Natural Resources Institute

Bulletin 54

A REVISION OF THE GRASSHOPPER GENUS *ORTHOCHTHA* AND ALLIES (ORTHOPTERA: ACRIDIDAE: ACRIDINAE)

Overseas
Development
Administration

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G. B. Popov and L. D. C. Fishpool

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NRI
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Summaries

SUMMARY

This revision concerns the genera *Orthochtha, Euprepoptera, Lobopoma, Pamacris* and *Xerophlaeoba*, which are diagnosed and redescribed, plus three others erected here: *Shabacris* for *Lobopoma robusta, Nimbacris* for *Lobopoma longicornis* and *Xenocymochtha* for a new species, *barkeri*, here described. As now recognized, *Orthochtha* comprises 25 species and 11 subspecies of which 12 species and five subspecies respectively are described here as new, while the identity of another species, *O. angustata*, remains uncertain. Of the other genera, two species are now recognized within *Euprepoptera*, one of which is new, three within *Lobopoma* (two new) and two within *Pamacris*, with *carterocera* transferred from *Lobopoma*.

In all, 36 species and 11 subspecies are diagnosed, illustrated, keyed and their distributions mapped. Six new synonymies are established and four specific names recalled but given new status as subspecies; two other species are reduced to the rank of subspecies. Six lectotypes and one neotype are designated. The affinities of the taxa are discussed on the basis of classical taxonomic criteria and also by numerical analysis. Their biogeographies are assessed, notably in terms of the postulated environmental influences on their evolution. A synopsis of the available information on the biology, ecology and economic importance is given for each species.

RESUME

Cette révision traite des genres *Orthochtha, Euprepoptera, Lobopoma, Pamacris* et *Xerophlaeoba*; elle établie trois genres nouveaux: *Shabacris* pour *Lobopoma robusta, Nimbacris* pour *Lobopoma longicornis* et *Xenocymochtha* pour une nouvelle espèce, *X. barkeri*, ici décrite. Dans son état actuel *Orthochtha* contient ainsi 25 espèces et 11 sous-espèces dont 12 espèces et cinq sous-espèces sont décrites comme nouvelles. L'identité de *O. angustata* demeure, quant à elle, incertaine. Pour les autres genres on reconnaît deux espèces pour *Euprepoptera* (dont une nouvelle), trois pour *Lobopoma* (dont deux nouvelles), et deux pour *Pamacris* (dont *P. carterocera* transférée de *Lobopoma*).

Au total, 36 espèces et 11 sous-espèces sont traitées dans une série de clés d'identification, de descriptions individuelles, de déssins de d'illustrations, y compris des cartes de distribution géographique. Six synonymies nouvelles sont établies et quatre espèces sont rappelées, mais dans un nouvel statut de sous-espèces; de plus, deux autres espèces sont réduites au statut de sous-espèces. Six lectotypes et un néotype sont désignés. Les affinitées taxonomiques sont examinées sur la base de critères classiques, ainsi que par analyse numérique. La biogéographie est discutée notamment dans le contexte des tendences évolutives probables du milieu. Pour chaque espèces est inclu un resumé des données disponibles sur la biologie, l'ecologie et l'importance économique.

RESUMEN

En esta revisión se presenta el diagnóstico y redescripción de los géneros *Orthochtha, Euprepoptera, Lobopoma, Pamacris* y *Xerophlaeoba*, junto con la introducción de otros tres géneros: *Shabacris* para *Lobopoma robusta, Nimbacris* para *Lobopoma longicornis* y *Xenocymochtha* para una nueva especie (*barkeri*), aquí descrita. Tal como ha quedado hoy día aceptado, el género *Orthochtha* se halla constituido por 25 especies y 11 subespecies, de las que este estudio presenta por primera vez 12 especies y cinco subespecies. La identidad de otra especie (*O. angustata*) sigue siendo incierta. De los otros géneros, dos especies han quedado reconocidas como pertenecientes a *Euprepoptera* (una de ellas es nueva), tres corresponden al género *Lobopoma* (dos de ellas son nuevas) y dos al género *Pamacris*. La especie *carterocera* ha sido transferida del género *Lobopoma*.

El estudio lleva a cabo el diagnóstico, ilustración, identificación y distribución de 36 especies y 11 subespecies. También se establecen seis sinonimias y se retiran cuatro nombres específicos, a los que se asigna la condición de subespecies. Otras dos especies han quedado reducidas al rango de subespecies. Además de realizar la designación de seis lectotipos y un neotipo, esta revisión examina las afinidades de los taxones de acuerdo con criterios taxonómicos clásicos y por análisis numérico y lleva a cabo una evaluación de sus biogeografías, particularmente, en términos de las influencias ambientales postuladas sobre su evolución. Finalmente, el estudio proporciona una sinopsis de la información sobre la biología, ecología e importancia económica de cada especie.

Introduction

SCOPE OF THE REVISION

This revision grew from an original attempt at an accurate determination of the West African species of *Orthochtha* Karsch as part of the authors' study of the grasshopper faunas of the West African savannas (Fishpool and Popov, 1984). It quickly became apparent however, that this would not be possible without a thorough examination of the whole genus, which was found to be in a state of taxonomic confusion. Eventually it became necessary to widen the scope of the revision to include a number of allied genera, *Lobopoma* Karsch and *Euprepoptera* Uvarov plus the more remote *Xerophlaeoba* Uvarov and *Pamacris* Ramme, as well as to erect three new ones: *Nimbacris* **gen.n.**, *Shabacris* **gen.n.** and *Xenocymochtha* **gen.n.**

HISTORY OF THE GENERA

The genus *Orthochtha* was originally established by Karsch (1891: 177) in a footnote to his description of the genus *Holopercna*, to accommodate material which he could not, on the basis of differences in pronotal structure, ascribe to either *Holopercna*, or to the allied *Duronia*. The material which he transferred to *Orthochtha* was cited by him as "*Chrysochraon dasycnemis* Gerst. (*Phlaeoba bisulcata* Krauss)" without further explanation. It is possible that Karsch regarded *bisulcata* as a synonym of *dasycnemis*, for there is no mention of *bisulcata* in his detailed description of the genus (Karsch, 1893: 62) in which there is further discussion of the type species *dasycnemis* and also a description of a new species, *brachycnemis*, from Bismarckburg (Togo). However, succeeding authors did not infer synonymy, the name *bisulcata* survived and, as a result of an early misidentification (Uvarov, 1926), became associated with another species (see under *ampla*, p. 28).

Another new species, *nigricornis*, also from Bismarckburg, described by Karsch in the same paper (1893: 68-69), was regarded as sufficiently distinct to justify the creation of a separate genus *Cymochtha*, its distinctive character being the narrow, parallel-sided dorsum of pronotum. The genus *Rasperecta* was described by Sjöstedt (1931a: 20-21), in which he placed his new species *ampla*, together with what he regarded as *bisulcata* (*sensu* Uvarov, 1926, not Krauss, 1877). The genus was said to be a close relative of *Orthochtha*, differing from it in strongly divergent pronotal carinae in the metazona and in proportionately longer wings. In the same paper (p.22) Sjöstedt described a second new genus *Macrocymochtha*, said to be close to *Cymochtha*, differing chiefly in the structure of the pronotum and male cerci. In it he placed his single new species *speciosa*, evidently unaware that it was earlier described as *Cymochtha venosa* by Ramme (1929: 267-9).

These genera were later synonymized under *Orthochtha*; *Cymochtha* by Uvarov (1953: 146), *Macrocymochtha* by Kevan (1956: 31) and *Rasperecta* by Dirsh (1958: 60).

By 1980, when this revision began, 24 species within Africa had been attributed to *Orthochtha* or its synonyms, or originally to other genera such as *Phlaeoba* and later transferred. Some of these were later synonymized such that Dirsh (1965: 434) listed 19 species for the genus. Since then Dirsh himself (1970: 435) synonymized four of these, but four others have been described very recently; two by Baccetti (1985: 311) and two more by Popov and Fishpool (1988: 299). To these should be added three Indian species placed under *Orthochtha*, one by Uvarov (1942), one by Popov (1981) while the third is described here, along with another new species of *Orthochtha* from Thailand.

There have however, been no critical studies of the genus, while attempts at identification without comparison with the original type material have led to increasing confusion. This point was made by Uvarov (1953: 147), while Descamps (1972) included *Orthochtha* in his short-list of acridoid genera most in need of revision.

The other genera included here are small with brief histories. *Euprepoptera* Uvarov 1953 is a monotypic genus with its type species *polychroma* Uvarov (1953: 146) (Angola) by original designation. No other species were recorded until Johnsen (1984: 316) noted the existence of a second species in Zaire and Zambia; it is described here (p. 110). *Pamacris* Ramme 1929, is another genus considered to be monotypic, with its type species *diversipennis* Ramme (1929: 270) (Cameroon), by original designation. The third is *Lobopoma* Karsch 1896, type species *ambages* Karsch (1896: 253) (Zanzibar), by original designation. Three species have been attributed to the genus since: *carterocera* Jago (1964: 211) (S. Sudan); *longicornis* Chopard (1958: 151) (Mt Nimba, Guinea) and *robusta* Bouvy (1982: 417) (Zaire). The first is here transferred to *Pamacris*, while the second and third are placed in separate new genera here described as *Nimbacris* and *Shabacris* respectively. Finally *Xerophlaeoba* Uvarov 1936 is included to clear up some taxonomic confusion (p. 132), and *Xenocymochtha barkeri*, a new genus and species from Namibia, related to the *Orthochtha* group, is described here to complete the revision (p.140).

The revision has resulted in considerable taxonomic change with many new additions and synonymies. These are discussed below (p. 6).

ECONOMIC IMPORTANCE

Some members of the genus *Orthochtha* are conspicuous components of tropical grassland ecosystems in Africa. Two species are of economic importance (COPR, 1982). *Orthochtha venosa* (Ramme, 1929) which, often in mixed populations with *Hieroglyphus daganensis* (Krauss), attacks and sometimes causes locally serious damage to rice in major river basins in western and central Africa (Popov, 1988), while Joyce (1952) records it feeding on leaves and grain of guinea corn. The second species is *O. brachycnemis* Karsch 1893, widespread in guinea savanna from western Africa to Uganda and Zaire. Gillon (1973, 1974) found it to be the principal species of the grasshopper fauna of the savanna of the Lamto area of Côte d'Ivoire, comprising 14% of the total population and 21% of the biomass. *Orthochtha brachycnemis*, like the other *Orthochtha* species for which such information exists, is strictly graminivorous and at the densities observed, it caused appreciable loss to pastures (Gillon, 1973, 1974). The other species of *Orthochtha* and the other genera included in the revision are not regarded as pests, but it is possible that their numbers and economic importance could increase in the future with the continuing conversion of forest and woodland to agriculture.

METHODS AND TERMINOLOGY

In this study the characters used for identification and separation of the taxa were features of external morphology, internal genitalia and colour. The format and terminology adopted are principally those used by Ritchie (1981, 1982) in his revision of *Oedaleus* Fieber and *Gastrimargus* Saussure with a few changes. Thus the measurements used in this study follow Dirsh (1953), so that the total length is the distance from the frons to the tip of the abdomen, not the apices of the folded tegmina. Subocular distance is measured along the sulcus below the eye, from the eye to the lower edge of the gena. Abbreviations and terms used in the description and illustration of the male genitalia agree with Dirsh (1965). Given the similarity of structure, only those of *O. dasycnemis* have been fully labelled. The nomenclature of female genitalic structures is that of Kevan *et al.* (1969), as shown in Figure 15 for *O. dasycnemis*. Where type material has been used for illustration this is stated, otherwise drawings are of the best available representative specimens. All measurements are in millimetres, as are the scale lines in illustrations. Measurements in the tables and in the text are given as size ranges only.

For the more common species details of the label data of the material examined are confined to listing localities and months of capture, but full lists have been deposited at NRI.

In addition to the traditional taxonomic treatment, there is a numerical taxonomic analysis and the results of the two treatments are compared and discussed.

SYSTEMATIC POSITION AND AFFINITIES OF THE GROUP

Following Uvarov (1953), Johnston (1956, 1968) attributed the genus *Orthochtha* Karsch, together with some 30 other African genera, to the group Phlaeobae within the subfamily Acridinae. The group was not given a precise taxonomic definition and was evidently merely a convenient grouping of acridine genera, of possibly polyphyletic origin, but sharing a generally similar habitus of mesotypic graminicoles (*sensu* Uvarov, 1966). Dirsh (1975) erected the Phlaeobinae as a subfamily of the Acrididae with its type genus *Phlaeoba* Stål (not *Phlaeobida* Stål as stated by Dirsh, possibly due to a lapsus (Jago, 1983)). The diagnostic feature of this subfamily was stated by Dirsh (1975) to be the combination of the following characters: monolobate lophi attached to the inner sides of lateral plates of the epiphallus, ensiform antennae and the absence of fastigial foveolae on the vertex. It was further stated that although these characters occurred individually in other subfamilies, their combination was distinctive of the Phlaeobinae.

With the exception of *Xerophlaeoba* (p. 132), this definition is true for all the genera considered in this revision, whether we accept Dirsh's classification, or, as we prefer, to agree with Jago (1983), that the raising of the Phlaeobae to subfamily rank is premature and that it is preferable to regard it as a genus group or a tribe within the Acridinae. Yet the heterogeneity of the group is such that to define the position of *Orthochtha* and the other revised genera within it, would require a review of the whole group and indeed the entire subfamily. Such a task is outside the scope of this revision, but it is hoped that it will be undertaken at a later date.

Among the African Phlaeobae, *Orthochtha* is closely related to *Euprepoptera* Uvarov and *Lobopoma* Karsch, both included in this revision. A close relative of the group is the new genus *Xenocymochtha* described here, together with its type species, *X. barkeri*, from Namibia. Another close relative is evidently *Lemuriacris* Dirsh (1966a) from Madagascar, but the unique type was not available for study. A further close relative is the Afro-Arabian genus *Duronia* Stål, the principal difference being the structure of the pronotum, where the metazona is subequal to the prozona in *Duronia* and distinctly shorter in *Orthochtha*. There are also notable differences in the structure of the epiphallus, which in *Orthochtha* is typical of the *Phlaeoba* genus group (*sensu* Jago, 1983), while in *Duronia* it is nearer that of the *Gymnobothrus* genus group.

The Afro-Arabian genus *Xerophlaeoba* Uvarov is superficially similar to *Orthochtha* and is occasionally confused with it, but differs in its smooth, matt integument, prominent vertex of the head, reduced arolia and particularly in the very elongate posterior lateral lobes of the epiphallus, which latter character should, according to the definition of Jago (1983), place it outside the *Phlaeoba* genus group. The genus *Pamacris* Ramme is very distinctive in its wide fastigium verticis, the peculiar structure of the mesonotum and the genitalia; its relationship with the other genera treated here is remote. It is included because one of the species placed under *Lobopoma* (*L. carterocera* Jago 1964) belongs to it. Two other species placed under *Lobopoma* required the erection of new genera to accommodate them: *Nimbacris* **gen.n.** for *L. longicornis* Chopard 1958, a close relative of *Pamacris*, and *Shabacris* **gen.n.** for *L. robusta* Bouvy 1982, which does not appear to have any obvious close relations within the *Phlaeoba* genus group.

While the taxa within *Orthochtha*, *Lobopoma* and *Euprepoptera* share an overall morphological similarity, they also exhibit a considerable degree of inter- and intra-specific variability. On this evidence it seems likely that some or all of these genera are in a state of active speciation and this in some cases has made it convenient to identify species-groups and to recognize subspecies in others.

The majority of the taxa are defined not so much by a few key characters, as by a combination of several, often minor, features; this has made it difficult to produce simple identification keys, necessitating rather long diagnostic descriptions. For the numerical analysis (p. 141) 50 characters were used, listed in Appendix 1. This can be used as an additional, if cumbersome, means of identification. For the purpose of the traditional taxonomic treatment however, emphasis is placed on those characters regarded as being of greatest diagnostic value in defining a given taxon. In addition to the more obvious external morphological structures and coloration, the concealed genitalic structures, notably the form of the epiphallus and the aedeagal valves of the male and of the receptaculum seminis of the female, were found to be of diagnostic value. The last character was found to be particularly useful in defining species-groups. Unfortunately its use presents some practical difficulties; the method of preparation used was that of Slifer (1939), involving removal of the posterior abdominal segments, maceration in hot 10% potassium hydroxide, and dissection under a microscope. The spermatheca alone was found to be of limited diagnostic value (except for separating the very distinctive *Pamacris*), but the structure and arrangement of the spermathecal duct showed considerable diversity. It is, however, a very fragile organ, difficult to dissect and subsequently to preserve in its original shape. It thus necessitated drawing the structure at the time of dissection, which inevitably limited the number of specimens that could be examined. There is certainly scope for improving upon our technique.

The *Orthochtha* species-groups and other taxa treated in this revision are:

Orthochtha

nigricornis **species-group**
- *nigricornis*
- *n. congoensis* **stat. n.**
- *n. prasina* **stat. n.**
- *ampla*
- *katangana* **sp. n.**

dasycnemis **species-group**
- *dasycnemis*
- *d. bisulcata*
- *d. trivittata* **stat. n.**
- *d. alca* **stat. n.**
- *d. lindneri* **stat. n.**
- *d. nana* **subsp. n.**
- *d. somalica* **subsp. n.**
- *browni* **sp. n.**
- *modesta* **sp. n.**
- *elegans* **sp. n.**
- *pulchripes* **sp. n.**
- *dimorphipes*

brachycnemis **species-group**
- *brachycnemis*
- *b. ottei* **subsp. n.**
- *sudanica*
- *tunstalli* **sp. n.**
- *t. brachyptera* **subsp. n.**
- *grossa*

Euprepoptera
- *polychroma*
- *sylvatica* **sp. n.**

Shabacris **gen. n.**
- *robusta* **comb. n.**

Nimbacris **gen. n.**
- *longicornis* **comb. n.**

Xenocymochtha **gen n.**
barkeri **sp. n.**

ungrouped species
- *venosa*
- *dimorpha*
- *nadiae* **sp n.**
- *coeruleipes* **sp. n.**
- *aurea*
- *angusticornis* **sp. n.**
- *a. zambiae* **subsp. n.**
- *rosacea*
- *zuluensis* **sp. n.**
- *ramchandrae*
- *indica*
- *schmidti* **sp. n.**
- *roffeyi* **sp. n.**

Lobopoma
- *ambages*
- *mitchelli* **sp. n.**
- *robertsoni* **sp. n.**

Pamacris
- *diversipennis*
- *carterocera* **comb. n.**

Xerophlaeoba
- *deserticola*

In addition, one putative *Orthochtha* species, recorded in Johnston (1956), has not been examined because the unique female type has been lost: *Orthochtha angustata* I. Bolivar 1889. (See p. 100.)

Section 1

Biogeographical and ecological considerations

HABITAT ASSOCIATIONS

The genera *Orthochtha, Lobopoma* and *Euprepoptera* comprise a relatively homogeneous group of graminicolous acridine grasshoppers, mainly of Afrotropical distribution. At least for those species for which there is information they are restricted to a relatively well defined range of habitat types. They are found typically in moist or fairly moist tall perennial grasslands of two broad types.

(1) Edaphic grasslands, which may either fringe temporary or permanent bodies of water and be seasonally inundated by fluctuating water levels, such as riverine flood plains, or which develop on rainfed, seasonally waterlogged soils that result from impeded drainage, such as those that occur characteristically in depressions at medium altitude on the Central African plateau, where they are known as 'dambos'. Representative grass genera of these habitats include *Loudetia, Diplachne, Sporobolus, Andropogon, Hyparrhenia* and *Pennisetum* and in the more humid parts, *Echinochloa* and *Oryza.* These grassland habitats are generally of fairly restricted occurrence.

(2) Derived or secondary grasslands that occur on a variety of soils (except alluvium) within the higher rainfall zones, for example, above approximately 800 mm in lowland West Africa, corresponding to the southern Sudan savanna. These grasslands, which may occur under varying degrees of tree cover, are usually at least partly maintained by grazing and, more importantly, by annual burning. At lower altitudes the genera *Andropogon* and *Hyparrhenia* are often dominant but are replaced altitudinally, for example in East and South Africa, by *Themeda triandra.* These habitat types are found widely throughout sub-Saharan Africa. Their occurrence and distributions are discussed by White (1983) and Lind and Morrison (1974).

While these distinctions are by no means clear-cut or exhaustive they provide a useful, if crude, means of distinguishing between the main habitat preferences of some members of the group. Table 1 gives a provisional classification of the taxa on this basis. It should be used with caution however, since there is little or no ecological information available for many of the taxa treated in this revision. The West African fauna, with which we have the most field experience, is the best documented; for many of the remainder there are only limited data available, from brief field observations by ourselves, from publications, specimen labels and personal communications by other observers. Hence inferences about the ecology and biogeography of many of the taxa are tentative. However given the overall homogeneity of the group and that a number of species found in West Africa are widely distributed over other parts of the continent, these inferences are probably justified.

Xerophlaeoba and *Xenocymochtha* are adapted to ecological conditions conspicuously different from those described above; as a consequence they are not comfortably encompassed by the following discussion and are therefore considered separately under their respective accounts in the taxonomic section. Of the more distant, poorly known genera, *Nimbacris, Shabacris* and *Pamacris,* little can be said and they are not considered further here.

Table 1 Tentative classification of the habitat preferences of *Orthochtha* and *Lobopoma* (not all taxa shown)

	Edaphic grasslands		Derived grasslands	
Taxa	Lowland: flood plains, marshland etc.	Highland: dambos, river margins etc.	Low altitude	Medium and high altitude
O. ampla			+	
O. angusticornis subspp.		+?		
O. aurea			+	
O. brachycnemis subspp.			+	
O. browni				+
O. coeruleipes				+
O. d. dasycnemis	+	+		+
O. d. alca	+?			
O. d. bisulcata	+			
O. d. lindneri		+		
O. d. nana				+
O. d. somalica	+?			
O. d. trivittata				+
O. dimorpha	+			
O. dimorphipes			+?	+
O. elegans		+?		
O. katangana				+
O. modesta				+
O. n. nigricornis			+	
O. n. congoensis			+	+?
O. n. prasina				+
O. pulchripes	+?			
O. rosacea				+?
O. sudanica	+			
O. t. tunstalli	+?	+?		
O. t. brachyptera	+?			
O. venosa	+			
L. ambages				+
L. mitchelli			+	
L. robertsoni				+?

With the exception of the three *Orthochtha* species known from India, and one from Thailand, the taxa treated here are restricted to the Afrotropical region and there can be little doubt that this is where they evolved. There is little information on the evolutionary history of acridoid grasshoppers (Sharov, 1968) but what there is suggests that arboricolous and herbicolous families are the more primitive, while graminicolous ones are the more derived (Uvarov, 1977). Thus, *Orthochtha* and allies, members of the Acridinae, a sub-family considered 'advanced', show numerous morphological features characteristic of specialized graminicoles. These include relatively elongate and laterally compressed bodies, oblique faces, long and narrow hind femora and large tarsal pulvilli indicating life histories mostly spent clinging vertically to culms and leaves of tall grasses (Uvarov, 1977). Gillon (1970) provides data demonstrating an exclusively graminivorous diet for *O. brachycnemis* in Côte d'Ivoire, while Hummelin and Gillon (1968) and Chapman (1962) indicate graminivory in *O. nigricornis* and *O. ampla* (as *O. bisulcata*) respectively, and these we believe may safely be taken as representative of the group as a whole. This view is borne out by the dissection of specimens (while examining the structure of internal genitalia), which have shown food remains in the gut to be exclusively graminaceous. Thus it is likely that the evolutionary history of *Orthochtha* and allies is intimately linked with that of the grassland ecosystems in sub-Saharan Africa.

EVOLUTION OF SAVANNA BIOMES IN AFRICA

Current evidence suggests that the evolution of grassland communities in the modern sense probably started in the Palaeocene and that they had become widely established by the mid Oligocene (Clayton, 1981). The super-continent of Gondwanaland had broken up during the Cretaceous so that by the time of the appearance of grasslands the continent of Africa had assumed much of its modern outline, although the Red Sea was not then in existence and hence the Arabian peninsula was not yet a separate entity. The wide expanse of the Tethys Sea separated Eurasia both from Africa with Arabia and from the Indian subcontinent, which at this time constituted an island (Adams, 1981).

The geological history of what is now the continent of Africa seems to have been remarkably stable right from Precambrian times until the Miocene. It is thought that before the Miocene the physiography of much of the continent consisted of a series of large depressions separated by ridges in a gentle basin-and-swell pattern, as may still be seen in parts of West Africa today (Hamilton, 1982). It is likely therefore, that the vegetational zonation over most of the continent reflected this topographic uniformity. However, from about 25 million years ago fundamental large-scale changes began when vast areas of eastern and southern Africa started to be uplifted by up to 1200 m. This process continued into, and intensified in, the Pliocene when in eastern Africa uplift and downwarping resulted in the formation of the eastern and western Rift valleys and the Lake Victoria basin (Morgan, 1973). These changes had profound effects on the biogeography of the flora and fauna of much of Africa.

The principal factors that shaped the distribution and speciation of *Orthochtha* and allies – along with much else – are much more recent however, and hinge upon climatic activity during the late Pliocene and the Pleistocene. From about 3 200 000 years before present (BP) there began the series of climatic fluctuations which have come to be known as ice ages. It is currently thought that there have been at least 17 of these worldwide glacial/interglacial fluctuations (Gentry and Sutcliffe, 1981). Their effects upon the biota of the Afrotropical region, whilst less dramatic than upon those of the northern continents, have, it is increasingly realized, been considerable.

Two points should be noted here. Firstly, the most recent glacial/interglacial fluctuation and its effect upon African biomes, is only the latest of many. It was preceded, with modifications, by numerous similar ones, the individual effects of which it may never be possible to disentangle. Secondly, the presently prevailing conditions represent part of a continuing process which are currently closer to an interglacial peak than a glacial one.

The last glacial period began approximately 80-70 000 BP and was at its most severe 18 000 BP. It is considered to have ended 12-10 000 BP (Hamilton, 1982; Van der Hammen, 1983). Over the period of the pleniglacial, that is, during extreme glacial conditions, much of the northern hemisphere was ice-covered and there was a corresponding increase in the ice cap of the South Pole. The resultant cooling of ocean currents and the coincident large-scale perturbations in atmospheric circulatory systems combined to cause a significant lowering of temperature of, on average, about 5 °C overall within Africa. In addition, there was a marked decrease in precipitation coupled with, in winter, deep penetration of southern Africa by polar air, often as high velocity winds, which combined would have resulted in considerable aridification across most of the continent (Van Zinderen Bakker, 1976). This had far-reaching effects upon the vegetation. The Sahara was much more extensive, with the southern edge of mobile dunes some 400-600 km farther south than at present; the Namib was similarly enlarged northwards. Forest biomes were reduced to fragmented 'core areas' or refuges, surrounded, it is thought, by relatively localized areas of moist woodlands. Montane vegetational zones descended by as much as 1000 m while the South Africa plateau was covered with alpine grassland. The remaining, larger part of the continent was covered with arid woodlands, savannas and dry grasslands. Lake levels were correspondingly low in all basins and river flow was much reduced or had ceased completely; the White Nile was reduced to, at most, a seasonal stream (Van Zinderen Bakker, 1976; Hamilton, 1982).

From 16 000 BP temperatures rose sharply worldwide and the ice sheets retreated. This trend continued, with brief relapses, to achieve a post-glacial optimum 10 000-6000 BP. During at least part of this period conditions were warmer and substantially wetter than at present. These effects resulted in the general diminishment and retreat of arid biomes to the advantage of forest and moist woodland. Particularly dramatic were the effects in the western Sahara where large areas of what is now full desert, for example, around Arouane in Mali and the Tenéré in Niger, held extensive areas of standing water. Lake Chad, at its maximum during this period, was five times the size of the present Lake Victoria, and the Sudd area of southern Sudan was similarly enlarged. Given this background it is perhaps not surprising that there are strong similarities in the composition of the freshwater fish faunas of all the major bodies of water in the region from the Senegal River to the Nile. A corresponding northward advance of mesic and hygric vegetation into areas now desert took place (Moreau, 1966; Beadle, 1974). Despite these striking ameliorations in climate and vegetation, the Sahara seems nonetheless to have remained an effective barrier to *Orthochtha* and allies, none (now) being found north of it.

Provisional vegetation maps illustrating these changes and corresponding to idealized glacial and interglacial maxima are given in Figure 1 and are simplified from Van Zinderen Bakker (1976) and Hamilton (1982). Hamilton (1982) points out that the proportion of time during at least the last million years of these glacial/interglacial fluctuations, occupied by full interglacials is small, approximately one tenth of the total. Thus, vegetation conditions will have been closer to the glacial rather than the interglacial for most of the time. Sinclair (1983) points out that each expansion and contraction of the forest biome would result in an alternate increase and relaxation of the selection pressures operating upon the inhabitants of savanna ecosystems, caused by the change in size of their habitat. This cyclical fluctuation would enable new forms to radiate within freshly available habitat which in turn could then be fragmented one from another upon the subsequent reduction of that habitat, whence isolation for greater or lesser periods could result in further divergence. Sinclair further concludes that, viewing savanna as a transitional stage in a continuum between forest and desert, intermediate conditions would have occurred twice as often but for shorter periods of time in any one place as either forest or desert. Thus savanna conditions would have prevailed both during the expansion and contraction phases of desert and forest.

In using the foregoing to attempt to interpret the current distribution patterns of orthochthan grasshoppers and allies we have to assume that their ecological requirements have not changed significantly over the course of the last glaciation. We do not know to what extent such an assumption is valid. Our feelings are that the group as a whole is probably relatively young. Some of the taxa, *Orthochtha dasycnemis sensu lato* in particular, are in a state of active evolution. Moreau (1966) felt that the events of the last 70 000 years (since the start of the last glacial) were sufficient to explain much of the contemporary geographical distribution of the African avifauna. We feel it is impossible at this stage to say to what extent the same is true of *Orthochtha* and allies but it is worth bearing in mind Moreau's (1966) comment that "a species need only be some 20 000 years old to have witnessed the full range of the continent's ecological vicissitudes."

ENVIRONMENTAL INFLUENCE ON THE EVOLUTION AND DISTRIBUTION OF *ORTHOCHTHA* AND ITS ALLIES

It is clear from Figure 1 that at the last glacial maximum suitable habitat available to *Orthochtha* and allies was much more restricted than at present. As shown above, they exhibit two main types of habitat preference, edaphic grasslands and secondary, chiefly savanna grasslands (Table 1). During the last pleniglacial the latter habitat would have been much reduced and probably confined to relatively narrow bands concentric with, and surrounding, forest refugia. The distribution of highland within sub-Saharan Africa is of fundamental importance in determining the location of these refugia (Figure 2), since the overall aridification of the continent at this time would have caused an altitudinal retreat, where possible, to the wetter biomes. Thus, in West Africa much of the

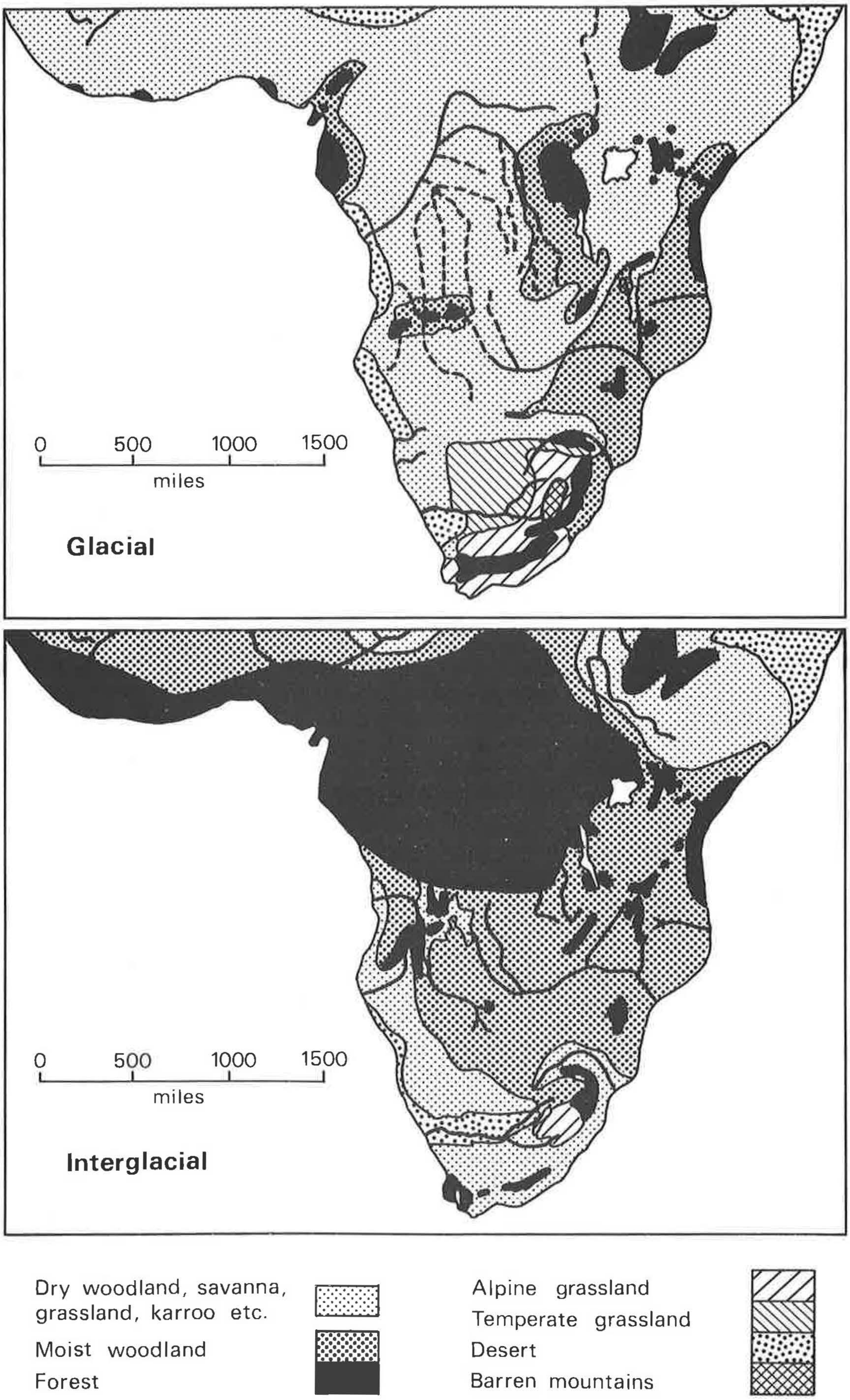


Figure 1 Provisional vegetation maps of sub-Saharan Africa during a glacial and an interglacial maximum (simplified from Van Zinderen Bakker (1976) and Hamilton (1982))

forest would have been eliminated, whilst it could persist in the highlands of Cameroon, Zaire, East Africa etc. The reduced rainfall of the period would have caused considerable reduction in river flow and lake levels but unless desiccation was total it is possible, if perhaps unlikely, that marginal riparian grasslands could have prospered in some areas on expanded river margins, partially exposed lake beds, etc. What is certain, however, is that an overall diminution and fragmentation of suitable habitats took place at this time. The selection pressure resulting from such, probably long lasting, fragmentation may well have been the causal factor in the divergence of these two more or less ecologically distinct groups, as well as the subsequent radiation within each.

Comparison of the distribution maps (Figures 3-7) with that of the relief of Africa (Figure 2) reveals that lowland West and Central Africa contains relatively few orthocthan species, most of which are widely distributed, whereas the highland parts of the continent (above 1000 m), that is, the east and south, contain many more species, few of which are widely distributed. Thus, ignoring *Nimbacris, Pamacris, Xenocymochtha* and *Shabacris,* West and Central Africa contains 12 species and subspecies (including the dubious *O. grossa*) of which six occur over large areas, whilst southern and eastern Africa supports 30 species and subspecies of which only a few have areas of distribution comparable in extent to those of West and Central Africa. Furthermore, only four species and

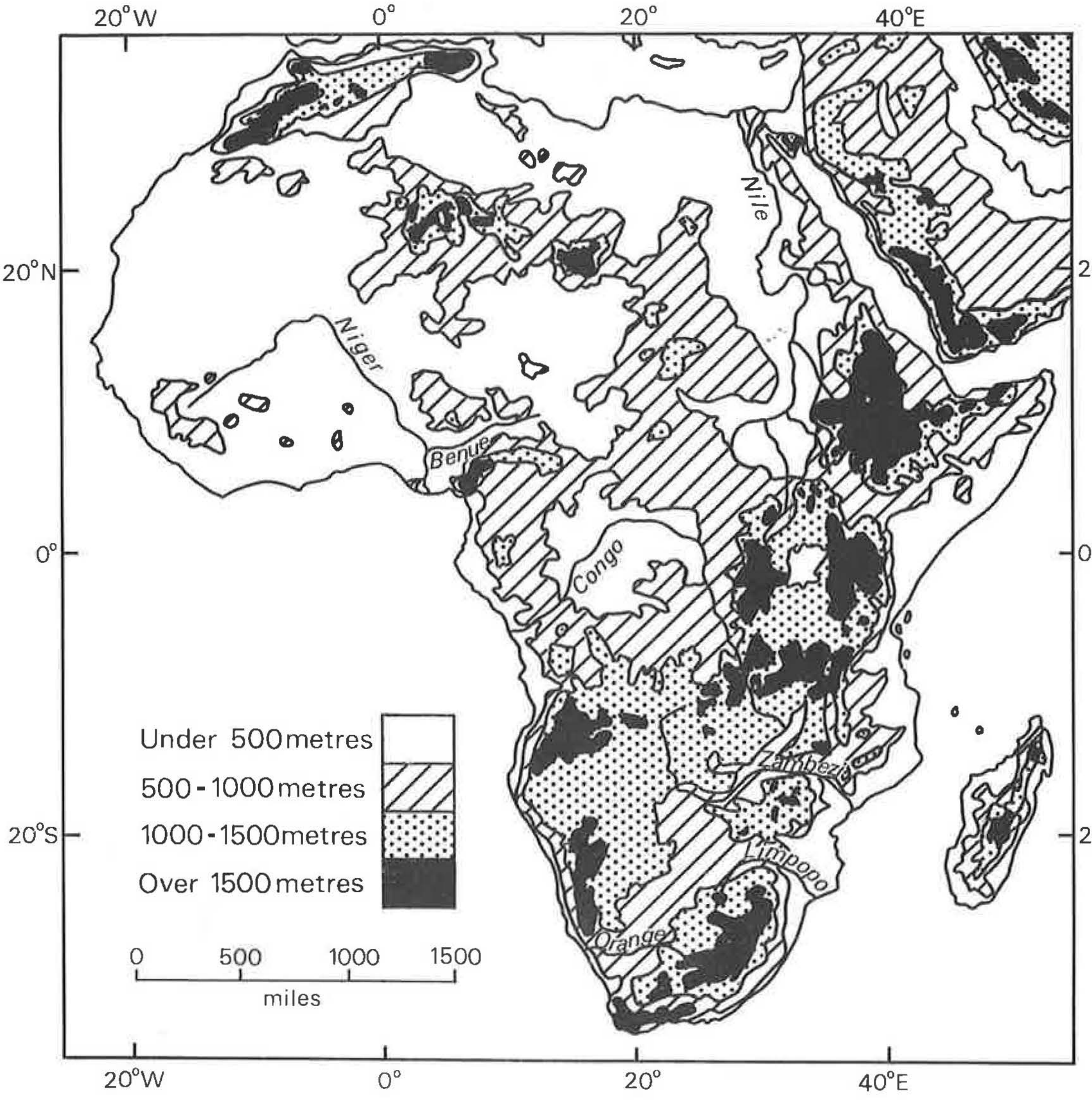


Figure 2 Distribution of highland within Africa (modified from Moreau (1966))

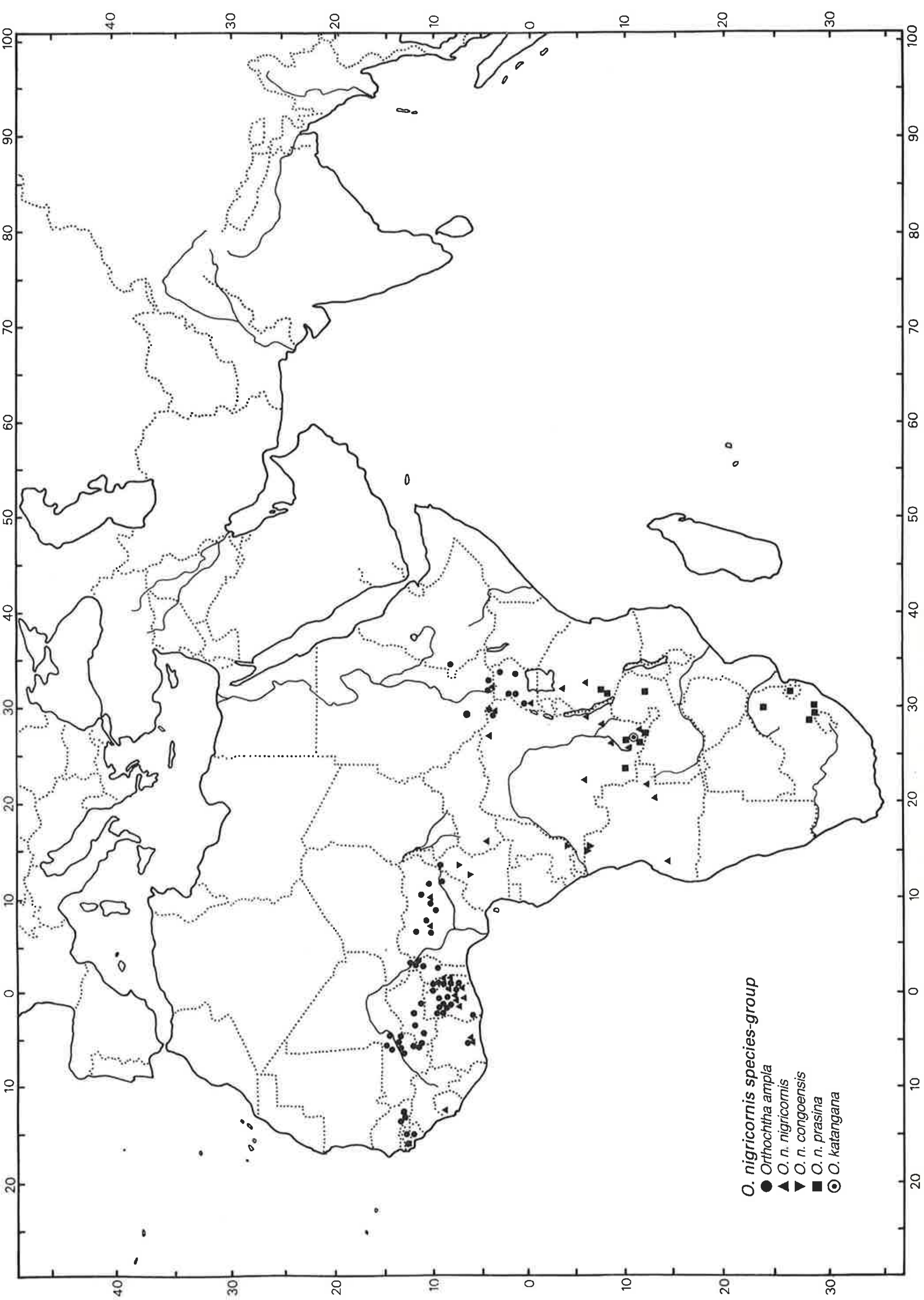


Figure 3 Distribution of the *Orthochtha nigricornis* species-group

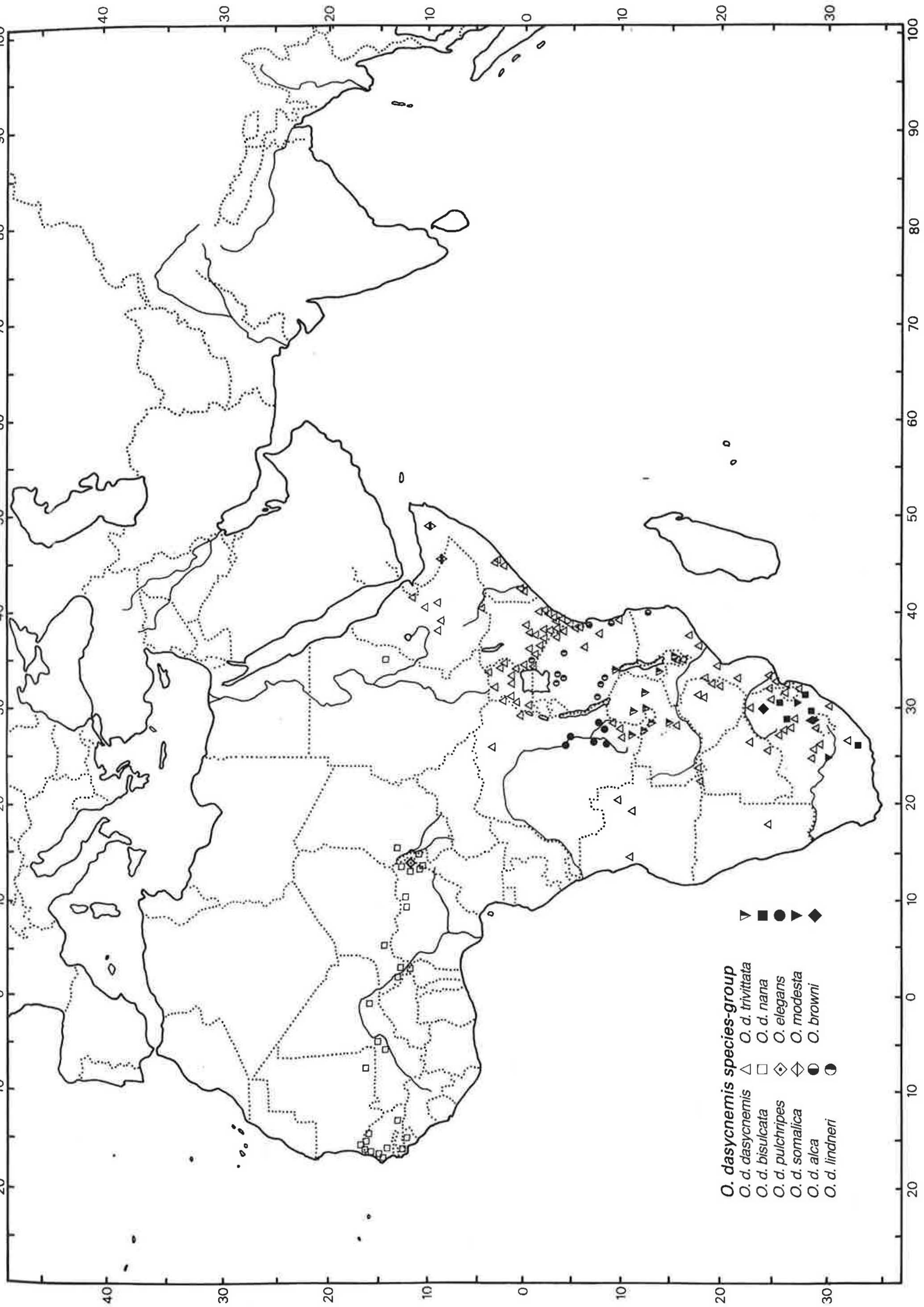


Figure 4 Distribution of the *Orthochtha dasycnemis* species-group

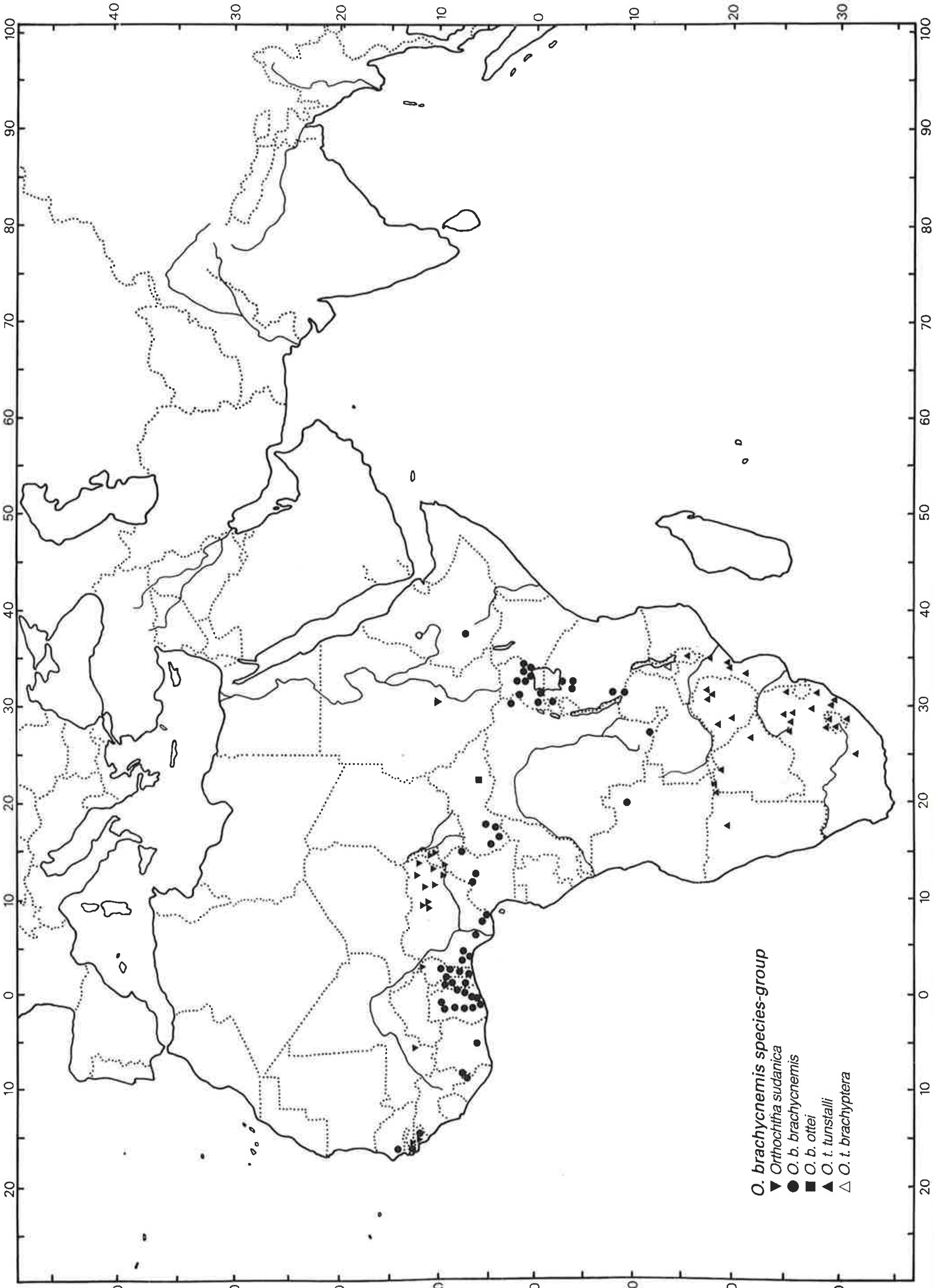
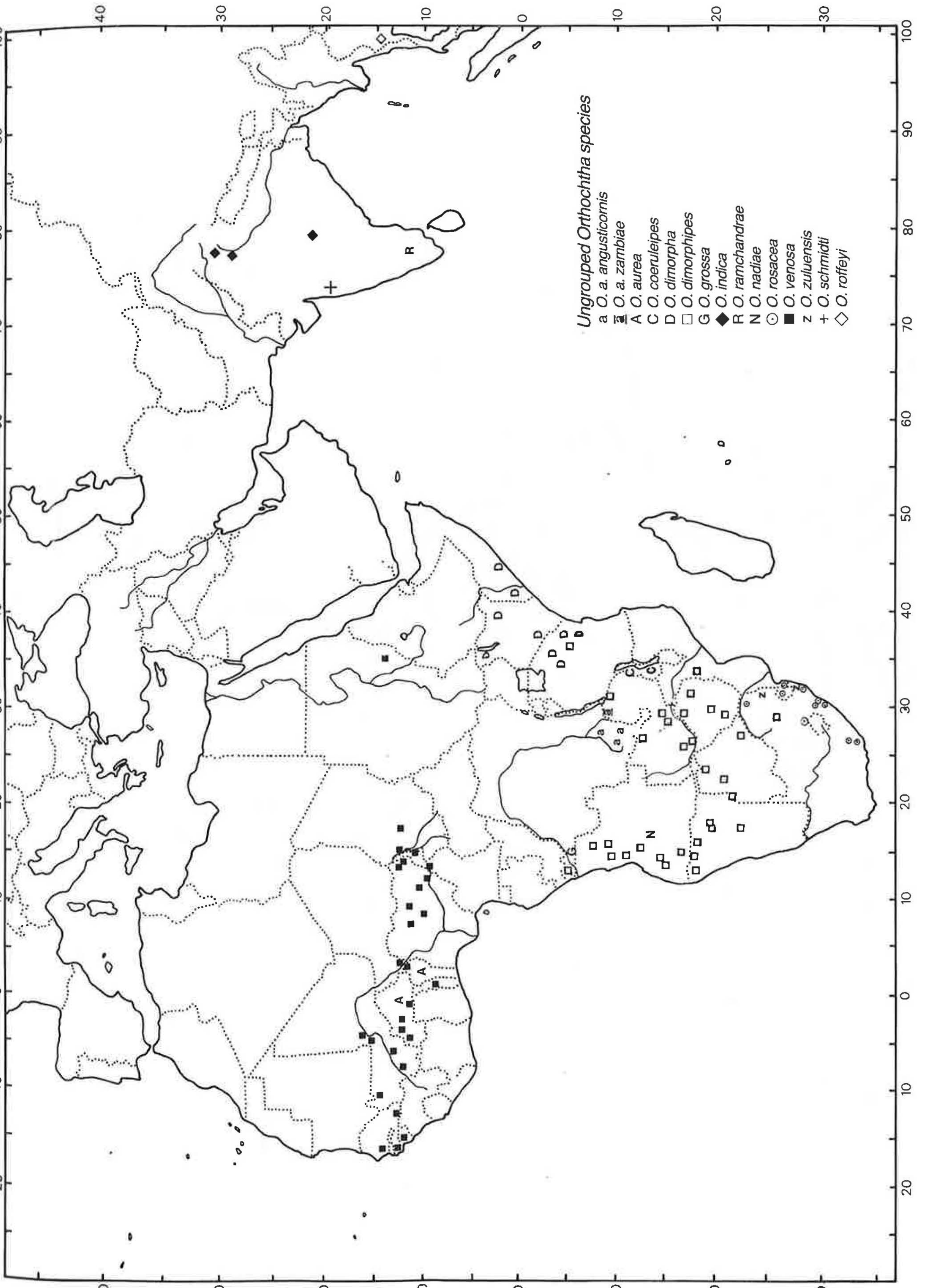


Figure 5 Distribution of the *Orthochtha brachycnemis* species-group



igure 6 Distribution of the ungrouped *Orthochtha* species

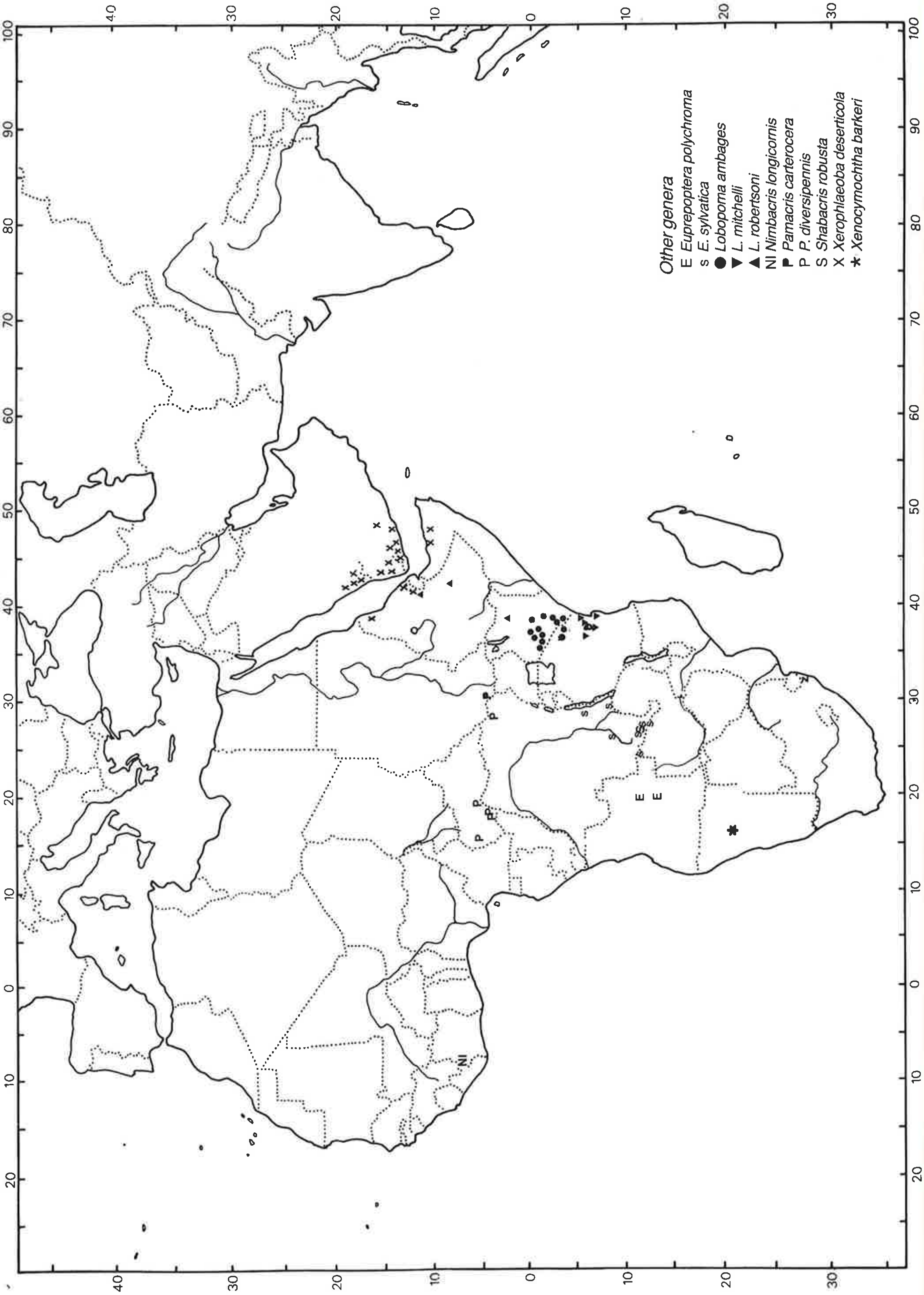


Figure 7 Distribution of genera other than *Orthochtha*

subspecies are common to both and the degree of inter-penetration is relatively small. Thus *O. d. dasycnemis* occurs in parts of lowland Zaire but otherwise is found only in the east and south of the continent. *Orthochtha ampla, O. n. nigricornis* and *O. brachycnemis*, all species predominantly of the lowlands of West and Central Africa (although the latter also occurs in parts of the Guinea and Cameroon highlands), are all found to varying but limited extents above the 1000 m contour in Uganda and parts of western Tanzania. With these few exceptions, and the occurrence of some taxa at low altitude in the 'highland' part of Africa (for example, *O. d. dasycnemis* and *Lobopoma ambages*), overall it is true that the lowland/highland divide has been of considerable significance in orthochthan evolution.

The richer fauna of the highland parts of the continent is probably due to the fragmentation of suitable highland habitats during glacial conditions, the resultant isolation leading to speciation and subspeciation. The restricted or relatively restricted areas of distribution of many of these species and subspecies is consistent with this (Figures 3-7). It is thought that perhaps these forms became specialized, to varying degrees, to their particular upland habitats such that in many cases, when conditions ameliorated, relatively few of them were able to exploit the resurgence of previously suitable habitat at lower altitude. The relative homogeneity of the physiography of West and Central Africa with its much restricted highland, has meant that speciation and subspeciation have been comparatively restricted.

Examination of the distribution maps indicates that within highland Africa there are four areas, all rising over 1500 m, in or near which numerous endemic species and subspecies are found. These are listed in Table 2. Comparison of these areas with the vegetation at the glacial maximum (Figure 1) shows that they all fall within the postulated forest and woodland remnants and suggests that suitable parts of these areas would indeed have remained available to orthochthan forms at this time. The expansion of alpine grassland in South Africa over this period is probably also significant here.

Table 2 Areas of speciation in highland Africa with their endemic and near-endemic taxa

(1) Southeast Zaire and Central Zambia	*O. katangana* *O. elegans* *O. a. angusticornis* *O. a. zambiae* *Euprepoptera sylvatica* *(O. dasycnemis trivittata)* also: *Shabacris robusta*
(2) Central Angola	*O. nadiae* *Euprepoptera polychroma*
(3) East Africa	*Lobopoma ambages* *L. mitchelli* *(L. robertsoni)* *(O. dimorpha)*
(4) Southern Africa (Drakensberg + Maluti Mountains)	*O. rosacea* *O. zuluensis* *O. browni* *O. modesta* *O. dasycnemis nana*

Species in brackets are also recorded away from the specified area.

As is clear from Table 1 insufficient is known of the ecology of many species, particularly those with restricted distributions, to be able to assign them with any certainty to either of the two main types of grassland habitat identified. However, while some may eventually prove to be associated with the highland edaphic grasslands of dambo type, as is thought possible for *O. tunstalli, O. coeruleipes* and *O. angusticornis*, it is improbable that many will be found to be affiliated with flood plain grasslands, such as commonly occur in 'lowland' Africa, if only because of the relative scarcity of such habitats south of the equator. It should be borne in mind however, that we have seen virtually no material from localities such as the Okavango. So far, from the 'highland' half of Africa only the versatile *O. d. dasycnemis, O. d. alca*, probably *O. dimorpha* and possibly *O. tunstalli*, seem to have been found in such an environment.

The more common species in western and central Africa exhibit one of two types of distribution pattern. Three species extend, virtually completely sympatrically, across the continent from Senegal to eastern Sudan within quite closely defined latitudinal limits, mainly in the Sudan savanna zone. These species, *O. dasycnemis bisulcata, O. sudanica* and *O. venosa*, are virtually confined to riverine and lakeside grassland on hydromorphic soils in otherwise semi-arid areas (average annual rainfall 300-600 mm/year) at latitudes which experience a protracted dry season. Another feature shared by these three species is that they are all, on the basis of light trap records, at least weakly vagile (Davey *et al.*, 1959; Fishpool and Popov, 1984). This capacity is shared, so far as we know, only by *O. ampla* which is partially sympatric with these species, and by *O. dasycnemis somalica*. This ability is probably an adaptation to the transitory and marginal nature of the habitats in which they occur, and is a feature of many grasshoppers of the region (Fishpool and Popov, 1984). It may partly help to explain their wide distributions. This contrasts with the situation in eastern and southern Africa where the apparent lack of vagility may to some extent account for the restricted distributions of many species and indicates different selection pressures.

The expansion of fluvial and lacustrine habitat in the region during the post-glacial optimum of *c.*6000 BP probably resulted in a large contemporary expansion in the area of distribution of these species. It is notable, however, how apparently well defined is the southern limit of their respective distributions at present. The presence of *O. venosa* in central Togo is not a contradiction since this is the area of the 'Dahomey Gap' where particular local climatic phenomena cause the savanna to extend much further south than it does to the east and west. If this circumscription of their distributions is due, for example, to specialization upon grass species adapted to a particular regime of inundation, then it is possible that the wetter conditions of the post-glacial optimum merely shifted their respective distributions northwards without enlarging them.

Whatever the cause of this restriction, it is unlikely to be due to direct competition with any of the other three widely distributed species of the region, *O. ampla, O. n. nigricornis* and *O. brachycnemis*, since these more southerly species are largely confined to derived grasslands. These share the second type of distribution pattern. *Orthochtha ampla* occurs predominantly in Guinea savanna, while the other two are associated with grassland within the moist woodland belt that surrounds the lower and upper Guinea forest blocks and mirror its distribution closely within lowland Africa. They are probably extending their ranges into grasslands that become established in the forest zone as it is cleared.

The fate of these species at the height of the glacial period probably differed from that of the three species of riverine habitat. The latter were probably confined to such marshy habitats as remained in river beds and lakes, possibly well south of where they now occur, whilst the derived grassland species are likely to have been isolated in moist woodland remnants encircling the small forest refugia of the area (Figure 1). The option of retreat into highland, such as occurred in southern and eastern Africa, would have been much less available to these species, although it may have happened in the montane refugia of Guinea, Cameroon and northeast Zaire.

The effectiveness of the lowland/highland barrier is well seen in the distributions of *O. ampla, O. n. nigricornis* and *O. brachycnemis*. These species do penetrate weakly above the 1000 m contour in Uganda and western Tanzania but generally their distributions skirt the edges of the highland block closely. *Orthochtha ampla* does not extend around Lake Victoria beyond the points where the 1500 m contour reaches the lake basin in the northeast and southwest. *Orthochtha brachycnemis* and *O. n. nigricornis* both occur further south but neither penetrates far into the highlands of the Zaire-Zambesi interfluve, where they seem to be replaced by closely related (? highland) taxa, *O. tunstalli* and *O. nigricornis prasina* respectively. The restriction of *O. brachycnemis* and *O. n. nigricornis* to western Tanzania might be due to the more arid conditions prevailing in the central plateau of the country. The occurrence of *O. n. nigricornis* in the central Angolan highlands appears exceptional.

The obstacles imposed by the considerable physiographic features of the eastern rift valley of Ethiopia-Kenya-North Tanzania, with their attendant climatic modifications and marked vegetational disjunctions, appear to have been an almost complete barrier in orthochthan evolution; only one form, *O. d. dasycnemis* occurs widely on both sides of it and another, *Lobopoma ambages*, is found in the associated highlands on either side and within parts of the rift itself. As two other *dasycnemis* subspecies are capable of at least a limited amount of sustained flight activity, it is thought probable that *O. d. dasycnemis* may also be vagile: if so, it would explain this exceptional distribution pattern. *Orthochtha dimorpha*, although not closely related to any of the three West African taxa associated with riverine grasslands appears, from what little is known of its ecology, to fill a similar niche in lowland areas of eastern Africa. The independent appearance of a species of seemingly similar ecology in East Africa may be ascribed to the effectiveness of the intervening highland as an isolating mechanism.

In the above discussion four areas of high endemicity in southern and eastern areas of Africa were identified (Table 2) and in West Africa two basic types of distribution pattern were described. Some 25 of 38 taxa, about two-thirds, conform largely or entirely to these patterns. If one considers the distribution patterns of grass species within Africa, a number of marked correspondences with those of *Orthochtha* and allies are seen. Clayton and Cope (1981), in a study of the chorology of the Gramineae, showed that in sub-Saharan Africa a number of grass phytochoria (floristic regions or species pools) could be identified. Fundamental to a phytochorion is the shared distribution patterns of endemic species within it. Endemicity is a relative term, however, and phytochoria of differing scale and floristic coherence may be identified.

Within sub-Saharan Africa Clayton and Cope (1981) identify four regional phytochoria based upon grass species' distributions, of which two, the Karoo-Namib and the Cape are of little importance to *Orthochtha* and allies. The remaining two, the Guineo-Congolan and the Sudano-Zambezian regions, between them embrace virtually the whole area of distribution of *Orthochtha*. The Guineo-Congolan region covers the humid lowlands of West and Central Africa, that is, the Upper and Lower Guinea forest blocks and immediate surrounds, while the Sudano-Zambezian region forms an arc around it to the northeast and south. Whilst there is considerable overlap between the two, the grass floras of these regions are thus fundamentally distinct at the species level. The Sudano-Zambezian region is divided into a Sudanian sub-region and an Afro-Oriental sub-region, which according to Clayton and Cope (1981) reflects the lowland-highland climatic divide. Their Sudanian sub-region agrees almost exactly with the distribution patterns of *O. dasycnemis bisulcata, O. sudanica* and *O. venosa*. Three domains are identified within the Afro-Oriental sub-region which Clayton and Cope term the Ethiopian (with its centre upon the Kenya highlands), the Zambezian (centred upon the Zaire-Zambezi interfluve) and the Transvaal (centred around the High Veld). There is thus a striking similarity between these areas of high grass species endemicity and three of the four areas of high orthochthoid endemicity (Table 2). Conformity of the distribution patterns of the remaining *Orthochtha* group (*O. brachycnemis, O. ampla* and *O. n. nigricornis*) with the Guinea-Congolan regional phytochorion is comparatively poor, as here the highest levels of grass endemicity are found in western Zaire, Republic of the Congo, Cameroon and in the Democratic Republic of Guinea, whereas these *Orthochtha* species are found more along the northern and eastern peripheries of the region. This is almost certainly due to high levels of endemicity in specialized, forest-adapted grasses, unavailable to orthochthan grasshoppers.

It is not suggested that there is necessarily a causal relationship between endemism and speciation in grass floras and diversity and chorology of *Orthochtha* and allies, but given *Orthochtha*'s intimate association with such habitats, it remains a possibility. It is at least likely they have both been subjected to similar vicissitudes, giving rise to speciation.

LIFE CYCLES AND SURVIVAL STRATEGIES

The distinction between the species of edaphic, largely riparian grasslands and those of the more mesic secondary grasslands, implies greater ecological differences than are at first apparent. Firstly, at least in West Africa, the species inhabiting edaphic grassland are univoltine and occur in otherwise relatively arid areas which experience a monomodal rainfall regime. They all pass the extended dry season in a state of egg quiescence. The same seems to be at least partly true of *O. tunstalli* in southern Africa which is definitely univoltine (see p. 72). It would be interesting to know more of *O. dimorpha* which ecologically probably belongs to this group. There is insufficient material from which to infer voltinism; its occurrence at equatorial latitudes experiencing a bimodal rainfall regime (Le Houérou and Popov, 1981), may give rise to two generations annually. The generally more equatorially distributed species of secondary grasslands are often bivoltine in both the wetter mono- and bimodal rainfall regime areas, for example, *O. brachycnemis, O. nigricornis, O. ampla* in the more southerly parts of their West African range, and *O. d. dasycnemis* in parts of its range. Also they pass the relatively shorter dry season(s) as adults in a state of arrested sexual development, recommencing reproduction at the onset of the rains. These species are long winged and therefore relatively mobile. The short-winged species from this habitat type, for example, *O. aurea,* are probably univoltine with an egg quiescence, similar to the edaphic grassland species. Indeed the apparent rarity of *O. aurea* is probably at least partially attributable to the (presumed) short duration of the adult stadium. Label data from the brachypterous *Lobopoma ambages* and *L. mitchelli* are ambiguous (pp. 120-122) but suggest they may be bivoltine: if so this probably derives from the strong bimodality of the rainfall regime of the areas of eastern Africa in which they are found.

The difference in dry season survival strategy between the faunas of the two main habitat types is attributable to the almost complete disappearance of the edaphic grassland habitat during the long, intense dry season at the latitudes concerned. This precludes the possibility of adult survival over that period, whereas the more equatorial secondary grasslands experience shorter dry seasons so that sufficient food material can always be found. The ability to fly is of considerable advantage to the denizens of such habitat because of the ubiquity and regularity of bush fires (originally probably natural, now largely anthropogenic but in either case resulting in considerable selection pressure (Gillon 1972, 1983)). Hence it is probably not coincidental that relatively immobile short-winged species of susceptible habitats avoid the phenomenon by modifying their life cycle so that the adult stage is completed before the onset of bush fires at the start of the dry season. This contrasts with edaphic grassland species where shortage of food material is probably the causal factor since bush fires in their habitats are less frequent. To what extent this is applicable to *Orthochtha* and allies more generally will have to await field observations.

The foregoing discussions are based upon the assumption that the species' distributions as shown in Figures 3-7 are reasonably accurate and generally provide a fair reflection of what occurs in the wild. Obviously, for many species this will only be partially true. In some cases interpolations may reasonably be made. It is assumed that the apparent disjunction of West African species between Lake Chad and eastern Sudan, or Uganda, depending upon the species, is apparent rather than real and merely reflects a paucity of collecting in eastern

Chad, the Central African Republic and western and southern Sudan. On the other hand no such inferences can be safely drawn as to what may occur in much of Cameroon and Gabon. This is a poorly known area which would repay investigation. We assume that the absence of orthochthan material from much of the lower Zaire basin is, or was, more real than apparent since lowland rain forest is unsuitable habitat for *Orthochtha* and allies. However, it is quite probable that further species await discovery, particularly in various highland parts of Africa where they have escaped collection through restricted distribution.

Section 2

Taxonomic treatment

Several keys are provided. The main key (1) aims to identify the genera and the more distinctive species-groups of *Orthochtha*. The genera, species-groups and ungrouped species have, as appropriate, separate keys, to which reference is made in the main key. As much use as possible is made of simple, more obvious characters; for fuller definition reference should be made to the descriptions and Appendix 1, the list of characters used in the numerical analysis.

KEY 1 GENERA AND SPECIES-GROUPS

1 Mesosternal interspace heart-shaped, sutures deeply etched black (Figure 43); last abdominal sternite in female with rows of transverse ridges (Figure 45) 2

– Not as above 3

2 Fastigial and facial planes of vertex of head forming a sharply defined angle (Figure 43) .... *Pamacris* Ramme (Key 8, p. 127)

– Vertex of head rounded (Figure 43) .... *Nimbacris* **gen.n.** (Key 8, p. 127)

3 Vertex of head produced, frons concave in profile (Figure 46); arolia small, less than half length of claw (Figure 46); integument smooth, matt *Xerophlaeoba* Uvarov

– Not as above 4

4 Of heavier, subcylindrical build, head 'bullet-shaped' (Figure 42); lateral pronotal carinae low and indistinct, presence of a median dorsal longitudinal black fascia .... *Shabacris* **gen.n.**

– Of more slender build, head elongate, acute, pronotal carinae sharper, no median dorsal black band 5

5 Fully winged, apex of remigium with expanded quadrate cells (Figure 36), hind wing brightly coloured .... *Euprepoptera* Uvarov

– Wings of variable length, coloured or not, venation normal 6

6 Sexual dimorphism pronounced; antennae basally strongly dilated; frontal ridge very narrow apically (Figure 39); micropterous or macropterous, wings brightly coloured .... *Lobopoma* Karsch (Key 7, p. 115)

– Sexual dimorphism less marked; antennae less dilate; frontal ridge broader; mostly macropterous, wings rarely coloured 7

7 Pronotum interrupted by posterior sulcus only; sculpturing on metazona a series of narrow ridges; male cerci short, broad at base, apically pointed (Figure 48) .... *Xenocymochtha* **gen.n.**

– Pronotum interrupted by posterior, second and sometimes third transverse sulci; sculpturing pitted, not ridged; male cerci not as above 8

8 Lateral dark fascia broad, at least a third width of pronotum at leading edge (Figure 8); lower hind angle of lateral pronotal lobe rounded; male cerci very small; conical epiphalli and receptaculum seminis as in Figures 10 and 11 .... *O. nigricornis* species-group (Key 2, p. 27)

– Not with above combination of characters 9

9 Male cerci slender, elongate and pointed (Figure 13); epiphallic lobes elongate and narrow (Figure 17); spermathecal duct very long, thin and repeatedly coiled in a flat spiral, like a watch-spring (Figure 16) ... *O. dasycnemis* species-group (Key 3, p. 40)

– Not with the above combination of characters 10

10 Male cerci broad and flat; epiphallic lophi broad and shallow (Figure 20) .... *O. brachycnemis* species-group (Key 4, p. 66)

– Not with the above combination of characters .... Ungrouped species of *Orthochtha* – African taxa – Key 5, p. 80; Asian taxa – Key 6, p. 101

Section 3

Orthochtha Karsch

Orthochtha Karsch 1891: 177. Type species *Chrysochraon dasycnemis* Gerstäcker 1869 by original designation (Karsch 1891: 177, in a footnote).

Orthochtha Karsch 1893: 53, 62. Full generic description.

Cymochtha Karsch 1893: 54, 68. Type species *Cymochtha nigricornis* Karsch 1893, by original designation. (Synonymized by Uvarov 1953: 146.)

Macrocymochtha Sjöstedt 1931a: 22. Type species *Macrocymochtha speciosa* Sjöstedt, 1931a, by original designation. (Synonymized by Kevan 1956: 31.)

Rasperecta Sjöstedt 1931a: 20. Type species *Rasperecta ampla* Sjöstedt, 1931a, by original designation. (Synonymized by Dirsh 1958: 60.)

Medium size (total length 22-45 mm male, 30-62 mm female). Integument shiny to matt, finely pitted on parts of the thorax. Antennae narrowly to moderately ensiform with basal segments of flagellum more or less expanded, their length slightly less, to much greater than, combined length of head and pronotum in both sexes. Head acute; frons strongly oblique in profile, weakly projecting apically, straight, or weakly convex; frontal ridge narrow, sulcate, lateral carinulae raised, undulate or straight, divergent and obsolescent towards clypeus, narrowly constricted towards fastigium of vertex, joining it in a rounded angle. Fastigium of vertex trapezoidal to parabolic, longer than wide in most males, as long as wide in most females, its surface more or less concave, with raised margins, a weak to obsolescent median longitudinal carinula and a transverse arcuate sulcus, whose position varies between species. Fastigial foveolae absent. Compound eyes elongate, more or less narrowed apically, their long axis oblique. Pronotum weakly tectiform to weakly sellate; dorsum elongate, narrow with well-developed, but low carinae; lateral carinae straight, weakly incurved, or divergent, usually more so in metazona; dorsum crossed by three transverse sulci, only posterior sulcus always well-defined and interrupting median carina; median and particularly anterior sulci sometimes weak; metazona subequal, to distinctly shorter than, prozona; hind margin rounded to obtuse-angular; lateral pronotal lobes weakly convex or flat, their lower margin roughly parallel to upper, or weakly ascending forward; lower anterior angle obtuse, posterior one acute, straight, or obtuse, sharp or rounded. Mesosternal interspace elongate, usually much narrower than, rarely subequal to, width of lobe in both sexes; metasternal interspace narrow, especially in males, in which it is often closed. Tegmina and wings fully developed or shortened, sometimes strongly so; membrane of tegmen transparent, reticulation sparse, intercalary vein of medial area weak, sometimes absent; reticulation of remigium normal, medial area not expanded. Hind femora slender, elongate, extending beyond tip of abdomen; upper genicular lobes weakly produced or not, the lower rounded, or more rarely subacute, the inner more so than outer. Tarsi unspecialized, arolia large. Male supra-anal plate shield-shaped, elongate, bearing a more or less pronounced longitudinal median groove, flanked by lateral swellings; cerci shorter than, to nearly as long as, subgenital plate (e.g. in *dimorpha*) their shape varying from narrowly cylindrical and acutely pointed, to flattened and rounded apically; subgenital plate simple, subconical, its apex acute, or more rarely truncate, or bilobate (as occasionally in *venosa*). Genitalia typical of *Phlaeoba* genus group, epiphallus with moderately thick to rather slender bridge, elongate, rounded, articulated ancorae, well-differentiated lobiform lophi which vary in depth and width between species, and short to moderately elongate posterior projections; apical valves of penis paired, elongate, slender, to moderately robust. Ovipositor short, with robust valves; posterior margin of female subgenital plate generally trilobate with pointed median lobe, but occasionally (in *venosa*) quadrilobate. Spermathecal duct with proximal loop characteristic of majority of Acridinae (Slifer, 1939), otherwise its structure varies between species: in majority elongate, slender, folded centrally and coiled as a watch-spring, with fold in central position within spiral, the latter located in a horizontal plane within abdominal cavity; in some species seminal duct proportionately shorter and thicker and number of coils fewer; in several species proximal part of duct greatly expanded (into a supplementary seminal vesicle?), with distal part forming a thin capillary tube connecting to spermatheca; spermatheca varies in size, less so in shape, having a sack-like caecum and a more or less developed rounded spermathecal appendage.

Ground coloration typical of majority of Phlaeobae and graminicolous Acridinae generally, varying through shades of green, stramineous or brownish, to a more contrasting pattern of greens and browns; most species (with a few exceptions, e.g. *O. rosacea*), with a lateral fascia on each side, extending from antennal pits to post-ocular area, then along upper part of lateral pronotal lobes, to costal area of the tegmina, where it narrows down, or fades apically; hind wing colourless in most species, more or less infumate in some and tinted in a few (*O. rosacea*); dark fascia absent; hind femur without distinct fasciation, but upper part of externo-median area sometimes of a different hue; hind knee brown to dark-black, when pigment may invade adjacent part of femur and tibia; hind tibia bright-pink, to dirty-pinkish, but in some species greyish, bluish, or testaceous; in one species (*O. dimorphipes*), colour differs between sexes.

AFRICAN TAXA

The *Orthochtha nigricornis* (Karsch) species-group

Diagnosis of the group

Head relatively short and inflated; antennae long and narrow, reaching hind margin of pronotum in female and base of femur in male; width of basal segments of flagellum not more than twice that of segments 8–12. Pronotum tectiform to sellate, lateral carinae low and thick, parallel, or strongly divergent in metazona; ratio of prozona to metazona 1.1-1.3; lower hind angle of lateral pronotal lobes broadly rounded. Inner and outer lower knee lobes rounded. Male cerci small, simple, acute. Epiphallus bridge thick; lophi broad, inflated, of varying depth; apical valves of aedeagus thick. Spermathecal duct of peculiar structure (Figure 11), highly characteristic of group; spermatheca small. Lateral dark fasciae broad and distinctive in all species, particularly in males; hind wing hyaline, or somewhat infumate, with dark veinlets, or sometimes with pinkish tinge.

Key 2 *Orthochtha nigricornis* species-group

1 Size small, M total length under 21 mm, F under 30 mm; apex of head acutely pointed (Figure 8F), frontal ridge narrow, deeply sulcate (Figure 9J); no green coloration .... *O. katangana* **sp. n.**

– Larger, M total length over 21 mm, F over 30 mm; vertex of head more rounded, frontal ridge broader and less sulcate (Figure 9G,H,I); some green coloration ... 2

2 Lateral pronotal carinae strongly divergent in metazona (Figure 9A); tip of male abdomen red; epiphallic lophi deep (Figure 10P); internal genitalia in F as in Figure 11A .... *O. ampla* (Sjöstedt)

– Lateral pronotal carinae parallel, or only slightly divergent in metazona; tip of male abdomen not red; lophi as in Figure 10Q,R,S and internal genitalia of F as in Figure 11B,C,D .... *O. nigricornis* subspp. (Karsch) 3

3 Head as in Figure 8B, not inflated; dorsum of pronotum very narrow, lateral carinae parallel (Figure 9C,D); hind wings infumate; western Africa to Congo basin .... *O. nigricornis nigricornis* (Karsch) **stat.n.**

– Head slightly inflated; dorsum of pronotum wider, lateral carinae weakly divergent in metazona 4

4 More slender; mesosternal interspace distinctly narrower than lobe (Figure 9L); hind wing pinkish; Cameroon, Congo Brazzaville, principally in highlands .... *O. n. congoensis* Sjöstedt **stat.n.**

– More robust; mesosternal interspace almost width of lobe; hind wings not pinkish; Shaba (Zaire), Ufipa (Tanzania), Swaziland and South Africa .... *O. n. prasina* (I.Bol.) **stat. n.**

N.B. Intermediate clinal forms are usual in subspecies of *O. nigricornis.*

Discussion

This is a very distinctive species-group; the genitalic structures in both sexes are so peculiar that it probably deserves recognition as an independent genus. However, in view of the occurrence of other distinctive groups within *Orthochtha* and their superficial resemblance to one another, the present arrangement appears to be more realistic. Also it upsets least the current nomenclatural usage, although this usage has had a particularly chaotic past. Thus the most common member of this species-group, *ampla*, was misidentified as *bisulcata* Krauss, at an early date. The first unequivocal occasion of this is by Uvarov (1926: 422), who lists it among the collection of grasshoppers from northern Nigeria as "obviously one of the commonest species", represented by "a very long series". Uvarov's reference to the red abdomen of the male (the only known species of *Orthochtha* so coloured) leaves no doubt as to its identity as *ampla*, which is further confirmed by the specimens in NHM from the original collection, bearing Uvarov's name labels. Thereafter the misidentification became perpetuated, appearing in such works as Dirsh (1956: 280; 1966b: 396; 1970: 438), Davey *et al.* (1959: 567), Chapman (1962: 48; 1964: 121), Descamps (1965: 1259); Jago (1968: 320), Lecoq (1979: 567) and other publications.

Sjöstedt (1931a: 20) erected the genus *Rasperecta* and designated as its type species his newly described species *ampla*, and also placed in it *bisulcata* Krauss. Examination of all this material established it as conspecific with *bisulcata sensu* Uvarov 1926, not *sensu* Krauss 1877, the only difference between *ampla* and '*bisulcata*' being one of size. Thus this synonymy provided a name for the hitherto misnamed taxon which was designated as *Orthochtha ampla* (Sjöstedt) by Fishpool and Popov (1984: 385). (See also p. 3.)

Two of the five taxa in the group, *nigricornis* Karsch and *congoensis* Sjöstedt were synonymized by Dirsh (1970: 438) under a third – '*bisulcata* Krauss' (= *ampla* Sjöstedt), while the fourth, *prasina* I.Bolivar, was synonymized two pages earlier in the same opus, under *dasycnemis* Gerstäcker. All three synonymized names are here reinstated: *nigricornis* as a distinct species with *congoensis* and *prasina* as its subspecies. While *nigricornis* and *congoensis* are closely similar, *prasina* is quite distinct from *dasycnemis;* the two species in fact belong to separate species-groups (Key 1). However, *prasina* has been indiscriminately applied on museum specimen labels to at least six *Orthochtha* species. For instance, the studies by Davey (1959), Davey *et al.* (1959) and Descamps (1965) of the Malian grasshopper fauna all cite *O. prasina*, which does not occur there; these records are likely to be misidentifications of the true *O. bisulcata* Krauss, or perhaps of *Orthochtha sudanica* Popov & Fishpool (p. 74).

Another point regarding *O. prasina* that needs elucidation is that raised by Walker's syntypes of *Opomala basalis.* In the NHM collection there are four that bear identical round green type labels and square Kirby labels with the legend '*Opomala basalis* one of Walker series so named', the name (in italics) handwritten, presumably by Kirby. Two of the syntypes are discussed by Uvarov

(1925: 273) and designated by him as synonyms of *Chrysochraon dasycnemis* (=*Orthochtha dasycnemis*) Gerstäcker 1869, a synonymy confirmed here (p. 44) and discussed on pp. 41-42; the third specimen is a *Duronia* and thus a misidentification but the fourth bearing a small, round, white locality label 'S. Africa' is an *Orthochtha prasina*. Having established that *dasycnemis* and *prasina* are distinct taxa, *basalis* cannot be a synonym of both; thus, since it has already been designated as a synonym of *dasycnemis* by Uvarov in 1925 and accepted as such since then, the obvious course is to regard the specimen of *prasina* as an original misidentification by Walker, inasmuch as his description of *basalis* provides no means whatever for differentiating between the four syntypes, and thus no grounds for questioning Uvarov's designation of the lectotype (Uvarov's 'single type').

The fifth taxon in the group is *O. katangana*, a distinctive new species described here, although originally collected in 1952.

Orthochtha nigricornis (Karsch 1893)

(Figures 8-11, distribution – Figure 3)
Cymochtha nigricornis Karsch 1893: 69, f. 7.
Orthochtha nigricornis (Karsch). Synonymized by Uvarov 1953:146.

This species is here divided into three subspecies; synonymies for each are listed separately.

Diagnosis

Size medium to small (Table 3). Head more or less acute according to subspecies; frontal ridge moderately wide (Figure 9H,I); fastigium of vertex concave, more so in male; arcuate sulcus in mid position in male, somewhat further forward in female (Figure 8I-L); dorsum of pronotum narrow to very narrow with parallel to weakly divergent lateral carinae according to subspecies; male and female genitalia as in Figures 10 and 11.

General coloration grass-green, rarely brownish; lateral fascia broad and deep black, somewhat weaker and paler in *O. prasina*; hind wing infumate, with or without pinkish tinge basally, according to subspecies; hind tibiae pink to dirty-pink. Tip of male abdomen without red coloration.

Affinities

Orthochtha nigricornis together with *O. ampla* and *O. katangana*, form the very distinctive *nigricornis* species-group, characterized particularly by the structure of the male and female genitalia (Figures 10 and 11). Yet all show marked differences at the species level, as comparison of Figures 10 and 11 readily shows. There are further differences in size and general build; with *katangana* being distinctly smaller and more slender; in the structure of pronotum, which is sellate and widened posteriorly in *ampla*, narrow and parallel-sided in *nigricornis* (but somewhat widening posteriorly in two of its subspecies) (Figure 9A,B,C,D); and in coloration (Key 2).

It is noteworthy that where mixed populations of *nigricornis* and *ampla* occur, for example, in the Lamto area of the Côte d'Ivoire, there is a marked tendency for them to show enhanced mutual resemblance. This phenomenon is also seen between sympatric *O. dasycnemis trivittata* and *Euprepoptera sylvatica* **sp.n.** (p. 114).

Distribution and geographical variation (Figure 3)

The nominate subspecies of *O. nigricornis* occurs in the lowland savannas of the Guinea zone and the grasslands of the forest zone of western Africa, extending eastwards to the Congo basin, where it overlaps and in places forms clines with *O. nigricornis congoensis*. The latter subspecies, characterized by its smaller size, more inflated head and pinkish hind wings, occurs in its typical form in the

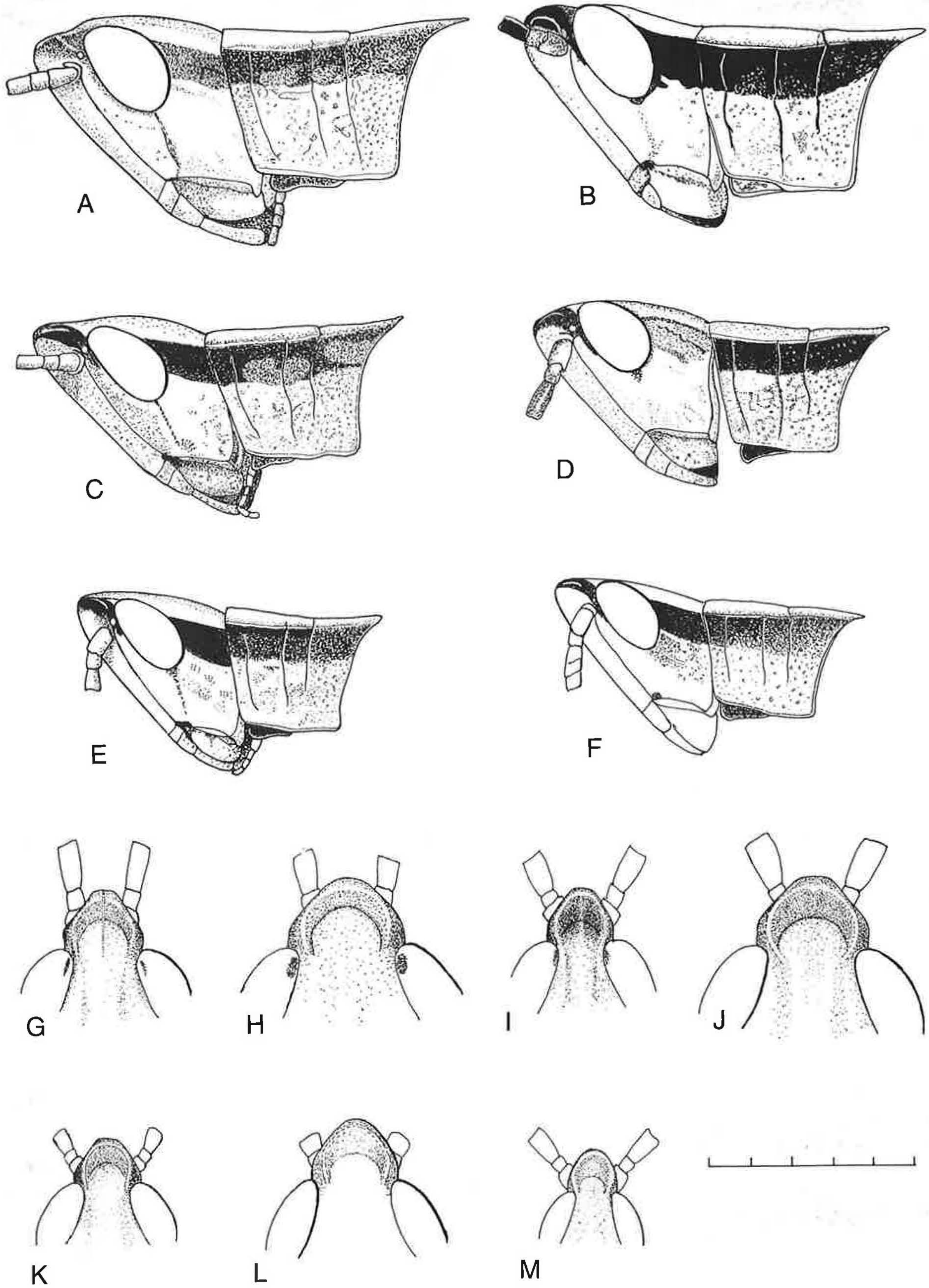


Figure 8 *Orthochtha nigricornis* species-group. A-G, I, K, M male, H, J, L female. A-F lateral view of head and pronotum, A *ampla*, B *nigicornis nigricornis*, C *n. congoensis*, Congo (holotype), D *n. congoensis*, Cameroon, E *n. prasina* (holotype), F *katangana* **sp. n.**; G-L dorsal view of fastigium verticis, G, H *ampla*, I, J *n. nigricornis*, K, L *n. prasina*; M *katangana* **sp. n.** Scale in mm. Drawings of *O. n. nigricornis* and *O. ampla* modified from Popov and Fishpool in Mestre (1988).

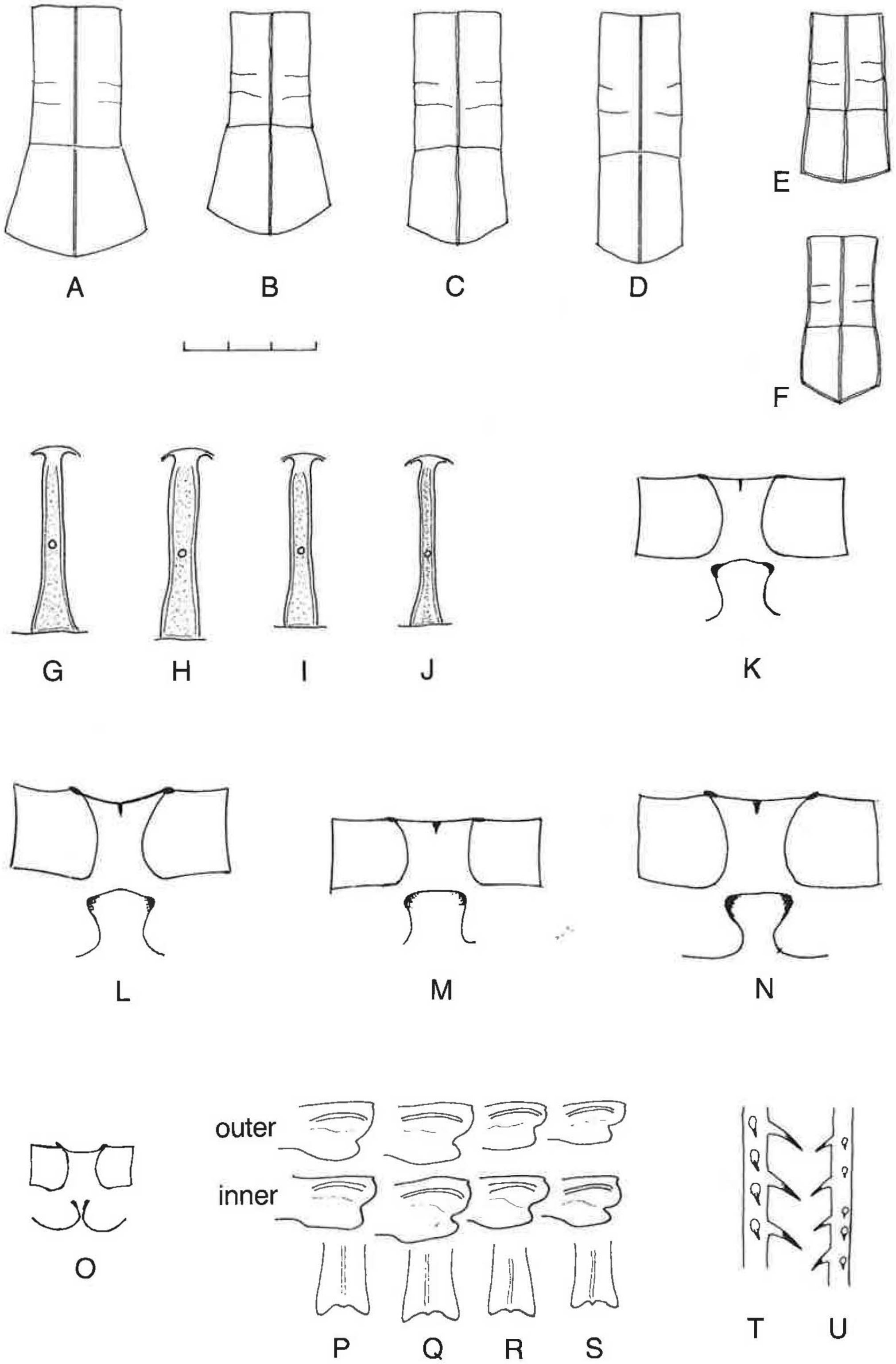


Figure 9 *Orthochtha nigricornis* species-group. A-J, O-U male, K-N female. A-F dorsal view of dorsum of pronotum of A *ampla*, Mali, B *ampla*, Zaire, C *nigricornis nigricornis*, Zaire, D *n. nigricornis*, Togo, E *n. prasina*, F *katangana* **sp. n.**; G-J frontal ridge of G *ampla*, H *n. nigricornis*, I *n. prasina*, J *katangana* **sp. n.**; K-O mesosternal interspace of K *n. nigricornis* (allotype), L *n. congoensis* (allotype), M *n. prasina*, N *ampla*, O *katangana* (male holotype); P-S lateral outer (top), lateral inner and dorsal views of hind knee of P *ampla*, Q *n. nigricornis*, R *n. prasina*, S *katangana* **sp. n.**; T, U spines of hind tibia of T *ampla*, U *n. nigricornis*. Scale in mm. Drawings of *O. n. nigricornis* and *O. ampla* modified from Popov and Fishpool in Mestre (1988).

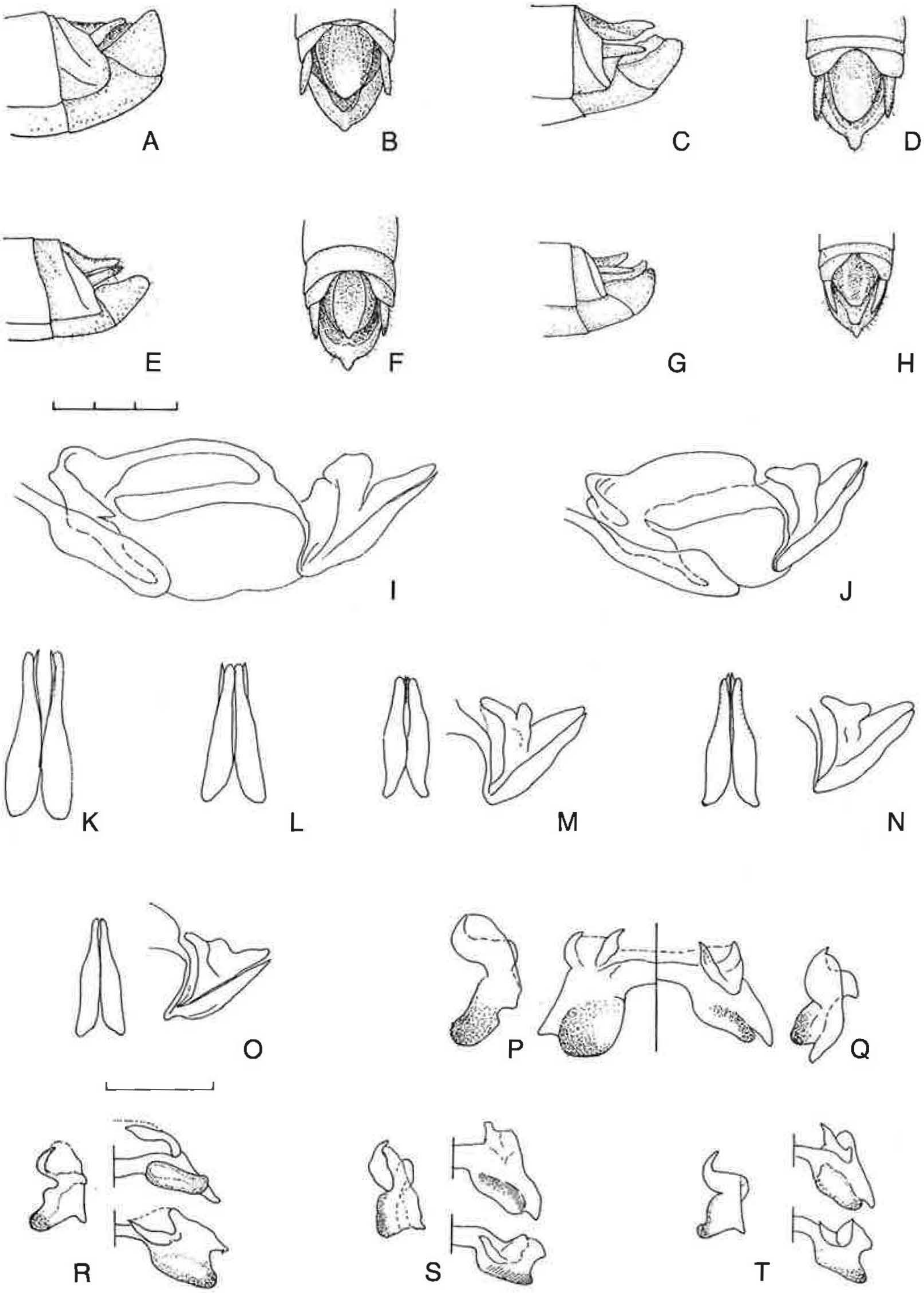


Figure 10 *Orthochtha nigricornis* species-group. Male genitalic structures. A lateral and B dorsal view of tip of abdomen of *ampla*, C, D *idem nigricornis nigricornis*, E,F *idem n. prasina*; G, H *idem katangana* **sp.n.**; I, J lateral view of phallic complex with apodemes removed, I *ampla*, J *n. nigricornis*; K, L ventral view of aedeagal valves, K *ampla*, L *n. nigricornis*; M-O ventral (left) and lateral (right) views of aedeagal valves, M *n. prasina*, N *n. congoensis*, O *katangana* **sp.n.**; P-T lateral, dorso-posterior (top) and dorsal views of epiphallus (right or left half only), P *ampla*, Q *n. nigricornis*, R *n. prasina*, S *n. congoensis*, T *katangana* **sp.n.** For explanation of I-T see Figure 15. Scales in mm, A-H upper, I-T lower scale. Drawings of *O. n. nigricornis* and *O. ampla* modified from Popov and Fishpool in Mestre (1988).

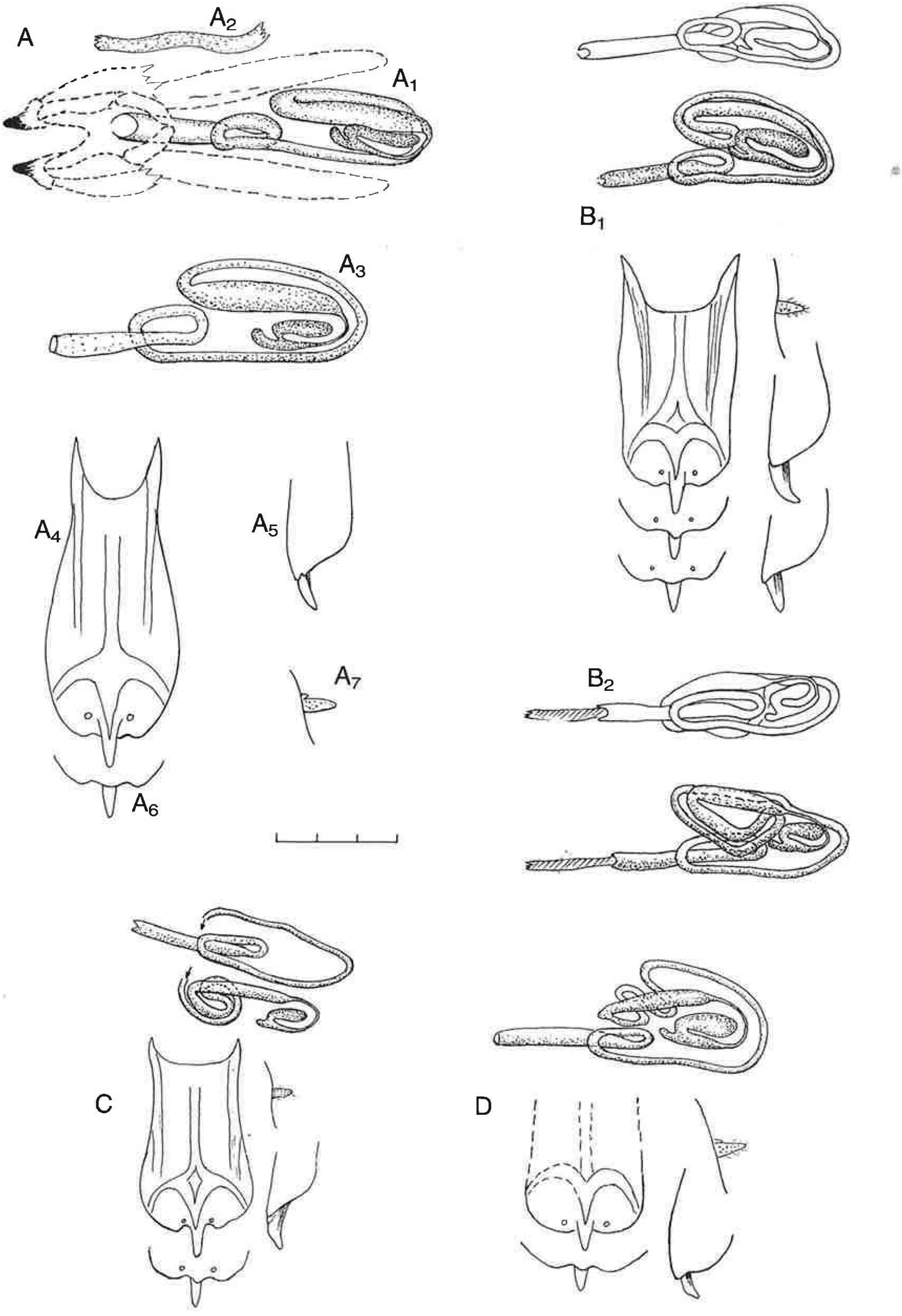


Figure 11 *Orthochtha nigricornis* species-group. Female genitalic structures. A *ampla* (Ghana); A_1, ventral aspect of receptaculum seminis in position; A_2 remains of spermatophore extracted from duct; A_3 expanded aspect of receptaculum seminis; A_4 dorsal view of subgenital plate; A_5 lateral view of apex of same; A_6 ventral view of apex of same; A_7 cercus.

B analagous structures of *n. nigricornis*, showing range of variation, (B_1 Angola, B_2 Central African Republic), C *idem n. prasina* (Natal), D *idem katangana* **sp.n.** For explanation see Figure 15. Scale in mm.

Table 3 Measurements of the *nigricornis* species-group (mm)

		Pronotum								
		Length		Width			Hind femur			
Taxon	Total length	total	prozona	prozona	metazona	Tegmen length	length	width	Antenna length	Head and pronotum
n. nigricornis	M 23.0-28.0	3.8-5.2	2.2-2.8	1.4-1.7	1.5-1.7	17.3-21.0	13.8-16.6	2.0-2.5	11.7-14.5	7.7- 9.5
	F 34.0-41.5	5.7-7.7	3.1-4.1	2.1-2.5	2.3-2.7	24.5-41.0	18.5-21.0	2.6-3.0	11.0-13.0	11.6-13.0
n. congoensis	M 23.0-25.0	4.0-4.6	2.2-2.5	1.4-1.7	1.5-1.8	19.0-20.0	16.0-16.5	2.0-2.4	11.0-13.5	7.5- 9.0
	F 35.0-42.0	6.2-7.8	3.2-4.0	2.3-2.8	2.8-3.2	26.0-28.3	22.0-23.3	2.7-3.0	10.8-12.8	11.2-13.5
n. prasina	M 17.0-23.0	3.6-3.9	1.9-2.2	1.6-1.8	1.7-1.9	14.0-17.6	12.0-14.0	1.8-2.1	8.0- 9.5	6.8- 8.0
	F 29.5-36.0	5.4-6.8	2.8-3.2	2.6-2.7	2.6-2.9	22.0-26.0	16.8-20.0	2.7-3.1	9.0-10.0	10.0-11.0
ampla	M 25.0-36.0	4.1-6.0	2.2-3.2	1.5-2.2	2.2-3.3	17.5-26.0	14.0-18.5	2.3-2.9	12.0-18.2	7.5-11.2
	F 37.0-55.0	6.5-9.0	3.5-4.7	2.5-3.5	3.4-4.5	31.3-38.8	20.0-26.7	2.8-3.9	14.0-17.5	12.7-16.0
katangana	M 17.5-20.0	3.6-3.8	1.8-2.0	1.3-1.4	1.7-1.8	14.5-15.5	11.5-12.3	1.9-2.0	9.5-10.0	7.0- 7.3
	F 25.5	*c.* 7.0	*c.* 3.0	*c.* 2.2	*c.* 2.8	*c.* 25.0	*c.* 17.5	?	*c.* 10.5	*c.* 9.5

uplands of Cameroon and in Congo Brazzaville. *Orthochtha nigricornis prasina* is found further south, from the Shaba province of Zaire and the adjacent parts of Zambia and the Ufipa plateau of Tanzania, southwards to parts of Natal, Transvaal and Orange Free State of South Africa, but generally avoiding the drier Miombo belt and the Kalahari sands of Angola, South Zaire and Zambia (Rattray, 1960; White, 1983). There are clinal changes, with some fairly rapid transitions; thus there is little change in the shape of the dorsum of pronotum, which remains narrow and parallel-sided throughout western Africa eastwards to the lowlands of the Congo Basin, including the Kahama area of Tanzania and the Upemba area of Zaire. Then east from Upemba, there is a fairly rapid transition towards the broad pronotal dorsum typical of *O. n. prasina* found in specimens from Lubumbashi and Lokafu; further east towards Mpika, and south to South Africa, it is associated with a decrease in size.

Over much of its range *O. nigricornis* is sympatric with the superficially similar *O. ampla* (recorded by most authors as *O. bisulcata*) and is probably sometimes confused with it (Jago, 1968).

There are no members of the *nigricornis* species-group known east of the Rift valley (Figure 3); a female specimen labelled 'Uebi Scebeli', Somalia (MIZS), diagnosed by Giglio Tos (1907) as *Cymochtha nigricornis* Karsch (and cited by Johnston (1956) and Dirsh (1965)) is in fact a *Duronia chloronota* Stål (Baccetti, 1985: 321).

Biology

Orthochtha nigricornis is a strict graminicole and generally inhabits secondary savannas and pre-forest grasslands (Jago, 1968; Dirsh, 1964; Gillon, 1974; Hummelin and Gillon, 1968; Popov and Fishpool, personal observations) but has not been recorded from wetter edaphic riverine grassland and marshes. Its general distribution matches fairly closely that of *Hyparrhenia* grassland (Rattray, 1960). The species thus has to cope with seasonal bush fires. It is generally more hygrotypic than *O. ampla* and where the two occur together, it tends to be less numerous (Jago, 1968), but not in the Lamto area of Côte d'Ivoire, where the reverse is true (Gillon, 1974). In Côte d'Ivoire, where *O. nigricornis* is bivoltine, the first nymphs appear at the end of the dry season with a peak in February-March and the second peak at the height of the rains, during June-August (Gillon, 1974). The duration of nymphal development during the rains is generally slower than at the end of the dry season. Nymphs and/or adults have been recorded in every month of the year. Jago's records for Ghana (1968) appear to be in general agreement with the above, although Jago considered that there could be a dry season diapause of at least some adults or eggs – his conclusion being based on assumed analogy with '*bisulcata*'. There are no direct records from other parts of the range, but the label dates on adult specimens from Zaire show a gap during July to October, suggesting a similar bivoltinism, or possibly a single rains generation.

The species has no economic importance.

Orthochtha nigricornis nigricornis (Karsh 1893) **stat.n.**

(Figures 8-11, distribution – Figure 3)

Cymochtha nigricornis Karsch 1893: 69, Figure 7. Lectotype female, TOGO [examined].
Cymochtha nigricornis (Karsch); Uvarov 1953: 147.
Orthochtha bisulcata (Krauss 1877); Dirsh, 1970: 438. (Incorrect synonymy.)
Orthochtha nigricornis (Karsch); Popov and Fishpool, 1988: 302.

Measurements

As in Table 3.

Material examined

Cymochtha nigricornis Karsch. Lectotype F, **Togo**: Bismarckburg, 1-15.iii. 1891, Uebergang zur Regenzeit (*R. Büttner S*); paralectotype M, 1.xi-15.xii.1890, same locality (in alcohol), (both MNHU), (here designated). Other material: **Sierra Leone**: I M,I F, Rokupr, v.1960 (*Phipps*) (NHM). **Togo**: 1 M, Pasa River (09°11′ N 01°22′ E), v.1980 (*Cheke*) (NRI); 1 M, Misahohe, xi.1894 (*Baumann*) (SMNS). **Ghana**: 1 M, 2 F, Ahamansu Hills, (07°44′ N 00°33′ W), xii.1961; 4 F, Amedzofe, (06°51′ N 00°26′ E), v.1960; 2 M, 2 F, Keti Krache, (07°46′ N 00°03′ E), v.1959 (*Jago*) (NHM); 1 M, Amedzofe, x.1963; 1 M, 11 km S. Keti Krachi, 1 M, Chiare Kilinga, v.1960 (*Jago*) (NRI); 2 M, 1 F, Ejwa Ashanti, v.1958 (*Chapman*) (NHM). **Nigeria**: 1 M, 100 km Kaduna-Tegina Road, xi.1970, (*Popov, Jago and Hollis*) (NRI). **Sudan**: 2 M, 1 F, Mongalla, Kafala Village, (05°12′ N 31°46′ E), v.1932 (*Johnston*) (NHM). **Uganda**: 1 M, W. Nile Dist., ix.1934 (*Buxton*) (NHM). **Tanzania**, 1 M, 2 F, Ushirambo Road, 25 km W. Kahama, ii.1953 (*Burtt*); 2 M, 24 km S. Tabora, xi.1937 (*Potts*) (NHM). **Zaire**: 3 F, Parc. Nat. Upemba, Munoi bifurc. Lupiala, 890 m, v-vi.1948 (*de Witte*) (IRSNB; 1 F NHM); 1 M, 2 F, Kalulu (06°38′ S 26°12′ E) v.1939 (*Bredo*) (MRAC; 1 F NHM); 1 F, Albertville (05°56′ S 29°12′ E), i.1919 (*Mayne*) (MRAC); 1 F, Luluabourg (05°54′ S 22°25′ E) i.1939 (*Dehayn*) (MRAC); 1 F Kolwezi (10°43′ S 25°28′ E) (*Exp. Fr. Scarabée, Isy-Schwart*) (MNHN); 4 F Elisabethville-Lubumbashi, xii.1928 (*Seydel*) (MRAC; 2 NHM); 1 F, Katanga Kiambi, v.1931 (07°20′ S 28°01′ E) (*de Witte*) (MRAC); 1 M, Nr Lubumbashi, 1300 m, v.1971 (*Bouvy*). **Central African Republic**: 1 M, Goungourou, 20 km N Nola; 2 M, 6 F, Berberati (04°19′ N 15°51′ E), xi.1934, (*Vanderbilt Exp. Rehn*) (ANS). **Angola**: Moxico, 1 M R. Loweje, v.1927; 1 M N. of Luena, v.1927 (*Burr*); 2 M, 15 km NE Cacula, ii.1972 (*BMNH S. Afr. Exp.*) (NHM).

Orthochtha nigricornis congoensis (Sjöstedt 1931) **stat. n. et nom. rev.**

(Figures 8-11, distribution – Figure 3)

Cymochtha congoensis Sjöstedt 1931b: 12. Lectotype male, CONGO BRAZZAVILLE (NR), here designated [examined].
Orthochtha congoensis (Sjöstedt); Uvarov, 1953: 147. (Synonymized by Dirsh (1970): 438 under *O. bisulcata* (Krauss).)

Measurements

As in Table 3.

Material examined

Cymochtha congoensis Sjöstedt. Lectotype M and paralectotype type F (labelled as 'TYPUS' and 'ALLOTYPUS', but cited as M F cotypes in the original description), here designated. **Congo Brazzaville**: (*Stenström*) (NR). **Cameroon**: 3 M, Ngaoundéré; 1 F Nr. Tibati, xi.1980 (*Popov and Jago*) (NRI). **Angola**: 13 M, 15 F Palavange (Pela 06°33′ S 15°00′ E and Vange 06°09′ S 14°48′ E), 2.xi.1930 (*Green, 2nd Pentis Gray Afr. Exp.*) (ANS; 4 M 4 F NHM).

Orthochtha nigricornis prasina (I. Bolivar 1912) **stat. n. et nom. rev.**

(Figures 8-11, distribution – Figure 3)

Cymochtha prasina I. Bolivar 1912: 77. Holotype male, ZAMBIA (MRAC) [examined].
Orthochtha prasina (I. Bolivar); Uvarov 1953: 149. Synonymized by Dirsh 1970: 436 under *Orthochtha dasycnemis* (Gerstäcker) and here reinstated as a subspecies of *O. nigricornis* (Karsch).

Measurements

As in Table 3.

Material examined

Cymochtha prasina I. Bolivar, 1912. Holotype M and paratype F. **Zambia**: Mpika, i.1908 (*Neave*) (MRAC). **Tanzania**: Ufipa, 3 M, Nsangu 2100 m, iii.1959 (*Vesey-Fitzgerald*); 1 M, Sumbawanga, Mbisi F. Reserve, v.1966 (*Jago*) (NHM). **Zaire**: 1 F, Kapiri (10°18′ S 26°10′ E), xi.1915 (*Charliers*); 1 M R. Kazenze-Lualaba, 1948 (*Lefebvre*) (MRAC); 1 M, Maka-Lualaba, i.1939 Lukafu, xii.1938 (*Bredo*) (NHM). **Swaziland**: 1F 12 km S. Mbabane, iv.1972 (*Brown*) (DATS). **South Africa**: Transvaal, The Downs, 40 km S. Tzaneen, iv.1963 (*Furst, Brown, White*) (1 M, 2 F NHM; 1 M DATS); Orange Free State, 1 M, 10 km E. Clarens (28°31′ S 28°25′ E), ii.1962 (*Furst*); Natal, 2 F, Little Berg, Cathedral Peak (28°57′ S 29°12′ E), xi.1963 (*Brown*); 1 M , Nelshoogte P. 48 km W. Barberton (25°48′ S 31°03′ E), iv.1963 (*Furst*) (DATS); Natal: 1 F, Nkandla Forest, Nr. Nkandla 28°43′ S 31°08′ E, 9.iv.1948; 7 M, 3 F, Giant's Castle Game Reserve, grassland, 15.iv.1986 (*Otte, Glenn*) (ANS; 2 M, 1 F, NHM); 1 M, 1 F, ditto, iii.1932 (*Mackie*) (NHM).

Orthochtha ampla (Sjöstedt 1931)

(Figures 8-11, distribution – Figure 3)

Orthochtha bisulcata Uvarov 1926: 422 (*nec Phlaeoba bisulcata* Krauss 1877: 24) (original misidentification of the taxon, which then found common usage, p. 28).
Rasperecta ampla Sjöstedt 1931a: 20. Holotype female, BURKINA FASO (NR) [examined].
Orthochtha ampla (Sjöstedt). (Generic synonymy by Dirsh (1958): 60.)
Orthochtha ampla (Sjöstedt); Popov and Fishpool (1988): 301, redescription.

Diagnosis

Size range as in Table 3. Head relatively short and inflated with face convex in profile and occiput rounded (Figure 8A); frontal ridge moderately wide, fastigium of vertex shallowly concave, fastigial arcuate sulcus ahead of mid position in both sexes, more so in female; median carinula weak; pronotum weakly sellate, lateral pronotal carinae parallel in metazona, strongly divergent in metazona (Figure 9A,B). Male and female genitalia as in Figures 10 and 11.

General coloration grass-green, sometimes somewhat brownish dorsally; antennae brown, distinctly paler than in *nigricornis* in both sexes; lateral fascia broad, blackish-brown, generally paler than in *nigricornis*; medial field of tegmina occasionally speckled – a feature more usually observed in early rains (v-vi) specimens; tip of male abdomen with reddish wash, which intensifies with maturation; hind knee dark, more so in male; hind wing more or less infumate, colour deepening with age.

Affinities

The nearest relative of *O. ampla* is *O. nigricornis* (p. 29). The superficial resemblance, due to the similarity of coloration, particularly in specimens from the same habitat (p. 29), is sometimes so great that the two are readily confused. For instance there are specimens of both species in the NHM collected by Chapman during the same period in Ghana, yet he mentions only *O. bisulcata* (i.e. *ampla*) (Chapman, 1962). This resemblance is, however, purely superficial; the structure of the pronotum alone is sufficient to distinguish the two species, the lateral pronotal carinae in the metazona being at all times more divergent in *ampla* than in *nigricornis* (Figure 9A-D).

Distribution (Figure 3)

Orthochtha ampla occurs in a belt extending west-east from Senegal to southern Sudan and western Ethiopia, whence there is a southward extension into Uganda and the extreme north-eastern corner of Zaire, but apparently no further. There is thus an overlap in the range of distribution of *ampla* and *nigricornis*, with *ampla* extending into somewhat drier grasslands to the north. The record of *O. bisulcata* (Krauss) from Buran, Somalia (Uvarov, 1930: 177) is not that of *O. ampla* (Sjöstedt), but of a subspecies of *O. dasycnemis* (Gerstäcker) (p. 60).

Biology

Fishpool and Popov (1984) found *O. ampla* to be widely distributed, but generally uncommon, in the savannas of Mali, Niger, Benin and Togo. It was associated with tall, open mesophilous grasslands characterized by *Andropogon* spp. and was strictly graminivorous. Their data indicated there was one annual generation in the northern part of the range they studied and continuous breeding in the south. Between the latitudes 11° to 12°N, adults were recorded from May to January, while nymphs were present from July to October. In the pre-forest savanna of Lamto (6°N) in Côte d'Ivoire, Gillon (1974), found *O. ampla* (cited as *O. bisulcata*) to be ten times less common than *O. nigricornis*. He recorded adults during two distinct periods, April-May and November-December; from this, and by analogy with *nigricornis* and *brachycnemis*, Gillon concluded that *O. ampla* was bivoltine. In Ghana, Chapman (1962) and Jago (1968) considered that dry season survival by *ampla* (cited as *bisulcata*) was probably in the egg stage and Jago (1968) suggested two annual generations were likely, at the beginning and end of the rains. The pooled label data from the available material show the presence of adults in every month except February with two distinct peaks: April-June and October-December, with a marked trough in July-August. This indicates bivoltinism is likely, at least in northern Ghana where most of the material originated. The *O. nigricornis* material similarly suggests bivoltinism.

There are few records of *O. ampla* at light and none of *O. nigricornis*, which argues very weak vagility.

The economic importance of *O. ampla* is negligible.

Measurements

As in Table 3. There is sometimes a marked size variation in specimens from the same locality, which appears to be largely seasonal; the smaller specimens having been collected principally at the beginning of the rains (v-vi) and the larger ones towards the end (ix-xii). It is possible that this difference, coupled with the associated colour variations, could be the origin of the distinction between '*bisulcata*' and *ampla*, although Lecoq (1979) separates them on the basis of the median fastigial carinula of the vertex, said to be absent in *bisulcata* and more or less distinct in *ampla*. In fact the median carinula is very faint in all the material examined. Some of the variation could also be geographical; in particular the specimens from Ethiopia are smaller and proportionately more robust. However, in the absence of adequate material collected throughout the year, seasonal effects remain unknown.

Material examined

Rasperecta ampla Sjöstedt. Holotype F, BURKINA FASO: Pundu (*Olsufiew*) (NR); also M specimen, same locality and data, diagnosed by Sjöstedt (1931a:21) as '*Rasperecta bisulcata* Krauss' (NR).

Senegal: Basse Casamance, Forêt Classée de Tabor (12°42′ N 16°14′ W); Niokolo Koba; Siné Saloum, xi. (IFAN). **Guinea Bissau**: Farim, xii. (NRI). **Mali**: Klela, Sikasso; Ban Markala, x, vi. (MNHN); Bamako, xii, xi. (at light); Dioura; Medina, xi, xi. (NHM). **Benin**: Parakou (09°21′ N 02°37′ E); Malanville

(11°52′ N 03°23′ E), vi, viii, ix, x, xii, i. (NRI). **Ghana**: Nr Larabanga, Mole Game Res., x. (NHMA); Adibo; Morro; Bole; Tuna; Chiranda (Ashanti); Shai Hills Ghermo, iv, v. (NHM); 3 km W.Doboye; Shai Hills, 5 km N. Mole; 20 km N.Gulumpe; Dagomba; 3 km S. Masaka; Keti Krachi; Ahamansu Hills, iv, vi, xii, i. (NHM). **Togo**: Pagala; Lama-Kara; Mt. Djamde; Bagan; Pewa, v, vi, x-xii, i. (NRI). **Nigeria**: Azare, vii. (NHM); Zaria, Samaru; Nr. Yola; Gusau, 125 km Jos – Zaria; 40 km Jos – Bauchi; 100 km Kaduna – Tegina, vii, x, xi, xii. (NRI). **Niger** Falmey (12°36′ N 02°51′E), iii. (NRI). **Cameroon**: 24 km Garoua – Yola, xi. (NRI). **Sudan**: Imatong Mts; Juba; Mvolo, iv, xi, xii. (NHM). **Ethiopia**: Gambela (NRI). **Uganda**: Toro-Niambinge, 1000-1300 m Azule; Buruikalanga; Bukumi, Lake Albert, v, vii, ix, xi. (NHM). **Zaire**: Mahagi Port, ix. (NHM); Imimua, II/gd/4 (no other data), v, xi. (MRAC); Parc Nat. de la Garamba, v. (IRSNB).

Orthochtha katangana sp. n.

(Figures 8-11, distribution – Figure 3)

Diagnosis

Size small for the genus (Table 3), smaller and more slender than *O. nigricornis prasina*. Antennae narrowly ensiform, almost reaching base of hind femur in the male. Head acutely pointed, face in profile straight and more oblique than in other members of the species-group; frontal ridge narrow, deeply sulcate, with raised, somewhat wavy margins strongly divergent towards clypeus and narrowed at fastigium. Fastigium of vertex concave, oblong with well-raised margins, longer than broad; fastigial arcuate sulcus well-defined, positioned centrally, median carinula very faint. Pronotum weakly sellate, front margin straight, the hind one obtuse-angular; all carinae well-raised, lateral carinae weakly outflexed in metazona and inflexed in prozona; sulci strong; prozona-metazona ratio about 4:5; lower margin of lateral pronotal lobe wavy and slight ascending forward; hind angle narrowly rounded. Mesosternal interspace somewhat less than width of lobe. Hind femur length/width ratio 6.3, hind knee lobes rounded on both sides. External male genitalia typical for the species-group; supra-anal plate spathulate with median longitudinal depression and somewhat upturned, pointed apex; cerci small, acutely pointed; subgenital plate short, pointed. Epiphallus with thick, curved bridge, without median process; ancorae moderately large, pointed, lophi square, broad but not deep, with thick margins and attenuate outer angle; posterior process attenuate and pointed; apodemes of cingulum relatively short and broad, pointed apically with wavy margins. Endophallic structures typical of species-group, with rather stout apical valves. Female genitalia likewise typical of species-group (Figure 11D); hind margin of subgenital plate weakly trilobate; receptaculum seminis similar to that in *nigricornis*, but spermatheca proportionately somewhat larger.

Coloration of type series unreliable, as specimens apparently initially preserved in alcohol; consequently both somewhat distorted (female particularly) and discoloured. The ground coloration fawn, although possibly stramineous, (or even greenish?) in fresh specimens, dark fascia distinct, broad and very dark blackish-brown, extending from antennal pits to post-ocular area, upper margin of lateral pronotal lobes and median field of tegmina; hind wings infumate; hind tibiae and tarsi pale pink, probably brighter in life.

Measurements

As in Table 3.

Affinities

While *O. katangana* clearly belongs to the *nigricornis* species-group, it appears to be only distantly related to the other members of the group, differing from them in its small size, slender build, narrow frontal ridge, and details of structure of pronotum and genitalia in both sexes.

Material examined

Holotype M, **Zaire**: Katanga, Kasompi, terr. Jadotville, Colline radioactive, x.1956 (*Mission Bacq, Marlier, Marlier, Laurent, Leleup*) (MRAC). Paratypes: 16 M, 1 F, same data (MRAC, NHM, NRI, MNHN).

Distribution (Figure 3)

Only known from the type locality.

Biology

There is no direct information on this species, but its general habitus is characteristic of graminicolous phlaeobines with mesic tendencies. The label 'colline radioactive' that accompanies the specimens is perhaps suggestive: according to White (1983: 101) where hills of heavy metal/uranium deposits occur in the region, they are characteristically treeless, supporting open bushland, or wooded grassland.

The *Orthochtha dasycnemis* (Gerstäcker) species-group

Diagnosis of the group

Of slender, elongate build, size small to above medium, brachypterous or macropterous. Face oblique, prominent, more so in male; frontal ridge moderately broad (but narrow in *elegans* and *trivittata*); fastigium of vertex elongate-parabolic in male, to oblong-circular in female, median carinula and arcuate sulcus weak but distinct; position of sulcus varies between taxa. Dorsum of pronotum flat to weakly tectiform, with straight parallel to sub-parallel lateral carinae, showing a tendency to divergence in the metazona in some taxa, particularly *bisulcata* in Chad basin. Lower hind angle of lateral pronotal lobe acute (somewhat less so in *dimorphipes* (Figure 19G)). Upper lobes of hind knee not produced, lower outer lobe rounded, inner subacute. Male cerci slender, elongate, subcylindrical, obtusely pointed. Hind margin of female subgenital plate trilobate. Epiphallus with narrow, elongate, rounded, upturned lobes, apical valves of aedeagus long and slender (in *dimorphipes* epiphallic lophi distinctly broader and aedeagal valves thicker (Figure 19L)). Spermathecal duct elongate and narrow throughout, spirally coiled into 3-4 double coils as a watch-spring; spermatheca small, but larger in *dimorphipes,* caecum of spermatheca relatively elongate (Figure 19M). Coloration of various shades of green, brown and stramineous, lateral fasciae of varying intensity, providing distinction at specific and subspecific level. Hind tibiae dirty pinkish in most taxa, dark pinkish-brown in *trivittata* and *nana,* deep cherry-red to black in *pulchripes* (only female known), while in *dimorphipes* it is greyish-dirty blue in male and pinkish in female. Hind wing infumate in *O. d. trivittata* and *O. d. nana,* clear in others.

Key 3 *Orthochtha dasycnemis* species-group

1 Brachypterous, wing tips well short of tip of abdomen in both sexes 2

– Macropterous, wings only a little shorter, to much longer than, tip of abdomen 3

2 Smaller and more slender; length of hind femur of M between 13.3 – 14.5 mm, 19 – 20.0 mm in F; coastal lowlands of East Africa ..... *O. d. alca* (I. Bolivar) **stat. n.**

– Larger and more robust; length of hind femur in M between 20.0 – 22.0 mm; inland areas of East Africa, notably the Rift Valley .... *O. d. lindneri* (Kevan) **stat. n.**

3 Size small, male under 20 mm; confined to southern Africa 4

– Larger, male over 20 mm; most of sub-Saharan Africa 6

4 Antennae in male barely as long as head and pronotum, pale basally; dorsum of pronotum broad; epiphallic lophi strongly upturned (Figure 17B); (South Africa) .... *O. modesta* **sp.n.**

– Antennae in male distinctly longer than combined length of head and pronotum, their coloration dark throughout; dorsum of pronotum narrow; epiphallic lophi not strongly upturned 5

5 Wings abbreviated in both sexes, not quite reaching tip of abdomen; tegmina tapering; wings not infumate; hind legs elongate .... *O. browni* **sp.n.**

– Wings extending well beyond tip of abdomen, tegmina not narrowed apically; wings infumate; hind legs not unduly elongate .... *O. d. nana* **subsp. n.**

6 Hind tibiae in female deep cherry-red, black apically, tarsi ivory-white (male unknown); Chad basin .... *O. pulchripes* **sp.n.**

– Hind tibiae in female in various shades of pink 7

7 Hind tibiae greyish-dirty blue in male, pinkish in female; central and southern Africa .... *O. dimorphipes* Uvarov, 1953

– Male tibiae concolorous with female, in various shades of pink 8

8 Of very slender build, length/width ratio of hind femur more than 7 9

– Of normal build, length/width ratio of hind femur 6 or less 10

9 Head elongate, acutely pointed; lateral fasciae in the male faint; Congo basin .... *O. elegans* **sp.n.**

– Head of normal shape, not unduly elongate; lateral fasciae in male dark; Somalia .... *O. d. somalica* **subsp.n.**

10 Above average size (Table 5); predominantly greenish; the lateral fasciae broad and dark, especially in male; Sahel and Sudan savanna zones of W. Africa .... *O. d. bisulcata* (Krauss)

– Of average size (Table 5); varying coloration; eastern, central and southern Africa 11

11 Head pointed, Figure 12F,G; coloration of dorsal parts of body dark; hind wing infumate; parts of central Africa .... *O. d. trivittata* (I. H. Bolivar) **stat.n.**

– Head more rounded, Figure 12A,C; coloration of upper parts of body not unduly darker than the rest, hind wings not infumate; other parts of eastern, central and southern Africa .... *O. d. dasycnemis* (Gerstäcker) **stat. n.**

Discussion

This is a distinctive complex of closely related taxa. At its core is *O. dasycnemis* (Gerstäcker 1869), the most widespread *Orthochtha* species, which shows considerable ecological plasticity and occurs over a large part of sub-Saharan Africa. The simplest treatment would have been to regard *O. dasycnemis* as a single highly polymorphic species and thereby reduce the most closely affiliated taxa to synonyms. Instead, given the degree of variation involved, we have sought to identify recognizable trends towards speciation and to examine the status of the named taxa in this context. Where intermediate forms exist, the diagnosed taxa are established as subspecies; where not, the more distinctive taxa are regarded as species. Even after separation from the main *dasycnemis* pool of the recognized taxa described below, the residue attributed to the nominate species remains a rather heterogeneous mixture, wherein further material may in time permit recognition of other distinct taxa. The taxa recognized in this revision are discussed in the distribution and geographical variation section below.

Orthoctha dimorphipes Uvarov 1953 is included here as it is of the same size and general appearance as nominate *dasycnemis* and shares many morphological characters. While the males of the two species are distinct in the structure of their epiphallic lophi and aedeagal valves and the coloration of the hind tibiae, the females can be difficult to separate.

A number of nomenclatural points need to be made. There is no ambiguity regarding the two syntypes of *Chrysochraon dasycnemis* Gerstäcker 1869, which agree well with the original description and the author's (1873) more detailed description and illustrations. Unaccountably however, the syntypes were located not in the original depository, MNHU, but at the NHM. By mutual agreement with the Keepers, the designated lectotype was sent to Berlin and the paralectotype deposited at NHM.

The two Walker syntypes of *Opomala basalis* Walker 1870 discussed by Uvarov (1925), are confirmed as synonyms of *O. dasycnemis* (Gerstäcker); the one from Natal (Uvarov's 'single type') as the lectotype and the second as paralectotype. As Uvarov points out, the two differ to some extent; while the lectotype is a fairly close match for the nominate subspecies, the paralectotype from 'South Africa' without precise locality, is smaller with somewhat shorter tegmina. However, it agrees more closely with nominate *O. d. dasycnemis*, which is subject to considerable variation in southern Africa, than with any of the other taxa in the group.

Attention has been drawn to the confusion arising from the incorrect use of the name *Orthochtha bisulcata* (Krauss) (p. 3); the problem was aggravated by the loss of the unique type of *Phlaeoba bisulcata* Krauss and the fact that since the name *O. bisulcata* became firmly attached to another rather distinctive species, the true *O. bisulcata* (Krauss) was given other names, usually *O. pachycerca* (Karny), or *O. prasina* (I. Bolivar). Curiously, its identity as *O. dasycnemis* (Gerstäcker) was recognized only recently (Johnsen, 1981) among a collection of grasshoppers from The Gambia. Investigation of the true identity of *O. bisulcata* involved, in addition to a study of the literature and the examination of the type material, consultations with Dr R. Roy and colleagues of IFAN, as well as intensive collecting in western Africa, particularly in the type locality Saint Louis, Senegal. From this Popov and Fishpool (1988: 300) concluded that the taxon concerned was indeed *Orthochtha dasycnemis* (Gerstäcker), (as in fact had been indicated by Karsch in 1891 (footnote on p. 177)), but that it is sufficiently distinct to merit recognition as a subspecies. A neotype from the type locality has been designated and deposited at NHM; other topotypes have been presented to NM, MNHN, IFAN and NRI.

Distribution and geographical variation of the group (Figure 4)

The nominate subspecies *Orthoctha d. dasycnemis* (Gerstäcker) is widespread throughout eastern, central and southern Africa, effectively bridging the gaps between the other subspecies and connected with them by clinal links. It is abundant in Kenya, where it occurs at all altitudes and in a variety of grassland habitats from sea level at Mombasa (the type locality) to the Ngong hills (2150 m). It occurs in many colour forms typical of graminicolous Acridinae, from predominantly green to mainly stramineous or brown, but more often a mixture of these with, usually, broad blackish-brown fasciae, pronounced in the male, faint or absent in the female. There is surprisingly little variation with altitude, or with latitude northwards to the northern limit in Ethiopia; specimens from both high- and lowland show very similar ranges of colour and form. Southwards however, through Tanzania, there is a clinal change to *O. trivittata* in Zambia and Zaire, while specimens from parts of Mozambique (Mucheve) are distinguished by their large size and those from Gabela in Angola by their very slender build. Conversely those from Natal are relatively short and stout and have a rounded vertex and a convex frons. It is therefore, possible that in addition to those recognized in this revision, further collecting and study would reveal the existence of other distinct taxa.

Orthochtha d. bisulcata (Krauss) occurs in the Sahel and the Sudan savannas of western Africa from Senegal and The Gambia to the Sudan; the Sudan populations show transition towards *O. d. dasycnemis*.

Orthochtha d. trivittata (I. Bolivar) **stat.n.** is recorded from the Shaba province of southeast Zaire, Zambia and southern Malawi. There are numerous specimens intermediate with the nominate subspecies in the zones of overlap.

Orthochtha d. alca (I. Bolivar) **stat.n.** is a brachypterous taxon which morphologically is nearest to the populations of the nominate subspecies from the type locality, Mombasa; it is found in the coastal areas of Tanzania and northern Mozambique.

Orthochtha d. lindneri (Kevan) **stat.n.** is also brachypterous; it is generally larger and more robust than *d. alca* and has so far been recorded from the Rift Valley, from Lake Rukwa in southern Tanzania (where the largest specimens have been collected), north to the shores of Lake Victoria in northern Tanzania and southwest Kenya (populations closer in size to *d. alca*). *Orthochtha d. alca, O. d. lindneri* and *O. d. dasycnemis* are apparently largely allopatric, but intermediate forms are known from the contact zone near Tanga (Tanzania) and from Muhoroni (Kenya).

Orthochtha d. nana **subsp.n.** is a small dark subspecies, rather like a miniature *trivittata*. It occurs at the extreme southern end of the range of distribution of the species-group, in southern Africa. Specimens intermediate between *nana* and nominate *dasycnemis* are known.

Orthochtha d. somalica **subsp.n.** resembles a very elongate *O. dasycnemis* and is known only from northern Somalia.

Orthochtha browni **sp.n.** and *O. modesta* **sp.n.** are two local endemics from the highlands of southern Africa, while *O. elegans* **sp.n.** and *O. pulchripes* **sp.n.** are distinctive local species from the Congo and the Lake Chad basins respectively. In addition, the Chad basin holds another distinctive variant of *O. dasycnemis*, in that some specimens of *O. d. bisulcata* have strongly divergent lateral pronotal carinae in the metazona. It is possible that these were what Golding (1948: 531) listed as *Rasperecta* sp., while through the same process of elimination, and on the evidence of his material in the NHM collection, typical *O. d. bisulcata* (Krauss) were apparently identified as '*Orthochtha pachycerca* Karny (?)' (Golding, 1948: 531). However, the presence of both the *Rasperecta*-like and the typical form, as well as intermediates in the same locality, suggests that this could be merely a local variant and we have refrained from naming it.

Orthochtha dimorphipes occupies a well-defined zone in south-central Africa, comprising Angola, Zambia, Zimbabwe, Botswana and Namibia; there are a few records from the adjacent parts of South Africa and Mozambique, and an outlying population, beyond the *Brachystegia* zone and the Rift Valley, in Tanzania.

Biology

Little is known of the biology of the group. Month of capture data, extracted from specimen labels, are summarized in Table 4. Despite the paucity of records, it is evident that the life cycle is closely geared to the periodicity of rainfall; taxa inhabiting areas with single well-defined rainy seasons are univoltine, those in areas with two rainfall peaks are bivoltine. The absence of adults during the dry season suggests an egg quiescence over this period. Fishpool and Popov (1984) recorded *O. d. bisulcata* (as *Orthochtha* sp.2, p.355) as univoltine with egg quiescence during the dry season, as inhabiting riverine and lacustrine (hygrotypic) grasslands, and as being graminivorous. Under the name *Orthochtha prasina*, Davey *et al.* (1959) recorded its presence on the flood plain of Lake Faguibine in Mali in December in cultivated rice on the lake edge, and in tall grassland (*Sporobolus* sp. and *Vetiveria nigritana*) at other localities in October and November; all females had fully developed ovaries, and many had laid. Many were taken at light during September and October (Davey *et al.*, 1959).

Robertson and Chapman (1962) recorded '*Orthochtha alca*' (more probably *O. d. lindneri*), in the Rukwa Valley of southwest Tanzania, as a grassland species – 2% only being taken in fringing woodland. The majority occurred in *Sporobolus* grassland. Adults were recorded from March to June and nymphs January to April. Ovarian development took place during March and April with oviposi-

Table 4 Monthly records of adults of the *O. dasycnemis* species-group from specimen label data (nymphs in brackets)*

		Month											
Taxon	Locality	i	ii	iii	iv	v	vi	vii	viii	ix	x	xi	xii
O. d. bisulcata				1				1	5	19	12	7	2
O. d. somalica						1				1			
O. d. dasycnemis:	Somalia			3	2	3		2	1 (1)		2	2	1
	Ethiopia								2	3		1	
	Kenya	1		4	8 (1)	6 (1)	16 (1)	1		3 (2)	12 (4)	1	3 (1)
	Tanzania	1	2				3	3		5	3	1	5
	Uganda				1	1		5		3	1	1	
	Zaire							1	2	7	3		1
	Zambia	1									1	1	2
	Malawi			3									1
	Zimbabwe		1		1							1	1
	Angola		1	1		1							
	Mozambique	1	3		2						2	1	1
	Namibia	1										2	
	S. Africa	2	6	1	6	6					1		1
O. d. trivittata		3	2	3							2	9	11
O. d. nana		1			6	1						2	2
O. d. alca				1	1	1	1			2	1	2	
O. d. lindneri		1	2	4	3								1
O. elegans		2	1		3	1				1			
O. modesta											1		
O. pulchripes										1			
O. dimorphipes		1	5	18	20	1	1						2
O. browni			2	2									

Note *Figures indicate specimen totals

tion in April and May. This subspecies is thus univoltine with dry-season egg quiescence. On the other hand, the superficially similar and equally brachypterous *O. d. alca* from coastal areas is evidently bivoltine, for adults occur during two distinct periods, March-June and September-November. Moreover, the two subspecies seem to be ecologically distinct, for *O. d. alca* occurs predominantly in wooded areas, in grasslands along forest edges and clearings.

The group is apparently of no economic importance (COPR 1982).

Orthochtha dasycnemis (Gerstäcker 1869)

Orthochtha dasycnemis dasycnemis (Gerstäcker 1869) **stat. n.**

(Figures 12,13,15, distribution – Figure 4)

Chrysochraon dasycnemis Gerstäcker 1869: 217. Lectotype male, KENYA (MNHU), here designated [examined].

Opomala basalis Walker 1870: 510. Lectotype female, SOUTH AFRICA (NHM) [examined]. (Synonymized by Uvarov 1925: 273.)

Opomala interlineata Walker 1870: 510. Holotype female, SOUTH AFRICA (NHM) [examined]. (Synonymized by Uvarov 1925: 273.)

Phlaeoba antennata Schulthess 1898 (=*Xerophlaeoba schulthessi* (I. Bolivar 1908)). Lectotype female, SOMALIA designated by Uvarov (1936): 539, (MCSN) [examined]. (Original diagnosis, by GBP in 1982, was published by Baccetti (1985): 309 as syn.n.)

Measurements

As in Table 5.

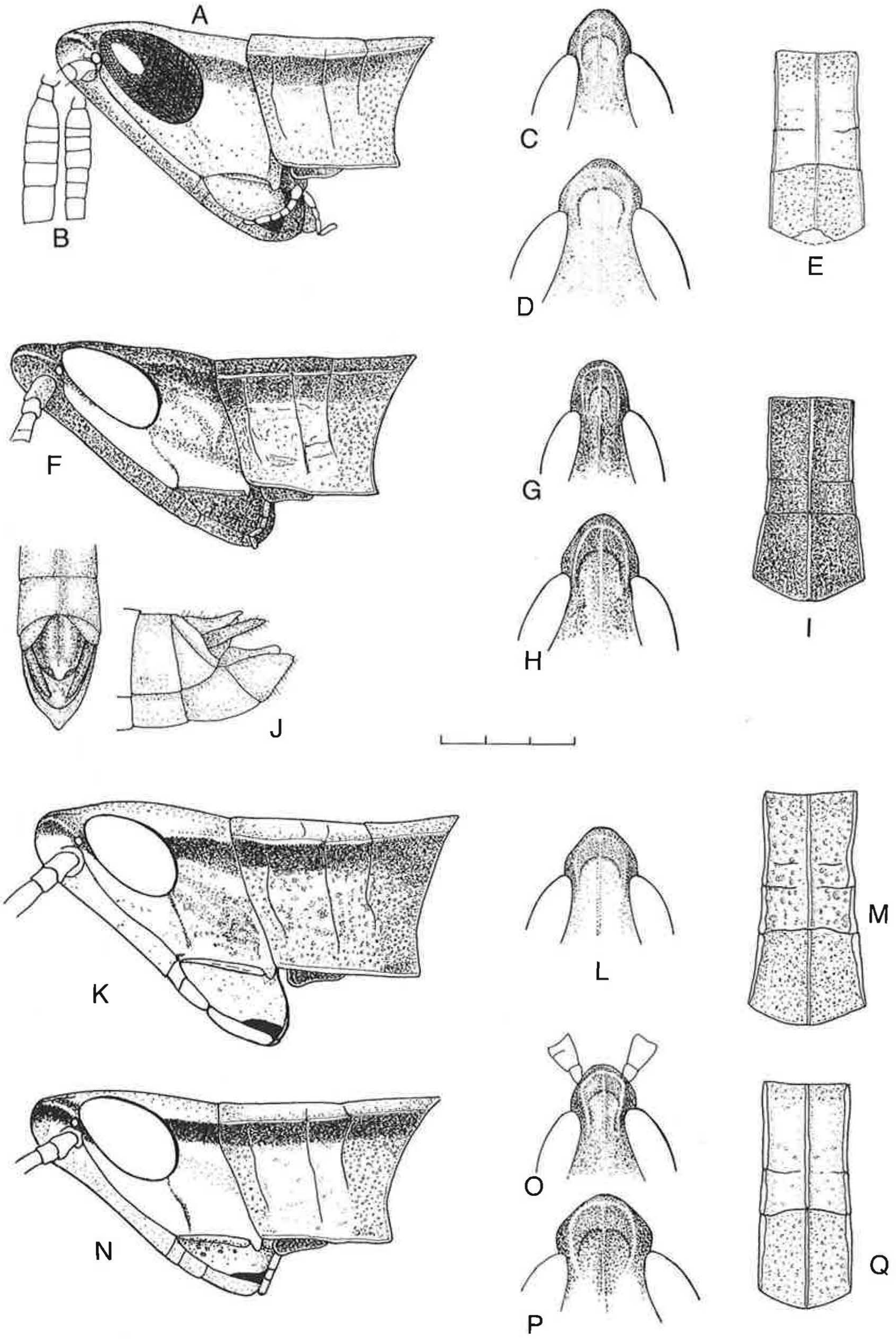


Figure 12 *Orthochtha dasycnemis* species-group. D, H, P female, remainder male. A-E,J *dasycnemis dasycnemis* (lectotype); F-I *d. trivittata*; K-M *d. bisulcata* (Chad), N-Q *idem* (type locality, Senegal). A, F, K, N lateral view of head and pronotum; B base of antenna (male right, female left); C, D, G, H, L, O, P dorsal view of fastigium verticis; E, I, M, Q dorsal view of dorsum of pronotum; J dorsal (left) and lateral view of tip of abdomen. Scale in mm. Drawings of *O. d. bisulcata* modified from Popov and Fishpool in Mestre (1988).

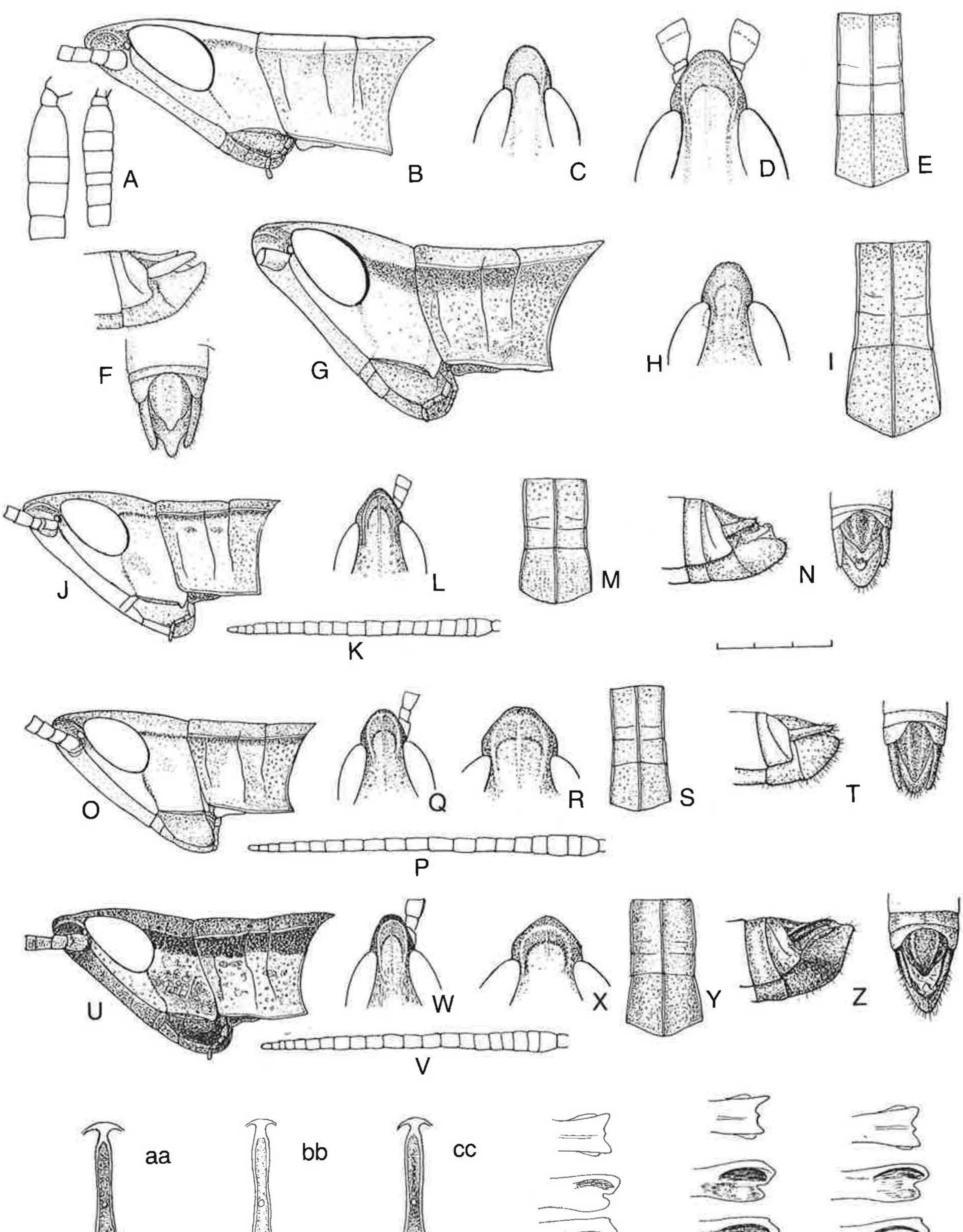


Figure 13 *Orthochtha dasycnemis* species-group. A, D, R, X female, remainder male. A-F *elegans* **sp.n.**; G-I *dasycnemis somalica* **subsp.n**; J-N, aa, dd *modesta* **sp.n**; O-T, bb, ee *browni:* **sp. n**; U-Z, cc, ff *dasycnemis nana* **subsp.n.** A, lateral view of base of antenna of female (left) male (right); B, G, J, O, U lateral view of head and pronotum; C, D, H, L, Q, R, W, X dorsal view of fastigium verticis; E, I, M, S, Y dorsal view of dorsum of pronotum; F, N, T, Z lateral and dorsal views of tip of abdomen; aa-cc frontal ridge; dd-ff dorsal (upper), outer lateral (centre) and inner lateral (lower) aspects of hind knee. Scale in mm.

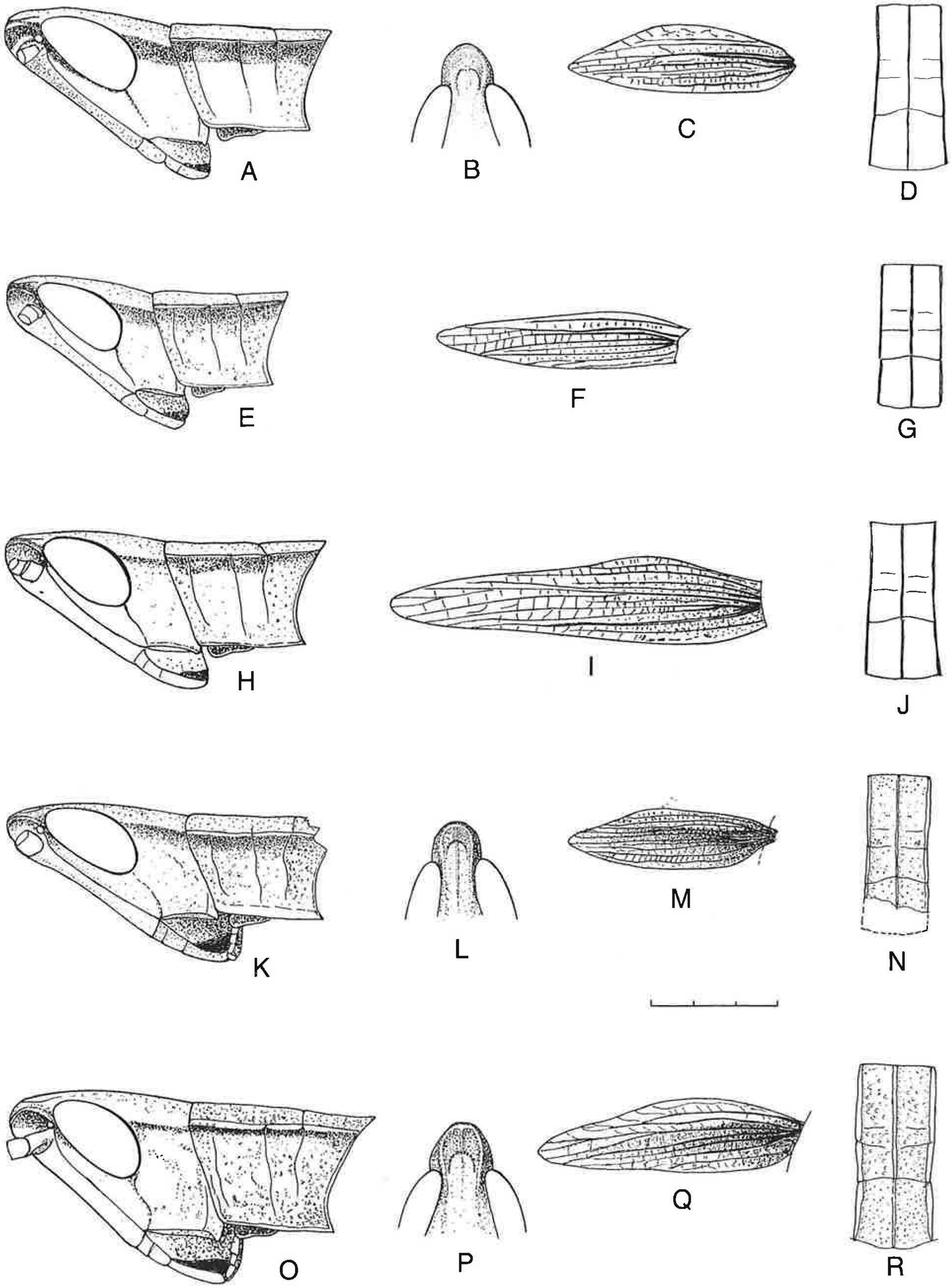


Figure 14 *Orthochtha dasycnemis* species-group. Males. A-G, K-N *dasycnemis alca*; A-D *O. squamipennis* Ramme – holotype; E-G *O. alca* Bolivar – holotype; K-N specimen from Port Amelia, Mozambique. H-J, O-R *dasycnemis lindneri*: H-J *O. lindneri* Kevan – holotype; O-R specimen from Rukwa, Tanzania. A, E, H, K, O lateral view of head and pronotum; B, L, P dorsal view of fastigium verticis; C, F, I, M, Q left tegmen; D, G, J, N, R dorsal view of dorsum of pronotum. Scale in mm.

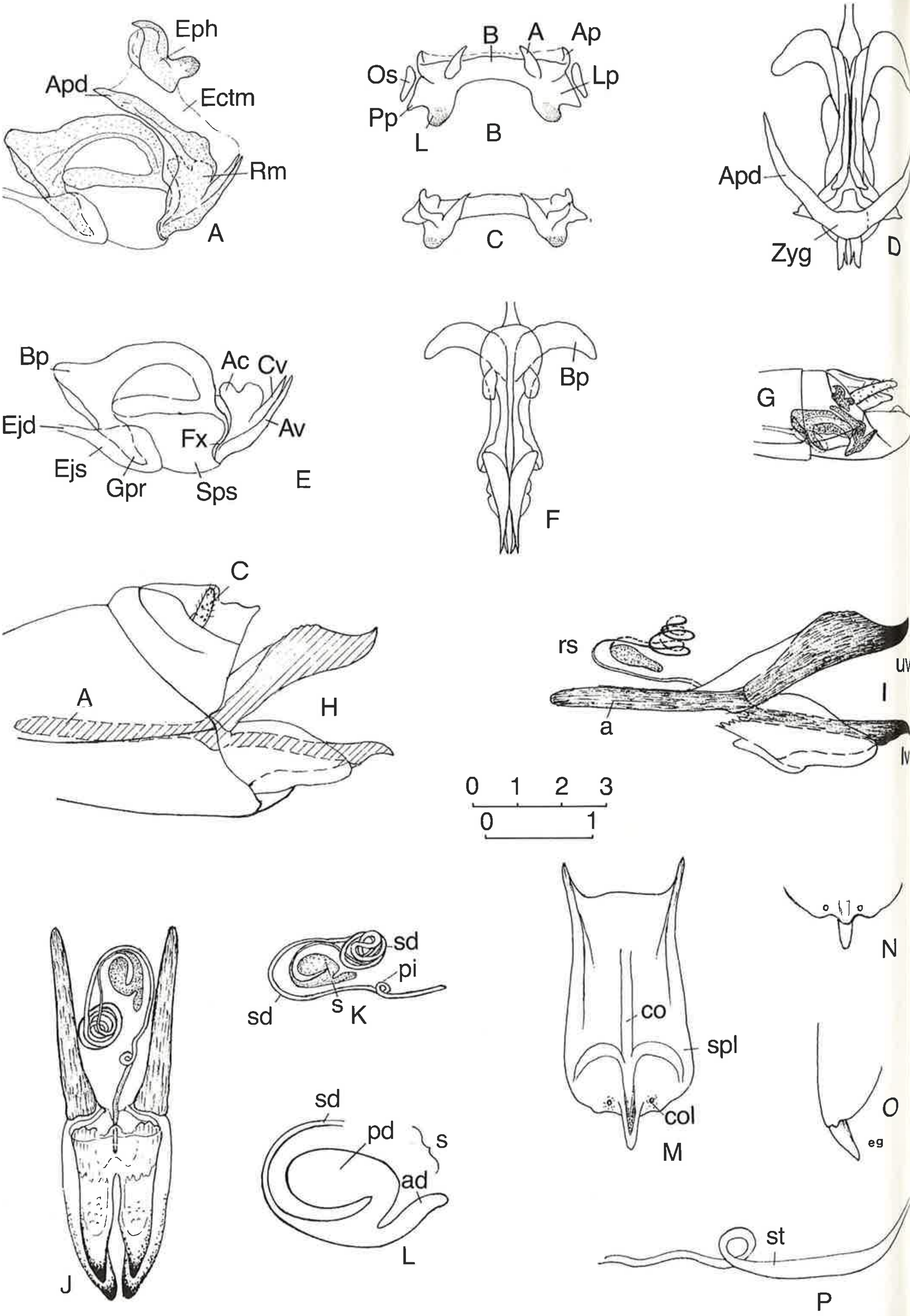

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Figure 15 *Orthochtha dasycnemis* species-group. Genitalic structures of *O. d. dasycnemis*; A-G male, H-P female. A lateral aspect of phallic complex and epiphallus; B dorso-posterior aspect of epiphallus; C *idem* dorsal aspect; D dorsal aspect of A with epiphallus removed; E lateral aspect of D with apodemes removed; F ventral aspect of E; G position of the phallic complex *in situ* within the body cavity; H tip of abdomen showing position of ovipositor and apodemes; I ovipositor and receptaculum seminis in normal position; J ventral aspect of I; K receptaculum seminis; L spermatheca; M subgenital plate, dorsal aspect; N,O ventral and lateral aspect of apex of M; P spermatophore (remains of which are frequently found implanted in the duct). Scale lines in mm, upper G-K, M, N; lower A-F, L, O,P.

Abbreviations: Male genitalia: Epiphallus (eph): a – ancorae; ap – anterior projections; b – bridge; l – lophi; lp – lateral plates; os – oval sclerities; pp – posterior projections. Phallic complex: ac – arch of cingulum; apd – apodemes of cingulum; av – apical valves of penis; bp – basal valves of penis; cv – valves of cingulum; ectm – ectophallic membrane; ejd – ejaculatory duct; ejs – ejaculatory sac; fx – flexure; gpr – gonopore process; sps – spermatophore sac; rm – rami of cingulum; zyg-zygoma.

Female genitalia: a – apodeme of ovipositor; ad – apical diverticulum; c-cercus; co-common oviduct; col – columella; eg – egg guide; lv – lower valve of ovipositor, pd – pre-apical diverticulum; pl – proximal loop of spermathecal duct; rs – receptaculum seminis; s – spermatheca; sd – spermathecal duct; spl – subgenital plate; st – spermatophore; uv – upper valve of ovipositor.

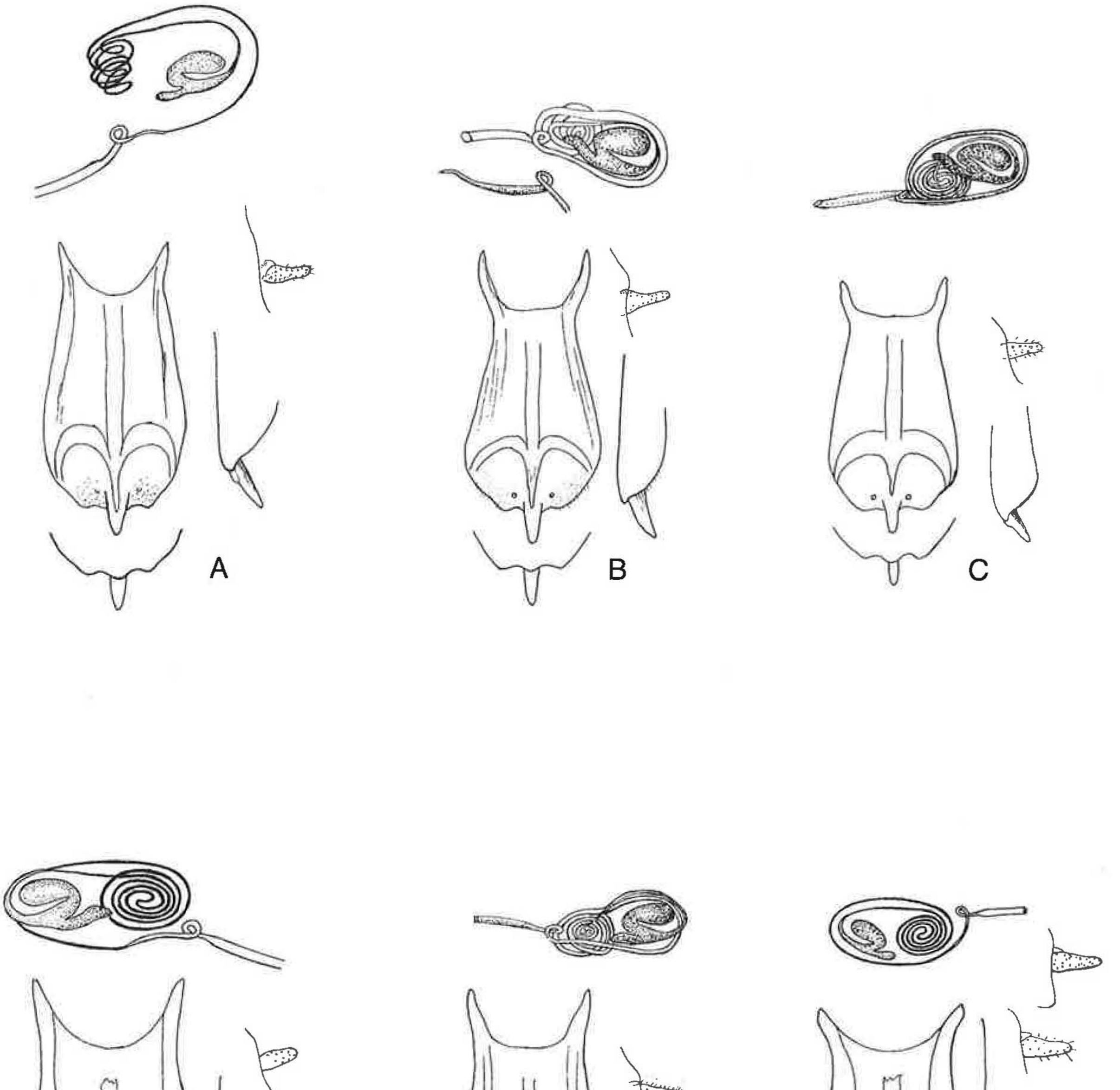

Figure 16 *Orthochtha dasycnemis* species-group. Female genitalic structures. A *dasycnemis trivittata* (Zaire, near type locality); B *idem* (Zambia); C *browni* **sp.n.**; D *d. bisulcata* (Senegal); E *d. alca* (Kenya); F *elegans* **sp.n.** Scale in mm. For explanation see Figure 15.

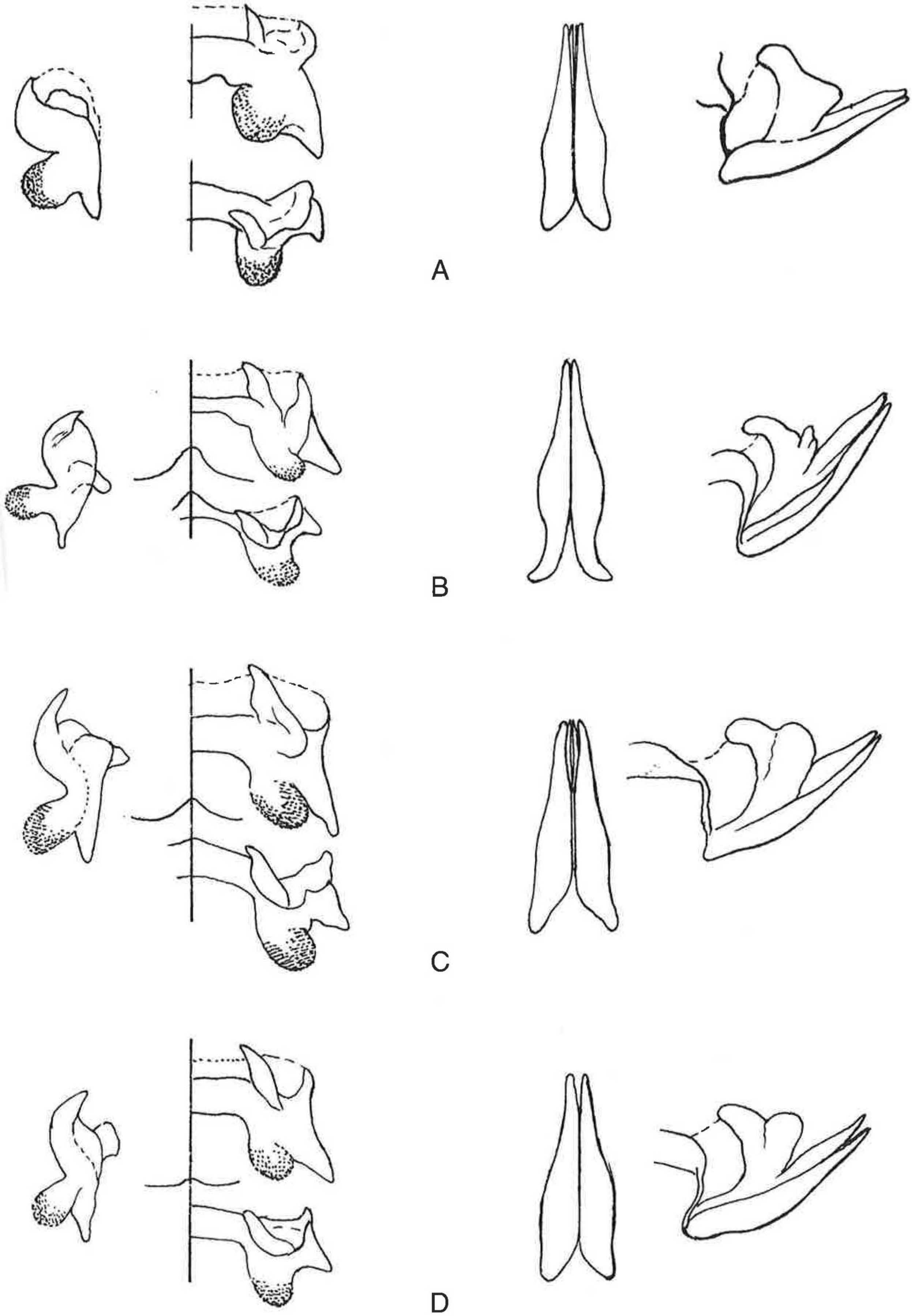

Figure 17 *Orthochtha dasycnemis* species-group. Male genitalic structures. Phallic complex in A *elegans* **sp.n**; B *modesta* **sp.n.**; C *browni* **sp.n.**; D *dasycnemis nana* **subsp.n.** Scale in mm. For explanation see Figure 15.

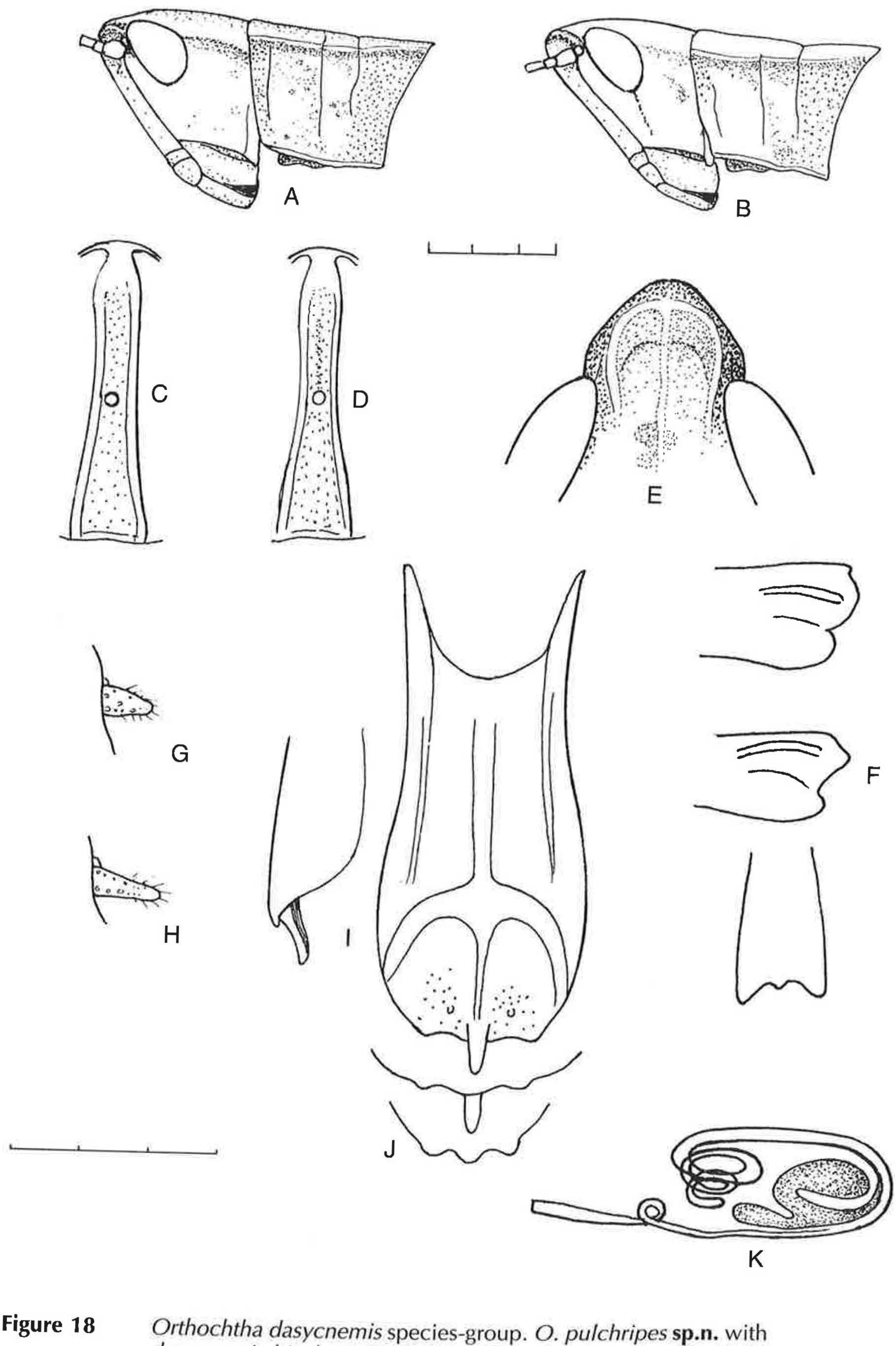

Figure 18 *Orthochtha dasycnemis* species-group. *O. pulchripes* **sp.n.** with *dasycnemis bisulcata* (B, D, H, J) from the same locality, Lake Chad, for comparison. A, B lateral view of head and pronotum; C, D frontal ridge; E dorsal view of fastigium verticis; F outer, inner and upper face of hind knee; G, H cercus; I, J subgenital plate; K receptaculum seminis. See Figure 15 for explanation of I-K. Scales in mm; A, B upper, remainder lower scale.

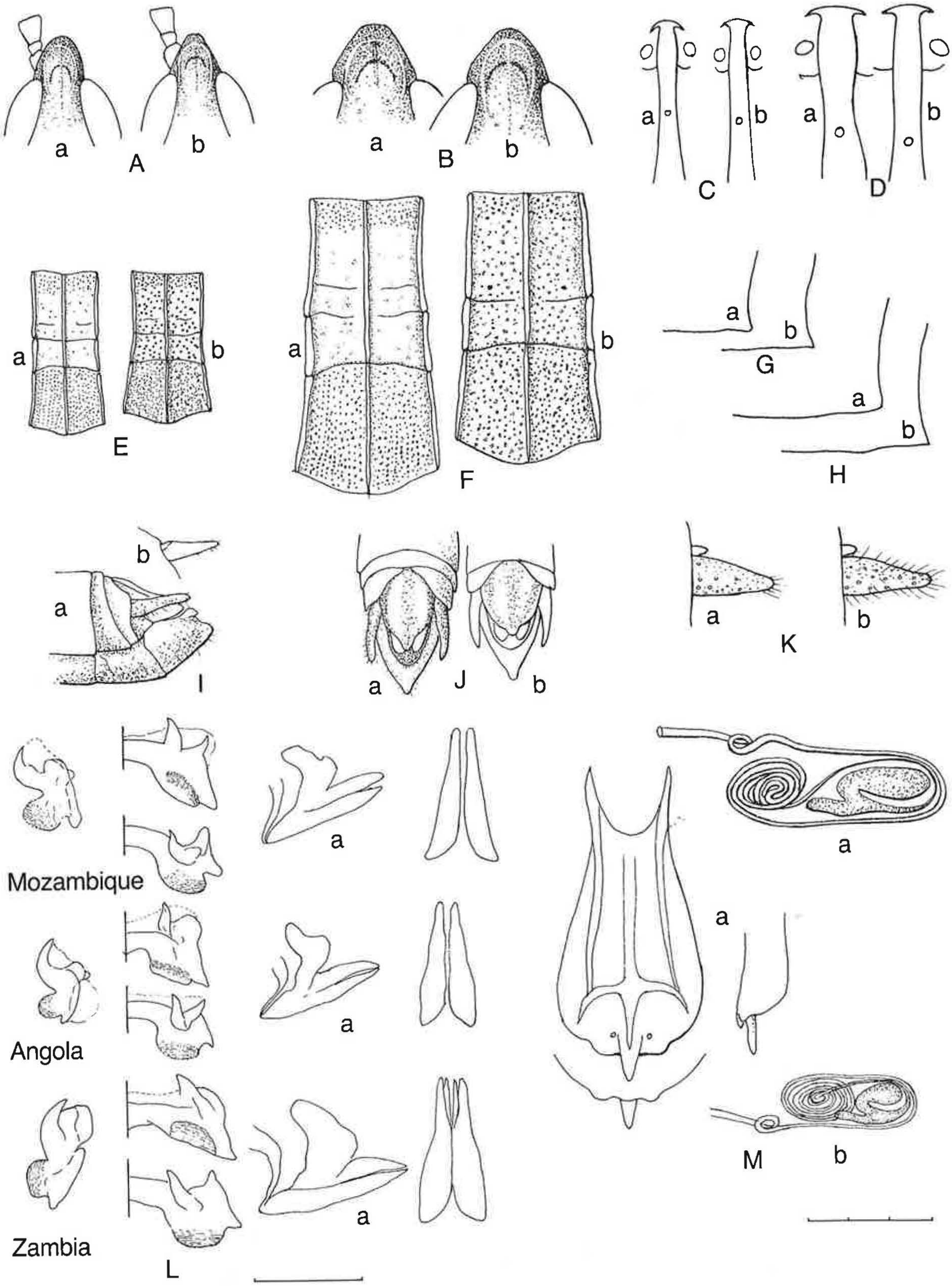

Figure 19 *Orthochtha dasycnemis* species-group. Comparison of *dimorphipes* (a) and *d. dasycnemis* (b). A, C, E, G, I, J, L males; B, D, F, H, K, M females. A, B dorsal view of fastigium verticis; C, D frontal ridge; E, F dorsal view of dorsum of pronotum; G, H lower hind angle of pronotal lobe; I lateral view of tip of abdomen (a) and cercus (b); J dorsal view of tip of abdomen; K lateral view of cercus; L male genitalic structures; M female genitalic structures. For explanation of L and M see Figure 15. Scales in mm; L left hand, remainder right hand scale.

Table 5 Measurements of the *O. dasycnemis* species-group (mm)

		Pronotum								
		Length		Width			Hind femur			
Taxon	Total length	total	prozona	prozona	metazona	Tegmen length	Length	Width	Antenna length	Head and pronotum
O. d. dasycnemis	M 22.0-28.5	3.7-4.7	2.2-2.8	1.6-2.0	1.9-2.4	16.5-19.5	14.5-16.5	2.3-2.7	10.5-13.5	7.7- 9.5
	F 31.0-42.0	5.6-7.6	3.3-4.3	2.5-2.9	2.8-3.2	22.0-26.0	19.5-23.0	2.9-3.7	7.0-11.0	11.0-13.5
O. d. trivittata	M 23.0-26.0	4.2-4.6	2.3-2.6	1.8-2.0	2.3-2.6	18.0-20.0	15.0-16.7	2.5-2.7	11.0-11.5	8.5- 9.0
	F 33.0-37.0	6.2-7.5	3.4-4.0	2.8-3.3	3.3-3.8	23.0-26.0	20.0-24.0	3.1-3.5	9.0-11.0	10.7-13.0
O. d. bisulcata	M 22.5-30.0	4.0-5.7	2.2-3.2	1.6-2.0	1.9-2.4	16.8-24.0	14.0-19.0	2.2-3.0	11.5-16.0	7.5-10.5
	F 35.0-45.0	6.7-7.6	3.7-4.3	2.6-3.2	3.0-3.5	24.5-29.0	21.0-24.0	3.2-3.8	12.8-14.2	12.2-13.3
O. d. nana	M 18.0-19.0	3.4	1.9	1.6	1.9	13.2-14.0	11.3-11.7	2.0	7.8- 8.2	6.9- 7.3
	F 28.0-32.0	5.4	3.0	2.7	2.9	19.5-21.3	16.0-16.7	2.8	?	9.3- 9.5
O. d. somalica	M 28.0	4.7	2.5	1.8	2.5	23.7	17.5	2.4	?	8.8
	F 39.5	6.5	3.6	3.0	3.6	29.0	22.0	3.5	10.0	12.8
O. d. alca	M 19.0-21.5	3.2-3.8	2.2-2.5	1.3-1.6	1.4-1.7	5.6- 7.8	13.3-14.5	2.1-2.2	10.0-12.2	6.8- 7.8
	F 29.5-32.5	5.5-6.2	3.2-3.6	2.5-2.7	2.7-2.9	12.4-15.0	19.2-20.0	3.0-3.2	10.0-12.0	10.2-11.0
O. d. lindneri	M 18.8-27.3	3.5-4.8	2.0-2.8	1.5-1.8	1.6-1.8	5.8-10.0	14.3-17.0	2.2-2.4	12.5-13.0	6.7- 9.0
	F 35.0-38.5	6.3-6.5	3.6-4.0	2.7-2.8	2.7-2.9	9.7-13.0	20.0-22.0	3.0-3.2	11.8-12.5	11.0-12.2
O. browni	M 18.5-22.5	3.2-3.8	1.9-2.2	1.6-1.8	1.7-1.8	11.0-12.5	11.5-14.5	1.8-2.3	6.6- 7.6	8.7- 9.2
	F 32.0	5.8	3.3	2.7	2.7	18.0	19.0	2.9	10.0	10.0
O elegans	M 24.0-26.0	4.5-4.6	2.5-2.6	1.5-1.7	1.8-2.0	19.0-21.0	16.5- 7.0	2.3-2.5	13.0-14.0	8.6- 9.0
	F 36.0-38.0	6.8-7.0	3.9-4.0	2.6-2.7	2.8-2.9	26.5-26.7	22.0-22.3	3.1-3.2	12.8-14.0	13.0-13.4
O modesta	M 17.0	3.2	1.8	1.6	1.9	13.0	11.0	2.2	6.7	6.4
O. pulchripes	F 44.0	7.5	4.1	3.4	3.8	29.5	24.0	3.8	13.5	13.5
O. dimorphipes	M 20.0-26.5	3.5-4.6	2.1-2.8	1.5-1.8	1.7-2.2	15.8-20.0	14.0-17.1	2.0-2.6	11.2-14.7	6.8- 8.5
	F 34.5-46.0	6.3-8.0	3.5-4.6	2.6-3.3	3.1-3.7	24.4-29.5	21.1-26.0	3.4-4.3	9.0-13.0	11.6-15.0

Material examined

Chrysochraon dasycnemis Gerstäcker. Lectotype M, Kenya: Mombasa (*Decken*) (MNHU); paralectotype M, similar data (NHM).

Opomala basalis Walker. Lectotype F, South Africa: Natal (NHM). Designated by Uvarov (1925): 273, as 'the single type'. Paralectotype F, South Africa (no other data) (NHM).

Opomala interlineata Walker. Holotype F, South Africa: Natal (no other data) (NHM).

Phlaeoba antennata Schulthess (= *Xerophlaeoba schulthessi* (I. Bolivar)). Lectotype F, Somalia: Deserto di Banas, vii. 1893 (*Ruspoli*) (MCSN). Misidentification – see note under *Xerophlaeoba* (p. 133).

In addition to the type material, 683 specimens were examined from the following localities. **Kenya**: Jadini, 25 km S. of Mombasa; Athi River, 1500 m; Garsen; Sultan Hamud, Emali Range; Kasigau (03°49′ S 38°40′E); Rabai (03°55′ S 39°30′E); Mombasa; Shimba Hills (04°14′ S 39°30′ E); Makuyu Kitito Coffee Estate, 1550 m (00°58′ S 37°17′ E); 205 km S. of Nairobi on Mombasa Road; 26 km N. Kilifi; Hola, 144 km S. of Garissa; Shimba Hills Nature Reserve; 6 km N. Kilifi; 1 km N. Diani forest edge; Mukaha forest edge, 14 km WSW. Diani beach; 25 km N. Kilifi forest edge; Narossura R. (01°35′ N 25°48′ E); Matuga Agric. Res. Station (04°10′ S 39°34′ E); Tana R. bridge on Thika-Makuya-Sangara Rd (00°17′ S 37°17′ E); Malindi (03°14′ S 40°07′ E); Tebere Cotton Res. Station, 1150 m (00°39′ S 37°23′ E); Koma Rock Rd, Dondora Estate, 1500 m (01°15′ S 36°58′ E); Ol Doinyo Sapuk (01°07′ S 37°15′ E); Munguni Hill, Tulia (01°12′ S 39°02′ E); Elementaita, 1900 m; Witu Forest Res., Lamu Dist., 5 km E. Lamu; Diani Beach (04°18′ S 39°35′ E); Elementaita, Soysambu; Ololua forest, Karen; 25 km N. Kilifi, Arabuko-Sokoke forest; Mwea plains, 1150 m (00°43′ S 37°22′ E); 22 km NW. Witu on Garsen Road (02°08′ S 40°17′ E); Taita Hills 1000 m; Ngong Hills 2300 m; Arabuko forest 17 km W. Malindi; Murinduko Hills, 5 km S. Embu; Meru National Park (00°13′ N 38°05′ E); S. of R. Thika, Mwea plain, 9 km S. of Ngurubani, fire protected fallow; Dwa, Nr. Kibwezi, Brooke Bond Sisal Estate, kopje behind Rest House; *idem*, 1.5 km N. of Rest House, dry woodland; *idem*, 0.5 km N. of Rest House, thorn scrub on lava flow; Mwangaro, Taita Hills Lodge area 1000 m; Mida creek, Kilifi Dist. (03°19′ S 39°58′ E); Shimba Hills, Thidret; W. side Shimba Hills, forest scarp road; Mrima Hill forest S. of Kakoneni, 250 m; S. of Mrima forest Rd, 8 km E. of road junction; 1 km along Jumba-Mruama Rd, Mombasa-Kilifi, fallow; Jaribuni-Ganze Rd, 1 km beyond Kanjora Rd; 48 km E. of Makutano, *Ficus* forest 1700 m; between Kisumu and Chemelil 10 km SE. Kisumu; 8 km from Laindi Rd, fallow in old maize; 3.5 km NW. of Jaribuni, savanna woodland with cycads and aloes; just N. of Jaribuni on S. side of N'dzoumi R; open thicket and tall grass; 6 km N. of Kilifi; Emali range; Lake Baringo; Hola, 144 km S. of Garissa; 1 km N. of Diani, forest edge; Muhaka, forest edge; 14 km WSW. of Diani beach; Muguga, edges of forest paths; 205 km SE. of Nairobi, Mombasa Rd (NHMA, NHM, NRI, NMK). **Tanzania**: Mkwawa; Mufindi (08°35′ S 35°20′ E); Zanzibar; Tanga; Muheza-Amani (05°11′ S 38°50′ E); Milangano (Nr. Tanga) Korogwe, Usambara Mts (05°10′ S 38°30′ E); Mambo, Usambara Mts (04°45′ S 05°38′ E); Kilimanjaro 1200-1500 m, Uzima dist. (02°30′ S 32°30′ E); Kahama (03°48′ S 32°18′ E); Morogoro; Mbugve; Korogwe-Msata Rd, 103 km N. Msata; Usambara Mts Sigi-Longuma; Korogwe-Handeni Road, 24 km NE. Sindeni, riverine grassland; Nr. Mgera, 102 km W. Sindeni, Korogwe-Kandea Rd; 10 km N. Mbwewe, bush fire; between Nombot and Korogwe, sisal plantation; Msata, summit of kopje (NHM, NHMA, NRI, LEM, SMNS, ZM). **Somalia**: Bidi Scionde; V. Duca degli Abruzzi; Afgoi Agric. Res. Inst., 30 km N. Mogadiscio; Alessandra Gelib (NHM, MCSN, NRI). **Ethiopia**: Meisso; Harerge Prov., Melka Werer; Lake Bishoftu, 2100 m; R. Hawash, Bukuru Brige; Danakil, Batie to Filoa; Shewa Prov., Giyan-Jima (NHM, NRI). **Uganda**: Semiliki Valley, Bwera Male (00°58′ N 30°11′ E); W. Nile Dist.; Karamoja (02°45′ N 34°15′ E); Acholi, Madi-Opei; Lango (02°00′ N 32°30′ E); Teriri-Dokolo (01°55′ N 33°10′ E) Moroto; Buruli (00°09′ S 30°05′ E); Butiaba

(01°50′ N 31°20′ E); Katanguru (00°08′ S 30°03′ E); Bugwere (01°05N (33°50′ E); Bululo (NHM, NRI, MCSN). **Botswana**: Serowe, Swaneng Hill (22°25′ S 26°44′ E); Gaberone; Lobatse (NHM, NHMA, DATS). **Zaire**: Mahagi Port (02°09′ N 31°14′ E); Ishwa, Lake Albert; Katala, Lake Albert; Kasenyi, Lake Albert (labelled as *prasina* by V M Dirsh, 1959); Ituri, Kasennye; Nioka; Katanga (NHM, MRAC, IRSNB). **Zambia**: Lusaka (NHM). **Malawi**: Shire River at Kapichira falls *c.* 150 m (15°53′ S 34°45′ E); Lengwe National park *c.* 170 m. (16°16′ S 34°39′ E); Thyolo Escarpment 10 km E. Chikwawa (16°01′ S 34°52′ E); Milanje Massif, west face, Likhubula Forestry dept. *c.* 1000 m (15°56′ S 35°30′ E); Zomba; Zomba plain; Zomba plateau; Blantyre; Fort Lister (NHM, NRI, ANS). **Zimbabwe**: Mashonaland, Salisbury; Mazoe; Mt. Selinda; Nr. Chirindi forest; Matapos hills; Nyanga; Odzi dist. (15°59′ S 32°29′ E) (NHM, NRI, ANS, NHMA). **Angola**: Mu-Simoj R.; 30 km SW. Gabela; Moxico Dist., 1500 m; Carula Isku (NHM, IIA). **Mozambique**: Luaho-Beira; Busi River; Zambezi River; Delagoa bay; Inhaca Island; Quelimane Dist., Niodaula; Massangeria; Cumbana Dist., Inhambane; Mucheve (20°34′ S 33°49′ E) (NHM, NRI). **Namibia**: E. Caprivi Zipfel; Sangwali Plains, Kwando River; Kwando R. W. Caprivi; Mariental (24°38′ S 17°58′ E) (DATS). **Lesotho**: Mamathes (29°08′ S 27°51′ E) (EMZI). **South Africa**: Natal, Zululand; Transvaal, Rustenburg; Bloemfontein; Hartebeste poort dam (25°50′ S 27°50′ E); Pretoria; Zoutpansburg; Johannesburg; Kiprievensburg; Zululand (no other data); Queenstown, Cape Prov.; Tongaland Mansongwenya, Lake Shaya; 45 km NW. Pretoria; 45 km E. Trichardt, Entobeni forest; Lebombo Mts, Crocodile R. Camp, Kruger National Park; 20 km S. Mtubatuba; Magwafontein, 25 km S. Kimberley Natal, Adams Mt. St; Natal, Hluhluwe Game Reserve; Transvaal, Kruger National Park Leeu Pan, NE. Skukoza; Transvaal: 22 km E. Graskop; Pretoria, Witbank; Chilovane, Zoutpan Dist.; Natal: Sodwana bay N.P. heaths; Natal: Port Shepstone; Gonlo (?) (NHM, NRI, EMZI, ANS, DATS). **Swaziland**: Mbabane; 3 km S. of Ehlane Game Reserve, acacia bush (NHM, ANS).

Orthochtha dasycnemis bisulcata (Krauss 1877)

(Figures 12,16,18, distribution – Figure 4)

Phlaeoba bisulcata Krauss 1877: 52. Neotype male, SENEGAL: Savoigne, (NHM) here designated [examined].

Orthochtha bisulcata (Krauss); Kirby 1910: 141.

Orthochtha dasycnemis bisulcata (Krauss); Popov and Fishpool, 1988: 300, redescription.

Diagnosis

As for group and in Key 3. Differs from nominate subspecies in larger size, more robust build, wider frontal ridge and fastigium verticis; less divergent pronotal carinae, heavier lophi, larger spermatheca and more markedly trilobate subgenital plate in female. Coloration predominantly shades of green to yellowish-green to stramineous; brown forms rare. Lateral fasciae well developed in male, much weaker in the female; hind wings hyaline; hind tibiae dirty-pink, less bright than in *d. dasycnemis*. Geographical variation much less marked than in *d. dasycnemis*. Some specimens from Lake Chad with markedly sellate pronota and divergent lateral carinae, particularly marked in female. Some of the latter collected by Gwynn and Golding are possibly the origin of the record of '*Rasperecta*' sp. cited by Golding (1948: 531).

Orthochtha d. bisulcata and *O. d. dasycnemis* are clinally linked in the Sudan and Uganda, where intermediates occur.

Measurements

As in Table 5.

Material examined

Neotype M, **Senegal**: Savoigne, 35 km E. St. Louis, 24.ix.1982 (*Fishpool*) (NHM). Topotypes: **Senegal**: 10 M, 3 F, same data as neotype (NHM); 1 M, Savoigne, 11.ix.1982, 3 M, 1 F, ditto 12.x.1982 (*Fishpool*); 3 M, 3 F, Lampsar, 22.ix.1982; 3 M, 2 F, 12 km E. St. Louis, 13.x.1982 (*Fishpool, Din and Sundermeyer*) (NHM, NRI, IFAN, MNHN, NM).

Senegal: I F, Bandia, 7.x.1958, 1 F, 2 F, Lac Tanma (14°53′ N 17°04′ W), 20.ix.1961 (*Condamin*) (IFAN); 2 M, 1 F, Almadies, 18.viii-20.iv.1962; 5 M, 6 F, Koalack, 11-19.ix.1962; 1 M, Mbour Nyae 21.viii. 1962 (*Farrow*) (NHM); Dakar, Lac Tanma, Kayer, Mboro, Richard Toll, x-xii.1967 (MNHN); 1 M, Ziguinchor 4 M, Kaolack, 11-13.ix.1962 (*Farrow*) (LEM). **Mauritania**: 1 M, 2 F, Nr. Nema, ix.1961 (*Popov*) (NHM). **Gambia**: 12 M, 1 F, Bakau, Cape St. Mary, 56.xi.1977 (*Lund University Exp. Senegal/Gambia*) (EMZI). **Guinea Bissau**: 2 M, 1 F, Farim area, xii.1985 (*Popov*) (NRI). **Mali**: 4 F, Doro, Gourma (16°09′ N 00°51′ W), 6.x.1959 (*Popov*) (NHM); 1 M, Buonankodje (*Demange*); 1 M, 2 F, Dioura (14°18′ N 05°15′ W), vii.1956; 1 M , 1 F, Dogo, viii.1954; Ourondia-Dogo, iii.1957 (*Davey*); 1 M, Dogo, 3.x.1950 (*Remaudiere*) (NHM); 1 M, Kogoni (14°44′N 06°02′W) (MNHN). **Benin**: 1 M, 2 F, Malanville, x.1977 (*Yonli*); 1 M, 1 F, Malanville, 16.ix.1978 (*Popov and Fishpool*) (NRI). **Niger** 1 M, Tahoua, ix. 1960 (*Popov*) (NHM); 4 M 8 F, Beylandé (12°42′ N 02°52′ E), 14.ix. 1978; 8 M, 3 F, ditto, 5.xi. 1978 (*Popov and Fishpool*) (NRI). **Nigeria**: 2 M, 3 F Kalkala, viii.1934; 2 M, 6 F, 19.ix.1933 (*Gwynn*); 1 M, Kalkala, 30.ix.1931; 1 F, Malari ((12°57′ N, (10°32′ E), 5.i.1933 (*Golding*) (NHM) [some of these specimens have sellate pronota (p. 56)]; 1 M, 1 F, Baga, Lake Chad, 4.xi.1970; 1 M, 50 km S. Bama, 14.xi.1970 (*Popov*) (NRI); 7 M, 2 F, Dikwa area (12°02′ N 13°55′ E) 4.x.1971 [some of these specimens have sellate pronota]; 2 M, 2 F, Alyas Market, 18 km SE. Mongonu, 27.ix.1971; 1 M, Mintaur – Marte, 2.x.1971 (*Jago*) (NRI). **Cameroon**: 2 M Kolofata, 500 m, 16.x.1975 (*Descamps*) (MNHN); 2 M Nr. Guirvidig (10°53′ N 14°50′ E), 10.xi.1980; 1 M, Yagoua-Pouss, 10.xi.1980 (*Popov and Jago*) (NRI); 1 M, Alagarno (11°00′ N 14°42′ E) 300 m, 17.ix.1975 (*Descamps*) (MNHN). **Chad**: 1 F, N'Gouri, Dist., Kanem, ix.1958 (*Renaud*) (MRAC). **Sudan**: 2 M, 2 F, Ghadambalya, 50 km W. Gedaref, viii.1948 (*Joyce*) (NHM); 2 M, 3 F, Gedaref, ix.1981 (*Popov and Fishpool*) (NRI).

Orthochtha dasycnemis trivittata (I. Bolivar 1912) **stat.n.**

(Figures 12,16, distribution – Figure 4)

Orthochtha trivittata I. Bolivar 1912: 77. Holotype male, ZAIRE (MRAC) [examined].

Diagnosis

Orthochtha trivittata I. Bolivar, regarded by Uvarov (1925: 273) as probably only a colour variant of *Orthochtha dasycnemis* and thus synonymous with it, is here retained as a subspecies. It differs from the nominate subspecies in: more slender and elongate habitus; frontal ridge narrow, strongly constricted at junction with fastigium of vertex (Figure 12G,H), fastigium vertex elongate in both sexes, arcuate sulcus deep and narrow. Pronotal disc broad, lateral carinae divergent in metazona (Figure 12I); ratio of prozona/metazona 1.3; cerci relatively more narrow and elongate and aedeagal valves thicker.

Coloration distinctive blackish-brown dorsally, particularly dark in male, merging with lateral fasciae, sides greenish to greenish-brown, underside and face brownish; hind wings infumate, hind tibiae dark reddish-brown.

The typical *trivittata* occurs in Shaba (Katanga) province of Zaire (the type locality), the adjacent parts of the Ufipa plateau of Tanzania and through much of Zambia; here it is so distinctive that it would merit recognition as a separate species, were it not for the numerous intermediate forms that link it with *O. d. dasycnemis*. These intermediates occur in Tanzania northwards to Kenya;

southwards through Malawi and Zimbabwe to Mozambique and westwards to Angola (Figure 4).

Measurements

As in the Table 5.

Material examined

Orthochtha trivittata I. Bolivar. Holotype M, **Zaire**: Katanga, Quamboia – Koloa, xi.1907 (*Sheffield-Neave*) (MRAC).

Zaire: 1 F, Lubumbashi, xi.1928 (*Seydel*); 1 M Madona-Bongweolo [? Bangweulu, Zambia], xii. 1907 (*Sheffield-Neave*) [bears label *O. brachycnemis* V M Dirsh]; 1 M, Sumba, xii.1907 (*Sheffield-Neave*); 2 M, Katanga-Lubumbashi (*Buttgenbach*) (MRAC); 1 M, no other data (IEE); 23 M, 12 F, Katanga-Elisabethville, xii.1938 (*Bredo*) (IRSNB); 7 M, 4 F, same data (NHM); 2 F, 1938 Lukafu (10°31′ S 27°33′ E), 6.xii.1938 (*Bredo*) (IRSNB); 1 F, same data (NHM); 1 M, Kalombo, 4.iii.1953 (*Vesey-Fitzgerald*) (NHM); 2 M, Katanga, 19-22.xii.1927 (*Burr*) (NHM) [The two Burr specimens are cited in Uvarov (1953: 149) as *Orthochtha prasina* (I. Bolivar) and one of them bears a label with the legend: '*Cymochtha prasina* I. Bol. Compared with paratype. Det. B.P. Uvarov, 1934'. It has also a hand-written label: 'This identification appears to be mistaken, this is *O. dasycnemis* E. Burtt, 1963'.] **Zambia**: 1 M, Mpika (11°54′ S 31°26′ E), xii.1907 (*Sheffield-Neave*) (MRAC); 1 M, Abercorn, Uningi plain, 2.ii.1961; 1 M, 1 F, Abercorn [now Mbala], Chiyanga, 6.xii.1961 (*Vesey-Fitzgerald*) (NHM); 6 M, 7 F Chingola, Kabundi Forest (12°32′ S 27°52′ E); 2 M, 1 F Ndola, i.1974; Lusaka, i.1974 (*Forchhammer*); 1 M, Ndola, ii.1958 (*Johnsen*) (NHMA). **Tanzania**: 1 M Ufipa, 13.i.1948 (*Burnett*) (LEM); 1 M Tukuyu, 1500 m, x.1923; 1 F, same data, xi.1923; 2 F, same data, xii.1923 (*Miller*) (NHM). **Malawi**: 1 M, Zomba plateau, xi.1973 (*Brown*) (DATS); 1 M, 1 F Zomba township, 19.xi.1973 (*Dudley*); 2 M, 1 F, Zomba plateau; 1 F, Chikowi/Mwambo region, xi-xii.1983; 1 M, Chitedzi, xi.1985 (*Murlis*) (NRI). **Zimbabwe**: 1 M, Odzi Dist. (18°59′ S 32°29′ E), 25.xi.46 (*Miller*) (NHM).

Orthochtha dasycnemis alca (I. Bolivar 1908) **stat.n.**

(Figures 14,16, distribution – Figure 4)

Orthochtha alca I. Bolivar 1908: 243. Holotype male and allotype female, TANZANIA (IEE) [examined].

Orthochtha squamipennis Ramme 1929: 266. Holotype male, TANZANIA (MNHU) [examined]. **Syn.n.**

Diagnosis

Differs from nominate subspecies in slightly smaller size and more slender build. Vertex more elongate, frontal ridge and fastigium narrower (Figure 14B,L); disc of pronotum relatively narrow and parallel-sided; mesosternal interspace narrower; tegmina reduced, barely reaching middle of abdomen in male, somewhat longer in female; hind wings even more reduced, barely 3/5 length of tegmina. External and internal genitalic structures in both sexes as in *O. d. dasycnemis*. Coloration very similar to *O. d. dasycnemis* from adjacent parts of area of distribution.

Distribution and geographical variation

See under *O. d. lindneri* (p. 59).

Measurements

As in Table 5.

Material examined

Orthochtha alca I. Bolivar. Holotype M is labelled 'Holotype' and bears the locality label 'Dar es Salam' (no other data; the addition of 'Ituri (Congo)' in original description is not supported by specimen label); the F is labelled 'Alotypo' and 'Dar es Salam, Rolle' (IEE).

Orthochtha squamipennis Ramme. Holotype M, **Tanzania** Mohoro (Ost-Afrika), vi.1904 (*Vosseler*) (MNHU).

Tanzania: 8 M, 2 F, Dar es Salaam, xi.1965 (*Jago*); 17 M, 1 F, University College Campus, 12 km W. of Dar es Salaam, 31.x-4.xi.1964; 1 M, same data, v.1966 (*Jago*); 2 M, University of Dar es Salaam, vi.1973 (*Einyu*); 4 M, Pugu hills, SW. of Dar es Salaam airport, 150 m, 25.ix.1982 (*Jago*) (NHM, NRI). **Mozambique**: 1 M, Port Amelia (12°75′ N 40°30′ E), 1914 (*Beste*) (NHM). **Tanzania**: 1 M (*alca-dasycnemis* cline), Dar-Tanga Road, 180 km from Tanga, 6.vi.1972 (*Forchhammer*) (NHMA).

Orthochtha dasycnemis lindneri (Kevan 1955) **stat.n.**

(Figure 14, distribution – Figure 4)

Orthochtha lindneri Kevan 1955: 483. Holotype male, TANZANIA (SMNS) [examined].

Diagnosis and affinities

Closely related to nominate subspecies and to *O. d. alca*, and, like the latter, is brachypterous. Differs from *alca* in heavier build, somewhat larger size and less acute head; hind femur proportionately longer and more slender in *lindneri*, particularly in male, length/width ratio being 6.1-6.4 in *alca* and 6.8-7.3 in *lindneri*.

Distribution and geographical variation

The specimens attributed to *O. d. alca* are from the coastal areas of Tanzania and Mozambique, while those diagnosed as *O. d. lindneri* come from the interior, mostly from localities along the Rift Valley, extending from the southern border of Tanzania to the shores of Lake Victoria in Kenya. As in *O. d. dasycnemis*, there is marked geographical variation. The smallest and most slender specimens of *d. alca* are from Port Amelia and Mohoro (the type locality of *O. squamipennis*); conversely, the largest and most robust *lindneri* are from Old Shinyanga, Torina and Tindiga. Torina is the type locality of *lindneri*, while Tindiga is the type locality of *O. dimorpha* Miller, of which the female paratype is a misidentification of *O. d. lindneri*. There is also a parallel variation in coloration; with *d. alca* dark-hued while *d. lindneri* is usually paler with the greatest amount of green; specimens of *d. lindneri* from Kisumu are, however, intermediate.

Orthochtha d. dasycnemis, *O. d. lindneri* and *O. d. alca* appear to be largely allopatric. Over much of their range the two brachypterous subspecies are separated by a broad belt of drier country; the two have different life cycles, *alca* is probably bivoltine and *lindneri* univoltine (p. 43). It is thus possible that their brachyptery might have arisen independently. This is supported by the fact that where the two brachypterous subspecies meet the nominate there is a convergence of characters and clinal forms, for example, specimens with tegmina and wings of intermediate length are known. The best examples are: *alca-dasycnemis*, **Tanzania**: 1 M, Dar-Tanga road, 180 km from Tanga (NHMA) and *lindneri-dasycnemis*, **Kenya**: 1 M, Mohoroni (NHMA) and 1 M, 2 km northeast of Mara bridge (NRI).

Measurements

As in Table 5.

Material examined

Orthochtha lindneri Kevan. Holotype M, **Tanzania**, Torina (02°10′ S, 34°40′ E), 4-18.iii.1952 (*D. O. Afrika Exp.*) (SMNS).

Orthochtha dimorpha Miller. Paratype F, **Tanzania**, Tindiga, 10.vi.1926 (*Miller*) (NHM). (Misidentification: see above and p. 86.)

Tanzania: 15 M, 9 F, Old Shinyanga (03°33′ S 33°24′ E), 8.iii-2.iv.1937; 9 M, 2 F, Tinde (03°53′ S 33°12′ E) iv.1945 (*Burtt*); 1 F, Mbayala, 25.i.1952, 1 M, 1 F, Kifumangao (07°32′ S 39°16′ E) (*Knipper*); 5 M, 8 F, Rukwa: Mkumbwa-Kati, Niombe Mbuga, 19.iv.1956; 11 M, 21 F, Kapalala Mbuga (08°15′ S 32°50′ E), 22.iii.1956; 1 M, Mkulwitimba Mbuga, 14.iii.1956; 3 M, ditto, 25.iv.1956; 2 M, 2 F, Lundi Mbuga, 17.xii.1953; 4 M, Kafukola, 29.iii.1956 (*Robertson*); 1 M, Nzega, 1 M, Santa, 7.ii.1962, 1 F, Nzega, roadside near old Nzega camp, 22.x.1958 (*Vesey-Fitzgerald*) (NHM). **Kenya**: 9 M, 4 F, Kisumu-Chemelil, lacustrine grass plain and thicket, route C34, 10 km SE. of Kisumu, 27.x.1982 (*Jago*) (NRI); 1 M, Kisumu, xi.1939 (*Oniko*) (NHM). The *lindneri/dasycnemis* cline specimens: *Kenya*: 1 M, campsite 61B on Mara R., Neduga, about 2 km NE. of Mara bridge (01°12′ S 35°03′ E), 1700 m, 24.iii.1975 (*Robertson and Robertson*) (NRI); 1 M, Mohoroni, 22.vii.1975 (*Trolle*) (NHMA).

Orthochtha dasycnemis nana subsp.n.

(Figures 13,17, distribution – Figure 4)

Diagnosis

Below average size, slender; antennae in male scarcely longer than combined length of head and pronotum. Frontal ridge with narrow, well-raised, slightly undulate, divergent margins; fastigial constriction marked; fastigium elongate-oblong in male, rounded, with indistinct margins in female. Pronotal disc relatively broad, carinae linear, parallel in prozona, markedly divergent in metazona; ratio of prozona to metazona 1.3; lower margin of lateral lobe undulate, hind angle acute, produced. Tegmina and wings relatively wide, extending to, or beyond, the tip of abdomen. Hind femur rather thick, length/width ratio less than 6. External and internal genitalia as in Figures 13 and 17, similar to *O. d. dasycnemis*. Coloration resembling *O. d. trivittata*, dark, blackish-brown dorsally, somewhat paler ventrally; hind tibiae brick-red, wings infumate, costal and precostal areas of tegmina pale greenish.

Affinities

Orthochtha d. nana is nearest to the nominate subspecies, differing from it in smaller size and darker coloration, as well as in proportionately more robust build. The smallest and darkest specimens are from the type locality, Cathedral Peak on the Drakensberg escarpment, South Africa at 2000 m; specimens from lower altitudes are larger, paler and closer in appearance to the nominate subspecies.

Measurements

As in Table 5.

Material examined

Holotype M, **South Africa**: Natal, Little Berg, Cathedral Peak (28°57′ S 29°12′ E), 24.xi.1963 (*Brown*) (DATS). Paratypes: **South Africa**: 5 M, same data as holotype (DATS); 1 M, same data as holotype (NHM); 1 M, Natal, Oliviershoek Pass, 25.i.1962 (*Pick*); 1 M, Transvaal, 25 km SW. Badplaas, 9.xi.1964 (*Brown*); 1 M, Johannesburg, Melvillekopjes, 20.iv.1963 (*White*); 1 M, Transvaal, 20 km SE. Machadodorp, 23.i.1963 (*Brown and Furst*); 1 M, E. Transvaal, 8 km NE. Kaapseehoop, 25.iv.1963 (*White*); 3 M, Karoo Region, Cape Prov., Bedford

South, 24.iv.1957 (*Brown*) (DATS); 1 M, Karoo, Cape Prov., Bedford South, 24.iv.1957 (*Brown*) (NHM); 1 F, OFS, Golden Gate, Nr. Clarens, Drakensberg, 13-16. xii.1982 (*Greyling*); 2 F, Pretoria, xii.1980 (*de Wet*) (DEU); 1 F, 1 F, Johannesburg, 2.iv.1943 (*Ramsay*); 1 M, Johannesburg, Modderfontein, iv.1939 (*Ramsay*); 1 F, Transvaal, Kilprieversberg, 3.v.1938 (*Burtt*) (NHM). **Lesotho**: 1 M, Maseru, Lancer's Gap, 22.iii.1951 (*Swedish S. African Exp., Brinck-Rudebeck*) (EMZI). **Mozambique**: 1 M, Delagoa, 1894 (*Ex coll. A. Finot*) (NHM).

Orthochtha dasycnemis somalica **subsp.n.**

(Figure 13, distribution – Figure 4)

Diagnosis

Size relatively large (male, 28 mm), slender, pronotum distinctly sellate, with posteriorly divergent metazonal lateral carinae; tegmina and wings elongate, extending well beyond the hind knee; hind femur slender, length/width ratio 7.5. Diagnostic morphological characters less pronounced in female paratype. Coloration similar to the stramineous form of *O. d. dasycnemis.*

Affinities

Orthochtha d. somalica is closely related to *O. d. dasycnemis*, but is sufficiently distinct to be recognized as a subspecies.

Material examined

Holotype M, **Somalia**: Northern Region, Haud (08°28′ N 45°38′ E), 760 m at light, 23.v.1932 (*Taylor*) (NHM). Paratype F, **Somalia**: Northern Region, Buran (10°13′ N 48°47′ E), 900 m, 14.ix.1929 (*Collenette*) (NHM).

Measurements

As in Table 5.

Orthochtha browni **sp. n.**

(Figure 17, distribution – Figure 4)

Diagnosis

Size small (Table 5), slender. Antennae in male longer than, in female as long as, combined length of head and pronotum. Vertex pointed, frontal ridge of medium width, weakly sulcate, with narrow, raised, weakly divergent margins, fastigial constriction marked; fastigium elongate-oblong in male, barely longer than broad in female. Pronotal disc narrow, carinae linear, lateral carinae parallel in female, weakly divergent in metazona in male; lower margin of lateral lobe straight or broadly bent, hind angle acute, produced. Tegmina and wings abbreviated in both sexes, not reaching tip of abdomen. Hind femur slender, length/width ratio greater than 6; both lower knee lobes subacute, inner upper lobe distinctly produced. Internal genitalic structures as in Figure 17C; broadly of *O. dasycnemis* type.

Coloration pale brownish above, greenish laterally; antennae brownish, darker apically in male, but not in female; lateral fasciae narrow and weak, particularly so in female. Hind femur greenish-brown basally with a reddish wash apically; the coloration brighter in male; hind knee dark in male; hind tibiae clear deep pink.

Measurements

As in Table 5.

Affinities

The species shows close affinities with *O. dasycnemis* but in the absence of intermediates it is erected as a closely related species rather than a subspecies. It is notable for the following features: small size; elongate habitus; elongate, slender hind legs; short, tapering tegmina and wings and coloration.

Material examined

Holotype M, **South Africa**: N. Transvaal, Magoebastkloof (23°15′ S 30°02′ E), 12.iii.1953 (*Brown and Furt*) (DATS). Paratypes: **South Africa**: 1 F, same data as holotype, (DATS); 2 M, 8 km NE. Duiwelskloof (23°42′ S 30°08′ E); 4 M, Magoebaskloof, 12.ii.1963, (*White*) (DATS); 1 M, Magoebaskloof, 12.ii.1963, (*White*); 1 F, 9 km NE. Haenertsburg (24°00′ S 29°50′ E), 16.iii.1963 (*White*) (NHM).

Distribution (Figure 4)

Orthochtha browni **sp. n.** is known from localities that lie on the Drakensberg Escarpment at a mean altitude of 1700 m, overlooking the Lowveld. Facing the sea, these areas receive heavy precipitation during the summer months. The vegetation is climax mist forest and montane grassland. This information was provided by Dr H. Dick Brown, the well-known acridologist from the Plant Protection Research Institute of Pretoria, after whom the new species is named. Dr Brown also states that several other endemic Acridoidea are known from this locality, for example, species belonging to the genera *Thericles*, *Parasphenella* and *Stenoscepa*.

Orthochtha modesta sp. n.

(Figures 13,17, distribution – Figure 4)

Diagnosis

Size small (Table 5), slender. Antennae narrowly ensiform, about as long as combined length of head and pronotum. Integument matt, sculpturing weak. Head in profile acute, face oblique; frontal ridge moderately wide, sulcate, margins linear, weakly divergent downwards, fastigial constriction marked. Fastigium verticis elongate, margins slender, well-defined; median carinula and arcuate sulcus weak, sulcus positioned well forward. Pronotal disc rather broad, with well-raised margins, the lateral ones parallel in prozona, divergent in metazona; all three transverse sulci distinct, ratio of length of prozona to metazona 1.3; lateral lobe with lower margin more or less straight, ascending forward, its hind lower angle straight, sharp. Tegmina and wings extending beyond tip of abdomen, but not reaching hind knee; tegmina with expanded precostal field and broadly rounded apices; wings relatively narrow, broadly rounded apically. Hind femur moderately heavy, length/width ratio 5.0; upper knee lobes not produced, the lower outer lobe rounded, the inner subacute. Male supra-anal plate rather short, broad at base, with narrowly rounded apex; cercus relatively short, slender, weakly flattened laterally. Bridge of epiphallus very narrow, with pronounced median projection; lophi narrow, rounded, upturned at right angle; apical valves of aedeagus slender (Figure 17B).

Coloration brownish-stramineous dorsally, faintly greenish laterally; lateral fasciae faint, narrow on head, broadening on pronotum; hind femur darker brown on upper side, only genicular crescent darkened; hind tibiae and tarsi dirty brown; spines ivory-white, tipped with black; wings not infumate.

Measurements

As in Table 5.

Affinities

Nearest to *O. dasycnemis*, but differing from it principally in smaller size, shorter and narrower antennae, the structure of fastigium verticis and the external and internal genitalia of the male.

Material examined

Holotype M, **South Africa**: Eastern Orange Free State, Clarens Dist., 22.x.1958 (*Brown*) (DATS). Paratypes: 1 F, same data as holotype (DATS); 1 M, same data as holotype (NHM).

Distribution

This is another endemic from the Drakensberg; according to its collector, although Clarens lies somewhat farther inland from the escarpment and is connected to the Maluti mountain range, it has an ecology essentially similar to that of the eastern Escarpment. See under *O. browni*, p. 61.

***Orthochtha elegans* sp. n.**

(Figures 13,17, distribution – Figure 4)

Diagnosis

Similar in size to *O. dasycnemis*, but distinctly more slender and elongate. Antennae extend backwards almost reaching base of hind femur in male and longer than combined length of head and pronotum in female; somewhat more dilate than in *dasycnemis*. Apex of head acute, frons strongly oblique (Figure 13B); frontal ridge narrow, with undulate, well-defined margins; fastigium verticis parabolic, distinctly longer than wide, moderately convex, with well-defined median carinula; fastigial arcuate sulcus weak and in median position. Pronotum tectiform, with all carinae well-developed, the lateral ones straight, scarcely divergent caudad; second and posterior sulci strong, ratio of length of prozona to metazona 1.6; lower margin of lateral lobe straight, hind angle acute, produced. Mesosternal lobes well-rounded, interspace less than half width of lobe. Tegmina and wings narrow, tapering, extending beyond tip of abdomen but not reaching hind knees. Hind femur moderately long and slender, length/width ratio 7.2 in male and 6.8 in female; upper inner knee lobe weakly produced, lower lobes as in *dasycnemis*. External and internal genitalic structures as in *dasycnemis*, but male cerci somewhat broader and flatter basally and epiphallic bridge plate and lophi heavier than in *dasycnemis* (Figure 17A).

General coloration yellowish-green to brownish, darker dorsally; lateral fasciae weak and narrow, brownish in both sexes. In some specimens pre-costal field with speculum of brighter green or whitish. Hind tibiae and tarsi dirty-brownish, genicular crescent narrowly darkened, spines tipped blackish-brown.

Measurements

As in Table 5.

Affinities

Orthochtha elegans **sp.n.** is related to *O. dasycnemis*, from which it differs in its more slender build, wider antennae, and details of structure of head, pronotum and male genitalia.

Material examined

Holotype M, **Zaire**: Nyangwe (08°08′ S 26°43′ E), 19.iv.1920 (*Ghesquière*) (MRAC). Paratypes: 6 M, 9 F, same data as holotype (MRAC); 1 M, 2 F (NHM); 1 M, 1 F (NRI); 4 M, 6 F (MNHN). **Zaire**: 4 F, Katanga, Nyonga, v.1925 (*de Witte*); 1

F, Katanga, Kibras, i-ii.1927 (*Bayet*) (MRAC); 1 F, Kibangula (04°53′ N 27°04′ E), 10.24.ix.1958 (*Henry*); 1 M, 3 F, Maka-Lualaba, 25.i.1939 (*Bredo*) (IRSNB); 2 M, 3 F, Kalombo (08°18′ S 26°19′ E), 4.iii.1953 (*Fitzgerald*) (NHM); 3 M, Nr. Lubumbashi, 1300 m, xi.1970, vi.1971, ii. 1972 (*Bouvy*) (IRSNB, NHM).

Distribution (Figure 4)

The Congo basin.

Discussion

All the MRAC material bears the name label '*Orthochtha prasina* I. Bol. V M Dirsh, 1959'. *Orthochtha prasina* was subsequently wrongly synonymized under *O. dasycnemis* by Dirsh (1970: 436) where the material from Nyangwe *inter alia* is cited as *dasycnemis.*

Orthochtha pulchripes sp.n.

(Figure 18, distribution – Figure 4)

Diagnosis

Only female known. Similar in size and general coloration to *O. dasycnemis bisulcata* from same locality, around Lake Chad basin, differing from it in somewhat shorter and more rounded head, broader frontal ridge, more rounded lower hind angle of lateral pronotal lobe, shorter and thicker cerci, and coloration of hind tibiae, which are dark vinous red, deepening to almost black basally and apically; dark pigment invades base of tarsi but remainder is contrasting ivory white. In *dasycnemis* tibiae pink.

Measurements

As in Table 5.

Affinities

Appears to be a close relative of *O. dasycnemis bisulcata* but its exact position cannot be determined in the absence of the male.

Material examined

Holotype F, **Nigeria**: Lake Chad, 2.4 km SW. Aliyas Market, 17.8 km SE. Mongonu, 27.ix.71 (*Jago*) (NHM). The holotype is unique.

Distribution

Only known from the type locality.

Orthochtha dimorphipes Uvarov 1953

(Figure 19, distribution – Figure 6)

Orthochtha dimorphipes Uvarov 1953: 147, Figure 180. Holotype male, ZAMBIA (NHM) [examined].

Diagnosis

In size and general appearance it is similar to *O. dasycnemis,* differing from it and other *Orthochtha* species by, amongst other characters, sexual dimorphism in colour of hind tibiae – bluish-grey in male and pinkish in female. However, where ranges of *O. dasycnemis* and *O. dimorphipes* overlap they may be difficult to separate, especially females. To facilitate identification, a comparative table (Table 6) is given below and illustrated by Figure 19A-M.

Table 6 Comparison of characters distinguishing *O. dasycnemis* and *O. dimorphipes*

Character	*O. dasycnemis*	*O. dimorphipes*
Sculpturing	coarser (Figure 19F,b)	finer (Figure 19F,a)
Frontal ridge	narrower, less expanded between antennae	broader, more expanded between antennae
Dorsum of pronotum	broader, more widened caudad, l/w ratio* M 2.2, F 2.1	narrow, less widened caudad, 1/w ratio* M 2.4-2.5, F 2.4-2.5
Lower hind angle of lateral lobe	sharper (Figure 19G,b)	more rounded (Figure 19G,a)
Cerci	narrower (Figure 19I,b)	broader (Figure 19I,a)
Epiphallic lophi	narrow (Figure 15B,C)	broad (Figure 19L,a)
Aedeagal valves	fine (Figure 15E,F)	thick (Figure 19L,a)
Spermatheca	smaller (Figure 19M,b)	larger (Figure 19M,a)
Coloration[†]		
Antennae	lighter (brownish in M)	darker (blackish in M)
Lateral fasciae	lighter (brownish in M)	darker (blackish in M)
Hind knee	lighter (brownish in M)	darker (blackish in M)
Hind tibiae	pinkish in M and F	bluish-grey in M pinkish in F

Notes:
* l = maximum length of dorsum; w = its width at posterior sulcus.
[†] Colour differences always more pronounced in males.

Measurements

As in Table 5.

Affinities

Orthochtha dimorphipes appears to be nearest to *O. dasycnemis,* which it resembles superficially, particularly the female. The female genitalic structures are also rather similar, but they differ considerably in the male. This suggests that the relationship is a distant one and that within the *dasycnemis* species-group, *O. dimorphipes* occupies a marginal position.

Material examined

Orthochtha dimorphipes Uvarov. Holotype M, **Zambia**: Luano Valley, Chisorwe, ii.1928 (*Burr*) (NHM). Paratypes: 20 M, 9 F, same data as holotype (NHM).

Zambia: 1 M, Livingstone, 26.iv.1975; 1 M, Chingola, 10.ii.1974 (*Forchhammer*) (NHMA); 1 M, Chisamba, 14.iv.1968 (*Denning*) (NHM). **Tanzania**: 1 M, Mpwapwa (06°21′ S 36°29′ E), 1300 m, 10.iv.1948 (*Wilkins*); 1 M, Kikombo, Mpwapwa (06°14′ S 35°59′ E), 16.iv.43 (*Burtt*) (NHM). **Zaire**: 1 M, Congo da Lemba, vi.1911 (*Mayne*) (MRAC). (Identified as *O.prasina* (I. Bolivar) by V. M. Dirsh, label date 1959.) **Mozambique**: 3 M, Mucheve, 6/13.iv.1965 (*Fereira*) (NRI). **Zimbabwe**: 1 F, West Nicholson, Masase (21°04′ S 29°22′ E), 1934 (*Bergman*) (NHMA); 1 M, 1 F, Magunje (16°50′ S 29°26′ E), 13.ii.1953 (*Boyd*); 5 M, 4 F, Umtebekwe River, 1000 m, 24.iii.1935 (*Miller*) (NHM); 1 M, 2 F, Shamra, 1000 m, 7.iii.1935 (*Miller*) (NHM). **Angola**: 3 M, Beihenga, 6.iv.1972; 1 M, Chiansa, s/ Hospedero; 1 F, D. de Braganza, 20.iii.1972 (*Carvalho*); 1 F, Sa de Bandeira, 31.iii. 1977 (*Maia*) (IIA); 2 M, 1 F, 20-22 km NW. Sa de Bandeira, Huila Dist., 24.iv.1971 (*Brown*) (DATS); 2 M, 2 F, Loanda, iv.1927; 1 M, Amboim, 22.iv.1927 (*Burr*); 1 F, Congulu, iv.1934 (*Jordan*); 1 M, Dist. de Moxico, Villa Loso, 1000 m, v.1927 (*Burr*) (NHM); 2 M, 1 F, Bruco, 26.ii-2.iii.1972; 2 M, 2 F, Salazar (09°18′ S 14°54′ E), 9.iii.1972; 18 M, 22 F, Sa de Bandeira (14°29′ S 14°10′ E), 22-24.iii.1972; 5 M, 3 F, Nr. Cacula, 5-25.iii.1972; 4 M, 1 F, Mt. Labiri, 10 km NW. Alto Hama (12°14′ S 15°33′ E), 7.iii.1972; 1 M, Duque de Bragança, 12.iii.1972; 1 M, Sta Comba, 8.iii.1972; 1 M, 3 F, 8 km NE. Negda, 25.iii.1972; 1 M, Roçadas, 30.iii.1972 (*BM S.Afr.Exp.*) (NHM). **Namibia**: 5 M, Kombat, 1-6.iv.1972; 1 M, 2 F, Rietfontein, 37 km SW. Grootfontein, 3.iv.1972; 1 M, 1 F, Gobiswater farm, 20 km N. Grootfontein, 5.iv.1972; 1 M, 1 F, Regenstein, 20 km

SSW. Windhoek, 9.iv.1972 (*BM S.Afr.Exp.*) (NHM); 1 M, 22 km N. Windhoek, 3.iv.1970; 1 F, Ovamboland, Ruacana Falls, 22.iv.1970; 1 F, 80 km SE. Ondongua, 20.iii.1971; 1 F, Kaokoveld, Omuhonga Mts, 7.iv.1970 (*Brown*) (DATS). **Botswana**: 8 M, 9 F, Serowe, Swaneng hill, xii-iii.1978-1980; 1 M, Serowe (*Forchhammer*) (NHMA); 1 M, Kuke pan, at light, 14-15.iv.1972; 1 M, Moremi Reserve (19°23′ S 23°33°E), 18-20.iv.1972 (*BM S.Afr. Exp.*) (NHM); 1 M, Selina Slipway, 17.iv.1971 (*Tunstall*) (NRI). **South Africa**: 1 M, 45 km NW. Pretoria, 3.iii.1961 (*Brown*); 1 M, Pretoria, 18.xii.1958 (*Venter*) (DATS).

Distribution (Figure 6)

Africa south of Tanzania-Zaire.

Biology

Very little is known, but the label data suggest that the species is univoltine (Table 4). This species is apparently one of the most xerophilic of the genus, being found in savanna under woodland, mostly mopane but also the drier miombo, in the 200-500 mm annual rainfall zone.

The *Orthochtha brachycnemis* Karsch species-group

Diagnosis of the group

Genitalic structures in both sexes particularly distinct and diagnostic. Male cerci large and broad at base, more or less flattened and tapering apically; subgenital plate rather small and obtusely pointed; epiphallic lobes very short, but broad (Figure 21J); aedeagal valves slender and pointed. Hind margin of subgenital plate of female distinctly trilobate; spermathecal duct as in Figures 21D and 22I, with a twin double spiral and a large spermatheca. Both inner and outer lower hind knee lobes broadly rounded.

Key 4 *Orthochtha brachycnemis* species-group

1 General coloration brownish and dark shades of green, lateral fasciae dark-brown in M, faint in F; hind wing orange, cinnamon-red, or pink (colour may be faint in young specimens); found in derived grassland in forest zones (annual rainfall generally above 750 mm .... *O. brachycnemis* Karsch (see below)

(The nominate subspecies *O. b. brachycnemis* **stat.n.**, occurs everywhere within the species' range, except for the Ouaka area of the Central African Republic where it is replaced by *O. b. ottei* **subsp.n.**, recognized by its smaller size, pink wings, shorter and more rounded head, expanded pronotum, and narrow, pointed cerci (Figure 21).)

– General coloration lighter green-stramineous, lateral fasciae deep black in both sexes, hind wings hyaline; distribution and habitat association, edaphic grasslands in savanna zones (annual rainfall generally below 750 mm) 2

2 Male cerci rounded with inner face flat; distribution – Sudan savanna of western Africa from Senegal to Sudan .... *O. sudanica* Popov & Fishpool

– Male cerci pointed, inner face concave; distribution – savannas of central and southern Africa .... *O. tunstalli* **sp.n.** 3

3 Macropterous .... *O. t. tunstalli* **subsp. n.**

– Brachypterous .... *O. t. brachyptera* **subsp. n.**

Orthochtha grossa I. Bolivar, only known from one (damaged) specimen, can be recognized by its short, rounded head and swollen, heavily sculptured pronotum (Figure 21O,P).

Discussion

This is another distinctive complex centred on a common widespread species: *O. brachycnemis* Karsch. The species was originally described from Togo (Karsch, 1893: 62), and is now known throughout the forest zone from Senegal to

Zaire, Uganda and Tanzania, where it occurs in grasslands along the edge of, and in clearings within, forest. Although there is some geographical variation, this is less marked than in *O. dasycnemis* (p. 42), with the result that only one population is sufficiently distinct to merit recognition as a separate subspecies; it is that from Oka (Ouaka) in the Central African Republic, and is described here as *O. brachycnemis ottei* **subsp.n.** Conversely two species, *Cymochtha pachycerca* Karny 1915, from Guinea and *Orthochtha elgonensis* Sjöstedt 1931b, from Uganda are reduced to synonyms of *O. brachycnemis*.

Of the other species in the group, one is known from the Sudan savanna zone, extending from Senegal to the Sudan where it occurs in hygrophilous edaphic grasslands; it has been recently described as *Orthochtha sudanica* Popov & Fishpool 1988. The second is from similar habitat in central and southern Africa; it has long been known in museum collections, but has remained unnamed, or misidentified, for example, as *prasina* (Miller, 1936). It is here described and named as *O. tunstalli* **sp.n.** It is divisible into two subspecies, the nominate and *O. tunstalli brachyptera* **subsp.n.**

In addition to these, three other taxa appear to be related more closely to this group than to any other. One is *Orthochtha grossa* I. Bolivar, from Zaire, which is provisionally placed here but the unique female type is so badly mutilated that an accurate diagnosis is impossible. The two others are Asian, *Orthochtha indica* Uvarov, and *Orthochtha roffeyi* **sp.n.** (pp. 104-106), but their relationship to the species-group is more distant and they are not treated as part of it.

Two subspecies *O. brachycnemis ottei* **subsp.n.** and *O. tunstalli brachyptera* **subsp.n.** are recognized and described here. On the evidence available, both have strictly localized distributions. To minimize repetition therefore, the synonymies, diagnosis and other data for the species and the typical subspecies are given together.

Orthochtha brachycnemis Karsch 1893

(Figures 20, 21, distribution – Figure 5)

Orthochtha brachycnemis brachycnemis (Karsch 1893) **stat.n.**

(Figures 20, 21, distribution – Figure 5)
Orthochtha brachycnemis Karsch 1893: 62. Lectotype male, TOGO (MNHU), here designated [examined].
Cymochtha pachycerca Karny 1915: 127. Lectotype male, GUINEA (NM), here designated [examined]. (Synonymized by Popov and Fishpool 1988: 301.)
Orthochtha elgonensis Sjöstedt 1931b: 20. Lectotype male MT. ELGON (NR), here designated [examined]. **Syn.n.**

Diagnosis

Male below average size, female nearer average size, much bulkier (measurements in Table 7); of fusiform build, head obtusely pointed to bullet-shaped. Antennae narrowly ensiform, 1.2-1.4 times combined length of head and pronotum in male, 0.85-0.90 times in female. Frons oblique, straight to weakly convex in profile; frontal ridge sulcate, its margins converging towards ocellus, then moderately divergent below towards clypeus, fastigial constriction weak; fastigium of vertex elongate, parabolic, arcuate sulcus deep, in mid position, median carinula distinct, more so behind sulcus (Figure 20A). Pronotum tectiform, with straight lateral carinae only slightly divergent caudad; second and third sulci distinct, the first usually obsolete; prozona 1.45-1.6 times length of metazona. Lower hind angle of lateral lobe straight, sharp to narrowly rounded. Tegmina in male sometimes shorter but usually longer than tip of abdomen, in female usually shorter. Hind femur moderately long, ratio of length to width 6.7-7.5 in male, slightly less in female. External genital appendages of male as in Figure 20C,D. Subgenital plate in male rather small, simple, pointed; cerci large,

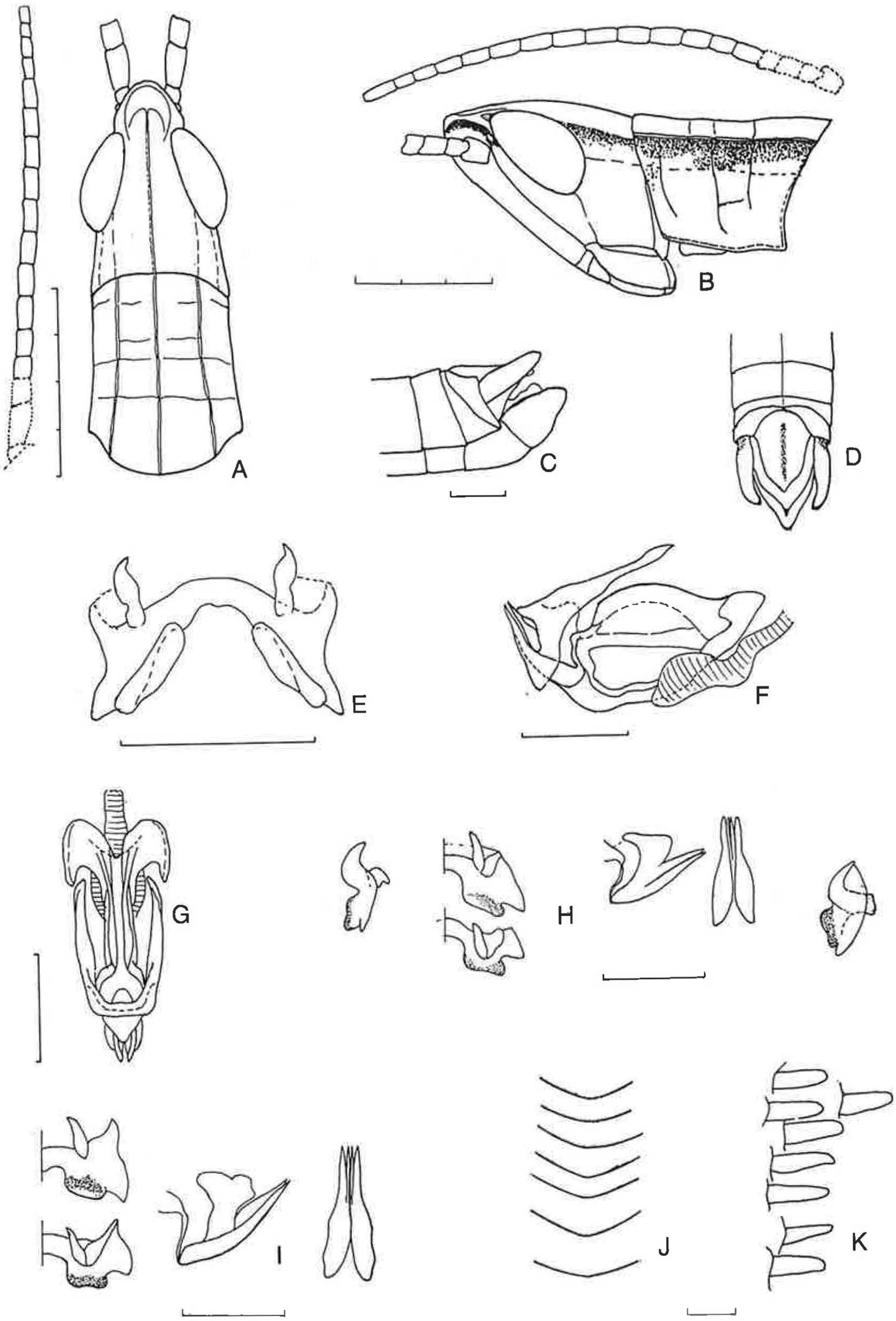

Figure 20 *Orthochtha brachycnemis* species-group. *O. b. brachycnemis* male lectotype (Togo). A, B dorsal and lateral views of antenna, head and pronotum; C, D lateral and dorsal views of tip of abdomen; E epiphallus; F, G lateral and dorsal views of phallic complex with epiphallus removed; H epiphallus and apical valves of aedeagus from a specimen from Uganda; I *idem*, holotype of *pachycerca* (Guinea); J, K variations in the hind angle of the pronotum and of the cercus. For explanations of E-I see Figure 15. Scales in mm. A-G drawn by Ms D. E. Johnstone, LEM. Partly modified from Popov and Fishpool in Mestre (1988).

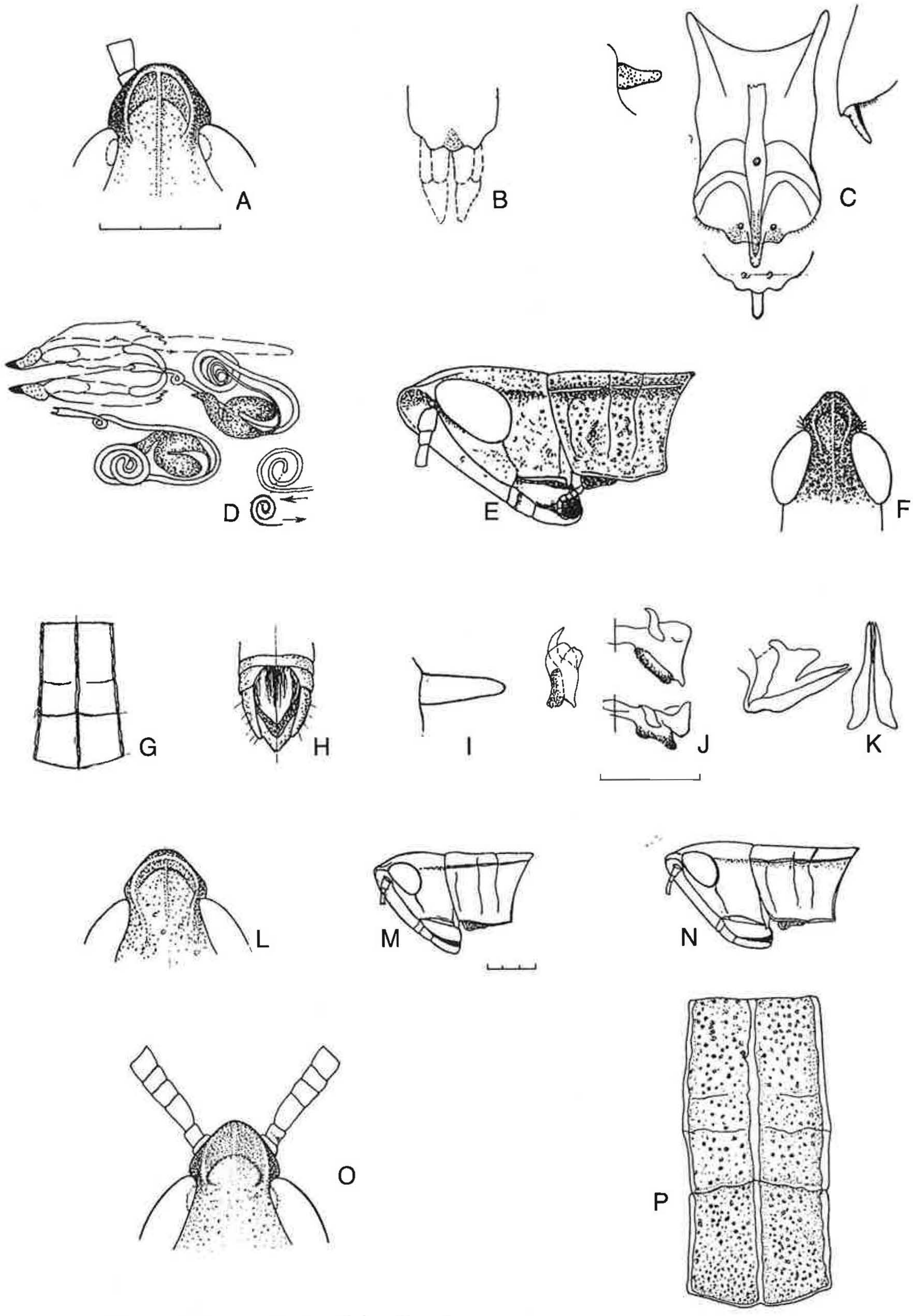

Figure 21 *Orthochtha brachycnemis* species-group. A-D, N *b. brachycnemis* female; E-M *b. ottei* **subsp.n.** (E-K male, L, M female); O, P *grossa* female. A dorsal view of fastigium verticis; B ventral view of tip of abdomen; C subgenital plate; D receptaculum seminis; E lateral view of head and pronotum; F, L, O dorsal view of fastigium verticis; G, P dorsal view of dorsum of pronotum; H dorsal view of tip of abdomen; I lateral view of cercus; J epiphallus; K apical valves of aedeagus; M, N lateral view of head and pronotum. See Figure 15 for explanation of C, D, J, K. Scales in mm, I-K middle, M, N lower, remainder upper scale.

thick at base, flattened and excurved and more or less tapering apically, inner face more or less concave (Figure 20D,K). Phallic structures as in Figure 20H,I; epiphallic bridge robust with median projection pointing ventrad, ancorae elongate, lophi short but very broad, anterior and posterior projections moderately developed; apical valves of aedeagus slender. Hind margin of subgenital plate of female distinctly trilobate; proximal end of spermathecal duct rather slender, with a tight loop; seen ventrally proximal end of duct forms two larger anti-clockwise coils enclosing two much smaller and thinner inner coils of distal half of duct; spermatheca large (Figure 21D).

General coloration brown dorsally, dark green-brownish laterally, lateral fasciae narrow, rather faint, darker brown; antennae blackish-brown in male, brown in female; episternum dark brown. Wings orange-cinnamon-brown to pink basally. Hind tibiae and tarsi dirty purplish-pink.

Measurements

As in Table 6.

Material examined

Orthochtha brachycnemis Karsch. Lectotype M, **Togo**: Bismarckburg, 15-31.xii.1890 (*R Büttner S*) (MNHU).
Cymochtha pachycerca Karny. Lectotype M, **Guinea**: Mamou, 12.ix.1911 (*Klaptocz*); F nymph, (paralectotype) same data; 1 M, 1 F, Ob. Niger, 1911 (*Klaptocz*) (identified by Karny (1915: 129) as *Orthochtha bisulcata* Krauss) (NM).
Orthochtha elgonensis Sjöstedt. Lectotype M, paralectotype F, **Mt. Elgon**, 1700 m, vi (*Loven*) (NR).

In addition to the type material, 178 specimens were examined from the following localities: **Senegal**: Ziguinchor Aerodrome (15°35′ N 16°16′ W) (NHM, NRI, LEM). **Guinea**: Nimba (07°35′ N 08°28′ W) (NHM). **Côte d'Ivoire**: Lamto (MNHN). **Ghana**: 10 km S. Ketekrachi (07°46′ N 00°03′ W); Wurupong (07°11′ N 00°20′ E); Techuman; Amedzofe (06°51′ N 00°26′ E); Shai Hills; 5 km W. Ajena; Near Legon; Legon-Dodowa Rd; Biakpa (06°51′ N 00°25′ E); Asikuma-Adome; Ho-Hohoe Rd, Nr. Volta Bridge; Ejura Ashanti (07°23′ N 01°22′ W); Kintampo (08°03′ N 01°43′ W); Owatu; Dodowa; Ofamkor (05°39′ N 00°16′ W); Nr. Ajena, Volta Gap (06°00′ N 00°17′ W); Nr. R. Dam Hohoe (07°09′ N 00°28′ E) (NHM, NRI). **Togo**: 1 M, Misahohe (06°57′ N 00°35′ E), 22.vi.1894 (*Baumann*), (labelled 'paratype' by Ramme, but not one of Karsch's syntypes), (NHM); NW Sokode (08°59′ N 01°08′ E); Bogan (09°02′ N 00°40′ E); Katchenke (08°12′ N 00°41′ E) (NHM, NRI). **Togo-Benin**: Cotonou-Lomé. **Benin**: Parakou (09°21′ N 02°37′ E); 25 km S. Abomey; Alfia (08°12′N 02°38′ E) (NHM, NRI). **Nigeria**: Ibadan (07°15′ N 04°23′ E); Calabar (04°56′ N 08°22′ E); S. Nigeria; Umudike (NHM, LEM). **Cameroon**: Nr. Banyo (06°45′ N 11°49′ E); 20 km W. Tibati (06°28′ N 12°38′ E) (NHM, NRI). **Central African Republic**: Berberati, Middle Congo (04°19′ N 15°51′ E); Gongouri, 24 km N. Nola (03°28′ N 16°08′ E); La Maboke (03°54′ N 17°53′ E); Oubangui-Chari, (05°16′ N 17°39′E) (NHM, ANS, MNHN). **Ethiopia**: Kefa Prov. NE. Gojeb R. Mission (07°16′ N 37°31′ E) (NRI). **Uganda**: Tororo (00°42′ N 34°11′ E); Baruli (01°25′ N 32°20′ E); Tororo Hills; Tororo-Jinja; Lwanda-Koki; Ankole-Kabula; Buddu Katumto (00°53′ S 31°30′ E); Masaka (00°20′ S 31°46′ E); Bugwese (01°05′ N 33°50′ E); Jororo-Mbale Rd, Butiaba escarpment (01°49′ N 31°19′ E); Lango; Bulemesi-Luwero (01°20′ N 32°28′ E); Bulemesi-Nakasongola (01°19′ N 32°28′ E); Mbale (01°04′ N 34°11′ E); Tororo Hills (00°42′ N 34°12′ E); Tororo-Sokolu (NHM); Bussu Busoga (MCSN). **Zaire**: Atso (72 km d'Aru S. route Aru-Aba; Elisabethville-Lubumbashi (11°40′ S 27°28′ E) (bears label '*O. prasina* I.Bol. det.V. M. Dirsh, 1959') (IRSNB). **Ruanda**: Kibungu (02°10′ S 30°32′ E) (bears label as above) (MRAC). **Tanzania**: Central Uzina, 50 km W. Mwanza; Ushirombo Rd, 30 km W. Kahama; Mkwami – Kahama; Ufipa plateau 20 km NW. Sumbawanga (NHM, NRI) **Zambia**: Abercorn (08°50′ S 31°25′ E) (NHM).

Table 7 Measurements of the *O. brachycnemis* species-group

		Pronotum								
		Length		Width			Hind femur			
Taxon	Total length	total	prozona	prozona	metazona	Tegmen length	Length	Width	Antenna length	Head and pronotum
O. b. brachycnemis	M 21.0-32.0	3.8-5.8	2.3-3.2	1.6-2.3	1.9-2.6	14.2-23.5	14.5-19.0	2.1-2.5	9.7-14.5	7.5-10.5
	F 35.0-45.5	6.3-7.7	3.6-4.7	2.8-3.5	3.2-4.4	23.0-27.0	19.0-24.0	3.2-3.7	10.5-12.5	11.1-14.3
O. b. ottei	M 22.0-23.0	3.8	2.4	1.8	2.0	15.5	14.3	1.9	9.6	7.7
	F 37.5	6.3	3.6	3.1	3.1	24.5	21.0	3.2	11.0	11.4
O. sudanica	M 25.0-33.0	4.8-5.7	2.9-3.4	1.8-2.3	2.1-2.6	18.2-24.0	15.7-20.2	2.3-2.8	12.7-15.5	8.7-10.8
	F 41.5-51.6	8.0-9.5	4.8-5.8	3.2-3.6	3.5-3.6	26.5-34.0	24.5-26.6	3.0-3.7	10.5-11.7	14.2-15.2
O. t. tunstalli	M 20.0-29.0	3.5-4.8	1.9-2.7	1.6-1.9	1.8-2.3	14.5-20.5	11.7-16.5	2.0-2.7	9.5-16.5	6.5- 9.0
	F 33.0-42.0	6.0-7.7	3.4-4.3	2.5-3.0	2.6-3.4	23.2-27.5	19.0-24.5	3.1-3.7	10.3-13.0	11.0-13.4
O. t. brachyptera	M 23.0-28.0	3.8-4.3	2.4-2.6	1.5-1.7	1.6-1.8	8.0- 8.3	15.3-16.0	2.3-2.5	13.5-14.0	7.7- 8.0
	F 40.5	6.8	3.7	2.4	2.6	15.5	22.3	3.4	13.0+	12.3
O. grossa	F 35.0+	7.7	4.5	3.7	3.6	26.5				12.7

Distribution (Figure 5)

The humid zone of western Africa to Nigeria, Cameroon, Central African Republic, Zaire, Ethiopia and Uganda, south to Tanzania and Zambia. The literature records on the whole agree well with the distribution of the material examined. We would in particular like to have included the record from Angola cited by Dirsh (1966b: 396): '4 M, R. Chicara, route Saumimo-Mona-Quimbundo, iv.1964 (Carvalho) (Dundo Mus.)'. These specimens were not seen by us and the species was not among material received from IIA, Huambo. There are, however, also obvious misidentifications: one of the most widely cited is the Sudan record, which can be traced through Johnston (1956: 629) to Giglio-Tos (1907: 7), who identified as '?*Orthochtha brachycnemis* Karsch', a male and female specimen collected by Camillo Lessona from Port Sudan. While the species could conceivably occur in southern Sudan (no specimens are known to us), it is certain not to exist in Port Sudan, which is climatically totally unsuitable. The likeliest candidate for misidentification would be *Duronia chloronota* or perhaps an *Ochrilidia* sp.

Biology

As one of the most common grasshopper species in grasslands associated with the humid forest zone in western Africa, *O. brachycnemis* is also one of the better known. Jago (1968) and Chapman (1962) provide information on its bionomics in Ghana, Descamps (1953, 1965) for Cameroon and Mali, Golding (1948) and particularly Jerath (1968) for Nigeria, while Gillon (1970, 1973, 1974) gives information on various aspects of its biology, ecology, feeding behaviour and energetics in the Lamto area of central Côte d'Ivoire. The summary below is extracted from these and other sources, including our own observations.

Orthochtha brachycnemis is a strict graminicole and inhabits humid, usually short, grasslands subject to seasonal flooding, but also patches of savanna and upland grassland, such as on Mt. Nimba (Chopard, 1958). It is strictly graminivorous; the structure of its mandibles is characteristically that of a grass feeder (Chapman, 1964; Gillon, 1970). In Côte d'Ivoire it was found to feed predominantly on the most common grass species, *Loudetia simplex*, *Andropogon schirensis* and *Hyparrhenia* spp. (Hummelin and Gillon, 1968).

Although *O. brachycnemis* has at times been found in cassava, citrus and vegetable crops (Jerath, 1968), no damage has been recorded and given its strict graminivory, it was probably feeding on weeds (COPR, 1982).

Data from specimen labels (Table 8), and literature sources (e.g. Gillon, 1970, 1974; Golding, 1948) indicate that *O. brachycnemis* is bivoltine. This is clearly influenced by bimodality of rainfall, and where rainfall is more continuous, there is some indication of continuous reproduction, as in eastern Nigeria (Jerath, 1968).

Table 8 Monthly records of adults of the *O. brachycnemis* species-group from specimen label data*

	Months											
Taxon/locality	i	ii	iii	iv	v	vi	vii	viii	ix	x	xi	xii
O. sudanica								1	2	13	5	7
O. brachycnemis												
(N of Equator)	5	1	2	4	8	1		3	3	1	8	5
(S of Equator)	3	2	2	3	4	6					1	4
O. tunstalli	1	5	10	4	1	1						

Note: * Figures indicate specimen totals.

This implies there is no obligate suspension of development at any stage; Gillon (1974) recorded the presence of nymphs in every month of the year which may indicate that breeding can continue in the absence of rainfall, in suitable areas of impeded drainage.

Discussion

Karsch (1893: 62) described *O. brachycnemis* from three syntypes. Only one of these, labelled 'Togo, Bismarckburg, 15-31.12.[18]90. R. Büttner S.' was examined and designated lectotype. It agrees well with Karsch's description, but is somewhat smaller in size; 22 instead of 24 mm quoted by Karsch. It was earlier seen by Dr D. K. Kevan of LEM, Quebec and drawn by Miss Diane Johnstone of that museum, whose drawings are reproduced here as Figure 20A-G. The other two syntypes, labelled 'Togo, Bismarckburg, 1.xi-15.xi.1890' (Dr Büttner) and 'bis 15 Marz 1891, Ubergang zur Regenzeit', are, like the lectotype, in Berlin. The male specimen in NHM bearing Ramme's label '*O. brachycnemis* Karsch paratype', while a good match of the lectotype, does not belong to the syntype series.

Cymochtha pachycerca Karny was described from three males, one female and one nymph syntypes, all from French Guinea, Mamou (Karny, 1915: 127). However, only two male syntypes and the nymph could be located in the original depository (NM), or elsewhere. The better preserved male syntype and the nymph were examined; both bore a label with the legend 'Mamou, 12.ix.1911 (A. Klaptocz)' and the identity label, '*Cymochtha pachycerca*'. The male is here designated as the lectotype and following comparison with the available material, *C. pachycerca* was diagnosed as a synonym of *O. brachycnemis* (Popov and Fishpool, 1988).

Orthochtha elgonensis Sjöstedt was described from four male and one female syntypes from Mt. Elgon 1700 m (Loven) (Sjöstedt, 1931b: 20) (NR). Later, Sjöstedt (1933: 4) cited a further five male and eight female specimens from the original series, (also NR). One male and one female labelled respectively 'Typus' and 'Allotypus', were sent to us by Dr Kronestedt. Since there was no original designation of a holotype, the male bearing the 'Typus' label is designated as lectotype and the female as paralectotype. As they fall within the range of variation of *O. brachycnemis*, *elgonensis* is established here as a synonym.

Geographical variation

The geographical variation of *O. brachycnemis* shows similar trends to that of *O. nigricornis*. The West African material is relatively stable. The green-brown ground coloration does vary however, which may be seasonally influenced. All-brown males are rare, but females usually are brown with sometimes only the pre-costal speculum green. All West African specimens have black hind knees in the male. The East African specimens are more variable. Those from Uganda are greener; some are multi-coloured, green, brown, brownish-purple, with strikingly deep purple hind tibiae.

The specimens from western Central African Republic (within the region 03°3'0-06°00' N and 15°30'-18°30' E) are strikingly large with well-developed dark lateral fasciae. Conversely those from eastern Central African Republic (Ouaka area) are small with well-rounded heads and pronota, pink hind wings and some structural characteristics which are so distinctive that they justify recognition as a separate subspecies – *O. brachycnemis ottei* **subsp.n.** (see below). Pink hind wings are otherwise only seen in populations from southern Uganda south of 00°30' N, and in parts of Zambia (e.g. Mbala), while in parts of Tanzania (e.g. Kahama), the hind wings are colourless. Some of the structural variation found in different parts of the distributional range is illustrated in Figure 20J,K.

Orthochtha brachycnemis ottei **subsp. n.**

Diagnosis

Differs from nominate subspecies in somewhat smaller size (Table 7), and shorter, more rounded head and pronotum. Antennae somewhat longer than combined length of head and pronotum in male, rather shorter in female. Frontal ridge broad, parallel-sided, fastigial constriction weak. Fastigium as in *O. b.*

brachycnemis, but transverse arcuate sulcus in more forward position (Figure 21F,L). Pronotum broad, in female somewhat inflated in prozona (Figure 21M). Male cerci heavy at base, narrowed and obtusely pointed apically (Figure 21H). Epiphallic lophi very short and broad, with somewhat attenuate outer lobes (Figure 21J).

Coloration brownish (discoloured), lateral fasciae faint; hind wings pink at base; hind knee brown in male and female; hind tibiae dirty greyish in male (discoloured?), pinkish in female.

Measurements

As in Table 7.

Material examined

Central African Republic (as **French Equatorial Africa**): holotype M, Oka (Ouaka) Middle Congo, 400 m, 2.ii.1948 (*Carpenter African Exp. 1947 and 1948*); paratypes: 3 M, 4 nymphs, same data, 6.ii.1948; 1 F, same data, 27.i.1948. Holotype and 6 paratypes (ANS), 2 paratypes (NHM). No other material known.

Orthochtha sudanica Popov & Fishpool

(Figure 22, distribution – Figure 5)
Orthochtha sudanica Popov & Fishpool 1988: 303, Figures 39-54, 75. Holotype male, BENIN (NHM) [examined].

The original description of this species was published in Mestre (1988). An English version of the original French text is given below.

Diagnosis

Differs from *O. brachycnemis* in somewhat larger size, more slender build and less marked sexual dimorphism; male in particular proportionately larger (Table 7). Antennae narrowly ensiform, but somewhat broader and more flattened at base than *brachycnemis*, length about 1.4 times combined length of head and pronotum in male, and 0.8-0.9 times in female. Frontal ridge broad, sulcate, with well-raised, somewhat undulate, moderately divergent margins, fastigial constriction weak (Figure 22A). Fastigium broadly parabolic, carinulae weak, but distinct; arcuate sulcus broad and shallow, in mid position (Figure 22B). Pronotum parallel-sided, with well-raised carinae, only hind sulcus distinct; ratio of prozona to metazona 1.4, the latter finely pitted (Figure 22C); lower hind angle of lateral pronotal disc about 90°, obtuse. Male tegmina just reach, or slightly exceed, tip of abdomen, but only rarely reach hind knees; fractionally shorter in female; both sexes capable of flight over tens of metres. Male supra-anal plate trapezoidal, with broad, shallow longitudinal median depression; subgenital plate moderately long, simple, pointed; cerci incurved, moderately long and uniformly thick, rounded apically, inner faces barely flattened (Figure 22E). Epiphallic bridge uniformly thick, with scarcely any median projection, ancorae slender, elongate, weakly incurved, lophi narrow, with elongate outer lobe (Figure 22F). Apical valves of aedeagus somewhat broader apically than *brachycnemis* (Figure 22G). Subgenital plate of female with broadly trilobate margin; spermathecal duct as in *brachycnemis*, but of equal thickness throughout and narrowed only in proximity of spermatheca; the latter large.

Coloration typically stramineous dorsally; pale green, or stramineous laterally, stramineous form more common in females; flagellum of antenna jet black in male except for a purplish-pinkish wash on inner side of basal segments; in female basal third to half of antennae pinkish. Lateral fasciae narrow, deep black, extending from antennal pits to fade in basal third of tegmina; hind wings hyaline; upper face of hind femur rusty-brown shading to green below; outer face sometimes with a dark fascia in upper part; hind knee, including base of hind tibiae blackish-brown, remainder of tibiae and tarsi bright pink.

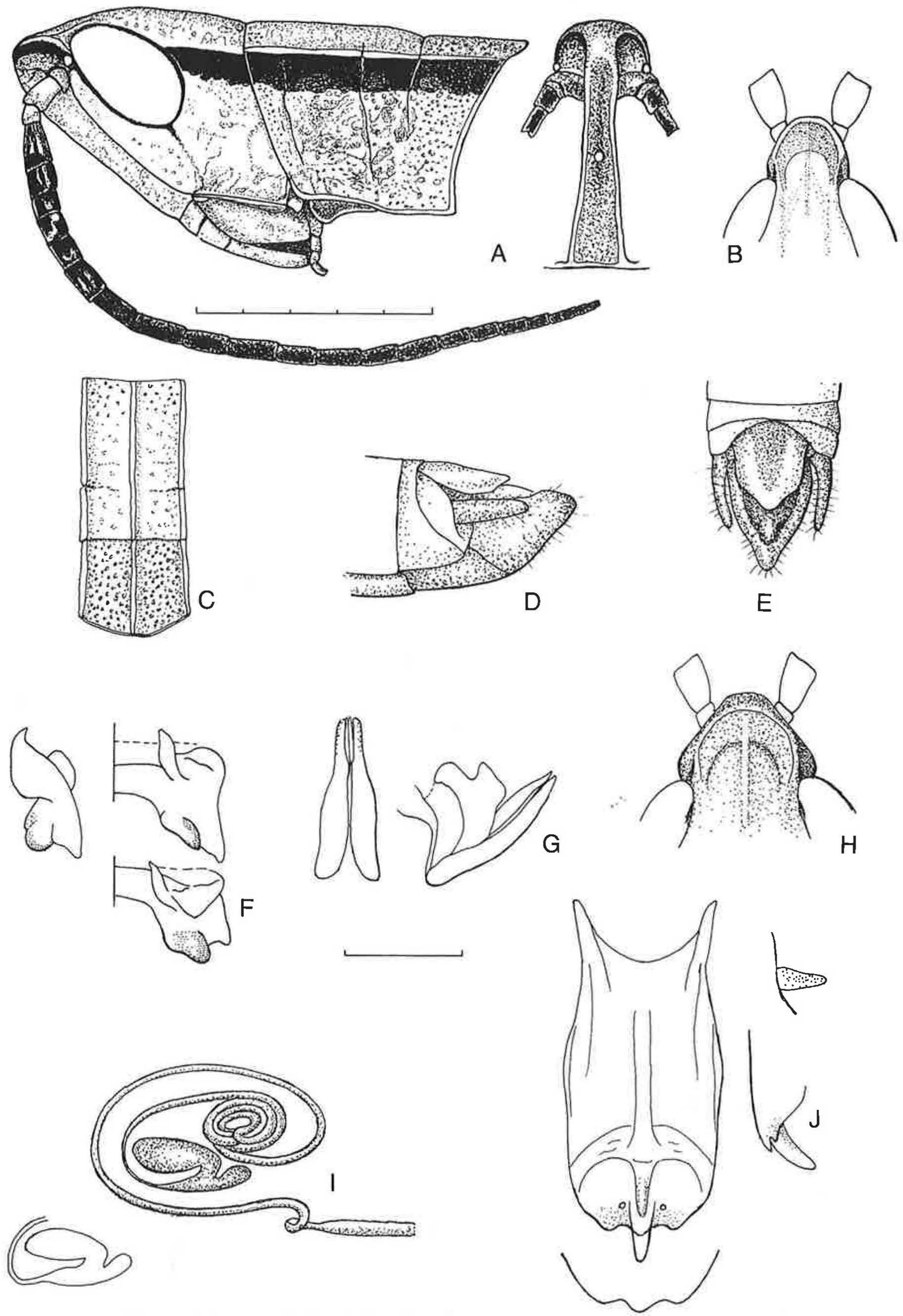

Figure 22 *Orthochtha brachycnemis* species-group. *O. sudanica* A-G male, H-J female. A lateral view of head and pronotum; B, H dorsal view of fastigium verticis; C dorsal view of dorsum of pronotum; D, E lateral and dorsal views of tip of abdomen; F epiphallus (right half); G apical valves of aedeagus; I receptaculum seminis; J subgenital plate. See Figure 15 for explanations of F, G, I, J. Scales in mm, F, G lower, remainder upper scale. Modified from Popov and Fishpool in Mestre (1988).

Measurements

As given in Table 7.

Material examined

Holotype M, **Benin**: Nr. Malanville (11°52′ N 03°23′ E) 16.ix.1978 (*Popov and Fishpool*) (NHM). Paratypes: 4 M, 3 F, same data; 20 M, 15 F, localities near Malanville: Tondikiré, Fendelguindé, vii 1976-ix.1978 (*Popov, Fishpool, Cheke, Yonli and Lawali*); 20 M, 10 F, 1 nymph, Malanville, 25.ix.1983 (*Popov*) (NHM, NRI, NM); 2 M, 2 F, same data (*Yonli*) (IFAN). **Senegal**: 1 M, savane arborée près Bafoulabé, 22.xi.1959; 1 M, Niokolo-Koba (13°00′ N 13°00′ W), 27.xi.1059 (*Mission IFAN*) (IFAN). **Guinea Bissau**: 1 F, Fajanguito, 19.ix.1980 (*Settle*) (NRI). **Mali**: 1 M, Kléla, Sikasso (11°42′ N 05°40′ W), 29.x.1963 (*Descamps*) (MNHN). **Nigeria**: 2 F, Nr. Mubi (10°16′ N 13°16′ E); 3 F, Nr. Difa (Gombe area), xi.1970 (*Popov*); 1 M, Gombe div., tall grass and cotton farms, 31.viii.1963; 5 M, 6 F, Yola (09°12′ N 12°29′ E), 16.ix.1974; 5 M, 3 F, 1.3 km S. Dikwa (12°02′ N 13°55′ E), riverine grassland and flooded wild rice in river bed, 6.x.1971 (*Jago*); 10 M, 5 F, localities near Gombe (Deba Habe, Filiya, Zambuk, Bajoga), ix.1970; 1 M Birnin Kudu (11°27′ N 13°16′ E), 19.x.1970 (*Popov*) (NHM, NRI); 1 M, 1 F, each from Numan, 200 m (09°28′ N 12°02′ E); Lau (12°30′ N 13°36′ E); Potiskum (11°43′ N 11°04′ E), ix.1975 (*Descamps*) (MNHN). **Cameroon**: 2 M, 32 km Garoua-Yola Rd (09°16′ N 13°22′ E); 4 M, 1 F Nr. Pouss (10°51′ N 15°03′ E), 7 M, 2 F, Nr. Guirvidig, xi.1980 (*Popov and Jago*) (NHM, NRI); Garoua, plaine inondable; Pitoa (09°23′ N 13°32′ E), ix.1975 (*Descamps*) (MNHN). **Chad**: Tounouri (*Descamps*) (MNHN). **Sudan**: 2 M, 3 F, Talodi (10°38′ N 30°20′ E), 19.ix and x, 1926 (*Rutledge*); 1 M, 1 F, Talodi, tall grass; 4.ix.1926 (*Cowland*) (NHM).

Distribution (Figure 5)

Orthochtha sudanica occurs in edaphic grasslands in a well-defined belt corresponding to the Sudan savanna, from Senegal to the Sudan. The gaps in its distribution, for example, in Chad, are probably a result of insufficient collecting.

Biology

From label data (Table 8) and from observations of the species at Malanville (Benin), it appears to be univoltine with the single generation produced during the rains. Young nymphs were observed in late June, about 6 weeks after the onset of the rains and older nymphs in July and August; the adults reached peak numbers in September, declined during October, and disappeared in November. The dry season is evidently passed in the egg stage.

The species is common in riverine grasslands and was recorded in several localities along the River Niger in Benin and in similar habitats in Nigeria, particularly in the Lake Chad basin. It often shares the same habitat as *Orthochtha venosa* (p. 81), but tends to favour the drier parts, where its life cycle starts and ends some 4-6 weeks earlier than *venosa*. There is no evidence of sympatry between *O. sudanica* and *O. dasycnemis bisulcata* despite the superficial similarity of their habitat associations; it seems, however, that *d. bisulcata* generally inhabits more northerly localities than *sudanica*. Ecologically *sudanica* is distinct from *O. ampla*, which is found in rainfed savanna grasslands. In the Malanville area of Benin the two types of grassland meet along a wide front, and the two species may occur there in close proximity to each other, with *sudanica* in the edaphic grassland community of *Oryza*, *Vetiveria* and *Eragrostis* sp., liable to seasonal flooding, and *ampla* in the rainfed savanna grassland dominated by *Andropogon gayanus*, *Hyparrhenia* spp. and *Loudetia* spp.

Fishpool and Popov (1984: 354) recorded this species as *Orthochtha* sp. 1.

Discussion

Orthochtha sudanica Popov & Fishpool appears to have escaped many of the earlier collectors. The oldest specimens known to us are those from the Sudan, collected in 1926 by Rutledge and Cowland. They subsequently became part of H.B. Johnston's collection, for in 1969 they were purchased from him by NHM and placed in the Accessions. One bears a hand-written label '*Orthochtha* sp.?' possibly in Johnston's hand. The remaining material was collected much later, in the late 1950s and during the 1970s. At that time, the specimens were generally misidentified as *O. pachycerca*, or sometimes as *O. prasina*, competing in this respect with *O. dasycnemis bisulcata* (p. 42). It is possible that Golding's *Orthochtha* **sp.n.** (1948: 531) refers to this species, but this is not confirmed by the material examined.

Geographical variation

The species manifests remarkably little geographical variation, reflecting in this respect the uniformity of the conditions of its environment. Indeed much of what variation in size and coloration there is can be found in specimens from the same locality. It includes differences in the predominance of green or stramineous coloration, or the occasional specimen having exceptionally long wings.

Orthochtha tunstalli **sp.n.**

(Figure 23, distribution – Figure 5)

Diagnosis

Very similar to *O. sudanica*, with which it is here compared. Size smaller, male 20-29 mm, female 33-42 mm (Table 7). Antennae proportionately longer and narrower, 1.7-1.8 times combined length of head and pronotum in male and 0.9-1.1 times in female. Frontal ridge broader and less widened downwards (Figure 23C); fastigium broader, especially in female, median carinula and transverse sulcus faint. Metazona proportionately longer, prozona-metazona ratio 1.3-1.4. Male cerci more pointed apically and concave on inner surface (Figure 23F). Epiphallic lophi square and more elongate; posterior lobes more produced. Genitalic structures in female similar.

Coloration similar to *O. sudanica*, but antennae without pinkish tinge at base. Lateral fasciae generally narrower except for specimens from Mozambique.

Affinities

Orthochtha tunstalli and *O. sudanica* are obviously close relatives. It could be argued that the difference is not more than subspecific. In view of the wide geographical separation (Figure 5), however, and the differences in the structure of the male genitalia, we prefer to regard the two as closely related, but distinct species.

Material examined

Holotype M, **Botswana**: Selina slipway (18°35′ S 23°33′ E), swamp grass, 17.iv.1971 (*Tunstall*) (NHM). Paratypes: 1 M same data (NHM); Serowe, Swaneng, Palapye Road (22°25′ S 26°44′ E), i-iii.1977-79; 4 M, Serowe, bush, 6-21.iii.1982 (*Forchhammer*) (NHM, NHMA). **Zimbabwe**: 1 M, 3 F, Amandas, 4200 ft (17°22′ S 30°57′ E); 3 M, 3 F, Shamva, 3100 ft (17°20′ S 31°32′ E), 7-10.iii.1935 (*Miller*) (misidentified as *Cymochtha prasina* (Miller, 1936: 158)); 5 M, 2 F, Mashonaland, Salisbury (17°50′ S 31°02′ E), ii.1905 (*Marshall*); 8 M, Shangani, De Beer's Ranch (18°45′ S 28°00′ E), v.1932; 1 F, Matopo hills (20°36′ S 28°20′ E), iv.1932 (*Mackie*) (NHM). **Malawi**: 1 F, Shire River Valley, Elephant marsh, 26.ii.1975 (*Brown*) (DATS). **Mozambique**: 1 M, Moyen Sargadze, env. de Moulims (*Lesne*) (MNHN); 1 M, 1 F, 35 km NE. Chitengo, Corongosa, 12-14.vi.1973; 1 M, Nova Lusitania, Buri flood plains (19°53′ S

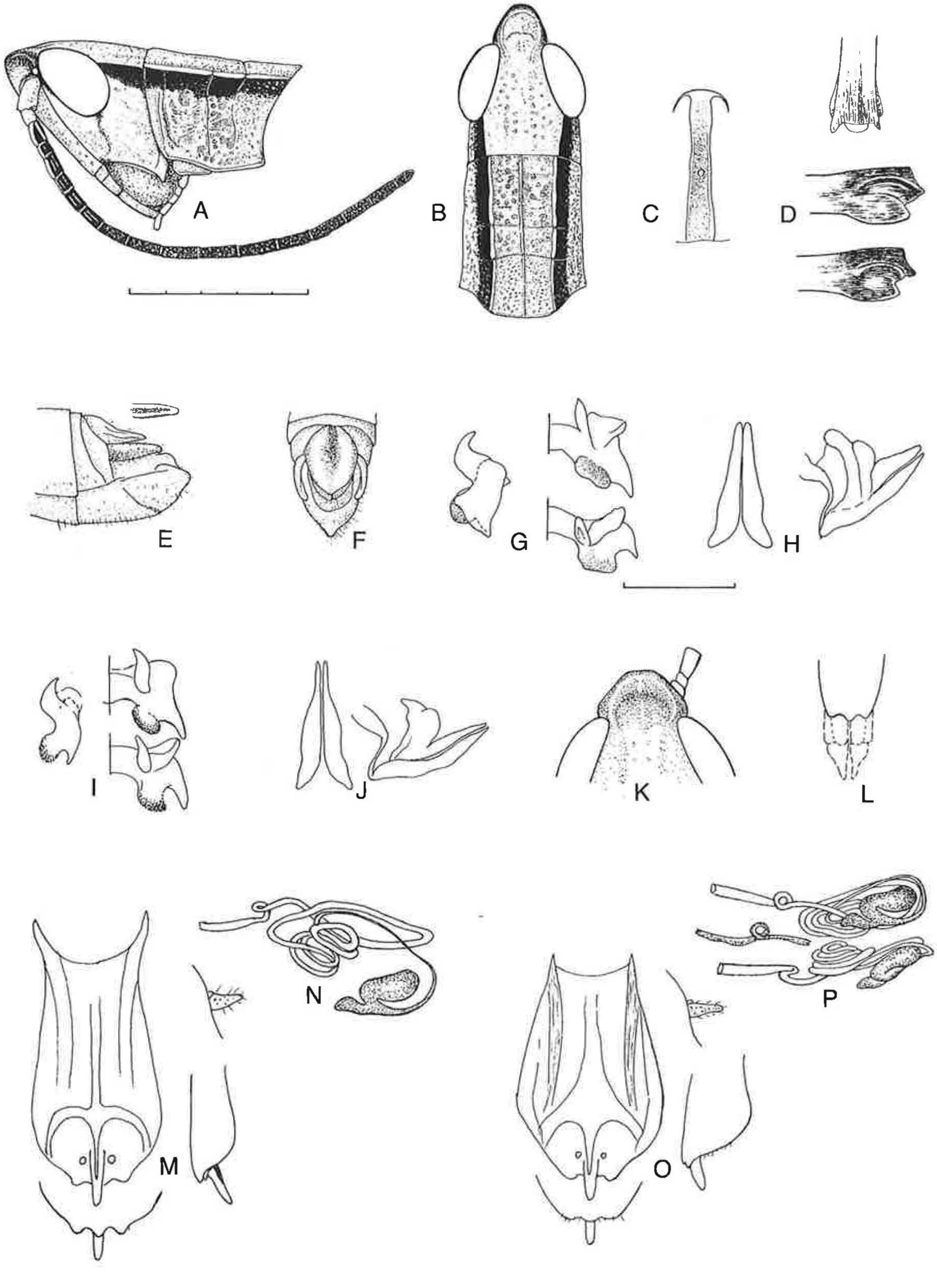

Figure 23 *Orthochtha brachycnemis* species group. *O. tunstalli* **sp.n.** I, J, O, P *O. t. brachyptera* **subsp.n.**, remainder nominate subspecies. A-J male, K-P female. A, B lateral and dorsal veiws of head and pronotum; C frontal ridge; D dorsal, outer lateral and inner lateral views of hind knee; E, F lateral and dorsal views of tip of abdomen, inner face of cercus also shown; G, I epiphallus (right half); H, J apical valves of aedeagus; K dorsal view of fastigium verticis; L ventral view of tip of abdomen; M, O subgenital plate; N, P receptaculum seminis. For explanation of G-J, M-P see Figure 15. Scales in mm, G, H, I, J lower, remainder upper scale.

34°36′ E); 1 F, Block 14 Nr. Tica, Beira,13.ii.1975 (*Brown*) (DATS, NHM); 1 F Mucheve (20°34′ S 33°49′ E) (*Fereira*) (NRI). **Namibia**: 1 M, 1 F, Katwitwi, Okavango R., 17.iv. 1970; 2 F, 37 km ENE. Tamsu, Kingveld, 11.v.1970; 1 F, Korokoka, Okavango, 130 km E. Runtu, 3.iv.1970 (*Brown*) (DATS); 4 M, Kombat (19°43′ S 17°42′ E), 16-17.ii.1972 (*B.M. S.Afr. Exp.*) (NHM). **Lesotho**: 3 M, 1 F, Maluti Mts, Niakoesuba 8000-9000 ft (29°33′ S 27°47′ E), 18.ii.1929 (*Scott*) (NHM). **South Africa**: 1 M, Pretoria, 10.iv.1918 (no other data); 1 F, Natal, Ingogo (27°34′ S 29°54E), iii. 1932 (*Ogilvie*); 2 M, 4 F, Natal National Park (28°41′ S 28°59′E), iii.1932 (*Mackie*); 1 M, 1 F, Orange Free State, Frickenburg, ii-iii. 1932 (*Ogilvie*); 2 M, 1 F, Orange River Colony, 1903 (*Hamilton*); 1 M, Maritzburg (29°37′ S 30°23′ E), 1916 (*Ackerman*); 1 F, Rustenburg (25°40′ S 27°15′ E), ii.1949 (*Copener*); 1 M, Pretoria, iii. 1939; 2 M, Pretoria, W.L.D. (no other data); 1 M, R. Limpopo (23°00′ S 27°57′ E), 26.iv. 1972 (*BM S. Afr. Exp.*); 2 M, 2 F, K.N.P., Muntshe hill, 6.ii.79; 1 M, 1 F, K.N.P. Lower Sabie, 20.ii.1979 (*Brown*); 4 M, Johannesburg, 1.ii.1979 (*Hepburn*) (NHM); 1 M, 1 F, Towomba, 3 m E. Warmbaths (24°53′ S 28°17′ E), 15.iii.1971 (*Koster*); 1 M, Natal, 24 m N. Hluhluwe, 17.i.1969 (*Rensburg*); 2 F, Zululand, Mkuze, 28.iv.1977; 1 M, P. Maritzburg (29°40′ S 30°20′ E), 10.vi.1963 (*Brown*) (DATS); 1 M, Natal, Pinetown (29°49′ S 30°51′ E), 11.vi.1909 (*Leigh*); 1 M, Transvaal, Louis Trichardt, Malta Forest, 5.iii.1984 (*Otte, Code and Toms*) (ANS); 1 M, Middleburg, Cape Province, iii. 1957 (*Reyneke*) (DATS); 1 M, Cape Prov., Mt. Frere (30°55′ S 28°59′ E), 5.iii.1951; 1 F, Natal, Tugela R. 12 m. WNW. Bergville (28°44′ S 29°22′ E) (*Swedish S. Afr. Exp., Brinck Rudebeck*) (EMZI).

Measurements

As in Table 7.

Distribution (Figure 5)

Orthochtha tunstalli inhabits edaphic grasslands in southern Africa, where it is recorded from about latitude 17°S in Malawi and Zimbabwe to about 30°S in Cape Province, South Africa. It appears to exhibit a wider ecological tolerance than *O. sudanica*, for it occurs both in lowland and highland, up to 9000 feet in Lesotho.

Discussion

Although known in the NHM collection from 1903, this is another species whose identity remained concealed due to early misidentification. In the literature this can be traced to Miller (1936: 158), who cites it as *O. prasina* (there are also specimens in the NHM collection that bear his name label to this effect), but the original misidentification may have occurred earlier. Until this revision there have been no attempts to identify this material as other than *prasina*, although the name *prasina* itself was by no means confined to this taxon (p. 28). The species is dedicated to the acridologist and collector, James Tunstall, formerly of the Centre for Overseas Pest Research.

Some of the material of this species is sufficiently distinct to merit recognition as a separate subspecies described below.

***Orthochtha tunstalli brachyptera* subsp. n.**

(Figure 23)

Diagnosis

Differs from nominate *O. t. tunstalli* in abbreviated tegmina and wings that fall short of middle of abdomen. Other characters, including genitalic structures, size and coloration (Table 7, Figure 23I,J,O,P), fall within range of variation of nominate subspecies.

Material examined

Holotype M, **Malawi**: 15 km S. of Monkey Bay, acacia woodland, 25.iii.1986 (*Otte, Glenn and Ruffin*) (ANS); 8 M, 1 F paratypes same data (5 M, 1 F, ANS; 2 M, NHM; 1 F, NRI).

Biology

Nothing is known of the biology or ecology of this subspecies, other than that it was collected in grassland fringing acacia woodland.

Orthochtha grossa I. Bolivar 1908

(Figure 21O,P, distribution – Figure 6)

Orthochtha grossa I. Bolivar 1908. Holotype female, ZAIRE (IRSNB) [examined].

Diagnosis

Redescription of female holotype

Six basal segments only of antennae present, these relatively narrow – somewhat narrower than in *O. brachycnemis*. Only upper part of frontal ridge intact; straight in profile, somewhat widened and convex between antennae, below it is deeply sulcate, with thick, gradually divergent margins. Vertex short and convex; fastigium trapezoidal, as long as wide, shallowly concave with low margins, indistinct median carinula and shallow arcuate sulcus positioned behind middle. Dorsum of pronotum distinctly swollen in middle, its surface coarsely pitted all over; carinae thick and low but distinct, middle one thickened in middle of prozona, lateral ones excurved at level of second sulcus, elsewhere parallel; front margin weakly incurved, hind margin broadly angular with a small median identation; sulci distinct, ratio of prozona to metazona 1.5. Lateral pronotal lobes sculptured like dorsum; lower margin almost straight and horizontal, hind angle straight, rounded. Mesosternal lobes quadrate, with broadly rounded angles, interspace slightly narrower than lobe. Hind legs and tip of abdomen missing. Tegmina and wings fully developed. Specimen badly discoloured, a dirty brownish; lateral stripe well developed and black in antennal hollows, narrow in post-ocular area, indistinct beyond.

Measurements

As in Table 7.

Material examined

Only F holotype known, **Zaire**: Lukongo (05°00′ S 14°16′ E) (*Haas*) (IRSNB).

Discussion

The holotype appears to be nearest to *O. brachycnemis* and could perhaps be an aberrant form of it, but despite its mutilated condition, it is sufficiently distinct in its shorter and more rounded head, and particularly the swollen dorsum of pronotum, to warrant its retention, at least for the time being, as a distinct species. It is quite different from *O. venosa*, of which it was once regarded as a senior synonym (Dirsh, 1970).

Ungrouped species

Key 5 Ungrouped African species of *Orthochtha*

1 Tegmina and wings abbreviated; micropterous or brachypterous 2

– Fully winged 5

2 Micropterous; the dark lateral fasciae very narrow (Figure 28A); distribution western Africa .... *O. aurea* Popov & Fishpool

– Micropterous or brachypterous; the dark fasciae of normal width; distribution eastern Africa 3

3 Of more slender build (Figure 27); hind tibiae blue .... *O. coeruleipes* **sp.n.**

– Of more robust build (Figure 29); hind tibiae pink 4

4 Micropterous; Zaire .... *O. angusticornis angusticornis* **subsp.n.**

– Brachypterous; Zambia .... *O. a. zambiae* **subsp.n.**

5 Hind wing pigmented 6

– Hind wing hyaline or infumate, not pigmented 8

6 Of slender build; head acute; lateral fasciae narrow but distinct (Figure 26A); hind wing pink; Angola .... *O. nadiae* **sp.n.**

– Of more robust build; head rounded (Figure 30A); lateral fasciae indistinct or obsolete; southern Africa 7

7 Hind wing pink; fasciae obsolete .... *O. rosacea* (Walker)

– Hind wing bluish; fasciae faint .... *O. zuluensis* **sp. n.**

8 Elongate and slender; head elongate, apex pointed, face strongly inclined and straight or concave in profile (Figure 25A) .... *O. dimorpha*

– Head short and rounded, face convex in profile .... *O. venosa*

Orthochtha venosa (Ramme 1929)

(Figure 24, distribution – Figure 6)

Cymochtha venosa Ramme 1929: 267. Holotype male, CAMEROON (MNHU) [examined].
Macrocymochtha speciosa Sjöstedt 1931a: 22. Holotype female, allotype M, BURKINA FASO, Pundu (NR) [examined].
Orthochtha venosa (Ramme 1929). Synonymy by Kevan 1956: 31.
Orthochtha grossa I. Bolivar 1908. Incorrect synonymy by Dirsh 1970:439.
Orthochtha venosa (Ramme 1929) reinstated by COPR, 1982: 393 footnote and Fishpool and Popov, 1984: 385, note 6.
Orthochtha venosa (Ramme 1929) Popov and Fishpool, 1988: 302 (redescription).

Diagnosis

A very distinctive species, differing from all others of genus in many characters, as follows. Size large (see measurements). Head short, inflated (Figure 24A). Fastigium verticis as in Figure 24C. Pronotum distinctly selliform, dorsum narrow with incurving lateral carinae; lower posterior angle of lateral lobe straight, rounded (Figure 24A). Subgenital plate of male with pointed, truncate, or bilobate apex; cerci large; epiphallic lobes short, aedeagal valves robust (Figure 24G,H,I). Subgenital plate of female with undulating, quadrilobate hind margin; structure of receptaculum seminis as in Figure 24J,K,L.

General coloration stramineous, sometimes with deeper brownish, or greenish tinge; face generally darker. Antennae reddish-brown basally, darker apically in male; of paler hue in female. Dorso-lateral fascia broad, usually shiny-black, sometimes dark-brown; hind femur rusty-brown dorsally, tibiae bright pink, spines the same colour, tipped with black. Coloration also partly density dependent (see below).

Measurements (mm)

Total length, M 33.5-40.0, F 51.5-61.5; pronotum length, M 6.2-7.6, F 9.3-10.3; prozona/metazona ratio, M F 1.4; tegmen length, M 25.7-33.3, F 33.5-41.5; hind femur-length, M 18.8-23.2, F 25.8-28.5, -width, M 2.3-2.8, F 3.1-3.4; antenna length, M 14.8-20.0, F 17.8-20.0; head + pronotum, M 11.2-13.3, F 16.0-17.7.

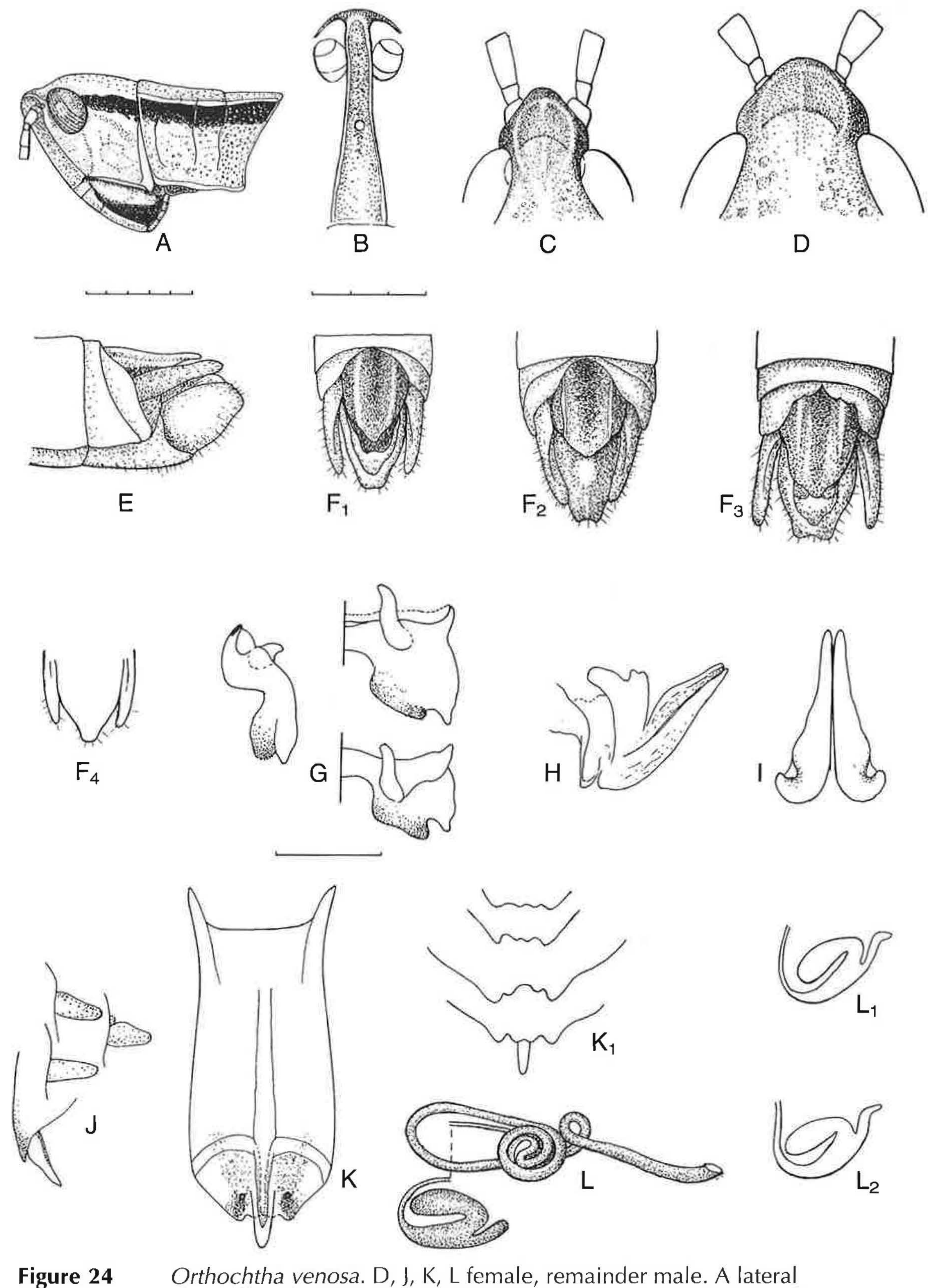

Figure 24 *Orthochtha venosa*. D, J, K, L female, remainder male. A lateral view of head and pronotum; B frontal ridge; C, D dorsal views of fastigium verticis; E lateral view of tip of abdomen; F_1-F_4 dorsal views of tip of abdomen showing range of variation of the tip of subgenital plate; G epiphallus (right half); H, I lateral and ventral views of apical valves of aedeagus; J lateral views of cerci; K subgenital plate; K_1 variations in the shape of posterior margin of subgenital plate; L receptaculum seminis, spermatheca detached; L_1, L_2 variations in shape of the spermatheca. For explanations of G, H, I, K, L see Figure 15. Scales in mm, A upper left, B-F, J-L upper right, G-I lower scale. Modified from Popov and Fishpool in Mestre (1988).

Affinities

Orthochtha venosa occupies a unique position in relation to other *Orthochtha* species, without obvious affinity with any of them.

Material examined

Cymochtha venosa Ramme. Holotype M, **Cameroon** (MNHU).
Macrocymochtha speciosa Sjöstedt. Holotype M, **Burkina Faso**: Pundu (NR).

In addition to the type material, 156 specimens were examined from the following localities: **Senegal**: Richard Toll (16°25′ N 15°42′ W), Niokolo Koba, (MNHN, IFAN). **Guinea Bissau**: Farit (NHM). **Mali**: Sikasso (11°19′ N 05°40′ W); Dogo (15°10′ N 04°26′ W); Kara (14°00′ N 05°20′ W); Sormé (14°52′ N 04°25′ W) (MNHN, NHM, NRI). **Benin**: Malanville (11°53′ N 03°23′ E) (NHM, NRI). **Togo**: Katchenke (08°11′ N 00°41′ E) (NRI). **Niger**: Gaya (11°55′ N 03°24′ E) (NRI). **Nigeria**: Kalkala, Malari, Shuari, Lake Chad, Dikwa (12°02′ N 13°55′ E); Gumnari (09°12′ N 12°01′ E); Lamurdi (09°36′ N 11°41′ E); Filiya (07°35′ N 11°07′ E); Numan (09°28′ N 12°02′ E); Yola, Birnin Kudu (11°27′ N 09°30′ E); Marte (12°22′N 12°50′E); Zaria, Samaru, IAR Farm, 75 km from Jos, on Jos – Zaria road, Nr. Difa, Nr. Debakabe, Lake Chad, E. of Mongonu, 8 km N. Kerenowa (NHM, NRI). **Cameroon**: Nr. Guirvidig (10°53′ N 14°50′ E); Pouss (10°51′ N 15°00′ E); Garoua (09°18′ N 13°24′ E). **Chad**: Fort Lamy (Ndjamena), Lac Toubouri (09°55′ N 15°01′ E) (MNHN). **Sudan**: Gedaref (NRI).

Biology

Orthochtha venosa is univoltine, surviving the dry season in the egg stage (Lecoq, 1980; Fishpool and Popov, 1984). In West Africa the nymphs usually appear in June, adults in July; adult numbers reach a peak in September, decline in November and disappear during December.

The species inhabits chiefly hygrophilous, tall grass communities that develop on hydromorphic soils liable to seasonal flooding. The common grasses are *Echinochloa pyramidalis, Vetiveria nigritana, Hyparrhenia, Sorghum* and *Pennisetum* spp. The grasshoppers are clearly adapted to flood conditions and the nymphs in particular will readily take to water, swim and even dive actively to avoid pursuit. In this respect their behaviour is similar to that of *Hieroglyphus daganensis* Krauss (Hemiacridinae), which occurs in the same habitat and with which they often form mixed aggregations (Popov and Fishpool, 1988). Like *H. daganensis, O. venosa* exhibits some gregariousness and change of coloration at high densities. The coloration of the nymphs in particular is very distinctive and density-dependent. In low density ('solitarious') populations, the older nymphs are pale-buff to yellowish, with fine dark mottling and speckling along the sides of the body; the face is dark and the dorsum of pronotum and remigium of wing-pads whitish, with dark veinlets; the lateral stripe is pale brownish, only slightly darker than the rest of body; the upper face of hind femur is brown and the lower stramineous, with a dark lower sulcus, hind tibiae dirty bluish, with dark inner face. The 'gregarious' nymphs from high-density populations are more brightly coloured; the lower parts of the body are bright-yellow with fine black speckling, the dorsum is a contrasting clear white, while the pattern on the upper abdomen is darker, shiny coal-black in extreme cases; the face is black below the clypeus, shading to brown above; the lateral stripe and upper face of hind femur rusty-brown, the lower sulcus and the inner face of hind tibia jet black. The coloration of the nymphs in *venosa* is thus markedly different from that of the adults, in contrast to other known species (*ampla, dasycnemis, sudanica*), in which the coloration of the nymphs closely resembles that of the adults (Popov, 1989).

This change of coloration frequently occurs in mixed populations of *H. daganensis* and *O. venosa* and it is possible that the two species are mutually gregariously stimulated; the black pigmentation that develops in the nymphs at high densities shows a similar pattern in the two species (Popov, 1989). It develops principally on the ventral part of the body; as such it is not readily visible in the normal resting posture adopted by these graminicolous species, only being seen when jumping.

The high-density populations in particular are fairly mobile and at times, spread beyond the limits of their natural habitats, to invade adjacent crop areas. This occurs in the Maga – Pouss area of northern Cameroon, where rice fields are occasionally invaded by such mixed populations, which in addition to *H. daganensis* and *O. venosa* may include *Orthochtha sudanica, Phyllocercus bicoloripes, Eyprepocnemis plorans* and *E. noxia*. Occasionally the flooded paddies are invaded by swimming nymphs. Another peculiarity of *O. venosa* is the occurrence of adults with very long tegmina and wings. Expressing tegmen length as the ratio of its length to that of the hind femur, in macropterous individuals it is 1.45-1.46 in females and 1.45-1.55 in males, as against 1.14-1.32 in 'normal' females and 1.18-1.20 in males. Whilst the 'normal' individuals are rather poor fliers, and often try to avoid pursuit by concealment rather than flight, macropterous individuals are strong fliers and it is these that are usually captured at light. There is, however, no evidence that macropterism in *O. venosa* is density dependent.

Distribution and geographical variation (Figure 6)

Orthochtha venosa ranges through the Sudan savanna and the southern border of the Sahel from the Atlantic to the Nile. Its presence is associated with hygrotypic grasslands on clay soils liable to flooding. Within these limits, although the bulk of the populations occurs south of the 500 mm isohyet, some penetrate into the drier areas farther north along the valleys of the Senegal and Niger rivers and around Lake Chad. *Orthochtha venosa* shows relatively little variation in size and coloration throughout its range of distribution. The Guinea Bissau specimens are among the smallest and darkest; specimens from Kara, Mali, collected in January are darker still, but others from the same locality taken in October, are of a stramineous colour. The largest specimens are from the Lake Chad Basin.

Orthochtha dimorpha Miller 1929

(Figure 25, distribution – Figure 6)

Orthochtha dimorpha Miller 1929: 69. Holotype male, TANZANIA (NHM) [examined].
Orthochtha elongata Kevan 1956: 31. Holotype male, KENYA (NHM) [examined]. **Syn.n.**
Orthochtha travaglini Baccetti 1985: 311. Holotype male, SOMALIA (Baccetti coll.) [examined]. **Syn.n.**
Orthochtha abukari Baccetti 1985: 315. Holotype male, SOMALIA (Baccetti coll.) [examined]. **Syn.n.**

Diagnosis

A distinctive species in its large size (see measurements) and elongate, slender build. Antennae long and broadly ensiform, shorter and more dilate in female. Head elongate, acutely pointed; face in profile oblique, straight or weakly concave, frontal ridge narrow above, strongly widened towards clypeus, fastigial constriction marked; fastigium verticis elongate, margins low, but distinct, median carinula obsolete, arcuate sulcus in mid position. Pronotum elongate, narrow, weakly sellate, lateral carinae parallel in prozona, weakly divergent in metazona; prozona/metazona ratio 1.4 in male, 1.25 in female; lower margin of lateral lobe straight, weakly ascending forward, lower hind angle acutely pointed. Tegmina in male extending to, or slightly beyond, tip of abdomen; in female slightly shorter. Hind wing hyaline, venation coarse, unspecialized. Hind femur elongate, slender length/width ratio 7.5-8; knee lobe rounded. Male subgenital plate simple, pointed; cerci very long, reaching tip of subgenital plate; concealed genitalic structures of both sexes as in Figure 25F,G,L.

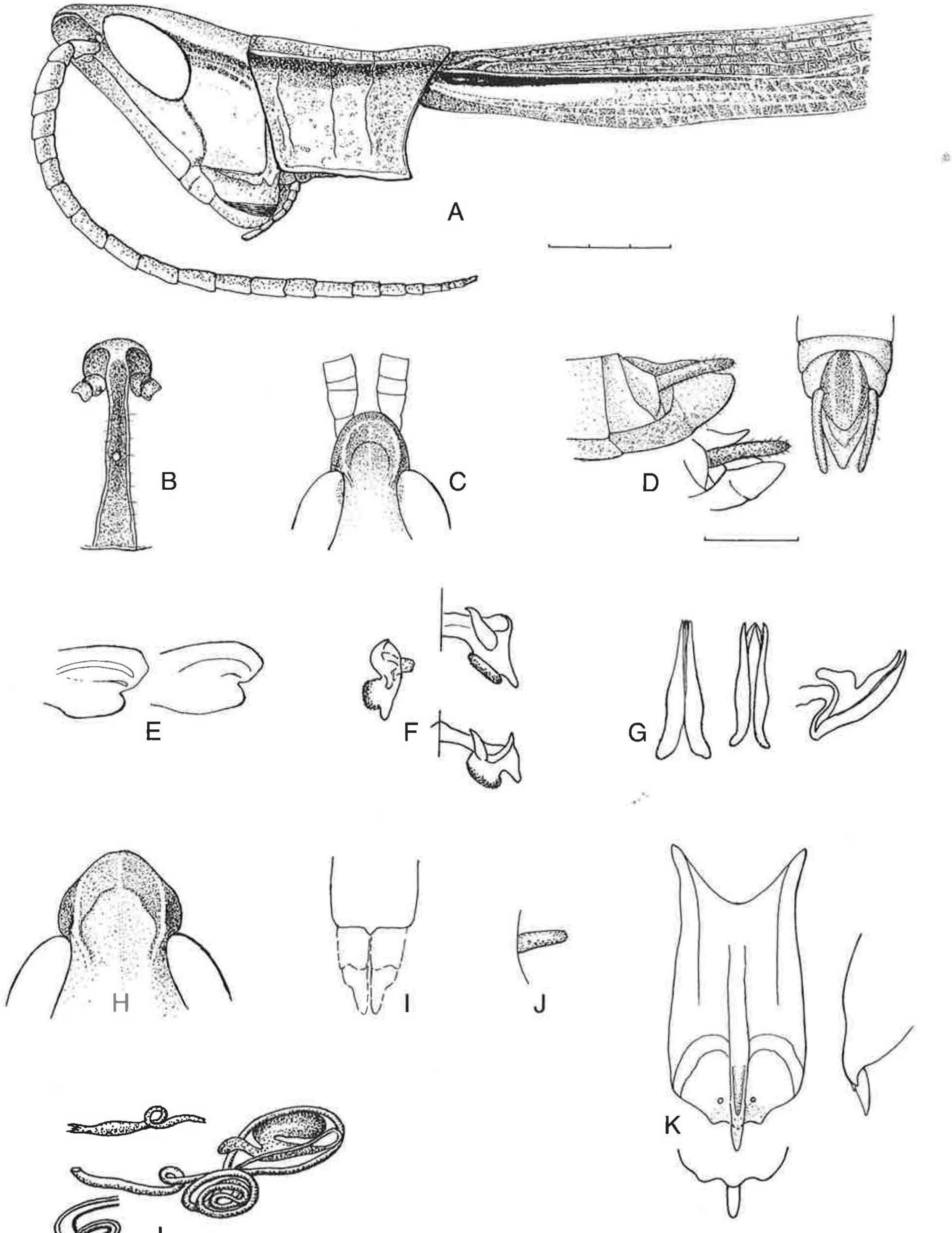

Figure 25 *Orthochtha dimorpha*. A-G male, H-L female. A lateral view of head, pronotum and base of tegmen; B frontal ridge; C, H dorsal view of fastigium verticis; D lateral and dorsal views of tip of abdomen and cercus; E inner (right) and outer lateral views of hind knee; F epiphallus (right half); G apical valves of aedeagus; I ventral view of abdomen (half upper scale); J cercus; K subgenital plate; L receptaculum seminis with expanded aspect of the coil (left) and spermatophore (above). For explanation of F, G, K, L see Figure 15. Scales in mm, F, G lower, remainder upper scale.

Coloration of male antennae black, fading to blackish-brown basally; side of body deep yellowish-green, to paler grass-green; face and dorsum brownish; lateral dark fascia narrow, weak to indistinct on head, darker on pronotum, and darkest in basal third of tegmina, constrasting with bright pale costal speculum; hind femur, like body, brownish above, greenish in lower half including lower sulcus, knee not markedly darkened; hind tibia and tarsus uniformly red, spines ivory-white, black-tipped. Coloration of female of lighter hue; body grass-green, antennae and dorsum light brown; lateral fascia often only distinct on tegmina, contrasting with white speculum, as in male; tibia paler pinkish red.

Measurements (mm)

Total length, M 27.0-37.0, F 48.0-61.0; pronotum length, M 4.5-6.0, F 8.0-10.0; prozona/metazona ratio, M 1.4, F 1.25; tegmen length, M 19.0-28.0, F 34.0-42.0; hind femur-length, M 15.0-22.0, F 24.0-29.5, -width, M 2.0-2.7, F 3.2-3.6; antenna length, M 12.0-20.0, F 12.0-19.0; head + pronotum, M 8.2-11.8, F 14.5-18.0.

Affinities

Like *O.venosa*, *O. dimorpha* occupies an isolated position relative to the other *Orthochtha* species, without obvious affinities.

Material examined

Orthochtha dimorpha Miller. Holotype M, **Tanganyika Territory**: Tindiga (04°02′ S 34°45′ E), 10.vi.1926 (*Miller*). The F paratype (same data) is a misidentification of *O. dasycnemis lindneri* (Kevan, 1955) (p. 59).

Orthochtha elongata Kevan 1956. Holotype M, **Kenya**: Nr. Kibwezi, small swamp (02°22′ S 37°54′ E), 2900 ft, 10-12.iv.1947 (*Kevan and Babault*); paratypes 14 M, 12 F, same data as holotype, but some collected at the same time from another small swamp near Kibwezi, at 37°58′ E (misprinted as 35°58′ E in the original description); 1 F, Turkana, Lokitaung (04°15′ N 35°44′ E), vi.1941 (*Jackson*); 1 M, Dela, Wajir Dist. (02°12′ N 39°42′ E), 16.vi.1946 (*Kevan*); 1 M, Kaiti R. (Masailand), ii.1947 (*van Someren*). **Tanzania**: 5 M, 6 F, Mpipiti, Sindiga Dist. (04°18′ S 03°50′ E), 18.vi.1938 (*Burtt*). **Somalia**: 1 M, Nr. Afmadu (00°27′ N 42°00′ E), 30.xi.1954 (*Greathead*) (all NHM).

Orthochtha travaglini Baccetti 1985. Holotype M, **Somalia**: Giballe (Jiballeye, (00°02′ S 42°37′ E), 20.xii.1984 (*Baccetti*) (Baccetti coll.).

Orthochtha abukari Baccetti, 1985. Holotype M, **Somalia**: Giohar (Jowhar) (02°46′ N 45°30′ E), 4.ii.1984 (*Baccetti*) (Baccetti coll.).

Distribution and geographical variation (Figure 6)

The species is known from eastern Africa from about latitude 4°N in southern Somalia and northern Kenya, to the latitude 4°20′ S in northern Tanzania, where it apparently inhabits lake and river margin grasslands at altitudes below about 1000 m. The smallest and darkest specimens are from Somalia and the largest and palest from Tanzania, but the single female specimen from Lokitaung in Turkana is exceptionally large. In addition to size, there are also some variations in the length of antennae, tegmina and cerci, but as some of these occur within series from the same locality they cannot be considered as of taxonomic significance.

Discussion

Miller (1929) described his *O. dimorpha* from a series of two macropterous males and a brachypterous female collected by him in Tindiga. The choice of name was made in the belief that the material was conspecific. The two males were indeed so, but the female specimen belongs to another taxon, subsequently described by Kevan (1955: 483) as *Orthochtha lindneri* and established here as *O. dasycnemis lindneri* (p. 59); it is thus a case of an original misidentification.

Orthochtha elongata Kevan 1956 was described from a long series of both sexes collected near Kibwezi, Kenya, and was said to differ from *O. dimorpha* Miller in the macroptery of both sexes and the longer cerci of the male. The latter character is subject to some variation and also the cerci may appear to be longer or shorter, when gauged against the tip of the subgenital plate which may itself vary in its relative position. In fact, in some of Kevan's paratypes of *elongata* the cerci are no longer than in Miller's holotype of *dimorpha*. The other characters, including the characteristic concealed copulatory structures, likewise fail to provide valid criteria for the separation of the two type series. The two are thus synonymous, and hence the rather inapt senior synonym, *dimorpha*, takes precedence over the much more appropriate *elongata*. Baccetti's *travaglini* and *abukari* are merely geographic forms of *dimorpha*; they differ only in their smaller size and darker coloration but not structurally, and are thus also reduced to junior synonyms of *O. dimorpha* Miller.

Biology

Practically nothing is known of the biology of this species, but the label data indicate the presence of adults in most months of the year, thus suggesting continuous reproduction, probably modified locally by the chronology of rainfall. The occurrence of the species in such isolated habitats as Lokitaung and Wajir, suggests possible vagility.

***Orthochtha nadiae* sp. n.**

(Figure 26, distribution – Figure 6)

Diagnosis

Only male known. Size a little below medium (see Measurements), slender; integument shiny, finely sculptured. Antennae lack apical parts, but basally structurally similar to *O. brachycnemis*. Head narrow, acute, face strongly oblique, straight in profile; frontal ridge moderately wide with low, thick margins, slightly expanded between antennae, weakly divergent and diffused towards clypeus; fastigial constriction pronounced. Fastigium of vertex narrowly elliptic, its marginal and median carinulae low, linear, but distinct; arcuate sulcus positioned well forward; occiput finely sculptured. Dorsum of pronotum narrowly tectiform, with linear well-marked carinae, its surface shallowly pitted; sculpturing on metazona appears as low, parallel callosities; front margin broadly excurved, hind one forms rounded, weakly emarginate angle (Figure 26B). Transverse sulci weak, only posterior and second distinct; prozona 1.6 times length of metazona; lower hind angle of lateral lobe straight. Mesosternal lobes quadrate, rounded, interspace narrow, less than half width of lobe. Tegmina and wings reach tip of abdomen; tegmina translucent, with coarse venation, intercalary vein distinct. Hind femur slender, length/width ratio 6.5; genicular lobes not produced, both inner and outer rounded. External genitalic structures as in Figure 26D,E, supra-anal plate cordate, pointed, basal depression well marked; cerci long and slender, somewhat compressed laterally; subgenital plate short, simple, pointed. Internal genitalic structures as in Figure 26G,H, outstanding features of which are very broad, laterally expanded epiphallic lophi, short posterior but elongate anterior projections and moderately heavy aedeagal valves.

Coloration light brownish dorsally and greenish laterally; antennae brownish basally; lateral fascia weak and narrow on head, somewhat more marked on pronotum, not reaching tegmina. Median dorsal carinula on head and median dorsal carina on pronotum edged in black; whole disc of hind wing clear pink, hind tibia brownish basally.

Measurements (mm)

Total length, 24.0; pronotum, 3.9, tegmen length, 15.5, width, 2.4; hind femur-length, 13.7, -width, 2.1; head + pronotum, 7.8.

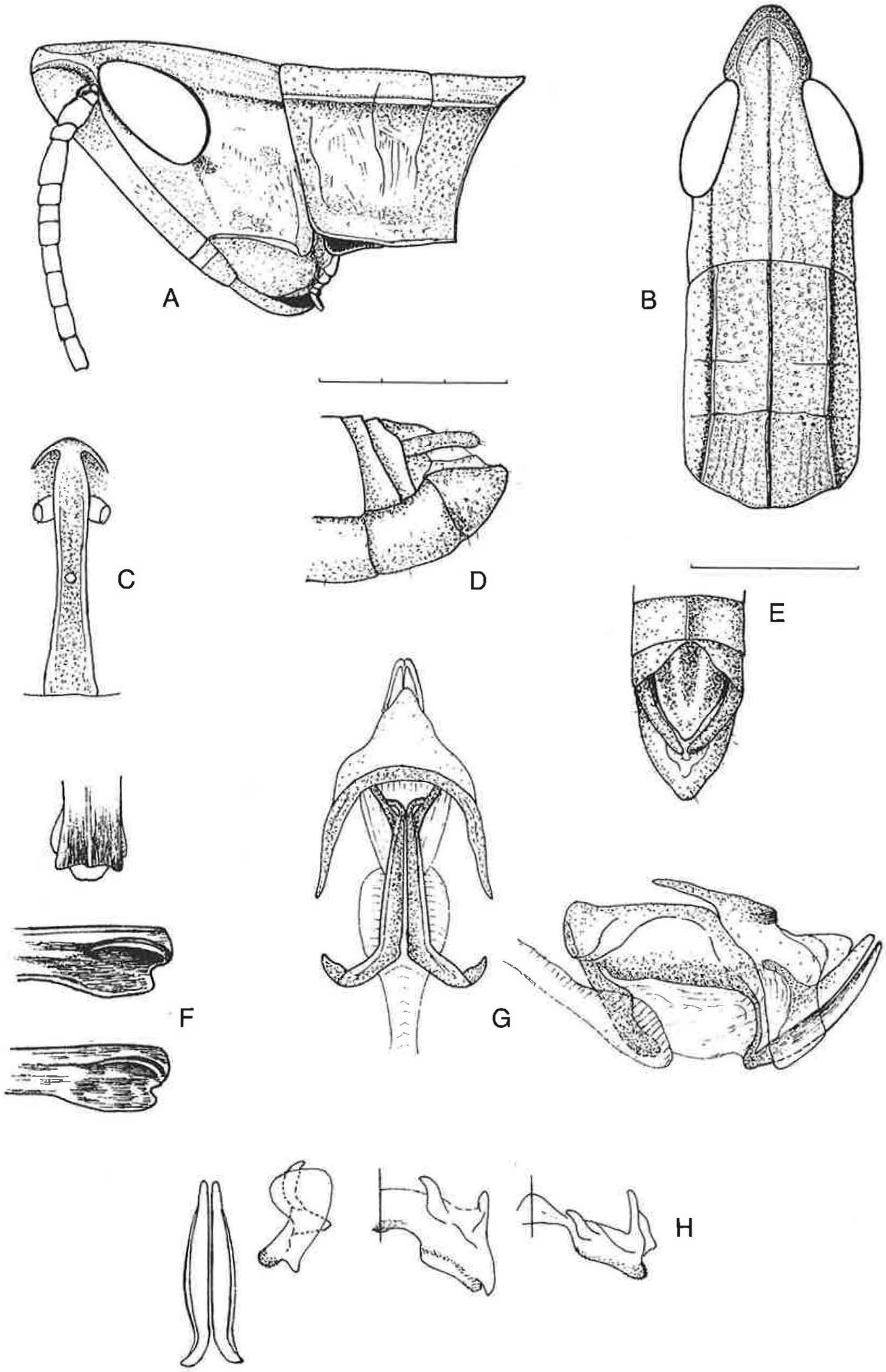

Figure 26 *Orthochtha nadiae* **sp.n.**, male. A, B lateral and dorsal views of head and pronotum; C frontal ridge; D, E lateral and dorsal views of tip of abdomen; F dorsal, outer lateral (centre) and inner lateral views of hind knee; G lateral (left) and dorsal views of phallic complex; H epiphallus (right half) and apical valves of aedeagus (left). For explanation of G, H see Figure 15. Scales in mm, A-F upper scale, G H lower scale.

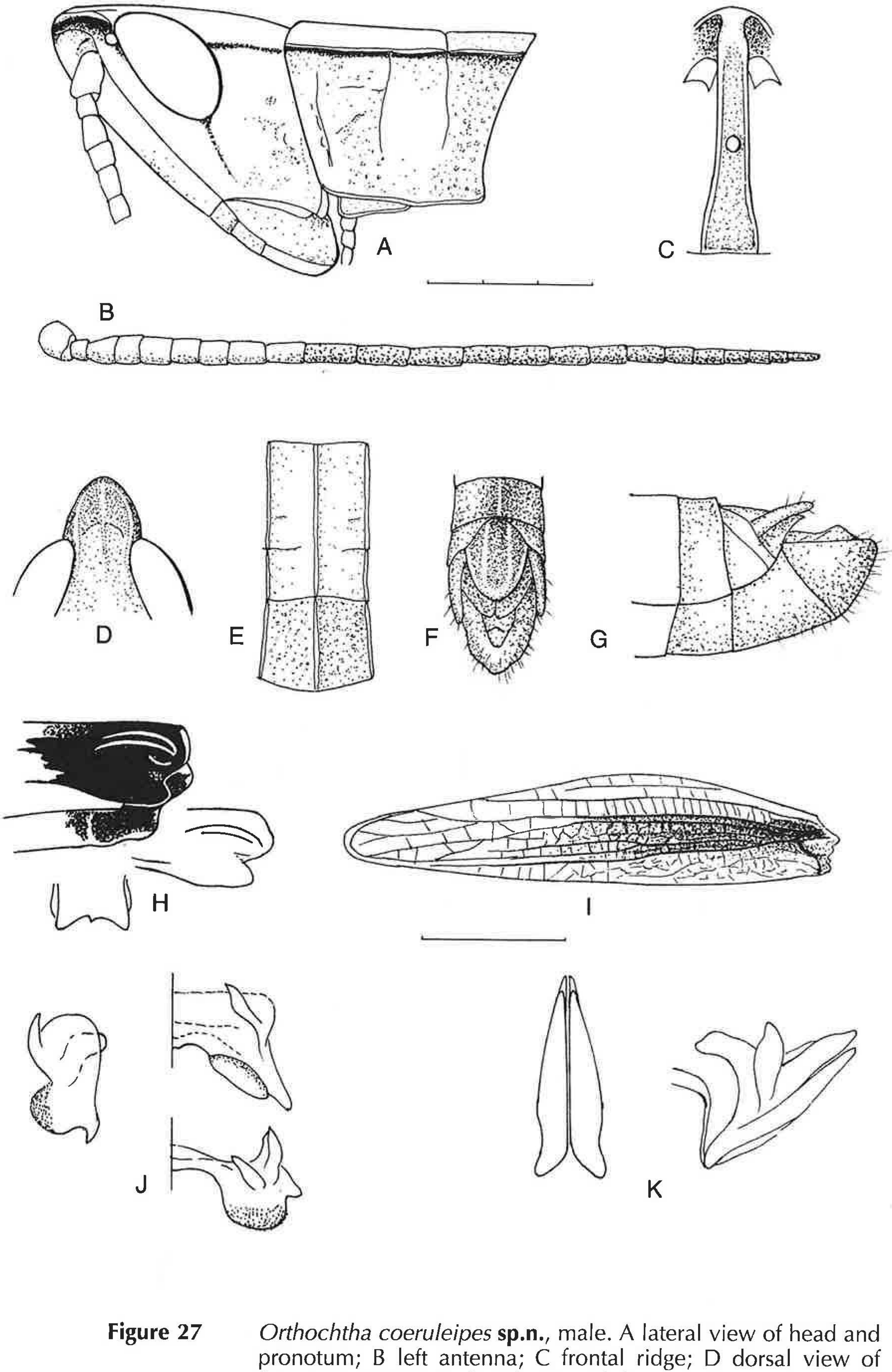

Figure 27 *Orthochtha coeruleipes* **sp.n.**, male. A lateral view of head and pronotum; B left antenna; C frontal ridge; D dorsal view of fastigium verticis; E dorsal view of dorsum of pronotum; F, G dorsal and lateral views of tip of abdomen; H outer lateral (left), inner lateral and dorsal views of hind knee; I left tegmen; J epiphallus (right half); K apical valves of aedeagus. For explanation of J, K see Figure 15. Scales in mm, A-I upper, J, K lower scale.

Material examined

Holotype, M, **Angola**: Chitan (*c.* 13°30′ S 17°00′ E); Bihe Dist. 4900 ft, 18.ii.1931 (*R and L Boulton*) (*Ex. Carn. Mus. Bruner Cln.*) (NHM).

Affinities

On the grounds of general morphology and coloration, the nearest relative of this distinctive species appears to be *O. brachycnemis*. However, *O. nadiae* differs from this and other known species in its slender build, elongate, pointed fastigium of vertex, the internal and external genitalic structures and also details of its sculpturing and coloration.

It is dedicated to the distinguished entomologist, Dr Nadia Waloff.

Orthochtha coeruleipes **sp. n.**

(Figure 27, distribution – Figure 6)

Diagnosis

Only the male known. Of medium size and build (slightly larger and more robust than typical *O. d. dasycnemis*). Integument smooth, only metazona of pronotum weakly punctate. Antennae long and slender, extending well beyond base of hind femur; 7 basal segments smooth, 14 apical ones densely punctate. Head pointed, face oblique and broadly convex in profile; frontal ridge well defined, weakly constricted below fastigium and divergent towards clypeus. Fastigium of vertex parabolic, shallow, flat, with well-marked narrow lateral margins; median carinula low, linear but distinct, arcuate sulcus weak, well behind middle. Compound eye oval, not markedly narrowed apically. Pronotum straight in profile, dorsum weakly tectiform, parallel-sided, barely constricted in the middle, carinae linear, distinct; all three transverse sulci weak, but distinct; prozona/ metazona ratio 1.8; upper and lower margins of lateral pronotal lobe parallel, upper straight, lower excurved; mesosternal interspace half width of lobe. Tegmina abbreviated to half length of abdomen, costal field widened, apex narrowly parabolic; wing 2/3 length of tegmen, hyaline. Hind femur of normal structure for genus, both genicular lobes rounded; hind tibiae with 15 outer and 13 inner spines. Subgenital plate simple, apex pointed, not attenuate; cerci moderately long and slender, scarcely flattened. Tip of abdomen and tibiae weakly pilose. Concealed copulatory structures as in Figure 27J,K. Epiphallus with relatively short, narrow ancorae and narrow bridge, lophi broad but not deep, broadly rounded, posterior projection long and slender; aedeagal valves moderately robust, valves of cingulum distinctly longer than valves of penis.

Ground coloration uniformly light yellowish-green; seven basal antennal segments light brown, remainder blackish-brown. Lateral stripe black, very narrow on head and pronotum, broadening on tegmina. Hind femur colour of body, hind knee and base of tibia intensely black, rest of tibia blue-grey with black lateral lines along inner face, spines tipped with black; hind tarsus blue-grey above, brownish below.

Measurements (mm)

Total length, 22.5-25.0; pronotum, 4.2-4.4; tegmen, 6.8-9.6; hind femur-length, 15.5-17.0, -width, 2.3-2.5 antenna length, 12.5-14.3; head + pronotum, 8.0-8.6.

Material examined

Holotype M, **Malawi**: Nkapola hill, ii.1976 (*Whellan*) (NHM). Paratypes: 1 M, Michiru mountain 8 km NW. Blantyre (34°58′ E 15°44′ S), 27.iii.1986; 2 M, Shire River at Kapuchira falls (34°45′ E 15°53′ S), 28.iii.1986 (*Otte, Glenn and Ruffin*). (1 paratype NHM, 2 paratypes ANS.)

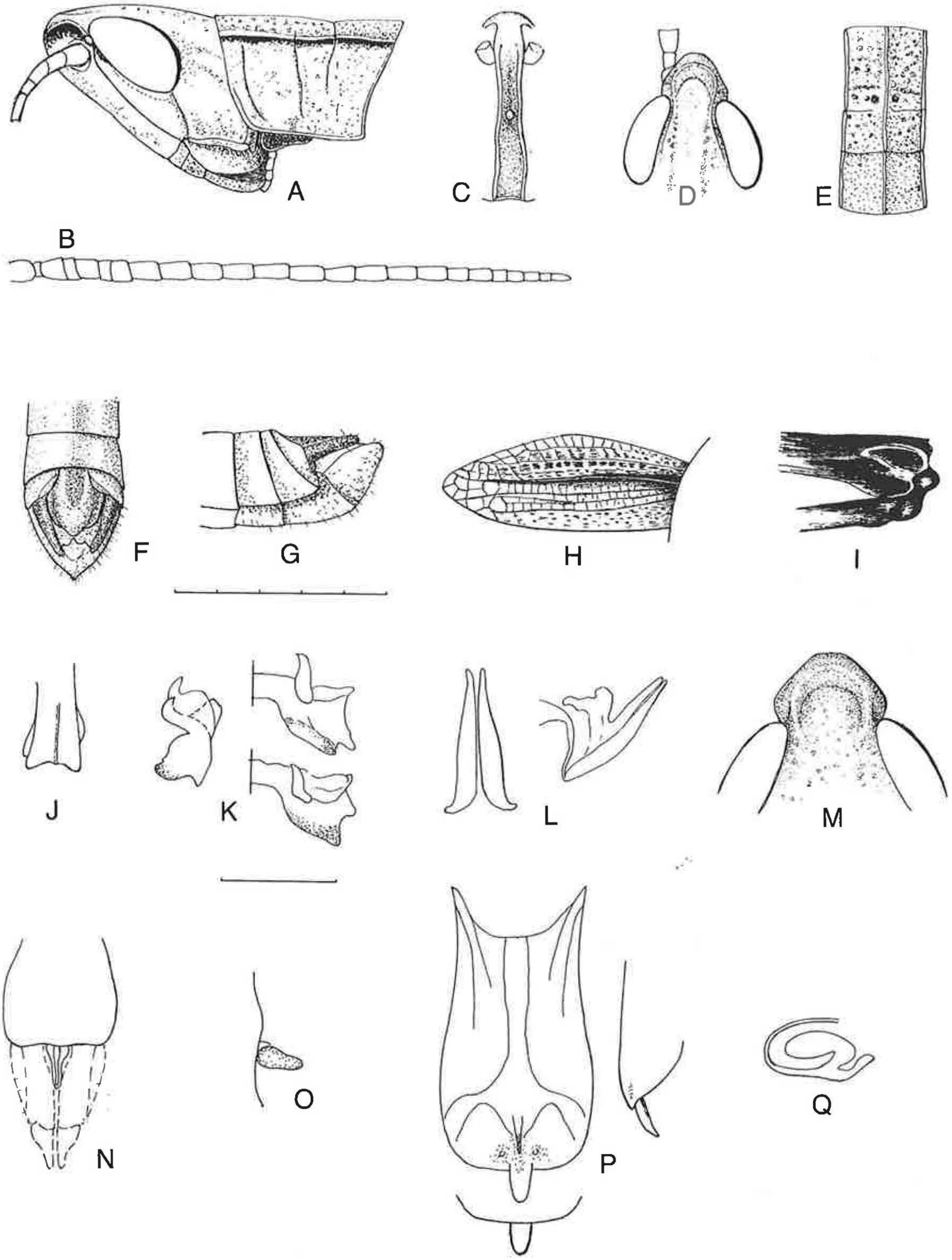

Figure 28 *Orthochtha aurea*. A-L male, M-Q female. A lateral view of head and pronotum; B antenna; C frontal ridge; D, M dorsal views of fastigium verticis; E dorsal view of dorsum of pronotum; F, G dorsal and lateral views of tip of abdomen; H left tegmen; I, J outer lateral and dorsal views of hind knee; K epiphallus (right half); L apical valves of aedeagus; N ventral view of tip of abdomen; O cercus; P subgenital plate; Q spermatheca. For explanation of K, L, P, Q see Figure 15. Scales in mm, K, L lower, remainder upper (but N half scale). Modified from Popov and Fishpool in Mestre (1988).

The paratypes are similar in size to the holotype, but darker; the lateral band is broader and darker and the ground coloration a deeper green, but the tibiae are blue as in the holotype.

Affinities

Superficially this species appears to be nearest to *O. aurea* as there are similarities in the structure of the frontal ridge, pronotum and in coloration, notably the blue hind tibiae. There are however, also marked differences in the structure of the vertex, tegmina and particularly the genitalia. Thus despite the superficial resemblance, it is doubtful if the two are related and both seem to occupy rather isolated positions within the genus.

Orthochtha aurea Popov & Fishpool 1988

(Figure 28, distribution – Figure 6)

Orthochtha aurea Popov & Fishpool 1988: 304. Figures 55,78. Holotype male, BENIN (NHM) [examined].

The original description of this species, like that of *O. sudanica* was published in Mestre (1988). An abridged English version of the original French text is given below.

Diagnosis

Male of medium size, slender; female larger and more robust. Antennae narrow, 1.5 times length of head and pronotum in male, shorter in female; frontal ridge as in Figure 28C; fastigium parabolic, shorter in female; arcuate sulcus in front of middle, median carinula obsolete. Pronotum tectiform, somewhat inflated in female; lateral carinae thick, parallel, prozona/metazona ratio 1.8 in male, 1.7 in female, hind angle rounded; lower posterior angle of lateral lobes straight, narrowly rounded. Tegmina proportionately same length in both sexes, barely longer than pronotum. Genicular lobe of hind knee rounded. Male cerci elongate, subcylindrical, inner face depressed; subgenital plate short, pointed, compressed laterally; internal genitalic structures as in Figure 28K,L. The genitalic structures of female as in Figure 28N,P,Q.

Coloration a shiny golden-green in male, duller in female. Antennae entirely black, lateral fasciae very narrow but sharply defined in both sexes, extending from antennal pits to base of tegmina, but absent in post-ocular zones; upper face of hind femora ferrugineous; knee, inner face and base of tibiae black, remainder of tibiae bluish-grey in male, pinkish-grey in female.

Measurements (mm)

Total length, M 21.0-22.0, F 41.5; pronotum, M 4.5-4.6, F 8.0; tegmen, M 5.7, F 11.5; hind femur-length, M 15.0, F 23.2, -width, M 2.5, F 3.5; antenna length, M 12.5, F *c.*12?; head + pronotum, M 8.7, F 14.5.

Material examined

Holotype M, **Benin**: Nr. Kandi, ix. 1983 (*Popov*) (NHM). Paratypes: 1 M, same data as holotype; 1 F, *Burkina Faso* near Kupela, about ix.1976 (*Plant Protection Service, Ouagadougou*) (NHM); 1 F, same data (MNHN).

Affinities

This brachypterous species does not show a close affinity with any other *Orthochtha* species, but is perhaps nearest to the *O. brachycnemis* species-group.

Discussion

This species is cited by Lecoq (1979: 567) as *Orthochtha* sp. (brachypterous species) and by Fishpool and Popov (1984: 401) as *Orthochtha* sp.3. Little is known of its ecology and biology. The two males were found late in the rainy season, in a wooded savanna dominated by *Andropogon gayanus*, near Kandi in Benin, where a few *Orthochtha ampla* were also found. The *aurea* were found perched on the tops of grass tussocks, but on the slightest disturbance would drop into the heart of the tussock, where their capture was extremely difficult. Such behaviour no doubt contributes to the rarity of this species in collections. As a brachypterous species however, it may be that the adult stage is short lived (and hence rarely caught), in order to avoid the regular seasonal burning of its savanna habitat that occurs at the start of the dry season. It is probable therefore, that the dry season is passed as diapausing or quiescent eggs.

So far *O. aurea* is only known from Benin and Burkina Faso, but may be expected to occur in similar savanna habitats from Côte d'Ivoire to Nigeria.

***Orthochtha angusticornis* sp. n.**

(Figure 29, distribution – Figure 6)

Diagnosis

Of medium size, integument very smooth and shiny. Antennae narrow and slender, extending to base of hind femur in male, slightly shorter in female. Face strongly oblique, apex well rounded, 'bullet shaped'. Frontal ridge relatively broad, deeply sulcate, margins raised, almost straight, weakly divergent towards clypeus. Fastigium of vertex parabolic, shallowly concave, slightly longer than wide in male, as long as wide in female, its margins thick and low; median carinula obsolete, arcuate sulcus shallow, positioned behind middle in both sexes. Sculpturing of pronotum weak, carinae low and thick, lateral ones parallel; hind margin broadly rounded; transverse sulci shallow, third obsolete; metazona half length of prozona; lateral pronotal lobes with wavy lower margin, front angle obtuse, hind one straight, not produced. Mesosternal lobes quadrate, with broadly rounded angles, interspace half width of lobe. Tegmina reduced to length of pronotum; wings 2/3 their length. Hind femur of medium build, both inner and outer lower genicular lobes rounded. External genitalic structures of male as in Figure 29G,H. Supra-anal plate with deep median sulcus and prominent lateral callosities; cerci elongate, moderately heavy, similar to that of *O. dasycnemis bisulcata*; subgenital plate short, pointed. Concealed genitalic structures as in Figure 29J – O. Epiphallus moderately robust, bridge rather broad, with median projection, ancorae large, lophi elongate, rounded and inflated, anterior process normal, posterior one produced. Apical valves of aedeagus moderately long and robust. Receptaculum seminis and subgenital plate of female as in Figure 29P,R.

Coloration greenish, shading to brownish-yellow, stramineous on face and hind femur. Antennae black; lateral stripe narrow, but sharply defined from antennal pits almost to tips of tegmina, where they fade to brownish; hind femur tinged rusty-brown above; hind knee black, hind tibiae pinkish, spines pale basally, tipped with black.

Measurements (mm)

Total length, M 22.0-26.0, F 31.0-43.0; pronotum length, M 4.3-4.8, F 5.6-7.5; prozona/metazona ratio, M 2.0, F 1.7; tegmen length, M 5.0-5.6, F 5.5-9.0; hind femur-length, M 14.5-16.7, F 20.0-23.5, -width, M 2.3-2.7, M 2.6-3.4; antenna length, M 12.5-14.0, F 10.0-13.5; head + pronotum, M 7.7-9.0, F 10.0-13.0; hind femur length/width ratio, M 6.3, F 6.7.

Affinities

This species is not closely allied to any of the other species of *Orthochtha*.

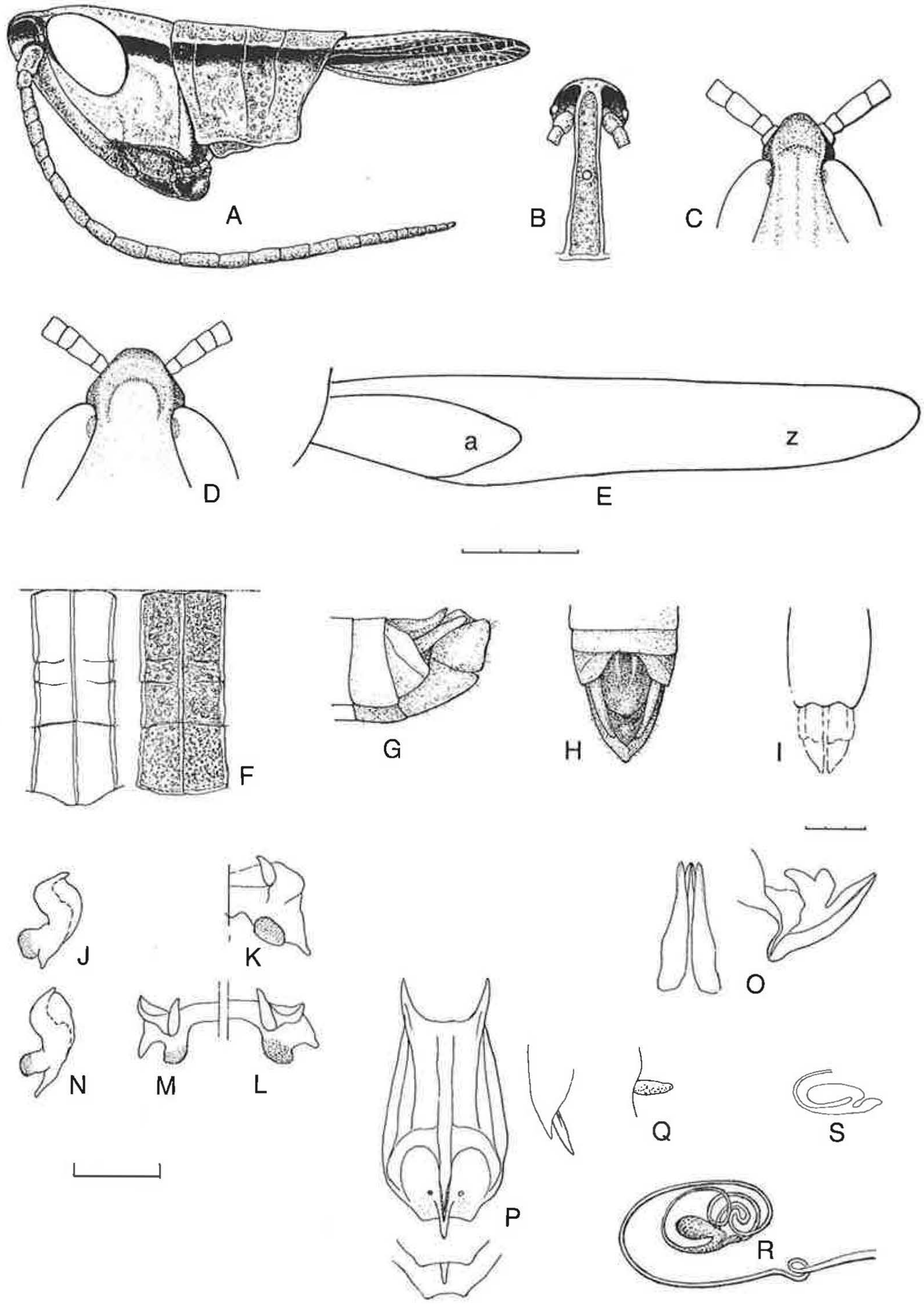

Figure 29 *Orthochtha angusticornis* **sp.n.** Nominate subspecies except where stated. A-C, E-H, J-O male, D, I, P-S female. A lateral view of head and pronotum; B frontal ridge; C, D dorsal views of fastigium verticis; E outline of tegmen of *a. angusticornis* (inner) and *a. zambiae* (outer); F dorsal view of dorsum of pronotum of *a. angusticornis* (right) and *a. zambiae* (left); G, H lateral and dorsal views of tip of abdomen; I ventral view of tip of abdomen; J, K, L lateral, dorso-posterior and dorsal veiws of epiphallus (right half) of *a. angusticornis*; N, M lateral and dorsal views of epiphallus (left half) of *a. zambiae*; O apical valves of aedeagus; P subgenital plate; Q cercus; R receptaculum seminis; S spermatheca, showing variation. For explanation of J-P, R, S see Figure 15. Scales in mm, A-H, P-S upper, I middle, J-O lower scale.

Material examined

Holotype M, **Zaire** (as Congo Belge): Kalulu (10°08′ S 26°37′ E), 3.v.1939 (*Bredo*) (IRSNB). Paratypes: 28 M, 30 F same data as holotype; 13 M, 13 F Mwashia, 1 km des Salines (10°42′ S 27°20′E), 3.v.1939; 1 F Mitwaba Kibaras (08°38′ S 27°20′ E), 1.xii.1938 (*Bredo*). (67 paratypes in IRSNB, remainder NHM, MNHN, NRI.)

Distribution and geographical variation

The type material from the Shaba province of Zaire shows some variation in size but very little in coloration. Nothing is known of the ecology and biology of this species, but the collection localities suggest a likely association with riverine grasslands.

Some of the material of this species is sufficiently distinct to merit recognition as a separate subspecies, described below.

***Orthochtha angusticornis zambiae* subsp. n.**

(Figure 29, distribution – Figure 6)

Diagnosis

Differs from the nominate subspecies in longer tegmina and wings, which extend to slightly beyond the middle of the abdomen in both sexes, a proportionately longer metazona of pronotum and in the structure of the epiphallus, notably in narrower and longer lophi and longer posterior processes (Figure 29E,F,N,M). There is no marked difference in the coloration of the two subspecies, which otherwise differ in their geographical distribution, with *O. a angusticornis* found in southern Zaire and *O. a. zambiae* occurring in neighbouring parts of northern Zambia.

Measurements (mm)

Total length, M 23.5-26.5, F 33.5-40.5; pronotum length, M 4.6-4.8, F 6.6-7.5; prozona/metazona ratio, M 1.6 F 1.6; tegmen length, M 12.5, F 16.5-18.5; hind femur-length, M ?, F 20.0-23.5, -width, M ? F 3.0-3.5; antenna length, ?; head + pronotum, M 8.5-9.5, F 11.8-13.0; hind femur length/width ratio, F 6.7.

Material examined

Holotype M, **Zambia**: Kabwe (00°34′ S 29°34′ E), 3.ii.1940 (*Bredo*) (IRSNB). Paratypes: 1 M, same data as holotype; 2 M, 8 F, Musosa (08°23′ S 29°38′ E), x-xi 1939 (*Bredo*). (2 paratypes at NHM, remainder IRSNB.)

Orthochtha rosacea (Walker 1871)

(Figures 30,31, distribution – Figure 6)

Pyrgomorpha rosacea Walker 1871: Suppl. 50. Lectotype male, SOUTH AFRICA, Port Natal (NHM) (designated by Uvarov (1925: 273)) [examined].
Orthochtha rosacea (Walker); Uvarov 1925:273.
Orthochtha martini I. Bolivar 1908: 242, holotype female, SOUTH AFRICA, Natal (IEE) [examined]. (Synonymized by Uvarov 1925: 273.)

Diagnosis

Of medium size, or slightly smaller, female much larger and bulkier than male (see measurements). Integument matt, finely punctured on thorax, smooth elsewhere. Antennae narrowly ensiform in both sexes, slightly longer in male, slightly shorter in female than combined length of head and pronotum. Face oblique, straight in profile in male, weakly convex in female; apex of head pointed, not projecting; fastigium of vertex parabolic, oblong in male, round in

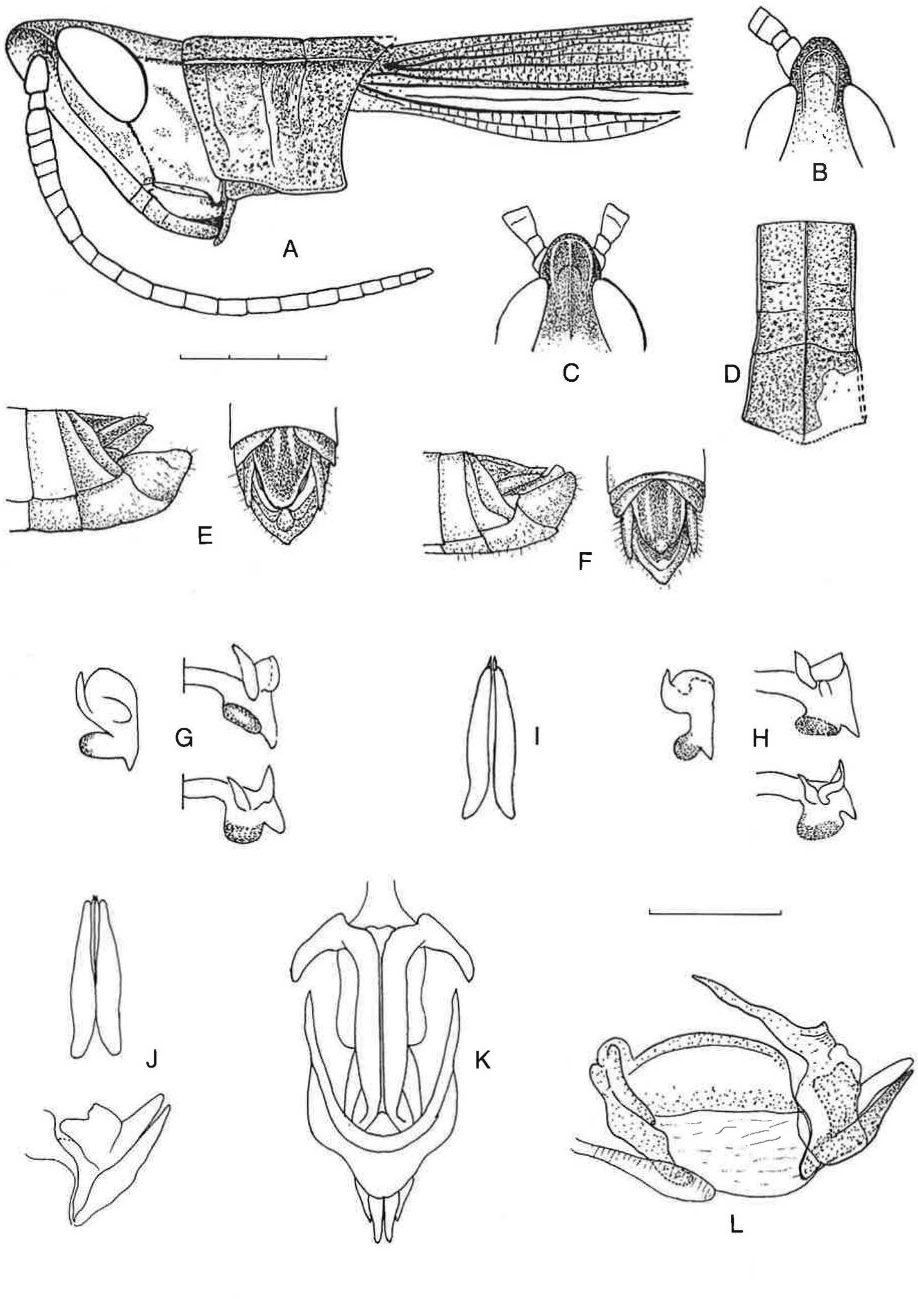

Figure 30 *Orthochtha rosacea* and *O. zuluensis* **sp.n.**, males. A, B, D, E, G, I, K, L *zuluensis*, C,F,H,J *rosacea*. A lateral view of head, pronotum and base of tegmen; B, C dorsal views of fastigium verticis; D dorsal view of dorsum of pronotum; E, F lateral and dorsal views of tip of abdomen; G, H epiphallus (right halves); I, J apical valves of aedeagus; K, L dorsal and lateral views of phallic complex with epiphallus removed. For explanation of G-L see Figure 15. Scales in mm, A-F upper, G-L lower scale.

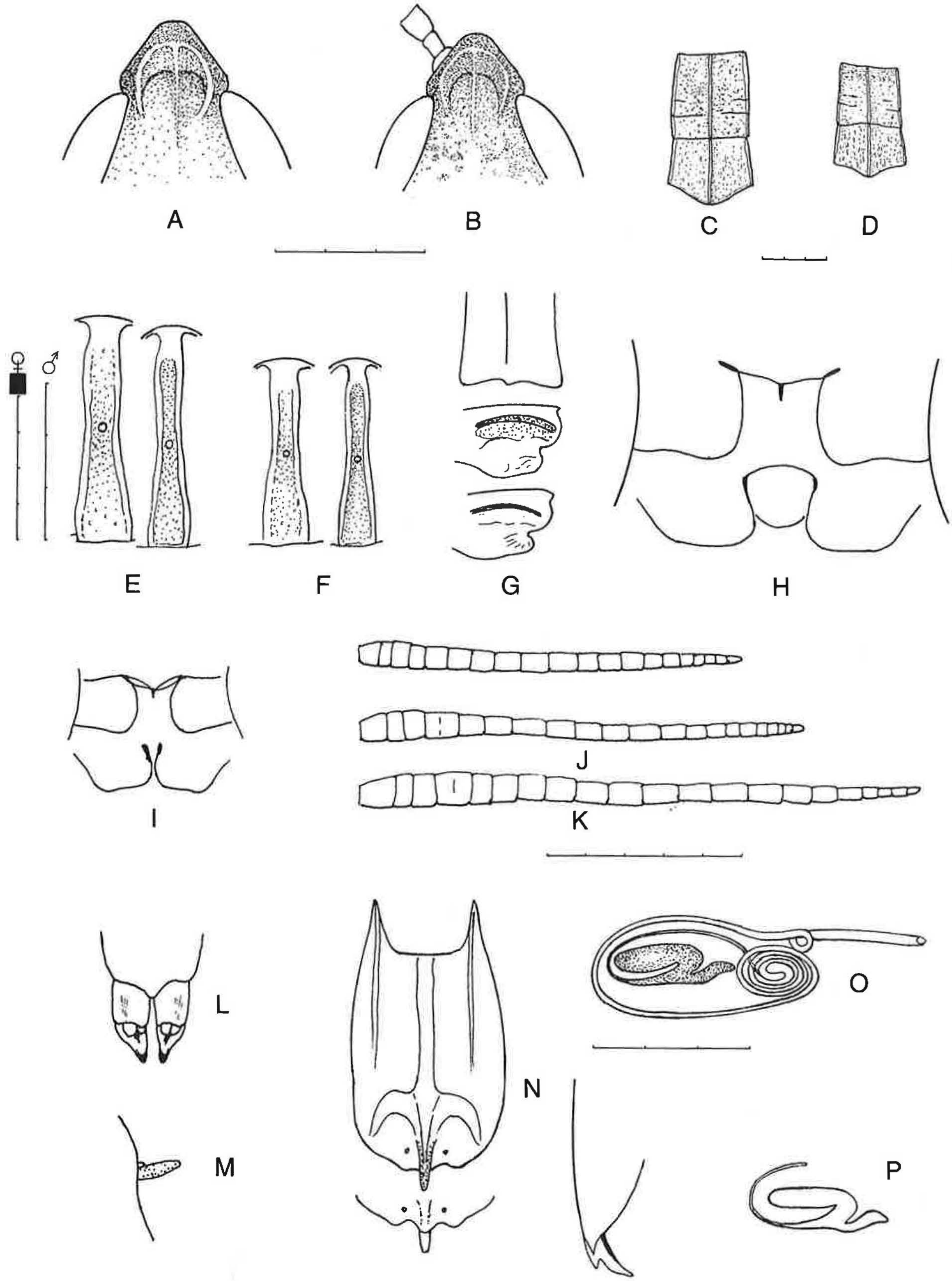

Figure 31 *Orthochtha rosacea* and *O. zuluensis* **sp.n.** Females except where indicated. A, C, E, G, H, I, K, L *zuluensis*, B, D, F, J, M, N, O, P *rosacea*. A, B dorsal views of fastigium verticis; C, D dorsal views of dorsum of pronotum; E, F frontal ridges, females on left, males on right; G (male) dorsal, outer lateral and inner lateral (below) aspects of hind knee; H, I (male) sterna; J (male above), K antennae; L ventral view of tip of abdomen; M cercus; N subgenital plate; O receptaculum seminis; P spermatheca. For explanation of N-P see Figure 15. Scales in mm.

female, its surface slightly depressed, margins and median carinula weak in female, more distinct in male, arcuate sulcus distinct, as in Figures 30C and 31B. Frontal ridge moderately wide, its margins thick, fastigial constriction weak (Figure 31F). Pronotum weakly tectiform, slightly swollen in prozona in female, dorsum rather broad, hind margin obtusangular, carinae linear, distinct, lateral ones weakly divergent caudad; posterior sulcus distinct, others weak, prozona only slightly longer than metazona; lower margin of lateral lobe bent, parallel to upper margin in posterior part, and ascending in anterior part; hind angle straight. Mesosternal lobes weakly transverse, interspace half width of lobe in male, quadrate in female. In female folded tegmina just reach tip of abdomen, or extend slightly beyond it; in male longer, but do not reach hind knee; reticulation somewhat denser basally than in most *Orthochtha* species; intercalary vein very weak. Hind femur moderately heavy, length-width ratio about 6 in both sexes; genicular lobes rounded. Male supra-anal plate spathulate, with a deep median groove; cerci simple, conical; subgenital plate short, conical. Epiphallus with relatively narrow bridge, short ancorae and lobiform, inflated and upturned lophi (Figure 30H). Apical valves of cingulum thick, somewhat longer than valves of penis (Figure 30J); structures of female as in Figure 31M-P.

General coloration grass-green, somewhat brownish dorsally, more so in male. Lateral fasciae indistinct, or completely absent, but some speckling of medial area of tegmina present in female. Hind wings usually pink, but sometimes bluish, or purplish. Hind femora colour of body, knees not unduly darkened; hind tibiae and tarsi brownish, spines pale, tipped black.

Measurements (mm)

Total length, M 16.2-20.5, F 33.5-34.2; pronotum, M 2.9-3.7, F 5.7-5.9; prozona/metazona ratio, M 1.11, F 1.14; tegmen length, M 12.0-16.2, F 23.0-23.5; hind femur-length, M 11.0-15.0, F 22.0-23.0, -width, M 2.0-2.4, F 3.5-3.7; antenna length, M 7.2-8.4, F 9.0-10.0; head + pronotum, M 6.0-7.4, F 9.0-10.

Material examined

Pyrgomorpha rosacea Walker. Lectotype M, **South Africa**: the specimen bears an old, round locality label: 'Pt. Natal no. 58/3', a square Kirby label with legend 'one of Walker's series so named – *P. rosacea*' and B.P. Uvarov's 1924 label inscribed in his hand '*Pyrgomorpha rosacea* Wlk. Selected type' (NHM). There is a second Walker M type with a similar Kirby label and a locality label 'S. Africa' (NHM).
Orthochtha martini I. Bolivar. Holotype F, **South Africa**: Natal (*Martin*) (IEE).

Other material: **South Africa**: 1 M, Orange Free State, Witzieshoek (28°30′ S 28°46′ E), 6100 ft, 22.ii.1929 (*Scott*); 1 F, Cape Prov., Pietermaritzburg (29°35′ S 30°25′ E) (*Bush*); 2 F, Transvaal, Louis Trichardt, iv.1932 (*Mackie*); 1 M, 1 F, Natal, Zululand, Umfulosi Dist. (28°30′ S 32°11′ E), 1922 (*Curson*); 4 M, 1 F, Cape Prov., Katbura (32°33′ S 26°41′ E), 15-30.i.1933 (*Turner*); 3 M, 3 F, Grahamstown (33°19′ S 26°32′ E), 12.iii.1955 (*Greathead*) (NHM); 2 M, Natal, Pinetown (29°50′ S 30°50′ E), ii.1902; 1 M, Hilton Road (29°33′ S 30°18′ E), 23.xii.1909 (*Leigh*); 1 M, Transvaal, Trichardsdaal, Malta Forest, 5.ii. 1984 (*Otte, Cade and Toms*) (ANS). **Swaziland**: Manzini (26°15′ S 31°30′ E), 17.i.1963 (*Whellan*) (NRI). **Mozambique**: 1 M, Porto Henrique (26°20′ S 32°26′ E), 6.iii.1965 (*Veiga Ferreira; Muso Lourenço Marques*) (NRI).

Biology

Nothing known, but the label data show that the specimens were all collected between December and April, suggesting the species may be univoltine, probably with an embryonic diapause.

Distribution and geographical variation (Figure 6)

Orthochtha rosacea is practically confined to the eastern part of South Africa, from Cape Province through Natal and Transvaal, just reaching the southern end of Mozambique at latitude 26°S. It appears to be principally associated with edaphic grasslands at middle and higher altitudes. The specimens from lower altitudes are larger and paler; the male from Witzieshoek at 6100 ft is only 16 mm long, and is among the smallest specimens of *Orthochtha* known; it does not however manifest any brachyptery. The colour of the body shows only a limited range of variation through shades of green with more or less brown on the dorsal side, but the hind wings show a diversity of colour form, second only to *Euprepoptera polychroma* (p. 109). However, shades of pink, purplish and blue occur in series from the same locality and are thus not geographical variants. It is possible however that the intensity of colour may increase with age and maturation. The occurrence of polychromatic variation in the hind wing of *O. rosacea* had previously been recorded in a note by E. Burtt pinned in the NHM collection.

Affinities

Orthochtha rosacea is closely related to the next species, *O. zuluensis* **sp.n.**, with which it forms a very distinctive species pair, remote from the other members of *Orthochtha*. The principal diagnostic characters they share are: small size and robust build; broad, tectiform pronotum, linear, somewhat raised carinae and very low prozona/metazona ratio; wide mesosternal lobes and interspace; genitalic structures as in Figure 30G–L; distinctive coloration, in particular the almost complete absence of dark lateral fasciae, coloured hind wings, hind tibiae the same colour as the body (not pink, or blue).

In the structure of pronotum and genitalia they are nearest to *Lobopoma*, from which they differ in size, build and the fully developed organs of flight in both sexes.

Orthochtha zuluensis sp. n.

(Figures 30,31, distribution – Figure 6)

Diagnosis

Similar in general build to *O. rosacea*, but somewhat larger, male proportionately more slender and female bulkier. Frontal ridge and fastigium verticis as in Figures 30B and 31A,E. Pronotum similar in structure to that of *rosacea*, but prozona/metazona ratio higher (M 1.36, F 1.23); hind femur somewhat heavier than in *rosacea* (length/width ratio, M 5.8, F 5.4); external genitalic structures similar in both species, but internally they differ somewhat in structural detail (compare G,I,L in Figure 30 with H,J). Coloration distinctive in separating the two species, in *zuluensis* general coloration of male is greenish laterally and brownish dorsally; antennae blackish-brown; lateral dark fasciae very faint; hind wing bluish basally, infumate apically; hind femur brownish, darker above; tibia and tarsi brownish; hind knee only slightly darkened, with one pale ring just above, at tip of femur and one just below, at base of tibia. Coloration of female more uniformly brownish with only a touch of green on lateral pronotal lobes and tegmina; antennae brown; lateral dark fasciae very narrow and faint on head and pronotum, characteristically breaking up into 4-5 oblong, dark spots in medial area of tegmina; coloration of wings and hind legs less pronounced than in male.

Measurements (mm)

Total length, M 21.0-25.0, F 37.0; pronotum, M 4.2-4.7, F 7.6; tegmen, M 16.0-18.0, F 24.0; hind femur-length, M 16.0-16.5, F 26.0, -width, M 2.7-2.8, F 4.8; antenna length, M 11.0-12.5, F 12.0; head + pronotum, M 8.2-8.8, F 13.3.

Material examined

Holotype F, **South Africa**: Natal, Hluhluwe game reserve (28°05′ S 32°02′ E), 18.iv.1951; 1 M paratype, Transvaal, Kruger National Park, Lecu Pan NE. Skukuza (24°59′ S 31°36′ E), 1.v.1951 (*Swedish S. Afr. Exp. 1950-51, Brinck-Rudebeck*) (EMZI). Other paratypes: **South Africa**: 1 M, Transvaal, KNP, Lower Sabie, Muntshe hill, 20.ii.1978 (*Brown*) (DATS); 2 M, Transvaal, 2 m. NE. Bandelierkip (23°18′ S 29°51′ E), 13.iii.63 (*White*) (1 M DATS, 1 M NHM). **Mozambique**: 7 F, Namaacha (25°58′ S 32°01′ E), 5.iii.67 (*M. C. and G. V. Ferreira*) (3 NRI, 4 NHM) (not mapped).

Distribution and geographical variation

Orthochtha zuluensis is so far known only from South Africa, where it has been recorded in the Kruger National Park in the north and the Hluhluwe game reserve in Natal in the south. This, and the other label data, suggest that it is principally a savanna species, and like *rosacea* is probably univoltine, with an embryonic diapause during the dry season. The material shows little geographical variation; differences in the coloration of hind wings are probably largely due to physiological age.

Species of uncertain taxonomic identity and position

Orthochtha angustata (I. Bolivar 1889)

(Not illustrated)

Phlaeoba angustata I. Bolivar 1889: 97. Holotype female ANGOLA, originally in Lisbon Museum, now lost.
Rodunia angustata (I. Bolivar); Kirby 1910: 139.
Orthochtha angustata (I. Bolivar); Uvarov 1953: 143.
Orthochtha angustata (I. Bolivar); Dirsh 1966b: 394.

Discussion

This species was described from a single female holotype, now lost. Kirby attributed it to *Rodunia* (= *Duronia* Stål), but Uvarov (1953) placed it under *Orthochtha*, presumably on the basis of the description alone, for he makes no mention of having seen the type. Dirsh (1966b) remarks that the original description is rather poor and can be applied to the majority of the known macropterous species of *Orthochtha*. Indeed the principal diagnostic characters given by I. Bolivar (1889) as "la estrechez del dorso del pronoto que apenas aleanza el doble de la anchura del vértex entre los ojos y el paralelismo de las quillas del pronoto, asi como la notable diferencia entre la longitud de la prozona y la de la metazona, pues esta ultima apenas llega á dos quintos de la longitud total" are not unusual in *Orthochtha* species. However, the size of Bolivar's type given as 27 mm, is exceptionally small for females of the genus; in all the material examined by us, females of this size are found only in *O. katangana* (25 mm) and in the smallest specimens of *O. rosacea* and *O. dasycnemis nana* from the highlands of southern Africa, none of which stands as a likely synonym of *O. angustata*, either in terms of known geographical distribution, or morphological characteristics. Thus, there appears to be no better alternative than that adopted by Dirsh (1966b), which is to maintain the identity of the taxon under the original I. Bolivar (1889) name and description (quoted verbatim below) in the hope that future collecting and studies might reveal its true identity.

Original description (I. Bolivar 1889: 97)

Also cited by Dirsh 1966b: 395. Fusco-grisea, impresso punctata. Caput supra planum, fastigium haud transversum, marginibus deplanatis. Frons rugulosa, a latere visa haud vel laevissime sinuata. Costa apicem versus sensim ampliata. Pronotum compressum, antice truncatum, postice obtuse angulatum, dorso angustissimo, carinis tribus rectis, parallelis, ante sulcum typicum, pone medium situm, integerrimis; lobis deflexis trapexoidalibus ad carinas marginales disei infuscatis; margine exteriore fere recto, medio laevissime sinuato; angulo postico recto. Elytra apicem abdominis superantia, griseo-fusca, venis nigro-adsperis, vena intercalata nigro maculata. F.

Long. corporis..F	27 mm
Long. pronoti	4.5 mm
Long. elytr	22 mm
Long. fem. post	? mm

Duque de Bragança (Bayao!) [09°S 16°E]

ASIAN TAXA

Key 6 Ungrouped Asian species of *Orthochtha*

1 Size below average, robust, sexual dimorphism pronounced; pronotum parallel-sided, only the typical sulcus distinct, others weak; tegmina tapering apically; lateral fascia indistinct; southern India .... *O. ramchandrae* Popov

– Not with the above combination of characters 2

2 Small and slender (M *c.* 20 mm); head acute, face oblique, straight, or weakly concave in profile (Figure 34A), frontal ridge narrow (Figure 34C) . *O. schmidti* **sp.n.**

– Of medium size, M above 30 mm, F above 40 mm, apex of head rounded, frons weakly convex in profile, frontal ridge moderately broad 3

3 Lateral fascia broader, fastigium as in Figure 32J; cercus broad and flat (Figure 24M); central India .... *O. indica* Uvarov

– Lateral fascia narrower, fastigium as in Fig. 32C, cercus narrower, its inner face depressed; Thailand .... *O. roffeyi* **sp.n.**

Orthochtha ramchandrae Popov 1981

(Figure 33, distribution – Figure 6)

Orthochtha ramchandrae Popov 1981: 45. Holotype male, INDIA (NHM) [examined].

Diagnosis

Of rather robust build, male slightly below average size for genus, female much bulkier (see Measurements). Integument shiny, somewhat pitted. Antennae longer in male, shorter in female than combined length of head and pronotum; segments 1-7 flattened and expanded, becoming progressively narrower, more rounded and their surface more pitted apically. Head almost as long as pronotum in male and shorter in female; face strongly oblique and weakly convex in profile; frontal ridge broadly sulcate with thick margins, weakly narrowed at apex, parallel-sided to median ocellus, divergent and obliterate towards clypeus. Fastigium verticis parabolic, as long as wide in male, transverse in female, its margins thick, median carinula low but distinct, arcuate sulcus positioned well forward (Figure 33C). Pronotum rather short and broad, straight in profile and weakly tectiform, somewhat inflated in females, its surface finely rugulose all over. All three carinae low, but distinct, lateral ones straight in male, weakly excurved in female, barely divergent caudad, hind margin of dorsum broadly rounded; only posterior sulcus well-defined, ratio of prozona to metazona 1.4 in male, 1.6 in female; lateral lobes longer than wide, lower margin weakly sinuate, front angle obtuse, hind angle straight, narrowly rounded. Mesosternal lobes weakly transverse, broadly rounded, interspace narrower than lobe. Tegmina not reaching tip of abdomen, pre-costal area expanded, apex narrow, tapering. Wing rather narrow, venation loose. Hind femur heavy, ratio of length to width 5.5. External genitalic structures of male as in Figure 33E,F, supra-anal plate shield-shaped, with a broad median depression flanked by narrow parallel ridges; cerci shorter than plate, simple, rather thick and blunt, slightly compressed laterally

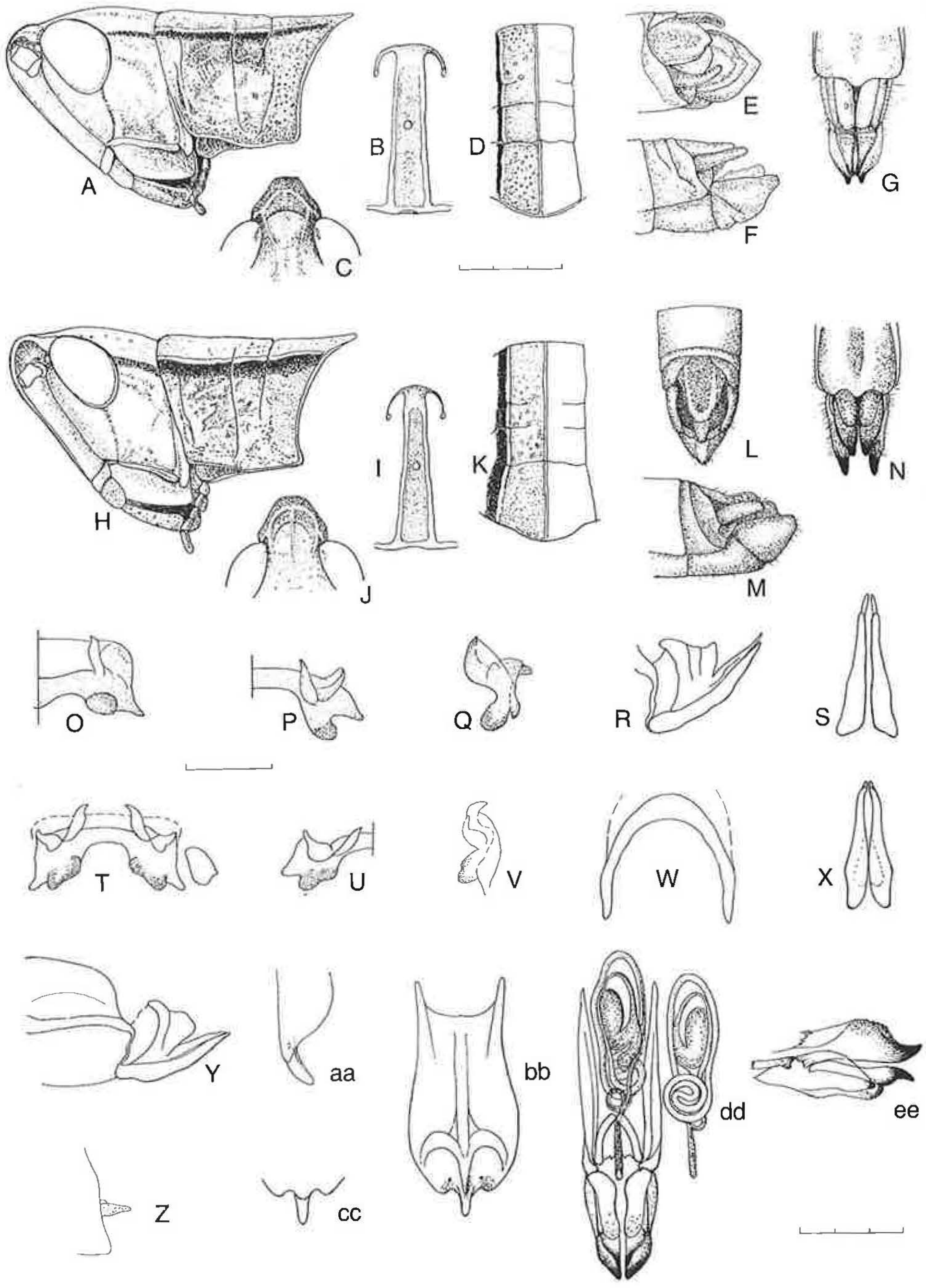

Figure 32 *Orthochtha roffeyi* **sp.n.** and *O. indica*. A-G, O-S *roffeyi*, H-N,T-ee *indica*. A-F, H-M O-Y male, G,N,Z-ee female. A,H lateral views of head and pronotum; B,I, frontal ridge; C,J dorsal views of fastigium verticis; D,K dorsal view of dorsum of pronotum; E,F,L,M dorso-lateral (E), lateral and dorsal views of tip of abdomen; G,N,dd ventral views of tip of abdomen with (dd) receptaculum seminis *in situ* and removed; O,T dorsal views of epiphallus (O right half only); P,U dorso-posterior views of epiphallus (right and left halves respectively); Q,V lateral views of epiphallus; R,Y lateral and S,X ventral views of apical valves of aedeagus; W dorsal view of apodeme of cingulum; Z cercus; aa-cc lateral, dorsal and ventral views of subgenital plate; ee lateral view of ovipositor valves. For explanation of genitalic structures see Figure 15. Scales in mm, A-N, Z-ee upper and lower, O-Y middle. Drawings of *O. indica* modified from Popov (1981).

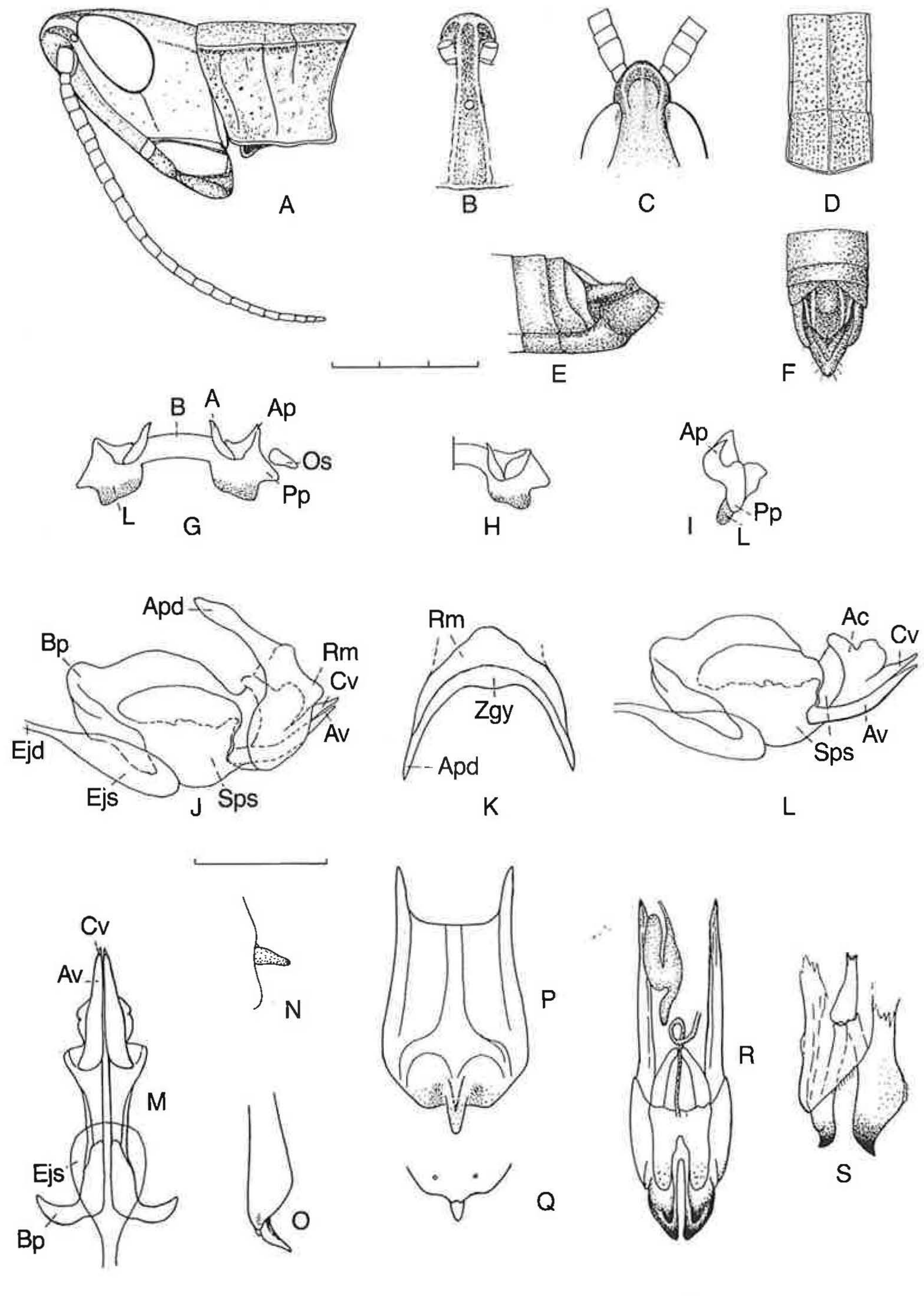

Figure 33 *Orthochtha ramchandrae* A-M male, N-S female. A lateral view of head and pronotum; B frontal ridge; C dorsal view of fastigium verticis; D dorsal view of dorsum of pronotum; E,F lateral and dorsal views of tip of abdomen; G dorsal, H dorso-posterior and I lateral views of epiphallus; J lateral view of phallic complex with epiphallus removed; K dorsal view of apodeme of cingulum; L as J with apodemes removed; M, ventral view of phallic complex with apodemes removed; N cercus; O lateral, P dorsal and Q ventral view of subgenital plate; R ventral view of receptaculum seminis *in situ*; S lateral view of ovipositor. For explanation of genitalic structures see Figure 15. Scales in mm, A-F, N-S upper, G-M lower scale. Drawings modified from Popov (1981).

and incurving; subgenital plate short, obtusely conical. Structure of phallic complex as in Figure 33G-M, and genitalic structures of female as in Figure 33O-S.

General coloration yellowish-green laterally and brownish dorsally; lateral fasciae weak in male, barely visible in female; tegmina green in pre-radial part, brown in post-radial; hind knees barely darkened; hind tibiae greyish pink in male, pinkish-buff in female; tarsus brownish.

Measurements (mm)

Total length, M 21.5-23.5, F 36.0; pronotum, M 4.2-4.5, F 7.5; prozona, M 2.4-2.6, F 4.6; tegmen length, M 12.5-13.5, F 20.7, width M 2.4-2.6, F 3.5; hind femur-length, M 13.5-15.0, F 24.7, -width, M 2.4-2.8, F 4.2; antenna, M 8.7-10.2, F ?

Material examined

Holotype M, **South India**: Dhimbam, Biligirrirangan hills, 29.i.1937 (*BM-CB Expedition to South India, April-May, 1937*); 6 M, 1 F paratypes, same data. (Holotype and 5 paratypes in NHM, 1 M paratype in the Indian Agricultural Research Institute, New Delhi.)

Affinities

Orthochtha ramchandrae is a very distinct species not clearly related to any Asian or African species. Its outstanding characters are its robust build, marked sexual dimorphism, the short, rugulose, parallel-sided pronotum with ill-defined transverse sulci and the acutely tapering forewings.

Orthochtha indica Uvarov 1942

(Figure 32, distribution – Figure 6)

Orthochtha indica Uvarov, 1942: 587. Holotype male, INDIA (NHM) [examined].

Diagnosis

Of medium size (see measurements), similar in general appearance to the African *O. sudanica* and *O. tunstalli*. Integument smooth, shiny, sculpturing fine, most pronounced on thorax. Antennae weakly ensiform, with segments 3-6 flattened and weakly expanded, longer than combined length of head and pronotum in both sexes, much more so in male. Head somewhat rounded, shorter than pronotum, face moderately oblique and convex in profile (Figure 32H); frontal ridge broadly sulcate throughout, except close to fastigium, margins well-defined weakly divergent downwards, fastigial constriction weak (Figure 32I). Fastigium verticis barely longer than wide in male, transverse in female; median carinula weak, arcuate sulcus shallow, forward of mid-position. Pronotum long, laterally compressed, all three carinae low, but distinct, lateral ones parallel in prozona, weakly divergent in metazona. First and second sulci weak, third complete, prozona half as long again as metazona. Lower margin of lateral lobes slightly sinuate, hind angle narrowly rounded, somewhat produced (Figure 32H). Mesosternal interspace narrow, constricted in middle. Tegmina reaching a little beyond hind knees; venation loose. External genitalic structures of male as in Figure 32L,M. Supra-anal plate tongue-shaped, with broad median depression. Cerci as long as supra-anal plate, rather broad and somewhat flattened and incurved. Subgenital plate short, obtusely conical. Phallic structures as in Figure 32T-Y, and genitalic structures of female as in Figure 32Z-ee.

General coloration light yellowish-green. Antennae blackish except at base. Lateral fasciae blackish-brown, moderately narrow, extending from antennal pits, behind eyes, along upper margin of lateral pronotal lobes, to basal third of radial veins. Tegmina light green in pre-radial part and light brownish in post-radial. Hind knee blackish in male, brownish in female. Hind tibiae light rose, with base black, tarsi rose.

Measurements (mm)

Type material only. Total length, M 31.2-33.3, F 42.0-45.0; pronotum length, M 5.6-5.7, F 7.7-8.2; prozona, M 3.3-3.4, F 4.8-5.0; tegmen length M 26.3-27.0, F 32.5-34.0; width M 4.0-4.2, F 5.0-5.2; hind femur-length, M 18.5-19.0; F 22.2-24.2, -width, M 2.6-2.8, F 3.4-3.5; antenna length, M 15.0-16.0, F 13.0-14.5.

Material examined

Holotype M, **India**: Delhi (28°40′ N 77°14′ E), viii. 1937, at light (*Kerr*). Paratypes: 1 M, 2 F, same data; 1 F, Nagpur (21°10′ N 79°12′ E), 8.vii.1927; 1 F, 20.viii.1927 (*Khare*). Other material 1 M, Simla hills (*c*.31°N 77°E), 5000-7000 ft, 1926 (*Jones*). (All NHM.)

Affinities

This and the next species, *O.roffeyi* **sp.n.** from Thailand, are close relatives and are in turn related, although more distantly, to the African *O. sudanica* and *O. tunstalli*. They differ principally in structural details of the head, pronotum, external and internal copulatory structures and in coloration, as is evident from a comparison of Figures 22,23 and 32.

Distribution and geographical variation

Despite the paucity of the material, the data suggest that the species may be widely distributed from the Himalayan foothills across the Indian plains south to about 21°N and possibly beyond. Although the Types from Delhi and Nagpur come from localities some 700 km apart, they show little morphological and colour variation, and hardly any in size; the Nagpur specimens are a little darker and greener with less divergent lateral carinae in the metazona. Both these localities are in the lowland plains at an altitude of about 250-500 m and the ecological conditions are probably not dissimilar. On the other hand, the unique male specimen from the Simla hills at some 2000-2500 m, is very much smaller (total length 21.5 mm, hind femur 13.0 mm long and 2.0 mm wide). Otherwise it shows no marked morphological differences that distinguish it from the others.

Biology

Nothing known.

Orthochtha roffeyi sp. n.

(Figure 32, distribution – Figure 6)

Diagnosis

Of medium size (see measurements). Similar in general appearance to *O. indica* and *O. tunstalli*. Integument smooth, shiny, sculpturing and pilosity weak. Antennae long and slender, in male considerably longer than combined length of head and pronotum, width of basal segments under 0.5 mm, narrower than in *O. indica*. Head somewhat inflated, apex obtusely rounded; frontal ridge in profile convex, distinctly broader than in *indica*, weakly sulcate, with well-developed, weakly divergent margins, fastigial constriction weak (Figure 32B). Fastigium verticis broad, roundly trapezoidal, wider in female than in male; median and lateral carinulae weak, arcuate sulcus shallower and positioned further caudad than in *indica* (Figure 32C); in female structure is similar in both taxa. Pronotum tectiform with low, thick carinae, lateral lobes parallel in male and somewhat excurved in female (Figure 32D); lateral lobes with broadly rounded lower posterior angles. Mesosternal lobes with broadly rounded angles, interspace very narrow in both sexes, distinctly more so than in *indica*, difference particularly marked in females. Tegmina and wings somewhat shorter than in *indica*, extending beyond tip of abdomen, but not reaching hind knee. Hind femur moderately slender, length/width ratio M 5.9, F 6.1. External male genitalia show minor structural differences compared with *indica*: supra-anal and subgenital plates are broader and shorter, but cerci, while similarly incurved, are concave on inner surface, not convex as in *indica*; internal structures also show some differences, particularly in shape of epiphallic lophi and aedeagal valves (Figure 33O-S). In female hind margin of subgenital plate less indented and ovipositor valves more slender than in *indica*.

Coloration green laterally and green or brown (in female) dorsally; lateral dark fasciae very narrow, but sharply defined and extending partly along radial vein of tegmen; hind knee nearly all black in male, but in female only genicular crescent black; hind tibiae pinkish in both sexes, spines tipped with black.

Measurements (mm)

Total length, M 31.5, F 40.7; pronotum length, M 6.0, F 7.9; prozona, M 3.6, F 4.7; prozona/metazona ratio, M 1.5, F 1.45; pronotum width, M 2.4-2.6, F 3.3-3.6; tegmen length, M 23.2, F 31.0; hind femur-length, M 18.8, F 23.8, -width, M 3.2, F 3.9; antenna length, M 14.2 (tip missing); head + pronotum, M 10.2, F 12.5.

Material examined

Holotype M, **Thailand**: Lopburi, Chaibadan area (15°N 101°E), Lot 2893/26 *Zea mays*, 3.ix.1963 (*Phol*); paratype F, 27 km S. Phayao (Phrae 18°00′ N 100°10′ E), Lot JR641016, 8.x.1964 (*Roffey and Smut*) (NHM). These specimens were among a batch of grasshoppers collected in an area of cleared forest, now mixed farmland and grass/scrubland. They were identified by D. Hollis as *Orthochtha* **sp. nov.** and cited as such in Roffey (1965:46).

Affinities

Discussed under *O. indica* (p. 105).

Orthochtha schmidti sp. n.

(Figure 34, distribution – Figure 6)

Diagnosis

Only male known. Similar in size and general appearance to the African *O. dasycnemis*, but differing from it and other *Orthochtha* species in its distinctive combination of characters. Integument smooth, matt, sculpturing and pilosity weak. Antennae only slightly longer than combined length of head and pronotum, weakly dilate at base. Apex of head prominent, acute, frons oblique, straight in profile (Figure 34A); frontal ridge moderately narrow and sulcate, with well-defined divergent margins, somewhat expanded between antennae, fastigial constriction weak. Fastigium verticis broadly parabolic and prominent, distinctly longer than wide, its surface weakly concave with weak median and lateral carinulae, arcuate sulcus well behind middle (Figure 34B). Pronotum tectiform with all carinae well-developed, the lateral carinae parallel in prozona, divergent in metazona; all three transverse sulci distinct, ratio of prozona to metazona 1.7; lateral lobes with well-rounded angles. Mesosternal lobes broadly rounded, interspace more than half width of lobe. Tegmina and wings narrow, almost reaching hind knee. Venation rather sparse, intercalary vein distinct. Hind femur moderately elongate and slender, ratio of length/width 5.6. Upper knee

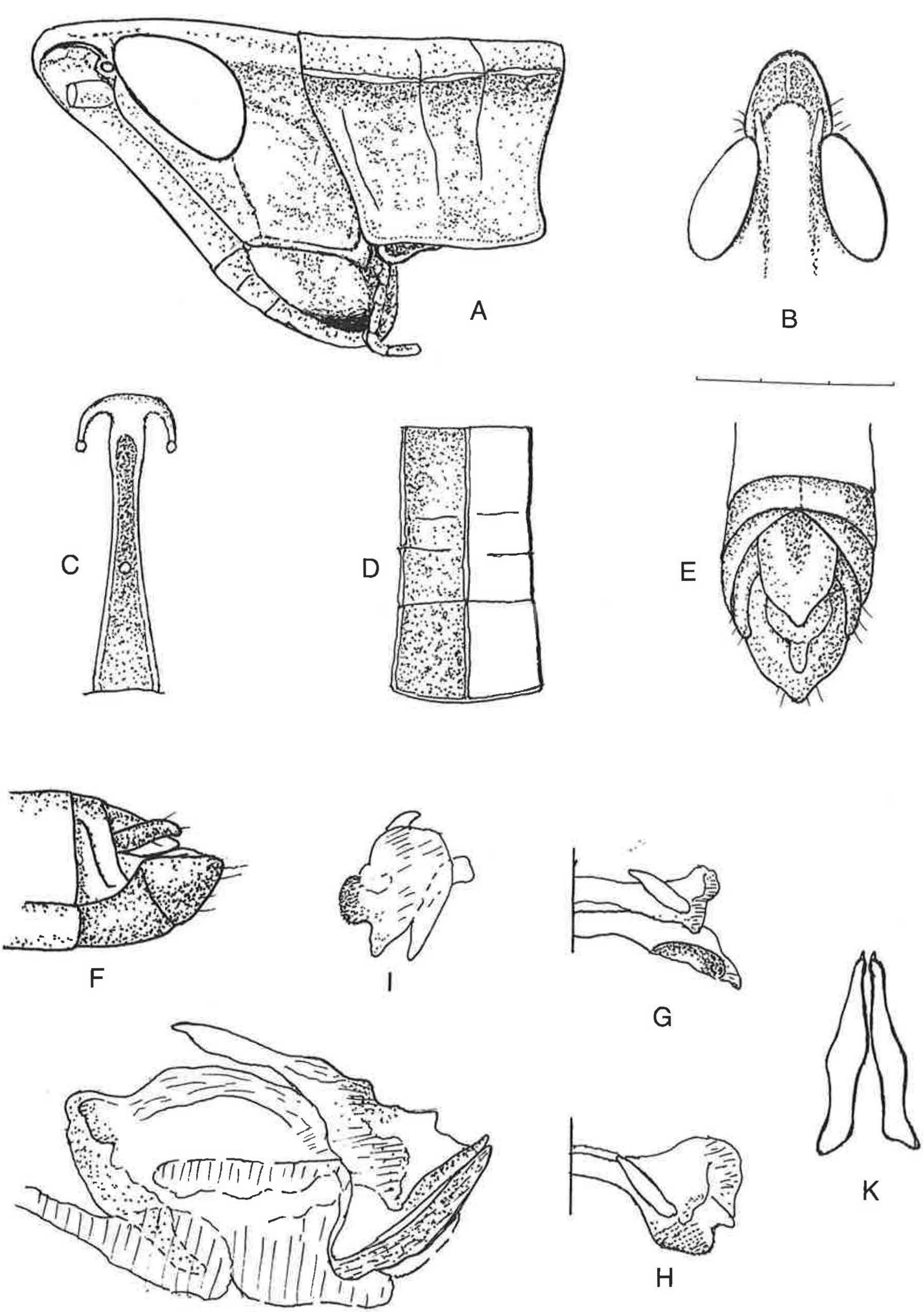

Figure 34 *Orthochtha schmidti* **sp.n.**, male. A lateral view of head and pronotum; B dorsal view of fastigium verticis; C frontal ridge; D dorsal view of dorsum of pronotum; E, F dorsal and lateral views of tip of abdomen, G, H, I dorsal, dorso-posterior and lateral views of epiphallus; J lateral view of phallic complex with epiphallus removed; K ventral view of apical valves of penis. For explanation of genitalic structures see Figure 15. Scales in mm, A-F, upper G-K, lower scale.

lobes short, lower well-rounded on both sides. Subgenital plate simple, short, pointed; cerci short, weakly incurved and downcurved, pointed. Supra-anal plate obtusely triangular, with a basal longitudinal depression. Internal genitalic structures as in Figure 34G-K, with elongate ancorae and short, broad lophi as outstanding diagnostic features. Both specimens badly discoloured young adults, but probably in life greenish laterally and brownish dorsally; antennae dark, lateral fasciae broad, but weak; hind tibiae and tarsi pink, spines pale, tipped with black.

Measurements (mm)

Total length, 20.0-20.5; pronotum, 4.3-4.4, prozona 2.7, width 2.1-2.3; tegmina, 17.3-17.5; hind femur-length, 14.4, -width 2.6; antenna length, 10.0-11.3; head + pronotum, 8.3-8.5.

Material examined

Holotype M, **India**: Poona (18°34′ N 73°58′ E), 17.viii.1980 (bred from nymphs) (*Schmidt*) (HU); paratype M, same data (NHM).

Affinities

Orthochtha schmidti occupies an isolated position within *Orthochtha* and is not obviously related to any of its congeners; it is similar in general appearance to *O. dasycnemis.*

Section 4

Other genera

EUPREPOPTERA UVAROV

Euprepoptera Uvarov 1953: 626. Type species *Euprepoptera polychroma* Uvarov 1953: 626, by original designation.
Euprepoptera Uvarov; Dirsh 1965: 396, 429 (redescription of the genus).

Diagnosis

Size medium (see measurements), slender, integument matt, finely rugulose especially on pronotum. Antennae long, ensiform. Head obtusely conical, somewhat ascending; frontal ridge in profile straight, moderately narrow, sulcate, margins distinct throughout, weakly divergent towards clypeus, somewhat dilate between antennae and narrowed at fastigium. Fastigium verticis parabolic, margins more or less well-defined, median carinula weak to obsolete, arcuate sulcus deep. Compound eye oblique, elongate, narrowed towards apex, its longest axis about equal to subocular distance. Pronotal disc weakly tectiform, lateral carinae sharply defined, straight, divergent caudad, interrupted by second and third sulci; median carina sharp, interrupted by posterior sulcus only, metazona subequal to prozona; hind pronotal margin obtusangular, somewhat rounded; lateral pronotal lobe vertical, flat to weakly concave, lower margin ascending in anterior part, hind angle straight, sharp to weakly rounded. Mesosternal lobes weakly transverse rounded, interspace less than a quarter to half width of lobe. Tegmina well developed, coriaceous in basal third, reticulation moderately dense, intercalary vein very weak. Wings coloured – coloration deeper in older specimens; wing venation moderately developed, cells in apical part of medial and radial fields of remigium distinctly widened (Figure 36). Hind femur somewhat heavier than in most *Orthochtha* species, upper genicular lobes not produced, lower lobes rounded. Male cerci obtusely pointed, incurved, longer than supra-anal plate; subgenital plate obtusely conical. Epiphallus with large ancorae, moderately narrow bridge, rounded lobiform lophi and elongate, pointed posterior processes. Valves of aedeagus elongate, pointed. Female subgenital plate broadly trilobate, spermathecal duct elongate, slender, spirally coiled.

Systematic position

This genus superficially resembles *Duronia* Stål, from which it differs principally in its coloured hind wings, in having the lateral pronotal carinae interrupted by two sulci (only one in *Duronia*), and the internal genitalic structures of both sexes. It is in fact more closely related to *Orthochtha*, from which it differs in a combination of characters, chiefly the more sharply defined lateral pronotal carinae, the proportionately longer metazona, the coloration and venation of the wings and the elongate posterior processes of the epiphallus. Within *Orthochtha* it is closest to *O. rosacea* and *O. zuluensis*.

Two species are placed in this genus, the original type species *E. polychroma* Uvarov 1953 and a new species *E. sylvatica*, described here and previously cited by Johnsen (1984: 314, Figure 274A-E) as *Euprepoptera* **n.sp.** from Zambia.

Euprepoptera polychroma Uvarov 1953

(Figures 35-37, distribution – Figure 7)

Euprepoptera polychroma Uvarov 1953: 626. Holotype male, ANGOLA (NHM) [examined].
Euprepoptera polychroma Uvarov; Dirsh 1965: 430, Figure 342.
Euprepoptera polychroma Uvarov; Johnsen 1984: 314, Figure 273A-F.

Diagnosis

Antennae narrowly ensiform, in female as long, in male half as long again as combined length of head and pronotum. Frontal ridge as in Figure 35J,P, fastigial constriction pronounced, fastigium verticis elongate, more so in male, arcuate sulcus positioned well forward (Figure 35K,O). Pronotum tectiform with straight, well-defined lateral carinae; metazona nearly as long as prozona, prozona/metazona ratio 1.2 in male, 1.0-1.1 in female. Mesosternal interspace half width of lobe in female, slightly more constricted in male (Figure 35N). Hind femur length/width ratio 6.5 in male, 5.9 in female. External genitalic structures as in Figure 35L,M, male cerci pointed, somewhat flattened and widened basally. Concealed copulatory structures as in Figure 37A-F, epiphallic lophi relatively broad.

General coloration light-green to brownish dorsally, sometimes with green, median longitudinal stripe, greenish laterally; no dark lateral fasciae as in *Orthochtha*, but medial field of tegmina sometimes darkened basally. Wings of various colours: bright rose (holotype), vermillion, yellowish, or purplish-blue, as in long paratype series. Hind femur brownish with a broad, imperfectly defined pre-apical ring, genicular crescents blackish; hind tibiae dirty testaceous. Coloration in females similar, but tegmina often with chain of small dark spots along radial veins.

Measurements (mm)

Total length, M 22.5-25.5, F 35.0-38.0; pronotum length, M 4.0-4.3, F 6.0-6.3; prozona, M 2.2-2.4, F 3.0-3.2; pronotum width, M min. 1.7-1.9, max. 2.2-2.5, F min. 2.5-2.7, max. 3.6-3.8; tegmen length, M 18.7-20.5, F 26.5-26.8; hind femur-length, M 14.7-16.4, F 20.0, -width, M 2.3-2.5, F 3.4; antenna length, M 11.0-12.0, F 11.2; head + pronotum: M 7.5-7.7, F 11.0-12.0.

Material examined

Holotype M, **Angola**: Luchase District, River Quangu, 5000 ft, 16.x.1947 (*Burr*). Paratypes: 1 M, same data as holotype; 14 M, 1 F, valley of R. Musimoji, 25.x.1927; 4 M, 3 F, Moxico Dist.; Villa Luso (11°47′ S 19°52′ E) (*Burr*) (NHM).

***Euprepoptera sylvatica* sp. n.**

(Figures 35-37, distribution – Figure 7)

Euprepoptera **n.sp.** Johnsen, 1984: 314, Figure 274A-E (description).

Diagnosis

Antennae as in *E. polychroma*; frontal ridge as in Figure 35B,H, fastigial constriction less marked than in *polychroma*; fastigium verticis as in Figure 35C,G, arcuate sulcus positioned behind middle. Prozona/metazona ratio of pronotum 1.2-1.4, more marked than in *polychroma*. Mesosternal interspace quarter width of lobe, or less, thus considerably narrower than in *polychroma*. Tegmina and wings when folded just reaching tip of abdomen and falling short of hind knee. Hind femur relatively slender, length/width ratio 6.4-7.0. External genitalic structures as in Figure 35E; male cerci long and slender, not markedly flattened or widened at base. Epiphallus as in Figure 37G, bridge rather narrow and bent with a short median projection; ancorae large, lophi short and inflated, distinctly narrower than in *polychroma*, posterior projections elongate. Apical valves of aedeagus as in Figure 37H.

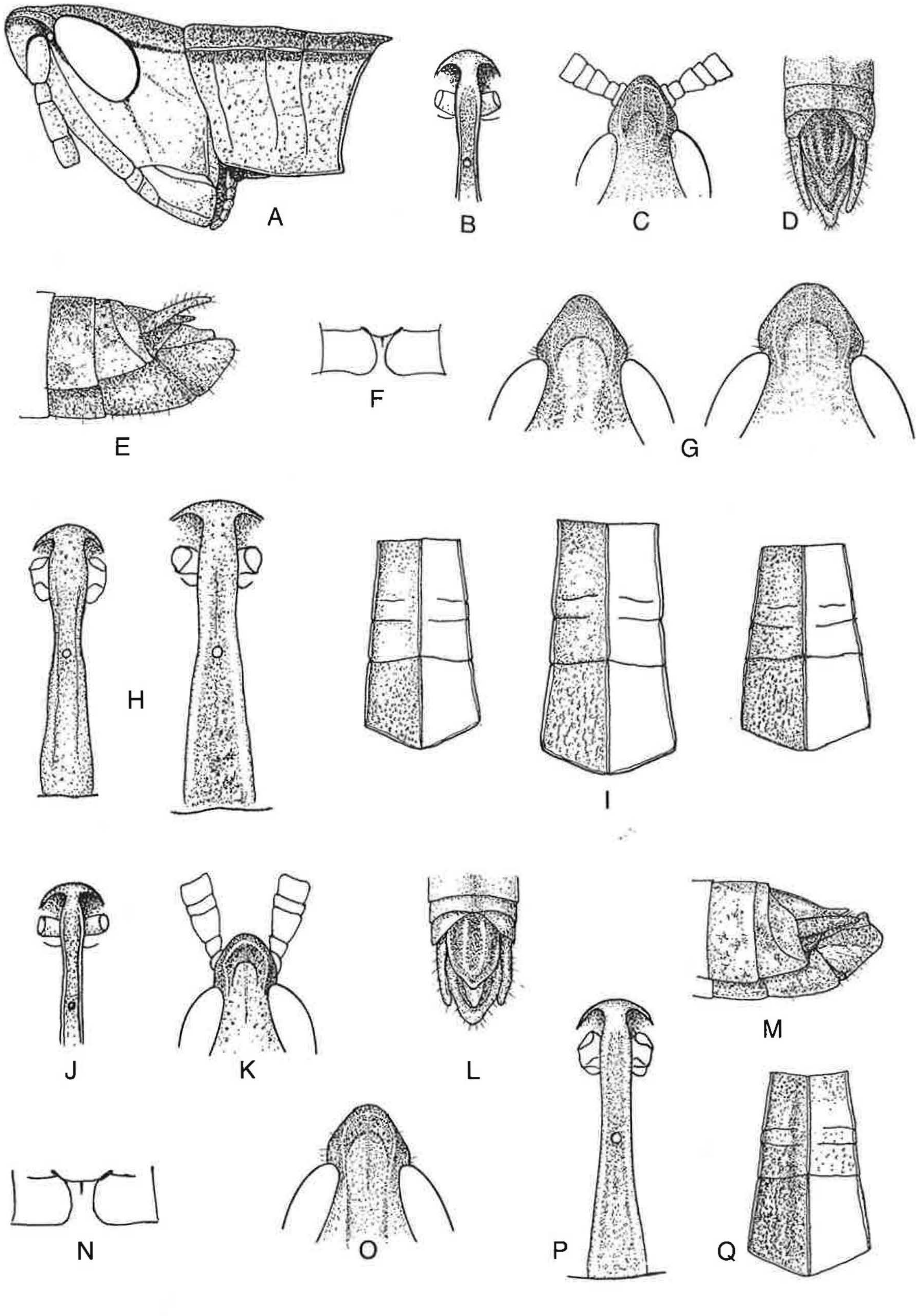

Figure 35 *Euprepoptera. E. sylvatica* **sp.n.** A-F male, G-I female; *E. polychroma* J-N male, O-Q female. A lateral view of head and pronotum; B, H (specimen from Zambia left, Katanga right); J, P frontal ridge; C, G (specimen from Zambia left, Katanga right); K, O dorsal view of fastigium verticis; D, E, L, M dorsal and lateral views of tip of abdomen; F, N mesosternal interspace; I, Q dorsal view of dorsum of pronotum (I – showing range of variation). Scale in mm.

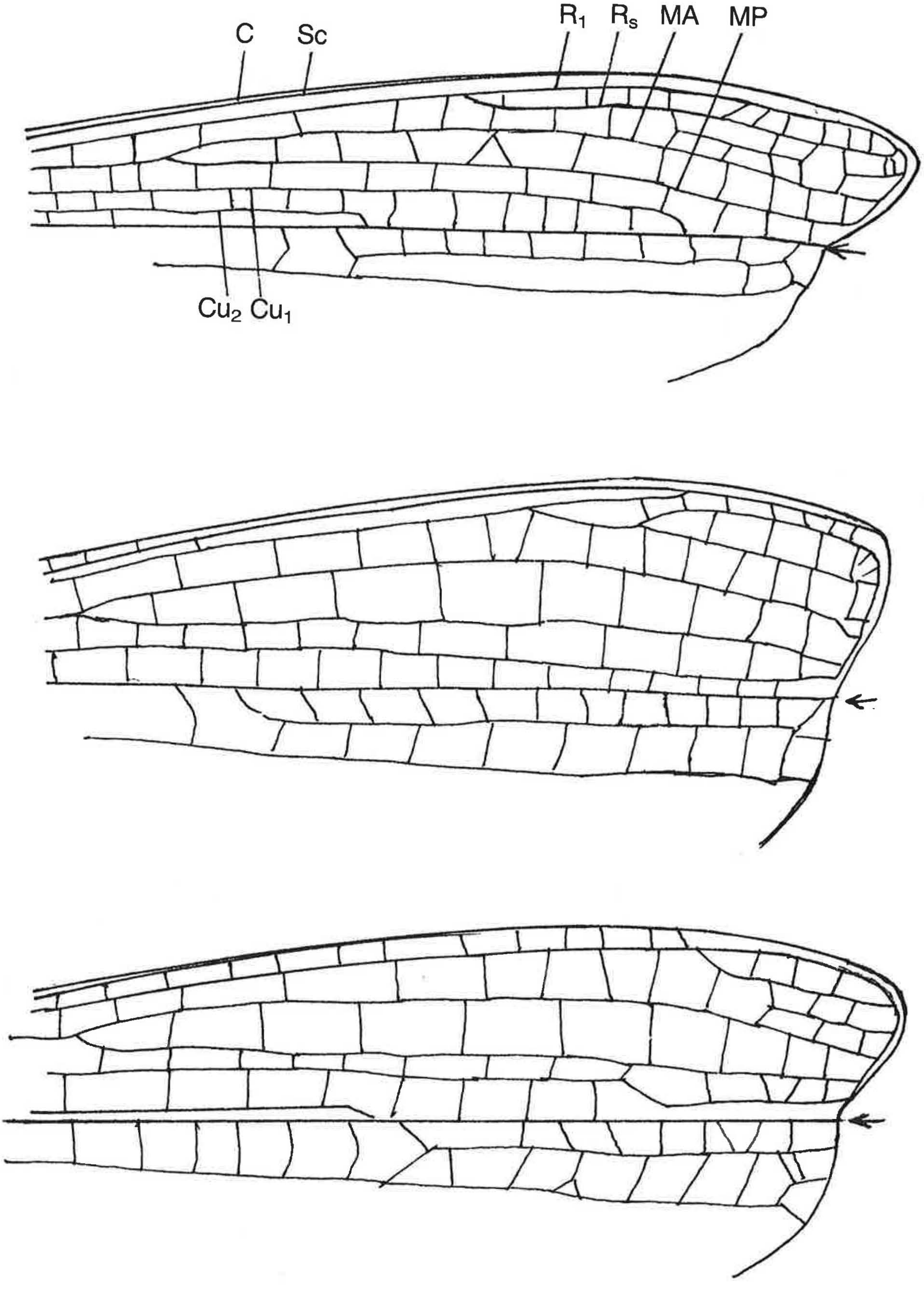

Figure 36 A *Orthochtha dasycnemis*, B *Euprepoptera polychroma* and C *E. sylvatica* **sp.n.** Dorsal view of part of right hind wing to show enlarged cells in medial and radial fields in *Euprepoptera*. Venation as follows: C costa; Sc subcosta; R_1 radius; Rs radial sector; MA media anterior; MP media posterior; Cu, Cu_2 first and second cubitus. Arrow indicates position of vena dividens.

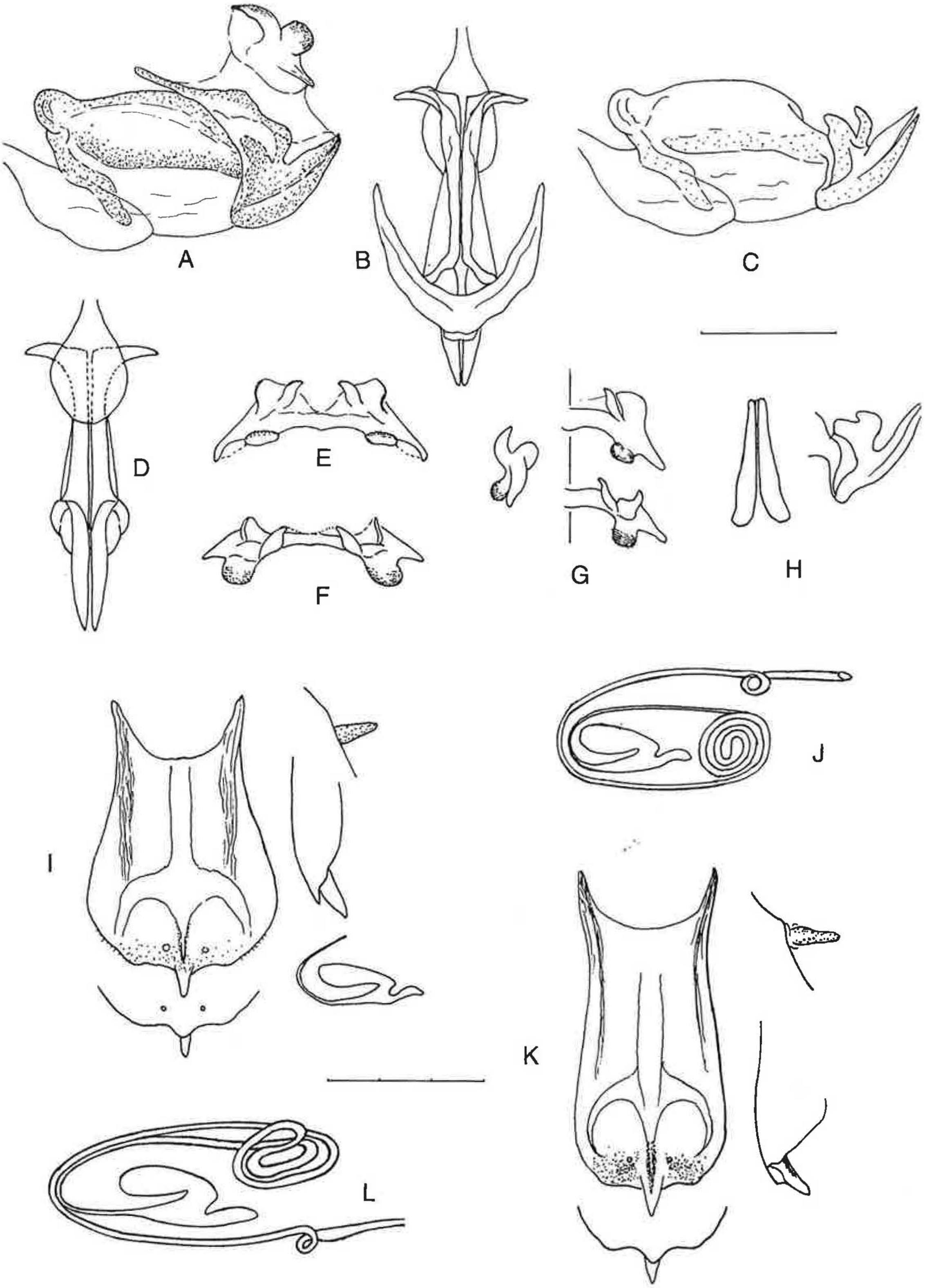

Figure 37 *Euprepoptera polychroma* and *E sylvatica* **sp.n.** Genitalic structures; *polychroma* A-F male, I-J female; *sylvatica* G, H male, K-L female. A lateral view of phallic complex; B dorsal view of phallic complex with epiphallus removed; C, D lateral and ventral views of phallic complex with epiphallus, apodemes and rami of cingulum removed; E, F dorso-posterior and dorsal views of epiphallus; G lateral, dorso-posterior and dorsal views of epiphallus (right half); H apical valves of aedeagus; I, K subgenital plate, cercus and (I) spermatheca; J, L receptaculum seminis. For explanations see Figure 15. Scales in mm, A-H upper, I-L lower scale.

Coloration green laterally and ventrally, brownish dorsally, lateral fasciae merely a narrow invasion of dark pigment from dorsum. Antennae purplish-black. Hind tibiae and tarsi dirty pinkish-brown. Wing pink, or cinnamon-orange, pigmentation darker basally. Coloration of female similar but duller, dorsum brown, or sometimes green, striped with brown.

Measurements

Total length, M 21.0-25.0, F 33.0-42.0; pronotum length, M 4.3-4.9, F 6.0-7.1; prozona, M 2.2-2.3, F 2.6-3.1; pronotum width, M min. 1.8, max. 2.2, F min. 3.0-3.2, max. 3.6-4.0; tegmen length, M 17.5-19.0, F 25.0-31.0; hind femur-length, M 16.0-16.5, F 20.0-26.0, -width, M 2.3-2.5, F 3.5-4.0; antenna length, M 11.5, F 12.0-13.5; head + pronotum, M 8.0-8.2, F 11.5-13.0.

Material examined

Holotype M, **Zaire**: Katanga, Shinkolobwe Kesompi Ouest (01°02′ S 26°35′ E) (*Prof. Baq.*); 8.ii.1956 (*Marlier*) (MRAC). Paratypes: 2 M, same data (1 MRAC, 1 NHM); 1 M, Elisabethville (11°40′ S 27°28′ E), iv. 1939 (*Bredo*); 1 F, Parc Nat. Upemba, Kaswoe sur Muye, 1320 m, 29.iv.1948; 1 M, Kabwekanono Lufisa, 25.iv.1949 (*de Witte*) (MRAC). **Zambia**: 3 M, 1 F, Ikelenge Mwinilunga (11°14′ S 24°16′ E – 11°45′ S 24°26′ E), ii. 1960; 1 M Kabwe (08°34′ S 29°34′ E), 13.ii.1940 (*Bredo*) (MRAC); 1 M 1 M, Kabundi Forest, Chingola (12°32′ S 27°52′ E), xii. 1974 (*Forchhammer*) (NHMA); 1 M, Lusombo rain forest near Kalene Hill, 22.iii, 1975 (*Townsend*) (NHM).

Discussion

As seen from the differential diagnosis, the two species differ in many respects. However both, particularly *sylvatica*, show considerable variability in coloration, and to some extent morphology, as in the structure of the dorsum of pronotum, in which the Zambian specimens in particular show some affinity with *polychroma*. *Euprepoptera sylvatica* overlaps in distribution with *O. dasycnemis trivittata* and some specimens of the two taxa bear identical locality labels, 'Elisabethville', 'Kabundi Forest', and could possibly even share the same habitat. These sympatric specimens are superficially strikingly similar in general appearance and provide a parallel with the *ampla-nigricornis* example (p. 29).

Biology

No information is available on either species, but the label data seem to suggest that they may be univoltine with an embryonic diapause during the dry season.

LOBOPOMA KARSCH

Lobopoma Karsch 1896: 253. Type species *Lobopoma ambages* Karsch 1896: 253, Figure 5 by original designation.

Lobopoma Karsch; Dirsh 1965: 396, 438 (redescription of the genus).

Diagnosis

Sexual dimorphism pronounced, female above medium size, brachypterous, male below medium size for group (see Measurements), brachypterous or macropterous. Integument rugose, matt. Antennae ensiform, basal dilation moderate to pronounced, especially in female. Head acute, moderately to strongly projecting between antennae. Frontal ridge narrow, its margins more or less developed and divergent towards clypeus; fastigium large, parabolic, its margins, median carinula and arcuate sulcus well defined. Pronotum weakly tectiform with sharply defined carinae; hind margin obtusangular; prozona/metazona ratio 1.3-1.6; lower hind angle of lateral lobe sharp, straight to acute. Mesosternal interspace wide, half to full width of lobe, narrower in male.

Venation in macropterous males dense; intercalary vein moderately developed. External genitalic structures of male simple, without outstanding diagnostic features, cerci simple, of medium length, obtusely pointed. Epiphallus with short, rounded lophi and short, pointed posterior processes. Aedeagal valves of equal length, penis valves more slender. Subgenital plate of female broadly trilobate; spermathecal duct long, slender, spirally coiled. Coloration shades of green, greyish-green to brownish, often a mixture of greenish laterally and brownish dorsally. Lateral dark fasciae weak and narrow, or absent. Hind wings bright red (*L. ambages* and *L. mitchelli* **sp.n.**) or bluish (*L. robertsoni* **sp.n.**). Hind tibiae pinkish or brownish.

Systematic position

Although related to *Orthochtha*, the three species of *Lobopoma* recognized here, *L. ambages* Karsch 1896, *L. mitchelli* **sp.n.** and *L. robertsoni* **sp.n.**, are, in their combination of characters, clearly distinct from it and the other genera in this revision. In two of these characters, the sharply defined pronotal carinae and the coloured hind wings, they closely approach *Euprepoptera*. The distinctive position of *Lobopoma* is clearly revealed by the numerical taxonomic treatment (p. 141).

In the past three species have been placed in *Lobopoma* that do not belong to it and are here removed: *Lobopoma carterocera* Jago 1964 is transferred to *Pamacris* Ramme 1929 (p. 126); a new genus *Nimbacris* is erected for *Lobopoma longicornis* Chopard 1958 (p. 132) and a new genus *Shabacris* for *Lobopoma robusta* Bouvy 1982 (p. 124).

Key 7 *Lobopoma*

1 Both sexes brachypterous; hind wings red 2

– Only female brachypterous, male macropterous; hind wings blue .... *Lobopoma robertsoni* **sp. n.**

2 Head elongate, vertex prominent (Figure 38G); tegmina narrow, acutely pointed (Figure 38J) .... *Lobopoma ambages* Karsch

– Head shorter, vertex less prominent (Figure 38A); tegmina broader, rounded apically (Figure 38D) .... *Lobopoma mitchelli* **sp. n.**

Lobopoma ambages Karsch 1896

(Figures 38-41, distribution – Figure 7)

Lobopoma ambages Karsch 1896: 253, Figure 5. Lectotype female, 'ZANZIBAR' (MNHU), here designated [examined]. See below regarding type locality.
Lobopoma ambages Karsch; Dirsh, 1965: 439, Figure 350.

Diagnosis

Sexual dimorphism pronounced, male 16-25, female 31-45 mm. Elongate and slender, head prominent, vertex pointed and projecting forward. Frons oblique, straight in profile. Frontal ridge narrow, more so in male, sulcate and carinate, margins divergent towards clypeus. Fastigium verticis as in Figures 37H and 38A, arcuate sulcus in mid position in female, behind middle in male, margins and median carinula distinct. Dorsum of pronotum tectiform, parallel-sided in male, somewhat expanded and swollen in middle in female. Hind margin broadly angular; all carinae distinct, typical and second sulci distinct, front sulcus obliterate; prozona/metazona ratio 1.6. Lower margin of lateral pronotal lobe almost straight and parallel with upper; hind angle acute. Mesosternal lobe quadrate with rounded angles, interspace width of lobe in female, half its width in male. Tegmina and wings strongly abbreviated, only slightly longer than length of pronotum in both sexes; wings about 3/4 length of tegmina; tegmina with acute, produced apices and densely reticulated, thick, calloused veinlets. Hind femur long and slender, length/width ratio 6.5-7. Upper genicular lobes

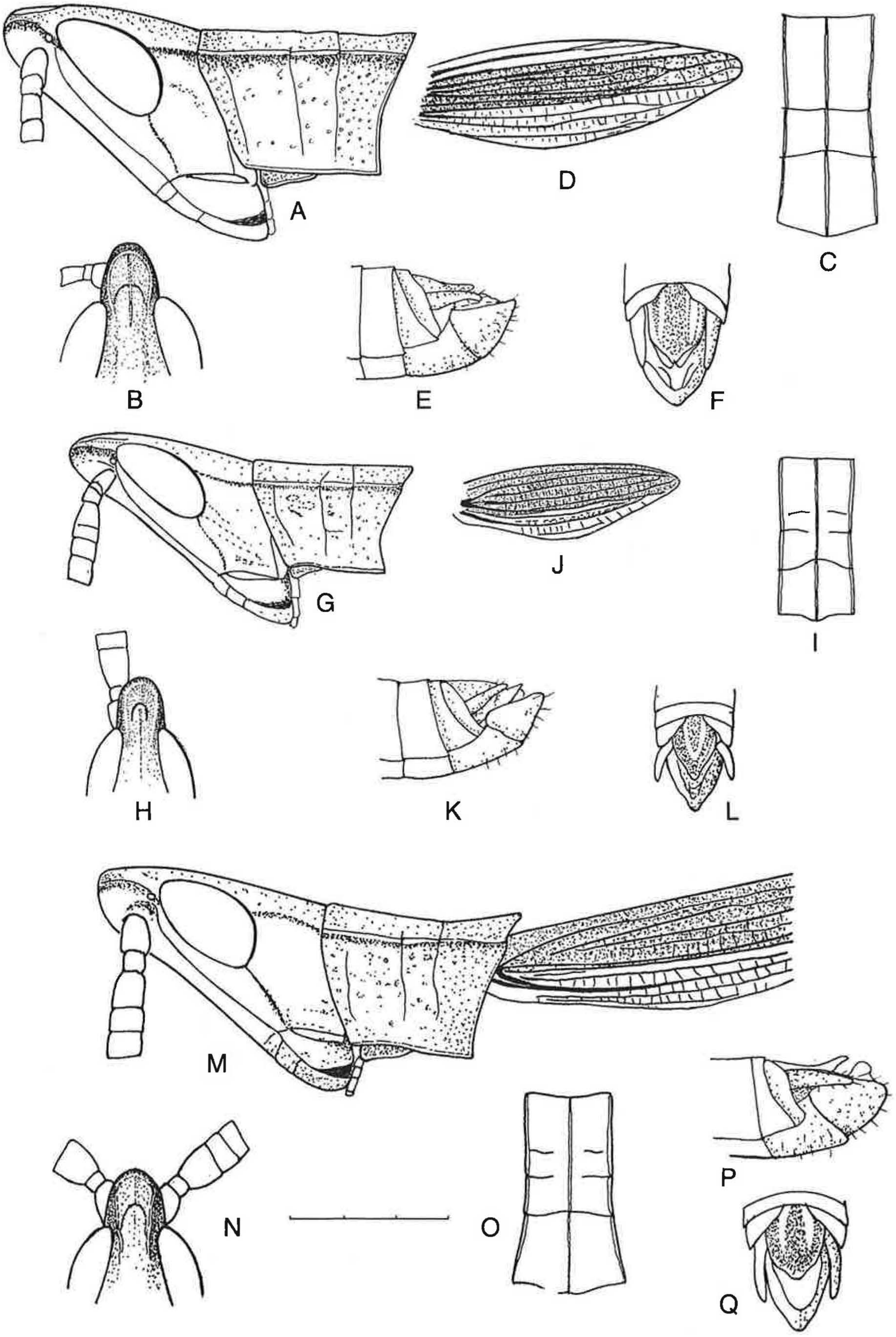

Figure 38 *Lobopoma* species, males. A-F *mitchelli* **sp.n.**, G-L *ambages*, M-Q *robertsoni* **sp.n.** A, G, M lateral views of head, pronotum and (M) base of tegmen; B, H, N dorsal views of fastigium verticis; C, I, O dorsal views of dorsum of pronotum; D, J left tegmen; E, K, P lateral views of tip of abdomen; F, L, Q dorsal views of tip of abdomen. Scale in mm.

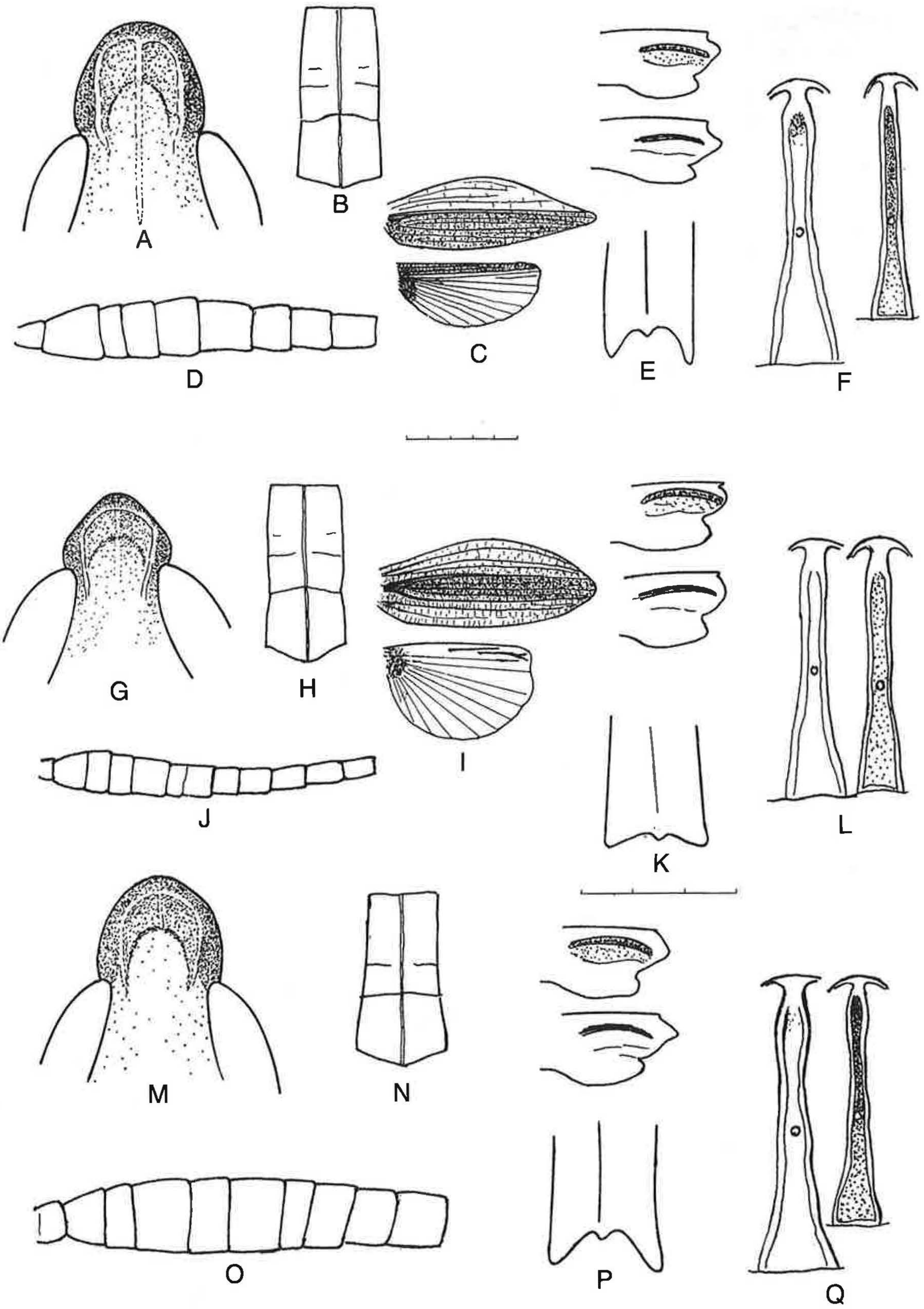

Figure 39 *Lobopoma* species, females except where stated. A-F *ambages*, G-L *mitchelli* **sp.n.**, M-Q *robertsoni* **sp.n.** A, G, M dorsal views of fastigium verticis; B, H, N dorsal views of dorsum of pronotum; C, I tegmen and hind wing; D, J, O base of antenna; E, K, P outer lateral (top), inner lateral and dorsal views of hind knee (males); F, L, Q frontal ridge, females (left), males (right). Scales in mm, B, C, H, I, N upper, remainder lower scale.

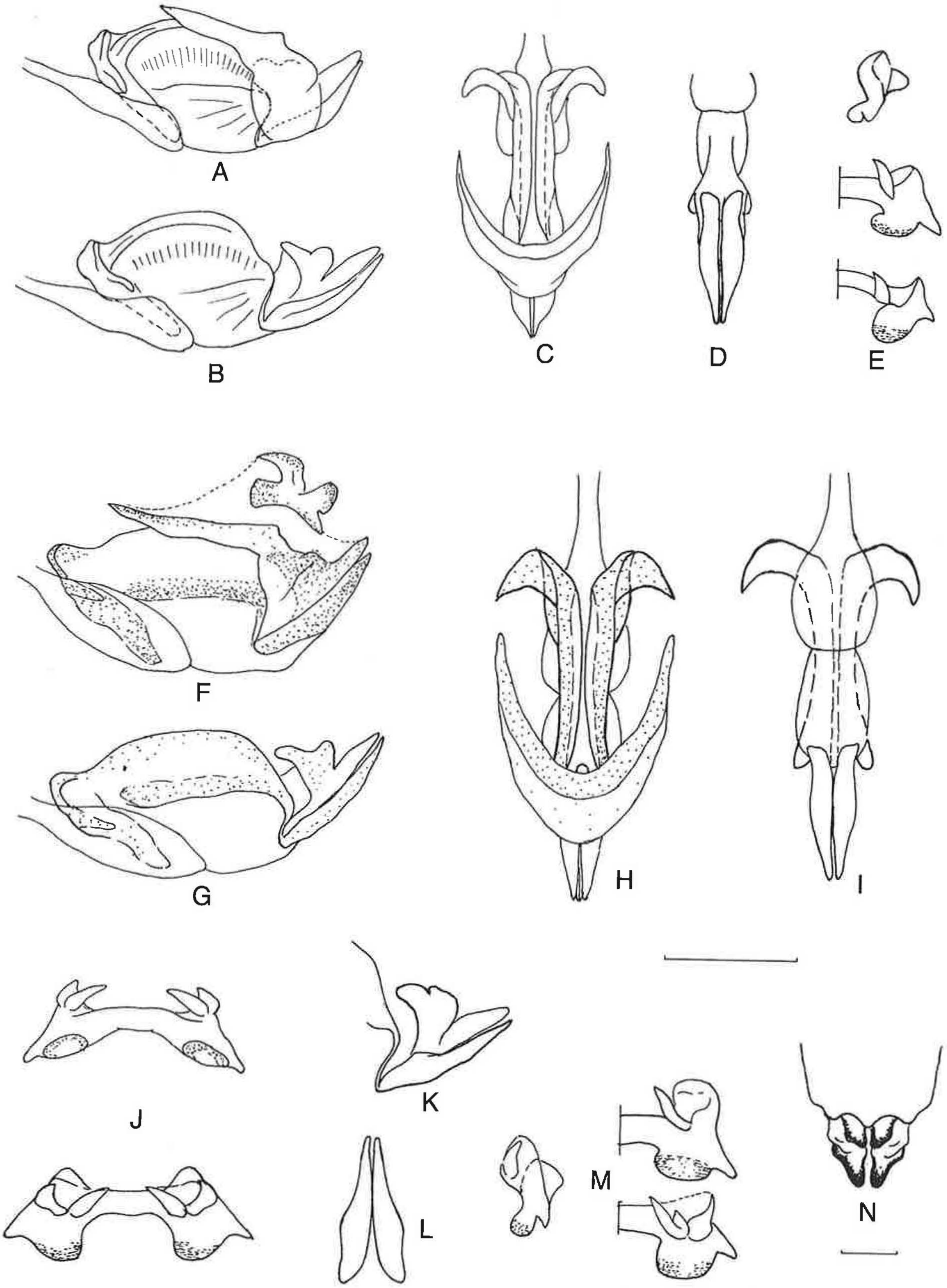

Figure 40 *Lobopoma* species. Genitalic structures of males except where stated. A-E *ambages*, F-J, N *mitchelli* **sp.n.**, K-M *robertsoni* **sp.n.** F lateral view of phallic complex; A *idem*, with epiphallus removed; C, H *idem*, dorsal views, B, G lateral views of phallic complex with epiphallus and rami of cingulum removed; D, I *idem*, ventral views; E, J, M lateral, dorso-posterior (E, M) and dorsal views of epiphallus (E, M right half only); K, L lateral and ventral views of apical valves of aedeagus; N (female) ventral view of ovipositor. For explanation of A-M see Figure 15. Scales in mm, N lower, remainder upper scale.

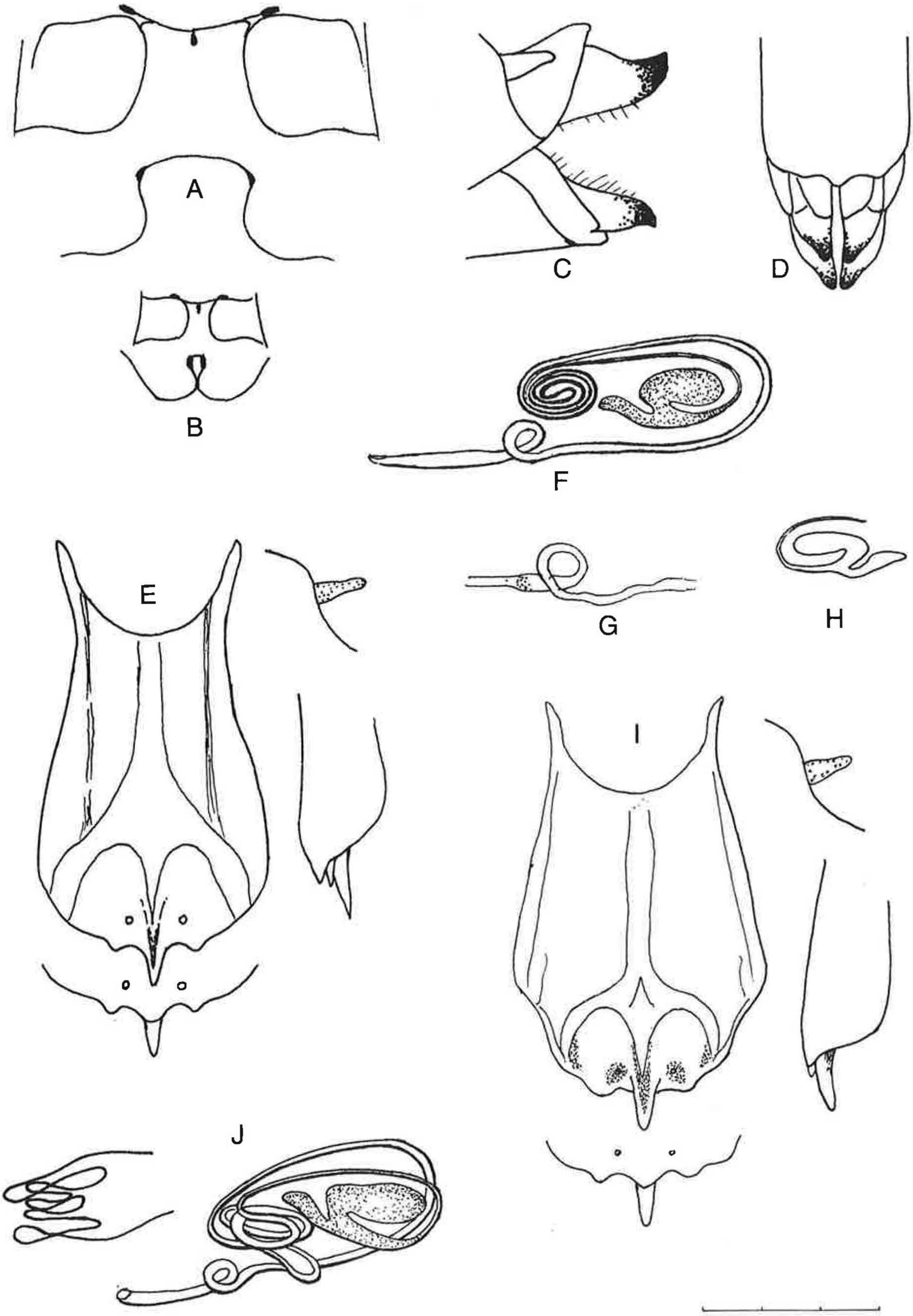

Figure 41 *Lobopoma* species. Sterna and genitalic structures of females. A-H *ambages*, I-J *mitchelli* **sp.n.** A, B sterna of female, above and male, below; C, D lateral and ventral views of ovipositer; E, I subgenital plates and cerci; F, J receptaculum seminis; G spermatophore; H spermatheca. For explanation of E-H see Figure 15. Scale in mm.

somewhat elongate, lower outer lobe rounded, inner subacute. External and internal genitalic structures as in Figures 38K,L, 40A-E, 41A-H.

Colour of body variable, shades of green and brown in lighter and darker hues, pre-costal area of tegmina frequently green; veinlets of remigium of hind wing black, vannus bright red; hind femur greenish to brownish, as body; hind tibiae pinkish to brownish. The colour variation is further discussed in relation to geographical distribution.

Measurements (mm)

Total length, M 16.3-25.0, F 31.2-45.2; pronotum length, M 3.0-4.2, F 5.8-7.8; prozona, M 1.9-2.6, F 3.6-4.8; pronotum width, min. M 1.4-1.9, F 2.7-3.2., max. M 1.6-1.9, F 2.9-3.8; tegmen length, M 3.5-5.5, F 8.2-10.8; hind femur-length, M 11.5-16.5, F 17.8-23.2, -width, M 1.8-2.3, F 2.6-3.1; antenna length, M 7.8-12.5, F 8.5-11.0; head + pronotum, M 6.3-8.6, F 11.2-13.8.

Material examined

Two F syntypes were received from MNHU, Berlin, similarly labelled 'Syntypus', 'Sansibar, Hildebrant S' and both with K.K. Gunther, 1981 name labels, '*Lobopoma ambages* Karsch 1896'. The syntype which agrees with the measurements cited by Karsch in his original description ("long corporis 45, femoris postici 23 mill"), is here designated as lectotype, and the second syntype as paralectotype (both MNHU). A third F specimen from MNHU, labelled 'Aruscha D.O. Afr.' (no other data) is not regarded as part of the type series. It is, however, similar to the two lectotypes, and this, together with the fact that to our knowledge the species has never since been collected from Zanzibar, casts some doubt on the identity of the type locality, suggesting that it may not be the island of Zanzibar, but the neighbouring part of the African mainland to which at that time the name Zanzibar was also applied (Packenham, 1979).

Other material: **Kenya**: 1 F, Buyuni (3°S 38°E), 9.iv.1897 (*Betton*); 1 M 2 F, Chyulu hills, 5600 ft (02°35′ S 37°50′ E), v. 1938 (*Coryndon Mus. Exp.*); 1 M, Ngong forest (01°24′ S 36°38′ E), 20.i.1947 (*Zeuner*); 2 M 2 F, Ngobit, Aberdare Mts 7000 ft (00°15′ S 36°50′ E), ix.1945 (*Buxton*); Karen, Nairobi (01°20′ S 36°44′ E), 6.xi.1953; 1 M 1 F, Ngong Hills 7000 ft, 8.xi.1953 (*Guichard*) 1 F, Maseraji, 40 km N. Narok (01°05′S 35°52′ E) (*Glover*) (NHM); 1 M, Muguga Forest (01°20′ S 36°44′ E); 1 M, 1 F, Nairobi, 2 M, 1 F, 30 km S. Nairobi, Magadi Rd.; 1 M, Bissel, 32 km S. Kajiado (02°07′ S 36°47′ E), 1 M 1 F, Kajiado (01°51′ S 36°47′ E) v-vi.1981 (*Ritchie*) (NHM); 4 M 1 F, Nanyuki up Guaso Nyiro R. W. of Mt. Kenya 6000 ft (00°01′ N 37°04′ E) 2 F, Laikipia plateau, 10 km W. Nanyuki, 6000 ft, 5-8.vii.1934 (*Rehn*) (ANS); 1 M, Juja farm, Ruiru (01°09′ S 36°58′ E), 25.v.1971 (*Brown*); 1 M, Ol Doinya Sapuk, 6000 ft (01°07′ S 37°15′ E), 23.v.1971; 2 M, Meru National Park 2500 ft (00°13′ N 38°05′ E); 1 F, Taita Hills, Mukiaio, 3400 ft (03°31′ S 38°17′ E); 1 M, Mwangaro (Lion Rock), Taita Hills (03°33′ S 38°11′ E), v.1975; 2 M 1 F 1 n Ngong hills Radio Station, 7500 ft (01°23′ S 36°48′ E), 1.v.1971; 6 M, Ktito Coffee Estate 5400 ft (00°58′ S 37°17′ E), 20.iv.1975; 1 M 1 F, Nr. Naro Moru 6500 ft (00°09′ S 37°02′ E); 1 M 1 F, Barmoral Rd. off Ngong Rd., 5500 ft (01°19′ S 36°45′ E), 25.x.1975; 1 M 2 n, Mara Rd., Narok 5 km W. Lemek 6600 ft (01°07′ S 35°21′ E), 25.iii.1975; 4 M 3 F 2 n, Mfunguni hill, Tulia, Kitui Dist. 5000 ft, (01°12′ S 38°02′ E); 5 M 2 F, Lukenia hill, Mombasa Rd., 35 km from Nairobi (01°29′ S 37°04′ E); 1 F Mfunguni Hill to Kyawea Hill, Tulia, 5000 ft (01°12′ S 38°02′ E), v.1975 (*Robertson and Robertson*); 6 M 6 n, Naro Moru (00°09′ S 37°02′ E), 10.v.1975; 1 F, 71 (208), 1 F, 71(268), 1 M, Koma Rock Rd. Dandora Estate, 5000 ft (01°15′ S 36°58′ E), 25.iv.1971 (*Robertson*) (NRI); 1 M, Nairobi, Karen-Ngong Rd., 27.ii.1988 (*Jago, Grunshaw and Ritchie*) (NRI); 1 M, Coast Prov., Kaya Kiwara, sandstone hill, 1000 ft (03°41′ S 39°41′ E), Brachstegia woodland, 29.ii.1988; 2 M, ditto, Mangea hill, (03°16′ S 39°43′ E), secondary thicket near dry pools, 1.iii.1988 (*Jago, Grunshaw and Robertson*); 12 M, 4 F, Nr. Elmau hill, 8 km NE. Makutano, dry open plain, 24.ii.1988; 3 M, Chyulu hills, 35 km from Makutano along hill track, grassland-lava flow border, 24-25.ii.1988; 2 M, ditto, 50 km from Makutano, forest next to *Heteropogon* grassland, 26.ii.1988 (*Jago, Grunshaw and Muli*) (2 M, 1 F, NHM, remainder NMK). **Tanzania**: 1 M, Moshe to Same, 9.v.1967; 3 M, Masai plains 12 km W. Arusha, 14.vi.1967 (*Jago*) (NRI).

Distribution and geographical variation (Figure 7)

Lobopoma ambages is predominantly a highland species; it is recorded most frequently in grassland and forest margin habitats in the central Kenyan highlands east of the Rift Valley above 1000 m, but it also descends into the Rift Valley proper and extends to the Taita hills near the coast and to the Moshi and Arusha area of Tanzania. There is considerable geographical variation in size; the specimens from the Kenyan highlands are consistently smaller than those from the lowlands, the lectotypes from 'Zanzibar' being among the largest. There is also considerable structural and colour variation; as a rule the highland specimens, especially the males, are more slender and dark than the lowland ones. In coloration the closest match to the lectotypes, is the Berlin specimen from Arusha and those from coastal Kenya, which are also predominantly green with pinkish hind tibiae, but in these the dorsa of pronota are brownish, with faint, narrow, dark fasciae along the upper margin of the lateral lobes. The males from the coastal areas are likewise larger and greener, while those from Moshi, apart from being much smaller (*c.* 17 mm as against 40 mm), are also much darker, with darkish-brown faces, sterna, fore and middle legs and hind tibiae, the latter often with a pale sub-basal ring. The antennae in the Moshi males are entirely black, but in females are, as in the lectotypes, pale. The specimens from the Kenya highlands vary not only across the recorded range, but also often from the same locality; for instance in the female specimens from Kitui the pronotum varies from flat to swollen, with the lateral carinae inflexed, parallel, or bent outwards. The two males from Meru at 2500 ft are markedly larger, somewhat more robust and with a brighter, more contrasting coloration, than specimens from higher altitudes. However, such diversification is probably not unexpected in brachypterous, sedentary species, inhabiting diverse, often disjunct, highland and lower altitude habitats.

Lobopoma mitchelli **sp. n.**

(Figures 38-41, distribution – Figure 7)

Diagnosis

Of medium size, sexual dimorphism somewhat less pronounced than in *L. ambages*, male *c.* 22 mm, female *c.* 35 mm; slender, head somewhat less elongate and prominent than in *ambages* (Figure 38A); integument as in *ambages*. Antennae in female shorter, in male half as long again as combined length of head and pronotum. Face straight in profile, fastigial constriction more than half width of ridge between antennae; fastigium verticis parabolic, as long as broad in female, somewhat more elongate in male; margins and median carinula thick, arcuate sulcus shallow, positioned behind middle (Figures 38B, 40G). Pronotum weakly tectiform, dorsum finely pitted, with a shagreened appearance, carinae linear, straight, very weakly divergent caudad; only posterior sulcus well-defined, prozona/metazona ratio 1.7 in male, 1.4 in female; lower hind angle of lateral lobe straight. Mesosternal lobe quadrate, interspace width of lobe in female, 2/3 its width in male. Tegmina lobiform, only slightly longer than length of pronotum, apices rounded – not elongate as in *ambages*. Hind femur elongate, length/width ratio 6.5 in male, 6.0 in female, both lower genicular lobes rounded, upper not elongate (Figure 39K). External and internal genitalic structures as in Figures 38E,F, 40F-J and 41I,J showing only small structural differences from *ambages*.

Colour of antennae black in male, brown in female; body predominantly green, brownish on abdomen; coloration of male brighter with very narrow lateral fasciae somewhat more distinct, as is dark maculation on abdomen; hind wing uniformly bright-red, only radial vein darkened; hind femur green, slightly darker above; hind knee, including adjacent basal part of tibia black, subtended by a pale, sub-basal ring, which also appears on femur, remainder of tibia and tarsus brown.

Measurements (mm)

Total length, M 20.7-24.0, F 34.2-36.8; pronotum length, M 3.8-4.8, F 7.4-7.8; prozona, M 2.4-3.0, F 4.2-4.5; pronotum width, min. M 1.6-1.8, F 3.2-3.3; max. M 1.7-2.1, F 3.4-3.5; tegmen length, M 5.6-6.5, F 8.5-9.0; hind femur-length, M 14.5-17.0, F 20.8-22.8, -width, M 2.3-2.6, F 3.4-3.8; antenna length, M 11.0-13.0, F *c.* 9.0; head + pronotum, M 7.8-9.0, F 11.7-12.8.

Material examined

Holotype F, **Tanzania**: University College campus 8 miles W. Dar es Salaam 31.x-4.xi.1964 (*Jago*) (NHM). Paratypes: 2 M, Dar es Salaam, xi.1965 (*Jago*); 1 M, Morogoro Dist., ii.1955 (*Phipps*) (NHM); 1 F Dar – Tanga Rd. 80 miles from Tanga, 10.vi.1972 (*Forchhammer*); 1 F, 8 miles S. Handeni (05°26′ S 38°01′ E), 1 M, 10 miles W. Korogwe (05°10′ S 38°30′ E), 23-24.xi.1974 (*Jakobsen*) (NHMA); 1 M, Dar es Salaam University, vi.1973 (*Einyu*); 1 M, 24 km NE. Sindeni, Korogwe-Handeni Rd., riverine grassland and degraded woodland, 3.x.1982; 2 M, Korogwe-Msata Rd., 103 km N. Msata, summit of kopje, 27.ix.1982 (*Jago*) (NRI); 4 n, Morogoro Dist., Turiani (06°05′ S 37°35′ E), 23.iii.1975 (*Townsend*) (NHM).

Distribution and geographical variation (Figure 7)

Lobopoma mitchelli is so far known only from the coastal and pre-coastal areas of Tanzania between the Usambaras (5°S) and Morogoro (7°S). Compared with *L. ambages* it shows little intra-specific variation; the small Dar es Salaam series is the best represented and preserved, its coloration is as described. The male Morogoro specimen is brownish, but this could be the result of discoloration. The Aarhus specimens have been kept in alcohol and are badly discoloured.

Biology

Nothing is known but the label data suggest bivoltinism, with egg quiescence, or possibly continuous reproduction.

Discussion

This species is nearest to *L. ambages*, from which it differs principally in the less prominent vertex of the head, the apically rounded tegmina, stouter hind femora with more rounded genicular lobes, details of the genitalic structures and coloration, particularly of the hind wings and hind femora. The species is dedicated to the memory of our late colleague and collector, Graham Mitchell.

***Lobopoma robertsoni* sp. n.**

(Figures 38-41, distribution – Figure 7)

Diagnosis

Female large (*c.* 50 mm), robust and brachypterous, male smaller (26-28 mm), slender and macropterous. Integument coriaceous, matt. Head acute, apex prominent, projecting forward between antennae; antennae ensiform, dilate basally, more so in female where shorter than combined length of head and pronotum but in male are half as long again; face strongly oblique in profile, frontal ridge narrow, sulcate, with thick undulate margins strongly divergent towards clypeus, fastigial constriction marked (Figures 38M, 39Q); fastigium trapezoidal in female, elongate in male, margins undulate, arcuate sulcus deep, prominently rounded (Figures 38N, 39M). Pronotum coarsely pitted, more so in female; carinae raised, lateral carinae inflexed and divergent caudad, more so in female; hind margin broadly rounded in female, obtusangular in male; posterior sulcus distinct, others weak, prozona/metazona ratio 1.5 in male, 1.3 in female; lower hind angle of lateral lobe rounded, produced. Mesosternal lobes quadrate with rounded angles, interspace subquadrate in female, half width of lobe in male. In female tegmina and wings abbreviated; tegmina coriaceous, with expanded pre-costal field and narrowed apex, barely extending beyond edge of third abdominal segment; in male tegmina and wings fully developed, extending slightly beyond tip of the abdomen, venation of tegmina rather dense, intercalary vein weakly developed. Hind femora elongate and slender, length/width ratio 6 in male, 7 in female, inner upper genicular lobe produced, lower rounded. Internal and external genitalic structures of male as in Figures 38P,Q and 40K-M; subgenital plate of female broadly trilobate, ovipositor valves short and stout.

General coloration similar to other *Lobopoma* species. In female holotype dorsal part is greenish-brown and sides clearer grass-green; tegmina coloured more contrasting brighter green in pre-costal and anal fields and brown in medial fields; abdomen with a narrow dorsal and two lateral chains of small brown maculae; hind wings are Prussian blue at base with thick, dark veins, apex faintly infumate; hind tibiae dirty brownish pink. Coloration of male brighter and more contrasting, dorsum brown, sides green, abdomen lighter yellowish-green; coloration of hind wing as in female, blue at base, with slightly infumate apex.

Measurements (mm)

Total length, M 26.5-28.2, F 50.5; pronotum length, M 4.2, F 7.5; prozona, M 2.5, F 4.3; pronotum width, min. M 1.7, F 3.2, max. M 2.2, F 3.8; tegmen length, M 18.5-19.0, F 15.0; hind femur-length, M 17.0-17.6, F 26.2, -width, M 2.8, F 3.7; antenna length, M 12.5-13.0, F 13; head + pronotum, M 8.7-8.9, F 15.0.

Material examined

Holotype F, **Kenya**: 17 km N. Loglogii, side of road (02°09′ N 37°53′ E) 1000 m open thicket, 19.v.1975 (*Robertson and Robertson*) (NHM). Paratypes: 2 M, same data as the type (1 NHM, 1 NRI). **Ethiopia**: 1 M, River Hawash (11°12′ N 40°40′ E) Nr. Bukuru Bridge, 15.ix.1946; 1 M 75 km S. Harar (09°19′ N 42°09′ E) Fich, v.1947 (*Guichard*) (NHM).

Distribution and geographical variation (Figure 7)

Lobopoma robertsoni apparently occurs along the eastern side of the Rift valley from about 2°N in northern Kenya, to 11°N in the Awash valley of eastern Ethiopia. It is possibly a relict species now confined to a few disjunct localities, or this may be an artefact of poor collecting of a rare species in a little frequented area. Nothing is known of its biology.

Discussion

This is a very distinctive species, easily recognized from its congeners by brachyptery in the female and macroptery in the male, blue hind wings and marked sexual dimorphism. It is named after its collectors, Ann and Ian Robertson.

SHABACRIS GEN.N.

Type species *Lobopoma robusta* Bouvy, 1982 here designated.

Diagnosis

Of medium size, male 20-22 mm, female 36-38 mm. Integument shiny, finely pitted. Antennae much longer than combined length of head and pronotum, narrowly ensiform. Head conical, obtusely rounded with convex frons and occiput. Frontal ridge broad; fastigial constriction weak, surface of ridge convex above antennae, weakly sulcate below, margins thick, weakly divergent towards clypeus. Fastigium verticis parabolic, somewhat more elongate in male, its surface concave, with well-defined arcuate sulcus positioned behind middle; margins low, thick, but distinct, median carinula weak. Pronotum subcylindrical, dorsum straight in profile, anterior and posterior margins broadly rounded, median carina linear, the lateral ones thick, weakly divergent caudad; posterior and second sulci distinct, anterior sulcus weak or obsolete. The prozona almost twice length of metazona; lower margin of lateral lobe broadly wavy, ascending, lower hind angle broadly rounded. Tegmina and wings lobiform, no longer than length of pronotum. Mesosternal lobes transverse in both sexes, interspace less than half width of lobe. Hind femur long, moderately heavy, ratio of length to width about 5-6; lower genicular lobes of equal length, rounded, upper not produced; arolium longer than claw. Male supra-anal plate elongate-cordate with a broad medial longitudinal excavation, cerci narrowly conical with subacute downcurved and incurved apex; subgenital plate short, subconical, upturned. Epiphallus with broad, short lophi and short, pointed posterior projections. Apical valves of penis slender, pointed. Ovipositor robust; subgenital plate of female with acute median projection and indistinct lateral callosities; receptaculum seminis as in Figure 42H. General coloration green to greenish-yellow or light-brownish with a bold dark, median fascia and a subdorsal fascia on either side; wings colourless, hind knees and tibiae bright bluish or reddish.

Affinities and discussion

This genus is erected to accommodate the recently described *Lobopoma robusta* Bouvy 1982: 417-421, Figures 61-63. The original attribution to *Lobopoma* was made by the author with some reservations, who pointed out that the new taxon differed from the current definition of *Lobopoma* in some respects. We have been able to compare the type material from MRAC, together with one specimen in NHM, both with the taxa treated in this revision, and also with the other genera of flightless Phlaeobae from the African mainland and Madagascar reviewed by Jago (1983) and conclude that it cannot be satisfactorily ascribed to any of them. We have also consulted Johnsen (1984) and consider that his "unknown genus and species" (pp. 324, 327, Figure 280) is Bouvy's *L. robusta.* (Johnsen was evidently unaware of Bouvy's publication, which he does not cite.) Johnsen's specimen from Chingola, Zambia was not available for study, but we have studied the NHM specimen from Zaire, quoted by him. In conclusion, we consider that *robusta* Bouvy has some affinities with *Orthochtha,* while in general appearance it resembles *Chokwea* Uvarov. However, these affinities are remote, and in agreement with Johnsen, we assign it to a separate genus, here described and named *Shabacris* after its type locality, the Shaba province of Zaire.

The following combination of characters separates it from all the other genera in the group: robust build and 'bullet-shaped' head; elongate, slender antennae; thick frontal ridge and a weak fastigial constriction; length of prozona almost twice that of metazona; scale-like tegmina and wings reduced to less than length of pronotum; short, thick but broad, epiphallic lophi and slender aedeagal valves; genitalic structure of female as in Figure 42H; dark median dorsal fascia.

Shabacris robusta (Bouvy 1982) **comb. nov.**

(Figure 42, distribution – Figure 7)

Lobopoma robusta Bouvy 1982: 417, Figures 61-63. Holotype male, ZAIRE (MRAC) [examined].

Diagnosis

As for genus; as known at present, it contains only the type species *S. robusta* (Bouvy 1982). The author provides a detailed description (pp. 417-421, Figures 61-63), thus no redescription is necessary.

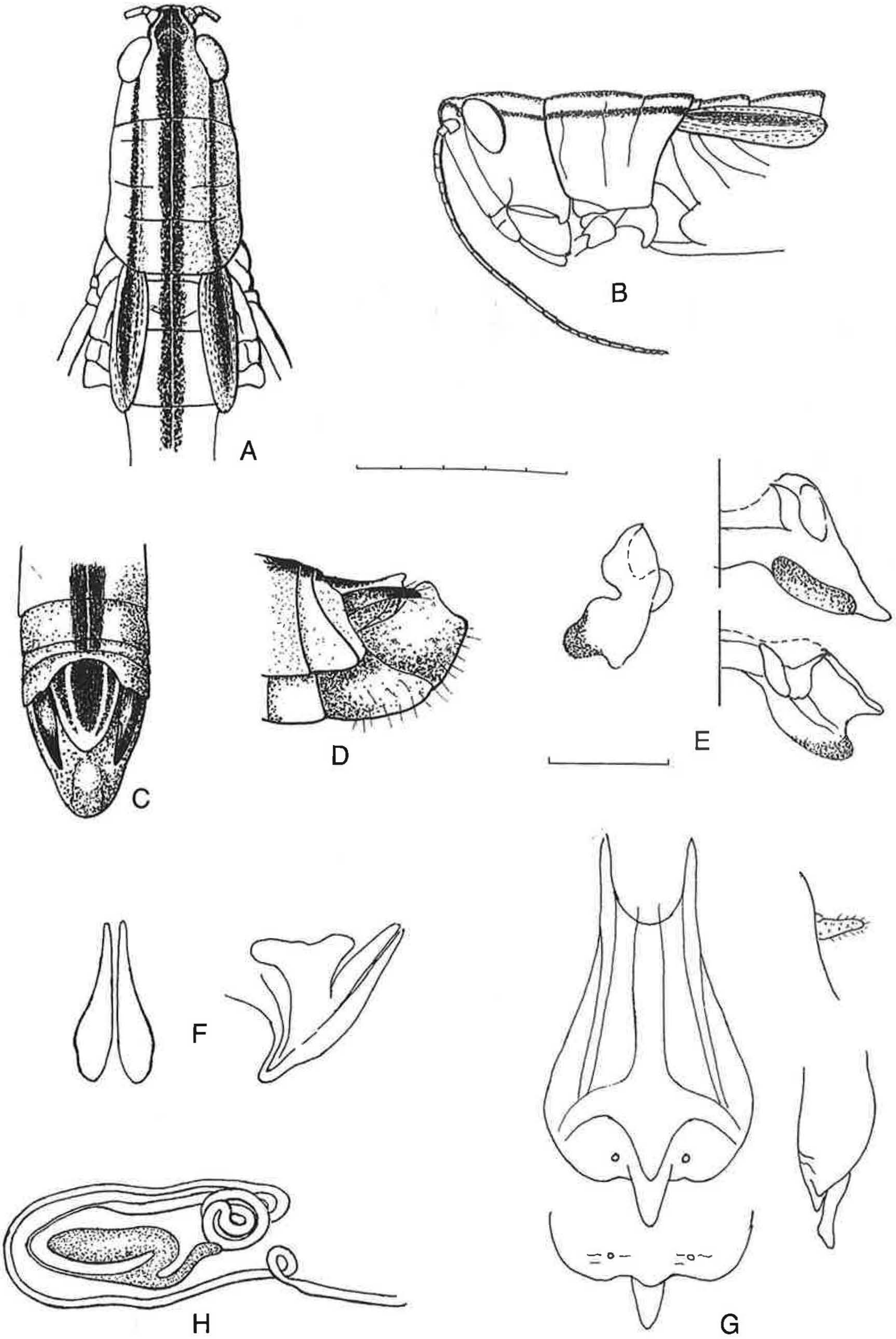

Figure 42 *Shabacris* **gen.n.** *S. robusta*, A-F male, G, H female. A, B dorsal and lateral aspects of head, pronotum and tegmina; C, D dorsal and lateral aspects of tip of abdomen; E lateral, dorsal-posterior and dorsal aspects of epiphallus (right half); F lateral and ventral views of apical valves of aedeagus; G subgenital plate and cercus; H receptaculum seminis. For explanation of E-H see Figure 15. Scales in mm, A-D, G, H upper, E, F lower scale.

Material examined

Holotype M, **Zaire**: Nr. Lubumbashi, 1300 m, 12.ii.1971. Paratypes: 1 F (described as allotype), 12.iv.1971; 1 M, 21.ii.1972; 1 n. i.1972, all same locality as holotype (*Bouvy*) (MRAC); 1 F, Shaba province, *c.* 20 km from Lubumbashi on road to Chililabangwe (Zambia), 9.iii.1975 (*Townsend*) (NHM). The latter specimen is cited in Johnsen (1984:325, Figure 280 A,B), as "genus and species unknown".

PAMACRIS RAMME

Pamacris Ramme 1929: 269. Type species *Pamacris diversipennis* Ramme 1929: 269 by original designation.
Pamacris Ramme; Dirsh 1965: 441, Figure 352 (redescription).

Diagnosis

Size medium to smaller. Integument shiny, densely pitted. Antennae long, almost twice combined length of head and pronotum in male; segments in basal third of flagellum smooth and somewhat flattened, more so in female; in apical part segments rounded and densely punctured. Vertex of head prominent, frons moderately oblique, frontal ridge broad, moderately sulcate with undulate margins, weakly divergent and obsolescent towards clypeus; fastigium verticis broad, parabolic, prominent, meeting frons at sharp, acute angle (Figure 43A), its surface concave in front of the arcuate sulcus, convex behind it; median carinula weak. Pronotum weakly tectiform, somewhat inflated in prozona, more so in female; median carina low, linear, lateral carinae thicker; in male parallel, in female more or less excurved in prozona and in both sexes divergent and obsolescent in metazona; hind margin obtusangular; only posterior sulcus distinct, others weak; prozona half as long again as metazona; lateral pronotal lobes with undulate lower margins, hind angle broadly rounded. Mesosternal interspace characteristically heart-shaped (Figures 43E,K), metasternal lobes well separated in both sexes, more so in female. Tegmina and wings reduced in both sexes or only in female (*diversipennis*); in fully alate male, pre-costal field somewhat expanded, intercalary vein absent. Hind femur moderately slender, upper genicular lobes not produced, lower rounded. Male supra-anal plate cordate, elongate with a median basal depression and a more or less distinct transverse sulcus; cerci short, conical, pointed; subgenital plate simple, short, pointed. Epiphallic bridge narrow, ancorae short and broad, lophi lobiform, posterior process short, pointed. Female subgenital plate with lateral rows of parallel, more or less sclerotized callosities of unknown function, posterior margin trilobate with a median projection; internal genitalic structures studied only in *P. diversipennis*, in which spermatheca and spermathecal duct (Figure 45K) characteristically different from those of other taxa in this revision.

General coloration grass-green with or without a brownish wash; sulci of lateral pronotal lobes and thoracic sutures narrowly lined with deep black; hind wings sometimes infumate, but not otherwise coloured; hind legs and external genitalia variously coloured in the different species.

Discussion

In discussing the affinities of his new species *carterocera*, which he placed under *Lobopoma* Karsch, Jago (1964: 211, Figures 3-8, 37-39) stated *Lobopoma* to be closely related to *Pamacris* and the generic limits between the two to be vague. He further considered his *Lobopoma carterocera*, *Lobopoma longicornis* Chopard 1958, and *Pamacris diversipennis* Ramme to be closer to each other morphologically than to the East African *Lobopoma ambages* Karsch. While we agree with Jago on the close relationship between the three taxa *diversipennis*, *carterocera* and *longicornis* and on their separation from *ambages*, we consider that the two genera *Pamacris* and *Lobopoma*, as defined by their type species *diversipennis* and *ambages* respectively, are quite distinct; indeed in our opinion *Pamacris* occupies a rather isolated position relative to the phlaeobine genera as a whole, a point made clear in the diagnosis. We further consider that while the two species *diversipennis* and *carterocera* are close enough to be considered congeneric and are thus placed here under *Pamacris*, the third, *longicornis*, is sufficiently distinct to justify recognition as a separate genus, here designated and named *Nimbacris* after its type locality (p. 131).

Key 8 *Pamacris* and *Nimbacris*

1 Apex of head in profile rounded (Figure 43M); lateral pronotal carinae distinct, not strongly divergent in metazona, hind angle broadly rounded, almost straight, metazona half length of prozona; externo-median area of hind femur deep pink; female subgenital plate with a single sclerotized ridge on each side (Figure 45I), and without red pigmentation; Mt. Nimba, Guinea .. *Nimbacris longicornis* (Chopard)

– Apex of head in profile an acute, sharp angle (Figure 43A); lateral pronotal carinae indistinct, strongly expanded in metazona, metazona more than half the length of prozona, its hind margin obtusangular; externo-median area of hind femur greenish-yellowish to brownish with no trace of pink; female subgenital plate tinged with red and with several callosities in parallel on each side; Cameroon-Central African Republic-Sudan 2

2 Male fully winged; female with lateral pronotal carinae strongly outflexed in the middle; antennae of same shade throughout; hind tibiae greenish-grey, cerci pale; Cameroon-Central African Republic-Sudan, Equatoria Province .... *Pamacris diversipennis* Ramme

– Both sexes brachypterous; lateral pronotal carinae only moderately divergent in female; antennae pale basally; hind tibiae greenish-blue; cerci dark-brown; Sudan, Equatoria Province .... *Pamacris carterocera* (Jago)

Pamacris diversipennis Ramme 1929

(Figures 43-45, distribution – Figure 7)

Pamacris diversipennis Ramme, 1929: 270. Holotype male, CAMEROON, Pama Quelle (MNHU), by original designation [examined].

Diagnosis

As in the generic description, key to species and Figures 43-45. Male 20-23 mm, sculpturing pronounced. Tegmina extending to tip of abdomen and almost reaching hind knees. Female larger and bulkier, 30-34 mm, tegmina barely reaching middle of abdomen. Subgenital plate with two well-defined and two weaker transverse callosities on each side (Figure 45C).

General coloration of male deep-green to brownish-yellow (probably much brighter in live specimens); underside greenish-yellow. All main thoracic sutures including sulci of lateral pronotal lobe, but not dorsum, narrowly lined with deep black. Hind wing colourless or lightly infumate, supra-anal plate light brown, subgenital plate red, cercus with dark red dots basally; hind femur brownish, hind knee brown; hind tibia pale greyish-green, dark basally and apically on inner face; tarsi dirty-white with brown maculation, spines as tibia, tipped with black. Coloration of female similar to male, but tibiae greener, subgenital plate red like male.

Measurements (mm)

Total length, M 20.0-23.0, F 30.0-34.0; pronotum length, M 4.1-4.6, F 7.0-7.2; prozona, M 2.4-2.6, F 4.2-4.4; pronotum width, min. M 1.6, F 2.6, max. M 2.3, F 3.5; tegmen length, M 15.5-16.5, F 10.0-1.5; hind femur-length, M 12.5-13.0, F 17.0-20.0, -width, M 1.8-2.0, F 2.5-2.7; antenna length, M 11.5-13.0, F 14.5-15; head + pronotum, M 7.3-8.0, F 12.0-12.5.

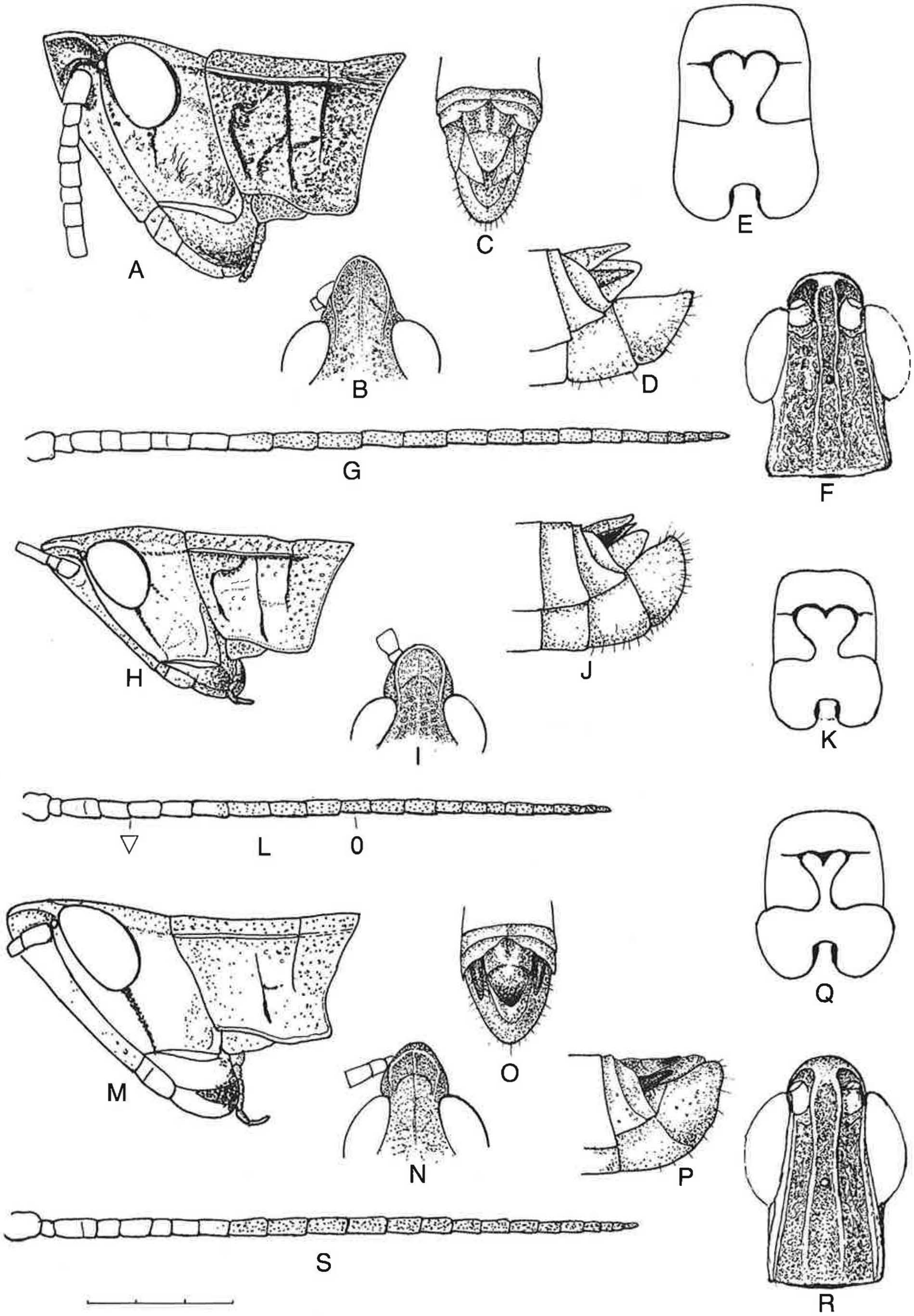

Figure 43 *Pamacris* and *Nimbacris* **gen.n.** A-G *P. diversipennis*, H-L *P. carterocera* and M-S *N. longicornis*, males. A, H, M lateral views of head and pronotum; B, I, N dorsal views of fastigium verticis; C, O dorsal views of tip of abdomen; D, J, P *idem*, lateral views; E, K, Q sternum; F, R frontal ridge; G, L, S antenna showing (L) transverse sections in proximal and distal portions. Scale in mm.

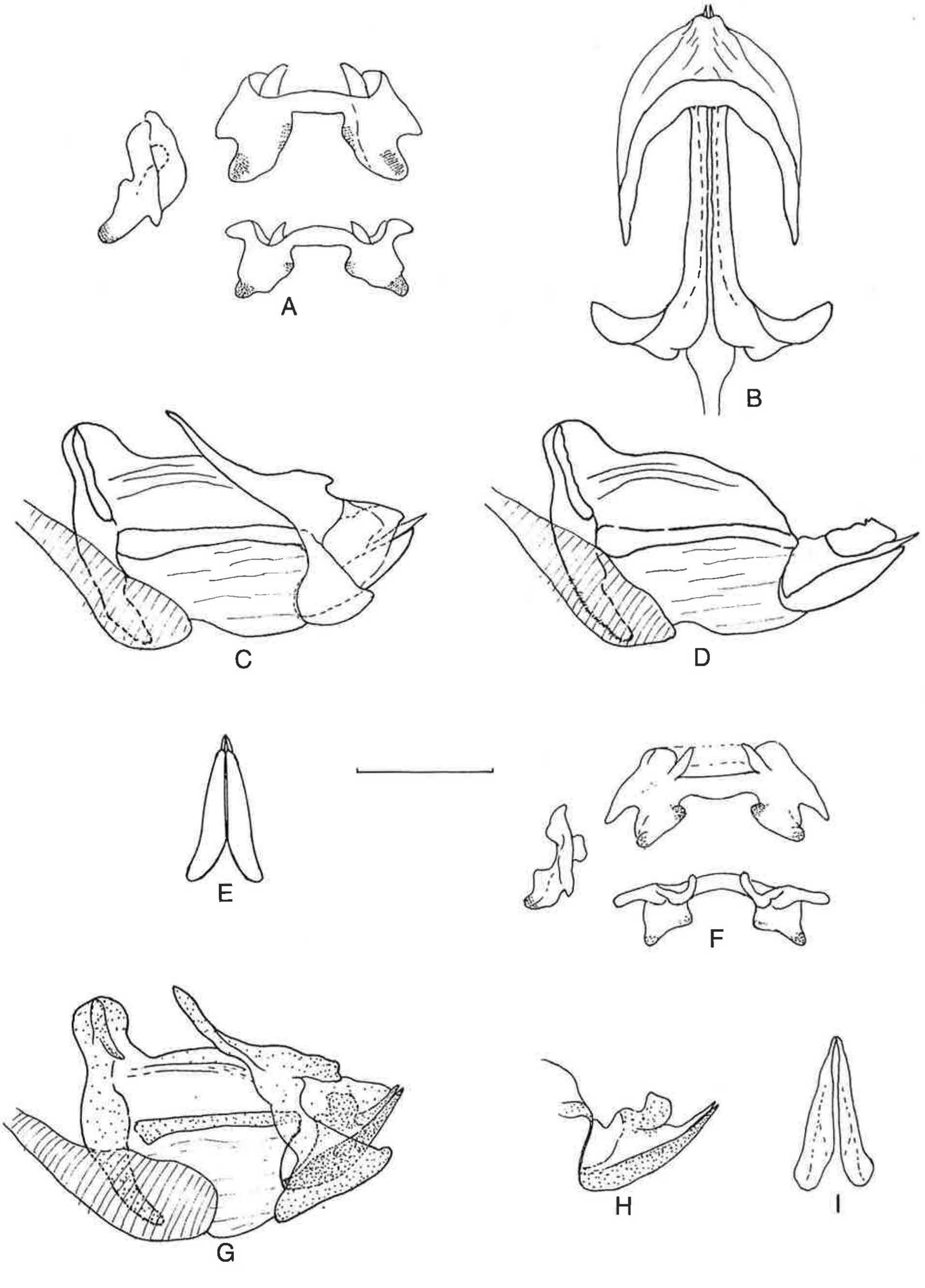

Figure 44 *Pamacris* and *Nimbacris* **gen.n.** Male genitalic structures, A-E *P. diversipennis*, F-I *N. longicornis*. A, F lateral, dorso-posterior and dorsal views of epiphallus; B dorsal view of phallic complex with epiphallus removed; C, G lateral views of phallic complex with epiphallus removed; D *idem*, with rami of cingulum removed; E, I lateral and H ventral views of apical valves of aedeagus. For explanation see Figure 15. Scale in mm.

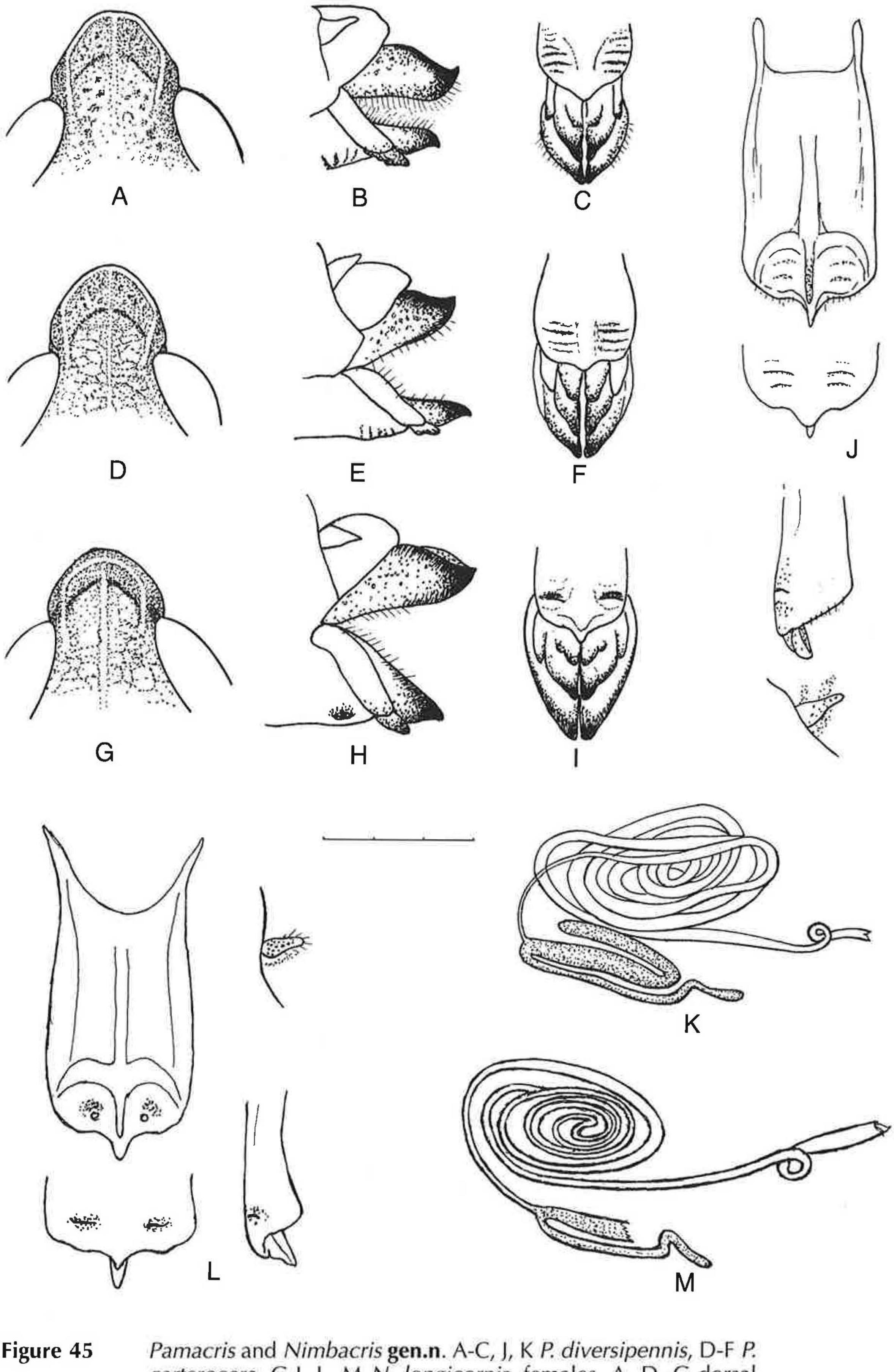

Figure 45 *Pamacris* and *Nimbacris* **gen.n.** A-C, J, K *P. diversipennis*, D-F *P. carterocera*, G-I, L, M *N. longicornis*, females. A, D, G dorsal views of fastigium verticis; B, E, H lateral views of tip of abdomen; C, F, I *idem*, ventral views; J, L subgenital plate and cercus; K, M receptaculum seminis. For explanation of J-M see Figure 15. Scale in mm.

Material examined

Paratype M, Cameroon, bearing the original paratype label, Ramme's name label, a locality label *Neu Kamerun*, Pama-Quelle (03°17′ N 10°03′ E-03°33′ N 10°18′ E), v.1913, (Houy S.G.) and also the label 'ex. Berlin Museum, BM 1934-254' and a similarly labelled F paratype with the locality label 'Pama-Quelle, Baiki, v. 1913, (Houy S.G.)' (both NHM). **Central African Republic** (as Ubangi-Shari): 2 M , 3 F, Fort Sibut, 13.x.1934 (*Vanderbilt Exp. French Eq. Africa, Rehn*) (ANS). **Zaire** (as Congo B.): 1 F, Alto Uele, Dungu (03°37′ N 28°34′ E), iv.1927 (*Patrizi*) (MCSN). **Sudan**: 2 M, 1 F, Yambio [= Yambas 04°35′ N 28°0′E], 4-11.xii.1950 (*Wilson, Sudan Gov.*) (NHM).

Distribution and geographical variation

On the basis of the above material and that cited by Ramme in his original description, which includes paratypes from Bosum (Central African Republic) (06°20′ N 16°20′ E), *P. diversipennis* is seen to occur in a belt lying roughly along the northern fringe of the tropical rainforest between 3° and 6°N and extending from the coastal lowlands eastwards to Dungu near the Zaire/Uganda border and the adjacent part of southern Sudan. Nothing is known of its ecology, but it is assumed that it inhabits grassland in clearings and along forest margins. The specimens from Sibut (05°45′ N 19°00′ E) agree well with the paratypes from Pama-Quelle (the type locality in the coastal lowlands southeast of Douala), in size and coloration, but the pronotum is more swollen and has thicker lateral carinae. In the specimens from Yambio and Dungu however, the pronotum is barely expanded; moreover these specimens are also considerably smaller and have a narrower fastigium.

Pamacris carterocera (Jago 1964) **comb.n.**

(Figures 43-45, distribution – Figure 7)

Lobopoma carterocera Jago 1964: 211. Holotype male, SUDAN (NHM) [examined].

Diagnosis

A species closely related to *P. diversipennis* Ramme, from which it differs in smaller size, brachyptery in both sexes and also some morphological characters, as given in the key and the figures.

Measurements (mm)

Total length, M 18.2, F 32.0; pronotum length, M 3.4, F 6.4; prozona, M 2.1, F 4.0; pronotum width, min. M 1.4, F 2.6, max. M 1.8, F 3.3; tegmen length, M 5.8, F 6.8; hind femur-length, M 12.6, F 17.2, -width M 1.7, F 2.3; antenna length, M 11.8, F 10+; head + pronotum, M 6.0, F 11.5.

Material examined

Holotype M, **Sudan**: Yei (04°05′ N 30°45′ E), 1.vi.1963 (*P and P Carter*) (NHM). Paratype F, same data as holotype. The species is only known from the type material.

***NIMBACRIS* GEN. N.**

Type species *Lobopoma longicornis* Chopard 1958, here designated.

Diagnosis

A genus closely related to *Pamacris* Ramme 1929, from which it differs in the following principal features: vertex of head prominent, but less angular and more rounded than in *Pamacris*, fastigium smaller, with thick, rounded margins.

Pronotum scarcely inflated even in female, lateral carinae of pronotum low but distinct, scarcely divergent in metazona; metazona half width of prozona, hind angle broadly rounded. Tegmina and wings lobiform in both sexes. Subgenital plate of female with only one sclerotized ridge on each side. Epiphallic lophi broad, expanding into rounded lobes on each side (Figure 44F), posterior projections moderately long, pointed. Rami of cingulum broad, somewhat sclerotized, forming a shield below apical valves of penis, both apical valves of penis and valves of cingulum slender and of same length.

Nimbacris longicornis (Chopard 1958) **comb. n.**

(Figures 43-45, distribution – Figure 7)

Lobopoma longicornis Chopard 1958: 151. Holotype male, GUINEA (MNHN) [examined].

Diagnosis

The type species of the new monotypic genus can be diagnosed by means of the generic description, the keys and Figures 43-45. In particular, the structure of vertex, pronotum, callosities of subgenital plate of female and coloration, are diagnostic.

Measurements (mm)

Total length, M 20.5-21.0, F 36.0-37.0; pronotum length, M 3.9, F 6.5-7.0; prozona, M 2.6, F 4.3-4.7; pronotum width, min. M 1.6, F 2.8-3.0, max. M 3.2, F 3.0-3.2; tegmen, M 4.2, F 6.0-7.2; hind femur-length, M 13.5, F 18.5-19.5, -width, M 2.0, F 2.5-2.8; antenna length, M 11.0+, F 11.5-12.0, head and pronotum, M 7.2, F 11.5-11.7.

Material examined

Holotype M, **Guinea**: Nimba, prairie d'altitude, 5.xii.1951 (*Lamotte and Roy*) (IFAN). Allotype F, same data (MNHN); 2 M, Nimba, ix-xi. 1956 (*Lamotte*) (NHM); 1 F, same data as holotype (IFAN).

Distribution

So far the species is known only from the type locality in highland grassland on Mt. Nimba, near the meeting of the borders of Guinea, Côte d'Ivoire and Liberia.

XEROPHLAEOBA **UVAROV**

Xerophlaeoba Uvarov 1936: 538. Type species *Cymochtha deserticola* Krauss 1902, designated by Uvarov 1936: 538.
Xerophlaeoba Uvarov; Dirsh 1965: 432, Figure 344 (redescription).

Diagnosis

Size medium to above medium, slender and elongate; integument matt, not shiny but smooth, not pitted. Antenna moderately long, ensiform basally, dilate for more than half length of flagellum. Head acute, face oblique, vertex projecting forward in both sexes. Frontal ridge sulcate with well-defined, somewhat undulate margins, strongly divergent towards clypeus and narrowed apically, fastigial constriction pronounced. Fastigium of vertex parabolic, longer than broad, concave, with thick, somewhat irregular margins; arcuate sulcus distinct, positioned near middle; median carinula linear, sometimes weak or absent. Compound eye elongate, oblique, its longest axis equal the subocular distance in female, shorter in male. Pronotum weakly tectiform, straight, or weakly compressed and depressed in male, straight, or weakly inflated in female. Lateral carinae straight, parallel, or weakly divergent caudad; all carinae well-developed, lateral ones interrupted by main and second sulci, median carina by main sulcus only, first sulcus weak or obsolescent; lateral lobes longer than high, lower margin straight or wavy, ascending in its anterior half; lower posterior angle straight to weakly obtuse, broadly rounded. Mesosternal lobe quadrate to weakly transverse, interspace subequal to width of lobe, or narrower; metasternal lobes contiguous in the male, weakly separated or contiguous in female. Tegmina and wings fully developed, rather narrow, scapular not widened; reticulation relatively dense, intercalary vein present, but weak and irregular. Posterior femora slender, upper inner lobe weakly produced, outer lower lobe rounded to subacute, inner more or less subacute. Arolium small, barely half length of claw. External genitalic structures simple, not presenting outstanding diagnostic features in either sex; male supra-anal plate elongate-angular, cerci narrow, conical, slightly incurved, subgenital plate short, obtusely conical. Structure of epiphallus characteristic, bridge rather thick, with elongate median projection, ancorae short, lophi in form of small, finger-like protruding tubercles, posterior projections very elongate, pointed (Figure 47B-D). Genitalic structures of female as in Figure 47G,H.

Coloration in sombre shades of stramineous yellows and brown, lateral fasciae broad, more or less developed in male, often weak, narrow or absent in female. Pre-costal area of tegmina with or without a pale speculum. Hind femora and tibiae colour of body, hind knees barely darkened.

Discussion

In creating the genus *Xerophlaeoba* Uvarov (1936: 538) placed two species under it, the designated type species *deserticola* Krauss 1902 from Arabia, and the East African *schulthessi* I. Bolivar 1908: 243 note. The syntypes of both species have been examined by us. There are no ambiguities concerning *deserticola*, but much confusion surrounds *schulthessi*. It was described originally as *Phlaeoba antennata* Schulthess 1898: 185, Plate 2, Figure 8, from a male and a female syntype; this name was later found to be preoccupied and it was renamed *Orthochtha schulthessi* I. Bolivar 1908. In examining the syntypes, Uvarov (1936: 539) correctly diagnosed the male as a *Duronia* (it is in fact a *Duronia chloronota* (Stål)), and designated the female as the lectotype of *Xerophlaeoba schulthessi* (I. Bolivar). The lectotype however, is an incontestable *Orthochtha dasycnemis* (Gerstäcker). Indeed, the specimen, in addition to its locality, type and Genoa Museum labels, also bears an early name label with the legend '*Orth. dasycnemis* K. Krauss det. 901'. Thus both syntypes are mere misidentifications, and the name *Xerophlaeoba schulthessi* becomes a synonym of *O. dasycnemis*. This diagnosis, made earlier (as a G. Popov 1982 label, attached to the specimen), has since been published by Baccetti (1985: 309). Baccetti (1985) considers the presence of *Xerophlaeoba* in Somalia as doubtful. It does, however, occur both there and in Ethiopia, but no new name is needed to designate the African *Xerophlaeoba*, since in our opinion all the material examined by us is conspecific with *deserticola*, as is discussed below.

Xerophlaeoba deserticola (Krauss 1902)

(Figures 46-47, distribution – Figure 7)

Cymochtha deserticola Krauss 1902: 2. Lectotype female, YEMEN (as Aden) (NM), here designated [examined].
Xerophlaeoba deserticola (Krauss); Uvarov 1936: 538.
Orthochtha prionocera I. Bolivar 1908: 243. Holotype female, SOUTH ARABIA (IEE) [examined]. (Synonymized by Uvarov 1936: 539.)

Diagnosis

General diagnosis as for genus; morphological characteristics and coloration discussed below under geographical variation.

Measurements

As in Table 9.

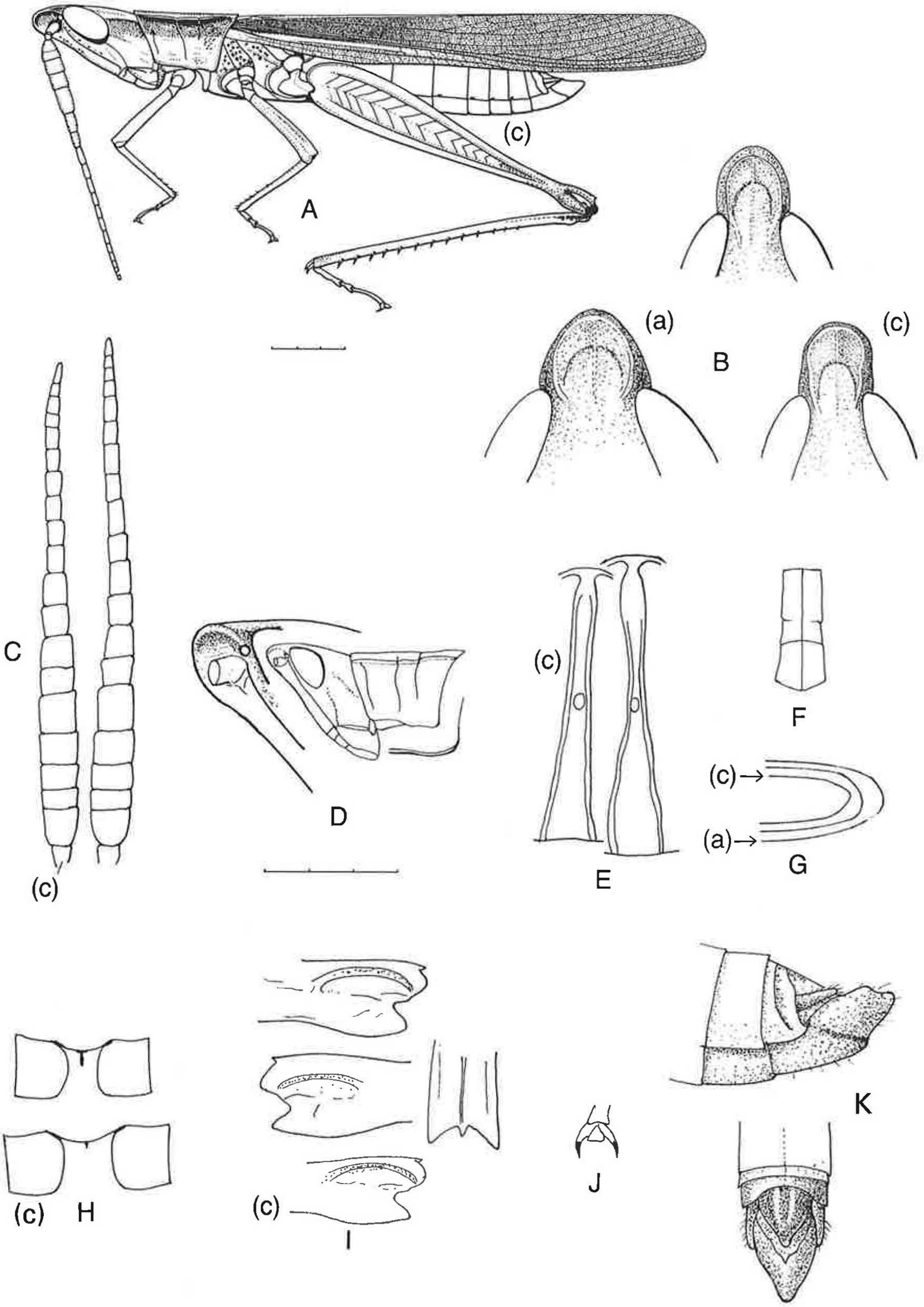

Figure 46 *Xerophlaeoba deserticola*. A, K male, remainder female, from type locality (Aden) except c – Cub-Cub, Eritrea and a – Assab, Ethiopia. A lateral view of whole insect (taken from Dirsh 1965; 432, Figure 344); B dorsal views of fastigium verticis; C antenna; D vertex of head and lower hind angle of pronotal lobe; E frontal ridge; F dorsal view of dorsum of pronotum; G outline of apex of tegmina; H mesosternal lobes; I lateral external (top and bottom), internal and dorsal views of hind knee; J arolium and claw of hind tarsus; K lateral and dorsal views of tip of abdomen. Scales in mm, A, D (part), F top, remainder lower scale.

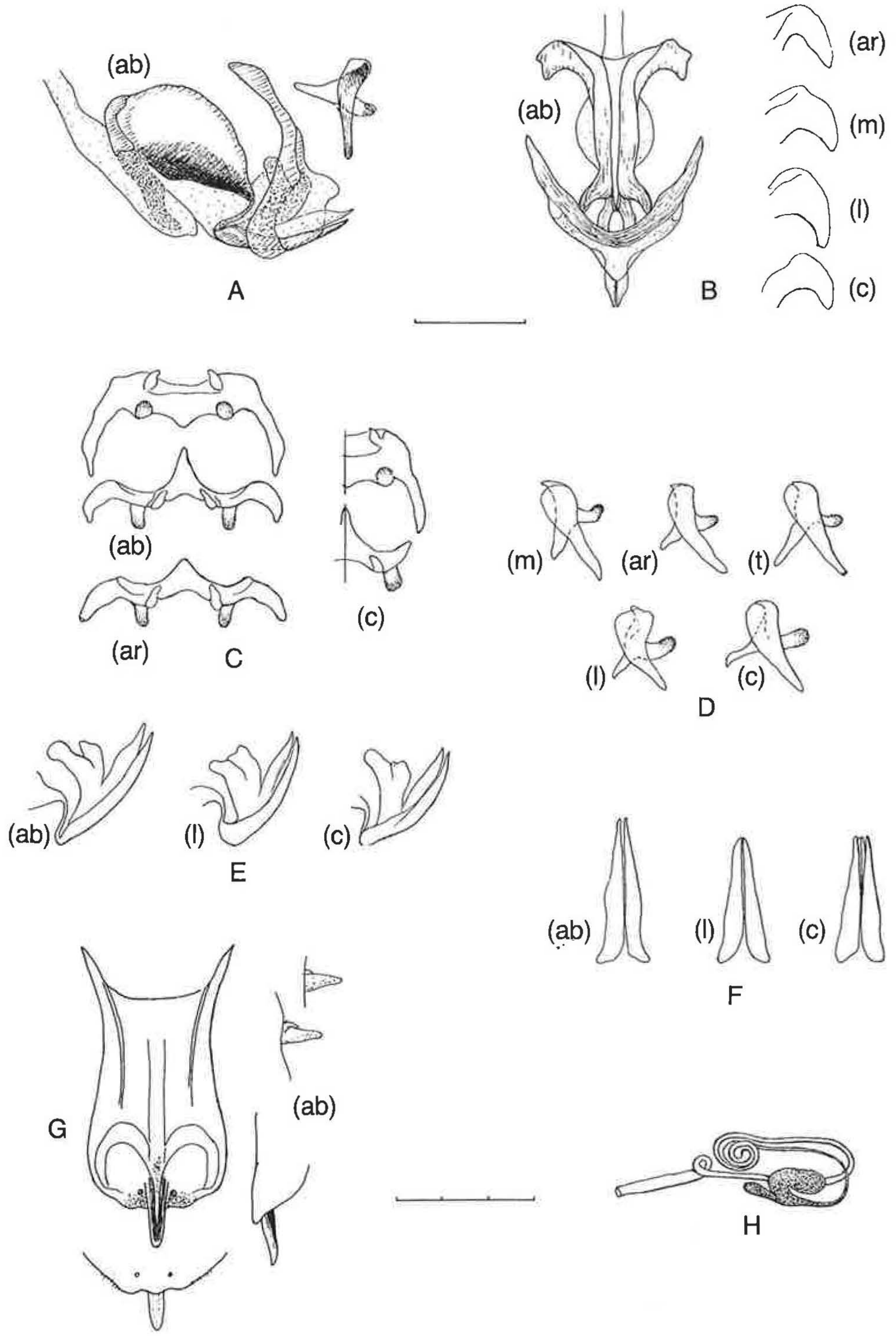

Figure 47 *Xerophlaeoba deserticola*. Genitalic structures, A-F male, G-H female. A lateral view of phallic complex; B dorsal view of phallic complex with epiphallus removed, showing variation in form of basal valves of penis; C dorso-posterior, (not (ar)) and dorsal views of epiphallus showing range of variation ((c), right half only); D lateral views of epiphallus showing range of variation; E lateral views of apical valves of penis, showing range of variation; F ventral views of apical valves of penis showing range of variation; G subgenital plate and cercus; H receptaculum seminis. Source of material: ab – Abyan, Yemen; ar – Ardha, Saudi Arabia; c – Cub-Cub, Eritrea; l – Las Dureh, Somalia; m – Mukalla, Yemen; t – Tendaho, Ethiopia. For explanation of A-H see Figure 15. Scales in mm, A-F upper, G, H lower scale.

Table 9 Measurements of *Xerophlaeoba deserticola* from different areas of its distribution

		Pronotum				Hind femur			
Area	Total length	Length	Prozona	Min. width	Tegmen length	Length	Width	Antenna	Head and pronotum
Arabia	M 25.0-33.0	4.5-5.7	2.8-3.5	1.5-2.0	21.0-30.0	15.0-18.5	2.7-3.2	12.0-13.5	9.0-10.0
	F 36.0-48.0	7.6-9.0	4.7-5.3	2.5-3.0	30.0-36.2	21.0-24.5	3.6-4.2	13.0-15.0	13.2-15.5
Northern Somalia	M 27.5-30.0	4.8-5.7	3.0-3.5	1.7-1.9	21.0-28.0	14.5-17.0	2.4-2.8	11.0-14.0	9.5-10.0
	F 44.0-46.0	7.7	4.6	2.6	31.0-34.0	23.0-24.0	3.6	15.0-16.5	12.5-13.4
Eritrea, Cub Cub	M 22.0-26.0	4.8	2.8	1.5	19.5-20.8	13.8-14.2	2.5-2.6	11.0-12.0	8.9- 9.4
	F 34.5	6.5	4.0	2.2	25.5	19.5	3.4	11.5	11.5
Ethiopia, Assab	o 55.0	10.1	6.2	3.8	42.5	28.3	4.5	10+	18.0

Material examined

Type material: *Cymochtha deserticola* Krauss 2 M and 2 F syntypes (NM) (a third M syntype not seen), and 2 M syntypes (NHM); all bear similar locality labels 'Aden, Simony, xii.98', or 'Aden, leg. Simony 98', as well as hand-written name labels '*Cymochtha deserticola* Krauss'. In addition, one of the female syntypes has a square, red Type label. The origin of this is obscure, as neither Krauss nor Uvarov made any distinction between the syntypes and we can find no reference in the literature. However, it is this syntype which is designated here as lectotype and the remainder as paralectotypes. (The epiphallus of the NHM paralectotype no. 891, is illustrated in Dirsh (1956: 280, Plate 54, Figure 20).)

Orthochtha prionocera I. Bolivar. Holotype F, **Yemen** (as S. Arabia) Lahadj (*Martin*) (IEE).

Phlaeoba antennata Schulthess. 1 M 1 F syntypes. **Somalia**: Deserto di Banas (MCSN) (both are misidentifications, see above).

Arabian material. **Saudi Arabia**: Asir Tihama and foothills: 1 M, 1 n, wadi Harub, 40 km NE. Sabya, 18.xii.1946; 3 M, Eyban 40 km NE. Sabya; 1 F, Harub/ Feifa (17°15′ N 42°50′ E); 1 M, wadi Jowra (17°15′ N 43°00′ E), 29-30. xii. 1946; 1 M, Mishrif, (17°02′ N 42°59′ E), 12.xi.1947; 3 M 2 F, wadi Beish (17°35′ N 42°35′ E), 23.xi.1947; 2 M, W. Beidh, 3.xi.1947; 1 M, 1 n, Ahwash, 40 km NE. Sabya, 28.xi.1947; 2 M, 2 F, W. Dafa (25°00′ N 45°00′ E), 27-30.xii.1947 (*Popov*) (NHM); 2 M, 1 F, upper wadi Yiba (19°00′ N 41°37′ E), 26.xii.1971; 1 M, Ardha (19°20′ N 41°25′ E), 3.ii.1971 (*Popov*) (NRI). **Yemen** (also as S. Arabia): 1 M, wadi Jaira, trib. of W. Siham, *c.* 3000 ft, 10.iii.1938 (*Scott and Britton, BM Exp. to S. Arabia*); 2 F, Useifera (Nr. Taizz), 8.ii.1950 (*Hewitt*); 1 M, 90 miles N. of Aden, 6.ii.1933; 2 F, Sheikh Othman, 10 miles N. of Aden, 24-28.xi.1932 (*Rant*); 3 n, Dathinah, 20.x.1962 (*Popov*); 1 M, 1 F, Abyan, 50 m 21.v.1967 (*Guichard*) (NHM); 3 M, 2 F, Abyan 50m. 21.v.1967 (*Guichard*) (NRI). **Hadhramaut**: 3 F, Shibam, xi-xii.1935 (*Darling*); 1 M, W. Mukalla, vi.1956 (Hall); 1 F, 20 miles NW. Mukalla, 15.viii.1956 (*Hussein*) (NHM).

African material. **Somalia**: 4 M, Las Dureh plain (10°05′ N 46°00′ E), 30.xiii.1953 (*Popov and Greathead*); 2 M, 2 F, Hodma (10°41′ N 46°13′ E), 24.ii.1949 (*Guichard*). **Ethiopia**: 1 M, Dubte (Nr. Tendaho), 28.ix.1968 (*Tunstall*); 1 F, Ghibdo R. Valley, 30 miles W. Assab, 16.ii.1947 (*Guichard*); **Eritrea**: 4 M 4 F, Cub Cub (16°22′ N 38°38′ E), 25.xi.1955 (*Greathead*) (NHM).

Geographical variation

The material examined shows a considerable degree of variation of size, morphology and to some extent, colour, on a geographical and a local scale. It is not easy to discern any clear trends since specimens from adjacent areas may exhibit a greater divergence in some important structural characters than specimens from mutually remote parts of the range of distribution. Thus, while the median and posterior epiphallic projections, regarded as characters of considerable taxonomic importance, are particularly elongate in specimens from the type locality, Aden, and in the African material, they are markedly shorter in the specimens from Asir and the Hadhramaut. The Arabian population varies little in size but more so in colour, with the specimens from the Hadhramaut being much paler than the rest. Structural differences are small, the most outstanding being the variation in the length of the posterior epiphallic projections mentioned above. Taking the Arabian material as the 'standard', the Cub Cub series shows the greatest divergence in its much smaller size, relatively broad frontal ridge, elongate trapezoidal fastigium of vertex, broad mesosternal interspace, narrow, pointed tegmina, acute outer, lower genicular lobe, and darker coloration, with well-developed lateral fasciae in both sexes. The female specimen from Assab is distinctive in its very large size, narrower antennae, short, round fastigium of vertex, rounded tegmina, pale coloration and weak lateral fasciae. Thus, four more or less distinct populations are recognized: the Arabian, the Somali, the single female from Assab and the series from Cub Cub in northern Eritrea. For the present no attempt is made here to bestow on them any separate taxonomic status as we prefer to regard them, as populations or demes. The range of measurements for all four populations is given in Table 9, while some of the morphological variation is illustrated in Figures 46 and 47.

Distribution and ecology (Figure 7)

The distribution and ecology of *Xerophlaeoba deserticola* are distinctive and quite different from the other taxa included in this revision. The species is found generally at middle and (more rarely) lower altitudes in the valleys of the coastal and sub-coastal mountains on both sides of the Gulf of Aden and southern Red Sea, south of about 20°N, where the average annual rainfall is less than 300 mm. It occurs in highly localized meso-hygrotypic, edaphic grassland communities that develop in sites such as wadi beds and depressions, where water is standing or near the surface. Typical members of these communities are halfa grass (*Desmostachya bipinnata*), *Phragmites*, *Typha* and *Juncus*. *Xerophlaeoba* is generally more common in *Desmostachya* than in stands of other species. Although not recorded at light, the adults are probably vagile and may at times occur in sorghum cultivations and associated fallows where grasses predominate. However, the numbers are generally too low to be of any economic importance. The label data indicate that adults occur predominantly during the principal rainy season, November to February in the Red Sea, May to August in the Gulf of Aden area.

In its habitus *Xerophlaeoba* is a typical graminicole; however its reduced arolia suggest some adaptation to the drier conditions of its habitat and possibly to a more gramini-terricole existence.

XENOCYMOCHTHA GEN. N.

Type species *Xenocymochtha barkeri* **sp.n.** Namibia (here designated).

Diagnosis

Of medium size, slender, integument finely rugulose, shiny. Antennae narrowly ensiform. Head acute, face oblique, straight in profile; frontal ridge narrow, deeply sulcate, margins raised, parallel for much of their length, somewhat widened between antennae and divergent towards clypeus, but strongly narrowed at junction with fastigium verticis; latter parabolic with sharp margins, without foveolae; surface of fastigium convex with well-defined median carinula, arcuate sulcus represented by oblique furrows on each side of carinula, forward of mid position. Pronotum tectiform, straight in profile, anterior margin of dorsum straight, posterior one obtusangular; carinae linear, well-defined, lateral ones straight, weakly divergent caudad; only posterior sulcus distinct and interrupting all three carinae; prozona slightly longer than metazona; prozona finely pitted, metazona and lateral lobes with a multitude of fine parallel small ridges and callosities; lateral pronotal lobes trapezoidal, upper margin straight, lower sinuate, ascending forward, both lower angles broadly rounded. Mesosternal lobes subquadrate, interspace narrower than lobe; metasternal interspace narrow in male, much wider in female. Tegmina and wings fully developed, both rather narrow, with rounded apices, venation rather dense, unspecialized, intercalary vein weak. Hind femora narrow, genicular lobes not produced, lower outer lobe rounded, inner subacute; arolium as long as claw. Supra-anal plate of male cordate, with transverse furrow in mid position; cerci short, simple, broad at base, acutely pointed; subgenital plate simple, short, pointed. Phallic complex of usual acridine structure: epiphallic bridge narrow, strongly bent, with blunt median process, ancorae elongate, slender; lophi lobiform, narrow, outer margin somewhat produced, posterior projections elongate; basal valves of aedeagus well-developed, apical valves elongate, slender. Posterior margin of subgenital plate of female trilobate, median lobe, like egg-guide, elongate; ovipositor with short, weakly sclerotized valves; spermathecal duct without proximal loop,

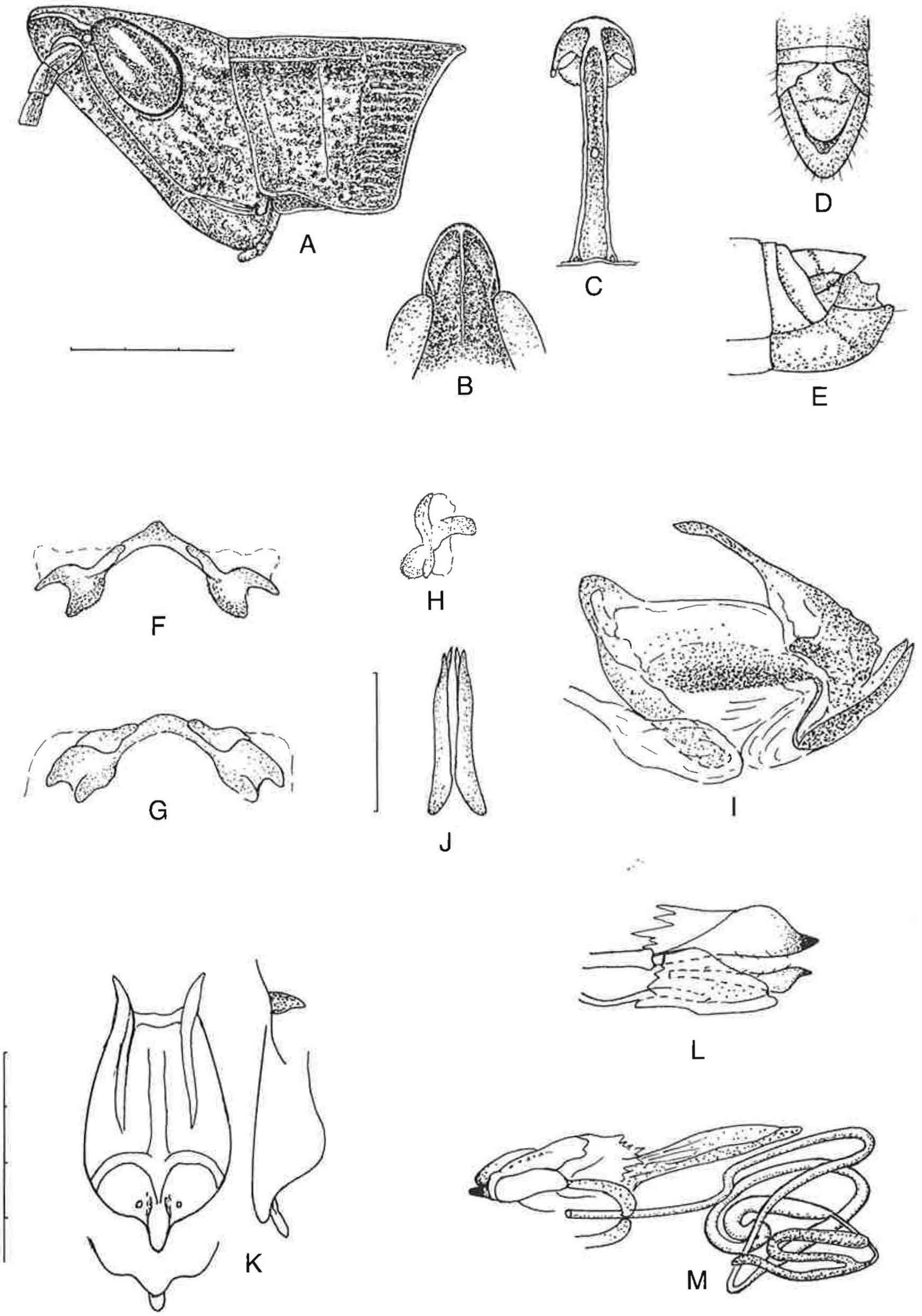

Figure 48 *Xenocymochtha barkeri* **gen.** and **sp.n.** A-I male, K-M female. A lateral view of head and pronotum; B dorsal view of fastigium verticis; C frontal ridge; D, E dorsal and lateral views of tip of abdomen; F, G, H dorsal, dorso-posterior and lateral views of epiphallus; I lateral view of phallic complex with epiphallus removed; J ventral view of apical valves of aedeagus; K subgenital plate and cercus; L lateral view of ovipositor valves; M ventral view of receptaculum seminis. For explanation of F-M see Figure 15. Scales in mm, A-E top, F-J middle, K-M lower scale.

loosely coiled and inflated at distal end of median fold; spermatheca with slender, elongate caecae.

Xenocymochtha barkeri sp. n.

(Figure 48, distribution – Figure 7)

Diagnosis

As for genus. Head and pronotum of male as in Figure 48A, frontal ridge as in Figure 48C and fastigium verticis as in Figure 48B. Length-width ratio of pronotum measured at posterior sulcus, 2 in male and 1.8 in female, prozona-metazona ratio 1.1 in both sexes. Length/width ratio of hind femur 5.3 in male and 5.1 in female; genitalic structures of male as in Figure 48F-J and of female as in Figure 48K-M.

General coloration uniformly testaceous; faint lateral fascia from antennal pits via post-ocular area to upper margin of lateral pronotal lobes, then breaking up into a number of dark spots in medial field of tegmina. Hind wings pinkish at base, apex weakly infumate, less so in female; hind knee dark in male only. Hind tibiae and tarsi colour of body in both sexes.

Measurements (mm)

Total length, M 22.7, F 34.5; pronotum length, M 4.6, F 6.0; prozona, M 2.4, F 3.2; pronotum width (at posterior sulcus), M 2.3, F 3.3; tegmen length, M 18.3, F 25.0, width, M 2.8, F 3.8; hind femur-length, M 13.8, F 17.5, -width, M 2.6, F 3.4; antenna length, M 10.8, F 11.7; head + pronotum, M 8.3, F 11.1.

Material examined

Holotype M, **Namibia**: Waterberg (20°15′ S 16°40′ E) (a small isolated plateau between Grootfontein and Windhoek), 11-12.v.1985 (*Barker*). Paratype F same data (both NHM). Only the types known.

Distribution and ecology

The type locality of *X. barkeri* in Namibia is located between the 400-500 mm isohyets and supports a semi-arid tree and bush savanna growing on sand. Common grasses at this site include *Stipagrostis* spp., *Eragrostis pallens* and *Aristida meridionalis* (J. Barker *in litt.*)

Discussion

The new taxon superficially resembles the *Orthochtha* group and also some of the oriental Phlaeobae, particularly the latter in its general appearance and coloration. However, the characteristic structure of its head, pronotum and genitalia place it in an isolated position with regard to both groups, without any obvious close relations. The species is named after its collector, Dr John Barker.

Section 5

Numerical taxonomic treatment

METHODS

The morphological criteria employed in the foregoing traditional taxonomic analysis were used to reinterpret the taxa using numerical taxonomic techniques. A data matrix was prepared for 41 taxa (listed in Table 10) and the 50 characters recognized. Each character was coded as being nominal or ordinal. Missing data were marked by setting their coded value at -1. The list of characters and character-states is given in Appendix 1, the data matrix itself as Appendix 2.

In a few instances some material or interpretations, incorporated into the traditional analysis, were acquired or made too late to be included in the numerical analysis. These include the finding of *Xenocymochtha barkeri*, *Orthochtha schmidti*, *O. roffeyi*, male *O. aurea*, the decision to keep *O. dasycnemis alca* and *O. d. lindneri* separate (they are both treated here as *O. d. alca*), and the creation of subspecies within *O. tunstalli* and *O. brachycnemis*. It is not thought however, that such relatively minor differences significantly affect comparisons between the techniques.

The data matrix was analysed in the following two ways.

(1) A hierarchical cluster analysis was performed on the 41 × 41 matrix of Gower similarity coefficients (Gower, 1971) without standardization of the data. Missing values were treated by not making the comparison between any pair of taxa in which one or both lacked the character concerned. Clustering was carried out by the weighted pair-group method of average linkage, using a program adapted from Davis (1973). The results are presented in the form of a dendrogram (Figure 49).

(2) A principal co-ordinate analysis was performed on the 41 × 41 matrix of distance coefficients, derived from the Gower similarity coefficients. Missing data were dealt with by replacing them with column means. The positions of the taxa on the first 10 co-ordinate axes were computed. The positions of the taxa on the first three axes are displayed in Figure 50.

Both analyses were made with equal weight given to all characters.

The numerical analyses were performed on the CDC 6400 computer at the Imperial College Computer Centre, London.

RESULTS

We do not present a detailed analysis of the results of the numerical treatments because the percentage variation in the data matrix accounted for by the first three axes of the principal co-ordinate analysis, as shown in Figure 50, was only 35% of the total. This is rather low and suggests that the characters used are not highly correlated with each other. Consequently interpretation can at best only be tentative. The general relationships and groupings inferred from the traditional treatment are however largely reflected in the results of both numerical treatments. The remoteness of *Pamacris*, *Shabacris* and *Nimbacris* from the main orthochthan stock is clearly demonstrated; *Xerophlaeoba* too is shown to be very distinct, particularly so in the dendrogram. The dendrogram (Figure 49) shows the *nigricornis* species-group to be quite distinct. The *dasycnemis* species-group forms a coherent whole although *O. dimorphipes* is shown to be more remote, as

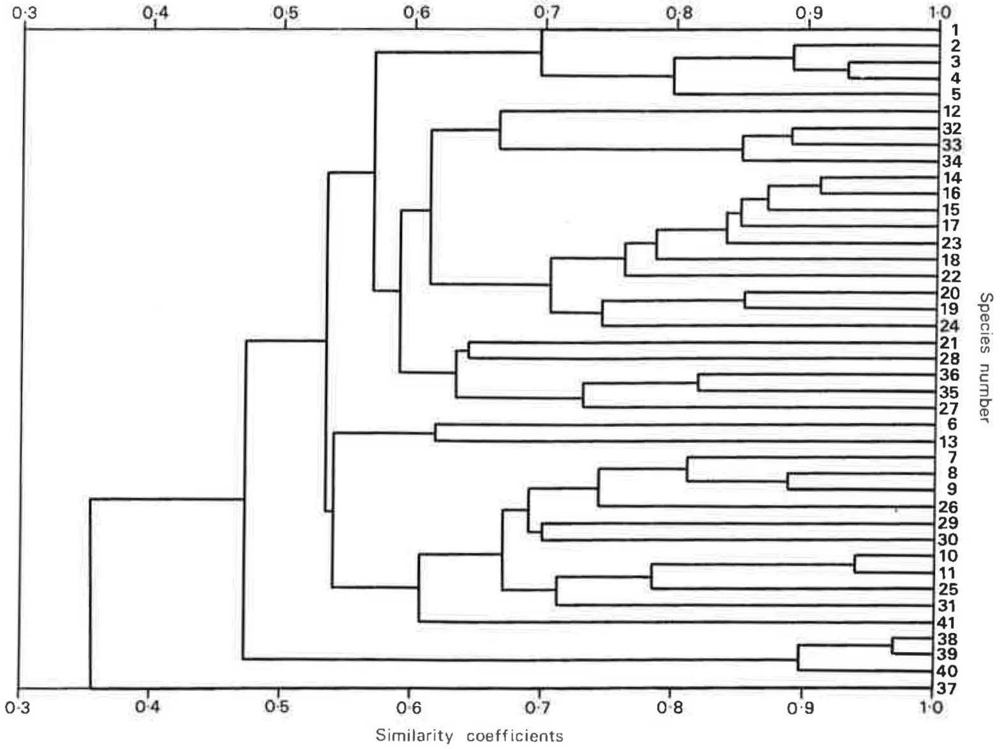

Figure 49 Dendrogram of the data set derived by weighted pair-group average clustering of a matrix of between-OTU Gower similarity coefficients. The taxa are listed in Table 10.

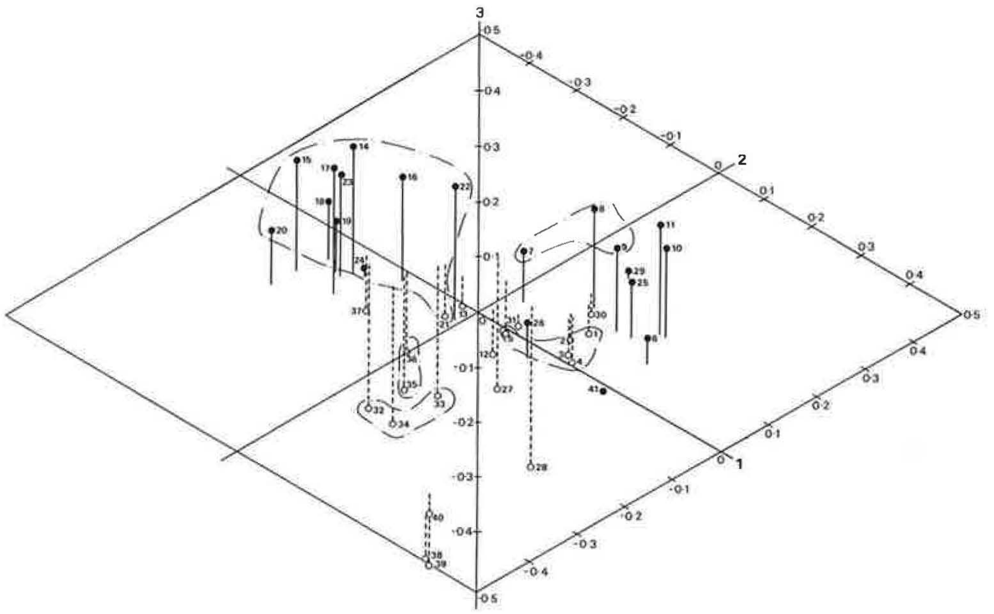

Figure 50 Principal co-ordinate analysis of the data set using a between-OTU Gower distance coefficient matrix. Principal co-ordinates I-III shown. Taxa shown by open circles below pecked lines lie below the plane formed by axes 1 and 2. Those taxa grouped together within the broken circles represent the main genera and species-groups recognized by the classical taxonomic treatment. The taxa are listed in Table 10.

Table 10 Taxon numbers used in numerical analysis

1	*Orthochtha ampla*
2	*Orthochtha nigricornis nigricornis*
3	*Orthochtha nigricornis prasina*
4	*Orthochtha nigricornis congoensis*
5	*Orthochtha katangana*
6	*Orthochtha venosa*
7	*Orthochtha brachycnemis*
8	*Orthochtha sudanica*
9	*Orthochtha tunstalli*
10	*Orthochtha angusticornis angusticornis*
11	*Orthochtha angusticornis zambiae*
12	*Orthochtha coeruleipes*
13	*Orthochtha dimorpha*
14	*Orthochtha dasycnemis dasycnemis*
15	*Orthochtha dasycnemis trivittata*
16	*Orthochtha dasycnemis bisculcata*
17	*Orthochtha dasycnemis alca*
18	*Orthochtha dasycnemis nana*
19	*Orthochtha dasycnemis somalica*
20	*Orthochtha elegans*
21	*Orthochtha dimorphipes*
22	*Orthochtha pulchripes*
23	*Orthochtha browni*
24	*Orthochtha modesta*
25	*Orthochtha aurea*
26	*Orthochtha grossa*
27	*Orthochtha rosacea*
28	*Orthochtha zuluensis*
29	*Orthochtha indica*
30	*Orthochtha ramchandrae*
31	*Orthochtha nadiae*
32	*Lobopoma ambages*
33	*Lobopoma mitchelli*
34	*Lobopoma robertsoni*
35	*Euprepoptera polychroma*
36	*Euprepoptera sylvatica*
37	*Xerophlaeoba deserticola*
38	*Pamacris diversipennis*
39	*Pamacris carterocera*
40	*Nimbacris longicornis*
41	*Shabacris robusta*

had been concluded from the traditional treatment. The three *Lobopoma* species are shown to be closely related and it is indicated that within *Orthochtha*, they are closest to *O. coeruleipes*. The genus *Euprepoptera* comes out closest to *O. rosacea* whilst *O. venosa* is remotely related to *O. dimorpha*, with these two being quite distinct from any other congeneric. Similarly *O. dimorphipes* and *O. zuluensis* form a distinct but distantly related species pair. The ill-defined *O. grossa* seems to be closest to the *O. brachycnemis* species group. The two Indian species also come closest to this group, whilst *O. angusticornis*, *O. aurea* and *O. nadiae* appear to form a loosely related grouping.

In Figure 50, in three dimensions, the generic and species group relationships are, to varying degrees, maintained. Thus, *Nimbacris* and *Pamacris* are clearly remote. *Shabacris* and *Xerophlaeoba*, less so but still fairly distant. The *dasycnemis* species group, without *O. dimorphipes*, is well separated, as are *Lobopoma* and *Euprepoptera* from the remainder but not from each other. The *nigricornis* species-group remains fairly discrete apart from *O. katangana*, which is separated from the others on axis 1. The *O. brachycnemis* species group is not so clearly defined and shows an equally strong association with *O. aurea* and *O. angusticornis* as it does within itself. None of the other loose relationships suggested by the dendrogram are present in the ordination.

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Appendices

APPENDIX 1 CHARACTERS AND CHARACTER-STATES USED IN NUMERICAL ANALYSIS

Character number	
1. General appearance (O)	0 Slender
	1 Intermediate
	2 Robust
2. Size (O)	0 Small
	1 Intermediate
	2 Large
3. Antennae (O)	0 Very narrow and elongate
	1 Narrow
	2 Intermediate
	3 Broad
4. Head shape (O)	0 Acute
	1 Intermediate
	2 Short and rounded
	3 Projecting forward
	4 Overhanging
5. Frontal ridge (N)	0 Narrow
	1 Intermediate
	2 Broad
6. Shape of fastigium of vertex (O)	0 Rounded
	1 Trapezoidal
7. Size of fastigium of vertex (O)	0 Length > Breadth
	1 Length < Breadth
8. Fastigial constriction (O)	0 Weak
	1 Intermediate
	2 Strong
9. Position of arcuate sulcus on fastigium of vertex (O)	0 Anterior
	1 Central
	2 Posterior
10. Occiput (O)	0 Flat
	1 Intermediate
	2 Convex
11. Shape of eye (O)	0 Pointed
	1 Intermediate
	2 Rounded
12. Subocular distance (O)	0 Less than length of eye
	1 Subequal to length of eye
	2 Equal to length of eye
13. Shape of lateral carinae of pronotum (N)	0 Parallel
	1 Divergent
	2 Incurved

14. Development of lateral carinae of pronotum (O)	0 Weak 1 Intermediate 2 Strong
15. Shape of pronotum (N)	0 Swollen 1 Tectiform 2 Sellate
16. Hind margin of pronotum (N)	0 Rounded 1 Obtusangular 2 Sharply angled 3 Indented or straight
17. Proportion of metazona to prozona (O)	0 2:1 1 3:2 2 4:3 3 5:4 4 1:1
18. Number of transverse sulci of pronotum (N)	0 One only 1 More than one
19. Development of transverse sulci of pronotum (O)	0 Weak 1 Intermediate 2 Strong
20. Lateral lobes of pronotum (O)	0 Convex 1 Flat 2 Concave
21. Lower margin of lateral lobe of pronotum (N)	0 Horizontal 1 Inclined
22. Shape of lower margin of lateral lobe of pronotum (N)	0 Straight 1 Curved 2 Sinous 3 Strongly S-shaped
23. Lower hind angle of lateral lobe of pronotum (O)	0 Acute 1 Intermediate 2 Rounded
24. Mesosternal interspace (N)	0 Narrow 1 Intermediate 2 Wide 3 Heart shaped
25. Length of tegmina and wings (N)	0 Very short 1 Short 2 Normal 3 Long in male, short in female
26. Colour of wings (N)	0 Clear 1 Infumate apically 2 Infumate 3 Coloured
27. Lower lobes of hind knee (N)	0 Both acute 1 Outer rounded, inner acute 2 Both rounded
28. Upper lobes of hind knee (N)	0 Normal 1 Inner elongate 2 Both elongate
29. Hind femur (O)	0 Slender 1 Intermediate 2 Robust

30. Pulvilli (O)	0 Small
	1 Intermediate
	2 Large
31. Shape of male supra-anal plate (N)	0 Attenuate
	1 Trapezoidal
	2 Rounded
	3 Triangular
32. Male cerci (N)	0 Normal
	1 Long and slender
	2 Moderately long and broad
	3 Short and thick
	4 Very small
	5 Triangular
33. Epiphallic bridge (N)	0 Slender
	1 Thick
	2 With a median process
34. Posterior process of epiphallus (O)	0 Normal
	1 Intermediate
	2 Greatly expanded
35. Lophi (N)	0 Slender and tapering
	1 Short and thick
	2 Long and swollen
	3 Broad
36. Penis valves (O)	0 Long and slender
	1 Intermediate
	2 Robust
37. Shape of subgenital plate of female (N)	0 Straight
	1 Weakly pointed
	2 Trilobate
	3 Quadrilobate
38. Surface of subgenital plate of female (O)	0 No transverse callosities
	1 One transverse callosity
	2 Several transverse callosities
39. Spermatic duct (N)	0 Swollen to form auxillary reservoir
	1 Short
	2 Intermediate
	3 Long and spirally twisted
	4 Long and loosely coiled
40. Colour of male antennae (N)	0 All dark
	1 Apically dark
	2 Pale
41. Colour of female antennae (N)	0 All dark
	1 Apically dark
	2 Pale
42. Pigmentation of lateral band (O)	0 Absent
	1 Weak
	2 Strong
43. Width of lateral band (O)	0 Absent
	1 Narrow
	2 Intermediate
	3 Wide
44. Median dorsal band of pronotum (N)	0 Absent
	1 Present

45. Colour of hind knee of male (N)	0 All dark 1 Partially dark 2 Pale
46. Colour of hind tibia (N)	0 Pink in both sexes 1 Sexually dimorphic 2 As body colour 3 Other
47. Colour of tip of abdomen (N)	0 Red 1 Not red
48. Sculpturing of pronotum (N)	0 Weak 1 Partial 2 Complete
49. Surface of integument (N)	0 Shiny 1 Intermediate 2 Not shiny
50. Degree of sexual dimorphism (O)	0 Not pronounced 1 Pronounced

(O) = Ordinal character
(N) = Nominal character

APPENDIX 2 DATA MATRIX USED IN NUMERICAL ANALYSIS

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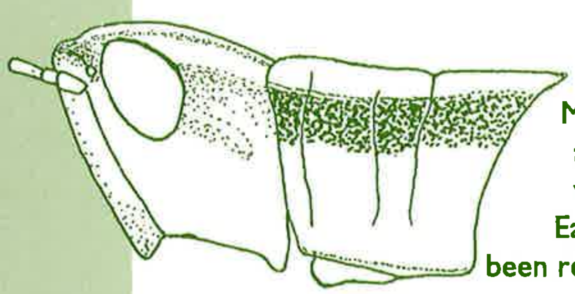
35	1	1	2	1	1	0	0	1	1	1	0	0	1	2	1	1	2	1	2	2	1	1	1	1	2	3	2	0	2	1	0	0	0	1	0	1	2	0	2	2	2	0	0	0	2	2	1	1	1	0
36	1	1	2	1	1	0	0	1	2	1	0	0	1	2	1	1	3	1	2	0	1	1	0	1	2	3	1	0	1	1	0	1	0	0	0	1	2	0	2	0	0	1	1	0	2	0	1	1	1	0
37	0	2	3	3	0	1	0	2	1	0	0	1	0	2	1	1	1	1	1	2	1	2	2	1	2	1	1	1	1	0	0	4	2	2	0	0	2	0	2	2	2	2	3	0	2	2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

The Bulletin series presents the results of research and practical scientific work carried out by the Natural Resources Institute. It covers a wide spectrum of topics relevant to development issues ranging from land use assessment, through agricultural production and protection, to storage and processing.

Each Bulletin presents a detailed synthesis of the results and conclusions within one specialized area, and will be of particular relevance to colleagues within that field and others working on sustainable resource management in developing countries.



Members of the large grasshopper genus *Orthochtha* are widely distributed throughout the Afrotropics with some representatives in India and the Far East. The taxonomy of the genus has, however, long been recognized by acridologists to be unsatisfactory.

A Revision of the Grasshopper Genus *Orthochtha* and Allies (Orthoptera: Acrididae: Acridinae) provides a thorough revision of *Orthochtha* together with seven allied genera, of which three are erected here. In all 36 species and 11 subspecies are treated of which 16 species and 5 subspecies are described here as new.

All taxa are diagnosed, illustrated, keyed, mapped and their affinities discussed. The biogeography of the group is considered and a synopsis of the available information of the biology, ecology and economic importance given for each species. As such this work will be of use both to taxonomists and to agricultural field workers, particularly in Africa.