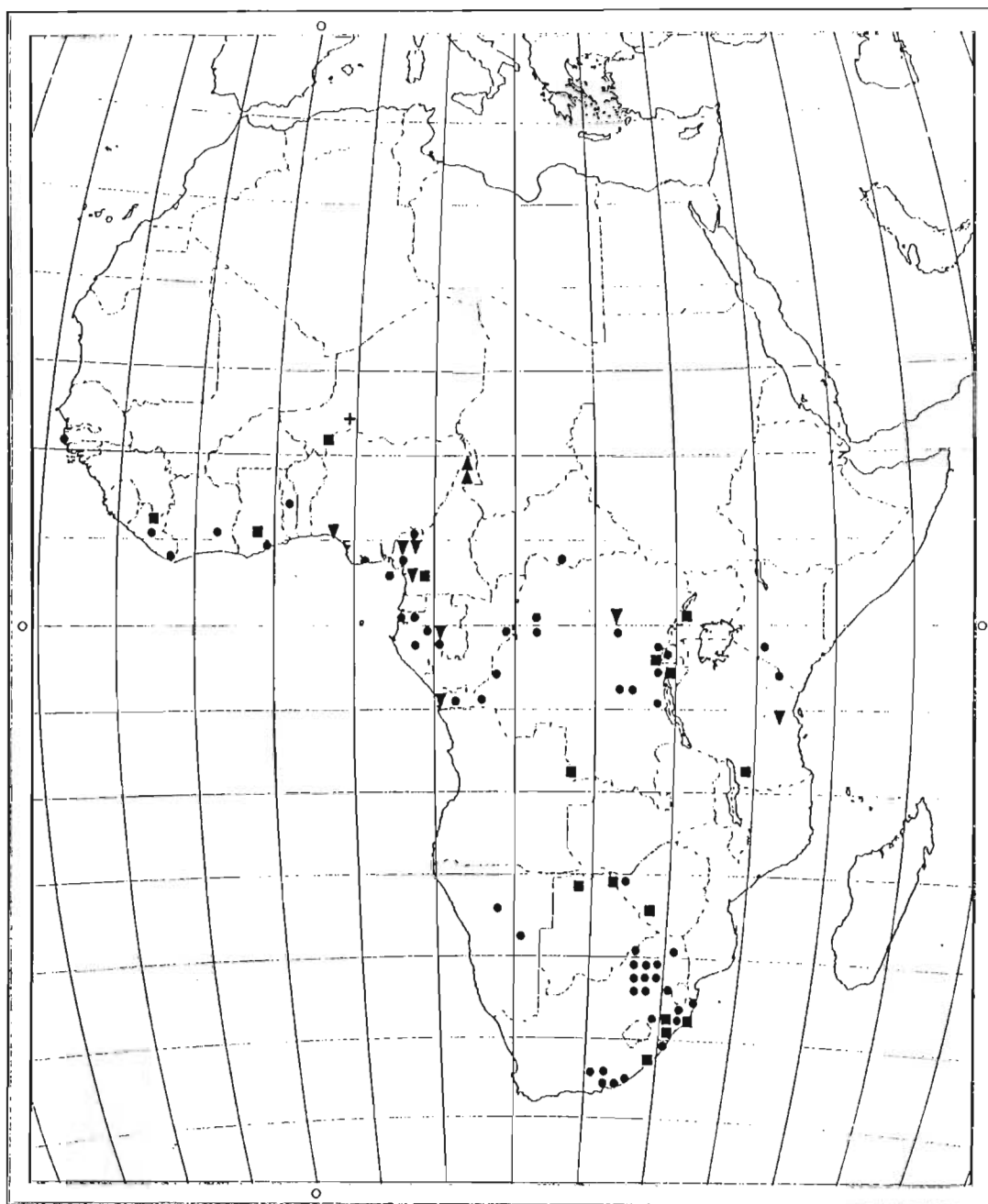
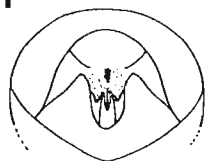
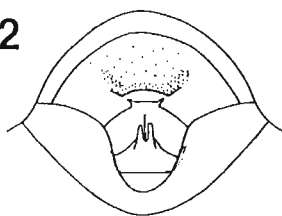


FIG. 21-34. *Pasites* spp. 21. *P. paulyi*, terminalia of female, posterior view; 22-25. *P. humecta*. 22. Terminalia of female, posterior view; 23-25. Male. 23-24. S7-S8, respectively; 25. Genitalia. 26-29. *P. bicolor*. 26. Terminalia of female, posterior view; 27-29. Male. 27-28. S7-S8, respectively; 29. Genitalia. 30. *P. tegularis*, terminalia of female, posterior view. 31-34. *P. gnoma*. 31. Terminalia of female, posterior view; 32-34. Male. 32-33. S7-S8, respectively; 34. Genitalia

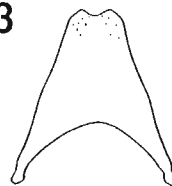
21



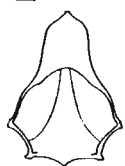
22



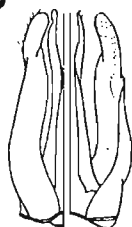
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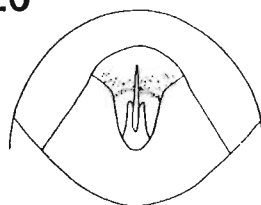
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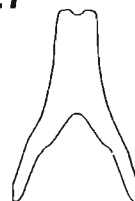
25



26



27



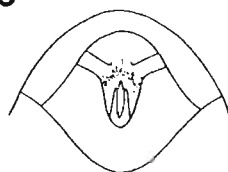
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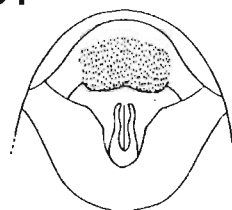
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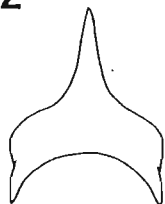
30



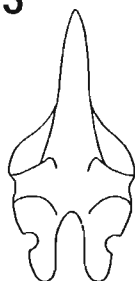
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33



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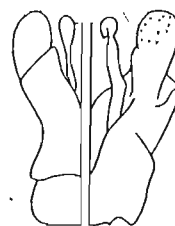


FIG. 35. Madagascar. The known distribution of *P. nilssoni*, ▲, *P. bicolor*, ●, and *P. tegularis*, ■

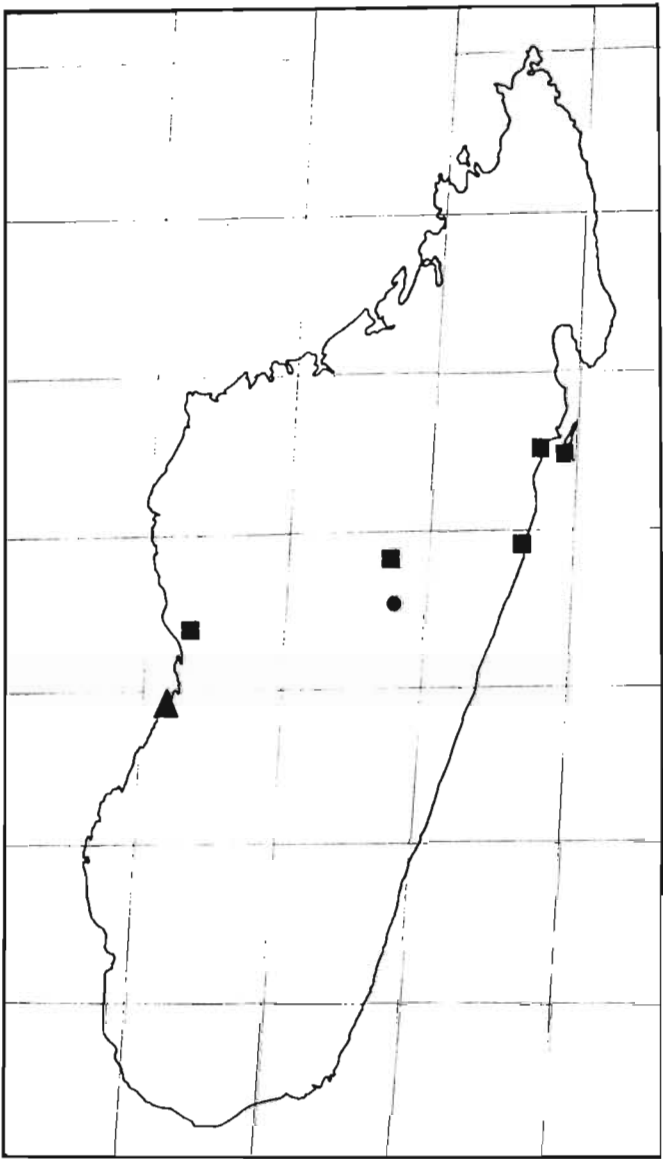


FIG. 36. *Pasites carnifex*, habitus of female, dorsal view (dark shading represents black integument and lightly shaded areas are orange)

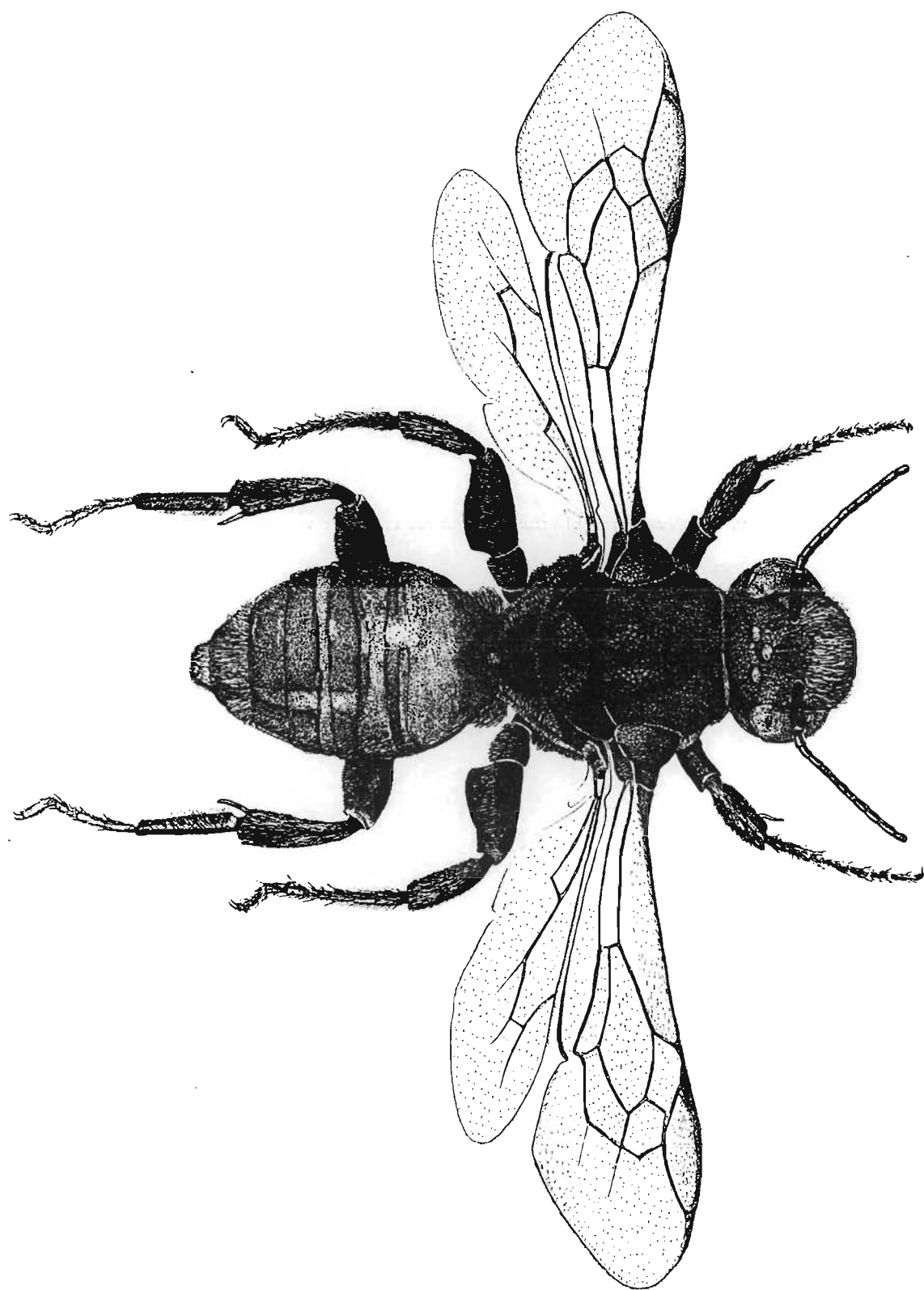
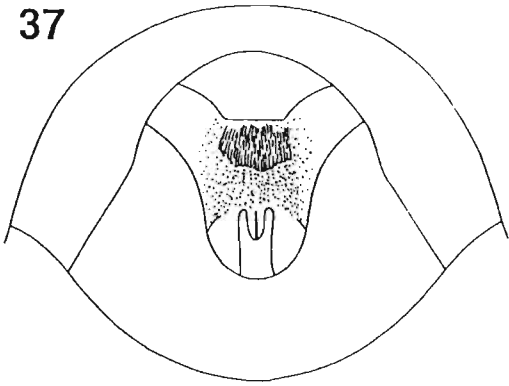
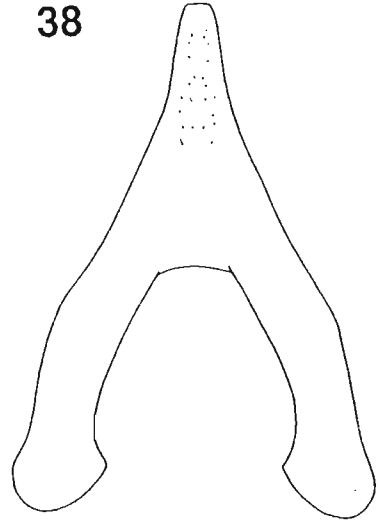


FIG. 37-43. *Pasites* spp. 37-40. *P. carnifex*, terminalia of female, posterior view; 38-40. Male. 38-39. S7-S8, respectively; 40. Genitalia. 41-43. *P. dichroa*. 41. Terminalia of female, posterior view; 42-43. Male. 42. S8; 43. Genitalia

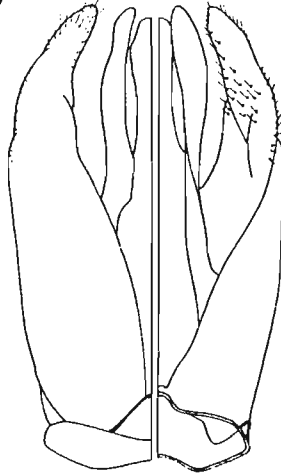
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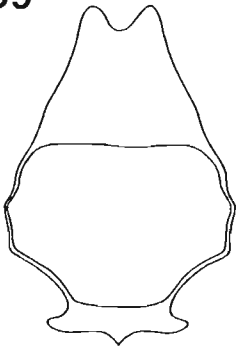
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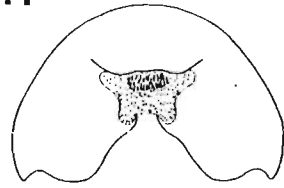
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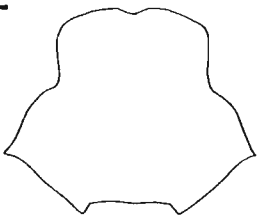
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41



42



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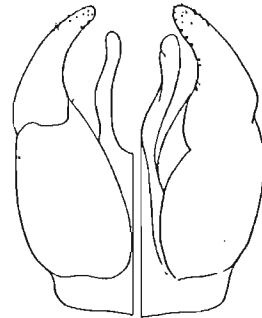


FIG. 44. Africa. The known distribution of *P. carnifex*, ■, *P. dichroa*, ▲, *P. jonesi*, ▼, *P. appletoni*, ●, *P. somalica*, +

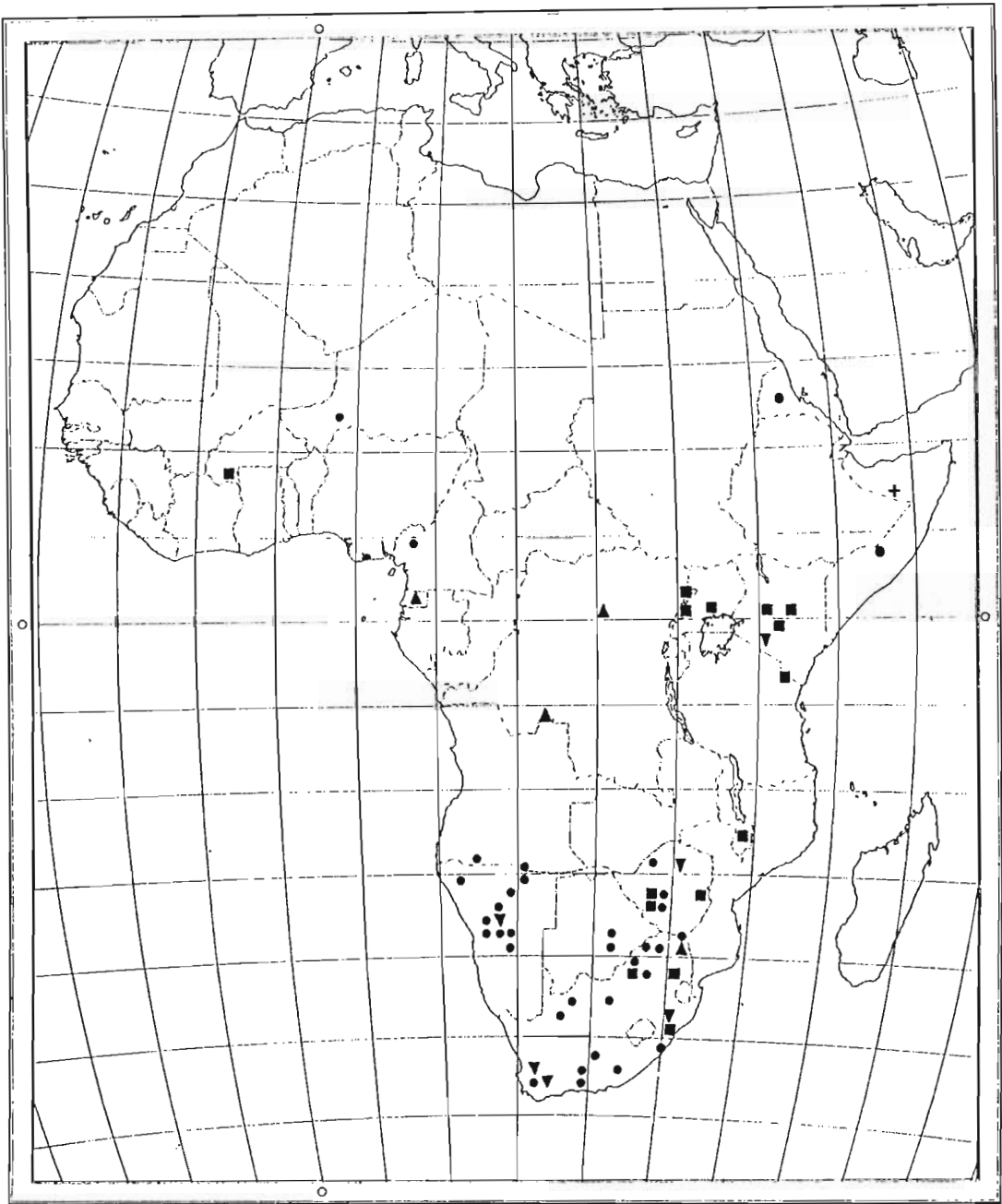


FIG. 45. *Pasites jenseni*, habitus of female, lateral view (integument black and vestiture largely white)

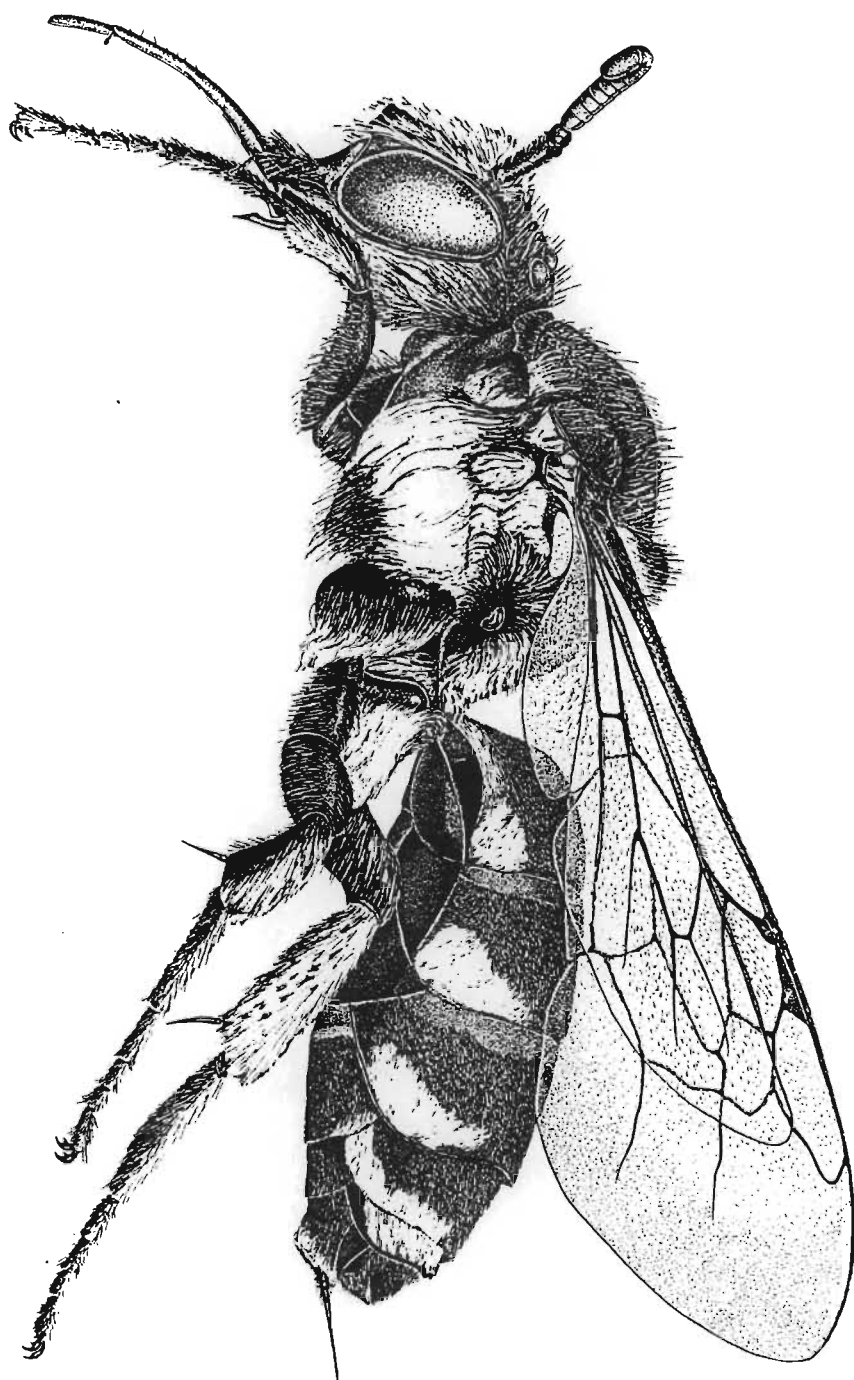
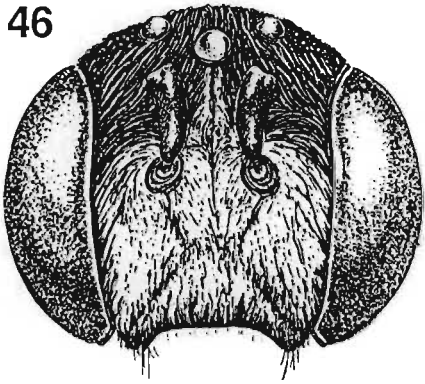
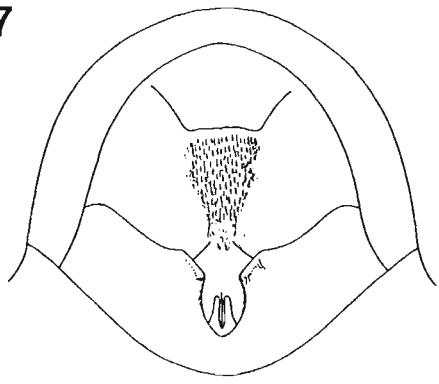


FIG. 46-55. *Pasites* spp. 46-50. *P. jenseni*. 46-47. Female. 46. Head, front view; 47. Terminalia, posterior view; 48-50. Male. 48-49. S7-S8, respectively; 50. Genitalia. 51-53. *P. namibiensis*. 51. Terminalia of female, posterior view; 52-53. Male S7-S8, respectively. 54. *P. jonesi*, terminalia of female, posterior view. 55. *P. rufipes*, terminalia of female, posterior view

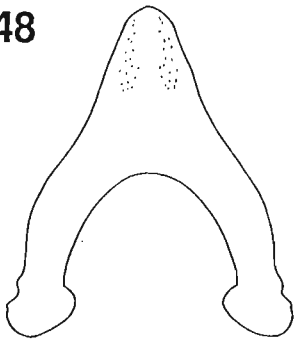
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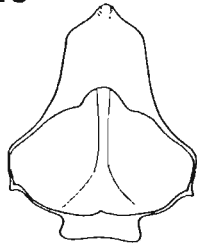
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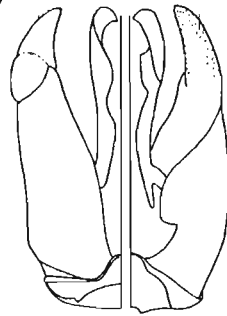
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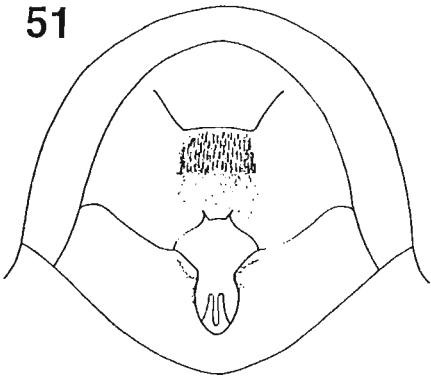
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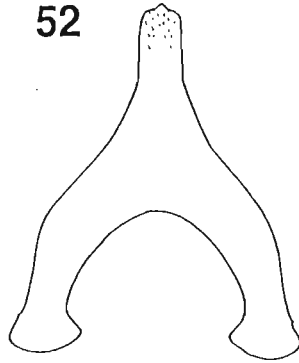
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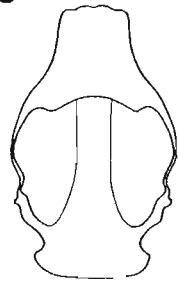
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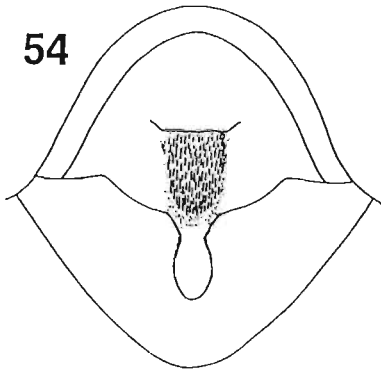
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54



55

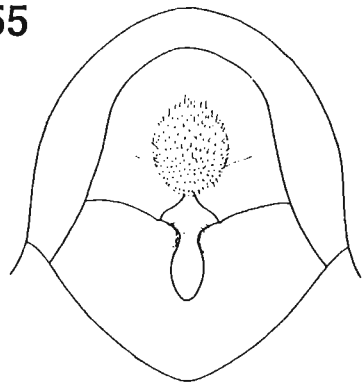


FIG. 56. Southern Africa. The known distribution of *P. jenseni*, +, *P. namibiensis*, ▲, *P. histrio*, ■, and *P. rufipes*, ▼

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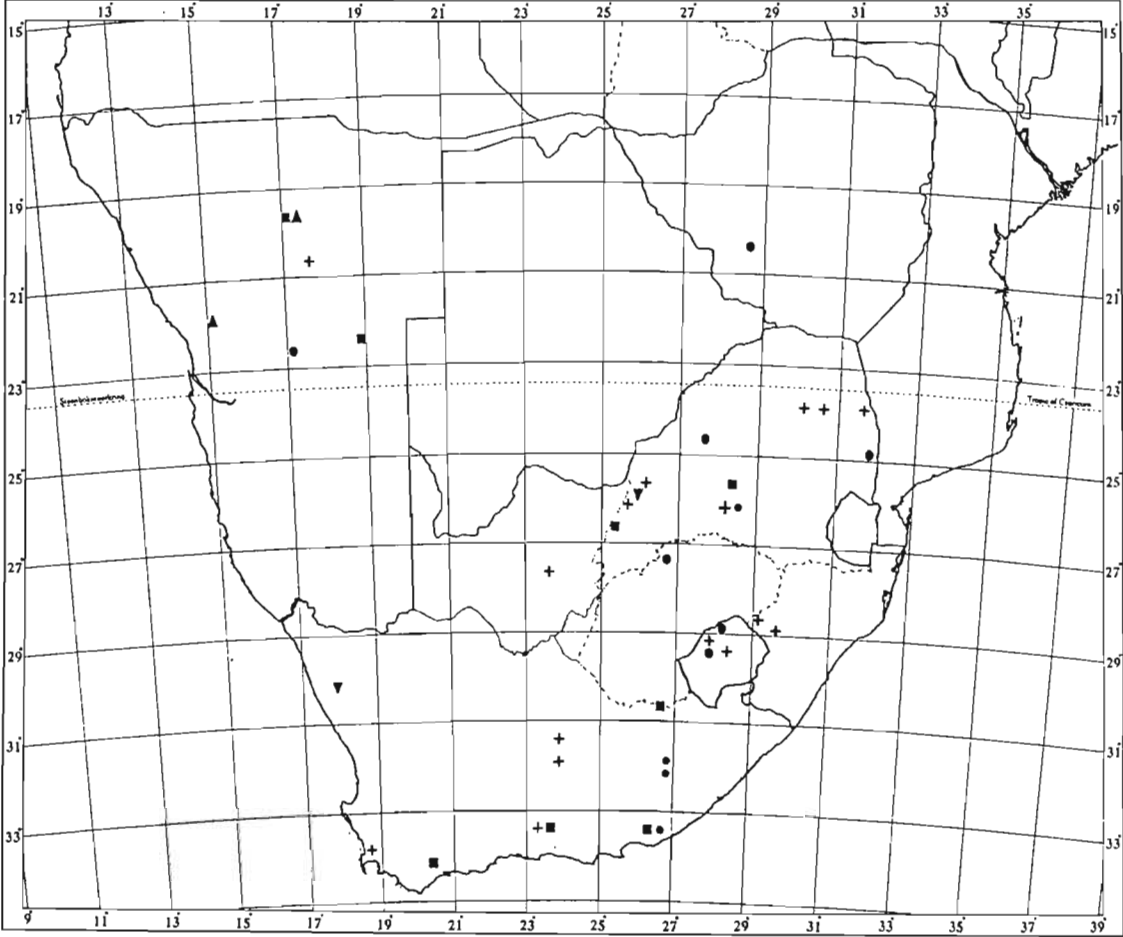


FIG. 57. *Pasites appletoni*, habitus of female, dorsal view (dark shading represents black or blackish integument and lightly shaded areas are orange)

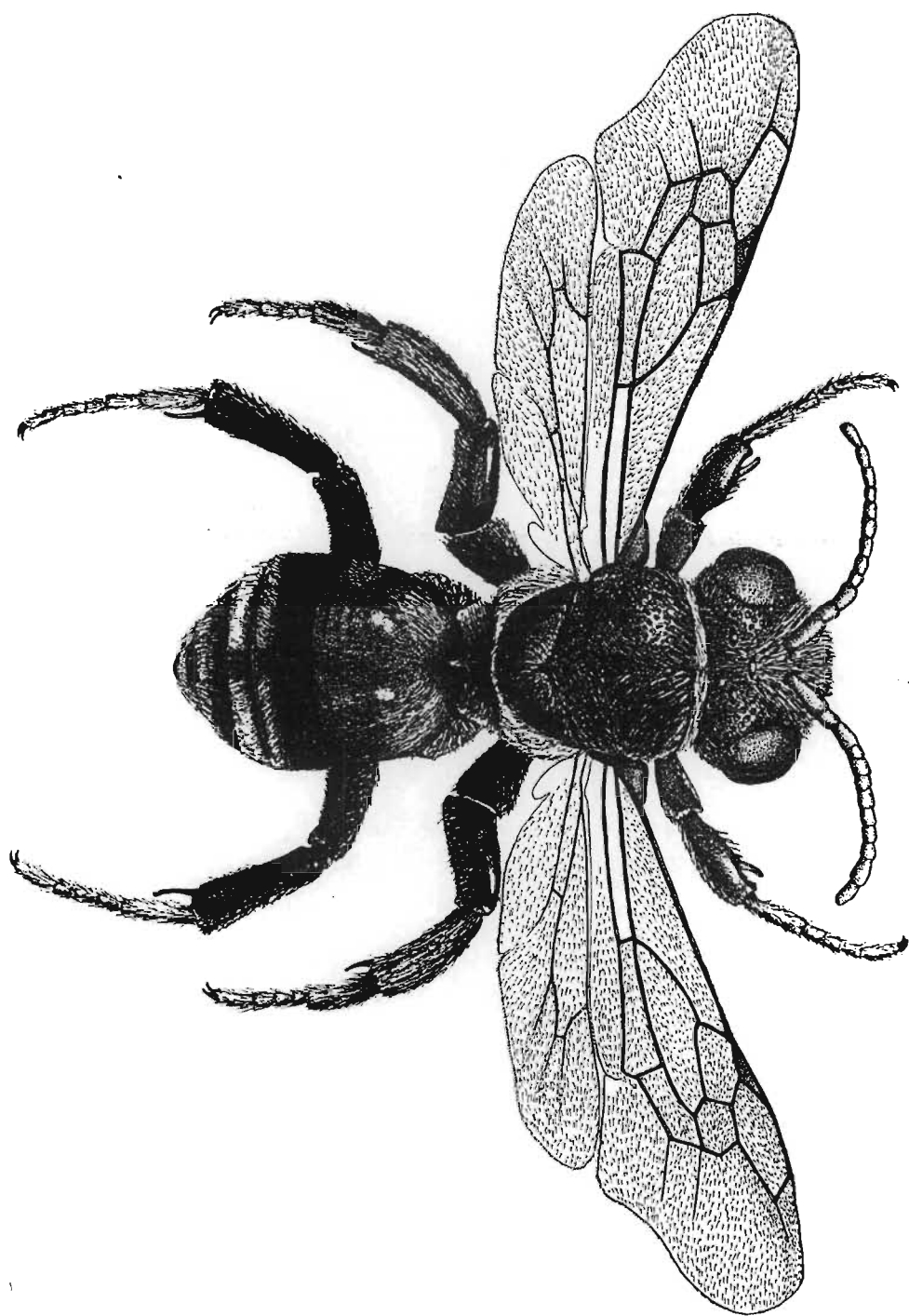
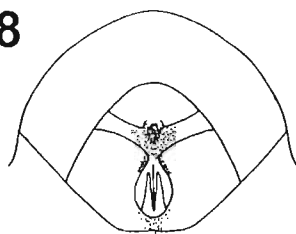
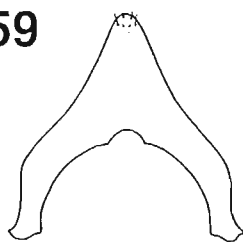


FIG. 58-62. *Pasites* spp. 58-61. *Pasites appletoni*. 58. Terminalia of female, posterior view; 59-61. Male. 59-60. S7-S8, respectively; 61. Genitalia. 62. *P. somalica*, terminalia of female, posterior view

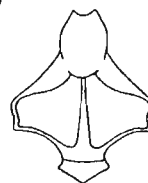
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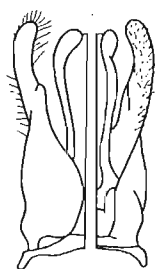
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60



61



62

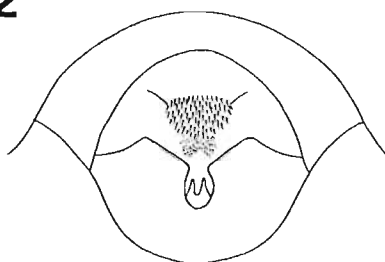


FIG. 63. *Sphecodopsis capicola*, habitus of female, dorsal view (dark shading represents black or blackish integument and lightly shaded areas are reddish)

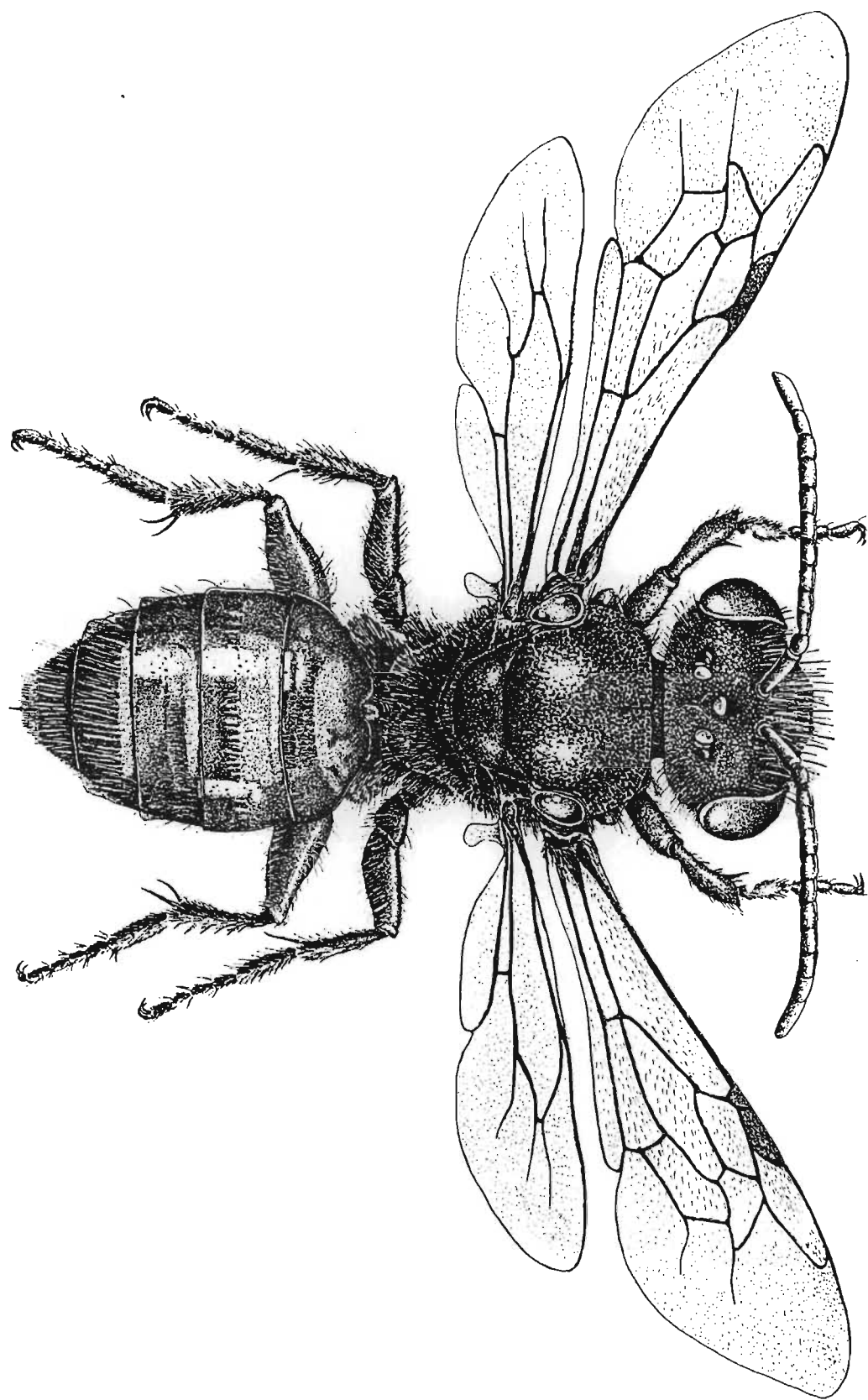


FIG. 64-72. *Sphecodopsis capicola*. 64-67. Female. 64. Head, front view; 65. T5, dorsal view; 66-67. S5-S6, respectively, ventral views; 68-72. Male. 68. T7, lateral view; 69-70. S7-S8, respectively; 71-72. Genitalia. 71. Dorsal and ventral views. 72. Lateral view

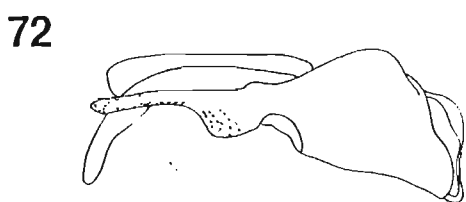
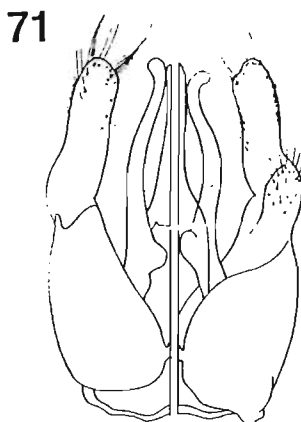
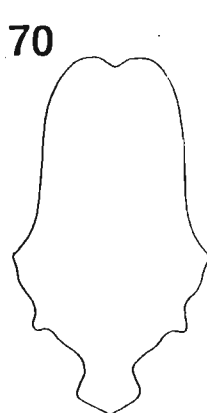
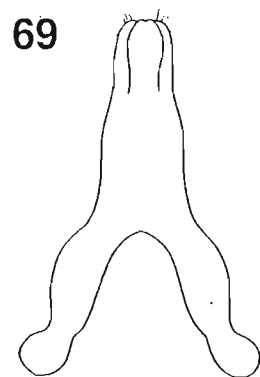
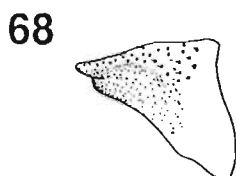
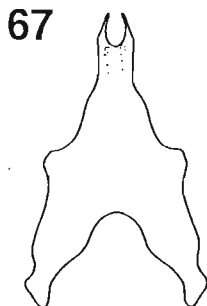
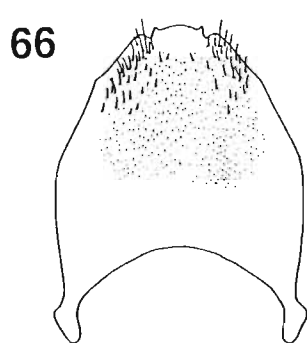
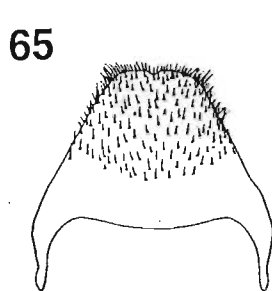
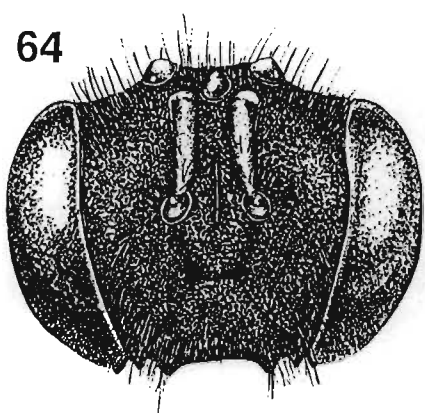
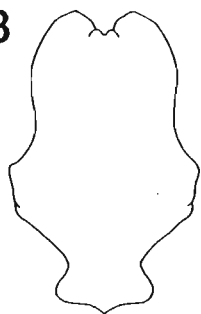
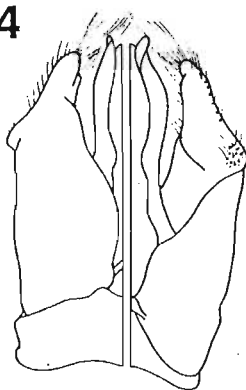


FIG. 73-80. *Sphecodopsis* spp. 73-75. *S. villosa*, male. 73. S8; 74-75. Genitalia; 74. Dorsal and ventral views. 75. Lateral view. 76-80. *S. longipygidium*, female. 76. T5, dorsal view; 77-78. T6, dorsal and lateral views, respectively; 79-80. S5 and S6, respectively, ventral views

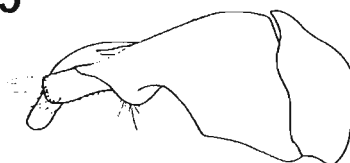
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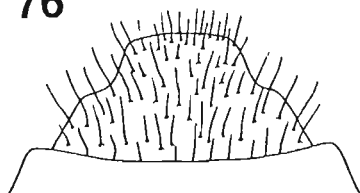
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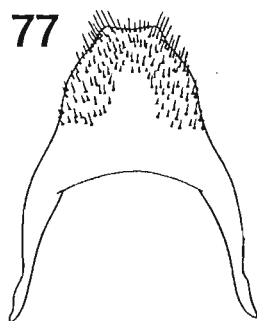
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76



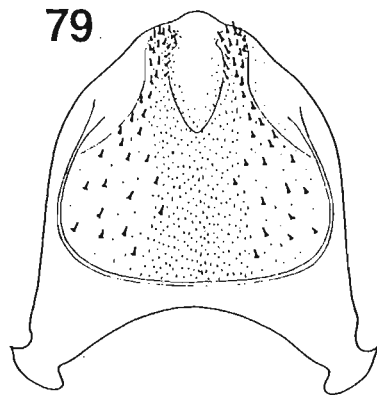
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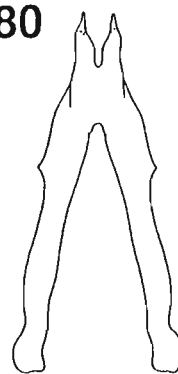


FIG. 81. Southern Africa. The known distribution of *S. capicola*, ■, *S. vespericena*, ●, *S. villosa*, ☒, *S. longipygidium*, ⊞, and *S. namaquensis*, ▲

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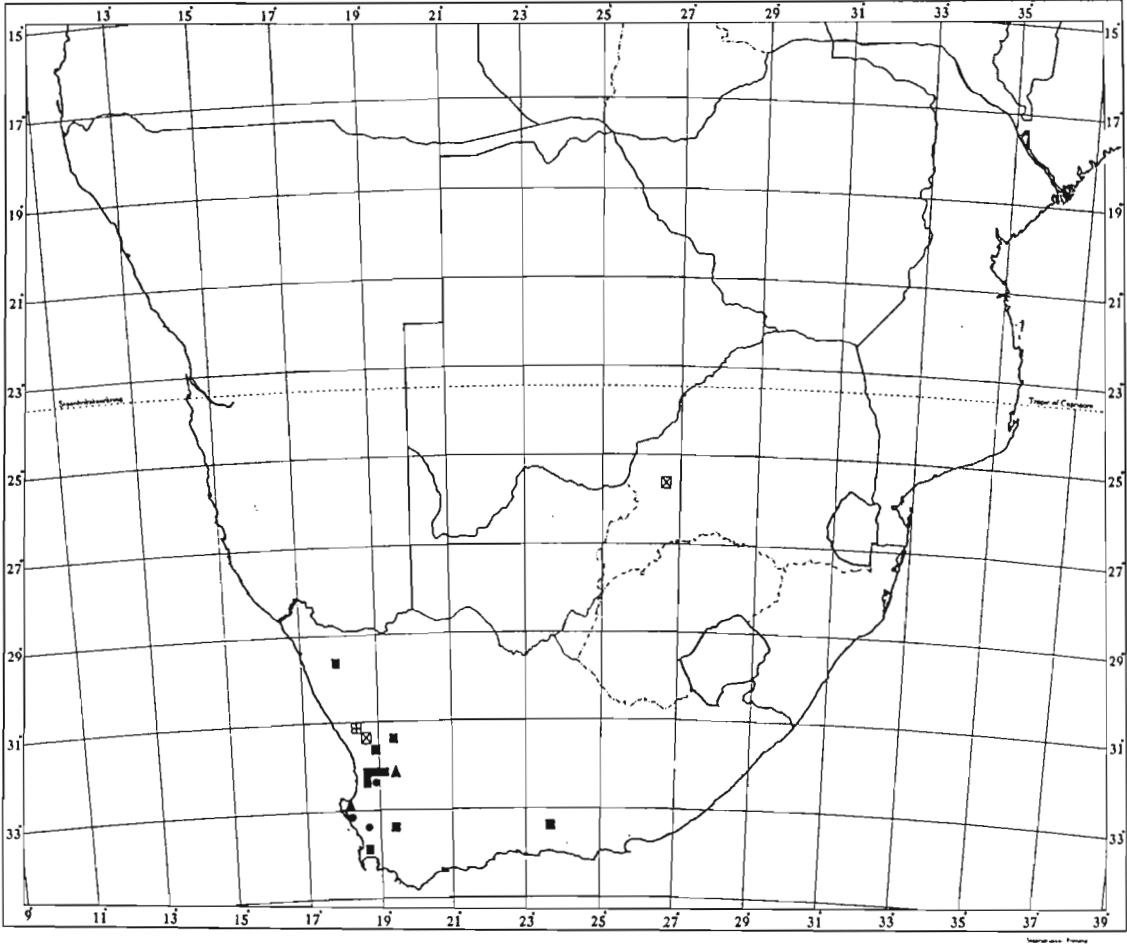


FIG. 82-93. *Sphecodopsis* spp. 82-83. *S. namaquensis*, female S5 and S6, respectively, ventral views. 84-89. *S. minutissima*. 84-85. Female S5 and S6, respectively, ventral views; 86-88. Male. 86-87. S7 and S8, respectively; 88-89. genitalia. 88. Dorsal and ventral views. 89. Lateral view. 90-93. *S. aculeata*, male. 90-91. S7 and S8, respectively; 92-93. Genitalia. 92. Dorsal and ventral views. 93. Lateral view

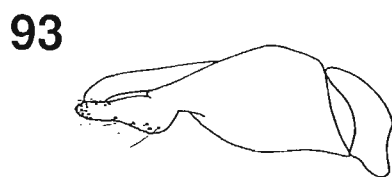
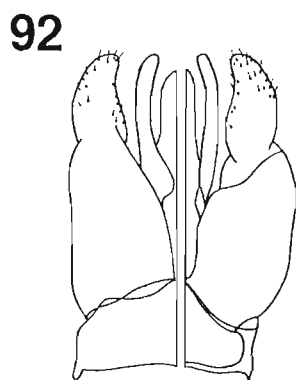
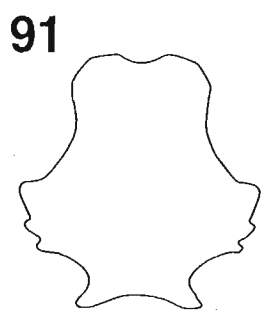
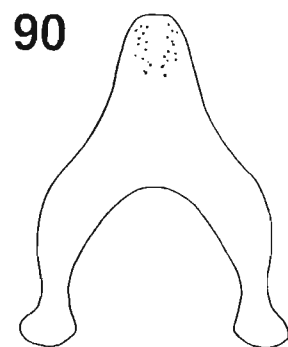
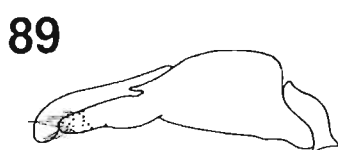
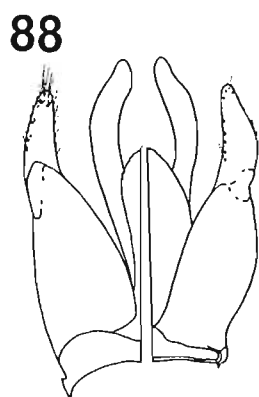
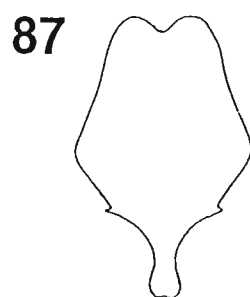
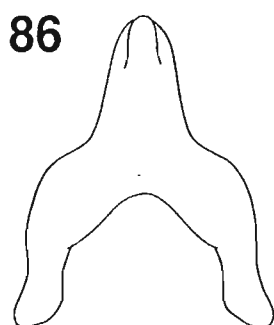
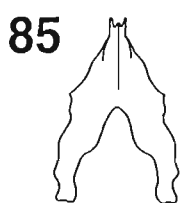
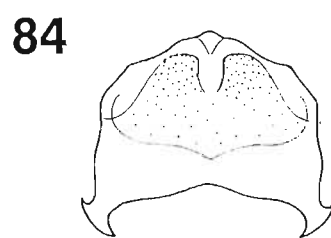
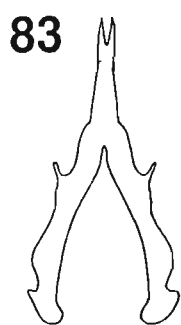
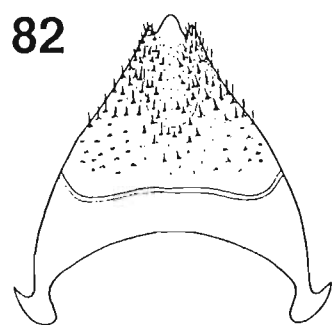


FIG. 94. Southern Africa. The known distribution of *S. minutissima*, ■, *S. aculeata*, ●, *S. semirufa*, ▲, and *A. auster*, ☒

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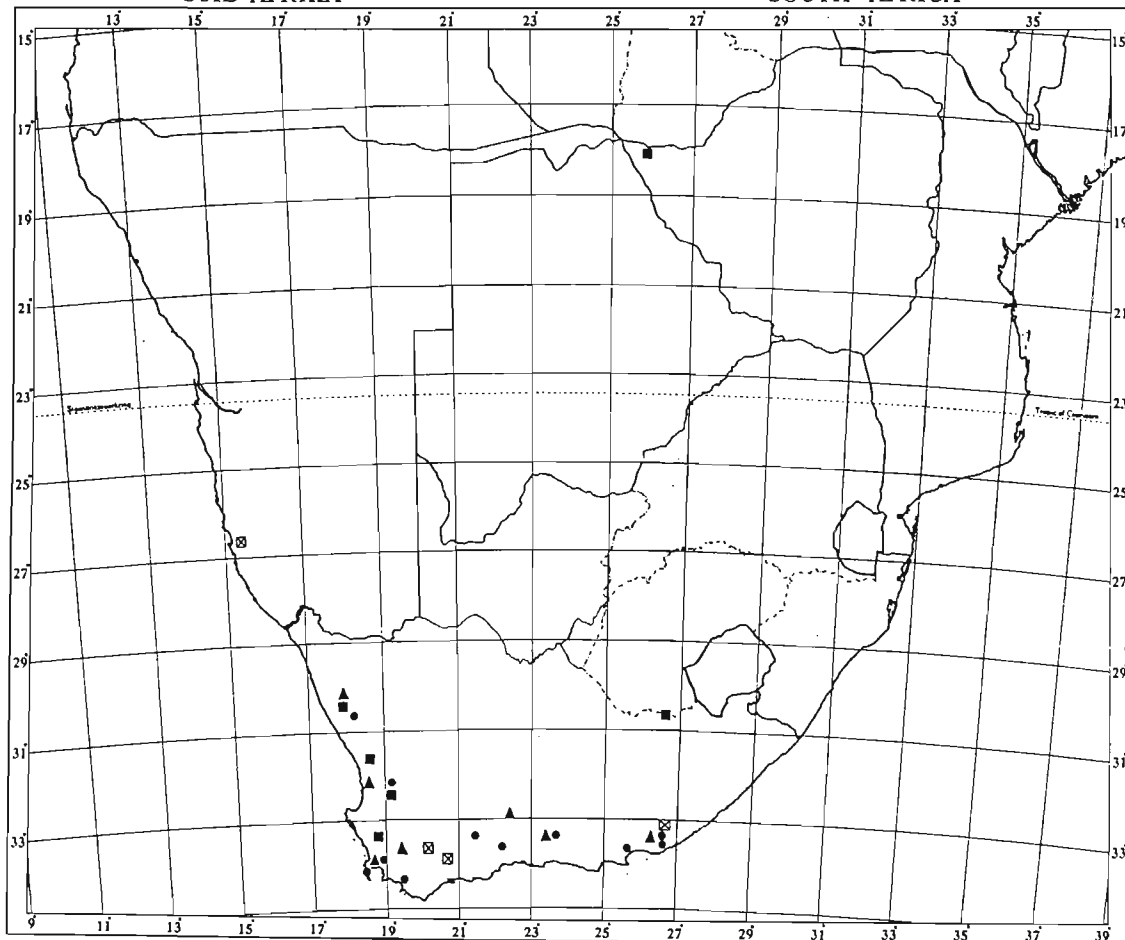
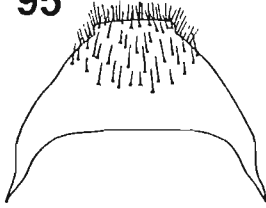
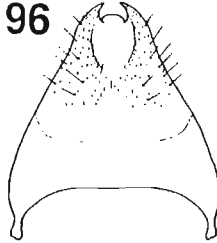


FIG. 95-101. *Sphecodopsis semirufa*. 95-97. Female. 95. T6, dorsal view; 96-97. S5 and S6, respectively, ventral views; 98-101. Male. 98-99. S7 and S8, respectively; 100-101. Genitalia. 100. Dorsal and ventral views. 101. Lateral view

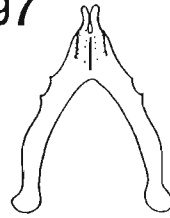
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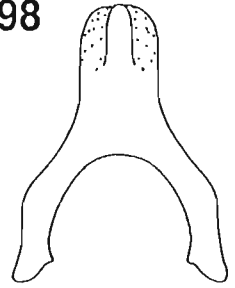
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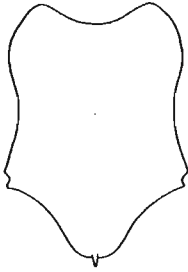
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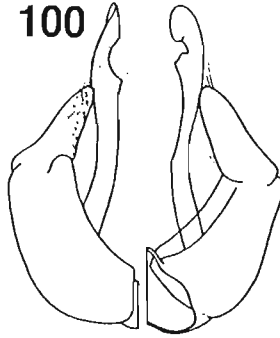
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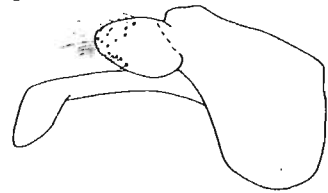
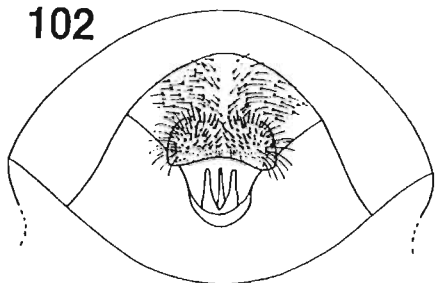
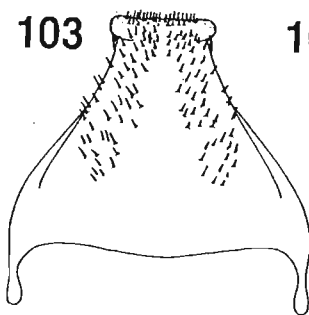


FIG. 102-110. *Ammobates auster*. 102-106. Female. 102. Terminalia, posterior view; 103-104. T6, dorsal and lateral views, respectively; 105-106. S5 and S6, respectively, ventral views; 107-110. Male. 107-108. S7 and S8, respectively; 109-110. Genitalia. 109. Dorsal and ventral views; 110. Lateral view

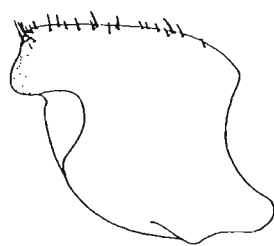
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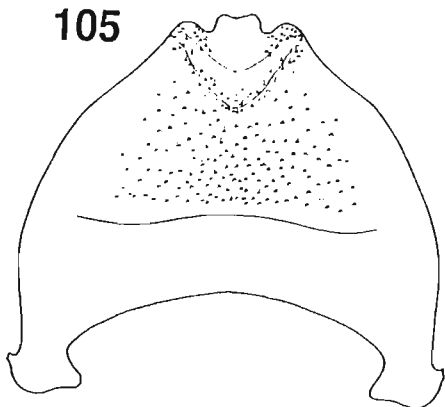
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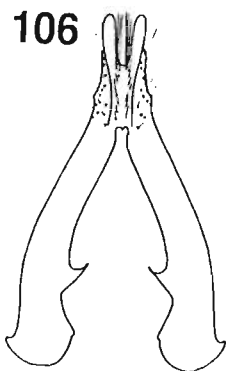
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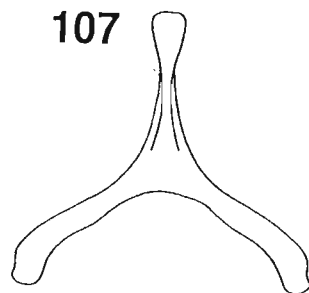
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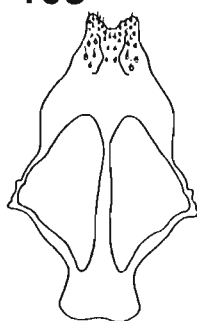
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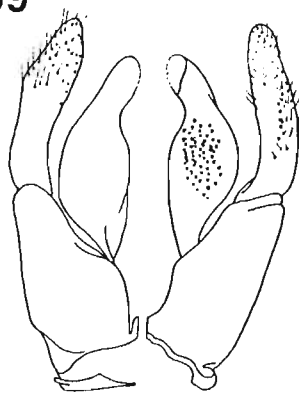
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