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On Palaearctic and Oriental species of the genera *Pseudapis* W. F. KIRBY, 1900, and *Nomiapis* COCKERELL, 1919

(Hymenoptera, Halictidae, Nomiinae)

With 20 figures

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Summary

A phylogenetic analysis of Palaearctic and Oriental nomiine bees conventionally assigned to the genus-group taxa *Pseudapis* W. F. KIRBY, 1900, and *Nomiapis* COCKERELL, 1919, supports the recognition of two genera. A synoptic catalogue of the regional species is provided and new synonymy is established. Certain names in common use are shown to have been misapplied. In particular, *Pseudapis nilotica* (SMITH, 1875) and *Nomiapis bispinosa* (BRULLÉ, 1832) are shown to be the correct names for the species currently treated as *armata* (OLIVIER) and *unidentata* (OLIVIER) respectively, both misidentified species. *Nomia armata* OLIVIER, 1812, is a subjective senior synonym of *N. monstrosa* COSTA, 1861, **syn. nov.**, and *N. unidentata* OLIVIER, 1812, while a nomiine, is referable neither to *Pseudapis* nor to *Nomiapis*. The following additional synonymy (in date order) is established: *Nomiapis bispinosa* (BRULLÉ, 1832) = *Nomia basalis* SMITH, 1875; *Pseudapis oxybeloides* (SMITH, 1875) = *Nomia latispina* CAMERON, 1898 = *Nomia lepidota* COCKERELL, 1905 = *Nomia biroi* FRIESE, 1913; *Pseudapis edentata* (MORAWITZ, 1876) = *Nomia orientana* WARNCKE, 1976 = *Nomia orientana negevensis* WARNCKE, 1976 = *Pseudapis guichardi* (PAULY, 1990); *Steganomus nodicornis* (SMITH, 1875) = *Nomia matalea* STRAND, 1913; *Pseudapis siamensis* (COCKERELL, 1929) = *Nomia umesaoi* SAKAGAMI, 1961 = *Nomia megalobata* WU, 1983, **synn. nov.** *Nomia* (*Paranomia*) *lutea* WARNCKE, 1976 is transferred to *Leuconomia*, *Nomia* (*Clavinomia*) *clavicornis* WARNCKE, 1980, to *Austro-nomia*, both **comb. nov.** Lectotype designations are made for *Nomia oxybeloides* Smith, 1875; *Cyathocera nodicornis* SMITH, 1875; *Nomia latispina* CAMERON, 1898; *Nomia biroi* FRIESE, 1913; and *Nomia matalea* STRAND, 1913. Additional species from NE Africa and SW Asia are described: *Pseudapis fayumensis*, *Ps. stenotarsus*, *Nomiapis kophenes*, *N. carcharodonta* **spp. nov.** A key to the ♂♂ of the regional species is provided. Biological information on *Nomiapis diversipes* (LATREILLE, 1806) and *Pseudapis nilotica* (SMITH, 1875) is appended.

Additional keywords

taxonomy – synonymy - biodiversity - Egypt - United Arab Emirates - Afghanistan - India - *Pseudapis fayumensis*, *Pseudapis stenotarsus*, *Nomiapis carcharodonta*, *Nomiapis kophenes*, **spp. nov.**

Zusammenfassung

Eine phylogenetische Analyse paläarktischer und orientalischer Nomiinae bestätigt die bisher übliche Praxis, sie zwei Gattungen, *Pseudapis* W. F. KIRBY, 1900, und *Nomiapis* COCKERELL, 1919, zuzuordnen.

Ein regionaler synoptischer Katalog wird erstellt. Einige in Gebrauch befindliche Namen wurden bisher fehlgedeutet. Insbesondere gilt dies für *Pseudapis nilotica* (SMITH, 1875) und *Nomiapis bispinosa* (BRULLÉ, 1832), für die bislang fälschlich die Namen *armata* (OLIVIER) bzw. *unidentata* (OLIVIER) verwendet wurden. *Nomia armata* OLIVIER, 1812, ist ein älteres subjektives Synonym von *N. monstrosa* COSTA, 1861, **syn. nov.**; *N. unidentata* OLIVIER, 1812 gehört zwar zu den Nomiinae, kann aber weder *Pseudapis* noch *Nomiapis* zugerechnet werden. Die folgenden weiteren Synonymien werden erkannt (nach Datum geordnet): *Nomiapis bispinosa* (BRULLÉ, 1832) = *Nomia basalis* SMITH, 1875; *Pseudapis oxybeloides* (SMITH, 1875) = *Nomia latispina* CAMERON, 1898 = *Nomia lepidota* COCKERELL, 1905 = *Nomia biroi* FRIESE, 1913; *Pseudapis edentata* (MORAWITZ, 1876) = *Nomia orientana* WARNCKE, 1976 = *Nomia orientana negevensis* WARNCKE, 1976 = *Pseudapis guichardi* (PAULY, 1990); *Steganomus nodicornis* (SMITH, 1875) = *Nomia matalaea* STRAND, 1913; *Pseudapis siamensis* (COCKERELL, 1929) = *Nomia umesaoi* SAKAGAMI, 1961 = *Nomia megalobata* WU, 1983, **syn. nov.** *Nomia* (*Paranomia*) *lutea* WARNCKE, 1976 wird in die Gattung *Leuconomia*, *Nomia* (*Clavinomia*) *clavicornis* WARNCKE, 1980, in die Gattung *Austronomia* gestellt, beide **comb. nov.** Für *Nomia oxybeloides* SMITH, 1875, *Cyathocera nodicornis* SMITH, 1875, *Nomia latispina* CAMERON, 1898; *Nomia biroi* FRIESE, 1913; und *Nomia matalaea* STRAND, 1913 werden Lektotypen designiert. Aus Nordostafrika und Südwestasien werden beschrieben: *Pseudapis fayumensis*, *P. stenotarsus*, *Nomiapis kophenes*, *N. carcharodonta* **spp. nov.** Eine regionale Bestimmungstabelle wird vorgelegt. Für *Nomiapis diversipes* (LATREILLE, 1806) und *Pseudapis nilotica* (SMITH, 1875) werden biologische Daten angefügt.

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INTRODUCTION

General

Enlarged tegulae are exceptional among bees, but are found in a few Megachilidae (Anthidiinae: *Afrostelis*) and in a number of Halictidae (Nomiinae) belonging especially to the genera *Steganomus* RITSEMA, 1873, *Pseudapis* W. F. KIRBY, 1900, *Stictonomia* CAMERON, 1905, *Nomiapis* COCKERELL, 1919, *Pachynomia* PAULY, 1980, and *Ruginomia* PAULY, 1990. *Steganomus*, with few species, is palaeotropical; vein 1 r-m is lost and the antennae in the males are capitate. *Pseudapis* occurs throughout the southern Palearctic, from northwest Africa and the Iberian Peninsula to China and Japan, southwards throughout the Ethiopian Region, and southwards again into southwest, south, and continental southeast Asia; a single record from Australia (*Nomia lepidota* COCKERELL) was based on mislabelled material. *Nomiapis* is palaeartic, with one widespread species occurring in North Africa but not penetrating south of the Sahara and one anomalous species in southern India. *Pseudapis* and *Nomiapis* are separated by certain characters noticed by PAULY (1990) and by a number of other characters not noticed by him (*vide infra*). *Stictonomia*, *Pachynomia* and *Ruginomia* are Ethiopian and do not extend north of the Sahel, but the last-named is perhaps not generically separable from *Pseudapis*: in particular, such characters as the shape of the basitibial plate in the female and the reduction of the marginal fasciae of the terga in the male appear to have been overvalued.

Male structural modifications

The species of *Pseudapis* and *Nomiapis* are strongly sexually dimorphic. Outgrowths or other structural modifications in the males affect variously the antennae, the scutellum, the mesepisterna and pseudosternum, all segments of the legs (the posterior femora and

tibiae especially, sometimes also the basitarsi, may, as frequent among nomiines, be grotesquely modified) and the metasomal terga and sterna (Figures 1 and 2). The purposes of these modifications, whose permutations are regularly species-specific and which may also, individually, be immediately diagnostic, are enigmatic but species-recognition, intra-specific display or competition, and mating functions could conceivably be involved.

Either for species-recognition or for intra-specific display, the latter whether related to competition between males or related to selection exercised by females, the first requirement for any structural signal would logically appear to be that it should be conspicuous, or should be capable of being made conspicuous, whether by size, shape, colour, location or movement. For intra-specific display, any structural signal should also show recognizable variation within populations.

As to species-recognition, the more or less expanded and contrastingly coloured mid-distitarsi of many species of *Pseudapis*, subtended by slender or even attenuated proximal tarsomeres, meet the conspicuity criterion and may well serve for species recognition. In species of the chiefly Ethiopian *anomala* group the signal given by the mid-distitarsi is amplified by the presence of a dense and conspicuous bilateral fan of black hairs (Figure 3), presumably homologous with that in numerous species of *Anthophora* (Anthophoridae) (Figure 3-5). The dilated and contrastingly coloured apical antennal segment of *Pseudapis fayumensis* (Figure 1) may serve a similar purpose. Most of the more bizarre structural modifications observed in *Pseudapis* and *Nomiapis* are, however, hardly so located as to attract attention, and presumably, whatever their function, do not serve as recognition signals. It is difficult to accept that such characters as the wing-like pseudosternal apophyses in *kophenes*, the nodose anterior trochanters in *rufescens* or the dagger-like processes of the posterior trochanters in *carcharodonta* could be perceptible in normal flight or resting attitudes and constitute recognizable visual signals. Further, the number and extent of the various modifications exhibited by individual species would appear, *a priori*, to be excessive for that purpose in the low-diversity (paucispecific) regional assemblages characteristic of the genera concerned, and it would seem unreasonable to predicate the former existence of high-diversity (multispecific) assemblages.

As to intra-specific display, personal observation of species of *Pseudapis* (chiefly *nilotica*) and *Nomiapis* (chiefly *diversipes*) has not suggested either that there is male competition into which visual factors may enter or that there is any visual component to eventual mating: pairing between a female and one of several males that may have responded to the (presumed) release of a pheromone would appear to take place either entirely haphazardly or perhaps as the result of a trial of strength or persistence on the part of the males. Further, where adequate samples have been available for study, little or no perceptible intra-population variation in the structures under consideration has been observed (other than, in some species, a small degree of variation in the development of the male scutellar spines). Far greater differences in appearance between individuals simultaneously on the wing result from normal rapid ageing processes such as fading and abrasion. The purpose that has been postulated for various conspicuous outgrowths in fossil and recent members of several higher vertebrate taxonomic categories, that they are to be interpreted as adaptations for intra-specific display - as visual mating symbols - would appear inapplicable to the group now in question, where, as already emphasized, the often bizarre structural modifications are far from prominently sited and often semi-concealed.



Fig. 1. *Pseudapis fayumensis* sp. nov., ♂, showing truncate anterior process of tibia and compressed and sinuate basitarsus of posterior leg. Holotype, EGYPT: Fayum, Karanis, 15 vi 1990 (C.G. Roche). [Neg. 121.18]



Fig. 2. *Nomiapis carcharodonta* sp. nov., ♂, showing dentiiform process of trochanter, inflated femur and contracted tibia of posterior leg. Holotype, INDIA: Kerala / Tamil Nadu, Walayar Forests, vi 1957 (P.S. Nathan). [Neg. 156.4]

As to functions in actual mating, unless the process varies very greatly from species to species, a supposition which the monotonous uniformity of structure among the females does not support, it is difficult to understand why so wide a range of frequently extreme structural modifications should be found in quite a small group of taxa: the position in *Pseudapis* would appear to be quite other than that found in the large genus *Megachile* (Megachilidae), where a single striking modification may be shared by a number of species. [The expanded and densely fringed anterior tarsus found in the males of many species has been interpreted as serving to blindfold the female during copulation. There appears to be a considerable danger of reading too much into too few, and too little understood, observations. There are other species in which they are the intermediate tarsi and not the anterior tarsi that are strongly fringed, and there are of course many *Megachile* in which other types of structural modification occur, either independently or in association, affecting, for example, the anterior coxa, or that part of the genal area adjacent to the proboscis fossa, for whose purposes anthropomorphic explanations have not yet been offered.]

Previous studies

The species of *Pseudapis* and *Nomiapis* of the Palaearctic Region were covered by FRIESE's dated but still useful monograph (1897). A travesty of a revision, with grotesque figures,¹ of the species of *Nomia* (including under that name several genus-group taxa described subsequently to FRIESE's monograph) of the western Palaearctic and the Turkestan basin, was published by WARNCKE in 1976, with addenda in 1979 and 1980. It is not proposed to devote time to a detailed critique of WARNCKE's papers, some of his numerous errors being dealt with individually below under the species concerned. It may however be noted that *Lobonomia* WARNCKE, 1976, is a subjective synonym of *Pseudapis* W.F. KIRBY, 1900; that *Nomia lutea* WARNCKE, 1976, referred by him to *Paranomia* MICHENER, 1944, treated as a subgenus of *Nomia*, belongs to *Leuconomia* PAULY, 1980 (**comb. nov.**); and that *N. clavicornis* WARNCKE, 1980, treated by him as the type species of a new subgenus *Clavinomia*, belongs to *Austronomia* MICHENER, 1965 (**syn. nov., comb. nov.**), being in fact related to the Indian species *sykesiana* (WESTWOOD, 1875) and other Indian species probably undescribed. The African species of *Pseudapis* and *Nomiapis*, including those of palaearctic Africa, were treated by PAULY (1990) [minor textual corrections by PESENKO, 1997]. There have been no recent comprehensive treatments of the extra-African species. VAN DER ZANDEN (1997) published records of a number of western palaearctic species. His nomenclature followed WARNCKE and he was apparently ignorant of PAULY's paper; his identifications are not reliable.²

¹ Compare WARNCKE's Figure 11 (1976), for example, with GUIGLIA's Figure 1 (1932) or SAVIGNY's Figure 20d (1809-1813).

² VAN DER ZANDEN, for example, treated *Pseudapis* 'armata Ol.' [*nilotica* (Smith)] as comprising two subspecies, *Ps. armata armata* with a range extending from Morocco through the Sudan to northern Iran and *Ps. armata latipes* with a range extending from Tunisia and Libya through Jordan to Turkmenistan. What VAN DER ZANDEN's material of these 'subspecies' actually comprised could be determined only from a study of his material. It may further be noted that VAN DER ZANDEN's spellings of place-names are frequently incorrect, and that the names of collectors were entirely suppressed.

Intentions

The purposes of the present study were limited. They were, firstly, to ascertain whether the recognition at generic level of the two genus-group taxa *Pseudapis* and *Nomiapis* might be supported by a phylogenetic analysis of a substantial proportion of the included species-group taxa; secondly, to re-define the two genera, if so recognized, in such a way as to enable the appropriate placement of all species that might be assigned to the *Pseudapis* / *Nomiapis* complex; thirdly, to provide a provisional, annotated list of the described species-group taxa, other than the Ethiopian forms dealt with by PAULY; fourthly, to provide descriptions of new regional species; and, fifthly, to provide a key to the regional species.

It was not a purpose of the phylogenetic analysis to provide a basis for a classification of all the regional species, for which in any event adequate material was and remains lacking, but, more particularly, to enable the placement in the most appropriate context of certain anomalous species that had long been known but which had remained undescribed. Some of these species present characters that are remarkable additions to the train of characters displayed in the hitherto known members of the group; others extend the range of variation in certain characters beyond that observed in the previously known species. In either instance the modifications are of course usefully diagnostic.

The analysis was based on the males. Females of *Pseudapis* and *Nomiapis* lack the many structural and other modifications of the males and the characters by which they may be separated, as, for example, tegula-shape and surface sculpture, are often subtle and not readily expressed in words. However, where species of *Pseudapis* do occur they commonly occur in numbers, and females may usually be determined by association, confirmed by the comparison of minor details of structure and sculpture, those of the tegulae, of the mesoscutum and of the basal area of the propodeum being commonly the most useful: fortunately, in the region under consideration, it is unusual to find more than a very few similar species flying together. It may be noted that PAULY (1990) found recognition of many females in the large sub-Saharan fauna impossible and recorded composite material under species-groups.

Annotations in the list of species include for some species diagnostic information, particularly when apparent autapomorphies are not particularized in the schedule of characters (Appendix 2) or are not referred to in published descriptions.

The key to regional species is an artificial key. It is intended for non-specialists and relies exclusively on characters whose observation requires no special preparation of material. The relationships of specimens rejected by the key may best be ascertained by noting salient features and matching these in the data matrix, Appendix 3. The data matrix may of course also be used for species identification where for any reason essential key characters are not observable in available material.

It will be clear that in no sense does the study pretend to completeness: it is a survey, not a revision. However, it may be hoped that NOVALIS' 'Durch Unvollkommenheit wird man der Einwirkung anderer fähig, und diese fremde Einwirkung ist der Zweck' will be found apposite.

Terminology

Morphology

The terminology is essentially that of MICHENER (1944). A1-A12(13) refer to the antennal segments, numbered from the scape, preferring common usage to the morphologically correct recognition of just three segments with the flagellum comprising flagellomeres 1-10(11). The term *sternaulus* (cf. BOHART & MENKE, 1976) here refers to the longitudinal ridge that in many species separates the pleural and ventral surfaces of the mesepisterna and which exceptionally may form a prominent carina or tubercle, in the latter instance its summit often conspicuously devoid of pubescence. When the ridges are well developed, the pseudosternum may be strongly concave. The term *precoxal carina* refers to the transverse ridge that in many species is developed anteriorly to the mesothoracic coxal cavity. Roman I, II and III refer to the anterior, intermediate and posterior legs and their divisions; L and R to left and right (e.g., 'tarsus LII indicates the tarsus of the left intermediate leg'); arabic T1, S1 etc to the metasomal terga and sterna. As to the male genital capsule, some explanation of the terms adopted is required.

The male genital capsule in *Pseudapis* and *Nomiapis* is large and, while subject to substantial modification in detail, essentially stable in its gross morphology. The volsellae are uniformly well developed, strongly sclerotized and not subject to remarkable variation. The capitate penis valves equally do not show remarkable diversity of form, and, similarly to the volsellae, their contours are readily appreciable from line drawings. The gonocoxites, in dorsal aspect, are deeply excavated internally and each is prolonged externally in (usually) a comparatively short, incurving, apical process. This process (which is not here regarded as a gonostylus) is commonly highly modified, bearing in various positions, internally, apically and ventrally, a complex of sclerotized, submembranous or membranous appendages of uncertain homology, whose interpretation is difficult. The circumstance that these structures lie in different horizontal and vertical planes also tends to render the interpretation of published drawings problematical.

The apical process of the gonocoxite subtends mesad a (usually) large submembranous lobe generally densely clothed ventrally with modified setae, the *internal apical lobe* (IAL). The apical process of the gonocoxite bears also a (usually) large, finely membranous, diversely shaped, transverse process, the *apical membranous process* (AMP). This process, analogous to and perhaps homologous with the 'retorse lobe' present in many Halictinae, is the *membrane apicale* of PAULY, 1990. It is strongly reflected and consequently may appear much foreshortened in dorsal or ventral aspect of the genital capsule. Where large, the processes of the left and right gonocoxites overlap and they may also appear more or less folded longitudinally within the genito-anal atrium. In dried material they are often seen to fill the space between the last exposed tergum and sternum. A slender, digitiform process of the ventral surface of the gonocoxite, originating before the internal apical lobe, and seen in ventral or lateral aspect to be closely applied distally to the outer margin of that lobe, the *inferior apicoventral process* (IAP), may represent a gonostylus. Anteriorly to the internal apical lobe, the gonocoxite bears a second *internal appendage of gonocoxite* (IAG) of variable form, which, if developed as a broad, membranous lobe, may posteriorly, in normal aspect, overlap the anterior margin of the internal apical lobe. This is the *membrane interne* of PAULY, 1990.

POL is the distance between the lateral ocelli, POM that between a lateral ocellus and the occipital ridge, OOL that between a lateral ocellus and the eye margin. POM is frequently given in approximate terms, where the transition between vertex and occiput is not defined by a distinct angulation or carina. Ratios between these measurements have been less used among bees than among, for example, Sphecoidea.

Recording of type material

In recording the labelling of primary types, / indicates end of line, // entry on reverse of label.

Acronyms for collections

AMNH	American Museum of Natural History, New York (material from Pakistan collected by J. G. Rozen and associates).
BMNH	Natural History Museum, London [formerly British Museum (Natural History)].
CGRC	C. G. Roche, private collection.
DBB	D. B. Baker, personal reference collection.
DEI	Deutsches Entomologisches Institut, Eberswalde.
FNSF	Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main.
HYAS	Entomological Laboratory, Hyogo University of Agriculture, Sasayama.
IEAN	Istituto di Entomologia Agraria, Università di Napoli, Portici.
ILHC	I. L. Hamer, private collection.
IZB	Institute of Zoology, Academia Sinica, Beijing.
IZK	Institute of Zoology, Academia Sinica, Kunming.
MARDI	Malaysian Agricultural Research and Development Institute, Kuala Lumpur.
MCSNG	Museo Civico di Storia Naturale, Genova.
MNHNP	Musée Nationale d'Histoire Naturelle, Paris.
MNHUB	Museum für Naturkunde der Humboldt-Universität zu Berlin.
NMW	Naturhistorisches Museum, Wien.
OLL	Oberösterreichisches Landesmuseum, Linz (Warncke collection).
OUM	Oxford University Museum of Natural History, Oxford [formerly Oxford University Museum] (Rothney and Wain collections).
UC	University of California, Davis (material from United Arab Emirates collected by E. A. Sugden).
UPMS	Universiti Pertanian Malaysia, Serdang.
ZISP	Zoological Institute, Russian Academy of Sciences, St. Petersburg.
ZMM	Zoological Museum, Moscow.

References

All references listed under that heading (p. 59) have, unless otherwise stated, been verified by autopsy and all interpretations of species-group taxa have been checked against primary written sources: it is regrettable that so many authors have seemed unwilling to refer to original descriptions, a particular case in point being that of the general accep-

tance of *Nomia armata* OLIVIER, 1812, *q.v.*, as a member of the group under discussion, while the original description plainly controverts this. In general, the species are well understood and comprehensive reference to primary types may be reserved for some future reviser.

PHYLOGENETIC ANALYSIS

Purposes

As indicated above, the primary purpose of the analysis was not to provide a classification of all the regional nomiines either currently assigned to *Pseudapis* or *Nomiapis* or clearly assignable to that complex, but rather to test the validity and taxonomic status of those conventionally recognized genus-group taxa and to enable the correct placement of the new species-group taxa to be described, some of which, in certain structural characters, departed radically from their apparent nearer relatives.

Selection of taxa for phylogenetic analysis

Regional and extra-regional material referable to over 50 species-group taxa, named and unnamed, was examined. Twenty-nine species for which more or less adequate material was available, and five additional species for which substantial, though incomplete, published information was available, were selected for phylogenetic analysis. Females of three of the species selected for analysis were not available, and published descriptions of the females of the five species included on the basis of their original or subsequently published descriptions were inadequate. The decision was therefore taken to exclude females from the analysis. The material on which the analysis was based, substantially previously unrecorded, is listed at Appendix 1.

Selection of characters

Number

Of the many taxonomic characters examined, 51, of which 48 were morphological, were selected for analysis. Preference was accorded to characters that enabled the inclusion, albeit with some missing data, of five taxa where no material was available. Apart from these, missing data were confined to a single character in a single species.

Characters investigated but discarded included head length : head width ratios; degree of convergence of anterior orbits; POL : OOL ratios; relative lengths of antennal segments; mouth-parts; proportions and shape of tegulae (the precise shape of the tegula is often diagnostic but appears never to have been used in descriptions); wing-lengths (as a measure of size, because body lengths, except as approximations, cannot meaningfully be stated owing to the contortion or contraction commonly found in dried material or to the degree of retraction of terminal metasomal segments); the ratios of the lengths of SM1 and SM3 and of the second abscissa of Rs and 1r-m; the number of hamuli; the length of tarsus III; and characters of S7, S8 and the genitalia.



Figs. 3-5. Modifications of tarsus of intermediate leg in ♂♂ of: (3) *Pseudapis anomala* W.F. Kirby, 1900, REPUBLIC OF YEMEN: Socotra, Hadibo Plain, Ras H.M., 31 iv 1967 (K.M. Guichard). [Neg. 157.4]; (4) *Anthophora scopipes* Spinola, 1839, MOROCCO: Km 50, Er Rachidia to Boudenib road, 7 iv 1995 (J.P.M. Roberts). [Neg. 157.16]; (5) *Anthophora plumipes pennata* Lepeletier, 1841, ALGERIA: Saïda, 5 iv 1950 (J. Aubert) [Neg. 157.12]. **Fig. 6.** *Anthophora plumipes* (Pallas, 1772), subsp. innom., ♂, visiting *Ornithogalum orthophyllum* Ten., displaying modified tarsus II. IRAN: Mazandaran, Tilrudsar, 23 ii 1966. [Transp. IRAN.1118]

These and other characters have however where appropriate been included in the descriptions of new taxa.

The decision to exclude from the present analysis certain suites of characters that would conventionally be included in similar analyses, such as those that might be derived from the mouth-parts, the concealed sterna and the genitalia, may be thought to require explanation. It was based on practical considerations: the inclusion of these suites of characters would have entailed either the exclusion of further taxa, where information on the individual characters involved was not accessible (species inadequately described or figured; species where specimens, while examined, were not available for dissection),³ or the appearance in data matrices of numerous voids. Owing to the plethora of readily observable external morphological characters in the group under consideration, the exclusion of characters that would demand inclusion in the study of a group showing a lesser degree of external modification, as, for example, *Andrena*, is considered justifiable in what in any event is not designed to be a comprehensive revision. It may be remarked further that the use of a data matrix or a key by non-specialists for purposes of routine identification is facilitated by the avoidance of characters that require the special preparation of material.

Characters, such as vertex length (POM) and calcar length, were not excluded from consideration merely because they were quantitative and showed no clear breaks in gradation. In such circumstances, breaks were selected arbitrarily to separate extreme plus and minus variants from the modal form.

Autapomorphies

Certain characters that would appear from the data matrix to be autapomorphies of the taxa concerned were not, *ipso facto*, excluded from the analyses. These apparent autapomorphies are either known to be shared, or suspected to be shared, by other species excluded from the review by reason of the inadequacy or unavailability of material, or because they were extralimital. The autapomorphies of terminal taxa are phylogenetically uninformative but obviously highly relevant when the classificatory import of cladograms is considered, and, from a purely practical viewpoint, their inclusion in a data matrix should facilitate its extension in subsequent studies, particularly by other authors to whom the same corpus of material may not be available, to embrace additional forms. Further, the inclusion of autapomorphic characters in phylogenetic analyses has been assessed as not being detrimental to bootstrap values (CARPENTER, 1996).

Weighting

The validity of *a priori* differential weighting of characters has been widely discussed. Equal weighting necessarily implies that all characters used provide equally strong evidence of relationships, an assumption for which there exists no incontrovertible evidence. So far as external morphological characters are concerned, those that find the greatest physical expression (which for obvious reasons are those that have most commonly been employed in taxonomic work) are not necessarily those that represent the most significant evolutionary trends. Characters of far greater evolutionary significance

³ It may be remarked that requests for the loan of material, or for permission to dissect material seen or loaned, particularly material in private collections, are not, however regrettably, always acceded to.

may well lie among those that are less readily observable or are more subtle and less readily expressible in words or figures (and of these use will increasingly be made as taxonomic practices are refined).

It would not, therefore, seem wise to assume, among the characters selected for analysis in the present study, either that all those of real evolutionary significance had been included or that all those included were of real evolutionary significance. It needs also to be emphasized that in the absence of a fossil record and in the impossibility of knowing or predicting what course future evolution may follow, it cannot be predicated what evolutionary stage an observed character-state may represent, whether nascent, in stasis or in retrogression. A decision to treat all characters utilized as of equal weight is therefore not so much evasion of a conventional obligation to quantify observed facts as a conscious assumption regarding character evolution: with no knowledge of the present evolutionary stages of a number of diverse and seemingly independent characters or modifications, and no possibility of predicting future configurations, there can be no valid case for differentiating between them. Nevertheless, there may be some integral weighting when a larger number of characters that may be supposed to be functionally related is drawn from a restricted body region, such as, in the present instance, the male metasomal sterna.

Coding of character-states

The character-states recognized were coded with reference to a relatively simple, less highly structurally modified, nomiine, *Curvinomia*, one well-known example of this genus, the widespread Oriental *fulvata* (FABRICIUS, 1804), being included in the matrix as an outgroup representative. Of course, not all the character-states exhibited by *fulvata*, for example the relatively elongate mouthparts (or the presence, in the female, of a well-developed propodeal corbicula, similar to that in the andrenid subgenus *Simandrena*), could be regarded as primitive.

Coded (0) was, where the character could be polarized, the primitive or plesiomorphic state, exhibited in most instances by the outgroup taxon and by other nomiine taxa, examined but not included in the study, that are less extravagantly modified than the taxa currently assigned either to *Nomiapis* or to *Pseudapis*. Coded (1), where the character could be polarized, were derived or apomorphic states. Fewer than half (23) of the morphological characters used in the analyses emerged as binary, *i.e.*, comprising a primitive and a single derived state. Twenty-five were multistate, *i.e.*, comprising a primitive and up to seven recognized derived states.

While most observed states could be polarized as either plesiomorphic or apomorphic, some could not be polarized with any degree of confidence, and, where more than one apomorphic state was recognized, it was not always possible to code states in a logical linear relationship. On the one hand, where states were matters of proportions, a linear coding might be indicated but polarity uncertain; on the other, where states were matters of shape or form, they might exhibit no obvious progression but be entirely dissimilar. All states recorded were therefore treated as unordered in the analyses.

The codification of two characters in particular presented problems. (1) Tibia III anteriorly in *nilotica* and its immediate allies is more or less strongly expanded apicad, in its extreme development, *e.g.* in *interstitinervis*, forming a broad lobe that extends considerably beyond

the tarsal articulation, and its anterior margin may also, as in *nilotica*, be more or less deeply incised or emarginate. In *monstrosa* and its immediate allies, modification takes instead the form of a laminar apical process of varied outline that is rotated in such a way as to become apposed to the ventral surface of the femur when the leg is flexed. Since the two basic types of modification could not be treated as an ordered progression, it seemed advisable to treat the recognized states of each as states of two independent characters recorded either as applicable or non-applicable. (2) Sterna 4 and 5, and to a lesser extent, 6, show a great variety of form, with various discal modifications, including basi-lateral bullae, median tubercles, spines or carinae, and erect paired apophyses, all of varying degrees of development, and more or less deep marginal incisions or emarginations, both the discal and marginal modifications with or without associated specialized setal characters. Some of the variant states observed were autapomorphies so far as taxa included in the group subjected to analysis were concerned (but not necessarily autapomorphies within the whole corpus of taxa examined) and therefore could not contribute to the grouping of taxa unless subsumed in some *a priori* transformation series. No clear sequence of diversification could, however, be discerned. Since, however, some groupings could be distinguished, it seemed preferable, rather than entirely discard characters of the sterna, to include them, this notwithstanding the facts that states could not be ordered and that unusually large numbers of states would have to be recognized (though probably still without capturing the real variation).

Phylogenetic analysis⁴

The characters selected and the character-states recognized are given at Appendix 2 and the data matrix obtained from the application of this tabulation to the selected taxa is given at Appendix 3. Appendix 3 includes five 'incomplete' taxa, prefixed *, included on the basis of published descriptions, where unknown states are marked either ? or, where the actual state could reasonably be inferred from knowledge of related taxa, with the inferred state in ***bold italics***. Apart from these five taxa, a single taxon is affected by one missing state.

The matrix was designed to be used in several different ways. It could be used inclusive-ly or exclusively of the 'incomplete' taxa, with the particular object of testing whether the inclusion of taxa with missing data resulted in significant changes in the ordering of the taxa with 'complete' data; and it could be used for testing whether the assumptions made in substituting inferred states for missing states, designed to reduce the number of missing states, were valid.

Matrices

For analytical purposes, data were extracted from the composite matrix, Appendix 1, to constitute three separate matrices:

Matrix 1	all taxa, original data with '?' for missing states.
Matrix 2	all taxa, inferred states substituted for some missing states.
Matrix 3	Matrix 1 with five incomplete taxa deleted

⁴ Treatment follows HARBACH and KITCHING (1998).

Analyses with all taxa included

The two subsidiary matrices Matrix 1 and Matrix 2 were analysed using the programmes Hennig86 (FARRIS, 1988) (commands mh*, bb*) and NONA version 1.5.1 (GO-LOBOFF, 1993) (commands hold 1000, hold/50, mult*30)

1. Analyses with characters unweighted

Analysis of Matrix 1 using Hennig86 yielded 612 most parsimonious cladograms [MPCs] of 171 steps (consistency index [CI] = 0.52, retention index [RI] = 0.72), while NONA found 90 MPCs of 171 steps (CI = 0.52, CI(i) [consistency index without uninformative characters] = 0.46, RI = 0.72). The strict consensus of the NONA MPCs is shown in Figure 7.

Analysis of Matrix 2 using Hennig86 found 2729 MPCs; using NONA, with additional command max* to swap further the cladograms found by mult, 1492 MPCs of 172 steps (CI = 0.52, CI(i) = 0.45, RI = 0.72). The strict consensus of the NONA MPCs is shown in Figure 8.

The topologies of the consensus trees are similar, but that based on Matrix 2 is less well resolved than that based on Matrix 1, suggesting that the substitution of inferred states for missing states has not been helpful.

The MPCs found by NONA represent the most conservative explanations of the data with all characters treated as of equal weight. Further analysis employed *a posteriori* weighting.

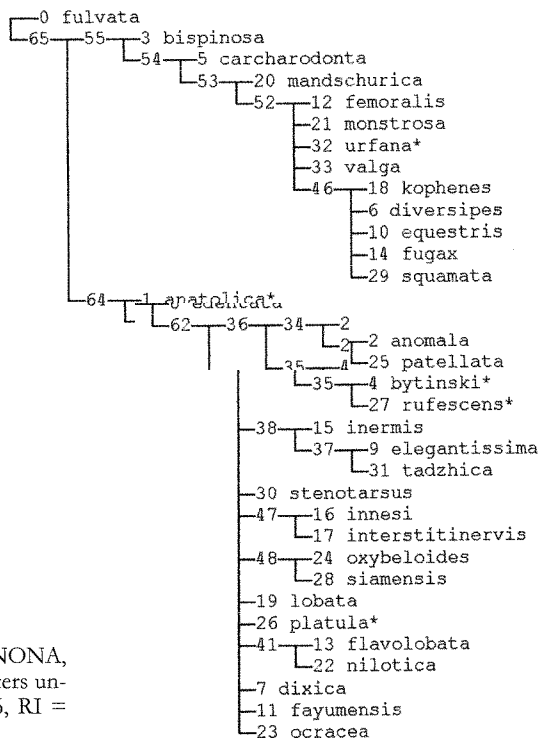


Fig. 7. Strict consensus of 90 MPCs found by NONA, all taxa included, observed states only, characters unweighted (L = 171, CI = 0.52, CI(i) = 0.46, RI = 0.72).

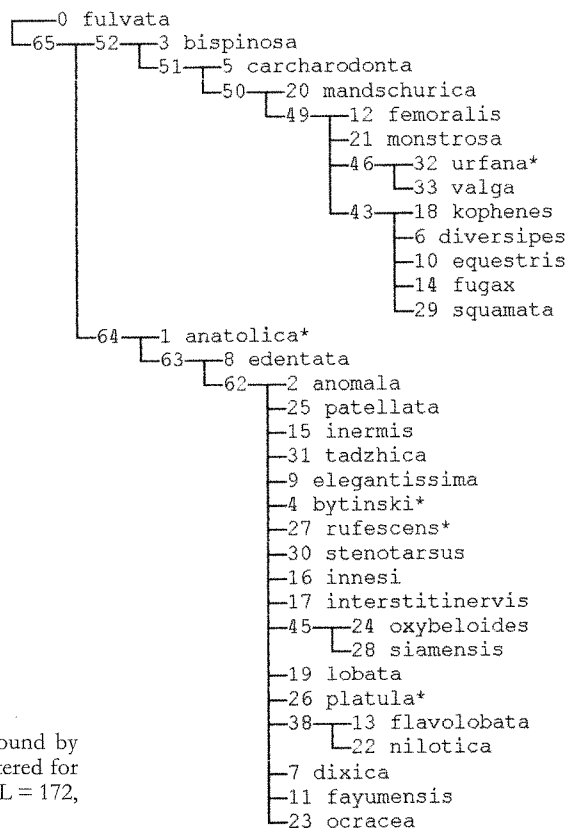


Fig. 8. Strict consensus of 1492 MPCs found by NONA, all taxa included, inferred states entered for some missing states, characters unweighted ($L = 172$, $CI = 0.52$, $CI(i) = 0.45$, $RI = 0.72$).

2. Analyses with characters weighted.

SACW [successive approximations character weighting] assigns weights to characters in accordance with their 'cladistic consistency', measured using the rescaled consistency index ($RCI = CI \times RI$) (Hennig86) or the CI (NONA). The process is iterative in that the weighted data are re-analysed to produce new sets of MPCs which are in turn used to assign new series of weights, the process being repeated until stable solutions are achieved.

SACW using Hennig86, applied to Matrix 1, gave 2720 MPCs of length 539 steps ($CI = 0.81$, $RI = 0.90$); applied to Matrix 2, 824 MPCs of length 578 steps ($CI = 0.81$, $RI = 0.90$). SACW using NONA, applied to Matrix 1, stabilized after two iterations, gave 22 MPCs of length 8960 steps ($CI = 0.67$, $CI(i) = 0.57$, $RI = 0.81$): the SCT [strict consensus tree] is shown in Figure 9 [repeated with hold 10000, hold/10, mult*10, max*, 22 MPCs as before]; applied to Matrix 2, again stabilized after two iterations, 11 MPCs of length 6861 steps ($CI = 0.66$, $CI(i) = 0.56$, $RI = 0.81$): the SCT is shown in Figure 10.

The topologies of Figures 9 and 10 are essentially similar, but that based on Matrix 1, with four polytomies, is less well resolved than that based on Matrix 2 with three, now suggesting that the substitution of inferred states for some missing states has been beneficial.

Analyses with incomplete taxa deleted

Analyses of the subsidiary matrix Matrix 3 gave:-

1. Unweighted. Analysis using Hennig86 found 5 MPCs of length 163 steps (CI = 0.52, RI = 0.71). However, analysis using JOYRIDE from the Random Cladistics package (SIDDALL, 1997), which randomly reorders the input of the taxa a specified number of times (here, 20) prior to analysis using Hennig86, sometimes found 5 MPCs and sometimes 10. These represent two 'islands' of 5 MPCs, the second set of which is found only with some taxon input orders. Analysis using NONA (commands hold 1000, hold/30, mult*25) found 7 MPCs of length 163 steps (CI = 0.52, CI(i) = 0.46, RI = 0.71). The 7 NONA MPCs were reduced from the 10 found by JOYRIDE, i.e., these 7 are the strictly supported MPCs of the 10. The SCT for these 7 MPCs is shown at Figure 11.
2. Weighted. SACW using NONA gave one MPC after 2 iterations (L = 8654 (6564), CI = 0.67, CI(i) = 0.57, RI = 0.80). This cladogram, Figure 12, is identical with tree 0 of the unweighted results.

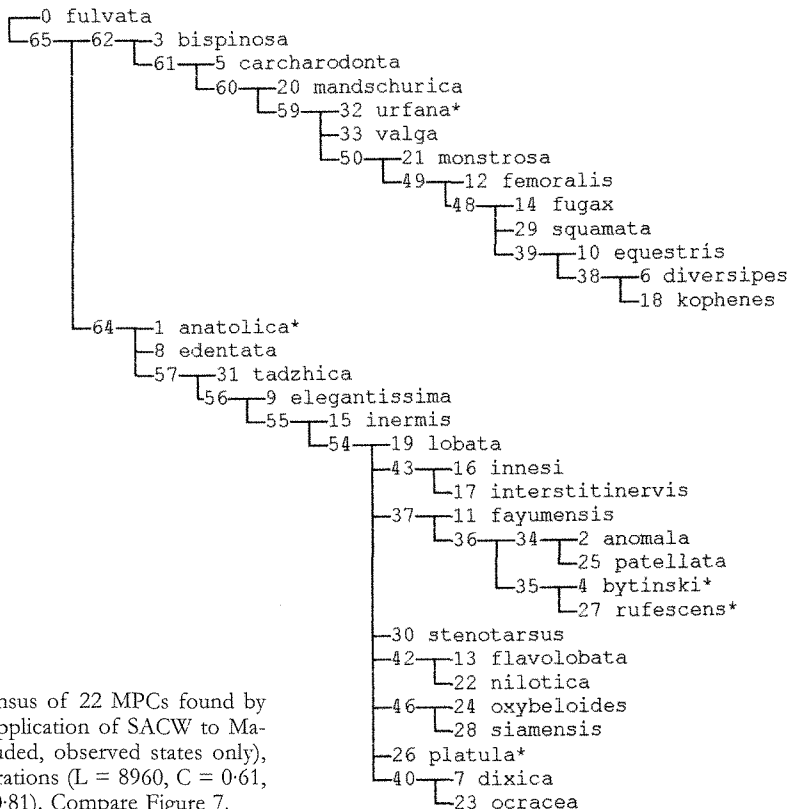


Fig. 9. Strict consensus of 22 MPCs found by NONA following application of SACW to Matrix 1 (all taxa included, observed states only), stabilized after 2 iterations (L = 8960, C = 0.61, CI(i) = 0.57, RI = 0.81). Compare Figure 7.

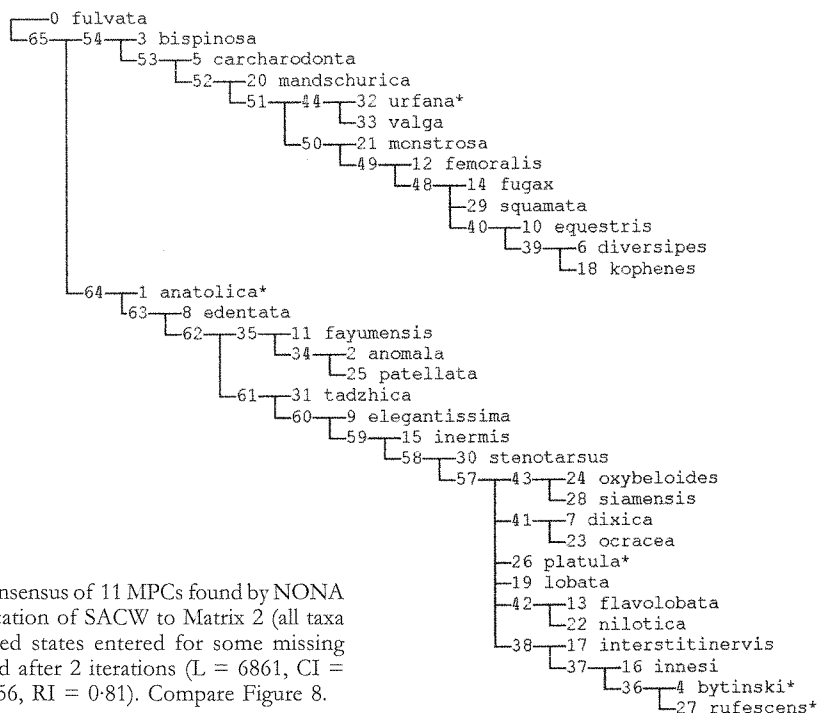


Fig. 10. Strict consensus of 11 MPCs found by NONA following application of SACW to Matrix 2 (all taxa included, inferred states entered for some missing states), stabilized after 2 iterations ($L = 6861$, $CI = 0.66$, $CI(i) = 0.56$, $RI = 0.81$). Compare Figure 8.

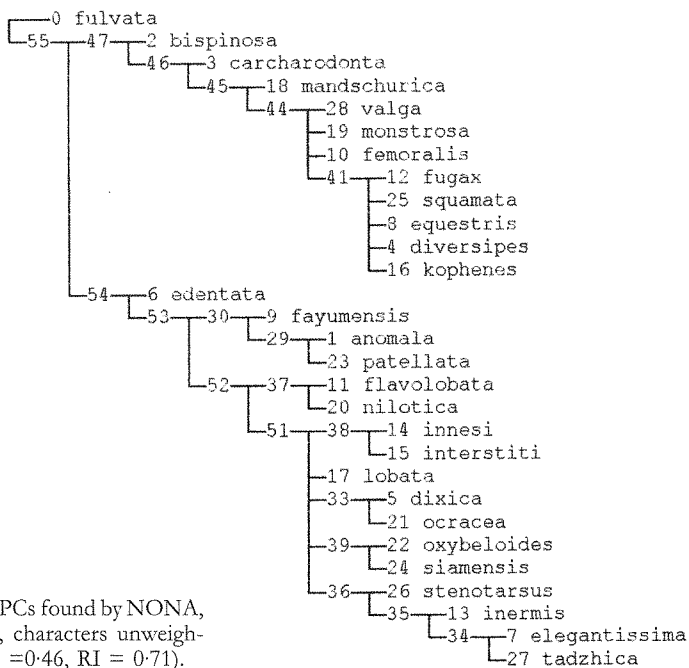


Fig. 11. Strict consensus of 7 MPCs found by NONA, five incomplete taxa excluded, characters unweighed ($L = 163$, $CI = 0.52$, $CI(i) = 0.46$, $RI = 0.71$).

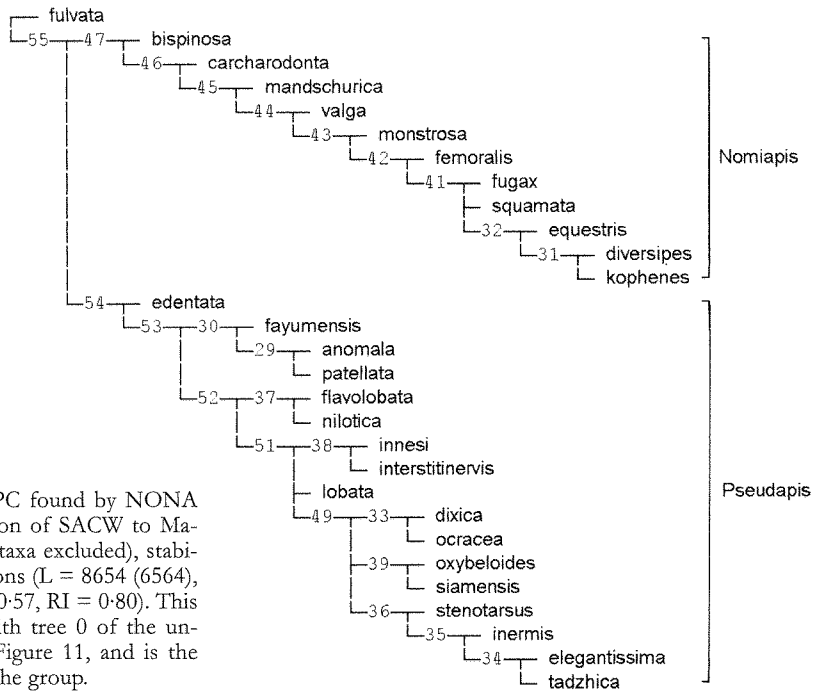


Fig. 12. Single MPC found by NONA following application of SACW to Matrix 3 (incomplete taxa excluded), stabilized after 2 iterations ($L = 8654$ (6564), $CI = 0.67$, $CI(i) = 0.57$, $RI = 0.80$). This tree is identical with tree 0 of the unweighted results, Figure 11, and is the preferred tree for the group.

Results

All MPCs showed a basal dichotomy corresponding with the genus-group taxa *Nomiapis* and *Pseudapis* as recognized by PAULY (1990). In no instance was any species-group taxon transferred between these two clades. In most cladograms the *Nomiapis* clade was well resolved, in all trees the *Pseudapis* clade less well resolved, the substitution of inferred states for some unobserved states in both instances improving resolution.

Both when all taxa were included and when incomplete taxa were excluded, the topologies resulting from the application of SACW were improvements on those derived from the unweighted data in that they had higher CIs and RIs. This was to be expected because the procedure was designed to accord greater weight to those characters that displayed greater cladistic consistency. The two SCTs, Figures 10 and 12, therefore represent the preferred topologies for the group, Figure 10 when all taxa are included, Figure 12 when incomplete taxa are excluded. A list of the character state changes for figure 12 is given at Appendix 4.

In the strict consensus tree Figure 10, the *Nomiapis* clade appears with a single trichotomy (*fugax* / *squamata* / *equestris* + *diversipes* + *kophenes*) at node 48; in the tree Figure 12 with an identical trichotomy at node 41 [33, 4 → 5; 34, 5 → 4]. The *Pseudapis* clade appears in the same figures with either a single (six-fold) polytomy at node 57 or trichotomies at nodes 51 and 49.

The species *edentata* (accompanied, where included, by the ‘incomplete’ species *anatolica*) appeared regularly in all consensus trees at the base of the *Pseudapis* clade. This is a smaller species lacking or possessing in reduced form several of the modifications found

in various combinations in other *Pseudapis*. As expected, the other 'incomplete' *Pseudapis* (*bytinski*, *rufescens*, *platula*) occupied varying positions in the different consensus trees. Certain species remained consistently paired: *anomala* + *patellata*, species with flabellate mid-distitarsi, members of a primarily African group [Figure 12, Node 29: 44, 0 → 1]; *dixica* + *ocracea*, superficially and especially in their vestiture strongly dissimilar [Node 33: 45, 1 → 0]; *flavolobata* + *nilotica*, possibly allopatric E-W forms (with apparently narrow overlap in the Gulf States), but, if so, structural differences unusually pronounced and no intermediates noted [Node 37: 25, 2 → 3; 33, 0 → 3]; and *oxybeloides* + *siamensis*, both oriental with uniquely modified basitarsus III [Node 39: 28, 0 → 2; 40, 2 → 1].

Taxonomic conclusions

The recognition of two monophyletic groups of nomiines corresponding with the generally accepted taxa *Pseudapis* and *Nomiapis* is supported by the analysis. Following PAULY (1990), and pending a fully comprehensive generic revision of Old World nomiines, these groups are recognized as of generic status.

SYSTEMATICS

Separation of *Pseudapis* and *Nomiapis*

Pseudapis and *Nomiapis* may be distinguished as follows:-

- ♂. Mesepisternum tuberculate or longitudinally carinate (*i.e.*, a distinct sternaulus present) at transition from lateral to ventral surfaces, the pseudosternum (united ventral portions of mesepisterna) medially concave; mesial processes absent; transverse precoxal carina absent. Distitarsus II modified (except in *anatolica*, *edentata*), expanded, occasionally also (*anomala* group) flabellate, usually black. Tibia III with more or less well-developed apical anterior lobe, usually rounded at apex, occasionally (*orientana*, *tadzhica*) acute or subacute, rarely truncate (*fayumensis*); calcar usually present. ♀. Terga with (usually interrupted) marginal fasciae. ***Pseudapis***
- ♂. Mesepisternum lacking lateral tubercle or carina, the pseudosternum not concave; a transverse carina present before coxal cavity 2; erect, paired mesial processes present (except *bispinosa*, *carcharodonta*). Distitarsus II not modified, concolorous with mediotarsus. Femur III with preapical anteroventral tooth (except *carcharodonta*). Tibia III short, with well-developed, angled apical laminar process, the process acute (*diversipes*, *equestris*, *kophenes*) or truncate; calcar absent. ♀. Terga without marginal fasciae. ***Nomiapis***

Provisional annotated catalogue of regional species

The species are listed in chronological sequence of the accepted names.

Pseudapis W. F. KIRBY, 1900

Pseudapis W.F. KIRBY, 1900: 15; type species *Pseudapis anomala* W.F. KIRBY, 1900 (monobasic).
Nomia (*Lobonomia*) WARNCKE, 1976: 99; type species *Nomia lobata* OLIVIER, 1812 (by original designation).

The genitalia and concealed sterna of two representative species [*Pseudapis tadzhica* (POPOV, 1956), and *P. umesaoi* (SAKAGAMI, 1961) [= *siamensis* (Cockerell, 1929)]] are well illustrated by the authors: for references see below.

Pseudapis lobata (OLIVIER, 1812)

Nomia lobata OLIVIER, 1812 : 375, 377; ♂; aux environs d'Amadan.⁵

Uncertainties exist concerning the identity of OLIVIER's species. (1) VACHAL (1897: 74) noted '*Nomia lobata* ♂ Ol. Encycl. Méth. VIII, 1811, existe au Muséum de Paris' and provided a description. He did not use the word 'type' and he gave no information concerning the labelling of the specimen. (2) WARNCKE (1976: 104) saw a specimen in MNHNP labelled, according to him, 'Arabia'. (3) PAULY (1990: 75) designated as lectotype a ♂ in MNHNP labelled, according to him, '*N. lobata*, neyi arab.', 'Mus.' and 'col. Sichel', presumably that seen by WARNCKE, but did not explain how a specimen from OLIVIER's collection (d.1814) came to be in SICHEL's collection (b.1802). If this was the same specimen as that described by VACHAL and seen by WARNCKE, it had in the interim lost its metasoma. PAULY did not refer to the discrepancy in the localities. OLIVIER⁶ recorded that he collected *lobata*, 'le soir, en grand nombre', 'aux environs d'Amadan', where he stayed between 10 and 22 June 1796 (OLIVIER, 1807a: 50, 61). OLIVIER's Arabia, or 'Arabie déserte', on the other hand, was, from his map (OLIVIER, 1801: pl.22), and following the usage of his time, the desert region between the Mediterranean coastlands and the Euphrates. This he traversed on his return journey, between 2 May and 4 July 1797, *en route* for Alep [Aleppo] from Bagdad (OLIVIER, 1807b: ch. X). A specimen labelled 'Arabia' should not, therefore, be one of OLIVIER's Amadan specimens. Notwithstanding the uncertainties, it would seem sensible, in the interests of stability, to accept PAULY's identification and type designation.

⁵ For the date see SHERBORN & WOODWARD (1906: 577).

⁶ OLIVIER, Guillaume-Antoine, 1756-1814. Travelled in the Levant in 1792-1798. For a brief note on his travels see BERLAND (1932: 163), for his own account OLIVIER (1807a, 1807b). He collaborated in the *Encyclopédie Méthodique*. Some of his material survives in MNHNP.

? *Nomia albifrons* SICHEL MS, VACHAL 1897: 74; ♀; Arabie. [See also under *albolobata* COCKERELL.]

Nomia (Lobonomia) lobata WARNCKE, 1976: 104; figs.

WARNCKE's comment on the type locality of *lobata* deserves to be quoted in full as an example of the quality of that author's research: 'Als Fundort steht in der Beschreibung Amadan; abgesehen davon, daß ich diesen Fundort auf keiner Karte finden konnte, scheint hier ein Druckfehler vorzuliegen, da auf der Etikett "Arabia" steht'. Amadan is of course Hamadan in Iran, as SMITH (1853: 89) for one well understood: '*Nomia lobata*, *Oliv. Ency. Méth.* viii. 377. 5. *Hab.* Hamadan, Persia'. Cf. also *Odynerus amadanensis* SAUSSURE, 1856, from 'Amadan, en Perse'.

Pseudapis ampla (WALKER, 1871)

Nomia ampla WALKER, 1871: 44; ♀; Tajura [Tadjoura, Fr. Terr. Afars & Issas]. Type material lost.

A ♂ in BMNH, collected by J.K. LORD, labelled 'Tajura (Straits Bab-el-Mendeb)' may be the ♂ of *ampla* or WALKER may have given the sex wrongly. [This ♂ is further labelled '*Nomia tegulata* Westw.'. WALKER 1871: 43) recorded '*Nomia tegulata* Westw. MSS', possibly this specimen, without indication of locality, but when the name was eventually published by SMITH (1875: 69) it was employed for a species from Sierra Leone. Cf. reference to *tegulata* under *duplocincta*.] In view of the uncertainties and, further, since this ♂ is in bad condition and the head is lost, it would be undesirable to treat it as a syntype of WALKER's species. ***Nomen dubium*** in ? *Pseudapis*.

Pseudapis pallicornis (WALKER, 1871)

Nomia pallicornis WALKER, 1871: 45; ♂; Tôr [Egypt: Sinai, El Tûr]. Type material lost.

Synonymized by WARNCKE (1976: 105) with '*armata* Ol.' [i.e., *armata* OLIVIER, WARNCKE, misidentification, = *nilotica* SMITH], but WALKER's 'hind legs very thick' does not support this. ***Nomen dubium*** in *Nomia s. latiss.*

Nomia pallidicornis DALLA TORRE, 1896: 168; invalid emendation.

Pseudapis nilotica (SMITH, 1875)

Nomia sp. innom. SAVIGNY, 1812: pl.5 fig.20.

Nomia nilotica SMITH, 1875: 63; ♀; White Nile [(Petherick): probably from Khartoum, where JOHN PETHERICK was the British Vice-Consul]. Holotype ♀, B.M. Type Hym. 17 a 1676, labelled 'White Nile / ⁶²/₇₂' and '*Nomia nilotica*. Type. Sm.' (examined).

Nomia latipes MORAWITZ, 1880: 368; ♂; bei Krasnowodsk. MORAWITZ, 1895: 73; ♀; Am Tedshen. POPOV, 1935: 368, 369, fig.4b.

Nomia magrettii GRIBODO, 1884: 270; ♀ ♂; 'Egitto. Collezione Gribodo'.

GRIBODO described *magrettii* from material from Egypt in his own collection and not only identified it with SAVIGNY's figures, i.e., *nilotica*, but remarked: 'Il maschio di questa notevole specie trovasi stupendamente disegnato con numerosi dettagli nelle magnifiche tavole del Savigny'. GRIBODO further recorded that the same species had been collected by MAGRETTI at Suakim and Kassala: 'Il Dott. Magretti ... la raccoglieva pure a Suakim (Mar Rosso) e Kassala (Abissinia)'. Unfortunately, while MAGRETTI's ♂ from Suakim was the same as GRIBODO's Egyptian species, i.e., *nilotica*, his ♀ from Kassala belonged to a species of the *anomala* group (cf. GUIGLIA, 1933), viz., the species whose ♂ MAGRETTI had described, also from, among other localities, Kassala, as *patellata*. To confound the situation, WARNCKE (1976: 108) recognized as the 'Typus' of '*magrettii*' [sic] a ♀ from 'Kassala Sudan' in MCSNG [probably the ♀ from 1-1883 described by GUIGLIA] and PAULY (1990: 77) designated as lectotype of *magrettii* a ♀ in the same collection said to be labelled 'Abyssinia'. Both of these ♀♀ belong to *patellata*, and PAULY's lectotype is a **false type**.

Nomia lucens VACHAL, 1897: 87; ♀; Abyssinie.

VACHAL described *lucens* from a single ♀ in Sichel's collection in MNHNP. Why PAULY, who (1990: 70) synonymized this taxon with '*armata*', thought to designate a lectotype is not apparent. VACHAL, in a copy of his paper presented to ALFKEN [present author's library], added the marginal comment: 'Espace cordiforme ayant sa partie verticale étroite, lisse, prolongée jusqu'au milieu de la paroi postérieure. Segment 2 et suivants pointillés sur la partie basale'.

Nomia savignyi KOHL, 1906: 179, pl.1 fig.16, 19, 24, 27; ♂; Südarabien (Aden). Lectotype ♂, Aden, xii 1898, designated by PAULY (1990: 70), in NMW.

KOHL (p.181), whose figures agree very well with SAVIGNY's, doubted whether GRIBODO's species could be SAVIGNY's, since GRIBODO made no reference to certain characters (specifically the scutellar spines, mesosternal depression, and armature of the fourth and fifth sterna) that were clearly portrayed in SAVIGNY's figures, characters 'von denen ich nicht recht glauben kann, dass sie Gribodo übersehen hätte'. However, it appears much more likely that these details were, in view of his having drawn particular attention to SAVIGNY's figures, as quoted above, consciously omitted by GRIBODO.

Nomia nilotica GUIGLIA, 1933: 134-137, fig.1, 2; redescription.

[*Nomia armata* OLIVIER, WARNCKE 1976: 105, 1980: 365; misidentification.

WARNCKE treated *nilotica* as a synonym of *armata*: 'Stimmt völlig überein'. OLIVIER's description (1812: 375, 376) of *armata*, 'un peu plus grande que la Nomie diversipède ... les cuisses postérieures sont très-renflées ... et ont une dent latérale vers leur extrémité ... Les jambes sont terminées par deux lobes d'un jaune-blanchâtre, dont l'extérieur est une fois plus long que l'autre', plainly excludes *nilotica* (and also *bispinosa*, VACHAL's suggestion, 1897: 74) and points to identity with *Nomiapis monstrosa* (COSTA, 1861), which, alone among regional species, has both femur III strongly incrassate and the apical process of tibia III distinctly bilobate. It can only be supposed that WARNCKE either did not read French or did not see the original description.]

[*Pseudapis armata* OLIVIER, PAULY 1990: 70; misidentification, presumably following WARNCKE.]

Egyptian and Gulf States (Qatar, UAE, Oman) populations of *nilotica* differ noticeably in the colour of the vestiture, yellow in the former, grey in the latter, but more particularly in their phenology (*vide* Appendix 5). The Egyptian form, nominotypical *nilotica*, is separated from the Gulf form, possibly referable to *latipes* (MORAWITZ) or *savignyi* (KOHLE), by the Naf d. Adequate topotypical material of *latipes* and *savignyi* has not been available for comparison, and consequently subspecies are not formally recognized here. In any event, the question of subspeciation in *nilotica* should be addressed only in the context of the wider range of the species, which extends from NW Africa to Pakistan.

***Pseudapis oxybeloides* (SMITH, 1875)**

Nomia oxybeloides (WESTWOOD) SMITH, 1853: 90; **nom. nud.**

Nomia oxybeloides SMITH, 1875: 42, pl.1 fig.6; ♀ ♂; Nischiodipore [? Bangladesh, Nischindipur, 23°16' N 90° 00' E]. 'This species has been received from several localities in India. In the [British] Museum are specimens from the Himalayas; only males were known until Mr. Rothney forwarded the sexes. Hab.- Nischiodipore.' The BMNH ♂, B.M. Type Hym. 17 a 1527, is now designated as **Lectotype**.

Nomia latispina CAMERON, 1898: 64, pl.4 fig.11, 11a; ♀ ♂; Allahabad. Two syntypes in BMNH, B.M. Type Hym. 17 a 1551a (♀) and 17 a 1551b (♂); a further syntype in OUM labelled 'A' [grey disc, = Allahabad, Rothney] and '*Nomia latispina* Cam. type. Allahabad' [CAMERON's hand]. The BMNH ♂, B.M. Type Hym. 17 a 1551b, is now designated as **Lectotype**. **Syn. nov.**

Nomia latipes CAMERON MS; ♂; Poona. Name presumably not adopted owing to homonymy.

Nomia lepidota COCKERELL, 1905: 218; ♀; Sydney [false locality]. Holotype ♀, B.M. Type Hym. 17 a 1740, ♀, Sydney, 'F.Sm. Coll. 79 22' (examined). **Syn. nov.**

Nomia biroi FRIESE, 1913: 84; ♀ ♂; '2 ♂ von Ceylon (bei Ragama) und Madras, Biro leg., 3 ♀ von India (Polgahawela), Biro leg., Ceylon (Seenigoda), v. Buttell leg., und von Annam (Thuc Sonun) im Dezember'. Type series MNHUB. **Syn. nov.**

Dr F. KOCH sent for examination the putative type series of *biroi*, five specimens all bearing FRIESE's determination label '*Nomia biroi* Fr.', variously dated. The series did not agree with FRIESE's listing. It comprised two ♂ ♂ with data 'Ceylon / Nietner S', one ♂ 'Madras / Biró 1902' and 'Type' [print, on red], one ♀ 'Ceylon / Seenigoda / 12.1911 / Butt.Reep.' and one ♀ 'Phuc Son, / Annam XI. XII.' and 'Typus' [print, on orange]. The two males collected by NIETNER, although FRIESE's determination labels are dated 1909, are not accepted as syntypes. The Annam ♀ is accepted as a syntype despite the discrepancies, probably due to carelessness in recording, in the data. The ♂ labelled 'Madras / Biró 1902', '*Nomia biroi* Fr. ♂ 1904 Friese det.' and 'Type' is now designated as **Lectotype**; the Seenigoda ♀ has been labelled as a paralectotype. The three ♂ ♂ and the Seenigoda ♀ are all *oxybeloides*; the Phuc Son ♀ *siamensis* (COCKERELL, 1929). It is remarkable that FRIESE, referring to the spatulate or racquet-shaped hairs of the ventral surfaces of the posterior coxae, trochanters and femora noted that they were 'ein Unikum in der Bienenwelt'. Similar hairs are present in other species that were well known to him at least as early as 1897 (e.g., *diversipes*, *equestris*).

***Pseudapis edentata* (MORAWITZ, 1876)**

Nomia edentata MORAWITZ, 1876: 259; ♀ *nec* ♂; prope Dschysack et Samarkand [July 1870: cf. Fedtschenko, Frau [O.A.], 1874].

Nomia inermis MORAWITZ, 1895: 73; ♂ *nec* ♀; Am Tedshen.

Nomia edentata MORAWITZ, POPOV 1949: 691-692.

MORAWITZ described from Central Asia both sexes of two small species of *Pseudapis* that, in the male, lacked scutellar spines. These were *Nomia edentata* Morawitz, 1876, from Turkestan, in which, in the male, the anterior and intermediate distitarsi were enlarged and black, and *N. inermis* MORAWITZ, 1895, from Turkmenia, in which they were slender and pale. Morawitz further noted (1895), in augmenting his description of *edentata*, that the anterior lobe of the posterior tibia in this species was substantially larger than that in *inermis*.

POPOV (1949) recognized that MORAWITZ had confused the sexes of his two species and applied the name *edentata* to (*edentata* Morawitz, 1876, ♀ + *inermis* MORAWITZ, 1895, ♂) and the name *inermis* to (*inermis* MORAWITZ, 1895, ♀ + *edentata* MORAWITZ, 1876, ♂). POPOV's action should have established the application of MORAWITZ's names but WARNCKE (1976), without any adequate explanation, sought to reverse the application of MORAWITZ's names, using the name *edentata* for *inermis sensu* POPOV and proposing a new name, *orientana*, for *edentata sensu* POPOV. WARNCKE further confused the issue by (1) designating a ♀ from 'Dshjusak' [Dschysack] (Moscow) as lectotype of '*edentata*' and (2) stating that both the ♂ 'Typus' of *inermis* (St Petersburg) and MORAWITZ's ♀ of that species [no locality or depository indicated] were '*edentata*'. This would give:-

(1) Species with distitarsi simple and tibial lobe small:-

inermis MORAWITZ, 1895, ♂ ex descr. (Turkmenien: Tedshen);

edentata POPOV, 1949 (= *edentata* ♀ + *inermis* ♂);

orientana WARNCKE, 1976.

(2) Species with distitarsi modified and tibial lobe large:-

edentata MORAWITZ, 1876, ♂ ex descr. (Turkestan: Dschysack, and Samarkand);

edentata MORAWITZ, 1895, ♂ ex descr. (Turkmenia: Tedshen and Serax);

inermis POPOV, 1949 (= *inermis* ♀ + *edentata* ♂);

edentata WARNCKE, 1976, and, following WARNCKE:-

edentata MORAWITZ 'lectotype' ♀ Moscow;

inermis MORAWITZ 'type' ♂ Leningrad;

'*inermis* MORAWITZ ♀'.

The only thing clear from this is that, if the 'type' of *inermis* in Leningrad does belong as given by WARNCKE to the species with modified distitarsi, then it cannot have served as the basis for MORAWITZ's description. In the circumstances, pending re-examination of the entirety of MORAWITZ's series in both Moscow and St Petersburg,

it would seem advisable to follow POPOV, unquestionably the more careful and competent author. Fortunately, perhaps, none of WARNCKE's references to type material of MORAWITZ's species appears to constitute a valid lectotype designation under the International Code of Zoological Nomenclature.

- Nomia (Lobonomia) orientana* WARNCKE, 1976: 95, 97 (in keys), 99, 115, fig.3, 24; ♀ ♂; Baigakum bei Djulek Turkestan. Holotype ♂ Baigakum bei Djulek, Turkestan, 15 vi 1907 (*Glasunov*) and 15 paratypes in OLL (BLANK & KRAUS, 1994: 731). **Syn. nov.**
- ? *Nomia (Lobonomia) orientana negevensis* WARNCKE, 1976: 94 (in key), 99, 116; ♀ ♂; Sedom Israel. Holotype ♀ Sedom, Israel, 25 ix 1971 (*Bytinski-Salz*) in OLL (BLANK & KRAUS, 1994: 731).

The fact that WARNCKE (1976) separated *orientana* and *negevensis*, at an early stage in his key, by structural characters that he apparently regarded as important ('Mittelfeld des Propodeum glatt und glänzend, ohne Begrenzung in den Stütz übergehend / Mittelfeld des Propodeum schmal und meist deutlich mit parallelen Längsleisten; zum Stütz hin mit scharfkantiger Querleiste') must cast doubt on the status of the latter taxon. Material of *negevensis* has not been available for examination. WARNCKE gave: 'Paratypen: siehe Artenverzeichnis, Nr 3b', but the entry there (p.99) included no reference to paratypes. BLANK & KRAUS (1994: 731) recorded two male paratypes in WARNCKE's collection (OLL).

- Pseudapis guichardi* PAULY, 1990: 73; ♂; Oman. Muscat, Qurum. Holotype BMNH. **Syn. nov.**

The series in BMNH [Muscat: Qurum, 11 iv 1976 (*K.M. Guichard*)] from which PAULY's type was drawn had already been labelled as *edentata* by the present author in 1981.

***Pseudapis rufescens* (MORAWITZ, 1876)**

- Nomia rufescens* MORAWITZ, 1876: 261; ♀; in valle Sarafschan ... near steppe lake Aikul' [August 1869].

WARNCKE (1976: 106) purported to designate a lectotype ('♀: Sarafschan Usbekistan, Lectotypus Mus. Moskau'), but the designation is invalid since no information identifying a particular syntype was given.

- Nomia rufescens* MORAWITZ, 1894: 79; ♂; Katty-Kurgan.

- Nomia heymonsi* FRIESE, 1911: 135; ♀ ♂; Goldnaya Steppe (Turkestan). VAN DER ZANDEN (1997: 756) purported to designate as lectotype one of two ♂ ♂ in Senckenberg [FNSF] with data '7. 1902, Goldnaja Step., Turkestan, leg. A. Weiß'. A synonym of *rufescens* according to WARNCKE (1976: 106).

***Pseudapis patellata* (MAGRETTI, 1884)**

- Nomia patellata* MAGRETTI, 1884: 621, pl.1 fig.15a, 15b; ♂; Sauakin, Kassala, Kor el Royan, Kor Lebka (Bogos) [for the last two localities see MAGRETTI pp.634, 635, and accompanying map]. Lectotype ♂, Suakin, 5 v 1983 (*Magretti*), designated by PAULY (1990: 77), in MCSNG.

Nomia magrettii GRIBODO, 1884: 270; ♀; Kassala. 'Lectotype' of *magrettii* in MCSNG.

For the confusion resulting from GRIBODO's association of MAGRETTI's ♀ from Kassala with his own species described from Egypt, see above, under *nilotica*.

Nomia chopardi BENOIST, 1950: 307; sex not stated [♀]; Air: Agadez. Lectotype, labelled 'Niger, Air Sud, Agadèz, 525m, vii.1947, L. Chopard et A. Villiers', designated by PAULY (1990: 77), in MNHNP.

[*Nomia (Pseudapis) magretti* [sic] GRIBODO, WARNCKE, 1976: 108; misidentification.]

? *Nomia (Pseudapis) magretti* [sic] *geddensis* WARNCKE, 1976: 108; ♀; Israel: En Gedi. Holotype ♀ Israel: En Gedi, 21 v 1966 (*Bytinski-Salz*) and 3 paratypes presumably in OLL but not included in BLANK & KRAUS's catalogue (1994).

Described as a subspecies of [*magrettii* GRIBODO, WARNCKE, a misidentified species, =] *patellata* MAGRETTI and therefore listed here under *patellata*, but the status of the taxon is doubtful: 'Ob eine eigene Art vorliegt werden erst die Männchen zeigen'. Not seen by PAULY; type depository not known. According to VAN DER ZANDEN (1997: 755) a valid species, but his notes (which omitted crucial information concerning, e.g., the presence or absence of spathulate hairs on femur III or the existence and nature of discal modifications to S4-S6) and figures convey nothing more than that his Israel material represented a species of the *patellata* group. Curiously, he noted that the ♂ ran to couplet 7 in WARNCKE's 1976 key but failed to state where it ran in that author's key (1980) to species of the *patellata* group. VAN DER ZANDEN's figure 1, of the 'Linkes Mittelbein' [actually the tarsus], suggests *patellata*; his figure 2, of the 'Linkes Hinterbein', showing femur and tibia as one structure, is hardly convincing.

Nomia (Pseudapis) patellata abbassa [sic] WARNCKE, 1980: 367 (in key, ♀), 368, fig.4; ♂ ♀; 50km NW Jask / Bandar Abbas, Iran. Holotype ♂ 50km NW Jask, Bandar Abbas, Iran, 22 v 1978, at *Alhagi pseudalhagi* [(Bieb.) Desv., LEGUMINOSAE] (*Warncke*) and 1 ♂ 1 ♀ paratypes OLL (BLANK & KRAUS, 1994: 731).

According to PAULY (1990: 77; type examined) a synonym of *patellata*.

[*Nomia magrettii* GRIBODO, PAULY 1990: 77; misidentification.]

The ♀ from 'Abyssinia' in MCSNG designated as lectotype by PAULY is a false type. For *magrettii* GRIBODO see under *nilotica*.

***Pseudapis innesi* (GRIBODO, 1894)**

Nomia innesi GRIBODO, 1894: 126; ♂; Egitto (Cairo). Type ? MCSNG: not traced (PAULY, 1990: 73).

Nomia innesi GUIGLIA, 1933: 137, fig.3, 4, 139; ♂; redescription from type.

According to WARNCKE (1976: 99), 'Seit der Monographie von Friese (1897) läuft diese Art unter dem Namen *N. edentata* Mor.'. What this was intended to convey is unclear, unless it meant that FRIESE had misidentified *innesi* as *edentata*. FRIESE, who reproduced GRIBODO's description of *innesi* without comment (p.78, as *innesii*), did not include the species in his key.

***Pseudapis inermis* (MORAWITZ, 1895)**

Nomia edentata MORAWITZ, 1876: 259; ♂ *nec* ♀; prope Dschysack et Samarkand.

Nomia inermis MORAWITZ, 1895: 73; ♀ *nec* ♂; Am Tedshen.

Nomia edentata MORAWITZ, 1895: 75; ♂ characters.

? *Nomia edentata* RADOSZKOWSKY, 1886: 2, pl.3 fig.16, pl.4 fig.16; ♂; no locality.

RADOSZKOWSKY's figure of S4 clearly excludes identity with *edentata* Morawitz.

? *Nomia minor* RADOSZKOWSKY, 1893: 54; ♀; Sérax.

PONOMAREVA (1960: 145) redescribed *minor* from a single ♀ from Kara-Kala and compared it with *edentata*, presumably *sensu* POPOV [*edentata* MORAWITZ, 1876, ♀, = *inermis* MORAWITZ, 1895, ♂]. According to WARNCKE (1976: 104), *minor* is a synonym of *edentata* in his sense, i.e., *inermis*. If WARNCKE's identification should be confirmed, the name *minor* would replace *inermis*.

Nomia albifrons (SICHEL MS) VACHAL, 1897: 74; ♀; Arabie. Type MNHNP.

Synonymized by WARNCKE (1976: 104) with '*edentata*'.

Nomia albolobata COCKERELL, 1911: 225; [♂]; Hyderabad, N.W. India. B.M. Type Hym. 17 a 1584 (examined).

WARNCKE (1976: 104), under '*edentata*', referred to a ♂ in BMNH, '♂, Bombay, Typus Brit. Mus. London' which, from the locality, would appear not to have been the type.

Nomia inermis MORAWITZ, POPOV, 1949: 692 (*inermis* MORAWITZ, 1895, ♀ *nec* ♂; *edentata* MORAWITZ, 1876, ♂ *nec* ♀).

For the application of this name *vide supra*, *edentata*.

[*Nomia edentata* MORAWITZ, PAULY, 1990: 72; misidentification, presumably following WARNCKE.]

In the male, the abruptly inflated distal half of tibia III is immediately diagnostic.

***Pseudapis duplocincta* (VACHAL, 1897)**

Nomia duplocincta (SICHEL MS) VACHAL, 1897: 74; ♀ ♂; Sénégal. 'Le ♂ parait être le même que M. Gribodo ... a décrit sous le nom d'*innesi*. La ♀ répond assez bien à la description de *Nomia tegulata* Smith ... de Sierra Leone' [*Nomia tegulata* SMITH, 1875: 69, B.M. Type Hym. 17 a 1725].

COCKERELL noted (1931: 281): 'I herewith propose to consider the male the type of *N. duplocincta*'. PAULY (1990: 72) designated as lectotype of *duplocincta* a ♂ labelled 'Sén., n61' in MNHNP (Sichel Collection).

There was no suggestion in VACHAL's description that distitarsi II in *duplocincta* were flabellate: he noted merely 'L'onychium du tarse intermédiaire aplati, dilaté, lenticulaire'. COCKERELL's '*duplocincta*' (1931: 281), with the distitarsi flabellate, must have been some other species.

Extra-regional (Sahelian) but known from Senegal and possibly entering the Mediterranean region in Morocco.

***Pseudapis aliena* (CAMERON, 1898)**

'*Nomia* (?) *aliena*' CAMERON, 1898 : 72, pl.4 fig.14; ♀; Poona.

CAMERON noted that his species differed from all the species included in BINGHAM's 'Section B. of *Nomia*' [BINGHAM, 1897: 448, key, 'Abdomen with pubescent transverse fasciae'], whence no doubt the question-mark inserted in the name. From his description, however, he was clearly describing a *Pseudapis*. His type material of *aliena* was recorded as having been collected by [R.C.] WROUGHTON. Type material was not traced in BMNH but a ♀ in the Rothney Collection in OUM, although labelled 'Mussoorie: Rothney' [printed, red], may well be the type: CAMERON was notoriously careless in his labelling and descriptions. [ROTHNEY noted in his personal copy of CAMERON's paper (in the Hope Library) that he had '1 spec'. in his collection. It is uncertain whether CAMERON received material collected by WROUGHTON directly from the latter, whose name appears frequently in the *Hymenoptera Orientalia*, or through ROTHNEY.] This specimen represents an unusually smooth species, the mesosoma dorsally and the metasomal terga virtually devoid of macrosculpture, the mesoscutum with a few scattered fine punctures.

***Pseudapis anomala* W.F. KIRBY, 1900**

Pseudapis anomala W.F. KIRBY, 1900: 16; [♂ ♀]; Moukaradia ... Homhil, E. Sokotra. B.M. Type Hym. 17 a 1774 (examined).

Pseudapis anomala W.F. KIRBY, 1903: 241, pl.15 fig.7; ♂ ♀; Sokótra: Moukaradia = Gebel Raggit ... [and] ... Homhil.

Nomia anomala KOHL, 1906: 176, pl.1 fig.15, 17, 18, 20, 23, 26.

? *Nomia* (*Pseudapis*) *sudanica* WARNCKE, 1980: 366 (in key), 367, 380 fig.3; ♂ ♀; Gebel Elba, Egypt. Holotype ♂ Gebel Elba (*Priesner*) and 2 ♀ paratypes in OLL (BLANK & KRAUS, 1994: 731), 1 paratype in MSC. Doubtfully distinct from *anomala* : cf. PAULY (1990: 78).

***Pseudapis enecta* (COCKERELL, 1911)**

Nomia magrettii enecta COCKERELL, 1911: 225; ♀ ♂; Karachi, N.W. India. B.M. Type Hym, 17 a 1588 (examined).

This is not *magrettii*, a species of an entirely different group. The ♂ of *enecta* is small, dark; mesoscutum black with thin, white, plumose pubescence anteriorly; scutellar spines long, pale; calcar II extending to less than half length basitarsus; basitarsus II not attenuate; distitarsus II expanded, long-oval, black; femur III ventrally densely clothed with long, racquet-shaped hairs; anterior lobe of tibia III small, straight, angular; discal impunctate areas of T2 extensive but not coalescent. In the key to species (p. 50), *enecta* would run to couplet 15, and then, ignoring characters of S4 (not clearly visible in the type, which has not been made available for more detailed examination), to the vicinity of either *tadzhica* (couplet 16) or *elegantissima* (couplet 22), with both of which it shares the weakly developed anterior lobe of tibia III.

***Pseudapis flavolobata* (COCKERELL, 1911)**

Nomia flavolobata COCKERELL, 1911: 226; ♂; Karachi, N.W. India. B.M. Type Hym. 17 a 1589 (examined).

[*Nomia* (*Lobonomia*) *armata latipes* MORAWITZ, WARNCKE 1976: 105; misidentification. WARNCKE noted of *flavolobata*: '♂, Bombay, Typus Brit. Mus. London. Stimmt [with 'armata ssp. latipes'] in allen Merkmalen überein'. COCKERELL's type did not come from Bombay and differs conspicuously from 'armata ssp. latipes', i.e., *nilotica* Sm.]

Nomia iranica WARNCKE, 1979: 169, fig.2; ♀; Bampur-Ufer, südwestlich Iranshar / Belutschistan. Holotype ♀ Bampur-Ufer, südwestlich Iranshar, Belutschistan, 22 v 1954 (Richter & Schäuffler) and two paratypes in OLL (BLANK & KRAUS, 1994: 731).

In both sexes, the projecting lip of the basal area of the propodeum is immediately diagnostic.

***Pseudapis interstitinervis* (STRAND, 1912)**

Nomia interstitinervis STRAND, 1912: 104; ♀; Guinea. Type MNHUB.

? *Nomia guineaella* STRAND, 1914: 123; ♂; Guinea.

Nomia lebrunae COCKERELL, 1935: 334 (in key), 342; ♂; Belgian Congo: Kasenyi (West shore of Lake Albert). Type MRAC.

Nomia interstitinervis auricauda COCKERELL, 1939: 129; ♂; Cape Province: Upington. B.M. Type Hym. 17 a 1716.

Pseudapis interstitinervis is not strictly regional but its range extends northwards beyond the range indicated by Pauly (1990: 74) into the Sudan (Eastern Equatoria) and the species may well penetrate further north. The above synonymy is as given by Pauly (*l.c.*).

[*Nomia matalea* STRAND, 1913]

Nomia matalea STRAND, 1913: 144; ♀; [Ceylon:] Negombo, Paradna und Matale. Type series DEL.

It might be thought from STRAND's description of *matalea*, as a *Nomia* with 'sehr großen Tegulae' that might be closely related to *biroi* FRIESE, i.e., *Pseudapis oxybeloides* (SMITH), that his species was a *Pseudapis*. Through the courtesy of Prof. Dr. Holger H. DATHE it has been possible to examine STRAND's type series preserved in DEL. *N. matalea* is in fact the well-known and widespread Indian species *Steganomus nodicornis* (SMITH, 1875), **syn. nov.** The ♀ syntype labelled 'Paradna / Ceylon / W. Horn 99' [ms], '♀', 'Syntypus' [print, on red] and 'Nomia matalea m. Strand det.' is now designated as **Lectotype**: this is the best preserved of STRAND's syntypes. The two paralectotype ♀♀ in the same collection are labelled: (1) 'Negombo / Ceylon / W. Horn 1899' [print], (2) 'Matale / Ceylon / W. Horn 1899' [print], other labels as above.

Steganomus nodicornis was described by SMITH under the generic name *Cyathocera* (SMITH, 1875: 47, pl. 1 fig. 5, 5a, 5b; ♀ ♂; 'two females were obtained by the British Museum from Captain Laing's collection; they were taken near Lucknow ... Mr. Rothney captured both sexes near Pulta, Barrackpore'. A ♀ in BMNH, labelled 'N.Ind / ⁷⁰/₄₅' [Capt. LAING, via HIGGINS] is now designated as **Lectotype**. There are specimens labelled Barrackpore in the Rothney Collection in OUM but not one of these can unequivocally be recognized as a syntype of SMITH's taxon: throughout the Rothney Collection, material that may have been seen by SMITH is mixed with later material. [On ROTHNEY's collection and SMITH's handling of ROTHNEY's material, *vide* BAKER, 1993: 253-254.] The OUM series comprises: (a) two ♂ ♂ in the type collection, labelled 'India Rothney 1877', which obviously cannot, owing to the date, be syntypes [the determination labels, further, are not in SMITH's hand]; (b) 6 ♂ ♂ and 5 ♀ ♀, labelled 'Barrackpore: Rothney' [printed in red: standard ROTHNEY labels], which are probably in part syntypes; (c) 20 ♂ ♂ and 6 ♀ ♀ without data (one with label '*Cyathocera nodi-cornis* Sm.')

which are of uncertain status and preferably not to be regarded as syntypes.] ⁷

***Pseudapis siamensis* (COCKERELL, 1929)**

Nomia siamensis COCKERELL, 1929: 134; ♂ ♀; Siam: Csjun. B.M. Type Hym. 17 a 1604, ♂, metasoma lost (examined).

Nomia umesaoi SAKAGAMI, 1961: 43, fig.1-4; ♂ ♀; Mae Hoi, Thailand. Holotype ♂ HYAS. SAKAGAMI, who described *umesaoi* from two ♂ ♂ and one ♀ in poor condition, compared it with *biroi* Friese, *siamensis* Cockerell and *tadzhica* Popov. From his remarks, it is clear that he knew none of these *in natura*, and he could not have known that Friese's type series of *biroi* was composite. The identity of his species is clear from his excellent description and figures. **Syn. nov.**

Nomia (Lobonomia) megalobata WU, 1983: 277, fig.19-25; ♂ ♀; Ledong, Hainan, Guangdong. Holotype IZB. Paratype ♂ examined. Minor differences between SAKAGAMI's and WU's figures probably result from differences in orientation and the displacement of parts. **Syn. nov.**

⁷ Two additional, smaller, Indian species of *Steganomus* were described by CAMERON: *S. fulvipennis* CAMERON, 1898: 56; ♂ ♀; Poona, Bombay (*Wroughton*) and *S. gracilis* CAMERON, 1898: 58; pl.4 fig.16; ♂; Mussooree (*Rothney*). The type material of both species is in OUM (examined). *Steganomus gracilis* CAMERON is identical with *Nomada bipunctata* FABRICIUS, 1804, **syn. nov.** The type of *Nomada 2punctata* FABRICIUS, 1804: 392; 'Habitat Tranquebariae Dom. Daldorff, Mus. Dom. Lund.' (a ♀ labelled 'N: bipunctata e Tranqu. Daldorff' in the Copenhagen collection, Zimsen number 1215) was courteously made available by the late Dr. Borge PETERSEN. *Nomada bipunctata*, as a **nomen oblitum**, does not replace *gracilis*. Recent material of CAMERON's species examined is from: *fulvipennis*, CENTRAL INDIA: Jabalpur, 500m, ix and x 1957, ♂ ♂ ♀ ♀ (P.S. Nathan) [also from the same locality, as 'Jubbulpore', 19 ix 1907 (C.G. Nurse)]; *gracilis*, SOUTH INDIA: Pondicherry State, Karikal, ii 1962 (P.S. Nathan) and SRI LANKA: Kalutara, 9 xii 1982 (I.L. Hamer).

***Pseudapis kingi* (COCKERELL, 1931)**

Nomia kingi COCKERELL, 1931: 282; ♂; Sudan: Erkowit. B.M. Type Hym. 17 a 1644, ♂, labelled 'Er Rowit / H.H. King / 10.6.17 // Sudan Govt.', 'Ent.Coll. C 4813 // WTRL' (examined). [Erkowit is correct: inland from Suakin, 18°49' N 37°01' E.]

PAULY (1990: 75) treated *kingi* as a valid species but curiously, following his reference to the original description, gave 'Syn. nov.'. The species belongs to the *anomala* group, with distitarsi II flabellate and the mesoscutum densely, regularly, not very coarsely punctate on a coriaceous ground.

Strictly extra-regional (African: southern Sudan to Kenya) but possibly entering the Mediterranean Region in Egypt.

***Pseudapis elegantissima* (POPOV, 1949)**

Nomia edentata elegantissima POPOV, 1949: 692; ♀ ♂; Tadzhikistan: Kurgan-Tyube ... Dzhi-likul' ... Aral ...; Turkmeniya: Uzun-Ada [type locality not specified]. Type series ZISP.
Nomia elegantissima POPOV, 1967: 52, 202 (Table 61). Treated as species but status left undecided.

N. elegantissima was described by POPOV as a subspecies of *edentata* MORAWITZ, 1876. MORAWITZ (1895: 74, 75) described [as *inermis* MORAWITZ ♂: see under *edentata*], the male of *edentata* as having the scutellum edentate ('scutello inermi') and distitarsi II as being slender and pale ('das Klauenglied nicht erweitert und hell gefärbt'). *N. elegantissima* POPOV of WARNCKE (1976) is keyed as having the 'Scutellum mit 2 seitlichen, nach hinten gerichteten Dornen' and distitarsi II 'schmal tropfenförmig': this would not appear to be POPOV's taxon (See also Appendix 1).

***Pseudapis tadzhica* (POPOV, 1956)**

Nomia tadzhica POPOV, 1956: 159-162, fig.1; ♀ ♂; S. Tadzhikistan: Kurgan-Tyube ... Dzhi-likul' ... Staraya pristan' [type locality not specified]. Aral ...; Turkmeniya: Uzun-ada. Type series ZISP.
Nomia (Lobonomia) tadzhica POPOV, WARNCKE 1976: 102. No reference to type material.

***Pseudapis anatolica* (WARNCKE, 1976)**

Nomia (Lobonomia) anatolica WARNCKE, 1976: 95, 97 (in keys), 99, 114, fig.2, 23, 45; ♀ ♂; Igdir/ Kars. Holotype ♂ Igdir, Kars, 1 ix 1960 (*leg. ?*) and two ♀ paratypes in OLL (BLANK & KRAUS, 1994: 730).

Pseudapis dixica (WARNCKE, 1976)

Nomia (Lobonomia) dixica WARNCKE, 1976: 95, 98 (in keys), 104, 117, fig.9, 30; ♀ ♂; Oase Tiout bei Ain Sefra Algerien. Holotype ♀ Oase Tiout bei Ain Sefra, Algerien, 1890 (*leg. ?*) [provenance ?] and 4 ♀, 3 ♂ paratypes, various localities, in OLL (BLANK & KRAUS, 1994: 730, whom see for the curious etymology, which does not, however, explain the choice of suffix).

Pseudapis platula (WARNCKE, 1976)

Nomia (Lobonomia) platula WARNCKE, 1976: 95, 98 (in keys), 104, 118, fig.10, 31; ♀ ♂; Schurab, Kirman, Iran. Holotype ♂ Schurab, Kirman, Iran, 27 v 1898 (*Zarudny*) [presumably expropriated from ZIL] and 8 ♀, 8 ♂ paratypes, various localities, in OLL (BLANK & KRAUS, 1994: 731). The specific name, perhaps derived from ornithology, is apparently meaningless.

Pseudapis bytinski (WARNCKE, 1976)

Nomia (Lobonomia) bytinski [*sic*] WARNCKE, 1976, 95, 97 (in keys), 108, 118, fig.13, 34, 44, 48; ♀ ♂; Jerewan/Armenien. Holotype ♂ Jerewan, Armenien, 4 vii 1932 (*Kostylev*) [presumably expropriated from ZMM] and 9 ♀, 7 ♂ paratypes, various localities, in OLL (BLANK & KRAUS, 1994: 730).

Pseudapis nubica (WARNCKE, 1976)

Nomia (Lobonomia) nubica WARNCKE, 1976: 96 (in key), 100, 117; ♀; Heliopolis/Ägypten. Holotype ♀ Heliopolis / Ägypten, ix 1913 (*Andres*) and 1 ♀ paratype in OLL (BLANK & KRAUS, 1994: 731). The presence of the type in WARNCKE's private collection is unexplained: ANDRES' material should be in the Senckenburg Museum, Frankfurt. The grossly misleading specific name does not refer to locality but was idly taken, as was WARNCKE's common practice, from ornithology (probably *Lanius nubicus* LICHTENSTEIN, also used by him elsewhere).

A ♀ from Oman [J. Huwayyah, 13 v 1988 (*I.L. Hamer*)], without associated ♂ ♂, is referred here, largely on the basis of PAULY's treatment, with some doubt. It appears close to *tadzhibica*.

Pseudapis algeriensis (WARNCKE, 1976)

Nomia (Lobonomia) algeriensis WARNCKE, 1976: 97 (in key), 100, 116, fig.4, 25; ♂; Ain Sfisiffa/ Algerien. Holotype ♂ Ain Sfisiffa, Algerien [Oran] and 2 paratypes in OLL (BLANK & KRAUS, 1994: 730).

***Pseudapis ocracea* PAULY, 1990**

Pseudapis xantholepis BAKER MS: as indicated by PAULY (1990:76), the series from which he described *ocracea* was standing in BMNH under the name *xantholepis* (1981); it may be found under that name in other collections.

Pseudapis ocracea PAULY, 1990: 68 (in key), 76, fig.170, 188, 193; ♂ ♀; Yemen, Red Sea coast near Hodeida. Holotype ♂ BMNH. The name evidently improperly formed from *ωχρός*, *ochros*.

***Nomiapis* COCKERELL, 1919**

Nomia (*Nomiapis*) COCKERELL, 1919: 208; type species *Nomia diversipes* LATREILLE, 1806 (by original designation).

The genitalia and concealed sterna of *Nomiapis mandschurica* (HEDICKE, 1940), a close relative of the type species, are well illustrated by HIRASHIMA (1961:249); those of *N. trigonotarsis* (HE & WU, 1990) by the authors.

***Nomiapis femoralis* (PALLAS, 1773)**

Apis femoralis PALLAS, 1773: 731; [♂]; in deserto ad Iaikurn.

Lasius difformis PANZER, 1803: 15; [♂]; Habitat Mannhemii. [For the date, revised from SHERBORN, 1923, see EVENHUIS 1997: 600.]

Andrena brevitarsis EVERSMAAN, 1852: 9 (in key), 18; ♀; in promontoriis Uralensibus australibus.

Nomia femoralis MORAWITZ, 1866: 9.

***Nomiapis diversipes* (LATREILLE, 1806)**

Nomia diversipes LATREILLE, 1806: xvj [no description], pl.14 fig.8; ♂; [no locality indicated]. LATREILLE, 1809: 155; ♂; [no locality indicated].

Andrena humeralis JURINE, 1807: 231, pl.14; [♀]; [Switzerland: ? Geneva (*Faure-Biguet*). Cf. p.188 where JURINE refers to a specifically indigenous *Simblephilus* also received from FAURE-BIGUET. *N. diversipes* is common in valleys of the southern Alps.]

Nomia hungarica FÖRSTER, 1853: 356; ♂; Ungarn.

Nomia humeralis COSTA, 1861: 6, pl.XXXI fig.2 (♂), pl.XXXIa fig.1 (♀).

For biological observations on this species *vide* Appendix 5.

***Nomiapis bispinosa* (BRULLÉ, 1832)**

Nomia bispinosa BRULLÉ, 1832: 348; ♂; dans les environs de Mistra. Type [MNHNP] lost (WARNCKE, 1976: 109).

- Nomia rufiventris* SPINOLA, 1839: 514; ♀; [no locality indicated]. CASOLARI & CASOLARI MORENO (1980: 154) record *rufiventris* under the coded entry '0, 23, 95, 1' [no author indicated; Egypte; received from WATTL; 1 ex.]: this is possibly a type – the species is common in Lower Egypt (not examined).
- Nomia ruficornis* SPINOLA, 1839: 514; ♂; [no locality indicated]. CASOLARI & CASOLARI MORENO (1980: 154) record *ruficornis* under the coded entry '1, 23, 95, 1' [author SPINOLA; other details as for *rufiventris*]; this again is probably a type (not examined). Synonymized by ALFKEN (1926: 99) with *rufiventris*.
- Nomia perforata* LUCAS, 1849: 185, pl.7 fig.3; ♂; dans les bois du lac Tonga, aux environs du cercle de Lacalle. Synonymized by GERSTÄCKER (1872: 306) with *ruficornis*.
- Nomia albocincta* LUCAS, 1849: 187, pl.7 fig.5; ♀; dans les lieux sablonneux aux environs du cercle de Lacalle. Synonymized by GERSTÄCKER (1872: 306) with *ruficornis*.
- Nomia aureocincta* COSTA, 1861: 8, pl.XXXI fig.3; ♂ ♀; Raccolta nella Calabria Ulteriore, nelle adiacenze di S. Luca. Synonymized by GERSTÄCKER (1872: 306) with *ruficornis*.
- Nomia basalis* SMITH, 1875: 55; ♀; India. Type ♀ labelled 'Ind // ⁵⁶/₄₃', B.M. Type Hym. 17 a 1532 (examined). **Syn. nov.** Junior secondary homonym of *Halictus basalis* SMITH, 1857, transferred to *Nomia* by COCKERELL (1922: 662) [now *Lipotriches basalis* (SMITH, 1857), **comb. nov.**].
- ? *Nomia albocincta* var. *basirubra* MAGRETTI, 1884: 624; ♀; Kassala, Aikota. Taxon not listed by PAULY (1990).
- Nomia aureocincta* var. *turcomanica* RADOSZKOWSKY, 1893: 54; ♀ ♂; d'Askhabad ou de ses environs [cf. Radoszkowsky, 1886: 4]. POPOV, 1935: 368: synonymized with *rufiventris* SPINOLA.
- Nomia bispinosa* VACHAL, 1897: 73; type; synonymy.
- Nomia basalicincta* COCKERELL, 1922: 663; nom. nov. for *Nomia basalis* SMITH, 1875, nec *Nomia basalis* (SMITH, 1857) [*Halictus*].
- [*Nomia unidentata* OLIVIER, WARNCKE 1976: 109, 1980: 369; misidentification.] OLIVIER (1812: 376) described *unidentata* as having the tegula 'petite, fauve', in contradistinction to the condition in, e.g., *armata*, where it was 'grande et d'un jaune pâle'. Clearly, *unidentata* cannot be referred to *Nomiapis* or to any other group with enlarged tegulae.
- [*Nomia rubribasis* COCKERELL, WARNCKE 1976: 110; misidentification.] WARNCKE synonymized *rubribasis* with '*unidentata* subsp. *albocincta* Lucas'. *N. rubribasis* COCKERELL, 1939, is however a species of *Lipotriches* ('cotype' [syntype] examined).
- [*Nomiapis unidentata* OLIVIER, PAULY 1990: 101; misidentification, presumably following WARNCKE.]

***Nomiapis monstrosa* (COSTA, 1861)**

- Nomia armata* OLIVIER, 1812: 375, 376; [♂]; dans le désert de l'Arabie [Iraq/Syria, desert between Bagdad and Aleppo].
- VACHAL (1897: 74) suggested identity with *bispinosa* BRULLÉ. WARNCKE (1976: 105) treated *armata* as a synonym of *nilotica*: 'Stimmt völlig überein'. OLIVIER's description, 'un peu plus grande que la *Nomie* diversipède ... les cuisses postérieures sont

très-renflées ... et ont une dent latérale vers leur extrémité ... Les jambes sont terminées pas deux lobes d'un jaune-blanchâtre, dont l'extérieur est une fois plus long que l'autre' plainly excludes both *bispinosa* and *nilotica*, and indicates identity with *monstrosa*, which, alone among the species that may be taken into contention, has tibia III bipartite. (Cf. comment under *Pseudapis nilotica*.) Although OLIVIER's name has priority, it should not, under the Code, displace COSTA's name, which has long been in general use.

As to the type locality, OLIVIER recorded of *armata*: 'Je l'ai trouvée ... dans le désert de l'Arabie, vers la fin de mai'. From his account of his travels (1807, ch. X) and his map (1801: pl. 22), OLIVIER's caravan left Bagdad on 2 May 1797, and, first following the Euphrates, arrived in Alep[po] on 4 July. This, with the 'fin de mai', places his 'désert de l'Arabie' locality as lying somewhere near the present Iraq/Syria border on the old caravan route. (See also *antea*, under *Ps. lobata*.)

Nomia monstrosa COSTA, 1861: 4, pl.XXXI fig.1; ♂; Raccolta nella Calabria Ulteriore nella adiacenze di Reggio e press S. Luca. Type series IEAN (one ♂ labelled as lectotype by WARNCKE, 1971). Junior synonym of *armata* OLIVIER, *q.v.*

? *Nomia polita* COSTA, 1861: 11, pl.XXXI bis, fig.2; ♀; alla adiacenze di Napoli [cf. p.10, Aggiunta]. According to WARNCKE (1976: 109) a synonym of *unidentata* OLIVIER, 1812, i.e., [*unidentata* OLIVIER, WARNCKE 1976, misidentification, =] *bispinosa* BRULLÉ, 1832, but OLIVIER's species was no *Nomiapis*: see under *bispinosa*. Type material could not be found in the collection of the Zoological Department of the University of Naples: Prof. E. TREMBLAY, *in litt.*, 7 November 1997.

Nomia rumelica FRIESE, 1922: 201; ♂ ♀; Kaluckova [Macedonia: Kaluckovo, 41°22'N 22°29'E]. FRIESE described the ♂ at length and included it in his key to ♂ *Nomia*; of the ♀ he noted merely: 'wie *monstrosa*-♀, kaum feiner skulpturiert, aber Segment 3-4 am Rande mit weißfilzigen Binden. 5. gelblich, 6. gelbbraun beborstet. L. 11 mm, Br. 4 mm.'. WARNCKE (1976: 111) synonymized *rumelica* with *monstrosa* and noted: '♂, Mazedonien, Typus Mus. Berlin'. While here as in other similarly worded statements in the same paper WARNCKE's 'Typus' fell short of being a formal lectotype designation, his intention was obvious and the designation should stand. VAN DER ZANDEN (1997: 755) formally designated as lectotype FRIESE's ♂ specimen dated 13.7.1917, presumably that seen by WARNCKE.

Nomiapis (?) *illepida* (WALKER, 1871)

*Anthophora illepida*⁸ WALKER, 1871: 57; ♀; Wâdy Ferran [Egypt: Sinai, w. Feirân]. Type material lost.

⁸ BROWN (1956: 434) gives 'illepidus, L. impolite, rude', standard dictionaries (e.g., SMITH, 1933: 365) inlepidus, inelegant, unmannerly ['in' before 'l' and 'r' properly remains unchanged]. Although the name has been used elsewhere in the Hymenoptera (e.g., *Limneria illepida* CRESSON) - with what intent is not known - its appositeness in the present instance is not suggested by any detail of WALKER's description; and, if the name was deliberately intended, the reason for his choice must remain obscure. However, WALKER in his description did have 'tegulae tawny, large', and it might therefore be surmised that 'illepida' in fact represents, or misrepresents, εὐ + λεπής, ἰδός.

This taxon, which was not recognized by PRIESNER (1957) as a species of *Anthophora*, is listed with considerable reservation. The combination of 'tegulae tawny, large' with other characters given in the description suggests a larger species of *Nomiapis*, such as *bispinosa* (Br.), which is common in Egypt, but discrepancies remain. WALKER's 'Abdomen with a band of cinereous tomentum along the hind border of each dorsal segment', however, could well refer to the broad and conspicuous postgradular fasciae that in *bispinosa* (and related species) are clearly visible through the transparent marginal areas of preceding terga.

***Nomiapis equestris* (GERSTÄCKER, 1872)**

Nomia equestris GERSTÄCKER, 1872: 302; ♂; Xanthus. Type MNHUB.

Nomia caucasica FRIESE, 1897: 51 (in key), 61; ♂; 'Im Museum Wien befinden sich 4 ♂ aus dem Kaukasus-Gebiet (Araxesthal 1890)'. FRIESE, 1922: 203 (in key).

In his 1897 monograph, FRIESE transcribed (pp.59-60), with minor alterations, GERSTÄCKER's description of *equestris* and, in describing *caucasica*, noted that it was 'Ganz wie *equestris* gebaut, aber das Scutellum jederseits ohne eine Spur von einem Dorne'; details of the sterna were virtually copied from GERSTÄCKER's description of *equestris* (and repeated in the 1922 key). According to WARNCKE (1976: 113), '*N. caucasica* Friese, 1922, ♂, Kaukasus, Typus Mus. Berlin, ist *N. femoralis* ssp. *valga*!'. The type series of *caucasica* (and 3 ♂♂ from the same locality determined by FRIESE as *equestris*) should, however, be in NMW, and the status of the Berlin 'type' must be suspect: FRIESE frequently labelled as types specimens that had in fact no type status. FRIESE, following his description of *caucasica*, noted '*Nomia caucasica* halte ich wie *valga* für eine var. der *equestris* und zwar derart, dass wir in *caucasica* die extreme Form - ohne Scutellumdorne - ... vor uns haben'; certainly, the degree of development of the scutellar spines in *equestris* and related forms is variable.

Nomia equestris var. *smyrnensis* STRAND, 1921: 316; ♂; Smyrna.

***Nomiapis valga* (GERSTÄCKER, 1872)**

Nomia valga GERSTÄCKER, 1872: 302; ♂; Andalusien.

Nomia femoralis valga WARNCKE, 1976: 113. WARNCKE treated *valga* as a subspecies of *femoralis* but the two are structurally distinct. Further, there appears to be no obvious reason for supposing GERSTÄCKER's locality 'Andalusien' to have been erroneous: *N. valga* was recorded from Granada by VAN DER ZANDEN (1997: 756).

***Nomiapis fugax* (MORAWITZ, 1877)**

Nomia fugax MORAWITZ, 1877: 93; ♀ ♂; Kurgulutschaiskaja [Caucasus, near Jelissawetpol]. MORAWITZ, 1895: 70; distinction from *femoralis* Pall.

Nomia fallax MORAWITZ, 1895: 73; presumed *lapsus* for *fugax*.

***Nomiapis squamata* (MORAWITZ, 1895)**

Nomia squamata MORAWITZ, 1895: 70; ♀ ♂; Nerduali.

Nomia squamata WARNCKE, 1976: 111. WARNCKE gives '♂: Tscheleken, Typus Mus. Leningrad'.

***Nomiapis fletcheri* (COCKERELL, 1920)**

Nomia fletcheri COCKERELL, 1920: 206; ♀; Tarnab, Peshawar District, India [Pakistan: Northwest Frontier Province, Tarnab: the U.S. Department of Defense Gazetteer gives three places of this name, all in the Peshawar area, at 71°36' E 34°15' N, 71°41' E 34°13' N and 71°42' E 34°00' N].

Vide infra, under *opacula*.

***Nomiapis opacula* (COCKERELL, 1920)**

Nomia opacula COCKERELL, 1920: 207; ♀; Nasik, India [Maharashtra, Nasik, 73°48' E 19°59' N].

Nomia fletcheri and *N. opacula* were described as having the tegulae enlarged, and from their totally inadequate descriptions, based on females, appear to be species of *Nomiapis* rather than of *Pseudapis*. They are therefore tentatively assigned here. COCKERELL did not indicate where the types were deposited, and although (from the collector, T.B. FLETCHER) they might be expected to be in BMNH, they have not been traced in that collection.

***Nomiapis mandschurica* (HEDICKE, 1940)**

Nomia (Nomiapis) mandschurica HEDICKE, 1940: 336; ♂ ♀; [Süd-Mandschurei:] Umgebung von Kintschou, Provinz Liauhsi. [Holo-]type ♂ MNHUB.

Pseudapis mandschurica HIRASHIMA, 1961: 248, fig.1, 6-14; redescription.

***Nomiapis urfana* (WARNCKE, 1980)**

Nomia (Nomiapis) urfana WARNCKE, 1980: 370, fig.5, 6; ♀ ♂; Halfeti / Urfa, Türkei. Holotype ♂, Halfeti, Urfa, Türkei, 29 v 1978 (*Schwarz*), and 4 ♀ 2 ♂ paratypes in OLL (BLANK & KRAUS, 1994: 731).

***Pseudapis trigonotarsis* (HE & WU, 1990)**

Nomia (Lobonomia) trigonotarsis HE & WU, 1990: 217, fig.1; ♂; Yunnan, Lijiang Naxi Aut. County. Holotype IZK.

Descriptions of new species

Pseudapis fayumensis sp. nov.

(Figures 1, 13)

Etymology

From the type locality, El Faiyûm.

Diagnosis

In the male, the capitate antenna is unique among regional *Pseudapis* or *Nomiapis* (capitate antennae appear not infrequently among other Old World nomiines and are characteristic of *Steganomus*) and the unusual form of basitarsus III is shared only by *rufescens*.

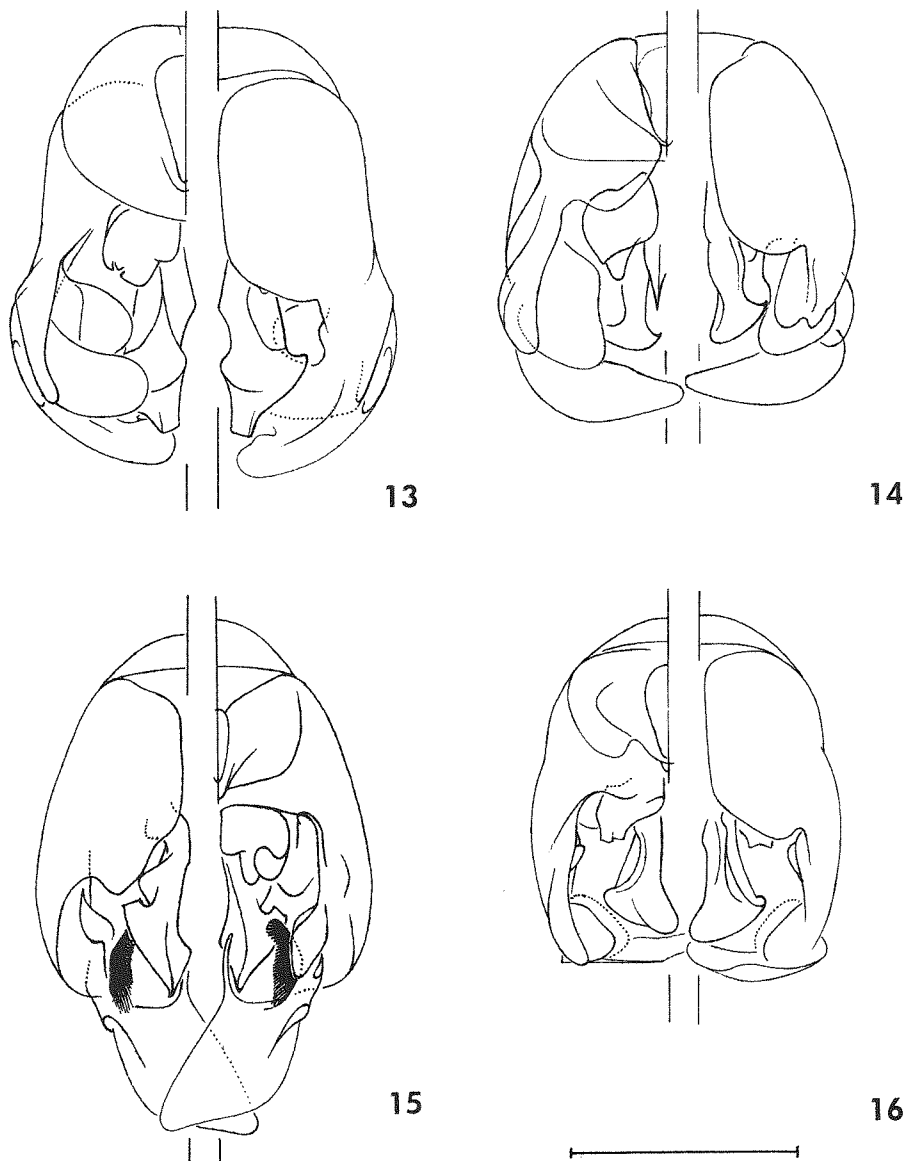
Description

♂. Length ca 9mm; forewing, measured from base of median cell, 6.2mm.

Head. Head in frontal aspect strongly transverse, length : breadth ratio 1 : 1.66; paraocular carinae present, normally developed; clypeus in profile convex; POL : OOL = 1 : 0.87; lateral ocelli separated from occipital ridge by 1.8x their diameter; A3 shorter than A4 or A5 (A3 : A4 : A5 = 1 : 1.13 : 1.17). [In the type, segments 8-11 of the left antenna are abnormal, partially fused, and remnants of the pupal exuviae adhere to segment 13 of both antennae.]

Mesosoma. Anterior truncation of mesoscutum well developed, high; scutellum mutic, weakly bigibbous; mesepisternal lateral carinae present, not strongly developed, more tuberculiform; pseudosternum concave; precoxal transverse carinae and anterior pseudosternal apophyses absent; tegulae expanding apicad with greatest breadth near apex, ratio greatest length : greatest breadth = 1 : 0.49, apex broadly rounded, inner apical angle not produced. Forewing: ratios lengths SM1: SM3 = 1 : 1.22, 2nd abscissa Rs : 1r-m = 1 : 1.09; 1st abscissa Rs and 1r-m divergent costad; hindwing, hamuli 12. Anterior leg unmodified, distitarsus slightly widened, parallel-sided; femur II moderately incrassate; tibia II moderately expanded apicad, its greatest breadth at two-thirds length; calcar II fine, short, less than one third length basitarsus; basitarsus II slightly arcuate, slightly narrowed apicad; distitarsus II broadly expanded, orbicular; femur III massive, strongly nodose, anteriorly, apicoventrally, overlapped by tibial lobe; tibia III with exceptionally large, truncate, anterior lobe subtended by whole anterior margin; basitarsus III elongate, dorsally carinate, curved, subparallel-sided in basal half, then strongly attenuate; distitarsus elongate. Propodeum with basal area not defined by a distinct carina.

Metasoma. T6 narrowly exposed, laterally edentate, medially slightly produced and broadly rounded; T7 exposed to a greater extent than T6, its apical margin bilobate; S3 unmodified; S4 with well-developed mesial carina, becoming higher apicad and then abruptly falling, not attaining margin; S5 discally little modified, with weak mesial ridge separating two shallow concavities, but apical margin on either side strongly, dentately produced,



Figs. 13-16. Male genital capsule, left half ventral aspect, right half dorsal aspect (except Figure 15, where positions are reversed), in: (13) *Pseudapis fayumensis* sp. nov., holotype, EGYPT: Fayum, Karanis, 15 vi 1990 (C.G. Roche, E 8306); (14) *Pseudapis stenotarsus* sp. nov., paratype, UNITED ARAB EMIRATES: Wadi Uyaynah, near Dibba, 7 viii 1981 (C.G. Roche, U 1431); (15) *Nomiapis carcharodonta* sp. nov., holotype, SOUTH INDIA: S. Malabar District, Walayar Forests, vi 1957 (P. Susai Nathan); (16) *Nomiapis kophenes* sp. nov., paratype, AFGHANISTAN: Kabul, Paghman, valley above town, 2100/2400m, flooded of river and adjacent cultivation, 17 vii 1977 (Cambridge Afghanistan Expedition, 1977, P.H.B. Baker & E.L. Munday). Dotted lines in Figure 16 indicate extent of protrusion mesad of brush of modified hairs clothing ventral surface of interior apical lobe of gonocoxite. Scale line represents 1 mm. [The figures were prepared over a period of many years and small differences in treatment exist. Hair characters generally omitted.]

the margin between these teeth broadly convex; S6 with weak mesial carina and strong lateral, submarginal, callosities; S7 apically broadly rounded with weak median emargination; apical margin of S8 produced medially as a small rounded lobe (superficially bearing two strong, acute teeth separated by a deep U-shaped emargination, the apparent emargination however closed with a fine membrane). Genitalia (Figure 13): IAG well developed, submembranous, broadly rounded at apex, posteriorly overlapping IAL; IAL large, broadly rounded at apex; IAP simple.

Integument. General surface glossy, without evident microsculpture at 25x. Mesoscutum densely, subreticulately punctate, the scutellum, especially the gibbosities centrally, less densely, with interspaces up to one puncture-width; basal area of propodeum irregularly rugose.

Terga 1-5 densely, more coarsely than the mesonotum, punctate, the punctation, except narrowly on T1 and T2, concealed by the dense pubescence; T2 without evident bilateral impunctate areas; marginal areas of T1-5 densely, finely punctate, on T1 the punctation except laterally confined to the basal half; T6 and T7 with well-separated punctures; S2 and S3 extensively impunctate, their recurving lateral areas finely and moderately densely punctate; disc of S4 with transverse, oval impunctate areas on either side of median carina.

Vestiture. Copious, generally white, but hairs of T6 and T7 and erect or slightly proclinate submarginal fimbriae of sterna 2 and 3 yellowish. Face to level of ocelli densely clothed with decumbent plumose hairs completely concealing the surface; vertex thinly clothed with erect hairs. Mesosoma almost completely, densely, clothed with decumbent or semidecumbent plumose hairs, only the pronotum anteriorly, a small discal area of the mesoscutum, the scutellum except peripherally, and the basal area of the propodeum with its immediately adjacent impunctate zone exposed; the hair clothing the pseudo-sternum long, dense and erect; tarsus I with well-developed posterior fimbria; ventral ridge of femur II with broad, dense, even fringe; long hairs thinly clothing the ventral surface of femur III not spatulate; dorsal ridge of basitarsus III glabrous, segment otherwise conspicuously setose. Terga 1-5 clothed similarly to the mesosoma dorsally, the fasciae filling the postgradular sulci invading the disc and merging with the fasciae filling the marginal areas, only T1 and T2 with the disc apically narrowly glabrous; exposed area of T6 weakly setose; T7 with shorter marginal and longer premarginal fimbriae; S2 and S3 substantially glabrous but with conspicuous erect or slightly proclinate submarginal fimbriae, long, thin and interrupted medially on S2, shorter and denser on S3; S4 with interrupted, subdecumbent marginal fimbria merging laterad with coarser hairs of lateral areas; S5 in apical half with areas of dense, fine, subdecumbent, simple (at 50x) hairs occupying greater part of surface between median ridge and lateral teeth.

Colour. Black; greater part of mandible, small macula at apex of (reddish) scape, flagellum beneath (except ultimate segment), tegula (except brownish umbo), tibiae I and II narrowly at base and apex, tarsus I (except for dark vitta in apical half), tarsus II (except distitarsus), femur III dorsally in apical half and anteriorly at apex, tibia III (except for dark, oval maculae anteriorly and posteriorly) and tarsus III (except narrowed apical half, which dorsally is darkened apicad and posteriorly bears a black vitta, and distitarsus) pale yellow; exposed area of T6 and T7 stramineous.

♀. Not known.

Type material

Holotype ♂ labelled: 'EGYPT / Fayyum / Karanis / 15.vi.1990 / C.G.Roche // E8306' [to be deposited in OUM].

Comment

From the description, and particularly from the conformation of basitarsus III, related to *rufescens* MORAWITZ, but that species appears from published records to be confined to Transcaspia (Turkmenistan, Uzbekistan, Tajikistan) and certainly no specimens referable to *rufescens* have been encountered among many hundreds examined from intervening territories.

***Pseudapis stenotarsus* sp. nov.**

(Figure 14)

Etymology

Gr. στενός + ταρσός, in allusion to the attenuate basitarsus II.

Diagnosis

In the male, the combination of mutic scutellum, strongly attenuate basitarsus II, unusually slender mediotarsus II, and exceptionally large, entire, anterior lobe of tibia III is unique. The female is similar, but the punctation of the mesonotum is less dense, with evident glossy interspaces, and, of the terga, relatively sparse, fine, shallow and oblique; the integument of tibia and basitarsus III is pale and the pygidial fimbria is dark.

Description

♂. Length ca 7.5mm; forewing, measured from base of median cell, 6.0mm. *Head.* Head in frontal aspect transverse, length : breadth ratio I : 1.26; paraocular carina present, normally developed; clypeus in profile convex, its anterior margin decurved; POL : OOL = 1 : 0.81; lateral ocelli separated from occipital ridge by 1.13x their diameter; A3-5 subequal in length (A3 : A4 : A5 = 1 : 1.0 : 1.05).

Mesosoma. Anterior truncation of mesoscutum well developed; scutellum mutic; mesepisternal lateral carinae well developed; pseudosternum concave; precoxal transverse carina and anterior pseudosternal apophyses absent; tegulae expanding apicad with greatest breadth near apex, ratio greatest length : greatest breadth = 1 : 0.46; apex broadly rounded. Forewing: ratios lengths SM1: SM3 = 1 : 1.19, 2nd abscissa Rs : 1r-m = 1 : 1.2; hindwing, hamuli 11. Anterior and intermediate legs not modified except basitarsus strongly attenuate and slightly arcuate; calcar II not attaining mid-length of basitarsus; femur III moderately inflated and nodose; tibia III with large, simple, anterior lobe similar in form to that of *dixica*, its length, measured from node above tarsal articula-

tion, equal to length of tibia measured to same point; basitarsus moderately narrowed apicad. Propodeum with basal area defined by a fine carina, obsolescent laterad.

Metasoma. T6 narrowly exposed, edentate; T7 concealed; S3 simple, posterior margin weakly convex; S4 with marginal area depressed, leaving the disc forming a slightly raised semicircular platform, medially with two small, rounded teeth separated by a shallow emargination; S5 with mesial, basal, bulbous carina prolonged by a very fine carina to the root of two minute teeth borne at the apex of a small marginal lobe; S6 with lateral callosities and median carina. Genitalia (Figure 14): IAL large, apically concave-truncate.

Integument. General surface glossy. Mesoscutum and scutellum subreticulately punctate, the scutellum slightly more coarsely; basal area of propodeum with a single series of longitudinal rugae (Cockerell's plicate), posterior wall coarsely, reticulately punctate. Terga medially coarsely, subreticulately punctate; marginal area of T1 minutely and moderately densely punctate in basal half; bilateral impunctate areas of T2 narrow (not much exceeding one puncture width) and ill-defined; S3 disc dull, minutely coriaceous; S4 general surface glossy, impunctate. *Vestiture.* Face densely pubescent, a central area, centred on the supraclypeal area, with particularly dense, short, even, arborescent hairs. Mesoscutum with longer, erect, simple hairs and towards the periphery, especially anteriorly and adjoining the scuto-scutellar suture, short, arborescent, subsquamiform hairs; coxa II posteriorly and coxa, trochanter and femur III with long spatulate hairs. Terga conspicuously fasciate, the fasciae formed of densely, shortly, branched plumose hairs; T1 basally broadly fasciate, T2-4 with dense fasciae filling postgradular sulci and extending progressively further onto disc (on T4 leaving only a narrow zone of the disc exposed), T1-5 with progressively broader, dense fasciae occupying marginal areas, broadly interrupted on T1; S1-4 lacking conspicuous pubescence but S5 with broad but not dense marginal fascia.

Colour. Black; antennae beneath ochreous; mandibles, except apices, labrum, all tibiae, except anterior lobe of tibia III, and segments 2-4 of tarsus II, reddish; tegulae, except inwardly from umbo, tarsus I, except distitarsus, basitarsi II and III, and anterior lobe of tibia III, yellow; distitarsi I and II black, segments 2-5 of tarsus III dark; calcaria pale; T6 orange. Pubescence of dorsal surfaces pale ochraceous in fresh material.

♀. Length ca 6.5mm, forewing 5.5mm. Similar to the ♂ but the surface sculpture weaker, the metasoma not as conspicuously fasciate, and only the tegulae conspicuously pale; tibia and basitarsus III, however, honey-coloured beneath the scopa and translucent.

Head. Length : breadth ratio 1: 1.23; POL : OOL = 1 : 0.9; lateral ocellus separated from occipital ridge by 1.27x its diameter.

Mesosoma without special characters. Basitibial plate entire, sharply marginate, apex rather narrowly rounded.

Metasoma. Pygidial plate rather narrowly obtuse, with median carina.

Integument. Mesoscutum and scutellum moderately strongly, moderately densely punctate, discally the punctures separated by about up to their own diameter but the punctation becoming denser towards the periphery, especially anteriorly; basal area of propodeum narrow, dull, the longitudinal rugae weak laterally and obsolete medially; posterior wall of propodeum rather coarsely and not densely punctate on a microsculptured ground. Terga much more finely and shallowly punctate than mesonotum, the punctation becoming increasingly more oblique and more widely spaced on succeeding sclerites; punctation of marginal area of T1 as in male; lateroventral area of T1 impunctate.

Vestiture. Pubescence of mesosoma dorsally inconspicuous, apart from the usual dense pubescence of the pronotal lobes and the metanotum; the mesoscutum anteriorly and posteriorly with narrow fasciae. Inner posterior angles of tegulae with dense, short erect hair. T1 with oblique lateral discal maculae separated by about their own length; T2 with weak, T3 weaker, laterally evanescent, basal fascia; marginal areas of T1-4 fasciate, the fascia of T1 broad, filling the marginal area but broadly interrupted medially, those of T2 and T4 entire but not quite filling the marginal area and on T2 distinctly attenuated mesad and diverging from the margin, that of T4 entire, broad, but medially more or less emarginate posteriorly. *Colour*. Flagellum pale beneath; dark area of tegula more extensive; tibia and basitarsus III pale, honey-coloured, translucent. Pubescence paler than in male, nearly white, except marginal area of T5 and pygidial fimbria with dark hairs, those of the former overlain by long pale hairs arising from the disc posteriorly. Scopal hairs unpigmented, the scopa appearing white in certain lights.

Type material

Holotype ♂ labelled 'UAE / Hatta / 15-iii-84 / JNB Brown' [to be deposited in OUM]. Paratypes: UNITED ARAB EMIRATES: Hatta, 27 xi 1981, 1 ♂ 1 ♀; Wadi Dibba, 10 vii 1981, 1 ♂; Wadi Uyaynah nr Dibba, 7 viii 1981, 1 ♂ 1 ♀ (all *C.G. Roche*). Hatta, 6 viii 1982, 1 ♂; Fagsha, 15 iii 1987, 1 ♀; 2 xii 1988, 1 ♀ (all *I.L. Hamer*) [DBB, ILH, CGRC]. Other material, not paratypes: PAKISTAN: **Northwest Frontier Province**, Mardan, Takht-e Bhai, hillside above main archaeological site, 30 iv 1979 (*P.H.B. Baker*), 1 ♂, at yellow composite [DBB].

Comment

Superficially very similar to *inermis* and perhaps sympatric with it in Pakistan, but, in the ♂, tibia III is not abruptly inflated distally and, in the ♀, the mesoscutum is much more densely punctate and the basal area of the propodeum is sharply defined. In the type series, the punctation varies in size and density, being weakest in the Hatta paratype of March 1984.

***Nomiapis carcharodonta* sp. nov.**

(Figures 2, 15)

Etymology

Gr. *καρχαρόδοντος*, in allusion to the trochanteric apophyses.

Diagnosis

A small, dark species, lacking conspicuous tergal fasciae, readily recognized in both sexes by the unusual sculpture and vestiture of the terga. The male is immediately distinguishable from all other described *Nomiapis* by the large, shark's-tooth shaped, apophyses of the posterior trochanters, but the erect apophyses of S4 indicate a relationship with the *femoralis* group although the mesosoma lacks median pseudosternal apophyses. The female shares the modified form of the tegulae.

Description

♂. Length ca 7mm; forewing, measured from base of median cell, 6.0mm. *Head*. Head in frontal aspect transverse, length : breadth ratio I : 1.31; paraocular carina present, normally developed; clypeus in profile weakly convex, anteriorly little deflexed; POL : OOL = 1 : 0.76; lateral ocelli separated from occipital ridge by 1.25x their diameter; A3-5 subequal in length (A3 : A4 : A5 = 1 : 0.91 : 1), A5 about 1.5x as long as maximum breadth.

Mesosoma. Anterior truncation of mesoscutum abrupt but not sharply carinate; scutellum weakly longitudinally sulcate, biconvex, not mucronate; mesepisternal lateral carinae absent, precoxal transverse carina present; anterior pseudosternal apophyses absent; tegulae expanding apicad with greatest breadth near apex, ratio greatest length : greatest breadth = 1 : 0.57; inner apical angle slightly incurved and narrowly rounded. Forewing: ratios lengths SM1: SM3 = 1 : 1.12, 2nd abscissa Rs : 1r-m = 1 : 1.63; hindwing, hamuli 11. Anterior and intermediate legs unmodified, distitarsi slender; calcar II not reaching mid-length of basitarsus; coxa III unmodified; trochanter III with massive, shark's-tooth shaped, apophysis; femur III massive, highly arched, greatest height slightly more than maximum length, apicolateral tooth absent but distal margin dorsally with angular projection accommodated to a similar projection at base of tibia; tibia III short, strongly nodose, with broad membranous anterior flange applied to and exceeding (when leg is flexed) apical half of femur; apical process of tibia III broad, truncate, parallelogrammatic, about as long as broad; tarsus III slender, elongate, basitarsus straight. Basal area of propodeum widened mesad, defined by a fine carina.

Metasoma. T6 narrowly exposed; T7 concealed. S3 with membranous apical lobes that extend over and largely conceal S4 laterad of its discal apophyses; S4 with erect laminar apophyses on either side of a deep median depression, these apophyses rising abruptly at base and then falling towards the margin, the margin between them arcuately excised; S5 with fine erect marginal teeth in line with the apophyses of S4 and with a minute, erect, capitate, mesial process; S6 basally laterally bullate, and having a fine median carina

that projects as a small spine over the narrowly rounded apex of the deep, angular, apical emargination of the sternum; S7 with median emargination; S8 with apical lobe medially tridentate, the lateral teeth rounded, the median truncate. Genitalia (Figure 15): marginal area of IAL ventrally with dense brush of short, black, modified setae, giving in oblique lateral view, at low magnification (50x), the appearance of a coarsely pectinate margin; AMP large, subhorizontally oriented, bizarrely shaped with long antrorse taenia.

Integument. Generally glossy, without evident microsculpture, but the marginal areas of T1-5 finely coriaceous and with minute, sparse setigerous punctures. Punctuation of mesoscutum coarse, reticulate, becoming subreticulate towards base of disc, of scutellum reticulate and slightly less coarse. Basal area of propodeum with fine, longitudinal rugae forming a single series of foveae. Terga coarsely (ca 1.5x Ø mesoscutal punctures), reticulately punctate, on T1 a narrow impunctate zone medially near end of disc, on T2-4 the punctures becoming finer, but still coarse, near base; marginal area of T1 basally with a single series of fine punctures.

Vestiture. Without exceptional hair characters. Hairs of mesoscutum appearing simple at 25x, anterior and scuto-scutellar fasciae not developed; ventrally no spatulate hairs present. Postgradular sulci of T2-4 with fine, inconspicuous fasciae; marginal areas of T2-5, and T1 laterally, thinly clothed with fine, inconspicuous, decumbent, hairs; femur III ventrally glabrous. Apical lobes of S3 clothed with strongly plumose hairs; S4 laterally with conspicuous, dense tufts of white plumose hairs.

Colour. Black, flagellum brown, paler beneath; calcaria pale; tibia III except dorsally at base, and basitarsus III in basal two-fifths, stramineous.

♀. Length ca 6.5mm; forewing 5.4mm. Similar to the ♂ but less coarsely and less densely punctate; dorsally, apart from the pronotal lobes and metanotum, without conspicuous pubescence.

Head. Length : breadth ratio 1 : 1.24; POL : OOL = 1 : 0.79; lateral ocellus separated from occipital ridge by 1.14x its diameter.

Mesosoma. Without special characters. Basitibial plate imperfect, margin free only dorsally and apically.

Metasoma. Pygidial plate narrowly rounded. *Integument.* Mesoscutum discally with punctures separated by one puncture width or more, towards the periphery, especially anteriorly, the punctuation becoming fine and dense; scutellum densely but irregularly punctate; a narrow tract bounding basal area of propodeum impunctate, beyond this zone the propodeum finely, moderately densely punctate; T1 anteriorly moderately densely and finely punctate, but the disc broadly, nearly as broadly as the marginal area, impunctate with a few widely scattered punctures adjacent to its posterior margin; T2-5 also moderately densely and finely punctate, the punctuation becoming progressively stronger on succeeding terga and, as in the ♂, coarser towards the apex of each tergum; the broad marginal areas as in the ♂, but on T1 basally with only minute, widely separated, setigerous punctures; lateroventral surfaces of T1 impunctate.

Colour. Black, flagellum brown beneath, legs tending to brownish apicad, calcaria pale, scopal hairs nearly colourless.

Type material

Holotype ♂ labelled: 'SOUTH INDIA / S. Malabar Distr. / Walayar Forests. / VI 1957. Nathan' [DBB]. Paratypes: 2 ♀ ♀, SOUTH INDIA: [**Kerala / Tamil Nadu** borders], Walayar Forests, vi and vii 1957 (*P. Susai Nathan*) [DBB, OUM].

Comment

This remarkable species was one among many interesting bees received by the author from the late Mr P. Susai Nathan⁹ during an association lasting nearly thirty years; it appears not to have been recovered by him in subsequent collecting and has not been encountered in more recent regional collections.

***Nomiapis kophenes* sp. nov.**

(Figure 16)

Etymology

Gr. κωφην (*cf.* Stephanus s.v. 'Ἀραχωσία'), identified with Kabul.

Diagnosis

The species is immediately distinguishable, in the male, by the wing-shaped processes of the pseudosterna and the fine longitudinal lamellae of coxae III. The female resembles that of *diversipes* but the lateral ocelli are less widely separated from the occipital ridge; the mesoscutal punctation, while equally dense, is less coarse; and the postgradular fascia of T2 is strongly developed.

Description

♂. Length ca 6.5mm; forewing, measured from base of medial cell, 5.8mm.

Head. Head in frontal aspect transverse, length : breadth ratio I : 1.21; paraocular carina normally developed; clypeus in profile strongly convex; POL : OOL = 1 : 0.8; lateral ocelli separated from occipital ridge by 1.8x their diameter; A3 and A4 nearly equal in length, slightly longer than maximum breadth, the following segments longer (A3 : A4 : A5 = 1 : 0.93 : 1.07).

⁹ P. Susai NATHAN was born on the 18th April 1891 and died on the 17th March 1976. He commenced collecting insects and supplying them at the age of about 15, while still at school. He became a government entomologist in Madras State (now Tamil Nadu State) and later was posted to Basra, then under British rule, as Port Officer. There he was responsible for screening imported seeds and plants for disease. In 1929 he retired voluntarily from government service in order to devote himself to collecting. [Information kindly supplied by Mr NATHAN's family.] Material supplied by Mr P. Susai NATHAN and subsequently by other generations of his family is to be found in a number of public and private collections, and it would be very useful, especially from the point of view of locating additional material of new and little-known taxa, to have a record of those to which material was supplied in quantity.

Mesosoma. Anterior face of mesosoma dorsally (vertical face of pronotum with anterior face of mesoscutum) weakly concave; mesepisternal lateral carinae absent, transverse precoxal carinae present; anterior pseudosternal apophyses laminar, distally transparent, wing-shaped (as in, e.g., *Pieris* ♀ ♀); scutellar spines long, slender, medially abruptly deflexed; tegulae expanding apicad with greatest breadth near apex, ratio greatest length : greatest breadth = 1 : 0.43; apex subtruncate. Forewing: ratios lengths SM1: SM3 = 1 : 1.27, 2nd abscissa Rs : 1r-m = 1 : 1.28; hindwing, hamuli 10. Anterior and intermediate legs unmodified; calcar II elongate, slightly shorter than basitarsus; distitarsi I and II slender; coxa III with low longitudinal lamella; femur incrassate, arched, greatest breadth before middle, ventral surface broad, concave, apicolateral tooth weak; tibia short, nodose, greatest breadth at middle, apical process as long as pre-tarsal region, acuminate; tarsus III slender, straight, weakly fusiform, longer than pretarsal region of tibia. Propodeum with distinct, short, basal area defined by a fine carina.

Metasoma. T6 edentate; T7 concealed; S2 with weak, median, angular projection; S3 unmodified; S4 with deep, narrowly angular, median incision, the margins of the incision thickened, cariniform, becoming weakly lamelliform apicad and projecting slightly beyond the sternal margin; S5 with deep, narrow median incision separating two small, broadly rounded lobes, their general surface weakly convex; S6 with median arcuate emargination. Genitalia (Figure 16): IAL moderate, its ventral surface densely, evenly, clothed with long, semidecumbent, capitate hairs forming a brush which, in normal aspect, projects mesad well beyond the lobar margin (and which, viewed ventrally at low magnification, suggests a papillate rather than a setose surface); IAG little developed; IAP slender, simple.

Sculpture. Integument glossy. Mesoscutum and scutellum reticulately punctate, the latter more coarsely; basal area of propodeum narrow, with longitudinal rugae; posterior wall reticulately punctate. Terga medially coarsely, reticulately punctate, on T2-5 the punctures becoming coarser and subreticulate apicad; marginal area of T1 basally with a single series of larger punctures, of T2-5 with single series of much finer, in part setigerous, punctures; T2 lacking distinct bilateral impunctate areas.

Vestiture. Face densely pubescent but the declivous anterior region of the clypeus glabrous. Mesoscutum with longer, erect coarser hairs, appearing simple at 25x, and generally shorter, more or less strongly arborescent, hairs, these becoming denser and longer anteriorly, dense and short adjoining the scuto-scutellar suture; femur III ventrally densely clothed with long spatulate hairs. T1 thinly clothed with long, simple, erect hairs; postgradular sulcus of T2 thinly clothed with semierect hairs, these partly invading disc; postgradular sulci of T3-5 with dense, decumbent fasciae; marginal areas of T1-5 effasiate, of T2-5 with thin fringes of widely spaced long decumbent setae arising from margin of disc; S4 and S5 with broad but not dense marginal fasciae becoming denser laterad, on S4 evanescent on either side of median incision, on S5 reduced medially to fine fimbriae fringing the median lobes; S6 with entire fascia widest medially.

Colour. Black, lateral lamellae of pronotum, tegulae, apices of scutellar spines, tibiae distally, tarsi, including distitarsi, and calcar II pale, yellowish or stramineous; lateral lamellae of pronotum and apices of tegulae becoming translucent; marginal areas of terga colourless, transparent. Flagellum pale brown.

♀. Length ca 7.5mm, forewing 6.0mm. Similar to the ♂ but the surface sculpture weaker and the pale areas inextensive.

Head. Length : breadth ratio 1 : 1.21; POL : OOL = 1 : 1; lateral ocellus separated from occipital ridge by 1.3x its diameter.

Mesosoma without special characters. Basitibial plate entire, apically broadly rounded.

Metasoma. Pygidial plate rather narrowly triangular, apically narrowly rounded.

Integument. Punctuation of mesoscutum subreticulate, with narrow but evident interspaces; punctuation of T1 discally subreticulate, of T2 and T3 discally fine and successively more widely spaced, the interspaces equal to or exceeding puncture diameters; marginal areas finely (at 25x) coriaceous; basal punctuation of marginal areas multiseriate, on T1 extending slightly beyond, on T2 as far as basal third; lateroventral surfaces of T1 largely impunctate, with a few fine punctures adjacent to the carina.

Vestiture. Mesoscutum with arborescent hairs confined to anterior margin; scopal hairs of trochanter, femur and tibia III strongly branched.

Colour. Black, pronotal lamellae marginally unpigmented, transparent; tegulae pale but umbo dark; calcaria pale; distal tarsal segments pale; scopal hairs white; apical fimbria of basitarsus III golden.

Type material

Holotype ♂ labelled: 'AFGHANISTAN / Kabul, Paghman, / valley above town. / 2100/2400m. / 17 VII 1977', 'floodbed of / river and adj[acent] / cultivation.' and 'CAMBRIDGE / AFGHANISTAN / EXPED. 1977' [OUM]. Paratypes: AFGHANISTAN: **Kabul**, Paghman, valley above town, 2100/2400m, floodbed of river and adjacent cultivation, 17 vii 1977, 1 ♂ ; **Lowgar**, Sajavand, fortress, ca 2300m, 11 vii 1977, 1 ♀ (both Cambridge Afghanistan Expedition, 1977, *P.H.B. Baker & E.L. Mun-day*) [DBB].

Comment

COCKERELL (1920: 206) described *Nomia fletcheri*, from the female, from Tarnab in the Peshawar district. On general zoogeographical grounds this could be *kophenes*, but *fletcheri* is a larger species and other characters in its largely inconsequential description ('metathorax ... basal enclosure small, without plicæ') do not suggest identity.

Key to males of regional species

Taxa prefixed * are included on the basis of published descriptions.

The following taxa are not included: *Pseudapis aliena* (CAMERON), known only in ♀; *Ps. enecta* (COCKERELL); *Ps. trigonotarsis* HE & WU; *Ps. duplocincta* (VACHAL) and *Ps. kingi* (COCKERELL), neither taxon certainly regional (see key in PAULY, 1990); *Nomiapis fletcheri* (COCKERELL) and *N. opacula* (COCKERELL), both known only in ♀.

To avoid confusion, certain names used by WARNCKE and PAULY are inserted in square brackets before the accepted names.

Diagnostic autapomorphies are shown in *italics*.

Owing to the unusual complexity of structural modifications affecting the normally exposed sterna, particularly sterna 4-6, the following notes, which are not exhaustive and which refer especially to the the modifications of sternum 4 in *Pseudapis*, may be helpful. The *postgradular area* is subject to extensive modification and may form discally a raised plateau, this plateau sometimes with posterior, cuspidiform emargination (e.g., *edentata*), or be laterally bullate (e.g., *patellata*), or possess lateral carinae or callosities that are convergent apicad (e.g., *interstitinervis*). Where the postgradular area medially is produced caudad in such a way that its apical margin forms part of the apparent apical margin of the sternum, the projecting portion may itself be variously modified, either its apical margin being simply, weakly, bidentate or bilobate (e.g., *interstitinervis*), or stronger teeth resulting from a prolongation caudad of carinae or other excrescences arising posteriorly in the postgradular area being present (e.g., *nilotica*, *flavolobata*). A distinct and more or less abruptly depressed *posterior marginal area* is usually developed. In some species it is narrowed mesad when it either vanishes entirely or becomes concealed, where this is present, beneath the apical extension of the postgradular area. The morphological *apical margin* of the sternum may be simple (subrectilinear or weakly convex), or, medially, variously modified: with a mesial linear incision (e.g., *fugax* [*Nomiapis*]), simply bidentate or bilobate (e.g., *ocracea*), or more or less strongly triangularly produced and apically incised (e.g., *bytinski*, *rufescens*). In a few species (e.g., *flavolobata*, *nilotica*) two teeth developed from the apical margin of the postgradular area project above two weaker, more closely approximated, teeth developed from the apical margin of the sternum (which in these species is continuous but concealed medially beneath the produced postgradular area),¹⁰ giving a quadridentate condition.

1. Tibia III of normal proportions, expanded apicad to form a more or less strongly developed anterior lobe, an angled apical process absent. Posterior marginal areas of T2-T4 with entire or interrupted fasciae of decumbent plumose hairs. [T6 laterally edentate; femur III lacking a preapical anteroventral tooth.](*Pseudapis*) 2

¹⁰ Cf. the condition in many *Anthidium*, where the marginal area of the terga is, except laterally, overlain by an expansion of the disc, forming a grooved margin, readily observed in caudal aspect.

- Tibia III contracted, dorsally strongly convex or nodose, bearing apically an angled, laminar process, the general surface of which, when the leg is flexed, is apposed to the ventral surface of the femur; or, if as above (*bispinosa*), then T6 laterally dentate and femur III with preapical anteroventral tooth. Posterior marginal areas of T2-T4 glabrous (but overlain by a series of long, spaced setae arising from the discal margin). (*Nomiapis*) 23

- 2. Distitarsus II unmodified, slender, concolorous with mediotarsus. [Scutellum mutic.] 3
- Distitarsus II modified, more or less strongly expanded, subparallel-sided, pyri-form or orbicular, black. 5

- 3. Femur III ventrally lacking spatulate or racquet-shaped hairs. [Apical margin of S4 medially with two small teeth; anterior lobe of tibia III weak; metasomal terga densely clothed with white, squamiform hairs. Saharan Atlas.] **algeriensis* (WARNCKE)
- Femur III ventrally with spatulate or racquet-shaped hairs. 4

- 4. Postgradular area of S4 unmodified, apical margin medially weakly emarginate; S5 with mesial carina, its apical margin simple; anterior lobe of tibia III developed only apically, weak, distally rounded; sternauli not developed ['Mesopleuren unten gerundet']; femur III in lateral aspect scarcely incrassate apicad; mesoscutal punctation dense but with evident glossy interspaces ('Abstand 1 Punktdurchmesser'). **anatolica* (WARNCKE)
- Postgradular area of S4 invaded posteriorly by a median cuspidiform expansion of the depressed, membranous, marginal area, consequently presenting the appearance of two low, inwardly rounded platforms, anteriorly these united in a weak, broad mesial ridge; S5 with strong mesial carina, the margin triangularly produced mesially, subangularly produced laterally; anterior lobe of tibia III well developed, distally broadly rounded; sternauli well developed, the ventral surface of the mesothorax concave; femur III strongly incrassate apicad and the abruptly contracted to tibial articulation, forming a strong dorsal node; mesoscutal punctation dense but not uniform, interspaces one puncture-width or less. [Small species with copious white, decumbent, subsquamiform pubescence, forming progressively broader basal fasciae on T2-T4, on T2 the exposed part of the disc, except for a few punctures medially and a single row of punctures preceding the marginal area, impunctate; propodeal area not delimited by a distinct carina, foveate; the racquet shaped hairs not confined to femur III but also present on coxa II and III and ventral surface of mesothorax; S6 with median carina and strong lateral callosities.] [*orientana* WARNCKE; *guichardi* PAULY] *edentata* (MORAWITZ)

- 5. Distitarsus II with dense bilateral fan of black hairs; mediotarsus with pecten of strong setae; S3 and S4 with long, decumbent premarginal fimbriae. [Anterior lobe of tibia III directed distad rather than anterad.] 6
- Distitarsus II without fan; mediotarsal segments lacking such a pecten; S3 and S4 variously setose or pubescent but not as above. 7

6. Posterior margin of S4 medially weakly angularly produced; postgradular area of S5 bilaterally bullate, apical margin with spinosely produced mesial carina; S6 with weak bullae; pecten of tarsus II weak, confined to mediotarsus; femur III strongly incrassate apicad, spatulate hairs of ventral surface exceptionally long, occupying whole length of femur; anterior lobe of tibia III distally broadly rounded; punctation of mesoscutum reticulate; bilateral impunctate areas of disc of T1 reduced, narrow, widely separated. Saharo-Sindian (Chad to peninsular India)...
..... *patellata* (MAGRETTI)
- S4-S6 not so modified, simple; setae constituting pecten of basitarsus and mediotarsus II long, black, more strongly developed posteriorly (Figure 3); femur III not strongly incrassate apicad, spatulate hairs of ventral surface shorter, confined to basal three-fifths of femur; anterior lobe of tibia III subacuminate; punctation of mesoscutum dense but with evident glossy interspaces; impunctate areas of T1 extensive, broad, narrowly separated. Socotra. *anomala* W.F. KIRBY
7. Scutellum mutic. 8
- Scutellum laterally mucronate. 15
8. Femur III ventrally lacking spatulate hairs. [*A13 dilated, black*; femur III strongly inflated; calcaria III absent; anterior lobe of tibia III large, *truncate* (Figure 1); basitarsus III arcuate, contorted, strongly attenuate apicad; S2 and S3 not structurally modified but with long, erect, marginal fimbriae; S4 with a well-developed mesial carina which becomes higher apicad and then falls abruptly, not attaining the margin; postgradular area of S5 discally little modified, with weak mesial ridge separating two shallow concavities, but apical margin on either side strongly, dentately produced, the margin between these teeth broadly convex; S6 with weak mesial carina and strong lateral, submarginal, callosities. Egypt.]
..... *fayumensis* **sp. nov.**
- Femur III ventrally with long spatulate hairs. 9
9. Basitarsus III compressed, expanded, anterior surface concave, longitudinal carina of posterior surface strong; Oriental. [Femur III strongly inflated, its greatest depth at about two-thirds length, ventrally with a transverse pre-apical ridge appearing in caudal aspect as a small, acute, tooth; propodeal area ill-defined, the punctures on either side of it coarse and well separated.] 10
- Basitarsus III not so modified, simple or weakly attenuate or incrassate; Palaearctic. 11
10. Basitarsus III broader, about 3 times as long as broad; anterior lobe of tibia III large, broad, expanded distad, truncate, with rounded angles; propodeal area not limited by a distinct carina, the foveae shallow and posteriorly ill-defined; postgradular area of S4 with strong sublateral callosities, its apical margin medially subtriangularly produced; S6 with lateral callosities; sternauli prominent, posteriorly tuberculate; tarsus II elongated and distinctly attenuated. Eastern Asia.
..... *siamensis* (COCKERELL)

- Basitarsus III narrower, about 4 times as long as broad; anterior lobe of tibia III of usual form, distally rather narrowly rounded; propodeal area limited by a fine carina, weakly or not at all foveate, frequently appearing, at least medially, as a shallow, smooth, trough; S4 with platform occupying greater part of postgradular area terminating mesially in a small tooth, the marginal area on either side becoming obsolete mesad and terminating on either side of the discal projection in a small, depressed, rounded tooth; S5 mesially carinate, margin medially produced; S6 concave with strongly reflexed, thickened lateral margins bearing a dense brush of plumose hairs, apically with a fine spine; tarsus II slightly attenuated, not elongated. Indian sub-continent. *oxybeloides* (SMITH)

- 11. Trochanter I basally abruptly expanded and angulate, its ventral surface (as that of trochanter II) broad, flattened; basitarsus II strongly attenuate, curved, mediotarsus II unusually slender. [Sternauli strong; anterior lobe of tibia III exceptionally large, its greatest length conspicuously greater than length of tibia, distally broadly rounded, its anterior margin, entire; S4 with marginal area depressed, leaving the postgradular area discally forming a slightly raised semicircular platform, the apical margin medially with two small, rounded teeth separated by a shallow emargination; S5 with mesial, basal, bulbous carina prolonged by a fine carina to the root of two minute teeth borne at the apex of a small marginal lobe; S6 with lateral callosities and mesial carina. United Arab Emirates to Pakistan.] *stenotarsus* **sp. nov.**
- Trochanter I not so modified, or, if approaching that condition, other characters different; basitarsus II not so modified. 12

- 12. Apical margin of S4 simple; postgradular area simple. [Femur III not strongly incrassate; anterior lobe of tibia III strong, arising from whole length of tibia, distally broadly rounded; S5 with weak basimesial carina, apical margin broadly, weakly concave; S6 with lateral callosities; propodeal area limited by a distinct carina and traversed by a series of carinulae, not appearing as a series of distinct foveae; posterior wall of mesosoma, except for small, impunctate, glossy, post-propodeal area, coarsely reticulately punctate; punctation of mesoscutum coarse, subreticulate, of terga exceptionally coarse. North-east Africa to Mesopotamia.] *innesi* (GRIBODO)
- Apical margin of S4 medially bi- or quadridentate; postgradular area modified or not. 13

- 13. Postgradular area of S4 with strong, sublateral, convergent, distally decrescent, callosities which attain the margin in small, angular projections at about one-fourth of the marginal width on either side, between them the margin produced and bearing two widely separated rounded teeth. [Sternauli strong; propodeal area well defined, traversed by fine carinulae; mesoscutal punctation strong, subreticulate. Sahelian, west to Senegal, not certainly regional.] *interstitinervis* (STRAND)
- S4 with callosities, if present, apico-medial. 14

14. Apical margin of S4 medially with two small closely approximated teeth; POM longer, two ocellar diameters; sternauli weak; tarsus II moderately attenuate; femur III relatively slender, moderately incrassate apicad, its greatest depth at about three-fourths of its length; anterior lobe of tibia III large, *tumid, abruptly separated from general surface of tibia*, distally broadly rounded, its anterior margin entire; propodeal area not delimited by a carina, narrow, irregularly sculptured; sternum 6 with mediobasal tooth/carina; mesoscutal punctation dense but with evident glossy interspaces; punctation of T1 disperse; bilateral impunctate areas of T2 moderate, discrete. [*edentata* WARNCKE, PAULY] *inermis* (MORAWITZ)
- S4 medio-apically with two well-separated callosities which arise from an extension of the disc above the marginal area, these callosities prolonged as strong, incurving teeth, the emargination between them deep; the marginal area narrow and inwardly of the discal teeth produced in two small digitiform processes that attain the same level as the discal teeth (*cf. nilotica*); POM shorter, about 1 ocellar diameter; sternauli strong, posteriorly tuberculate; femur III massive, strongly incrassate apicad, its greatest depth more than half its length; anterior lobe of tibia III not inflated, its anterior margin with median emargination (*cf. nilotica*); propodeal area well defined, *with projecting lip*; S6 with mediobasal carina and strong lateral callosities; mesoscutal punctation subreticulate; punctation of T1 subreticulate; bilateral impunctate areas of T2 extensive, subcoalescent. United Arab Emirates to Pakistan. *flavolobata* (COCKERELL)
15. Apical margin of S4 simple. 16
- Apical margin of S4 modified. 17
16. Sternauli not developed; trochanter I unmodified; calcar II about half length of basitarsus; tarsus II not attenuate; femur III slender, unmodified; anterior lobe of tibia III weak, distally narrowly rounded; propodeal area ill-defined; S6 unmodified; mesoscutal punctation finer, less than 0.15 ocellar diameter, dense but with evident glossy interspaces. *tadzhica* (POPOV)
- Sternauli well developed; trochanter I basally abruptly expanded and angulate; calcar II distinctly less than half length basitarsus; tarsus II moderately attenuate; femur III incrassate apicad; anterior lobe of tibia III strong, distally weakly inflated, apically broadly rounded, its anterior margin with median node; propodeal area clearly defined by a fine carina; S6 with mesial carina and well-developed lateral callosities; mesoscutal punctation coarser, more than 0.15 ocellar diameter, subreticulate. *lobata* (OLIVIER)
17. Apical margin of S4 broadly, subtriangularly produced and medially incised, weakly bilobate; sternauli weak. [Anterior lobe of tibia III well developed.] 18
- Apical margin of S4 straight, medially bidentate or quadridentate; sternauli strong, the concavity between them (except in *dixica*) with long spatulate hairs. 19
18. Femur I sub-basally dentate, distally arcuate; posterior margin of basitarsus I fimbriate; distitarsus II elongate-pyriform, strongly attenuated basad; femur III

- lacking spatulate hairs [ex figure: not indicated in WARNCKE's key or description]; anterior lobe of tibia III narrower; basitarsus III slender, parallel-sided, weakly arcuate; smaller species (length not given in original description but that of ♀ given as 8-9 mm). **bytinski* (WARNCKE)
- Femur I unmodified; posterior margin of basitarsus I normally pubescent; distitarsus II pyriform; femur III ventrally with spatulate hairs; anterior lobe of tibia III broader; basitarsus III arcuate, contorted, strongly attenuate apicad (*cf. fayumensis*); larger species (length of ♀ given by MORAWITZ as 10 mm). **rufescens* (MORAWITZ)
19. Femur III ventrally lacking spatulate hairs. 20
- Femur III ventrally with long spatulate hairs. 21
20. Basitarsus II attenuate apicad; femur III moderately incrassate apicad; anterior margin of anterior lobe of tibia III large, apically broadly rounded, its greatest length much greater than tibial width, its anterior margin entire; T7 invaginated; mesoscutum glossy, its punctation coarser, the punctures separated by up to one puncture-width, the surface largely exposed, the squamiform hairs confined to a broader anterior and a narrower posterior fascia; tegulae narrower, posteriorly broadly rounded; femora black; distitarsus I black; pubescence white. Egypt to Morocco. *dixica* (WARNCKE)
- Basitarsus II not attenuate; femur III strongly inflated; anterior lobe of tibia III small, shorter than tibial width, its anterior margin with weak median emargination; T7 exposed; mesoscutum matt, its punctation finer, subreticulate, the surface largely concealed by the squamiform hairs; tegulae broader, externally strongly convex, semilunar, posteriorly narrowly rounded; legs extensively yellow, femur III predominantly yellow; distitarsus I concolorous with mediotarsus; pubescence ochraceous. Yemen. *ochracea* PAULY
21. Anterior margin of anterior lobe of tibia III angularly emarginate; S4 medio-apically with a U-shaped depression bounded by two parallel callosities which arise from an extension of the disc above the marginal area, these callosities prolonged as short, blunt teeth, the emargination between them shallow; the depressed marginal area narrow and, beneath the discal teeth, and nearly concealed by them, with two further, small blunt teeth (*cf. flavolobata*). *nilotica* (SMITH)
- Anterior margin of anterior lobe of tibia III entire; apical margin of S4 bidentate. 22
22. Mesoscutum densely, subreticulately punctate; distitarsus II nearly orbicular; anterior lobe of tibia III exceptionally large, conspicuously broader than femur. **platula* (WARNCKE)
- Mesoscutum less densely punctate, with evident glossy interspaces of up to more than one puncture diameter; distitarsus II narrowly pyriform; anterior lobe of tibia III narrower, scarcely exceeding breadth of femur. [Scutellum sparsely punctate, spines slender, long; propodeal area weakly defined. This is *elegantissima sensu* WARNCKE but probably not *elegantissima* (POPOV): see text.] *elegantissima* (POPOV)

23. Medial mesepisternal apophyses absent. 24
 - Medial mesepisternal apophyses present. 25
24. Scutellum mutic; POM short, 1.25 x ocellar diameter; precoxal carina present, weak; calcar II less than half length of basitarsus; *trochanter III with massive, compressed, ventral spine* [Figure 2]; femur III massively inflated, its greatest depth more than its length; tibia III with strong apical process, the portion extending beyond the tarsal articulation subquadrate, obliquely truncate; apical margin of T6 edentate; S3 with membranous apical lobes that extend over and largely conceal S4 laterad of its discal apophyses; S4 with erect laminar apophyses on either side of a deep median depression, these apophyses rising abruptly at base and then decrescent towards the margin, the margin between them arcuately excised; S5 with fine erect marginal teeth in line with the apophyses of S4 and with a minute, erect, capitate, median process; S6 basally laterally bullate, and having a fine mesial carina that projects as a small spine over the narrowly rounded apex of the deep, angular, apical emargination of the sternum; bilateral impunctate areas of T2 coalescent; mesoscutum coarsely, subreticulately punctate, glossy, with fine, short, inconspicuous pubescence; femur III ventrally glabrous; smaller species, 7 mm (n = 1). Peninsular India. *carcharodonta* **sp. nov.**
- Scutellum mucronate; POM long, equal to or exceeding two ocellar diameters; precoxal carina absent; calcar II about half length of basitarsus; trochanter III mutic; femur III moderately incrassate, its greatest depth near mid-length; tibia III not contracted, abruptly expanded anteriorly at basal fourth and thence carinate, the carina running into the weak, distally rounded, anterior apical lobe; apical margin of T6 laterally dentate, medially shallowly emarginate; S3 and S4 simple; postgradular area of S5 apically with a median chevron-shaped callosity, open posteriorly, apical margin medially with two closely approximated, small, styli-form processes; S6 with mesiobasal carina and strong, oblique lateral callosities, its apical margin mesially incised; bilateral impunctate areas of T2 linear, discrete; mesoscutum less coarsely, reticulately punctate, matt, with conspicuous long pubescence, about equal in length to flagellar diameter; femur III ventrally densely clothed with short, spatulate hairs; larger species, 8-11 mm. Mediterranean Region, east to Transcaspia. *bispinosa* (BRULLÉ)
25. *Mesial mesepisternal apophyses lamelliform, broadly wing-shaped*; coxa III with low, longitudinal ventral lamella; smaller species, 6.5 mm. [Scutellum mucronate, the spines long, slender, incurving; calcar II little shorter than basitarsus; femur III moderately inflated, arched, its greatest depth at basal third; apical process of tibia III acuminate; S4 apically with deep, narrowly angular, median incision, the margins of the incision thickened, cariniform, becoming weakly lamelliform apicad and projecting slightly beyond the sternal margin; S5 with deep, narrow median incision separating two small, broadly rounded lobes, their general surface weakly convex; S6 with median arcuate emargination. Afghanistan.] *kophenes* **sp. nov.**
- Mesial mesepisternal apophyses compressed, narrow, blade-like; coxa III distally with small, erect, ventral spine; larger species, except in small individuals of *diversipes* exceeding 8 mm. 26

26. Scutellum mutic. [Apical process of tibia III truncate.] 27
 - Scutellum laterally mucronate. 29
27. POM longer, length c. three ocellar diameters. [Apical process of tibia III sigmoid, of nearly uniform breadth, apically anteriorly angulate, posteriorly rounded; mesoscutum and tegula with long, minutely branched hairs (of mesoscutum longer than flagellar diameter); lamellae of S4 high, in lateral aspect truncate, the apex produced posteriorly as a sharp tooth.] [China (Manchuria), Korea, Japan.]
 *mandschurica* (HEDICKE)
 - POM shorter, less than two ocellar diameters. 28
28. Vertex narrowly rounded into occiput, not carinate; marginal area of S4 medially deeply, narrowly excised, the excision bounded by two parallel carinae that project beyond the margin as small teeth; S5 with mesial carina developed basally as a high triangular tooth; marginal area of S5 medially deeply, triangularly emarginate, the two fine, parallel, digitiform processes that arise from the base of the emargination attaining the same level as the triangular lobes enclosing it, the margin laterad of these lobes produced on either side as an incurving, densely pubescent spine; S6 broadly, angularly, emarginate; apical process of tibia III abruptly narrowed at mid length, less than half as wide in apical as in basal half. South-eastern Anatolia. **urfana* (WARNCKE)
 - Occipital ridge carinate; marginal area of S4 with broader median emargination bounded by incurving lamellae, these in lateral aspect convex, posteriorly dentately produced (*cf. femoralis*); S5 with mediobasal carina, the margin medially produced in two narrowly separated, raised, convex, tongue-like processes; S6 with mesiobasal carina; apical process of tibia III as in *mandschurica* but broader. [Mesoscutum and tegula with short hair (of mesoscutum discally shorter than flagellar diameter), anteriorly and posteriorly subsquamiform; lamellae of S4 not so strongly raised as in *mandschurica*.] Balkans and Levant east to Transcaspi; ? Spain [type locality, questioned by WARNCKE]. *valga* (GERSTÄCKER)
29. *Tibia III with arcuate, digitiform, basidorsal process*; apical process of tibia III broad, with a smaller, interno-basal, subsidiary lobe. [Tibia II clavate, ventral margin angulate at apical two-thirds; spatulate hairs of ventral surface of femur III short, confined to basal third.] *monstrosa* (COSTA)
 - Tibia III dorsally more or less strongly nodose but lacking a detached basidorsal process; apical process of tibia III lacking such a secondary lobe, narrower than in *monstrosa*. 30
30. Apical process of tibia III broad, sinuous, apically truncate; femur III strongly inflated, its greatest depth near base; calcar II exceeding half length of basitarsus. 31
 - Apical process of tibia III acuminate, recurved distally; femur III relatively slender, strongly arched, its greatest depth near middle. [Precoxal carina well developed.] 33

31. S5 with mediobasal carina; S5 apical margin with two narrowly separated, raised, more or less convex, tongue-like processes (*cf. valga*); apical process of tibia III sinuous, slender, of uniform width; occipital ridge with reflexed carina; hairs of mesoscutum long, erect, simple or minutely branched. [Lamellae bounding median emargination of S4, in lateral aspect, anvil-shaped, erect, expanded apicad, truncate, anteriorly and posteriorly sharply pointed (*cf. valga*); mesoscutum densely punctate, with evident interspaces, glossy.] *femoralis* (PALLAS)
- S5 with mediobasal tubercle; S5 apical margin produced and with a deep V-shaped emargination, the margins of the excision slightly thickened; apical process of tibia III narrower in its apical half than basally; hairs of mesoscutum short, subsquamiform; mesoscutum reticulately or subreticulately punctate, matt. 32
32. Apical process of tibia III weakly sinuate, of nearly uniform width; scutellum medially scarcely depressed; scutellum medially weakly depressed; propodeal area longer, little shorter than metanotum; calcar II two-thirds length basitarsus. *fugax* (MORAWITZ)
- Apical process of tibia III more strongly deformed, contracted at mid-length to half its basal width, the anterior margin strongly sinuate, the posterior margin medially subangulate; S6 laterally strongly and angularly tumescent; scutellum medially strongly depressed; propodeal area short, less than half length metanotum; calcar II long, nearly attaining apex of basitarsus. *squamata* (MORAWITZ)
33. Occipital ridge carinate; vertex shorter, POM less than two ocellar diameters; tegulae comparatively shorter, broader; femur III lacking preapical anteroventral tooth; tibia III dorsally strongly, uniformly convex; punctuation of mesoscutum reticulate; impunctate areas of disc of T2 reduced, generally marked only by more widely separated, irregular, punctuation; marginal area of S4 medially with two closely approximated, fine, parallel carinae which project apically beyond the sternal margin; S5 mesially carinate, medially produced and emarginate; S6 with lateral, posteriorly dentiform, carinae. *diversipes* (LATREILLE)
- Vertex narrowly rounded into occiput, not carinate; vertex longer, POM greater than two ocellar diameters; tegulae comparatively shorter, broader; femur III with preapical anteroventral tooth; tibia III dorsally with strong node at distal two-thirds, the node posteriorly with broad, palmate, squamiform hairs; punctuation of mesoscutum subreticulate, discally medially with narrow but distinct interspaces; impunctate areas of disc of T2 well developed, discrete; marginal area of S4 medially triangularly produced and deeply incised, the margins of the incision thickened; S5 with mediobasal tubercle, apically deeply, roundly excised, the margin on either side of the excision produced in the form of narrow, incurving, forcipate lobes; S6 with lateral callosities. *equestris* (GERSTÄCKER)

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APPENDIX 1. Regional material examined Much material, in various collections, that had been examined in earlier years, but had not been recorded in detail, was not readily re-available when the decision to draft the present paper was taken. The records now given therefore relate in large part to material examined or re-examined more recently as a consequence of that decision. Some material seen previously is however recorded, following the more detailed entries, prefaced 'Also seen from: ...'. It is particularly regretted that extensive material in the Natural History Museum, London, determined by the writer prior to 1997, could not be reviewed owing to restrictions on loan imposed by the authorities. Records are given in alphabetical order of species. Acronyms in square brackets following entries indicate the collections in which the material recorded is deposited. Where the material recorded reduces to duplicates retained for reference purposes on the determination, prior to 1997, of BMNH material, the existence of more extensive material in the BMNH collections may be assumed. 'PALESTINE' has been used in the sense of the former mandated territory to avoid the complications of distinguishing between Palestinian, Israeli and Israeli-occupied territories.

anomala

REPUBLIC OF YEMEN: **Socotra** [Suqutrá]: Hadibo Plain, Ras H.M., 31 iv 1967, 1 ♂; Hadibo Plain, s.l., 29 iii 1967, 1 ♀ (both *K.M. Guichard*, B.M. 1967-455) [DBB ex BMNH].

bispinosa

TURKMENISTAN: Kosch-Lagar (*D.K. Glasunov*), 1 ♀ [DBB].

EGYPT: Cairo, 9-20 v 1978, 1 ♂; 12 v 1981, 1 ♂ (both *K.M. Guichard*) [DBB]. Cairo, Warra' al Arab, 22 vi 1984, 1 ♀; El Minia, 17 v 1988, 3 ♂; 19 v 1988, 3 ♂; Mersa Matruh, 28 v 1987, 1 ♂ 1 ♀; Tel el Kebir, 10 vii 1987, 1 ♀; Fayyum, Karanis, 26 vi 1987, 3 ♀ (all *C.G. Roche*) [CGRC, DBB].

AFGHANISTAN: **Bamian**: Bamian, 8 viii 1975, 14♂ 12♀, 11 viii 1975, 4♂ 20♀ (*P.H.B. Baker & E.J. Munday*) - found in great numbers at a bare bank at the foot of the colossal Buddha. **Kabul**: Kabul, gardens of tomb of Abdul Rahman, 17 viii 1975 (*P.H.B. Baker*), 1♂. All Cambridge Bactria Expedition, 1975 [DBB].

PAKISTAN: **Baluchistan**: Quetta, 9 v 1984, 18♂ 6♀; Jalogir, 32km N of Quetta, 12 v 1984, 12♂ 9♀, 16 v 1984, 6♂ 9♀, 23 v 1984, 8♀; Yaaro, 37km N of Quetta, 12 v 1984, 2♀; Pishin, 40km N of Quetta, 23 v 1984, 1♂ 10♀, 25 v 1984, 1♂ 2♀, 27 v 1984, 8♀; Pringabad, 30km S of Quetta, 26 v 1984, 1♂; Sariab, 16km S of Quetta, at coriander, 16 v 1984, 1♂ 1♀, 26 v 1984, 1♂; Kuchlagh, 23 v 1984, 1♂ (all *Rozen, Lodhi & Stupakoff*) [AMNH, DBB]. **Northwest Frontier Province**: Rawalpindi, 18 v 1984 (*Rozen, Lodhi & Stupakoff*), 9♂ 6♀ [AMNH, DBB].

diversipes

IRAN: **Mazandaran**: coastal plain between Chalus and Shahsavari [STA 1, Tilrudsar], - 20m, various dates, 1965-1967, 35♂ 55♀, vide Appendix 5; Si Sangan forest, s.l. [STA 37], 30 ix 1967, 1♂, 24 x 1967, 1♀; Kujur, Nazerabad road 1km NE of Bastan, 900m [STA 39], 28 vi 1967, 1♂; Chalus valley 3km below Marzanabad, 400m [STA 47], 10 vi 1967, 1♂ 5♀; coast 2km W of Alamdeh [STA 54], 26 vii 1967, 1♂ (all Baker Exp., 1965/68) [DBB]. Coastal plain 5km W of Behshahr, 3 ix 1975, 1♂. **Semnan-Damghan**: 1km SE of Qusheh, 16 vii 1975, 2♂ 5♀. All Cambridge Bactria Expedition, 1975 (*P.H.B. Baker & E.J. Munday*) [DBB]. **Hamadan**: Malayer, garden off Khiaban-e Amir Kabir, 16 viii 1977 (Cambridge Afghanistan Expedition, 1977, *E.J. Munday*), 1♀ [DBB].

PAKISTAN: **Baluchistan**: Quetta (Col C.G. Nurse), 1♂ [DBB, ex Rothney Collection]. Jalogir, 32km N of Quetta, 12 v 1984, 2♂, 16 v 1984, 7♂ 4♀, 23 v 1984, 1♂ 2♀; Hanna, 15km E of Quetta, 24 v 1984, 1♂ 1♀; Sariab, 16km S of Quetta, 16 v 1984, at coriander [*Coriandrum*, UMBELLIFERAE], 1♂ 11♀ (all *Rozen, Lodhi & Stupakoff*) [AMNH, DBB]. **Northwest Frontier Province**: Rawalpindi, 18 v 1984 (*Rozen, Lodhi & Stupakoff*), 3♂ [AMNH, DBB, CGRC].

dixica

EGYPT: Wadi Digla, 9 ix 1988, 1♂, 26 v 1989, 2♂, 8 vii 1989, 1♂, 14 vii 1989, 1♀, 23 vii 1989, 2♀, 25 v 1990, 1♂, 17 v 1991, 1♂, 24 v 1991, 2♂; 31 v 1991, 1♂, 23 vi 1991, 1♀, 5 vii 1991, 1♂ 2♀; Wadi Hagul, 14 vii 1991, 1♂ (all *C.G. Roche*) [DBB, CGRC].

edentata

MUSCAT: Qurum, 11 iv 1976 (*K.M. Guichard*), 2♂ [DBB].

UNITED ARAB EMIRATES: Abu Dhabi, 14 x 1981 (*C.G. Roche*), 1♀ [CGRC].

PAKISTAN: **Baluchistan**: Quetta, viii 1902 (*Col C.G. Nurse*) [BMNH].

elegantissima

An anomalous male from TAJIKISTAN: Kurg[an]-Tyube, 11 vi 1939 (*A. Romanov*) [DBB] was used as the basis for the inclusion of this taxon in the data matrix. *Nomia elegantissima* Popov was described, in part from material from Kurgan-Tyube, as a subspecies of

edentata Mor., and was not noted as differing structurally from that species. However, the present male, which is certainly the *elegantissima* of Warncke's key (1976) has well-developed scutellar spines and differs also in other structural characters from *edentata*, notably in the dilated and darkened anterior and intermediate distitarsi. While it seems unlikely that Popov could have confused the species represented by the present specimen with either *edentata* or *inermis*, it seems equally unlikely that it should not have been represented in his apparently extensive material, comprising several species of *Pseudapis* and *Nomiapis*, from the locality in question.

equestris

CYPRUS: Polemedia, v 1939 (*G.A. Mavromoustakis*), 1 ♀ [DBB].

LEBANON: N Bekaa, Deir Mar Maroun, ca 700m, 26 v 1996, 1 ♂, 2 vi 1996, 1 ♂ 1 ♀, 9 vi 1996, 2 ♀; N. Bekaa, Jdeide, ca 1000m, 2 vi 1996, 1 ♀ (all *C.G. Roche*) [CGRC, DBB].

PALESTINE: Upper Galilee, Metulla, 6 viii 1931 (*A. Greenberg*), 1 ♂ [DBB].

Also seen from:

IRAN: 'S.W. Persia' [Khuzistan/Isfahan: cf. Baker 1995: 281] (*Escalera*), ♂ [BMNH].

femoralis

GREECE: Ródhos, Ixia, 26-30 vi 1981 (*K.M. Guichard*), 1 ♀ [BMNH].

RUSSIA: former **Bashkir ASSR**: Ufa, 2 vii 1959 (*K. Nikiforuk*), 1 ♂ 2 ♀ [DBB].

flavolobata

UNITED ARAB EMIRATES: Suweihan road, 20 iv 1984 (*J.N.B. Brown*), 1 ♂ [DBB]. Liwa, 8 v 1987 (*I.L. Hamer*), 1 ♀ [DBB]. Leyahlia (plantation), 21 viii 1981 (*C.G. Roche*, U01491), 1 ♂ [CGRC].

PAKISTAN: **Sind**: Karachi, vi 1909 (*E. Comber*), 1 ♀, *Nomia savignyi* Kohl det. Cockerell [DBB ex BMNH].

INDIA: **Gujarat**: Deesa, vi 1901, 1 ♂; iii 1901, 1 ♀ both *Col C.G. Nurse*, B.M. 1920-72) [DBB ex BMNH].

fugax

DAGESTAN: Novo Biryuzyak, at *Statice meyeri* [*Limonium meyeri* (Boiss.) O. Kuntze, PLUMBAGINACEAE] (*B.A. Vorobyov*), 1 ♂ [DBB].

ARMENIA: Sardarabad [between Mastara and Echmiadzin (Vagarshapat), 1 vii 1875: cf. Morawitz, 1876: 9] (*F.F. Morawitz*), 1 ♂ [DBB].

IRAN: **Kordestan**?: 'Kermanshahan, 48 km N of Hamadan', 30 viii 1966, at *Medicago sativa* L. [LEGUMINOSAE] (Iranian Survey US Dept Agr., U. Cal., Karadj College), 1 ♂: the collection data are given as on the specimen label, but Kermanshah and the administrative district of Kermanshahan lie well to the west of Hamadan, while the '48km N of Hamadan' would place the locality in Kordestan]. Also seen from: **Esfahan**: Esfahan (*Escalera*), ♂ ♂ [BMNH].

inermis

SAUDI ARABIA: Riyadh, 18 iv 1980, 2♂ (*K.M. Guichard*, B.M. 1980-178) [DBB ex BMNH].
Hofuf, 7 x 1975, 1♂ (*W. Büttiker*) [DBB].

IRAN: **Khuzestan**: Dezful, 3 vi 1966, 1♂ (*S. Tirgari*) [DBB].

AFGHANISTAN: **Helmand**: nr Mūsá Qal'eh on Kajaki road, 27 vii 1977, 1♂; Kenjak-e Soflá, between Now Zād and Do Sang, in orchard near a spring, ca 1200m, 29 vii 1977, 1♂; Do Sang, nr Qal'eh, 29 vii 1977, 1♀. **Qandahar**: Qandahar, roadside between Hindu Chowq and Chehel Zina, ca 1000m, 23 vii 1977, 1♂. All Cambridge Afghanistan Expedition, 1977 [DBB].

PAKISTAN: **Baluchistan**: Sariab, 16km S of Quetta, 16 v 1984, on coriander [*Coriandrum*, UMBELLIFERAE], 2♂; 26 v 1984, 1♂; **Sind**: Gharo, 6 v 1984, 1♀ (all *Rozen, Lodhi & Stupakoff*) [AMNH, DBB]. **Baluchistan**: Quetta, vii 1902 (*Col C.G. Nurse*, B.M. 1920-72), 1♀ [DBB].

Also seen from:

INDIA: **Punjab**: Ferozepore [Firozpur].

innesi

EGYPT: Cairo, the barrages, 1 viii 1987, 1♂; Giza - Pyramids, 2 vii 1983, 1♀; El Minia, 2 vii 1989, 1♂ (all *C.G. Roche*) [CGRC, DBB].

interstitinervis

SUDAN: **Eastern Equatoria**: Juba, 10 xii 1981, 10♂, 12 xii 1981, 5♂, 13 xii 1981, 2♀; ca 3 mi. N of Juba, 12 xii 1981, 1♂ (all *E.J. Munday*) [DBB].

KENYA: **Coast Province**: Malindi Beach, 22 vii 1980, 3♂ 1♀; Watamu, 24 vii 1980, 1♂ 2♀ (all *E.J. Munday*) [DBB].

MALI: Bamako, 15 i 1976 (*G. Popov*), 1♂ [DBB].

lobata

IRAN: **Hamadan**: Malayer, garden off Khiaban-e Amir Kabir, ca 1550m, 16 viii 1977 (*E.J. Munday*), 2♂ 1♀; 17 viii 1977 (*P.H.B. Baker & E.J. Munday*), 1♂ 1♀. **Esfahan**: on waste ground behind Hasht Behesht, 1550m, 27 viii 1977 (*E.J. Munday*), 1♂ 2♀. All Cambridge Afghanistan Expedition, 1977 [DBB]. **Tehran**: Golshar, 13 viii 1966 (Iranian Survey US Dept Agr., U. Cal., Karadj College), 1♂ [DBB].

monstrosa

TURKEY: **Adana**: Osmaniye area, 2,200ft, 19 vi 1960 (*Guichard & Harvey*), 1♂ [DBB ex BMNH].

ISRAEL: Upper Galilee, Metulla, 23 viii 1931 (*A. Greenberg*), 1♀ [DBB].

nilotica

EGYPT: Md. el Sharqiya, Fayid, 3 vii 1948, 3♂, 15 vii 1948, 1♂, 22 vii 1948, 1♂, 27 vii 1948, 4♂, 29 vii 1948, 7♂, 10 viii 1948, 2♂, 14 viii 1948, 2♂, 7 ix 1948, 1♂, 11 ix

1948, 1 ♂, 9 x 1948, 1 ♀, 19 x 1948, 1 ♀; Md el Sharqiya, Serapeum, 22 v 1949, 1 ♂, 27 v 1949, 1 ♂, 4 vii 1949, 3 ♀ (all *D.B. Baker*) [DBB]. Mersa Matruh, 16/19 viii 1986, 1 ♀, 30 v 1987, 1 ♂; Wadi Digla, 4 vi 1988, 1 ♂, 8 vii 1989, 1 ♀, 14 vii 1989, 1 ♂, 25 v 1990, 3 ♂; 23 vi 1990, 2 ♂ 2 ♀; 24 v 1991, 1 ♂; 5 vii 1991, 1 ♀; 13 ix 1991, 1 ♂; Wadi Hagul, 25 vi 1991, 1 ♀, 14 vii 1991, 4 ♂; Cairo, Kerdasa, 17 vi 1983, 2 ♂, 1 vii 1983, 5 ♂, 18 ix 1983, 1 ♂, 10 viii 1984, 1 ♀, 23 viii 1985, 2 ♂; Helwan, 18 ix 1987, 1 ♂, 11 x 1991, 1 ♀; 2km S of Saqqara, 30 ix 1982, 1 ♂; Fayyum, Kom el Atl, 11 ix 1987, 1 ♂; Fayyum, Karanis, 11 ix 1987, 2 ♂; 28km W of Shakhshuk, 28 v 1988, 1 ♂, 29 vii 1988, 1 ♂; Abu Rawash, 20 vii 1984, 1 ♀, 3 vii 1987, 1 ♂; Ain Sokna rd, 29-43km E of Maadi, 26 vii 1991, 1 ♀; Ain Sokna rd, 50-85km E of Maadi, 1 vi 1991, 1 ♂; Kom Awshim, 25 ix 1982, 2 ♂, 16 x 1982, 1 ♀, 13 v 1983, 1 ♂ 1 ♀, 10 vi 1983, 1 ♀, 24 viii 1985, 2 ♂ 1 ♀, 26 viii 1985, 2 ♂, 8 viii 1986, 1 ♂; Fayid, 5 vii 1985, 2 ♂ (all *C.G. Roche*) [CGRC, DBB]. Also seen from: Maragi; Sinai; Fayum (L. Karun).

SUDAN: **Northern Province:** Nabardi, 22 xii 1907 (*Swale*, B.M. 1919-120), 1 ♂ [DBB ex BMNH]. Also seen from Gerafat (*Swale*) [BMNH].

SAUDI ARABIA: Jeddah (Buraiman), (*K.M. Guichard*, B.M. 1948-200), 1 ♂ [DBB ex BMNH]. Abha-Gizan km 53, Wadi Ad Dilla, 300m, 21 iv 1976 (*Wittmer & Büttiker*), 1 ♂ [DBB]. Hofuf [Al Hufuf], 21-26 iv 1980 (*K.M. Guichard*), 2 ♂ [DBB]. Also seen from: Al-Kharj, 1 x 1980; Riyadh, iv/v 1981 (*A.S. Talhouk*) [BMNH].

OMAN: Masirah I., RAF Camp, 15-19 iv 1976 (*K.M. Guichard*), 1 ♂ [DBB ex BMNH]. Adam, 13 i 1985, 1 ♂; S. Huwayyah, 16/18 iv 1987, 1 ♀ (both *I.L. Hamer*) [DBB]. Madabah, 20 xi 1981 (*J.N.B. Brown*), 1 ♂ [DBB].

Also seen from:

MUSCAT: Gaizan.

UNITED ARAB EMIRATES: Hatta, 29 v 1981, 2 ♂, 3 vii 1981, 1 ♂, 27 xi 1981, 2 ♂ 1 ♀; Abu Dhabi, 17 ii 1981, 1 ♂, 16 iii 1981, 3 ♂, 21 iii 1981, 1 ♀, 18 iv 1981, 1 ♀, at *Heliotropium* [BORAGINACEAE], 20 iv 1981, 1 ♂; Abu Dhabi (sewage farm), 4 iii 1981, 4 ♂ 1 ♀, 30 v 1981, 1 ♂, 1 vi 1981, 1 ♂ 1 ♀, 2 vi 1981, 1 ♂, 17 vi 1981, 1 ♀, 14 viii 1981, 3 ♂ 1 ♀, 1 x 1981, 2 ♂ 3 ♀, 14 x 1981, 10 ♂ 3 ♀, 22 x 1981, 4 ♂ 1 ♀; Al Saad, 30 i 1981, 1 ♂, at *Zygophyllum* [ZYGOPHYLLACEAE], 4 ix 1981, 2 ♂, 30 x 1981, 1 ♀, at *Heliotropium*, 4 xii 1981, 1 ♂; Al Babha, 24 iv 1981, 4 ♂; Al Babha (plantation), 6 iii 1981, 9 ♂ 2 ♀; Bidy Al-Ajam, 10 iv 1981, 1 ♀; Wadi Uwaynah, nr Dibba, 10 vii 1981, 3 ♀, 7 viii 1981, 1 ♀; Leyahlia (plantation), 21 viii 1981, 3 ♀; Sweihan rd, 1 i 1982, 1 ♂; Al Markhaniyeh, nr Al Ain, 11 xii 1981, 2 ♂ 1 ♀; Dhaid-Mileiha rd, 2 xii 1981, 1 ♀; Al Futaisi I., 6 xi 1981, 1 ♀ (all *C.G. Roche*). Abu Dhabi, 8 xi 1985, 1 ♂, 4 vii 1986, 1 ♀, 10 iv 1987, 1 ♀, 7 iv 1989, 1 ♀; Jebal Ali, 27 ix 1985, 1 ♂; Das I., 19 x 1986, 1 ♂; Suweihan, 5 ix 1986, 1 ♂; Wadi Asimah, 15 xi 1985, 1 ♂; Remah, 10 iv 1988, 1 ♀; Shweib / Madam, 13 vii 1983, 1 ♀; Wadi Bih, 11 vii 1983, 1 ♂ (all *I.L. Hamer*). Abu Dhabi, 3 ix 1982, 1 ♂, 12 ix 1982, 1 ♀, 29 ix 1982, 1 ♂ 1 ♀, 27 v 1983, 1 ♀, 29 vii 1983, 1 ♀, 9 xi 1984, 1 ♀, 7 xii 1984, 2 ♂ 1 ♀, 23 xi 1984, 6 ♂, 11 i 1985, 1 ♂; Sila / J. Dhana, 30 vi 1983, 1 ♂; Shweib / Madam, 22 i 1982, 1 ♂, 7 vi 1983, 1 ♂; Wadi Bih, 12 vii 1983, 1 ♂ 2 ♀; Jebal Hafit, 15 i 1984, 1 ♂; Fili, 17 xi 1986, 1 ♀; Al Liyyah island, 12 vi 1984, 1 ♀ (all *J.N.B. Brown*). [CGRC, DBB, ILHC]

QATAR: Doha, 7 ix 1979, 1 ♂ 2 ♀, 14 ix 1979, 3 ♂ 2 ♀, 28 ix 1979, 1 ♂; Al Shahaniyeh, 19 x 1979, 1 ♂ 6 ♀, 26 x 1979, 1 ♀, 1 xi 1979, 4 ♂ 1 ♀, 2 xi 1979, 1 ♂ 1 ♀, 3 xi 1979, 2 ♂ 3 ♀, 9 xi 1979, 1 ♂, 7 iii 1980, 1 ♀, 11 iv 1980, 2 ♀, 2 v 1980, 1 ♂, 30 v 1980, 1 ♂, 6 vi

1980, 1 ♂, 8 viii 1980, 1 ♂, 22 viii 1980, 1 ♂, 31 x 1980, 2 ♂; Umm Ghain, 26 ix 1980, 2 ♂ 2 ♀; Al Sinnah, 7 ix 1979, 1 ♀, 21 ix 1979, 1 ♂ (all *C.G. Roche*) [CGRC, DBB].

AFGHANISTAN: **Samangan**: Pol-e Khomri - Mazar-e Sharif road, 14km beyond Robatak turning (52km beyond Mazar-e Sharif / Qonduz fork), 22 viii 1975, 2 ♂ 2 ♀. **Balkh**: Balkh, Bala He ar, 23 viii 1975, 1 ♂. All Cambridge Bactria Expedition 1975 [DBB].

PAKISTAN: **Sind**: Karachi, v 1909 (*E. Comber*), 1 ♂ [DBB ex BMNH]. **Baluchistan**: Quetta, vii 1903 (*Col C.G. Nurse*), 1 ♂ [DBB, ex Rothney Collection]. Hanna, 15km E of Quetta, 24 v 1984, 1 ♀; 35km W of Ziarat. 11 v 1984, 1 ♂; Killi Sarda, 14 v 1984, 1 ♀ (all *Rozen, Lodhi & Stupakoff*) [AMNH, DBB].

TURKMENISTAN: 'Trans-Caspia', 1 ♂ [DBB]. Also seen from Krasnovodsk.

Also seen from:

TERR^E FRANÇAIS DES AFARS ET DES ISSAS: Djibouti, Ambouli Oasis.

ocracea

REPUBLIC OF YEMEN: Red Sea coast nr Hodeida, 12-14 iii 1938, from succulent plant on sand-dunes [*Suaeda*?: cf. Scott, 1947: 186] (B.M. Exp. to S.W. Arabia, *H. Scott & E.B. Britton*, B.M. 1938-246), 2 ♂ 2 ♀ [DBB ex BMNH].

oxybeloides

PAKISTAN: **Sind**: Gharo, 38 mi E of Karachi, 6 v 1984, 3 ♀; Lake Haleji, 6 v 1984, 1 ♀ (all *Rozen, Lodhi & Stupakoff*) [AMNH, DBB].

INDIA: **Tamil Nadu**: Coimbatore, 5 iv 1950, 1 ♂, vi 1956, 1 ♂, vii 1957, 1 ♀; Karikal, ii 1962, 1 ♂, iii 1962, 1 ♂; Anaimalai Hills, Cinchona, 3500 ft, iii 1956, 1 ♂; Tanjore [Thanjavur] District, Kurumbagaram, 19 iv 1951, 1 ♀ (all *P.S. Nathan*) [DBB]. Madras, 1902 (*Birô*), 1 ♂, lectotype of *biroi* (Fr.) [MNHUB]. Madhya Pradesh: Jabalpur, 500m, x 1957 (*P.S. Nathan*), 1 ♀ [DBB]. **Rajasthan**: Mount Abu, 1200m, 14 iv 1990, 1 ♀; Udaipur, Saijan Niwas Gdn, 8 iv 1990, 1 ♂ (both *L. Packer*) [DBB]. Abu (*Col C.G. Nurse*, BMNH 1920-72). 1 ♂ [DBB ex BMNH]. **Gujarat**: Deesa (*Col C.G. Nurse*), 1 ♂ [DBB, ex Rothney Collection]. **Kerala**: Alwaye Khizhak-Rambalan, 30 xi 1971 (*F.L. Wain*), 1 ♂, 'on *Leucas* sp. probably' [OUM, Wain Collection, 7-1979]. **Maharashtra**: W Ghats, Lonavla, 20 i 1959, 1 ♀; 1 v 1963, 1 ♀, 18 ii 1964, 1 ♀, 9 i 1965, 1 ♀, 28 i 1967, 1 ♀, 22 v 1967, 1 ♀; W Ghats, Khandala, 4 v 1963, 2 ♀ (all *F.L. Wain*) [OUM, Wain Collection, 7-1979]. Also seen from: **Maharashtra**: Nasik; Poona; Salsette I. **W Bengal**: Calcutta [BMNH, OUM].

CEYLON: Colombo, v 1908 (*O.S. Wickwar*), 1 ♂ [DBB ex BMNH]. Seenigoda, xii 1911 (*H. von Buttel-Reepen*), 1 ♀ [MNHUB]. 'Ceylon' (*J. Nietner*), 2 ♂ [MNHUB]. Also seen from: 'Sigiri' [Sigiriyah?] [BMNH].

patellata

CHAD: Tibesti, Zouar, 11 iii 1953 (*K.M. Guichard*, B.M. 1953-315), 1 ♂ 1 ♀, *aurigera* Ckll det. Pauly [DBB ex BMNH].

SUDAN: Gendettu, 20 i 1925 (*W.E. Giffard*, B.M. 1931-292, ex IIE), 1 ♂, *Nomia duplocincta* Sichel det. Cockerell [DBB ex BMNH]. Also seen from: Khor Arbaat Delta (♀); Shambat; Dissa F.P.; W. Darfur, S Jebel Murra, Kallikitting [BMNH].

REPUBLIC OF YEMEN: Wadi Dareija, SW of Dhala, ca 4500 ft, 6-9 xi 1957 (*Scott & Britten*), 1 ♂ [DBB ex BMNH]. N. Yemen, coastal plain, 12 iv 1982 (*I.L. Hamer*), 1 ♂ [DBB]. Also seen from: nr Ta'izz (♀); Usaifira, 1 mi. N Ta'izz (♀); Wadi Hardaba (♀); Al Huseini, nr Lahej (♀); S. Othman (♀) [BMNH].

SAUDI ARABIA: Abha-Gizan km 53, Wadi Ad Dillah, 300m, 21 iv 1976 (*Wittmer & Büttiker*), 4 ♂ 1 ♀ [DBB]. Also seen from: Asir, W. al Tarya, 1400m, 5 iv 1980 (*K.M. Guichard*), ♂; Jeddah (♂ ♀) [BMNH].

UNITED ARAB EMIRATES: Wadi Bih, 12 vii 1983, 1 ♂; Khor Fakkan, 17 vi 1983, 1 ♀ (both *J.N.B. Brown*) [DBB]. Wadi Dibba, 10 vii 1981 (*C.G. Roche*), 2 ♀ [CGRC, DBB]. Hatta, 23 viii 1991 (*I.L. Hamer*), 1 ♀ [DBB].

OMAN: Al Hamra, 14 iv 1985, 1 ♂; Rayy, 17 iv 1987, 1 ♂ (both *I.L. Hamer*) [DBB]. Also seen from: J. Howrah, 23 ii 1986 (*I.L. Hamer*), ♂ [ILHC]; Bareimi (♀); Dhofar, Salalah (♀) [BMNH].

INDIA: **Tamil Nadu**: Coimbatore, 5 iv 1950, 1 ♂, 11 iv 1950, 1 ♂, 9 ix 1950, 1 ♂, vii 1957, 4 ♂ 2 ♀, viii 1957, 1 ♀, xi 1957, 1 ♂ 1 ♀, viii 1958, 1 ♂; Tanjore [Thanjavur] District, Kurumbagaram, iv 1951, 1 ♀ (all *P.S. Nathan*) [DBB].

siamensis

VIETNAM [?]: 'Annam, Phuc Son', xi/xii (collector ?), 1 ♀, syntype of *Nomia biroi* Fr. [MNHUB].

MALAYSIA: **Selangor**: Ladang Puchong, 15 v 92, at *Asystasia* [ACANTHACEAE] (collector ?), 1 ♂ [DBB ex UPMS]; Klang, 20 i 1993 (*Dr Fauziyah*), 1 ♂ 1 ♀ [MARDI].

CHINA: **Hainan** (no further data), 1 ♂; Hainan, Guangdong, 14 vii 1960, 1 ♀, paratype of *Nomia megalobata* Wu [DBB].

squamata

PAKISTAN: **Baluchistan**: Quetta, viii 1903 (*Col C.G. Nurse*), 1 ♂ [DBB ex Rothney Collection]. Also seen from: Quetta, vi 1903 (*Col C.G. Nurse*), ♂ [BMNH].

tadzbica

SUDAN: **Northern Province**, Nabardi, x 1907 (*H. Swale*), 1 ♂ [DBB ex BMNH].

OMAN: Adam, 13 iv 1985 (*I.L. Hamer*), 1 ♂ [DBB].

UNITED ARAB EMIRATES: Umm an Nar, 22 v 1983 (*J.N.B. Brown*), 1 ♂ [DBB]. Suweihan rd, 14 iv 1981, 1 ♂ 1 ♀; Hatta, 27 xi 1981, 1 ♂ (all *C.G. Roche*) [CGRC]. Suweihan, 12 iv 1988, 2 ♂; Abu Dhabi, 3 iv 1991, 1 ♂; Futaisi, 14 v 1982, 1 ♀ (all *I.L. Hamer*) [DBB].

valga

CYPRUS: Polemedia, v 1939 (*G.A. Mavromoustakis*), 1 ♂, *Nomia monstrosa* Costa det. Mavromoustakis [DBB].

PAKISTAN: **Baluchistan**: Quetta, 9 v 1984, 3 ♂ 2 ♀; Killi Shandanzi, 10 v 1984, 1 ♂ (all *Rozen, Lodhi & Stupakoff*) [AMNH, DBB].

APPENDIX 2. Characters and character states

Head

- 1 Occipital ridge: (0) broadly rounded into occiput (*fulvata*); (1) narrowly rounded or weakly carinate; (2) sharply carinate; (3) carinate and reflexed (*femoralis*).
- 2 Postocular carina: (0) absent; (1) present (weak in *valga*, *elegantissima*). The postocular carina is a fine carina running parallel with and close to the superior part of the posterior ocular margin, absent in most nomiines.
- 3 Ocelloccipital distance: (0) narrow, one ocellar diameter or less, or vertex merging indistinguishably with occiput; (1) moderate, between one and two ocellar diameters; (2) two ocellar diameters or greater.
- 4 Glossa: (0) short; (1) elongate.
- 5 Antenna: (0) unmodified; (1) capitate. Capitate antennae are typical of *Steganomus* and occur in other nomiine genera, also sporadically among other apoids.

Mesosoma

- 6 Lateral lobe of prothorax: (0) carinate; (1) lamellate.
- 7 Mesoscutum anteriorly: (0) low, not raised above dorsum of pronotum; (1) high, transversely carinate, with distinct, vertical, anterior surface (weaker in *monstrosa*).
- 8 Scutellum: (0) mutic; (1) with sublateral spiniform processes. The spines are occasionally reduced or absent in some individuals. Coding assumes the normal condition.
- 9 Tegulae: (0) of normal proportions; (1) greatly enlarged.
- 10 Mesepisternal mesial apophyses: (0) absent; (1) present, compressed, blade-like; (2) present, lamellar, broadly wing-shaped (*kophenes*).
- 11 Sternaulus: (0) absent or weak; (1) well developed. The sternaulus is the longitudinal ridge, more or less sharply rounded and occasionally, when well developed, more or less strongly tuberculiform, separating the lateral and ventral surfaces of the mesepisterna; between the sternauli the ventral surface of the mesosoma is usually markedly concave.
- 12 Precoxal carina: (0) absent; (1) present (weak in *carcharodonta*). The precoxal carina is a transverse carination of the ventral surface of the mesepisterna anterior to the coxal cavity.
- 13 Trochanter I: (0) unmodified; (1) nodose (*rufescens*); (2) basally abruptly expanded and angulate (*lobata*, *stenotarsus*).
- 14 Femur I: (0) unmodified; (1) sub-basally dentate, distally arcuate (*bytinskai*); (2) with ventral carina (*equestris*).
- 15 Femur II: (0) not or little modified, occasionally deeper medially (e.g., *diversipes*) or incrassate apicad, subclavate (e.g., *equestris*), but with simple ventral profile; (1) with distinct median lobe (*monstrosa*); (2) with prominent basiventral lobe (*anomala*).
- 16 Calcar II length: (0) distinctly less than half length of basitarsus (minute in *dixica*); (1) approximately equal to half-length of basitarsus; (2) distinctly exceeding half length of basitarsus. (3) calcar absent.

- 17 Basitarsus II: (0) unmodified or slightly arcuate; (1) moderately attenuate apicad (*dixica*, *innesi*, *interstitinervis*); (2) elongate and strongly attenuate (*stenotarsus*).
- 18 Distitarsus II: (0) unmodified, slender; (1) expanded, dorsoventrally compressed, pyriform to orbicular.
- 19 Coxa III: (0) mutic; (1) with small, erect, distal, ventral spine (*femoralis* group); (2) with low, longitudinal, ventral lamella (*kophenes*).
- 20 Trochanter III: (0) mutic; (1) with massive compressed ventral spine (*carcharodonta*).
- 21 Femur III shape: (0) slender, unmodified; (1) more or less incrassate apicad and dorsally usually more or less gibbous preapically; (2) strongly inflated, often massive.
- 22 Femur III preapical anteroventral tooth: (0) absent; (1) present.
- 23 Tibia III: (0) of normal proportions, more or less expanded apicad, a distinct *anterior lobe* normally present, this developed in the same plane as that in which the femur and tibia articulate; (1) much contracted, dorsally strongly convex or nodose, with a distinct, post-tarsal, angled, laminar *apical process*, the general surface of which is apposed to the ventral surface of the femur. In either instance, the apophysis itself variously shaped.
- 24 Tibia III basidorsal process: (0) absent; (1) present, arcuate, digitiform (*monstrosa*).
- 25 Tibia III anterior lobe: (0) absent, tibia unmodified (*fulvata*); (1) weak, apically more or less acute (*edentata*, *tadzhica*); (2) strong, apically rounded or occasionally (*fayumensis*) truncate; (3) as (2) but anterior margin with angular median emargination (*nilotica*); (4) as (2) but tibia distally abruptly but not strongly inflated (*inermis*). An anterior lobe may arise from the full length of the tibia or be confined to a distal portion.
- 26 Tibia III apical process: (0) acuminate; (1) truncate, with sinuous lateral margins, occasionally (*monstrosa*) with a smaller, interno-basal subsidiary lobe.
- 27 Calcaria III, number: (0) two; (1) one; (2) absent.
- 28 Basitarsus III: (0) normal or weakly attenuate or incrassate; (1) arcuate, contorted, strongly attenuate apicad (*fayumensis*, *rufescens*); (2) compressed, expanded (moderately in *oxybeloides*, broadly in *siamensis*, in which species also with erect marginal fringes, and the following segment also expanded), outer surface concave, carina of inner surface strong.
- 29 Propodeal area: (0) not or ill-defined, if a punctate area present this not delimited by a continuous carina; (1) clearly defined by a fine carina; (2) clearly defined, with projecting lip (*flavolobata*).

Metasoma

- 30 Tergum 6, apical margin: (0) edentate; (1) laterally dentate (*bispinosa*).
- 31 Tergum 7: (0) exposed; (1) normally concealed beneath tergum 6 in dried material.
Note: Characters 32-35. Sterna 4-6 in *Pseudapis* and *Nomiapis* show a variety of modifications that cannot be reduced to a small number of states without substantial risk of confusing probably non-homologous conditions. In most species these modifications are immediately diagnostic, and while therefore of great use

in the discrimination of species, of less use as indicators of evolutionary trends. 'Warncke 000' and 'Warncke 1980: 000' refer to figures in Warncke (1976) and (1980) respectively; 'Pauly 000' to figures in Pauly (1990). While these are diagrammatic rather than exact, they are generally adequate for the recognition of the species they portray.

- 32 Sternum 4, postgradular area: (0) unmodified; (1) with sublateral convergent carinae (Pauly 184, *interstitinervis*); (2) with mesial, apically abruptly terminated, carina not reaching apical margin (*fayumensis*); (3) with lateral bullae (*siamensis*).
- 33 Sternum 4, marginal area: (0) unmodified or with weak, simple, median emargination or angulation (e.g., Pauly 176, '*guichardi*' [*edentata*]; 178, *patellata*); (1) with two small, closely approximated, teeth or lobes, separated by an arcuate or angulate emargination (e.g., Pauly 187, '*edentata*' [*inermis*]; 188, *ocracea*; 191); (2) with larger, more widely separated teeth arising from an extension of the disc above the marginal area (Pauly 184, *interstitinervis*); (3) similar to (2) but the margin between with two smaller teeth, consequently the sternite quadridentate (*flavolobata*, *nilotica*, in *nilotica* the marginal teeth very small and nearly concealed beneath the upper teeth); (4) with two more or less broadly separated carinae (Warncke 41, *monstrosa*) or erect laminar apophyses (*femoralis*, *carcharodonta*, *mandschurica*, *valga*, and, ex descr., *urfana*), these separated by a more or less deep angular or arcuate emargination (cf. Warncke 42a, *femoralis*, apophyses apically triangularly expanded, truncate; 42b, *valga*, apophyses posteriorly dentately produced); (5) more or less produced medially, with an incision bounded by thickened margins or fine carinae, the incision linear, with parallel or subparallel carinae (e.g., Warncke 37, *diversipes*, 39, *equestris*; also *fugax*, *kophenes*), or more open, the carinae divergent (Warncke 40, *squamata*); (6) broadly, subtriangularly produced, apically weakly bilobate (Warncke 33, *rufescens*; 34, *bytinski*); (7) with median incision and strong apicolateral emarginations (*fulvata*: typical of Oriental *Curvinomia*, in which the apicolateral emarginations are very variable in extent, the disc sometimes reduced to a T-shape).
- 34 Sternum 5: (0) not or little modified, lacking either median tubercle or carina or strong lateral callosities; (1) with median tubercle (Pauly 189, *nubica*) or carina (Pauly 176, '*guichardi*' [*edentata*], 184, *interstitinervis*, 187, '*edentata*' [*inermis*]), the carina sometimes ending in a minutely bilobate (Warncke 29, *lobata*) or bifurcate (Warncke 32, Pauly 190, '*armata*' [*nilotica*]; Pauly 192, *dixica*) process; (2) basally strongly bigibbous (the swellings in dried material usually more or less concealed beneath sternum 4) and with a median carina prolonged as a spine beyond the apical margin (Pauly 178, *patellata*); (3) margin medially with two small, styliform processes (*bispinosa*); (4) with mediobasal tubercle, the margin produced and with a V-shaped emargination, the lobes thus formed angular (*diversipes*, *fugax*), rounded (*squamata*) or incurved, forcipate (*equestris*); (5) with mediobasal carina and two narrowly separated, raised, more or less convex, tongue-like processes (*femoralis*, *kophenes*, *mandschurica*, *monstrosa*, *valga*); (6) of special form (Warncke 1980: 6, *urfana*; also, with strong lateral teeth, *fayumensis*).
- 35 Sternum 6: (0) not or little modified; (1) with mediobasal tooth or carina; (2) with mediobasal tooth or carina and lateral bullae (Pauly, 190); (–) other, unique, modifications.

Integument

- 36 Mesoscutal punctation size: (0) fine [$< 0.15 \times$ ocellar \emptyset]; (1) medium [0.15-0.25], occasionally shallow and ill-defined (*dixica*); (2) coarse [> 0.25]. The apparent diameter of punctures may vary with the incidence of the lighting and absolute values could be given only for measurements made under specified conditions. For the purposes of the present investigation all measurements were made under standard conditions (ring illuminator, 50x magnification, mean of several observations made in uniform location in several examples). The measurements recorded and the codings consequently assigned (expressed as factors of the ocellar diameters) are therefore consistent *inter se* but may not in all instances agree with codings that might be arrived at under different conditions.
- 37 Mesoscutal punctation density: (0) disperse; (1) dense, but with evident interspaces; (2) subreticulate or reticulate. The density of punctation may accurately be determined by the use of an integrating eyepiece (such as the Zeiss Kpl 8x eyepiece with Graticule I) but this procedure is not suited to routine use. The codings recorded here are based on visual assessment.
- 38 Mesoscutal microsculpture: (0) surface glossy, or imperceptibly sculptured at 25x; (1) surface dulled by conspicuous microsculpture (punctiform in *fulvata*). [In ♀♀ of the *patellata* group, but not in the ♂♂, the integument is finely coriaceous.]
- 39 Tergum 1 discal punctation: (0) disperse; (1) dense, but with evident interspaces; (2) subreticulate or reticulate.
- 40 Tergum 1 marginal area: (0) impunctate; (1) narrowly punctate, the punctures not extending beyond basal third; (2) with punctation extending beyond basal third.
- 41 Tergum 2 bilateral impunctate areas: (0) absent or much reduced; (1) present, more or less well developed, discrete; (2) extensive, subcoalescent or coalescent.

Vestiture

- 42 Mesoscutal hairs: (0) unspecialized to branched; (1) at least anteriorly and adjacent to scuto-scutellar suture densely branched, arborescent, usually short (as, e.g., Noskiewicz 1958: fig. 25), in some species (e.g. *ocracea*) very short, superficially appearing squamiform.
- 43 Basitarsus I: (0) normally pubescent; (1) posterior margin fimbriate (*anomala*, *bytinski*, *fayumensis*, *patellata*).
- 44 Distitarsus II: (0) glabrous or with fine and inconspicuous hair; (1) with strong bilateral black fan.
- 45 Ventral surface femur III: (0) glabrous or with unmodified hairs; (1) with few to many more or less elongate spatulate hairs (very short in *bispinosa* and *monstrosa*; extending onto ventral surface of mesosoma and appendages in *elegantissima*).
- 46 Postgradular sulci of terga 2(-4): (0) glabrous; (1) fasciate (weakly so in *carcharodonta*).
- 47 Marginal areas of terga 2-4: (0) glabrous, or overlain by a series of long, spaced, setae arising from discal margin; (1) with entire or interrupted fasciae of decumbent plumose hairs.

- 48 Sterna: (0) S3-S5 lacking exceptional hair characters; (1) S2 and S3 with long, erect, marginal fimbriae (*fayumensis*); (2) S3 and S4 with long, decumbent, premarginal fimbriae (*anomala* group); (3) S5 margin mesially with two erect pencils of agglutinated setae resembling flattened spines (*fulvata*). [While not possessing exceptional hair characters comparable with (1)-(3), the species of *Pseudapis* and *Nomiapis* generally have sterna 3-5 variously and to some extent species-specifically setose. They cannot therefore legitimately be grouped as representing a single character state and have accordingly been coded as '-'.]

Colour

- 49 Distitarsus I: (0) concolorous with mediotarsus; (1) black (if mediotarsus pale).
- 50 Distitarsus II: (0) concolorous with mediotarsus, occasionally with darker apical macula; (1) black (if mediotarsus pale).
- 51 Marginal areas of terga: (0) of body colour or unpigmented, translucent; (1) green or blue, more or less opaque.

APPENDIX 3. Data matrix for phylogenetic analysis

Key

Taxa prefixed * are included on the basis of original descriptions amplified or not by subsequently published information. Under taxa so prefixed, (1) an entry '?' indicates state uncertain (neither noticed in original or subsequent description nor predictable), (2) an entry in ***bold italics***, substituted for a '?', indicates a state that may confidently be predicted from knowledge of closely related taxa. An entry '-' indicates character inapplicable. *Curvinomia fulvata* is the representative outgroup taxon.

Character	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
Taxon	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5
<i>*anatolica</i>	?	<i>I</i>	?	0	0	<i>I</i>	<i>I</i>	0	1	0	0	?	<i>0</i>	<i>0</i>	?	?	<i>0</i>	0	<i>0</i>	<i>0</i>	1	<i>0</i>	0	0	1
<i>anomala</i>	1	1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1
<i>bispinosa</i>	1	1	2	0	0	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	1
<i>*bytinski</i>	?	<i>I</i>	?	0	0	<i>I</i>	<i>I</i>	1	1	0	0	<i>0</i>	0	1	?	<i>0</i>	?	1	0	0	1	0	0	0	2
<i>carcharodonta</i>	1	1	1	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	0	1	2	0	1	0	-
<i>diversipes</i>	2	1	1	0	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	2	0	1	0	-
<i>dixica</i>	1	1	1	0	0	1	1	1	1	0	1	0	0	0	0	0	1	1	0	0	1	0	0	0	2
<i>edentata</i>	1	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
<i>elegantissima</i>	1	1	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	2
<i>equestris</i>	1	1	2	0	0	1	1	1	1	1	0	1	0	2	0	2	0	0	1	0	2	1	1	0	-
<i>fayumensis</i>	1	1	1	0	1	1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	2	0	0	0	2
<i>femoralis</i>	3	1	2	0	0	1	1	1	1	1	0	1	0	0	0	2	0	0	1	0	2	1	1	0	-
<i>flavolobata</i>	1	1	1	0	0	1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	3
<i>fugax</i>	2	1	2	0	0	1	1	1	1	1	0	1	0	0	0	2	0	0	1	0	2	1	1	0	-
<i>fulvata</i>	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
<i>inermis</i>	1	1	2	0	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	4
<i>innesi</i>	1	1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	1
<i>interstitinervis</i>	1	1	1	0	0	1	1	0	1	0	1	0	0	0	0	3	1	1	0	0	0	0	0	0	2
<i>kophenes</i>	2	1	1	0	0	1	1	1	1	2	0	1	0	0	0	2	0	0	2	0	2	1	1	0	-
<i>lobata</i>	1	1	1	0	0	1	1	1	1	0	1	0	2	0	0	0	0	1	0	0	1	0	0	0	2
<i>mandschurica</i>	2	1	2	0	0	1	1	0	1	1	0	1	0	0	0	2	0	0	1	0	2	0	1	0	-
<i>monstrosa</i>	2	1	2	0	0	1	1	1	1	1	0	1	0	0	1	1	0	0	1	0	2	1	1	1	-
<i>nilotica</i>	1	1	1	0	0	1	1	1	1	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	3
<i>ocracea</i>	1	1	1	0	0	1	1	1	1	0	1	0	0	0	0	0	0	1	0	0	2	0	0	0	2
<i>oxybeloides</i>	1	1	1	0	0	1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	2
<i>patellata</i>	1	1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	2
<i>*platula</i>	?	<i>I</i>	?	0	0	<i>I</i>	<i>I</i>	1	1	0	1	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	1	<i>0</i>	<i>0</i>	1	0	0	0	2
<i>*rufescens</i>	?	<i>I</i>	?	0	0	<i>I</i>	<i>I</i>	1	1	0	0	<i>0</i>	1	0	?	?	?	1	?	0	1	0	0	0	2
<i>siamensis</i>	1	1	1	0	0	1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	2	0	0	0	2
<i>squamata</i>	2	1	3	0	0	1	1	1	1	1	0	1	0	0	0	2	0	0	1	0	2	1	1	0	-
<i>stenotarsus</i>	1	1	1	0	0	1	1	0	1	0	1	0	2	0	0	0	2	1	0	0	1	0	0	0	2
<i>tadzhica</i>	1	1	1	0	0	1	1	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1
<i>*urfana</i>	2	1	<i>I</i>	0	0	1	1	0	1	1	0	1	0	0	0	2	0	0	<i>I</i>	0	2	1	1	0	-
<i>valga</i>	2	1	1	0	0	1	1	0	1	1	0	1	0	0	0	2	0	0	1	0	2	1	1	0	-

Character	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	5	5
Taxon	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1		
<i>anatolica</i>	-	I	0	?	0	1	0	0	1	?	?	1	0	?	?	?	I	0	0	1	I	1	-	0	0	0		
<i>anomala</i>	-	1	0	1	0	1	0	0	0	0	1	1	0	2	1	1	1	1	1	1	1	1	2	0	1	0		
<i>bispinosa</i>	-	2	0	1	1	1	0	0	3	2	2	2	0	2	1	0	1	0	0	1	1	0	-	0	0	0		
<i>bytinski</i>	-	1	0	?	0	?	0	6	0	?	?	?	?	?	?	?	I	1	0	0	I	1	?	1	1	0		
<i>carcharodonta</i>	1	2	0	1	0	1	0	4	6	2	2	2	0	2	1	2	0	0	0	0	1	0	-	0	0	0		
<i>diversipes</i>	0	2	0	1	0	1	0	5	4	2	2	2	0	2	2	0	1	0	0	1	1	0	-	0	0	0		
<i>dixica</i>	-	1	0	1	0	1	0	1	1	1	1	0	0	2	2	0	1	0	0	0	1	1	-	1	1	0		
<i>edentata</i>	-	1	0	0	0	1	0	0	1	1	0	0	0	2	1	2	1	0	0	1	1	1	-	0	0	0		
<i>elegantissima</i>	-	1	0	0	0	1	0	1	1	2	0	1	0	1	2	2	1	0	0	1	1	1	-	1	1	0		
<i>equestris</i>	0	2	0	1	0	1	0	5	4	2	2	2	0	2	1	1	1	0	0	1	1	0	-	0	0	0		
<i>fayumensis</i>	-	2	1	1	0	0	2	0	6	2	1	1	0	2	1	0	1	1	0	0	1	1	1	0	1	0		
<i>femoralis</i>	1	1	0	0	0	1	0	4	5	1	2	1	0	1	1	1	0	0	0	1	1	0	-	0	0	0		
<i>flavolobata</i>	-	1	0	2	0	1	0	3	1	2	1	2	0	2	2	2	1	0	0	1	1	1	-	1	1	0		
<i>fugax</i>	1	2	0	1	0	1	0	5	4	2	2	2	0	2	1	1	1	0	0	1	1	0	-	0	0	0		
<i>fulvata</i>	-	0	0	1	0	0	0	7	0	-	0	2	1	1	0	0	0	0	0	0	0	0	3	0	0	1		
<i>inermis</i>	-	1	0	0	0	1	0	1	1	1	1	1	0	0	2	1	1	0	0	1	1	1	-	1	1	0		
<i>innesi</i>	1	1	0	1	0	1	0	0	0	1	2	2	0	2	2	1	1	0	0	1	1	1	-	1	1	0		
<i>interstitinervis</i>	-	2	0	1	0	1	1	2	1	0	2	2	0	2	2	1	1	0	0	1	1	1	-	1	1	0		
<i>kophenes</i>	0	2	0	1	0	1	0	5	5	0	2	2	0	2	1	0	1	0	0	1	1	0	-	0	0	0		
<i>lobata</i>	-	1	0	1	0	1	0	0	1	1	1	2	0	2	2	1	1	0	0	1	1	1	-	1	1	0		
<i>mandschurica</i>	1	2	0	1	0	1	0	4	5	2	2	2	0	2	1	0	0	0	0	1	1	0	-	0	0	0		
<i>monstrosa</i>	1	2	0	1	0	1	0	4	5	2	2	2	0	2	1	0	1	0	0	1	1	0	-	0	0	0		
<i>nilotica</i>	-	1	0	1	0	1	0	3	1	1	1	2	0	2	2	0	1	0	0	1	1	1	-	1	1	0		
<i>ocracea</i>	-	1	0	1	0	0	0	1	0	0	1	2	0	2	2	1	1	0	0	0	1	1	-	0	1	0		
<i>oxybeloides</i>	-	1	2	1	0	1	0	1	1	1	1	2	0	2	1	1	1	0	0	1	1	1	-	1	1	0		
<i>patellata</i>	-	1	0	1	0	1	0	0	2	1	1	1	0	2	1	1	1	1	1	1	1	1	2	1	1	0		
<i>platula</i>	-	I	0	1	0	I	0	1	1	?	?	2	0	?	?	?	I	0	0	1	I	1	?	?	1	0		
<i>rufescens</i>	-	?	1	?	?	?	0	6	?	?	?	?	?	?	?	?	1	0	0	1	?	1	?	1	1	0		
<i>siamensis</i>	-	1	2	0	0	1	3	1	1	1	1	2	0	2	1	1	1	0	0	1	1	1	-	1	1	0		
<i>squamata</i>	1	2	0	1	0	1	0	5	4	2	2	2	0	2	1	1	1	0	0	1	1	0	-	0	0	0		
<i>stenotarsus</i>	-	1	0	1	0	1	0	1	1	2	1	1	0	2	2	1	1	0	0	1	1	1	-	1	1	0		
<i>tadzhica</i>	-	1	0	0	0	1	0	0	1	0	0	1	0	2	2	1	1	0	0	1	1	1	-	1	1	0		
<i>urfana</i>	1	2	0	I	0	1	0	4	6	?	2	2	0	2	I	?	I	0	I	1	0	?	0	0	0			
<i>valga</i>	1	2	0	1	0	1	0	4	5	2	2	2	0	2	1	0	1	0	0	1	1	0	-	0	0	0		

APPENDIX 4. Apomorphy list for Figure 12

Character state changes on the branches of the cladogram shown in Figure 12.

Changes are not listed for outgroup and terminal taxa.

Node 29:
char 44: 0 → 1

Node 30:
char 37: 2 → 1
char 43: 0 → 1

Node 31:
char 3: 2 → 1
char 41: 1 → 0

Node 32:
char 26: 1 → 0

Node 33:
char 45: 1 → 0

Node 34:
char 8: 0 → 1
char 36: 1 → 0

Node 35:
char 11: 1 → 0
char 29: 1 → 0

Node 36:
char 37: 2 → 1

Node 37:
char 25: 2 → 3
char 33: 0 → 3

Node 38:
char 17: 0 → 1
char 36: 1 → 2

Node 39:
char 28: 0 → 2
char 40: 2 → 1

Node 41:
char 33: 4 → 5
char 34: 5 → 4

Node 42:
char 41: 0 → 1

Node 43:
char 8: 0 → 1

Node 44:
char 22: 0 → 1

Node 45:
char 1: 1 → 2
char 10: 0 → 1

char 19: 0 → 1
char 34: 1 → 5

Node 46:
char 12: 0 → 1
char 21: 1 → 2

char 23: 0 → 1
char 33: 0 → 4

Node 47:
char 3: 0 → 2
char 36: 0 → 2

Node 49:
char 33: 0 → 1

Node 51:
char 41: 02 → 1

Node 52:
char 40: 1 → 2
char 49: 0 → 1

Node 53:
char 3: 0 → 1
char 18: 0 → 1

char 36: 0 → 1
char 50: 0 → 1

Node 54:
char 47: 0 → 1

Node 55:
char 1: 0 → 1
char 2: 0 → 1

char 4: 1 → 0
char 6: 0 → 1

char 7: 0 → 1
char 9: 0 → 1

char 21: 0 → 1
char 31: 0 → 1

char 33: 7 → 0
char 34: 0 → 1

char 38: 1 → 0
char 39: 1 → 2

char 40: 0 → 1
char 45: 0 → 1

char 46: 0 → 1
char 51: 1 → 0

APPENDIX 5. Biological observations on *Pseudapis nilotica* (SMITH), *Nomiapis diversipes* (LATREILLE) and *N. bispinosa* (BRULLÉ)

Pseudapis nilotica (SMITH) (Figure 17)

As noted in the text, Egyptian and Gulf States (Qatar, UAE, Oman) populations of *nilotica* differ noticeably in the colour of the vestiture, yellow in the former, grey in the latter, but more particularly in their phenology as indicated by the bar chart, Figure 13. The data on which this chart was based are given under *nilotica* in the text (Systematics). The chart shows that in Egypt (between ca. 29°N and 31°25'N) the species is active between late April and early October with peak activity in July-August, while on the Gulf (between ca. 22°N and 26°N) it is active throughout the year with peak activity in September-October. Available material from the intervening area is limited to a few specimens from coastal (Red Sea) Saudi Arabia, and the Egyptian and UAE populations are presumably isolated by the barrier of the Nafūd.

Nomiapis diversipes (LATREILLE) (Figure 18)

A population of *Nomiapis diversipes* (LATREILLE, 1806) was observed intermittently during three consecutive seasons, between May 1965 and November 1967, on a site adjoining the mouth of the Tīlrūd, on the Māzandarān coast between Chālūs and Shāhsavār, in northern Iran (approximate coordinates 51°13' E, 36°43'N).

The bee occurred on the sand-stretch between the edge of the forest, here a small relic of the Hyrcanian forest, and the narrow belt of taller vegetation, including the trees *Alnus subcordata* C.A. Mey. and *Pterocarya fraxinifolia* (Poiret) Spach, marking the head of the beach (*vide* Baker, 1996: 111). The vegetation of the sand-stretch included mosses and lichens, coarse grasses (*Imperata*, *Setaria*), sedges (*Cyperus esculentus* L.), scattered herbs, such as *Achillea vernalis* Waldst. & Kit. [COMPOSITAE], *Allium aucheri* Boiss. [LILIACEAE], *Conyza canadensis* (L.) Cronq. (COMPOSITAE), *Crepis foetida* L. subsp. *rhoeadifolia* (M.B.) Bobek / Schinz & Kell. (COMPOSITAE), *Eryngium caucasicum* Trautv. [UMBELLIFERAE], *Lithospermum officinale* L. [BORAGINACEAE], *Lythrum salicaria* L. [LYTHRACEAE], *Origanum vulgare* L. [LABIATAE], *Petrorhagia saxifraga* (L.) Link. [CARYOPHYLLACEAE], *Solanum nigrum* L. [SOLANACEAE], *Tribulus terrestris* L. [ZYGOPHYLLACEAE], *Trifolium arvense* L. [LEGUMINOSAE], *Verbascum punalense* Boiss. & Buhse [SCROPHULARIACEAE], and *Verbena officinalis* L. [VERBENACEAE], nowhere forming a closed turf, and scattered shrubs, such as *Paliurus spina-christi* Mill. [RHAMNACEAE], *Mespilus germanica* L., *Prunus divaricata* Ledeb., and a prostrate *Rubus* [all ROSACEAE], and *Punica granatum* L. [PUNICACEAE].

Nests were scattered and no denser nesting aggregations were observed; nest entrances appeared usually to be unshaded (cf. ROZEN, 1986). The flight period extended from 27 May to 15 October (♂♂) or 4 November (♀♀), in two probably overlapping generations, May - end July and beginning August - November, as suggested by the bar chart, Figure 14. The data on which this chart was based are given below (Records). Males predominated in the first generation, females in the second. Plants belonging to at least nine families were visited, but principally the flowers of *Allium* and *Eryngium* (first

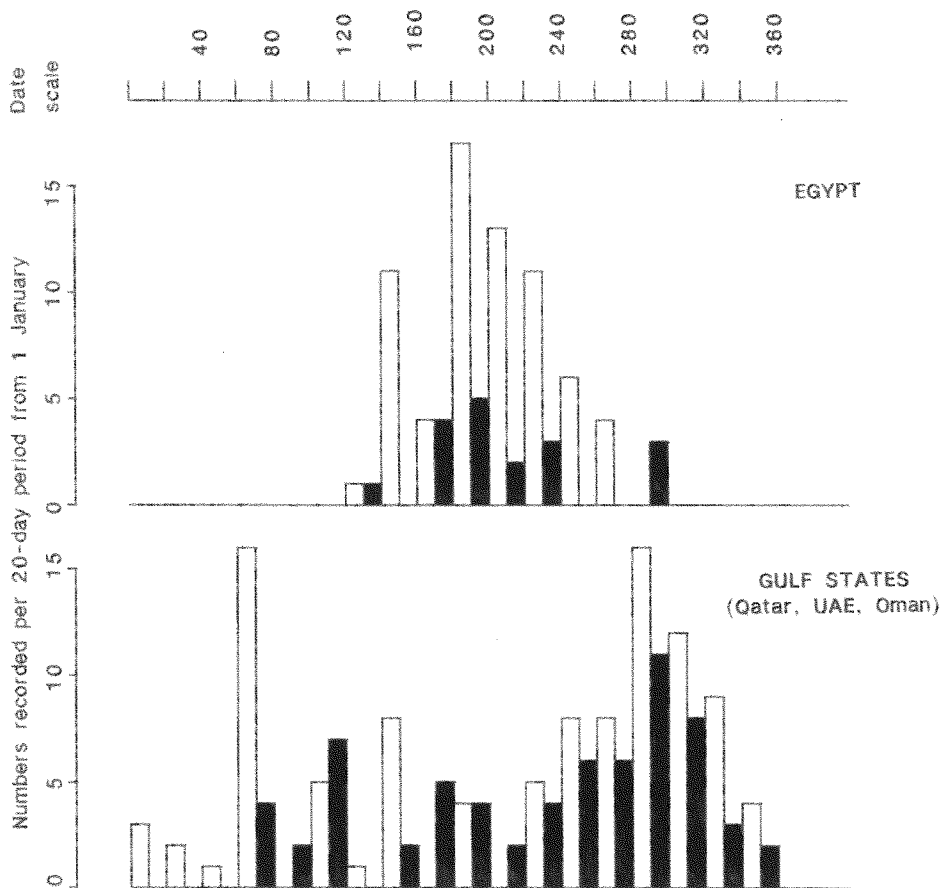


Fig. 17. Bar charts of flight periods of *Pseudapis nilotica* (SMITH, 1875) in Egypt (above) and Gulf States (below). Date scale in 20-day intervals from 1 January. Male columns unshaded, female black. The charts indicate that in Egypt (between ca. 29°N and 31°25'N) the species is active between late April and early October, with peak activity in July-August, while on the Gulf (between ca. 22° and 26°N) the species is active throughout the year, with peak activity in September-October.

generation) and, from July, *Origanum*. The *Nomiapis* was accompanied in both generations by its regular but much less numerous parasite, *Pasites maculatus* (JURINE, 1807) (Apidae, Nomadinae, Pasitini): cf. ROZEN 1986, especially p.7, referring to this population.

In Central Asia (Uzbekistan and Tajikistan) the flight period would appear to be from 13 May to 15 September (♂♂) and from 17 May to 7 October (♀♀) (POPOV 1967, Table 56, pp. 192-196, with, p. 50, supplementary data, Доп[олнительные] м[атериалы], by PONOMAREVA). While the overall flight period is substantially the same as that in northern Iran, it is not clear whether here also the species may be similarly bivoltine: unfortunately, the bracketing of sexes under date-ranges for the individual species of plants visited renders much of POPOV's extensive data unusable.

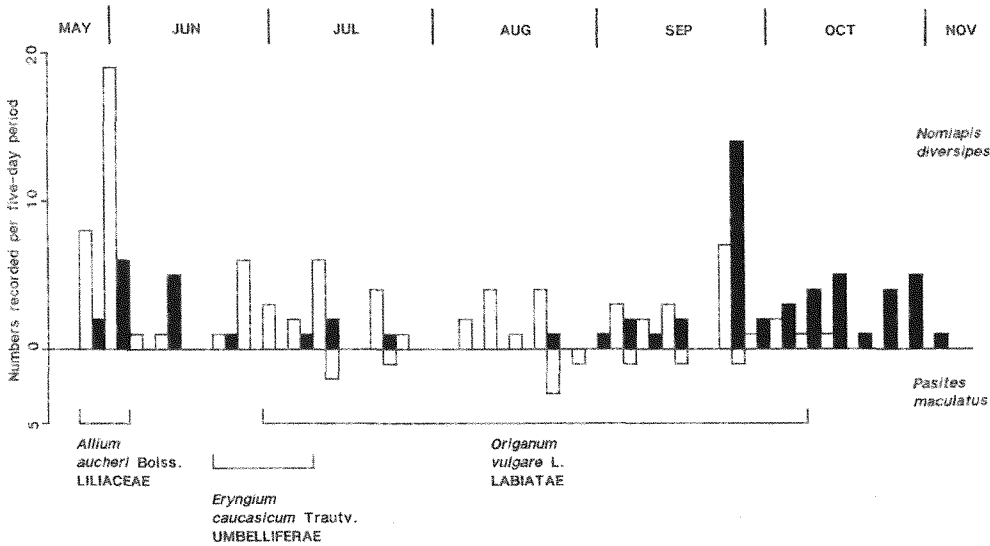


Fig. 18. Bar chart of flight periods of *Nomiaapis diversipes* (LATREILLE, 1806) and its cleptoparasite, *Pasites maculatus* JURINE, 1807 (Apidae, Nomadinae, Pasitini) on the Caspian coast, northern Iran, with indication of principal plants visited. Abscissa in five-day intervals. Male columns unshaded, female black. Chart indicates two generations with males predominating in first, females in second.

Records

1965: 30 v, 2♂ (1 at *Paliurus*), 1♀ (*Allium*); 2 vi, 3♂; 3 vi, 3♂ 1♀ (all at *Allium*); 4 vi, 1♀; 22 vi, 1♀ (*Eryngium*); 27 vi, 3♂ (*Eryngium*); 29 vi, 1♂ (*Eryngium*); 30 vi, 2♂ (*Eryngium*); 3 vii, 1♂ (*Origanum*); 5 vii, 2♂ (1 at *Eryngium*), 1♀; 10 viii, 2♂ (*Origanum*); 13 viii, 1♂ (*Origanum*); 29 viii, 1♀ (*Solanum*); 3 ix, 1♂ 1♀; 7 ix, 2♂ 1♀; 8 ix, 1♂ 1♀; 9 ix, 1♂; 14 ix, 1♂; 15 ix, 1♂; 16 ix, 1♂ 2♀; 23 ix, 3♀; 24 ix, 3♂ 1♀; 25 ix, 1♂ 1♀; 27 ix, 2♂ 4♀ (♀♀ partly at *Origanum*); 12 x, 1♂ (*Origanum*); 23 x, 1♀ (*Cucurbita*, cultivation); 28 x, 1♀; 30 x, 2♀. **1966:** 27 v, 3♂ (*Allium*); 31 v, 1♂; 2 vi, 3♂; 3 vi, 1♂ (*Allium*); 24 vi, 1♂; 26 ix, 4♀; 30 ix, 2♀; 5 x, 1♀; 6 x, 2♂ (*Conyza*), 2♀; 11 x, 1♀; 15 x, 4♀; 27 x, 1♀ (*Rubus*). **1967:** 27 v, 3♂ (*Allium*), 1♀; 31 v, 1♂ 1♀ (both *Allium*); 2 vi, 8♂ 3♀ (all *Allium*); 7 vi, 1♂; 27 vi, 1♂; 10 vii, 1♂ 1♀; 11 vii, 2♂; 12 vii, 3♂ 1♀; 20 vii, 2♂ 1♀; 24 vii, 2♂; 1 viii, 1♂; 5 viii, 1♂; 10 viii, 1♂; 16 viii, 1♂; 19 viii, 2♂; 22 viii, 1♂; 23 viii, 1♂ 1♀ (both *Petrorhagia*); 26 ix, 1♂ 1♀; 9 x, 2♀; 10 x, 1♀; 15 x, 1♂ 1♀; 19 x, 1♀; 23 x, 1♀; 29 x, 2♀; 4 xi, 1♀.

(80 ♂♂, 58 ♀♀)

Nomiaapis bispinosa (BRULLÉ) (Figures 19-20)

This species was found (Cambridge Bactria Expedition, August 1975) nesting in great numbers in a bank at the foot of the colossal Buddha carved in the cliffs at Bamian in Afghanistan (Figure 19). No *Pasites*, the species' known cleptoparasite, appeared to be present. Females of the *Nomiaapis* were collecting pollen from *Peganum harmala* L. [Zygo-

phyllaceae]. This host was recorded by POPOV (1967: 198) as one of the plants visited by *ruficornis* [*bispinosa*] in Central Asia [Uzbekistan, Dzhusa, in June] but only ♂♂ were taken - Popov, however, recorded few ♀♀ from any of the localities listed. The very conspicuous tergal fasciae of the ♀ (Figure 20) are post-gradular, not marginal, and are partly overlapped by the transparent margins of preceding terga.

Afternote

Subsequently to closure of the manuscript, it was possible, through the courtesy of Prof. WU YAN-RU, to examine the holotype of *Pseudapis trigonotarsis* HE & WU, 1990. Although described as a species of *Lobonomia* (i.e., *Pseudapis*), its affinities lie rather with *Nomiapis* and, in particular, with the anomalous species *diversipes* (LATREILLE, 1806). The following details amplify the original description.

Holotype ♂ labelled: 'Yunnan, Lijiang Naxi Aut. County, 1 ix 1983 (*He Wan*) [in Chinese] / 06008', '4', 'HOLOTYPE' [printed, on red] and '*Nomia* (*Lobonomia*) *trigonotarsis* Wu et He ♂'.

♂. *Head*. Occipital ridge carinate; postocular carina well developed; clypeus in profile weakly convex, little more so apicad; lateral ocelli separated from vertex by 3x their diameter. *Mesosoma*. Mesoscutum anteriorly medially carinate with distinct anterior surface; scutellar spines short, weak; mesepisternal mesial apophyses, lateroventral ridges, and precoxal ridges absent; coxa, trochanter and femur I simple; distitarsus I enlarged, black; calcar II attaining mid-length basitarsus; distitarsus II enlarged, slender-pyriform, black; coxa III simple; trochanter III ventrally weakly nodose; femur III not strongly incrassate, its greatest depth at second third, not strongly arched, a preapical anteroventral tooth absent; tibia III not contracted, strongly enlarged apicad, its breadth at apex greater than greatest breadth of femur; no anterior apical lobe present, but a slightly outcurved, acuminate apical process, similarly formed to that in *diversipes* but shorter (not more than apical breadth of tibia) present; calcar absent; basitarsus III elongate, slender. *Metasoma*. T6 edentate; T7 broadly emarginate, bilobate; S3 and S4 structurally unmodified, S4 with decoloured marginal area arcuately expanded basad medially; S5 [gummed on card] discally unmodified, laterally acutely dentate, the gradulus running into the tooth, mesially broadly, nearly semicircularly emarginate, the emargination bounded by strong angular teeth, the margin between these and the lateral teeth again, bluntly dentate (the sternal margin therefore effectively hexadont); S6-8 and genitalia [figured by the authors] not present. *Integument*. Mesoscutum coarsely, irregularly, reticulately punctate; basal area of propodeum broad (broader than ocellar diameter), sharply defined posteriorly, traversed by strong carinulae; marginal area of T1 finely punctate in basal third; discal area of T2 lacking impunctate areas, medially, adjacent to the gradulus, densely, finely punctate, posteriorly abruptly very coarsely punctate. *Vestiture*. Femur III ventrally densely clothed with long, spathulate hairs, as in *diversipes*; terga without marginal fasciae; T2 and T3 with strong postgradular fasciae.

In the key to species, *trigonotarsis* would run best (tibia III with apical process, not anterior lobe; posterior marginal areas of terga not fasciate) to couplet 23 (medial mesepisternal apophyses absent) and then run out.



Figs. 19-20. *Nomiapis bispinosa* (BRULLÉ, 1832), AFGHANISTAN: Bamian, 11 August 1975 [Photographs Dr P. H. B. Baker]: (19), nest site in bank at foot of the colossal Buddha – ♀♀ were collecting pollen from *Peganum harmala* L. [Zygophyllaceae]; (20) ♀ entering nest.

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