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A REVISION OF THE GENERA *PHANEROPTERA* SERVILLE AND *NEPHOPTERA* UVAROV (ORTHOPTERA: TETTIGONIIDAE), WITH CONCLUSIONS OF ZOOGEOGRAPHICAL AND EVOLUTIONARY INTEREST

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(With 131 figures in the text)

CONTENTS

INTRODUCTION

This revision covers all the species included in the genus *Phaneroptera* Serville, 1831 by Kirby (1906) except *Ph. annulata* Brunner, 1891, which is now put in *Xenoderus* Carl, 1914, and the two species *Ph. adusta* Haan, 1842 and *Ph. hordeifolia* Haan, 1842, which are generically quite distinct. The species of the genus *Euanerota* Karny, 1927 are here regarded as congeneric with *Phaneroptera* Serville, and all species which have been described in that genus are also included here. The genus *Eulioptera* is new, and *Nephoptera* Uvarov, 1929 is conveniently included as a very close relative. The species which Bei-Bienko (1954) included in the genus *Pseudanerota* Bei-Bienko, 1951 are regarded in this work as congeneric with *Nephoptera* Uvarov, and are also covered by this revision. Further generic names, now universally rejected, have become involved in this complex, for reasons which are made clear in the following brief historical account.

The genus *Phaneroptera* was erected by Audinet-Serville in 1831 for the two species *Locusta lilifolia* Fabricius, 1793 (Paris) and *Locusta curvicauda* Degeer,

1773 (Pennsylvania); no type species was designated at this time. In 1839 Audinet-Serville admitted that he had wrongly identified the Parisian insect, which he now realized was *Ph. falcata* (Poda, 1761); *Locusta lilifolia* became the type of *Tylopsis* Fieber in 1853, and the New World species, *curvicauda* Degeer, subsequently became the type of *Scudderia* Stål, 1873. In 1906 Kirby designated *Gryllus falcata* Poda as the type species of *Phaneroptera* Serville. Caudell (1921) later rejected this designation as invalid (on the grounds that *Gryllus falcata* Poda had not been originally included by name in *Phaneroptera* Serville), designated *Locusta curvicauda* Degeer as the type of *Phaneroptera* Serville, thus making *Scudderia* Stål a synonym of *Phaneroptera* Serville, and proposed the new name *Anerota* Caudell (type *Gryllus falcata* Poda) for the genus previously known as *Phaneroptera* Serville. From 1923 onwards the matter was taken up by the International Commission on Zoological Nomenclature. Uvarov, in 1924, refused to accept Caudell's proposals, pointing out that Paris was outside the range of *lilifolia* Fabricius, *falcata* Poda being the only Phaneropterine occurring in this locality. During the years following Caudell's publication American workers adopted the name *Anerota* Caudell for what had been called *Phaneroptera* Serville, and used the name *Phaneroptera* Serville for what had been called *Scudderia* Stål, while European workers used the original names for these two genera. After about 1930 the American workers, following discussions with various specialists, decided to revert to the European practice, and uniformity was again established.

During the controversial period, however, Karny (1926) proposed a new genus *Paranerota* for two species of *Phaneroptera* Serville with elongate male subgenital plates and reduced fore coxal spines; he designated *Ph. gracilis* Burmeister, 1838 as the type species. The following year this author (Karny, 1927) found what he believed to be two of Burmeister's type specimens of this species and realized that *Ph. gracilis* Burmeister was the same species as *Ph. elongata* Brunner, 1878; this species has the normal male subgenital plate and well-developed fore coxal spine typical of *Phaneroptera* Serville. Karny's designation of *Ph. gracilis* Burmeister as the type of *Paranerota* Karny thus made the latter genus a synonym of *Phaneroptera* Serville, and Karny (op. cit.) proposed the new name *Euanerota* to replace *Paranerota* Karny. He did not make a definite type designation for *Euanerota* Karny as he was in doubt as to the correct name for the species which he had misnamed *Ph. gracilis* Burmeister, but he suggested that it was very probably *Ph. brevis* Serville.

The genus *Nephoptera* was erected by Uvarov in 1929 with a new species *tibialis* Uvarov, 1929 as the type; until now this genus has been regarded as monotypic. In 1951 Bei-Bienko erected the genus *Pseudanerota* for *Ph. persica* Uvarov, 1929, which he designated as the type, and *Ps. robusta* Bei-Bienko, 1951. The three species *tibialis* Uvarov, *persica* Uvarov, and *robusta* Bei-Bienko, form a small homogeneous unit which is here regarded as one genus.

In 1944 the International Commission on Zoological Nomenclature finally designated *Gryllus falcata* Poda as the type species of *Phaneroptera* Serville, which they placed on the Official List of Generic Names in Zoology.

In the complete absence of revisionary work on the group the usual chaotic situation has resulted, in which identification of a number of the less common

species has been impossible and in which many of the common species have been given the wrong names: it is hoped that this revision will remedy this state of affairs.

Phaneroptera Serville was last revised by Brunner in his monograph of 1878 ; he included eleven species and five further synonyms. Kirby (1906) listed twenty species and seven synonyms. In the present work twenty-three species (five of them new) are included in *Phaneroptera* Serville, and four further species (three of them new) constitute the new genus *Eulioptera*. Fourteen synonyms (eight of them new) are listed, all in *Phaneroptera* Serville, so that the total number of specific names involved in the complex is now forty-four, including the three species of *Nephoptera* Uvarov. Two generic synonyms are newly established and one new subspecies is described.

Access was gained to all the existing type specimens of the previously described species (including synonyms) except for one in Japan, two in the Naturhistorisches Museum, Basel, and five in the Zoological Museum of the U.S.S.R. Academy of Sciences, Leningrad. The type specimens of five species are, in addition, lost or destroyed.

ACKNOWLEDGMENTS

My most sincere gratitude is due to the following specialists who have spared time and energy to send me type specimens and other material from their respective Museums and Universities :—

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Dr. P. Brinck, Mr. E. S. Brown, Mr. & Mrs. R. W. Crosskey, Dr. R. Ebner, Mr. G. E. Maul, Mr. J. A. Whellan, and Dr. C. Willemse.

I should like to express my appreciation of Mr. D. E. Davies' advice on statistical matters.

Finally I wish to thank Dr. B. P. Uvarov for valuable comments, Dr. V. M. Dirsh for his frequent help and advice, and Miss P. M. Stock for her practical assistance.

MATERIAL

In addition to the collection of the *Phaneroptera* complex in the British Museum (Natural History) material was lent by the sources listed below, through the kindness of the specialists acknowledged above.

Musée du Congo Belge, Tervuren; Naturhistorisches Museum, Vienna ; Muséum National d'Histoire Naturelle, Paris ; Institut Royal des Sciences Naturelles de Belgique, Brussels ; Rijksmuseum van Natuurlijke Historie, Leiden ; Naturhistorisches Museum, Basel ; South African Museum, Cape Town ; Universitetets Zoologiska Institution, Lund ; Naturhistoriska Riksmuseum, Stockholm ; Instituto Español de Entomología, Madrid ; Zoologisches Museum of the Humboldt-Universität, Berlin ; Department of Entomology, Cambridge University.

Further valuable material was obtained on loan from the private collections of Dr. R. Ebner (Vienna), Dr. C. Willemse (Eygelshoven), and Mr. J. A. Whellan (Salisbury, Southern Rhodesia).

Where the material is listed under each species, these sources are abbreviated as follows :—

Mus. Congo Belge ; Nat. Mus. Wien ; Mus. Hist. Nat. Paris ; Inst. Sci. Nat. Brux.; Rijksmus. Nat. Hist. Leiden ; Nat. Mus. Basel ; S.A. Mus.; Zool. Inst. Lund ; Univ. Camb. ; coll. Ebner ; coll. Willemse.

Altogether nearly 2,000 specimens were made available for study, over half of these, however, belonging to the common species *Ph. nana* Fieber. A large proportion of this material was collected in a few small areas of tropical Africa ; other parts of this region and most of the rest of the range of *Phaneroptera* Serville have been very poorly collected for Tettigoniidae, many large areas being quite untouched. Parts of the world from which members of this family are most needed at present are Iraq, Persia, Afghanistan, Kashmir, Australia, New Guinea, the whole of the Mediterranean region, and the Communist Bloc in Asia. *Phaneroptera* Serville itself is at present most needed from Jordan, Israel, Lebanon, Syria, S. and E. Turkey, and Armenia ; the significance of these regions is made clear on p. 228.

TREATMENT

Many of the genera of Phaneropterinae are very poorly defined and doubtless only a small proportion of the species of this subfamily have so far been described. In these circumstances it is, of course, advisable to view the supraspecific taxa from a conservative standpoint, not basing genera on morphological discontinuities which may later be bridged. Thus, although the genera treated in this revision may be usefully subdivided when the group has become more extensively worked out, the author has considered it unwise to recognize more than three genera in this complex at present.

At the specific level the extreme variability of many of the species gives rise to difficulties. The structural drawings are intended to show the most usual shape of the character concerned ; in a few cases of extreme variability more than one figure is given. All the drawings were made from actual specimens using a camera lucida.

A preliminary investigation showed that a full bibliography giving references to all records of taxonomic importance would run to several pages for the more common species ; the repeated misidentification of many of the species, furthermore, makes it impossible to know whether the bulk of the records are valid or not. It was decided, therefore, to list only synonyms and sources of major taxonomic significance ; in the case of the generic name *Phaneroptera* Serville, however, which has had a particularly confusing history, a fuller bibliography is given, only references to purely faunistic works, where no new species are described, being omitted (this bibliography is confined to the present century, references prior to 1900 being listed by Kirby (1906)).

A diagnosis listing all the characters of diagnostic importance is given for all the species ; the most important characters are mentioned first. A redescription is given only in the case of *Ph. nana* Fieber, a species which lacks any striking

features and is therefore difficult to diagnose. In *Phaneroptera* Serville and *Eulioptera* gen. n. it is far more difficult to characterize the females than the males, the male genitalia being particularly useful. The female genitalia are extremely uniform in these two genera and no diagnostic characters were found on the females of some species (their identity being deduced from their data). Separate diagnoses are usually given for each sex, characters common to both being mentioned only under the male. The remark " as male except for genitalia (etc.) ", which will often be made when diagnosing females, is not necessarily true of all the external characters, but only of those mentioned in the male diagnosis.

Figures are referred to wherever verbal description is impossible or inadequate. The wing-vein nomenclature used is that of Ragge (1955). The terms " dorsal ", " ventral ", " internal ", and " external ", as applied to the spines and spurs of the legs, are used on the assumption that the legs are extended horizontally, the fore legs forwards and the other two pairs backwards. The hind femora are described as " unarmed " when they have no ventral spinules. The dorsal spines of the hind tibiae are often in various sizes ; every size is included when these are counted. The two lateral oval-shaped sclerites at the base of the ovipositor in *Phaneroptera* Serville and *Eulioptera* gen. n. are referred to as " basal plates ".

Fortunately, no difficult shades of colour are involved. Most species are either green or brown, often with dark spots. Dried specimens of species which are green when alive, however, are frequently brown ; these species are described and diagnosed on the assumption that their colour has not changed or faded. Attention is only drawn to the possibility of *post mortem* colour-change in cases where it is likely to be particularly misleading ; it is, however, a possibility in every species which is green when alive.

A word of explanation is necessary regarding the measurements given. The present author considers the body-length to be a very unreliable measurement in most Tettigoniidae and certainly in the genera treated here. In a specimen in which the abdomen has been stuffed this measurement may be almost double the value for a specimen of the same species with a rather contracted abdomen, and even when consistent methods of preservation are used the varying degree of curvature of the abdomen introduces a big source of error. As a measure of overall size, therefore, body-length is replaced in the present work by " total length ", which is the distance from the most anterior part of the head to the tips of the flexed hind wings. The measurement of the exposed part of the hind wings is of course taken with the wings in their position of rest. The measurement given for the ovipositor is the distance from its apex to the tip of the subgenital plate ; this latter point usually corresponds with a slight emargination in the ventral margin of the ovipositor, and this point is used in cases where the subgenital plate has been pulled forwards by shrinkage.

The pronotal length, vertical width of the hind femur, and length of the ovipositor were measured with a screw micrometer eyepiece ; this method was also used for measuring the length of the raised part of Cu_2 in the two subspecies of *Eulioptera reticulata* (Brunner). The remaining measurements were

all made with vernier callipers. All measurements are given in millimetres. The number of specimens measured in each case is given in parenthesis.

The best characters for separating the species of *Phaneroptera* Serville and *Eulioptera* gen. n. are found in the male genitalia. Only a few species of these genera can in fact be diagnosed with certainty without any knowledge of these characters. The two sexes of the species of these two genera have therefore been keyed separately and male specimens should always be used when available. Only those diagnostic characters which are of most practicable use are mentioned in the keys ; other characters of diagnostic importance are listed in the diagnosis of each individual species, and it is expected that these diagnoses will be referred to before an identification is regarded as final.

The exact status of *Ph. bivittata* Bei-Bienko, *Ph. cretacea* Uvarov, and *Ph. nakanoensis* Matsumura & Shiraki, none of which were represented in the available material, the type specimens of which were unobtainable, and which are not (according to the original descriptions) strikingly dissimilar from other species of *Phaneroptera* Serville, cannot be settled at present. These species are included, however, for the sake of completeness.

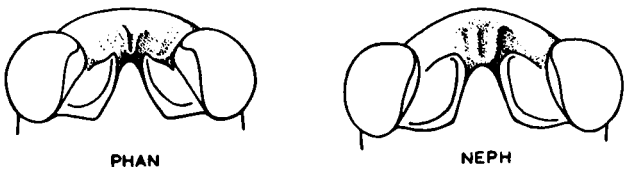
A few further undescribed species of *Phaneroptera* Serville and *Eulioptera* gen. n. have not been described here, either because no males were available or because the specimens were in very poor condition.

KEY TO THE GENERA

1. Fastigium of the vertex hardly compressed, broad, as in Fig. 2. Mid tibiae strongly swollen in the basal half (Figs. 5 & 6)..... *Nephoptera* Uvarov (p. 279)

–. Fastigium of the vertex compressed, narrow, as in Fig. 1. Mid tibiae only slightly swollen in the basal half (Fig. 4) (except for *Ph. acaciae* Chopard (Fig. 3), in which the swelling is almost as advanced as in *Nephoptera* Uvarov ; this species has the narrow vertex and 6 hind tibial spurs of *Phaneroptera* Serville, however) 2

2. Hind tibiae with two apical spurs on each side (Fig. 8). Cells of the fore wings transparent with shiny surfaces. Unicolorous except for maculation ..... *Eulioptera* gen. n. (p. 266)



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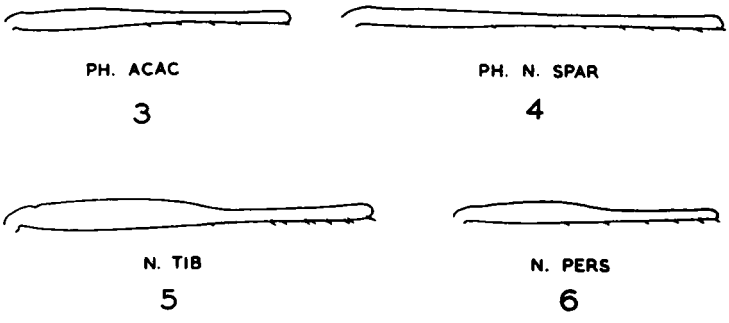
Figs. 1 & 2.—Anterior view of the dorsal part of the head of (1) *Phaneroptera* Serville ; (2) *Nephoptera* Uvarov. The antennae have been removed.

–. Hind tibiae with three apical spurs on each side (Fig. 7) or, if with two (*Ph. albida* Walker), coloration conspicuously variegated in green and white. Cells of the fore wings opaque, at least in the posterior half ..... *Phaneroptera* Serville (p. 211)



Figs. 3–6.—Lateral view of the left mid-femur of (3) *Phaneroptera acaciae* Chopard ; (4) *Ph. nana sparsa* Stål ; (5) *Nephoptera tibialis* Uvarov ; (6) *N. persica* (Uvarov).

Figs. 7 & 8.—Lateral view of the apex of the left hind tibia of (7) *Phaneroptera nana nana* Fieber ; (8) *Eulioptera reticulata* (Brunner).

PHANEROPTERA Serville, 1831

Phaneroptera Serville, 1831, *Ann. Sci. nat.* **22,** 158. Type, by subsequent designation, *Gryllus falcata* Poda, 1761.

Phaneroptera Serville, Burr, 1900, *Proc. zool. Soc. Lond.* **70,** 41.

Phaneroptera Serville, Bolivar, 1900, *Ann. Soc. ent. Fr.* **68,** 764.

Phaneroptera Serville, Matsumura & Shiraki, 1908, *J. Coll. Agric. Tokyo* **3,** 19.

Anerota Caudell, 1921, *J. Wash. Acad. Sci.* **11,** 488. Type, by original designation, *Gryllus falcatus* [sic] Poda, 1761.

Phaneroptera Serville, Uvarov, 1924, *Bull. Minist. Agric. Egypt* **41,** 9.

Paranerota Karny, 1926, *J. F.M.S. Mus.* **13,** 105. Type, by original designation, *Phaneroptera gracilis* Burmeister, 1838.

Paranerota Karny, Karny, 1926, *Treubia* **9,** 138.

Euanerota Karny, 1927, *Z. Naturw.* **88,** 12. Type, by tentative original designation, *Phaneroptera brevis* Serville, 1839. **Syn. n.**

Phaneroptera Serville, Uvarov, 1929, *Annu. Mus. zool. Acad. St. Pétersb.* **30,** 628.

Phaneroptera Serville, Uvarov, 1934, *Ark. Zool.* **26A,** 7.

Euanerota Karny (*pro parte*), Willemse, 1942, *Natuurh. Maandbl.* **31,** 109.

Phaneroptera Serville, Hemming, 1944, *Opin. int. Comm. zool. Nom.* Opin. 154. (Type designation and addition to Official List.)

Phaneroptera Serville, Ramme, 1951, *Mitt. zool. Mus. Berl.* **27,** 348.

Euanerota Karny (*pro parte*), Willemse, 1953, *Bull. Inst. Sci. nat. Belg.* **29** (7), 7.

Phaneroptera Serville, Bei-Bienko, 1954, Fauna of the U.S.S.R., *Fauna Rossii* (New Series). Orthoptera **2** (2), 61.

Diagnosis

Fastigium of vertex compressed, narrow, sulcate above, as in Fig. 1. Lateral pronotal lobes fairly smoothly rounded, not forming angle with disc,

with fairly sharp emargination at posterior end of insertion. Fore coxae usually with well-developed spine (Fig. 9). Fore tibiae with oval tympanic opening on both sides. Mid tibiae only slightly swollen in basal half. Hind tibiae with 3 external and 3 internal apical spurs (Fig. 7) (except *Ph. albida* Walker, in which there are 2 apical spurs on each side). Cells of fore wings opaque, at least in posterior half of wing. Abdominal tergites without median carina. Male cerci almost always terminating in black point. Ovipositor without strongly developed basal folds; basal plates approximately oval, unmodified.

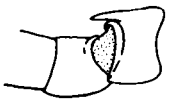


Fig. 9.—Posterior view of the base of the left fore-leg of *Phaneroptera falcata* (Poda), showing the coxal spine.

Discussion

With the single exception of *Ph. albida* Walker, this genus is easily separated from *Eulioptera* gen. n. and *Nephoptera* Uvarov by the hind tibiae having 3 apical spines on each side (the latter two genera and *Ph. albida* Walker having only 2). *Ph. albida* Walker may be separated from species of *Eulioptera* gen. n. and *Nephoptera* Uvarov by the opaque cells in the posterior half of the fore wings, and the narrow fastigium of the vertex.

Phaneroptera Serville has proved to be unusually interesting from the zoogeographical and evolutionary points of view. Three of the more common species, *Ph. nana* Fieber, *Ph. gracilis* Burmeister, and *Ph. brevis* Serville, have each contributed points of interest, and these are briefly discussed below.

In the case of *Ph. nana* Fieber, it will be shown when this species is treated individually that it is very probably in the process of developing from a polytypic species into a superspecies (*Artenkreis*). The combined ranges of its two components (here regarded as subspecies) cover Southern Europe, Africa, Arabia, and, to an extent which is not yet known, the extreme south-west of Asia. The two forms are separated by the Sahara Desert in Africa but meet in a zone extending through the Levant and possibly up to southern Armenia. A fairly continuous cline in the relative length of the fore wings from north to south across the entire range suggests that a single taxonomic unit is involved, or at least that this has been the case in recent geological times. This is supported by the extreme morphological similarity of the two forms. So far not much material has been available from the zone of contact; however, no two specimens of *Ph. nana* Fieber from this zone bearing the same data have yet been found to be taxonomically separable—i.e. there is no direct evidence of overlap. It is, on the other hand, impossible to draw a geographical dividing line between the forms in this small area which is at all smooth; some specimens of the southern form have been collected from localities which one would have expected to fall inside the range of the northern form, and *vice versa*. A few individuals from this zone of contact are morphologically intermediate between the two forms; extremes in each direction, however, also occur. From the

limited material available it is only possible to put forward the suggestion that reproductive isolation is gradually becoming more effective in this zone, due perhaps to changing ecological factors, and that a transition is taking place from two freely interbreeding subspecies to two distinct species.

Ph. gracilis Burmeister is unusual among Orthoptera in that it extends right across the more southern part of the Old World from Africa to the Solomon Is., showing extremely little geographical variation (see Fig. 101). It has previously been known under six different names in various parts of its range, but examination of material distributed over the whole of this region has made it quite clear that only one species is involved. There is in fact less variation in *Ph. gracilis* Burmeister from tropical Africa to the Solomon Is. than would be expected in a sample of *Eulioptera reticulata* (Brunner) from one part of, say, Nigeria. As in *Ph. nana* Fieber specimens from the tropics have relatively shorter wings than those from the more northerly parts of the range ; this cannot be accurately analysed with the material available at present, but it seems unlikely that a division into subspecies on the basis of this character will be practicable as this would probably involve giving specimens from the tropical parts of Africa, India, and Australasia, the same subspecific name.

A point of particular interest with this species is that it is dimorphic in tropical Africa, though showing no polymorphism in any other part of its range.

Ph. brevis Serville is the most common of a group of six closely inter-related species found in the Indo- and Austro-Malayan regions. These species are all characterized by an elongated and thickened male subgenital plate, and it was this feature which prompted Karny (1926) to erect for this group the genus *Paranerota* Karny, this name being changed in the following year to *Euanerota* Karny for reasons mentioned earlier. There are, however, species showing every intermediate form between the more normal, relatively membranous, male subgenital plate found in such species as *Ph. nana* Fieber and *Ph. falcata* (Poda), and the robust, extremely elongate, type found in *Ph. brevis* Serville and *Ph. celebica* Haan (the species *Ph. gracilis* Burmeister, *Ph. myllocerca* sp. n., *Ph. curvata* (Willemse), and *Ph. brevis* Serville, for example, show a gradual change from the normal to the elongate type). In view of this gradual transition, and the fact that the females show no parallel development, *Euanerota* Karny, has not been recognized as a separate genus in this revision. The genus *Eulioptera* gen. n. also shows the two types of male subgenital plate, the females again being almost indistinguishable ; this character is clearly not suitable for generic separation in the *Phaneroptera* complex.

The distribution of the species in the *brevis* group is interesting (see Fig. 103). *Ph. neglecta* (Karny) and *Ph. furcifera* Stål are known only from the Philippine Is. and (in the case of *Ph. furcifera* Stål) Guam. *Ph. celebica* Haan occurs on Celebes, the Solomon Is., and probably New Guinea ; *Ph. curvata* (Willemse) is found on Bali, Sumbawa, Sumba, and probably other adjacent islands ; and *Ph. dentata* (Willemse) is known only from Flores. The range of *Ph. brevis* Serville, on the other hand, covers the whole of this region, except the Philippine Is. and the Solomon Is.

These distributions enable one to hazard a guess as to the evolutionary history of these species. The close similarity in the general facies of the group

suggests a comparatively recent monophyletic origin. It seems likely that the parent form spread throughout most of the East Indies area, subsequently giving rise to the sibling species *Ph. furcifera* Stål and *Ph. neglecta* (Karny) in the Philippine Is. and *Ph. brevis* Serville in Indonesia. *Ph. celebica* Haan was possibly differentiated later (being more similar to *Ph. brevis* Serville) in Indonesia. In due course *Ph. brevis* Serville spread again into the region now occupied by *Ph. celebica* Haan but was apparently unable to penetrate into the Philippines. The relatively much smaller known ranges of *Ph. curvata* (Willemse) and *Ph. dentata* (Willemse) suggest that these species have been differentiated much more recently; this is rather doubtful, however, as, although the two species form a closely related pair, they are not particularly similar to *Ph. brevis* Serville. A third species, *Ph. longicauda* (Willemse), has also evolved in the Flores area, but the male is not yet known and no conclusions are possible. All these observations must of course be regarded as mere possibilities ; more intensified collecting, and consequently a more reliable knowledge of their respective ranges, may in due course allow more definite conclusions to be made regarding the phylogeny of the *brevis* group.

Certain other evolutionary trends may be traced in the genus. *Ph. myllocerca* sp. n. is almost certainly a development from *Ph. falcata* (Poda), where the range of the latter borders on the Oriental region. These are the only two species in the genus which have the distal ends of the male cerci bent upwards into a vertical plane ; the females are almost indistinguishable.

Judging from the fact that the greater part of the range of *Phaneroptera* Serville has been very poorly collected as far as Tettigoniidae are concerned, and that all the recently described species come from small regions which have been visited by collecting expeditions during the last few years, it seems likely that many more species remain to be described. No attempt has therefore been made to segregate the species into groups, as this would have to be provisional at present and would serve no useful purpose.

Distribution (Figs. 101, 102 & 103)

The genus *Phaneroptera* Serville covers almost the whole of the Old World south of about 55° N. It reaches southern Germany and Czechoslovakia in Western Europe but probably does not occur in the British Isles. In European Russia it extends as far north as Kursk and Chkalov, and up to N. Kazakstan, Sayan, Lake Baykal, and Khabarovsk, in Asia ; it ranges westward as far as the Azores. Its southern limit is the coast of Cape Province and Northern Australia, and its range extends eastwards as far as the Solomon Is.

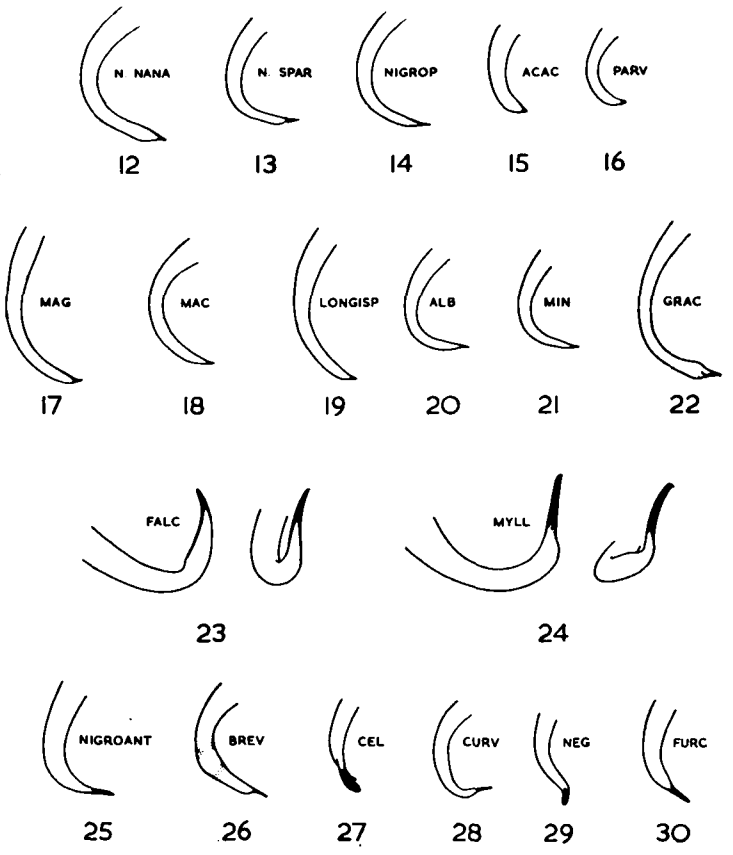
1. *Key to the species*

Ph. bivittata Bei-Bienko, *Ph. cretacea* Uvarov, and *Ph. nakanoensis* Matsumura & Shiraki, are not included in the key as their status cannot be definitely settled at present ; descriptions of these species are, however, given on pp. 237, 249, & 257, respectively.

No males of *Ph. longicauda* (Willemse) have yet been found ; this species is therefore not included in the key to males. *Ph. maculosa* sp. n. and

Ph. longispina sp. n., of which no females are yet known, and *Ph. dentata* (Willemse), of which the females cannot to the author's knowledge be satisfactorily diagnosed, have not been included in the key to females.

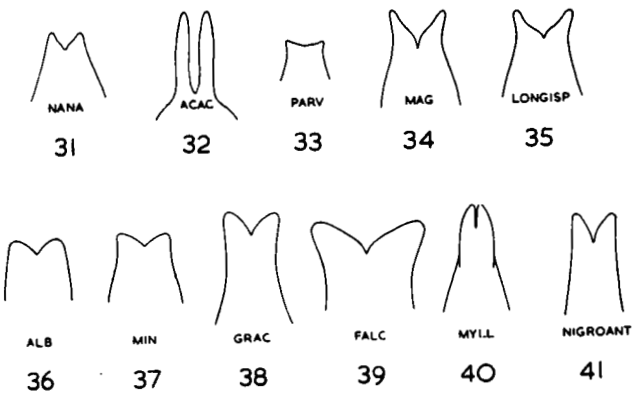
Figs. 10 & 11.—Lateral and dorsal views of the male tenth abdominal tergite of (10) *Phaneroptera brevis* Serville; (11) *Ph. celebica* Haan.



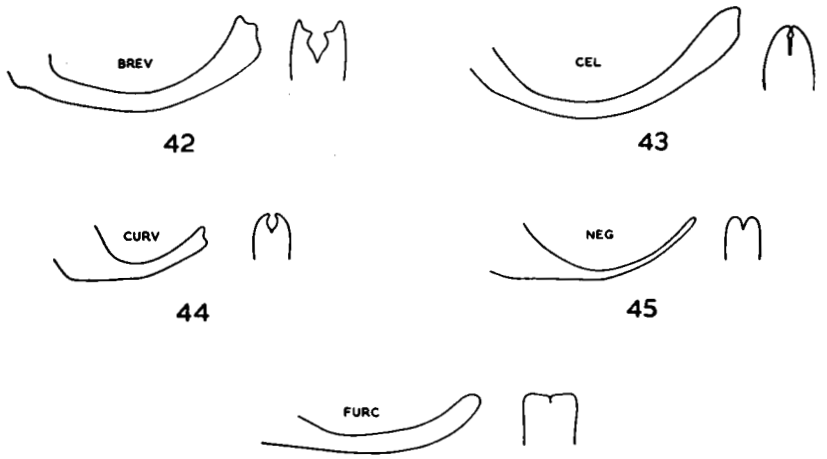
Figs. 12–30.—Dorsal view of the left male cercus of (12) *Phaneroptera nana nana* Fieber; (13) *Ph. n. sparsa* Stål; (14) *Ph. nigropunctata* Chopard; (15) *Ph. acaciae* Chopard; (16) *Ph. parva* sp. n.; (17) *Ph. magna* sp. n.; (18) *Ph. maculosa* sp. n.; (19) *Ph. longispina* sp. n.; (20) *Ph. albida* Walker; (21) *Ph. minima* Brunner; (22) *Ph. gracilis* Burmeister; (23) *Ph. falcata* (Poda), lateral and end views; (24) *Ph. myllocerca* sp. n., lateral and end views; (25) *Ph. nigro-antennata* Brunner; (26) *Ph. brevis* Serville; (27) *Ph. celebica* Haan; (28) *Ph. curvata* (Willemse); (29) *Ph. neglecta* (Karny); (30) *Ph. furcifera* Stål.

MALES

1. Hind tibiae with two apical spurs on each side (as in Fig. 8). Lateral pronotal lobes with a ventral white band..... *Ph. albida* Walker (p. 245)
–. Hind tibiae with three apical spurs on each side (Fig. 7). Lateral pronotal lobes without a ventral white band..... 2
2. Tenth abdominal tergite much enlarged, as in Figs. 10 or 11, forming a hood over the supra-anal plate, which is not bifurcate and usually hidden 3
–. Tenth abdominal tergite not as in Figs. 10 or 11, unmodified, or, if slightly enlarged (*Ph. furcifera* Stål), supra-anal plate deeply bifurcate (Fig. 85). Supra-anal plate always visible... 4
3. Posterior margin of the tenth abdominal segment smoothly rounded (Fig. 10). Cerci with a conspicuous bulge towards the distal end, which is not spatulate (Fig. 26). Subgenital plate as in Fig. 42..... *Ph. brevis* Serville (p. 258)
–. Posterior margin of the tenth abdominal segment with an acute median projection (Fig. 11). Cerci without a bulge, spatulate apically (Fig. 27). Subgenital plate as in Fig. 43... *Ph. celebica* Haan (p. 261)
4. Cerci with a large, blunt, dorsal tooth about halfway along their length ..... *Ph. dentata* (Willemse) (p. 265)
–. Cerci without a dorsal tooth halfway along their length..... 5
5. Dorsal spines of the hind tibiae large and widely spaced, as in Fig. 49 ..... *Ph. longispina* sp. n. (p. 244)
–. Dorsal spines of the hind tibiae small and closely spaced, as in Figs. 47 & 48..... 6
6. Subgenital plate deeply bifid, as in Fig. 32. Stridulatory organ (wing-area Cu) forming about a quarter of the total area of the fore wings..... *Ph. acaciae* Chopard (p. 239)
–. Subgenital plate not as in Fig. 32. Stridulatory organ (wing-area Cu) forming much less than a quarter of the total area of the fore wings..... 7
7. Costal and precostal areas of the fore wings more or less translucent with comparatively sparse venation..... 8
–. Costal and precostal areas of the fore wings of the same texture as the remaining areas..... 9
8. Fore wings more than 18 mm. in length. Hind femora attenuate, as in Fig. 50. Lateral pronotal lobes longer than deep (Fig. 64) ..... *Ph. gracilis* Burmeister (marginate form) (p. 250)
–. Fore wings less than 18 mm. in length. Hind femora not attenuate, as in Fig. 52. Lateral pronotal lobes about as deep as long (Fig. 63)..... *Ph. minima* Brunner (p. 246)
9. Fore wings less than 13 mm. in length. Hind wings extending beyond the fore wings by at least two-thirds of the length of the latter ..... *Ph. parva* sp. n. (p. 240)
–. Fore wings more than 13 mm. in length. Hind wings extending beyond the fore wings by less than two-thirds of the length of the latter..... 10
10. Distal part of the cerci bent vertically, with the apex directed upwards, as in Figs. 23 & 24..... 11
–. Cerci not as in Figs. 23 & 24, only curved in the horizontal plane, with the apex not directed upwards..... 12
11. Cerci as in Fig. 23. Supra-anal plate wider than long (Fig. 80). Subgenital plate very broad with spreading lobes, as in Fig. 37. *Ph. falcata* (Poda) (p. 253)
–. Cerci as in Fig. 24. Supra-anal plate quadrate (Fig. 81). Subgenital plate comparatively slender with almost contiguous lobes, as in Fig. 40..... *Ph. myllocerca* sp. n. (p. 254)



Figs. 31–41.—Ventral view of the male subgenital plate of (31) *Phaneroptera nana* Fieber; (32) *Ph. acaciae* Chopard; (33) *Ph. parva* sp. n.; (34) *Ph. magna* sp. n.; (35) *Ph. longispina* sp. n.; (36) *Ph. albida* Walker; (37) *Ph. minima* Brunner; (38) *Ph. gracilis* Burmeister; (39) *Ph. falcata* (Poda); (40) *Ph. myllocerca* sp. n.; (41) *Ph. nigro-antennata* Brunner.



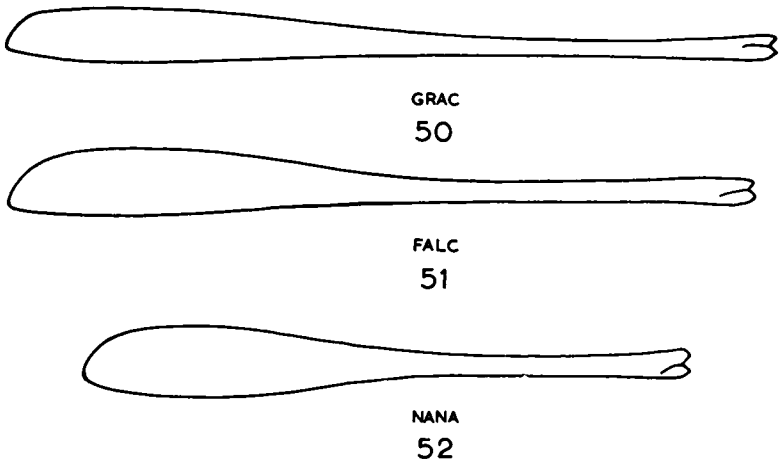
Figs. 42–46.—Lateral and end views of the male subgenital plate of (42) *Phaneroptera brevis* Serville; (43) *Ph. celebica* Haan; (44) *Ph. curvata* (Willemse); (45) *Ph. neglecta* (Karny); (46) *Ph. furcifera* Stål.

12. Hind femora attenuate, as in Fig. 50. Lateral pronotal lobes longer than deep ..... *Ph. gracilis* Burmeister (p. 250)
–. Hind femora not attenuate, as in Fig. 52. Lateral pronotal lobes at least as deep as long 13
13. Subgenital plate considerably thickened, sharply truncate at the apex, as in Fig. 46. Ninth abdominal tergite somewhat enlargèd ..... *Ph. furcifera* Stål (p. 264)
–. Subgenital plate relatively thin, bilobate at the apex. Ninth abdominal tergite unmodified 14
14. Distal lobes of the subgenital plate smoothly rounded (Fig. 45). *Ph. neglecta* (Karny) (p. 263)
–. Distal lobes of the subgenital plate not as in Fig. 45, pointed .. 15
15. Apices of the cerci abruptly bent inwards, as in Fig. 28 ..... *Ph. curvata* (Willemse) (p. 262)
–. Cerci not as in Fig. 28 16

16. Stridulatory organ large, almost as wide as long, as in Fig. 86. Fore wings with dark brown cells and green veinlets. (Japan and Formosa.) ..... *Ph. nigro-antennata* Brunner (p. 256)
-. Stridulatory organ relatively smaller, not shaped as in Fig. 86. Fore wings uniformly green (except along the posterior margin) or mottled brown and black with no green. (Europe and Africa.) 17
17. Hind femora more than 19 mm. in length ..... *Ph. magna* sp. n. (p. 242)
-. Hind femora less than 19 mm. in length 18
18. Vertex very convex with steeply sloping fastigium, as in Fig. 87. Colour mottled brown and black ..... *Ph. maculosa* sp. n. (p. 243)
-. Vertex only slightly convex with almost horizontal fastigium, as in Fig. 88. Colour green 19
19. Hind tibiae with less than 35 external dorsal spines. Antennae with dark bands ..... *Ph. nigropunctata* Chopard (p. 238)
-. Hind tibiae with more than 40 external dorsal spines. Antennae unicolorous ..... *Ph. nana* Fieber (p. 222)

47 48 49

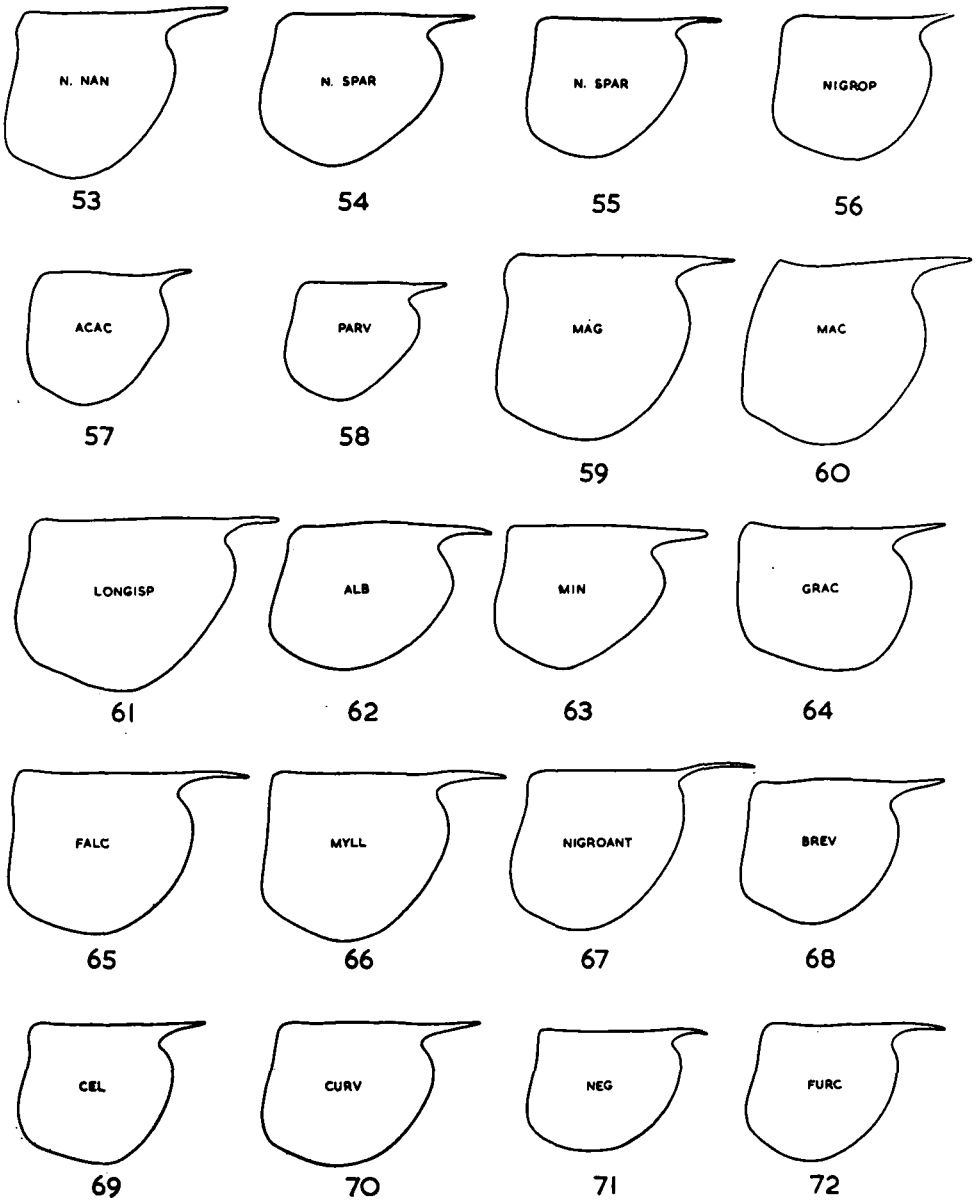
Figs. 47–49.—Lateral view of part of the left hind tibia of (47) *Phaneroptera nana sparsa* Stål; (48) *Ph. nigropunctata* Chopard; (49) *Ph. longispina* sp. n.



Figs. 50–52.—Lateral view of the left hind femur of (50) *Phaneroptera gracilis* Burmeister; (51) *Ph. falcata* (Poda); (52) *Ph. nana* Fieber.

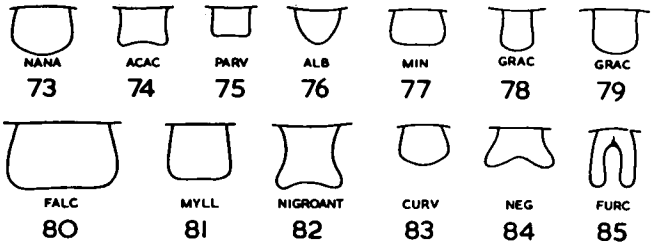
FEMALES

As mentioned previously it is very difficult to diagnose the females of several of the species; the key given here is far from infallible, and identifications made with it of all but the first six species mentioned below should be regarded as very tentative.



Figs. 53–72.—Lateral view of the pronotum of (53) *Phaneroptera nana nana* Fieber ; (54) *Ph. n. sparsa* Stål (tropical African form) ; (55) *Ph. n. sparsa* Stål (South African and Malagasian form) ; (56) *Ph. nigropunctata* Chopard ; (57) *Ph. acaciae* Chopard ; (58) *Ph. parva* sp. n. ; (59) *Ph. magna* sp. n. ; (60) *Ph. maculosa* sp. n. ; (61) *Ph. longispina* sp. n. ; (62) *Ph. albida* Walker ; (63) *Ph. minima* Brunner ; (64) *Ph. gracilis* Burmeister ; (65) *Ph. falcata* (Poda) ; (66) *Ph. myllocerca* sp. n. ; (67) *Ph. nigro-antennata* Brunner ; (68) *Ph. brevis* Serville ; (69) *Ph. celebica* Haan ; (70) *Ph. curvata* (Willemse) ; (71) *Ph. neglecta* (Karny) ; (72) *Ph. furcifera* Stål.

1. Hind tibiae with two apical spurs on each side (as in Fig. 8). Lateral pronotal lobes with a ventral white band..... *Ph. albida* Walker (p. 245)
–. Hind tibiae with three apical spurs on each side (Fig. 7). Lateral pronotal lobes without a ventral white band..... 2
2. Ovipositor shaped as in Fig. 90. Fore wings brown except for the costal area, which is translucent..... *Ph. acaciae* Chopard (p. 239)
–. Ovipositor not shaped as in Fig. 90. Fore wings not brown, or, if brown, costal area of the same texture as the remainder of the wing 3
3. Ovipositor more than 7 mm. in length, shaped as in Fig. 92. *Ph. longicauda* (Willemse) (p. 265)
–. Ovipositor less than 7 mm. in length, not shaped as in Fig. 92 4
4. Costal and precostal areas of the fore wings more or less translucent, with comparatively sparse venation..... 5
–. Costal and precostal areas of the fore wings of the same texture as the remaining areas..... 6
5. Fore wings more than 20 mm. in length. Hind femora attenuate, as in Fig. 50. Lateral pronotal lobes longer than deep (Fig. 64).....*Ph. gracilis* Burmeister (marginate form) (p. 250)
–. Fore wings less than 20 mm. in length. Hind femora not attenuate, as in Fig. 52. Lateral pronotal lobes about as deep as long (Fig. 63)..... *Ph. minima* Brunner (p. 246)



Figs. 73–85.—Dorsal view of the male supra-anal plate of (73) *Phaneroptera nana* Fieber; (74) *Ph. acaciae* Chopard; (75) *Ph. parva* sp. n.; (76) *Ph. albida* Walker; (77) *Ph. minima* Brunner; (78) *Ph. gracilis* Burmeister (from tropical Africa); (79) *Ph. gracilis* Burmeister (from India); (80) *Ph. falcata* (Poda); (81) *Ph. myllocerca* sp. n.; (82) *Ph. nigro-antennata* Brunner; (83) *Ph. curvata* (Willemse); (84) *Ph. neglecta* (Karny); (85) *Ph. furcifera* Stål.

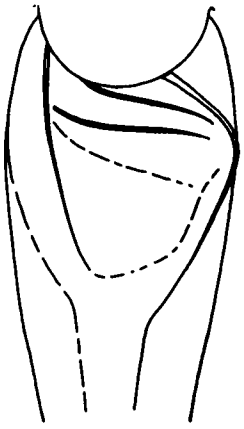
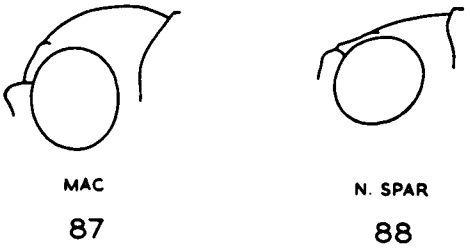
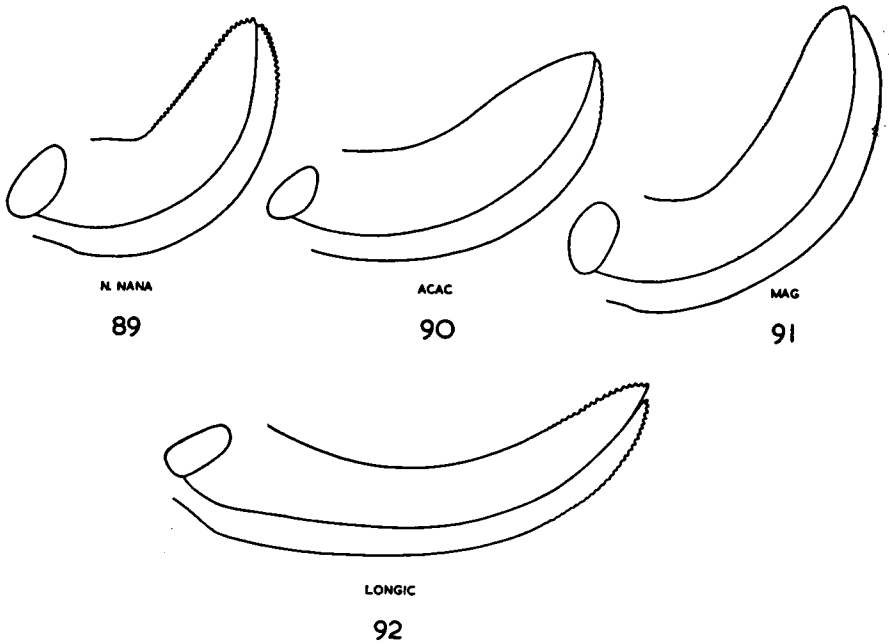


Fig. 86.—Dorsal view of the stridulatory organ of *Phaneroptera nigro-antennata* Brunner.

6. Fore wings less than 15 mm. in length. Hind wings extending beyond the fore wings by at least two-thirds of the length of the latter ..... *Ph. parva* sp. n. (p. 240)
–. Fore wings more than 15 mm. in length. Hind wings extending beyond the fore wings by less than two-thirds of the length of the latter 7
7. Ovipositor more than 6 mm. in length..... *Ph. magna* sp. n. (p. 242)
–. Ovipositor less than 6 mm. in length..... 8
8. Lateral pronotal lobes longer than deep, shaped as in Fig. 64. *Ph. gracilis* Burmeister (p. 250)
–. Lateral pronotal lobes at least as deep as long, not shaped as in Fig. 64 9
9. European, Asiatic, and African species..... 10
–. Austro-Malayan species..... 14
10. Fore wings less than 21 mm. in length..... 11
–. Fore wings more than 21 mm. in length..... 12



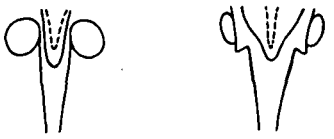
Figs. 87 & 88.—Lateral view of the dorsal part of the head of (87) *Phaneroptera maculosa* sp. n.; (88) *Ph. nana sparsa* Stål.



Figs. 89–92.—Lateral view of the ovipositor of (89) *Phaneroptera nana nana* Fieber; (90) *Ph. acaciae* Chopard; (91) *Ph. magna* sp. n.; (92) *Ph. longicauda* (Willemse).

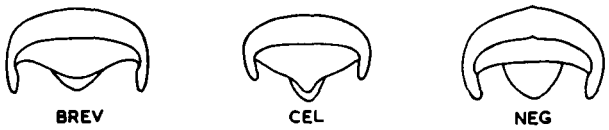
11. Hind tibiae with less than 35 external dorsal spines. Antennae with dark bands ..... *Ph. nigropunctata* Chopard (p. 238)
–. Hind tibiae with more than 40 external dorsal spines. Antennae unicolorous ..... *Ph. nana* Fieber (p. 222)
12. Fore wings with dark brown cells and green veinlets *Ph. nigro-antennata* Brunner (p. 256)
–. Fore wings uniformly green, at least in the anterior part 13
13. Posterior margin of the fore wings red-brown ..... *Ph. myllocerca* sp. n. (p. 254)
–. Fore wings uniformly green ..... *Ph. falcata* (Poda) (p. 253)
14. Ovipositor with a protruding flap at the base of the dorsal margin of the lower valves, beneath each basal lobe, as in Fig. 94 ..... *Ph. curvata* (Willemse) (p. 262)
–. Ovipositor without a protruding flap, as in Fig. 93 15
15. Base of the anal area of the fore wings conspicuously darkened *Ph. celebica* Haan (p. 261)
–. Base of the anal area of the fore wing not darkened 16
16. Tenth abdominal tergite slightly produced posteriorly, as in Fig. 95 ..... *Ph. brevis* Serville (p. 258)
–. Tenth abdominal tergite unmodified, as in Fig. 97 ..... *Ph. furcifera* Stål (p. 264) and *Ph. neglecta* (Karny) (p. 263)

(For the separation of these two species see under *Ph. neglecta* (Karny))



93 94

Figs. 93 & 94.—Ventral view of the base of the ovipositor of (93) *Phaneroptera brevis* Serville ; (94) *Ph. curvata* (Willemse).



95 96 97

Figs. 95–97.—Dorsal view of the terminal abdominal tergites of the female of (95) *Phaneroptera brevis* Serville ; (96) *Ph. celebica* Haan ; (97) *Ph. neglecta* (Karny).

2. *Descriptions of the species*

1. *PHANEROPTERA NANA* Fieber, 1853

Phaneroptera nana Fieber, 1853, *Lotos* **3**, 173.
Type locality PORTUGAL. Type material in Charpentier's collection, probably lost.

Diagnosis

♂. Subgenital plate as in Fig. 31. Cerci as in Figs. 12 or 13. Supra-anal plate as in Fig. 73. Tenth abdominal tergite unmodified. Hind tibiae with more than 40 external dorsal spines.

♀. Satisfactory diagnosis is impossible.

Redescription

♂. Lateral pronotal lobes as in Figs. 53–55. Spine of fore coxae well-developed. Hind tibiae with more than 40 external dorsal spines. Hind wings extending beyond fore wings by almost (subsp. *nana* Fieber) or quite (subsp. *sparsa* Stål) half length of latter. Exposed parts of both pairs of wings with rough surface ; membrane of archedictyon not transparent.

Tenth abdominal tergite unmodified. Supra-anal plate as in Fig. 73, showing tendency to form three posterior angles. Subgenital plate as in Fig. 31. Cerci as in Figs. 12 or 13.

Coloration green, usually with dark spots on vertex, pronotum, thoracic pleura, large part of legs, and abdominal tergites. Bases of fore wings usually showing four dark spots, three on left fore wing and one on right, or sometimes (Malagasian and some South African material) more extensive dark coloured area in region of Cu_2.

♀. As male except for genitalia and fore wing-bases. Ovipositor as in Fig. 89. Subgenital plate with acute apex. Fore wings almost invariably unicolorous, rarely with dark spot in region where Cu_{1b} meets Cu_2.

Discussion

This is the only species of *Phaneroptera* Serville in the most southern parts of Europe ; in Africa it is the most common one. It is easily distinguished from *Ph. falcata* (Poda), whose range it overlaps in Europe, by the lateral pronotal lobes, which are deeper than long in the Palaearctic part of its range, by the less attenuate hind femora, and by the genitalia and stridulatory organ of the male.

In the past the taxonomic unit here called *Ph. nana* Fieber has been treated as two distinct species, " *Ph. quadripunctata* " and " *Ph. nana* ", the former being regarded as predominantly European in distribution and the latter as predominantly African. A wide zone of overlap was believed to exist, including both the north and south sides of the Mediterranean region. There were, however, extremely few published records of " *Ph. nana* " from north of the Sahara, and its supposed intrusion into the Palaearctic region was doubtless only recognized because of the type locality, Portugal. I have attempted to show in this study that these two forms, hitherto called " *Ph. quadripunctata* " and " *Ph. nana* ", are best regarded as conspecific, at least for the present ; that they are allopatric ; that their ranges meet along a line from the Sahara, across the Syrian Desert, possibly to southern Armenia ; and that they show a cline in fore wing-length/hind femur-length ratio from north to south across their combined ranges. An adjustment in nomenclature follows, of course, from these propositions, no new names fortunately being necessary, and some interesting zoogeographical conclusions are possible.

So that the new nomenclature for these forms may be applied in this discussion, this matter will be dealt with first. The conspecificity of the two forms necessitates the earlier name being retained for the resulting species ; *Ph. quadripunctata* Brunner, 1878 is thus preoccupied by *Ph. nana* Fieber, 1853, and becomes a synonym of the latter (**syn. n.**). Now the outcome of this

discussion is that the two forms of *Ph. nana* Fieber are best regarded as subspecies pending a better knowledge of their geographical dividing line, and the names of the two subspecies must now be considered. The type locality of *Ph. nana* Fieber is Portugal, within the range of the northern subspecies ; the latter is therefore the nominate subspecies, *Ph. nana nana* Fieber. The southern subspecies is thus left without a name, as it is shown in this study that the name " *nana* " has been misapplied in its old sense ever since Brunner's monograph of 1878, where this author shifted the name " *nana* " from the northern to the southern form and renamed the northern one " *quadripunctata* ". The first available synonym for the southern form is *sparsa* Stål, 1857, and its name therefore becomes *Ph. nana sparsa* Stål.

It is not always easy and occasionally impossible to separate the two subspecies. The three principal characters used in the past were the relative lengths of the fore wings and hind femora, the shape of the pronotum, and the shape of the male cerci. The examination of a fairly large number of specimens soon made it clear that these characters are very variable and often unreliable.

The use of the relative lengths of the fore wings and hind femora in separating the two forms suggested the possibility of a cline in this character from the European part of the range to the tropics. The fore wing and hind femur measurements of 322 males from throughout the range soon showed that this was in fact the case. The females were not included as they lack the important diagnostic character provided by the male cerci, and in any case would require separate treatment as their fore wing-length/hind femur-length ratio (from now on referred to as the *fw/hf* ratio) is about 5 per cent higher than that of the males ; measurements of female samples from representative parts of the range, however, showed that an exactly similar trend occurs.

The scatter diagram obtained by plotting fore wing-length against hind femur-length is shown in Fig. 98. It will be seen that, although the mean ratios of the two forms are well separated, there is an appreciable overlap. The coefficient of difference (C.D.) was calculated as follows (Mayr, Linsley & Usinger, 1953, p. 146) :—

$$\text{C.D.} = \frac{\bar{x} - \bar{y}}{\sigma x + \sigma y} = \frac{1{\cdot}173 - 1{\cdot}011}{0{\cdot}0538 + 0{\cdot}0885} = 1{\cdot}144,$$

where x is the *fw/hf* ratio for *Ph. n. nana* Fieber, y is that for *Ph. n. sparsa* Stål, and σ is the standard deviation. This coefficient corresponds to a joint nonoverlap (assuming, among other things, normal distributions) of about 87 per cent, and if the *fw/hf* ratio were the only diagnostic character it would probably be inadvisable to give the two forms separate subspecific status. It will also be noted from the scatter diagram that it is the relative length of the fore wing which shows geographical variation, the hind femur merely being used as a measure of size.

The mean *fw/hf* ratios and the mean latitudes of the specimens measured for each political area in the combined range of the two forms are shown below (p. 226) ; the sample sizes and the standard deviations are also given.

If these mean ratios are entered on a map on their appropriate mean latitudes, it is possible to draw approximate isophenes ; the result is shown in Fig. 99. The general distribution shown is interesting. The ratio reaches a minimum along a diagonal line stretching from the southern part of French West Africa across equatorial Africa to Mozambique and Madagascar ; south of this region the ratio becomes larger again, corresponding to the value for north-east Africa and the Canary Is. In general the lines run parallel to the

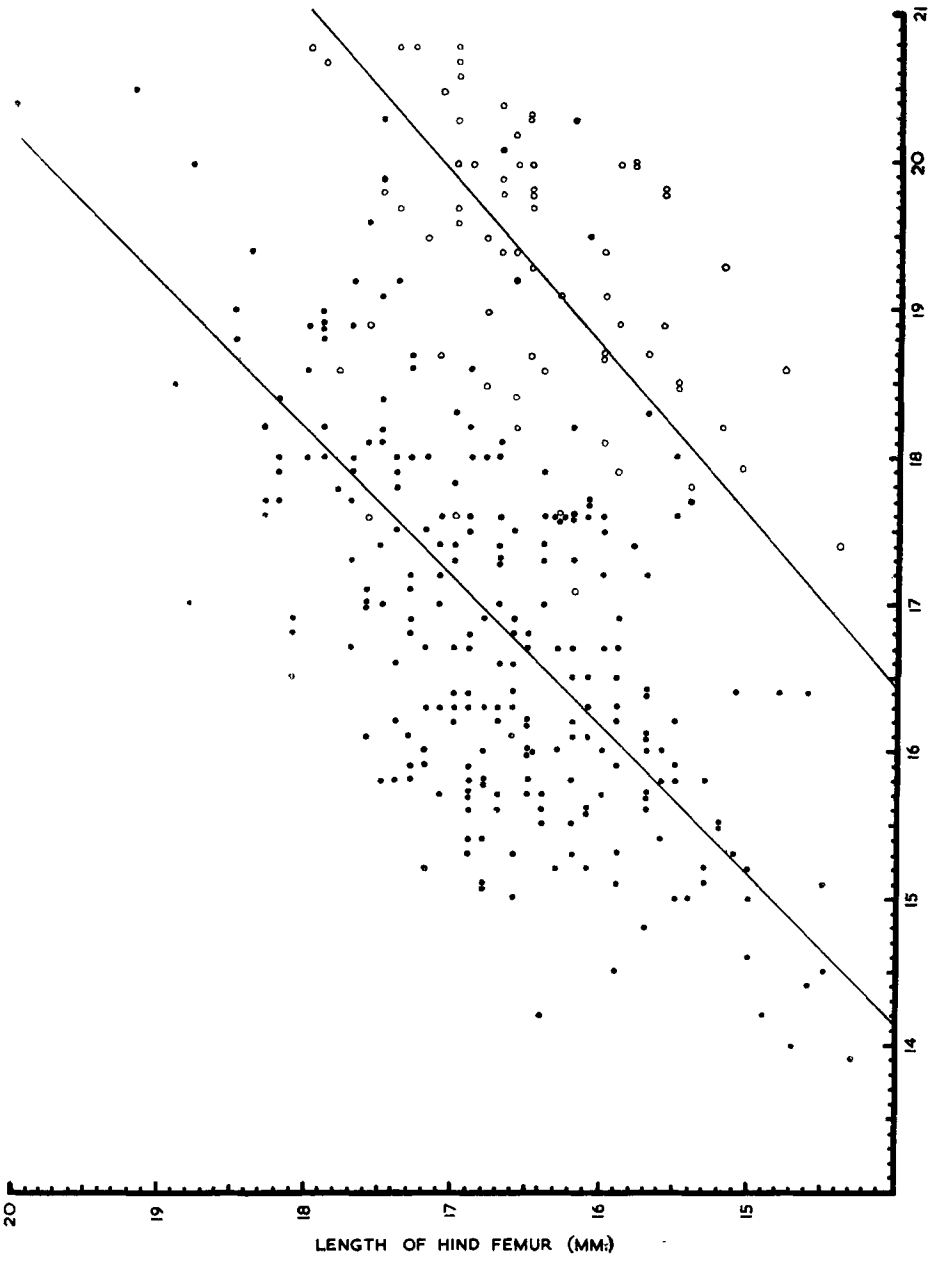


Fig. 98.—Scatter diagram showing the relationship between the length of the hind femur and the length of the fore wing in *Phaneroptera nana nana* Fieber (circles) and *Ph. n. sparsa* Stål (dots). The mean ratio is drawn in for each subspecies.

Ph. n. nana Fieber

Country	Mean Latitude	Sample Size	Mean *fw/hf* Ratio	Standard Deviation
Albania	41·3 N.	2	1·18	0·021
Algeria	36·1 N.	3	1·19	0·029
Azores	38·7 N.	2	1·19	0·028
Corsica	42·1 N.	3	1·27	0·000
Cyprus	34·8 N.	7	1·13	0·046
France	43·8 N.	4	1·21	0·059
Italy	45·3 N.	14	1·18	0·046
Lebanon	34·0 N.	2	1·20	0·071
Madeira	32·7 N.	7	1·11	0·093
Morocco	32·0 N.	1	1·16	—
Palestine	32·1 N.	3	1·22	0·055
Portugal	39·4 N.	1	1·22	—
Spain	39·6 N.	4	1·20	0·050
Switzerland	46·2 N.	2	1·18	0·021
Tunisia	34·5 N.	4	1·10	0·043
Turkey	38·2 N.	2	1·18	0·021
Yugoslavia	44·5 N.	7	1·17	0·038

Ph. n. sparsa Stål

Country	Mean Latitude	Sample Size	Mean *fw/hf* Ratio	Standard Deviation
Aden	13·4 N.	4	1·10	0·067
A–E Sudan	13·4 N.	2	1·06	0·050
Aldabra	9·3 S.	2	1·01	0·042
Angola	11·7 S.	9	1·08	0·070
Arabia	20·1 N.	5	1·08	0·071
Belgian Congo	0·9 S.	32	1·00	0·185
British Somaliland	10·1 N.	5	1·02	0·045
Cameroons	3·5 N.	2	0·98	0·007
Canary Is.	28·2 N.	9	1·03	0·104
Eritrea	15·3 N.	4	1·07	0·001
Ethiopia	9·0 N.	6	1·04	0·085
F E Africa	3·6 N.	13	0·99	0·056
F W Africa	11·6 N.	16	0·98	0·051
Gold Coast	7·0 N.	1	0·98	—
Kenya	2·0 S.	6	1·02	0·049
Madagascar	16·6 S.	10	1·00	0·051
Mozambique	17·5 S.	6	0·95	0·023
Nigeria	7·2 N.	17	0·96	0·058
N. Rhodesia	10·3 S.	3	1·00	0·092
Nyasaland	14·5 S.	6	0·96	0·052
Palestine	32·0 N.	4	1·07	0·036
Sierra Leone	8·0 N.	4	0·98	0·002
Socotra	12·4 N.	1	1·08	—
S Africa	31·2 S.	19	1·06	0·074
S W Africa	19·3 S.	2	0·98	0·061
S Rhodesia	18·5 S.	14	1·06	0·031
Tanganyika	5·9 S.	17	1·00	0·076
Uganda	0·4 N.	30	1·01	0·044
Yemen	13·6 N.	4	1·03	0·057
Zanzibar	6·4 S.	1	0·93	—

lines along which one type of vegetation is replaced by another. Thus the western part of the area enclosed by the 100 line is roughly the area of tropical forest, woodland, and savannah, giving way both northwards and southwards to steppe grassland and then semi-desert ; it is also the area of tropical agriculture, giving way to the wheat belt in the north, to nomadic stock-rearing in the south-west, and to wheat-growing again in the south-east.

The belt enclosed by the 110 line to the north and the 100 line to the south is of particular interest. A large part of this area is, of course, desert and pure semi-desert where *Phaneroptera nana* Fieber does not occur. This provides an effective barrier between *Ph. n. nana* Fieber and *Ph. n. sparsa* Stål in the more western part of their ranges. However, *Ph. n. sparsa* Stål extends up the semi-desert and steppe of western Arabia, across the Syrian Desert, and possibly to the Anatolian steppe of southern Armenia. This latter possibility is suggested by the original description of *Ph. bivittata* Bei-Bienko, 1954 (type locality : Dhuga, nr. Dzhulfa, on the river Arax, S. Armenia), which agrees well with *Ph. n. sparsa* Stål (for discussion see under *Ph. bivittata* Bei-Bienko). Bei-Bienko's measurements give an *fw/hf* ratio of about 1·06, which would extend the range of *Ph. n. sparsa* Stål up to latitude 40° N and suggests the possibility of this subspecies being found in eastern Turkey. *Ph. bivittata* Bei-Bienko is also recorded from Kopet Dagh.

It may be noticed that the mean ratio values given for a few of the political areas do not fall between the correct isophenes in Fig. 99 ; these exceptional values are mostly based on very small sample sizes. It would of course be possible to modify the isophenes so that there are no exceptional values, but these lines have been drawn so that there are no irregularities in them which would be difficult to account for on the grounds of vegetation, climate, topography, etc. As they stand at present it is very probable that the mean ratio given by a sample of ten or more specimens taken from several different populations in the same region of Africa would fall between the correct isophenes on the map. The high individual variability of this ratio, however, perhaps enhanced by the effect of local ecological factors, tends to obscure the cline, and the author felt it desirable to show mathematically that the change in *fw/hf* ratio across the range is a real one and not the effect of high variability and small samples.

It was not considered worth while to show statistically a correlation between *fw/hf* ratio and vegetation or climate or any other environmental factor. The author's intention has been merely to show that a cline exists, and that the isophenes in Fig. 99 are approximately in the correct positions ; any correlation with vegetation, etc., can then be seen from the trend of the isophenes. After careful consideration of various methods of approach, it was decided to group the mean ratios according to the isophenes between which they fell and to compare the grand means of adjacent groups. While the arbitrary nature of the isophenes is fully recognized, a comparison of adjacent means nevertheless gives a measure of the probability that there is a real difference between adjacent areas ; the likelihood of a cline existing then depends on the smoothness and general intelligibility of the isophenes. The result of applying this method is set out below

Area	Mean	Significance
90–100	98·5	
100–110	103·9	$p<5$ per cent
100–120	116·1	$p<0{\cdot}1$ per cent
120–130	121·6	$p>10$ per cent

This, in the author's opinion, is an indication that the 100 and 110 lines are statistically justified and that the 120 line is not. This is of course what would be expected from an inspection of Fig. 99; insufficient material was available from the Mediterranean region to show whether a cline exists within this area, but the 120 line is drawn in to show that a slight trend is suggested. The vegetation is much more uniform in the range of *Ph. n. nana* Fieber than it is in the range of *Ph. n. sparsa* Stål, and it is quite probable that further material will show that geographical variation is very slight or quite absent within the Mediterranean region.

Material from Palestine and Lebanon shows an increased variability in several characters. This is the region where the two forms meet, and from which it will be necessary to have much more material before their subspecific status can be finally accepted or rejected. The male cerci of the specimens referable to *Ph. n. sparsa* Stål are particularly variable, extreme forms in both the attenuate and broad directions appearing. *Ph. tenuicerca* Ramme was in fact described from a form with extremely attenuate male cerci, and yet which has an *fw/hf* ratio of about 1·13. It is possible that the two forms are interbreeding in this zone and that the unusual phenotypes have resulted from the genetic interaction associated with this. Some of the Arabian males examined also had unusually attenuate cerci. Specimens from Palestine and Lebanon which are referable to *Ph. n. nana* Fieber have an unusually high *fw/hf* ratio for this part of the range of this subspecies.

The range of variation in the male cerci is shown in Fig. 100. Cerci (*d*)–(*f*) are drawn from specimens of *Ph. n. sparsa* Stål, (*e*) being typical and (*f*) being an exceptionally attenuate one from Arabia. Cerci (*b*) and (*c*) are of *Ph. n. nana* Fieber, (*c*) being the more typical one of the two. Cercus (*a*) is of particular interest: it is from a South African specimen from Fish Hoek, Cape Province. Three of the South African males had cerci of this type, the other two being from Ceres and Table Mountain. These three males were also characterized by the longitudinal veins of the fore wings, which were more sharply defined than usual. On the basis of this latter character a female specimen from Stellenbosch was grouped with them. In all other characters these specimens agreed with *Ph. n. sparsa* Stål; the *fw/hf* ratios were normal for South Africa. Now all four specimens came from the central part of the relatively small area of Hard Leaf, Mediterranean-type vegetation which forms a south-westerly coastal fringe to Cape Province. An obvious interpretation is that a third subspecies has split off in this Mediterranean-type region, having cerci resembling *Ph. n. nana* Fieber and an *fw/hf* ratio agreeing with *Ph. n. sparsa* Stål. However, some typical specimens of *Ph. n. sparsa* Stål also come from this region, one, for example, coming from Hout Bay. This pachycercal form is therefore probably either an extreme variant or polymorph, or a distinct sibling species. Further material is necessary before this question can be finally settled; there is a

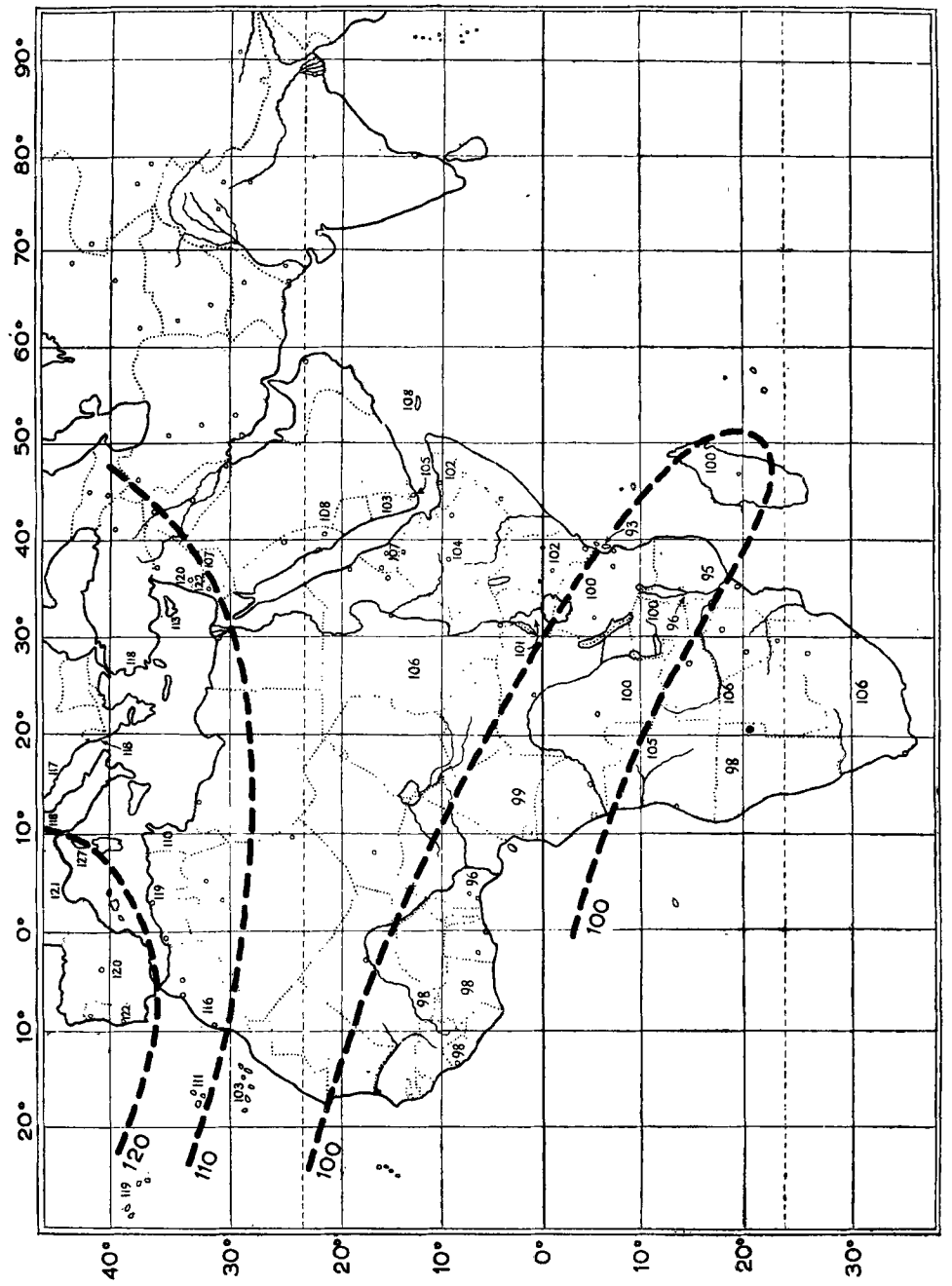


Fig. 99.—Map showing the mean values for the length of the fore wing, expressed as a percentage of the length of the hind femur, for each political area of Africa and southern Europe. Each value is entered on the mean latitude of the specimens from which it was obtained. Approximate isophenes are drawn at intervals of 10.

suggestion, however, that the shape of the male cercus is affected by environmental factors in a similar way to the relative length of the fore wings, though with much less continuity. The discontinuity in the shape of the male cercus which occurs at the zone of contact between *Ph. n. nana* Fieber and *Ph. n. sparsa* Stål may be seen in Fig. 100. There is a distinct difference in the degree and quality of curvature between cerci (*b*) and (*c*), and cerci (*d*)-(*f*); this character may always be used to separate the two subspecies.

So far, amongst all the material available from the contact zone, batches of two or more specimens bearing the same data have been wholly referable either to the one form or to the other, or have been to some extent intermediate. There is thus no evidence of the ranges actually overlapping. On the other hand the available material from this region has been completely inadequate for finally establishing non-overlap. It seems very likely, however, that the two forms have been conspecific in recent geological times at least, for when viewed as a whole they show a fairly continuous cline in *fw*/*hf* ratio from the northern to the southern parts of their combined ranges. The material from Madeira was all referable to *Ph. n. nana* Fieber except for two male specimens which were undoubtedly of *Ph. n. sparsa* Stål ; the latter subspecies has doubtless been introduced to the island comparatively recently, and it is of course possible that this also applies to *Ph. n. nana* Fieber.

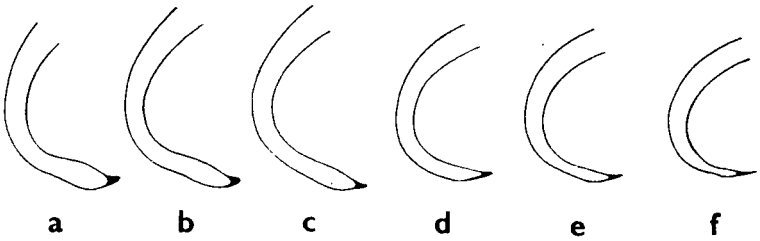


Fig. 100.—Dorsal views of the left male cerci of specimens of *Phaneroptera nana* Fieber from (*a*) Fish Hoek, Cape Province, (*b*) & (*c*) the Mediterranean region, (*d*) & (*e*) tropical Africa, and (*f*) Arabia.

The available evidence is insufficient for any final decision as to the status of *Ph. n. nana* Fieber and *Ph. n. sparsa* Stål. It may be stated confidently, however, that *Ph. nana* Fieber considered as a whole is near the borderline between a polytypic species and a superspecies. Further material may well prove the latter to be the case. The two forms are regarded as subspecies here for four reasons :—

1. Morphologically they are almost identical, some females not being definitely assignable to either one form or the other.

2. There is at present no direct evidence that their ranges overlap.

3. When considered as a whole they show a continuous cline in *fw*/*hf* ratio from the northern to the southern parts of their combined ranges.

4. If they were regarded as distinct species considerable confusion in nomenclature would result. The arguments presented here would necessitate giving the name *nana* Fieber, originally used for the southern form, to the northern form and renaming the southern form *sparsa* Stål. Should conspecificity be eventually disproved, the interpretation presented here would form a useful intermediate step towards this rather violent change in nomenclature for such common insects.

Distribution (Fig. 101)

Ph. nana Fieber covers the Mediterranean region, western Arabia, Africa, and Madagascar. In parts of Europe it reaches north to about 50° N.

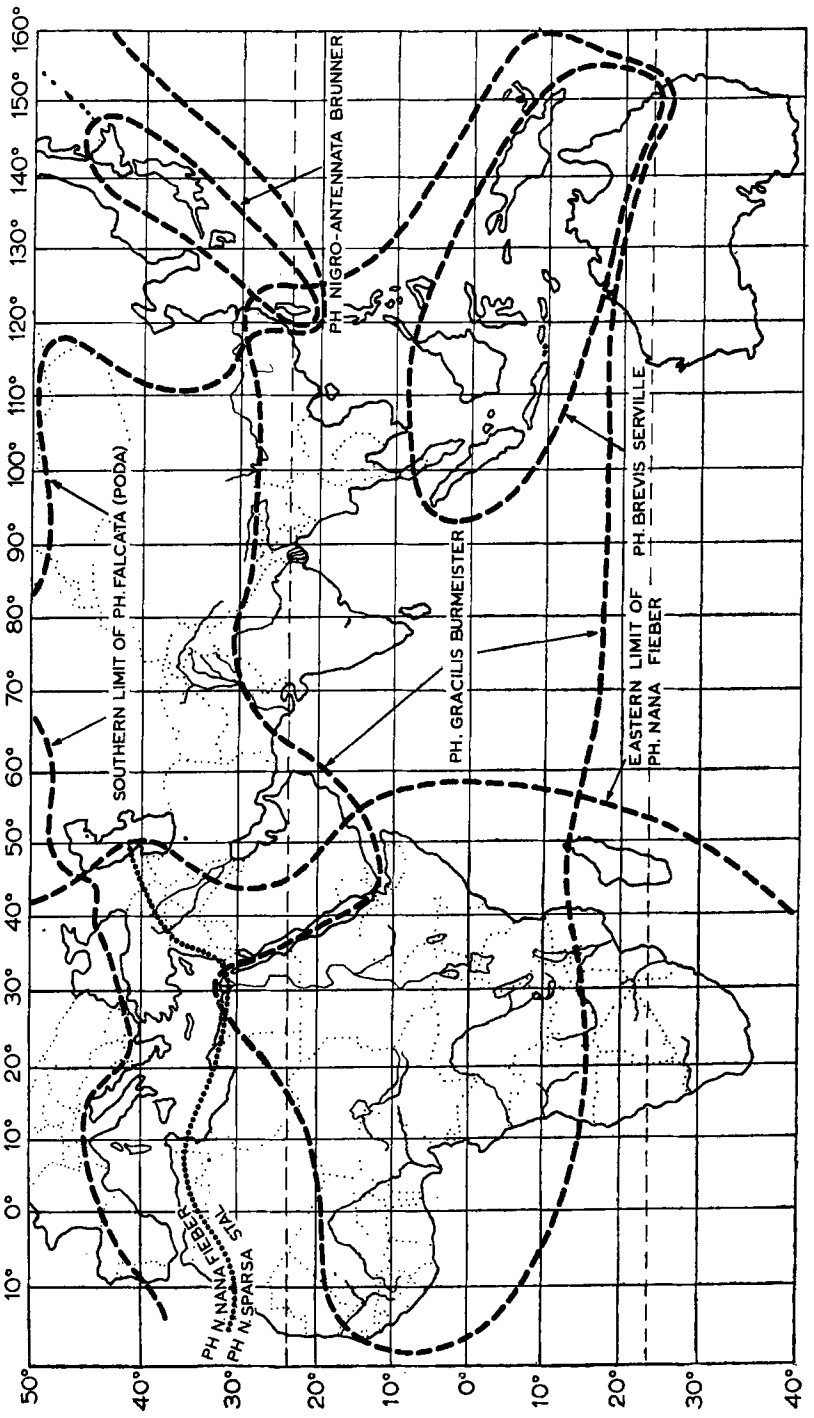


Fig. 101.—Map showing the approximate distribution of *Phaneroptera nana* Fieber, *Ph. gracilis* Burmeister, *Ph. falcata* (Poda), *Ph. nigro-antennata* Brunner, and *Ph. brevis* Serville.

Key to the subspecies

1. Fore wing-length/hind femur-length ratio more than 1·1, the fore wings usually extending beyond the hind knees. Lateral pronotal lobes deeper than long, as in Fig. 53. Male cerci as in Fig. 12 ..... *Ph. n. nana* Fieber (p. 232)
-. Fore wing-length/hind femur-length ratio less than 1·1, the fore wings usually not reaching the hind knees. Lateral pronotal lobes about as long as deep, as in Figs. 54 & 55. Male cerci as in Fig. 13 ..... *Ph. n. sparsa* Stål (p. 235)

1. *PHANEROPTERA NANA NANA* Fieber, 1853, **stat. n.**

Phaneroptera nana Fieber, 1853, *Lotos* **3**, 173.

Phaneroptera quadripunctata Brunner, 1878, Monographie der Phaneropteriden, p. 212. Lectotype ♂, ITALY: Trieste (C. Brunner von Wattenwyl Collection, No. 4460). Three ♂ cotypes, FRANCE: Montpellier, SARDINIA, SPAIN: Malaga (C. Brunner von Wattenwyl Collection, Nos. 1591, 2629, & 2594, respectively). Three ♀ cotypes, ITALY: Venice, SICILY, TURKEY: Ismir (C. Brunner von Wattenwyl Collection, Nos. 5130, 7409, & 9891, respectively). All in the Naturhistorisches Museum, Vienna. **Syn. n.**

Phaneroptera quadripunctata Brunner, Burr, 1910, A synopsis of the Orthoptera of Western Europe, p. 88.

Phaneroptera quadripunctata Brunner, Chopard, 1943, *Faune de l'empire français* **1**, 101.

Phaneroptera quadripunctata Brunner, Chopard, 1951, *Faune de France* **56**, 86.

Phaneroptera quadripunctata Brunner, Bei-Bienko, 1954, Fauna of the U.S.S.R., *Fauna Rossii* (New Series) Orthoptera **2** (2), 71.

Diagnosis

♂♀. Fore wing-length/hind femur-length ratio more than 1·1, fore wings usually extending beyond hind knees. Lateral pronotal lobes as in Fig. 53, deeper than long. Male cerci as in Fig. 100 (*b*) and (*c*), slightly swollen near apex, showing no constriction throughout length.

Measurements

Males	Females
Total length (20): 28·7–33·3, mean 31·18.	Total length (20): 30·7–35·8, mean 33·18.
Median length of pronotum (20): 3·0–3·7, mean 3·34.	Median length of pronotum (20): 3·2–4·1, mean 3·55.
Length of hind femur (68): 14·4–18·0, mean 16·52.	Length of hind femur (20): 16·4–20·5, mean 18·02.
Maximum vertical width of hind femur (20): 1·6–2·1, mean 1·85.	Maximum vertical width of hind femur (20): 1·6–2·3, mean 2·02.
Length of fore wing (68): 17·1–20·8, mean 19·36.	Length of fore wing (20): 20·2–22·7, mean 21·32.
Length of exposed part of hind wing (20): 7·3–9·9, mean 8·67.	Length of exposed part of hind wing (20): 7·7–10·3, mean 8·79.
	Length of ovipositor (20): 4·4–5·5, mean 4·92.

Discussion

This subspecies may be distinguished from *Ph. n. sparsa* Stål by the relative length of the fore wings and by the shape of the male cerci (Fig. 100).

The taxonomic status of *Ph. n. nana* Fieber has been fully discussed above. The eight specimens (2♂♂, 4♀♀, 2 nymphs) examined from the type

locality, Portugal, belonged indisputably to the northern subspecies, which must therefore bear the name *nana* Fieber. The cline in *fw/hf* ratio, which is shown over the whole range of *Ph. nana* Fieber, is least well-marked in the Mediterranean region. There is a suggestion that the ratio tends to be rather higher in S.W. Europe than in S.E. Europe and N. Africa, but this cannot be definitely established until many more specimens are available.

I have selected and marked a male lectotype from among the cotypes of *Ph. quadripunctata* Brunner; this specimen is No. 4460 of Brunner's collection.

Material examined

♂ lectotype, 3 ♂ cotypes, and 3 ♀ cotypes, of *Ph. quadripunctata* Brunner.

AUSTRIA: Anninger, 13.ix.1951 (Ebner) (1 ♀) (coll. Ebner); SWITZERLAND: Lugano, Ticino, 10.ix.1928 (Zeuner) (1 ♂, 1 ♀); FRANCE: Alpes Maritimes, Le Rouret, 300 m., 1.xi.1946 (Korsakoff) (1 ♂); Mentone, 13.ix.1937 (Zeuner) (1 ♂); Alpes Maritimes, Cagnes, viii-ix.1924 (Morton) (1 ♂, 2 ♀♀); Var, Bagnoles, x.1946 (Korsakoff) (1 ♀); Montpellier (Daube) (1 ♂, 1 ♀) (Nat. Mus. Vienna); Montpellier, 1870 (Türk) (1 ♀) (Nat. Mus. Vienna); Bézu-St.-Eloi, Eure, 1888 (Brongniart) (1 ♀) (Mus. Hist. Nat. Paris); Provence, Mirabeau, 2.ix.1949 (Willemse) (1 ♀) (coll. Willemse); Bagnols, 1.ix.1887 (Finot) (1 ♂) (Inst. Sci. Nat. Brux.); ITALY: Vicenza, Schio, 1928 (Gray) (4 ♂♂, 1 ♀); Castellamare, 22.ix,1917 (Hargreaves) (1 ♂); Rome (Vito Zanon) (1 ♂, 2 ♀♀); Col. Mogliano, x.1918 (1 ♂); Strupinigi, 22.ix.1919 (Ashby) (1 ♀); Arquata, ix-xi.1918 (Ashby) (1 ♂, 3 ♀♀); Madonna Delpilone, 30. viii.1919 (Ashby) (1 ♂); Calabria, Cosenza, x.1922 (Salfi) (1 ♀); Apuan Alps, Camaiore Lombrici, 100 m., 17.ix.1937 (Zeuner) (1 ♀); Venice (1 ♂) (Nat. Mus. Vienna); Ceraino-Roveredo (1 ♂) (Nat. Mus. Vienna); Görz (Brunner) (1 ♂) (Nat. Mus. Vienna); Monfalcone (2 ♂♂, 2 ♀♀) (Nat. Mus. Vienna); Lesina (Bucchich) (1 ♂, 1 ♀) (Nat. Mus. Vienna); Trieste, Mori, 200 m., 8.viii.1937 (Ebner) (2 ♂♂) (coll. Ebner); Voltaggio, ix.1876 (Bormans) (1 ♂, 1 ♀); Trentino, Storo, 400–500 m., 9–13.viii.1937 (Ebner) (1 ♀) (coll. Ebner); HUNGARY: ——— (1 ♀) (coll. Willemse); RUMANIA: Bucharest (Moutandon) (1 ♀) (Inst. Sci. Nat. Brux.); YUGOSLAVIA: ——— (1 ♂); Rijeka, iii.1877 (Krauss) (4 ♂♂, 7 ♀♀) (Nat. Mus. Vienna); Curzola, 1870 (Türk) (2 ♂♂) (Nat. Mus. Vienna); Mostar (Brunner) (1 ♂) (Nat. Mus. Vienna); ——— (Staudinger) (3 ♂♂, 3 ♀♀) (Nat. Mus. Vienna); Lesina (Finot) (1 ♀) (Inst. Sci. Nat. Brux.); ALBANIA: Durazzo, ix.1917 (Karny) (2 ♀♀) (coll. Ebner); PORTUGAL: Alcamiser (?), 8.viii.1923 (1 ♂ nymph); Mata de Leiria, 11.viii.1925 (1 ♂); Pedras Salgadas, 18.viii.1926 (1 ♀); Matasiphos (Wattison) (1 ♀); ——— (1 ♂, 1 ♀); Porto (1 ♀); Monchique, 500 m., 30.viii.1938 (Ebner) (1 ♀ nymph) (coll. Ebner); SPAIN: Moratalla, 15–18.ix.1935 (Burr) (1 ♂); L. Navás, 19.ix.1907 (1 ♀); ——— 1864 (1 ♀) (Nat. Mus. Vienna); Uclés (3 ♂♂, 2 ♀♀) (Nat. Mus. Vienna); Malaga (Staudinger) (1 ♀) (Nat. Mus. Vienna); TURKEY: Istanbul, Bebek, 19.xi.1952 (Burr) (1 ♀); Istanbul, Bebek, ix–xi.1953 (Burr) (2 ♂♂); Bosphorus, Bebek, 13.ix.1951 (Burr) (1 ♀); Burnova, nr. Smyrna, 26.vii.1931 (Uvarov) (1 ♂); U.S.S.R.: Caucasus, Kasikoporan (Ebner) (1 ♀) (coll. Ebner); Poln.

Ischifslück, 15.viii.1909 (Fahringer) (1 ♂) (coll. Ebner); AZORES: Fayal, ix.1952 (Carthy) (2 ♂♂); Terceira, Monte Brasil, 1930 (Chopard) (1 ♀) (Mus. Hist. Nat. Paris); San Miguel, Ponta Deloada, 1930 (Chopard) (1 ♀) (Mus. Hist. Nat. Paris); MADEIRA: ———, 1954 (Vieira) (3 ♂♂, 2 ♀♀); ——— (Wollaston) (1 ♀); Ribeira do Bento, 8.viii.1929 (Balfour-Browne) (1 ♀); nr. Funchal, viii–ix.1936 (Chopard) (2 ♂♂, 2 ♀♀) (Mus. Hist. Nat. Paris); CORSICA: Aleria, 1.viii.1931 (Mosely) (4 ♂♂); MALTA: ———, 1924 (Harford) (2 ♀♀); CYPRUS: Kilani, Krios R., ix–x.1937 (Mavromoustakis) (2 ♂♂, 12 ♀♀); Ayies Nikoloos, Papho, 20.vii.1937 (Mavromoustakis) (1 ♂); Limassol, 13.viii. 1920 (Mavromoustakis) (1 ♂); Limassol, 17.viii.1927 (Mavromoustakis) (1 ♂); Platres, Limassol distr., ix.1901 (Bates) (1 ♂); Platres, 4,500–5,000 ft., 5.ix.1926 (Mavromoustakis) (1 ♀); Platania Forest station, 11–12.ix.1951 (Mavromoustakis) (1 ♂, 1 ♀); Ortu Keny, 11.xii.1945 (Mavromoustakis) (1 ♀); Platres, 15.ix.1945 (Mavromoustakis) (1 ♀); MOROCCO: High Atlas, Goundafa, 1,200 m., 21–29.vi.1933 (Zerny) (1 ♂) (Nat. Mus. Vienna); Taroudant, 820 ft., vi.1936 (Chapman & Bisset) (1 ♀); Rabat (Thery) (1 ♀) (Mus. Hist. Nat. Paris); ALGERIA: Sidi Terruch (Thery) (1 ♀) (Mus. Hist. Nat. Paris); Mustapha, nr. Algiers, 1903 (Joly) (1 ♀) (Mus. Hist. Nat. Paris); Philippeville (Thery) (1 ♂) (Mus. Hist. Nat. Paris); St. Croix de l'Edough, 700–1,000 m., 1917 (Chevreux) (1 ♂) (Mus. Hist. Nat. Paris); Boufarik (Thery) (2 ♀♀) (Mus. Hist. Nat. Paris); Mascara, 1922 (Cros) (1 ♂); Sidi-bel, Abbes (Ebner) (1 ♀) (coll. Ebner); TUNISIA: Bou Hedma, 1929 (Dumont) (1 ♀) (Mus. Hist. Nat. Paris); Maknassy, 1929 (Dumont) (3 ♂♂, 1 ♀) (Mus. Hist. Nat. Paris); Gafsa, 1904 (Weiss) (1 ♂, 2 ♀♀) (Mus. Hist. Nat. Paris); EGYPT: ——— (1 ♂) (Rijksmus. Nat. Hist. Leiden); LEBANON: Wadi el Harir, 22.vii.1945 (G.H.Q. M.E.F.) (1 ♂); Dover Schweir, ix.1923 (Christiansen) (1 ♂); nr. Beirut, Kahlaé, 17.xii.1951 (Waterston) (1 ♀); SYRIA: Damascus, vi.1945 (G.H.Q. M.E.F.) (1 ♀); Damascus, 1.xi.1944 (G.H.Q. M.E.F.) (1 ♀); PALESTINE: Mellaha, 7.x.1935 (Washbourn) (1 ♂); Mt. Carmel, 800 ft., 30.vi.1931 (Buxton) (1 ♂); Beit Jibrin, Judaean Highlands, 23.ix.1922 (Buxton) (1 ♂).

All in the British Museum (Natural History) unless otherwise stated.

Distribution (Fig. 101)

Ph. n. nana Fieber is distributed throughout the Mediterranean region. Its northern limit in Europe is probably about 50° N., though it is not often found north of 48° N. It occurs on the Azores, Madeira, and throughout the Mediterranean islands. The range of this subspecies is almost exactly the area of Mediterranean-type vegetation and Mediterranean crops. This is particularly true of the southern and eastern limits: it is found in Morocco, the northern subcoastal fringe of Algeria, Tunisia, Egypt (probably only in the region of the Nile delta), Israel, Lebanon, western Syria, and western Turkey. This close correlation with vegetation suggests that *Ph. n. nana* Fieber also occurs in Greece, southern Turkey, and in the extreme north-west and north-east of Libya. In the region of the Syrian Desert, and probably also in the region of the Anatolian Steppe, this subspecies is immediately replaced beyond its range by *Ph. n. sparsa* Stål; in N. Africa the two forms are of course widely separated by the Sahara Desert.

2. *PHANEROPTERA NANA SPARSA* Stål, 1857, **stat. n.**

Phaneroptera sparsa Stål, 1857, *K. svenska Vetensk. Akad. Handl.* **13,** 170. Holotype ♀, SOUTH AFRICA: Caffraria. In the Naturhistoriska Riksmuseum, Stockholm.

Phaneroptera lurida Walker, 1869, Catalogue of Dermaptera Saltatoria, p. 339. Holotype ♂, W. AFRICA. In the British Museum (Natural History).

Phaneroptera tetrasticta Gerstaecker, 1869, *Arch. naturgesch.*, **35,** 215. Holotype ♂, TANGANYIKA: Uru (Decken). In the Zoologisches Museum of the Humboldt-Universität, Berlin.

Phaneroptera conspersa Stål, 1874, Recensio Orthopterorum **2,** 29. *Nom. nov.* for *Ph. sparsa* Stål, 1857.

Phaneroptera punctulata Burr, 1900, *Proc. zool. Soc. Lond.* **1900,** 41. Holotype ♂, BRITISH SOMALILAND: Whardi Datal, 26.vii.1895 (Peel). In the University Museum, Oxford. **Syn. n.**

Phaneroptera tenuicerca Ramme, 1951, *Mitt. zool. Mus. Berl.* **27,** 348. Holotype ♂, LEBANON: Djezin. In the Zoologisches Museum of the Humboldt-Universität, Berlin. **Syn. n.**

Diagnosis

♂♀. Fore wing-length/hind femur-length ratio less than 1·1, fore wings usually not reaching hind knees. Lateral pronotal lobes as in Figs. 54 & 55, about as deep as long, often tumescent in posterior part in tropical specimens. Male cerci as in Fig. 100 (*d*)–(*f*), more sharply incurved and with more attenuate apex than in *Ph. n. nana* Fieber, not swollen near apex, but often constricted in this region, thus giving apex swollen appearance.

Measurements

Males	Females
Total length (20): 27·6–33·1, mean 29·84.	Total length (20): 28·1–36·5, mean 31·64.
Median length of pronotum (20): 2·9–4·0, mean 3·35.	Median length of pronotum (20): 3·1–3·8, mean 3·28.
Length of hind femur (254): 13·9–20·5, mean 16·71.	Length of hind femur (20): 16·5–20·0, mean 18·42.
Maximum vertical width of hind femur (20): 1·6–2·1, mean 1·72.	Maximum vertical width of hind femur (20): 1·7–2·3, mean 1·91.
Length of fore wing (254): 14·3–20·0, mean 16·89.	Length of fore wing (20): 17·5–21·9, mean 19·76.
Length of exposed part of hind wing (20): 8·3–10·5, mean 9·68.	Length of exposed part of hind wing (20): 7·1–10·5, mean 9·42.
	Length of ovipositor (20): 4·0–4·7, mean 4·41.

Discussion

This subspecies may be distinguished from *Ph. n. nana* Fieber by the relative length of the fore wings, and the more sharply incurved and more attenuate male cerci. Its chief feature of interest is the cline in *fw/hf* ratio which occurs across its range and the relationship which this bears to vegetation; an adequate discussion of this has been given above.

Ph. n. sparsa Stål shows distinct geographical variation in other characters, the most important of which is the coloration of the male stridulatory organ. All the males available from Aldabra and the Seychelles had the black spot situated at the distal end of Cu_2 in the left fore wing much enlarged; in some specimens the spot near the base of Cu_2 was also enlarged, often making the spots more or less confluent. In many of the Madagascan males this process

was accentuated ; in some specimens there was a broad black band across the base of the left fore wing. This was also true of almost all the South African material. The lateral pronotal lobes of most of the South African specimens were intermediate in shape between those typical of *Ph. n. nana* Fieber and of tropical *Ph. n. sparsa* Stål (see Figs. 53–55). This character showed a similar tendency in the Madagascan material, but the specimens from Aldabra and the Seychelles had lateral pronotal lobes similar to those of tropical *Ph. n. sparsa* Stål. Thus this character and the coloration of the stridulatory organ are both varying geographically but in different ways. The change in shape of the pronotum is gradual, but the difference in coloration of the male stridulatory organ is abrupt and was carefully considered as grounds for further subspecific differentiation. This course has been rejected for the time being, as no good supporting characters are shown, and the material available at present is inadequate for a satisfactory assessment of the reliability of the coloration of the stridulatory organ as a racial characteristic. It should be noted, however, that if further material shows that a subdivision of *Ph. n. sparsa* Stål would be useful the South African–Malagasian subspecies would retain this name (type locality : Caffraria) and the tropical African subspecies would take the name of the next available synonym, i.e. *Ph. lurida* Walker, 1869 (type locality : W. Africa).

Examination of the type specimens of *Ph. punctulata* Burr and *Ph. tenuicerca* Ramme has made it quite clear that these names are synonyms of *Ph. nana* Fieber. In the former case the holotype is a normal specimen of *Ph. n. sparsa* Stål, but *Ph. tenuicerca* Ramme is intermediate between the two subspecies (see p. 25).

Material examined

♀ holotype. ♂ holotype of *Ph. lurida* Walker. ♂ holotype of *Ph. tetrasticta* Gerstaecker. ♂ holotype of *Ph. punctulata* Burr. ♂ holotype and ♀ paratype (same data and depository as holotype) of *Ph. tenuicerca* Ramme.

As over 1,000 specimens of *Ph. n. sparsa* Stål were examined it would be impracticable to list the data of every one. Full data is therefore given only for the countries near the zone where *Ph. n. nana* Fieber and *Ph. n. sparsa* Stål meet ; the remaining countries and islands are listed without further details.

PALESTINE : Tabghah, 6.x.1942 (Lumsden) (1 ♂) ; Haifa, 29.vi.1919 (Barraud) (1 ♀) ; Jerusalem, 21,ix.1922 (Buxton) (1 ♂) ; Ain Farah, nr. Jerusalem, 4.vii.1928 (Ebner) (1 ♂) (coll. Ebner) ; Ferum, 25.vii.1928 (Ebner) (1 ♂) (coll. Ebner) ; SAUDI ARABIA : Bir Sharah, 1.i.1937 (Philby) (1 ♂) ; Arif, 28.xii.1935 (Philby) (2 ♂♂) ; Dhofar, Salalah, aerodrome, 22.ix.1943 (Fitzgerald) (1 ♂) ; Taif, 4,000–5,000 ft., vii.1934 (Philby) (1 ♂, 1 ♀) ; Taif, 22.ix.1930 (Philby) (1 ♂) ; Salya, 17° 10′ N., 42° 40′ E., iii.1945 (Waterston) (1 ♀) ; YEMEN ; ADEN ; CANARY IS. ; SOCOTRA ; FRENCH WEST AFRICA ; GAMBIA ; SIERRA LEONE ; GOLD COAST ; NIGERIA ; FERNANDO POO ; FRENCH EQUATORIAL AFRICA ; ANGLO-EGYPTIAN SUDAN ; ERITREA ; ETHIOPIA ; BRITISH SOMALILAND ; BELGIAN CONGO ; UGANDA : KENYA ; TANGANYIKA ; ZANZIBAR ; ANGOLA ;

NORTHERN RHODESIA ; SOUTHERN RHODESIA ; NYASALAND ; MOZAMBIQUE ; SOUTH-WEST AFRICA ; BECHUANALAND ; SOUTH AFRICA ; MADAGASCAR ; ALDABRA ; SEYCHELLES.

All in the British Museum (Natural History) unless otherwise stated.

Distribution (Fig. 101)

This subspecies covers Africa south of the Sahara Desert, western and southern Saudi Arabia, and extends northwards through the Levant, probably to eastern and central Turkey, and possibly to southern Armenia. It occurs on the Canary Is., Socotra, Madagascar, and some of the other islands of the western Indian Ocean. The northern boundary of the range is at present very poorly known ; possible evidence on this subject is given by the next species, *Ph. bivittata* Bei-Bienko.

2. *PHANEROPTERA BIVITTATA* Bei-Bienko, 1954

Phaneroptera bivittata Bei-Bienko, 1954, Fauna of the U.S.S.R., *Fauna Rossii* (New Series), Orthoptera **2** (2), 74. Holotype ♂, ARMENIA : Dhuga, nr. Dzhulfa, on R. Araks, 4.vii.1931 (Riabov). In the Zoological Museum of the U.S.S.R. Academy of Sciences, Leningrad.

Original description (translated from Russian)

♂. Body not large, delicate, pale green. Apex of vertex slightly broadened at the base, with a long, narrow, longitudinal sulcus, which reaches to the anterior end. Antennae pale. Pronotum relatively small, usually with a pale longitudinal stripe on the sides ; disc moderately convex in anterior two-thirds, flat in posterior part ; lateral lobes not forming an angle with the disc, as long as high, their posterior margin obliquely bow-like, lower margin also distinctly oblique. Elytra quite or almost reaching the apex of the hind femur, rather narrow, slightly broadened at the base ; costal area with moderately thick irregular veinlets, except the apical part, which, as well as the neighbouring part of the subcostal area, has rather sparse, partly regular, transverse veinlets ; stridulatory organ of male not projecting over margin of elytron, brownish-yellow, without black spots ; area along anal margin is basally the same width as the apex of the stridulatory organ, semi-pellucid, with irregular venation, becoming gradually narrower, pellucid, not darkening, with fairly regular transverse veinlets beyond the middle of the elytron. Wings pellucid, with brown main longitudinal veins. Anterior tibia 1·9–2 times as long as pronotum. Supra-anal plate of male small, almost square, with slightly rounded posterior margin and parallel sides, its postero-lateral angles slightly rounded and very slightly downcurved, giving the impression of slight thickening. Male cercus slender, strongly arcuate, moderately conical in basal half, then cylindrical, slightly flattened in apical part, very gradually tapering towards acute apex, which has the appearance of an attenuated, flat, straight, spine ; the spine itself is not black, but at least the tip is brownish. Subgenital plate of male with straight parallel sides in apical part, its posterior margin with a distinct obtusangulate or rectangulate incision and acutangulate lobes. Length of body of male 11·5–13·5, pronotum 2·8–3·1, elytron 16·5–18·5, hind femur 16–17 mm.

♀ unknown.

Discussion

The type material of this species was not available for study, but from the description it closely resembles *Ph. nana* Fieber, differing by the absence of black spots on the stridulatory organ, the parallel-sided subgenital plate, and the more gradually tapering cerci. In view of these slight differences, and bearing in mind the variation, both individual and geographical, shown by *Ph. nana* Fieber, it is quite possible that *Ph. bivittata* Bei-Bienko is no more than a further subspecies of *Ph. nana* Fieber, or perhaps an infrasubspecific variant of it. It should be noted that the range of *Ph. n. sparsa* Stål, with which *Ph. bivittata* Bei-Bienko agrees well in the shape of the pronotum and cerci, extends northwards through Arabia and across the Syrian Desert ; its northern limit cannot yet be definitely fixed, and it is quite possible that it reaches into the Anatolian Steppe country of southern Armenia in the form of *Ph. bivittata* Bei-Bienko. This question can only be settled by more extensive collecting in the critical area of the Middle-East.

Distribution

Ph. bivittata Bei-Bienko is so far only known from southern Armenia and southern Turkmenistan.

3. *PHANEROPTERA NIGROPUNCTATA* Chopard, 1955

Phaneroptera nigropunctata Chopard, 1955, South African Animal Life, **2**, 269. Holotype ♂, SOUTH AFRICA: Cape Province, Drakensbergen, 8 miles E.N.E. of Rhodes, 10.iii.1951 (Brinck & Rudebeck). In the Universitetets Zoologiska Institution, Lund.

Diagnosis

♂. Very similar to *Ph. n. sparsa* Stål, but hind tibiae with less than 35 external dorsal spines, which are larger than in *Ph. n. sparsa* Stål (see Fig. 48). Frons with few dark spots. Antennae with dark bands. Lateral pronotal lobes as in Fig. 56. Supra-anal and subgenital plates as in *Ph. n. sparsa* Stål.

♀. As male, except for genitalia.

Measurements

Males	Females
Total length (2) : 25·0–25·5, mean 25·25.	Total length (2) : 28·1–29·6, mean 28·85.
Median length of pronotum (2) : 3·0–3·1, mean 3·05.	Median length of pronotum (1) : 3·3.
Length of hind femur (2) : 15·1–15·3, mean 15·20.	Length of hind femur (2) : 16·2–16·4, mean 16·30.
Maximum vertical width of hind femur (2) : 1·7–1·7, mean 1·70.	Maximum vertical width of hind femur (2) : 1·8–1·9, mean 1·85.
Length of fore wing (2) : 15·6–15·6, mean 15·60.	Length of fore wing (2) : 18·1–19·2, mean 18·65.
Length of exposed part of hind wing (2) : 6·3–6·3, mean 6·30.	Length of exposed part of hind wing : (2) 6·6–8·3, mean 7·45.
	Length of ovipositor (2) : 5·6–5·7, mean 5·65.

Discussion

This species is extremely similar to *Ph. n. sparsa* Stål. The most important distinction lies in the smaller number of dorsal spines on the hind tibiae. The shape of the lateral pronotal lobes differs from that usually found in *Ph. n. sparsa* Stål, but is approached to some extent by South African specimens of this subspecies (cf. Figs. 55 & 56).

Material examined

♂ holotype ; 1 ♀ paratype, same data as holotype, also in the Universitetets Zoologiska Institution, Lund.

SOUTH AFRICA : Maluti Mountains, Nyakoesuba, 8,000–9,000 ft., 18–19. ii.1929 (Scott) (1 ♂, 1 ♀). In the British Museum (Natural History).

Distribution

Known only from the Drakensberg mountain ranges in South Africa.

4. *PHANEROPTERA ACACIAE* Chopard, 1954

Phaneroptera acaciae Chopard, 1954, *Trans. R. ent. Soc. Lond.* **105**, 323. Holotype ♂, KENYA : Mandera distr., Rahmu, 3° 55′ N, 41° 14′ E, desert grass and thorn-bush, 19.vi.1944 (Kevan). In the British Museum (Natural History).

Diagnosis

♂. Subgenital plate deeply bifid (Fig. 32). Stridulatory organ (wing-area Cu) forming about quarter of total area of fore wings. More distal part of areas C and Sc and sometimes anterior part of area R_1 translucent in fore wings. Cells of archedictyon of posterior part of fore wings dark brown ; veinlets paler. Supra-anal plate subquadrate (Fig. 74). Cerci as in Fig. 15. Lateral pronotal lobes as in Fig. 57. Spine of fore coxae very small or absent.

♀. As male except for stridulatory organ and genitalia. Ovipositor very large and gently curved, as in Fig. 90 ; dorsal margin smooth or minutely denticulate distally.

Measurements

Male	Females
Total length : 21·1.	Total length (3) : 25·9–27·3, mean 26·70.
Length of hind femur : 13·2	Median length of pronotum (3) : 2·8–3·0, mean 2·91.
Maximum vertical width of hind femur : 1·6.	Length of hind femur (2) : 14·4–15·7, mean 15·05.
Length of fore wing : 12·3.	Maximum vertical width of hind femur (2) : 1·8–1·9, mean 1·85.
	Length of fore wing (3) : 16·8–17·9, mean 17·30.
	Length of exposed part of hind wing (3) : 6·6–7·4, mean 6·87.
	Length of ovipositor (3): 5·7–5·8, mean 5·77.

Discussion

This species may be easily diagnosed by the large stridulatory organ and deeply bifid subgenital plate of the male, and by the disproportionately large and unusually shaped ovipositor of the female. In this latter character, in the appreciably swollen basal part of the mid tibiae (Fig. 3), and in the obsolescence of the anterior coxal spine, this species approaches *Nephoptera* Uvarov. The shape of the pronotum also shows an affinity in this direction, and the species may be looked upon as an intermediate between *Phaneroptera* Serville and *Nephoptera* Uvarov. The fastigium of the vertex, the basal structure of the ovipositor, and the six apical spurs of the hind tibiae, however, necessitate its inclusion in the former genus.

Material examined

♂ holotype : 1 ♀ paratype, KENYA : N.D.F., Mandera, desert grass and thorn-bush, 22.xii.1944 (Kevan).

KENYA : Mandera distr., Damassa, 3° 09′ N., 41° 20′ E., desert grass and thorn-bush, 17.xii.1944 (Kevan) (1 ♀) ; ETHIOPIA : Ogaden, nr. El Mara, 5° 48′ N., 42° 07′ E., 2,000 ft., thorn-bush, 3.vi.1947 (Kevan) (1 ♀).

All in the British Museum (Natural History).

Distribution

The four known specimens of this species, though all with different data, were collected from a small area in north-east Kenya and south-east Ethiopia. It is quite possibly confined to the thorn-bush areas associated with the rivers Juba and Shibeli ; if this is the case the species would doubtless also occur in southern Somalia.

5. PHANEROPTERA PARVA sp. n.

Holotype ♂, BELGIAN CONGO : Kasongo, 25.vi.1918 (Mayné). In the Musée du Congo Belge, Tervuren.

Diagnosis

♂♀. Small, length of fore wings less than 13 mm. in male and less than 15 mm. in female. Hind wings extending beyond fore wings by at least two-thirds length of latter. Male cerci as in Fig. 16, with blunt apex.

Description

♂. Fastigium of vertex moderately compressed, sulcate above, not raised at apex.

Pronotum without lateral carinae, lateral lobes shaped as in Fig. 58. Spine of fore coxae usually well-developed, of moderate length. Fore tibiae with 2–4 external spurs, including 1 or 2 apical ones. Mid tibiae with 4–5 external spurs. Hind femora unarmed, or occasionally with 1 or 2 ventral spinules near apex, extending well beyond fore wings, often by third length of latter. Hind tibiae with 60–70 external dorsal spines, and 3 apical spurs on each side. Fore wings usually with distinct bifurcate R_s, which is sometimes fused with MA for short distance. Hind wings extending beyond fore wings by at least two-thirds length of latter.

Tenth abdominal tergite unmodified. Supra-anal plate subquadrate, usually similar to Fig. 75. Cerci of moderate length, narrowest about halfway along length, evenly curved to apex, where curve is usually slightly more abrupt ; apex blunt (Fig. 16). Subgenital plate as in Fig. 33, median apical incision obtuse or absent.

Coloration usually green with dark brown or red-brown spots on vertex, pronotum, thoracic pleura, large part of legs, and abdominal tergites. Tarsi rather darker in colour. Tibial spines and spurs black or black-tipped. Bases of fore wings with four dark spots, three on left fore wing and one on right, and also with dark spot at base of C ; cells darkened along region of $MP+Cu_{1a}$. Hind wings hyaline except for exposed part. Cerci with black tip.

♀. As male except for genitalia and fore wing-bases. Ovipositor very deep at base, rapidly tapering to apex ; distal three-quarters of dorsal margin and distal fifth of ventral margin crenulate or denticulate. Base of each fore wing usually with dark spot by pronotal hind margin, and another in region where Cu_{1b} meets Cu_2.

Measurements

Males	Females
Total length (6) : 20·9–23·5, mean 22·55.	Total length (6) : 24·1–26·2, mean 25·02.
Median length of pronotum (6) : 2·2–2·5, mean 2·38.	Median length of pronotum (5) : 2·3–2·5, mean 2·41.
Length of hind femur (6) : 13·3–14·8, mean 14·08.	Length of hind femur (5) : 13·8–14·6, mean 14·02.
Maximum vertical width of hind femur (6) : 1·4–1·6, mean 1·52.	Maximum vertical width of hind femur (5) : 1·5–1·7, mean 1·62.
Length of fore wing (6) : 10·2–12·3, mean 11·45.	Length of fore wing (6) : 12·7–14·0, mean 13·38.
Length of exposed part of hind wing (5) : 8·3–9·3, mean 8·72.	Length of exposed part of hind wing (6) : 8·6–9·5, mean 9·17.
	Length of ovipositor (6) : 3·3–3·9, mean 3·57.

Variation

The fore coxal spine varies in its degree of development. There is much variation in the armature of the tibiae. The venation of the fore wings is rather variable. The male supra-anal plate varies in size, and the male cerci vary a little in shape, especially at their apices. The ovipositor varies considerably in the extent of the crenulation, and somewhat in size. The black marks at the bases of the female fore wings vary in extent and prominence.

Discussion

This species has the general appearance of a small version of *Ph. n. sparsa* Stål. It may, however, be easily distinguished from that species by the male cerci and by the relatively very long hind wings, which extend beyond the fore wings by two -thirds or more of the length of the latter.

Material examined

♂ holotype ; 1 ♂ paratype, same data as holotype ; 1 ♂ paratype, BELGIAN CONGO : Lualaba, Kabelwe, 24.vi.1947 (Poll) ; 1 ♂ paratype, BELGIAN CONGO : Stanleyville, 18.ii.1928 (Collart) ; 1 ♀ paratype, BELGIAN CONGO : Katanga, Kindu, 1950 (Dierckx) ; 1 ♂ (Mus. Congo Belge) and 2 ♀ (1 Mus. Congo Belge, 1 British Museum (Natural History)), paratypes, BELGIAN CONGO : Gandajika, 29.viii.1950 (Francquen) ; 1 ♂ and 2 ♀ paratypes, N. NIGERIA : Gombe, Matyoro Lakes, i.1929 (Lloyd) ; 1 ♀ paratype, NYASALAND : Fort Johnston.

All in the British Museum (Natural History) unless otherwise stated.

Distribution

The data given above suggests a distribution covering most of tropical Africa.

6. PHANEROPTERA MAGNA sp. n.

Holotype ♂, UGANDA: Mabira Forest, vi.1934 (Johnston). In the British Museum (Natural History).

Diagnosis

♂♀. Large, total length more than 34 mm. in male and more then 37 mm. in female. Male cerci as in Fig. 17, rather swollen towards base. Male subgenital plate as in Fig. 34, median apical incision rather deep, acute. Ovipositor large, shaped as in Fig. 91, with relatively small denticulation. Antennae pale at base, dark towards apex, intermediate region dark with pale bands.

Description

♂. Fastigium of vertex moderately compressed, sulcate above, hardly or not at all raised at apex.

Pronotum without lateral carinae, lateral lobes shaped as in Fig. 59. Spine of fore coxae relatively rather small, occasionally very reduced or absent. Fore tibiae with 4–5 external spurs, including 1 or 2 apical ones. Mid tibiae with 6–9 external spurs. Hind femora unarmed. Hind tibiae with 40–70 external dorsal spines, and 3 apical spurs on each side. Fore wings with distinct bifurcate, occasionally three-branched, R_s, which is free from MA. Hind wings extending beyond fore wings by between third and half length of latter.

Tenth abdominal tergite unmodified. Supra-anal plate usually similar to Fig. 73, showing tendency to form three posterior angles. Cerci as in Fig. 17, rather swollen towards base. Subgenital plate as in Fig. 34, median apical incision rather deep, acute.

Coloration usually green and brown, sometimes variegated with orange or black. Vertex, pronotum, thoracic pleura, and part of legs and abdominal tergites, with dark spots. Tarsi and distal ends of tibiae usually rather darker in colour. Antennae pale at base, dark towards apex, intermediate region dark with pale bands. Hind tibiae sometimes with dark band near proximal end. Tibial spines and spurs black or black-tipped. Cells of posterior part of fore wings usually darkened. Hind wings hyaline except for exposed part. Cerci with black tip.

♀. As male except for genitalia and fore wing-bases. Ovipositor large, shaped as in Fig. 91, with relatively small denticulation along most of dorsal margin and along distal extremity of ventral margin.

Measurements

Males	Females
Total length (4): 35·1–37·4, mean 36·00.	Total length (4): 38·6–39·6, mean 39·20.
Median length of pronotum (4): 3·7–3·9, mean 3·81.	Median length of pronotum (5): 3·8–4·2, mean 4·03.
Length of hind femur (4): 19·8–21·2, mean 20·45.	Length of hind femur (3): 22·2–24·9, mean 23·50.
Maximum vertical width of hind femur (4): 2·0–2·2, mean 2·09.	Maximum vertical width of hind femur (3): 2·4–2·5, mean 2·47.
Length of fore wing (4): 20·7–22·4, mean 21·75.	Length of fore wing (5): 24·2–25·8, mean 24·98.
Length of exposed part of hind wing (4): 10·1–10·6, mean 10·30.	Length of exposed part of hind wing (4): 9·3–10·8, mean 9·92.
	Length of ovipositor (5): 6·3–7·0, mean 6·47.

Variation

The fore coxal spine varies considerably in its degree of development from being quite absent to being fairly well-developed though only of very moderate length. There is much variation in the armature of the tibiae. The coloration is very variable : one female specimen examined had a broad black band along the posterior part of each fore wing.

Discussion

This species has the general appearance of a large version of *Ph. n. sparsa* Stål, from which, however, it may be distinguished by the male cerci and subgenital plate, the large ovipositor, and the pale-banded antennae.

The fact that only ten specimens of this large species were found among about a thousand specimens of *Phaneroptera* Serville from tropical Africa suggests that it is uncommon or possibly very localized by its ecological requirements.

Material examined

♂ holotype ; 1 ♂ paratype, same data as holotype ; 1 ♂ paratype, FRENCH EQUATORIAL AFRICA : Lolodorf (Conradt) (Zool. Mus. Berlin) ; 2 ♀ paratypes, UGANDA : Entebbe, 11.viii.1910 (Gowdey) ; 1 ♀ paratype, UGANDA : Entebbe, 16.viii.1911 (Gowdey) ; 1 ♀ paratype, ANGOLA : Congulu, iv. 1934 (Jordan) ; 1 ♂ paratype, BELGIAN CONGO : Eala, viii.1936 (Ghesquière) (Mus. Congo Belge).

BELGIAN CONGO : Mwilambongo, 1947 (Imelda) (1 ♀) (Mus. Congo Belge) ; Beni (Bonnevie) (1 ♀) (Mus. Congo Belge).

All in the British Museum (Natural History) unless otherwise stated.

Distribution

The known range stretches from the Cameroons across equatorial Africa to Lake Victoria, and southwards as far as Angola.

7. PHANEROPTERA MACULOSA sp. n.

Holotype ♂, FRENCH EQUATORIAL AFRICA : Lolodorf (Conradt). In the Zoologisches Museum of the Humboldt-Universität, Berlin.

Diagnosis

♂. Vertex strongly convex, fastigium sloping steeply to frons (Fig. 87). Coloration orange-brown, conspicuously mottled with dark brown and black. Antennae dark brown with pale bands. Lateral pronotal lobes shaped as in Fig. 60. Cerci as in Fig. 18.

Description

♂. Vertex strongly convex, fastigium somewhat compressed, sulcate above, sloping steeply to frons (Fig. 87).

Pronotum without lateral carinae, lateral lobes shaped as in Fig. 60. Spine of fore coxae rather small. Fore tibiae with 4–5 external spurs, including 1 or 2 apical ones. Mid tibiae with about 8 external spurs. Hind femora with 2–3 ventral spinules towards apex. Hind tibiae with 60–70 external dorsal

spines, and three apical spurs on each side. Fore wings with distinct bifurcate R_s, which is free from MA. Hind wings extending beyond fore wings by about half length of latter.

Tenth abdominal tergite unmodified. Supra-anal plate similar to Fig. 73. Cerci as in Fig. 18, their minimum width about two-thirds length from base. Subgenital plate similar to Fig. 31.

Coloration orange-brown, mottled with dark brown and black. Frons with dark markings. Pronotum with two median black spots ; lateral lobes with two ventral pale marks and one posterior pale mark. Tibial spines and spurs mostly black or black-tipped. Tarsi and distal ends of tibiae dark-coloured. Hind wings hyaline except for exposed part. Cerci pale with black tip.

♀ unknown.

Measurements

Male

Total length : 32·6.
Median length of pronotum : 3·1.
Length of hind femur : 18·6.
Maximum vertical width of hind femur : 1·8.
Length of fore wing : 18·5.
Length of exposed part of hind wing : 10·2.

Discussion

The unique holotype of this species is remarkable for its conspicuously mottled coloration, which is not approached elsewhere in the genus. This appearance, however, may not be typical of the species, which may also be diagnosed by the strongly convex vertex with its steeply sloping fastigium, and by the shape of the lateral lobes of the pronotum.

Material examined

The holotype is unique.

8. **PHANEROPTERA LONGISPINA** sp. n.

Holotype ♂, UGANDA : Ruwenzori Range, Kilembe, 4,500 ft. (Edwards). In the British Museum (Natural History).

Diagnosis

♂♀. Dorsal spines of hind tibiae large and widely spaced (Fig. 49). Lateral pronotal lobes shaped as in Fig. 61. Male cerci as in Fig. 19. Male subgenital plate as in Fig. 35.

Description

♂. Fastigium of vertex small, hardly compressed, sulcate above, not raised at apex.

Pronotum without lateral carinae, lateral lobes shaped as in Fig. 61. Spine of fore coxae rather small. Fore tibiae with 3–4 external spurs, including 1 or 2 apical ones. Mid tibiae with about 5 external spurs. Hind femora unarmed. Hind tibiae with 20–30 large, widely spaced, external dorsal spines (Fig. 49),

and three apical spurs on each side. Fore wings with distinct bifurcate or three-branched R_s, which is free from MA. Hind wings extending beyond fore wings by less than third length of latter.

Tenth abdominal tergite unmodified. Supra-anal plate similar to Fig. 73. Cerci as in Fig. 19. Subgenital plate as in Fig. 35.

Coloration green, without conspicuous dark spots on body. Tibial spurs and spines black or black-tipped. Left fore wing with large dark brown mark in region of Cu_2, and both fore wings with black spot in region where MP fuses with Cu_{1a}, black spot at base of C, and black spots along more distal part of hind margin. Hind wings hyaline except for exposed part. Cerci with black tip.

♀. As male except for genitalia and fore wing-bases. Ovipositor with distinct angle near base of dorsal margin ; part beyond this angle crenulate or denticulate, as is distal quarter of ventral margin. Base of each fore wing with dark spot in region where Cu_{1b} meets Cu_2.

Measurements

Male	Female
Total length : 27·6.	Total length : 25·4.
Median length of pronotum : 3·9.	Median length of pronotum : 3·7.
Length of hind femur : 18·9.	Length of hind femur : 18·1.
Maximum vertical width of hind femur : 2·4.	Maximum vertical width of hind femur : 2·4.
Length of fore wing : 18·0.	Length of fore wing : 17·5.
Length of exposed part of hind wing : 5·2.	Length of exposed part of hind wing : 3·9.
	Length of ovipositor : 5·0.

Discussion

The large, widely spaced, hind tibial spines are unique in the genus.

In view of the type locality it is possible that this species is confined to the higher regions of E. Africa.

Material examined

♂ holotype ; 1 ♀ paratype, BELGIAN CONGO : Mt. Ruwenzori, Kalunga, 6.vii.1935 (Brédo), also in the British Museum (Natural History).

9. *PHANEROPTERA ALBIDA* Walker, 1869

Phaneroptera albida Walker, 1869, Catalogue of Dermaptera Saltatoria, p. 335. Holotype ♂, no data. In the British Museum (Natural History).

Diagnosis

♂. Hind tibiae with two apical spines on each side (as in Fig. 8). Pronotal disc with white band along each lateral margin ; lateral pronotal lobes with ventral white band. Precostal and costal areas of fore wings translucent and whitish, with comparatively sparse venation. Hind femora whitish externally in basal half. Sc of fore wing not darkened. Pronotal disc without median dark band. Lateral pronotal lobes shaped as in Fig. 62. Supra-anal plate as in Fig. 76. Cerci as in Fig. 20. Subgenital plate as in Fig. 36.

♀. As male except for genitalia.

Measurements

Males	Females
Total length (13): 27·3–31·0, mean 29·35.	Total length (17): 29·7–35·0, mean 31·58.
Median length of pronotum (11): 3·0–3·3, mean 3·12.	Median length of pronotum (14): 2·9–4·0, mean 3·12.
Length of hind femur (12): 15·0–18·9, mean 17·20.	Length of hind femur (17): 16·7–21·1, mean 18·41.
Maximum vertical width of hind femur (13): 1·4–1·6, mean 1·48.	Maximum vertical width of hind femur (17): 1·5–1·8, mean 1·69.
Length of fore wing (13): 15·6–18·4, mean 17·31.	Length of fore wing (19): 17·2–21·5, mean 19·35.
Length of exposed part of hind wing (13): 8·6–10·2, mean 9·08.	Length of exposed part of hind wing (17): 8·2–10·3, mean 9·08.
	Length of ovipositor (19): 4·2–4·8, mean 4·35.

Discussion

For the prolonged confusion of this species with *Ph. minima* Brunner, see under the latter species. As far as is known at present, *Ph. albida* is unique in the genus in having only two apical spurs on each side of the hind tibiae, instead of the usual three. This suggests an affinity with the related genera *Nephoptera* Uvarov and *Eulioptera* gen. n,. but the vertex, wings, genitalia, and all other characters, are typical of *Phaneroptera* Serville.

Material examined

♂ holotype.

SAUDI ARABIA: Taif, 6.ix.1934 (Philby) (1 ♂); Najrah, x.1936 (Philby) (2 ♂♂); Ashaira, iv–v.1936 (Philby) (2 ♂♂); Hawi Valley, v.1936 (Philby) (1 ♂); Mecca, ii.1931 (Philby) (1 ♂, 1 ♀); Jidda, ii.1926 (Philby) (1 ♂, 1 ♀); Asir, Bisha, on *Acacia*, vi.1946 (Vesey-Fitzgerald) (1 ♂); Makhari, 17.ii.1946 (Thesiger) (1 ♀); Jidda, ii.1928 (Philby) (1 ♀); Shaira, i.1952 (Townsend) (1 ♀); ——— (Vesey-Fitzgerald) (1 ♂); Buraiman, at light, 18.vii.1944 (Waterston) (1 ♀); ADEN: Makhnug, at light, x.1935 (Darling) (3 ♀♀); PAKISTAN: Las Bela, Kalmat, x.1933 (1 ♂); FRENCH SOMALILAND: Lake Abbe, 28.i.1954 (Popov) (2 ♀♀); ANGLO-EGYPTIAN SUDAN: Um Darag, at light, 28.iii.1933 (Darling) (1 ♀); FRENCH EQUATORIAL AFRICA: Tibesti, Tao, 8.iii.1953 (Guichard) (1 ♂, 2 ♀♀); Tibesti, Wadi Tao, 13.iii.1953 (Guichard) (1 ♀); Tibeste, Zouarke, iv.1953 (Guichard) (1 ♂); LIBYA: Jebel Fezzan, 10 miles north of Brak, 12.v.1952 (Guichard) (1 ♂, 3 ♀♀); MOROCCO: Tafilalet, Erfoud, 15.v.1933 (Rungs) (1 ♀).

All in the British Museum (Natural History).

Distribution (Fig. 102)

Ph. albida Walker is a desert form ranging right across the Sahara from Morocco to Somaliland, Arabia, and the Persian plateau. It is quite possible that its range extends to Uzbekistan and south Kazakhstan.

10. *PHANEROPTERA MINIMA* Brunner, 1878

Phaneroptera minima Brunner, 1878, Monographie der Phaneropteriden, p. 214. Holotype ♂, EGYPT. In the Zoologisches Museum of the Humboldt-Universität, Berlin.

Phaneroptera albida Walker, Uvarov, 1924, *Bull. Minist. Agric. Egypt* **41**, 9.

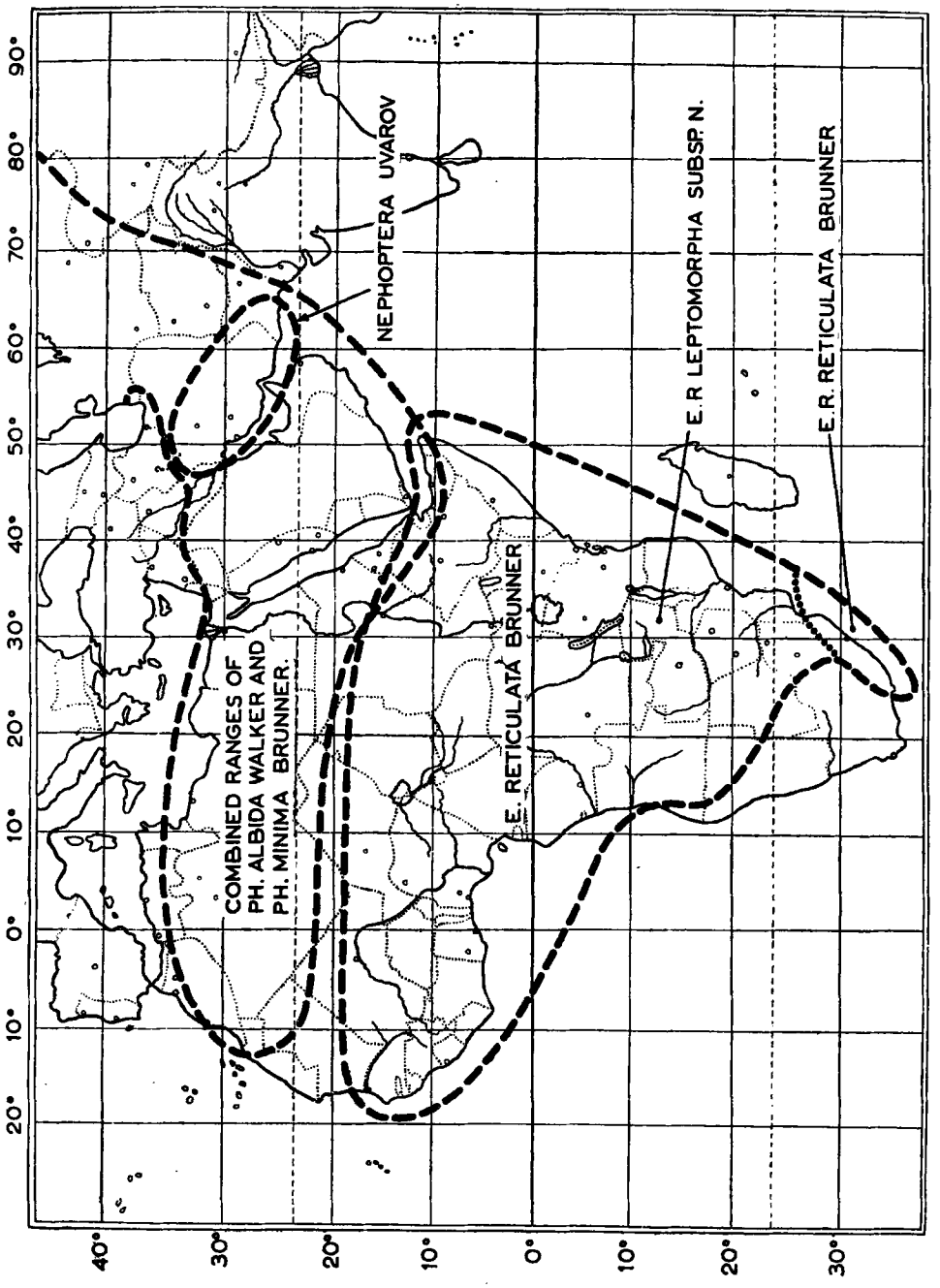


Fig. 102.—Map showing the approximate distribution of *Phaneroptera albida* Walker, *Ph. minima* Brunner, *Euliopteraa reticulata* Brunner, and *Nephoptera* Uvarov.

Diagnosis

♂. Sc (and sometimes R) of fore wing dark-coloured for part of its length. Precostal and costal areas of fore wing translucent and whitish, with comparatively sparse venation. Pronotal disc usually with central dark mark or stripe, its lateral margins sometimes whitish ; lateral pronotal lobes without ventral white band. Bases of C, R, and M, darkened in fore wings ; fore wings with dark spot in region where Cu_{1a} fuses with MP. Tarsi usually rather dark in colour, especially third segment. Hind femora sometimes with transverse dark bands, and darkened subapically. Lateral pronotal lobes as in Fig. 63. Supra-anal plate as in Fig. 77. Cerci as in Fig. 21. Subgenital plate as in Fig. 37.

♀. As male except for genitalia and fore wing-bases. Fore wings similar in coloration to male, but without dark spot in region where Cu_{1a} fuses with MP.

Measurements

Males	Females
Total length (20) : 23·5–27·0, mean 25·80.	Total length (20) : 23·3–30·7, mean 28·30.
Median length of pronotum (20) : 2·9–3·4, mean 3·08.	Median length of pronotum (20) : 2·9–3·5, mean 3·23.
Length of hind femur (20) : 13·1–16·5, mean 15·22.	Length of hind femur (20) : 14·0–17·9, mean 16·35.
Maximum vertical width of hind femur (20) : 1·5–1·9, mean 1·61.	Maximum vertical width of hind femur (20) : 1·5–2·0, mean 1·80.
Length of fore wing (20) : 14·2–16·1, mean 15·04.	Length of fore wing (20) : 15·9–19·3, mean 17·51.
Length of exposed part of hind wing (20) : 6·4–8·4, mean 7·78.	Length of exposed part of hind wing (20) : 6·9–9·0, mean 8·02.
	Length of ovipositor (20) : 3·6–4·3, mean 3·91.

Discussion

In 1924 Uvarov synonymized this species with *Ph. albida* Walker, and for thirty years the two species have been regarded as one. Examination of the types, however, at once revealed that they were specifically distinct. *Ph. minima* Brunner may be easily distinguished from *Ph. albida* Walker by the six apical spurs on each hind tibia, the dark-coloured Sc (and sometimes R) of the fore wings, and the longitudinal dark band in the middle of the pronotal disc (this latter character, however, not being invariably present). The confusion of the two species has been facilitated by their similar general facies, ecological requirements, and distribution.

Material examined

♂ holotype.

TURKMENISTAN : Great Balkhan (1 ♀) (Nat. Mus. Vienna) ; SAUDI ARABIA : Hanakiya, 14–15.iv.1944 (Vesey-Fitzgerald) (1 ♀) ; Tihama, Qunfida area, iv.1950 (Guichard) (1 ♂, 2 ♀♀) ; Tihama Sabata, nr. Wadi Hali, 23.iv.1950 (Guichard) (1 ♀) ; Jidda, 28.vii.1944 (Waterston) (1 ♀) ; Huweris, iii-iv.1945 (Waterston) (1 ♂, 1 ♀) ; Lith, 8.xii.1944 (Popov) (2 ♂♂, 1 ♀) ; 40 miles north of Lith, 27.iii.1948 (Uvarov) (6 ♂♂, 1 ♀) ; Lith, 22.xi.1944 (Waterston) (2 ♂♂) ; Wadi Qanuna, nr. Qunfida, 31.iii.1948 (Uvarov) (1 ♂) ; Jidda, 3.v.1929 (Philby) (1 ♂) ; Madach Salih, v.1946 (Popov) (1 ♂) ; Asir, Ardha,

26.xi.1947 (Popov) (1 ♀); Jidda to Lith, 13.iii.1948 (Popov) (1 ♀); Hejaz, x–xi.1945 (Vesey-Fitzgerald) (1 ♀); S. Hedjaz, Qui'iya, 18.ix.1931 (Philby) (1 ♀); Madain Salih, iv.1946 (Vesey-Fitzgerald) (1 ♀); ADEN: Sheikh Othman, iv–x.1932 (Rant) (8 ♂♂, 1 ♀); 10 miles north of Aden, ix–x.1932 (Rant) (3 ♂♂, 2 ♀♀); Aden, vii.1932 (Rant) (3 ♀♀), Aden, xii.1898 (Simony) (1 ♀) (Nat. Mus. Vienna); YEMEN: Red Sea coast, nr. Hodeida, from succulent plant on sand-dunes, 12–14.iii.1938 (Scott & Britten) (1 ♂); BRITISH SOMALILAND: Berbera, 26.viii.1929 (Collenette) (1 ♂); Haud, 2,000 ft., 13.iii.1932 (Taylor) (1 ♀); ERITREA: Tai Shamar, 21.iv.1950 (Waloff) (1 ♀); Emberemi, vi–xi.1955 (Greathead) (1 ♂, 1 ♀); ANGLO-EGYPTIAN SUDAN: Ashat, 11.iv.1934 (Darling) (1 ♀).

All in the British Museum (Natural History) unless otherwise stated.

Distribution (Fig. 102)

Like *Ph. albida* Walker a desert form, this species is known from north-east Africa, Arabia, and as far north as Turkmenistan. It is quite possible that its range extends across the Sahara to Algeria and Morocco, and in the north-easterly direction perhaps as far as Lake Balkhash.

11. *PHANEROPTERA CRETACEA* Uvarov, 1929

Phaneroptera cretacea Uvarov, 1929, *Annu. Mus. zool. Acad. St. Pétersb.* **30**, 629. Holotype ♂, S. E. PERSIA: Bampur and environs, 12.iv.1901 (Zarudnyj). In the Zoological Museum of the U.S.S.R. Academy of Sciences, Leningrad.

Diagnosis

♂. Pronotal disc with white band along each lateral margin; lateral pronotal lobes with ventral white band. Costal area of fore wings translucent and white, with comparatively sparse venation. Cerci undulate in apical third, not smoothly tapering to sharp point. Fastigium of frons roundly obtuse.

♀. As male except for genitalia.

Description given by Bei-Bienko (1954) (translated from Russian)

Body small, with characteristic pattern of white longitudinal stripes in the sides of the disc and on the lower margin of the lateral lobes of the pronotum, as well as along the anterior and posterior margins of the elytra. Head white; apex of vertex short, triangular, with sulcus and thick lateral margins. Apex of frons not acutangulate, with roundly obtuse apex. Pronotum with broad median dorsal longitudinal stripe of a brownish green colour, with reddish dots, and with similar slightly oblique stripe along lateral lobes. Lateral lobes as long as high, with broadly rounded posterior margin. Elytra scarcely reaching hind knee, narrow; white costal margin with sparse, irregular, transverse veinlets; median dark stripe composed of thick net of greenish veinlets, and brownish spots inside cells. Base of stridulatory organ brownish. Anterior coxa with short, thick, spine. Supra-anal plate of male moderately large, almost transverse, partly covering base of cerci, its posterior margin projecting slightly, arcuate. Male cercus long, thin, arcuately incurved, undulate in apical third, apical part without separate spine, appearing spine-like in lateral view and compressed, acutangulate, in posterior view. Female cercus elongate, conical, noticeably curved, slightly shorter than maximum width of ovipositor. Male subgenital plate short, rather broad, parallel-sided in apical

part, tectiformly raised in the middle, its posterior margin with rectangular incision and thin, shallow, median slit. Subgenital plate of female elongate, triangular, with roundly obtuse apex. Ovipositor short, broad, its length scarcely more than twice its maximum width, its upper margin curved at the base in an indistinct obtuse angle ; lower valve slightly narrowed at the base ; lateral fold weak, in the form of a slightly thickened and slightly raised margin. passing a short distance from the lower margin of the upper lobe. Length of body ♂ 12·5, ♀ 14 ; pronotum ♂, ♀ 2·8 ; elytra ♂ 17, ♀ 18·5 ; ovipositor 4·6 mm.

Discussion

The holotype of this species was not available for study, and no definite conclusions can therefore be drawn. According to the original description there is a strong resemblance in coloration to *Ph. albida* Walker. The fastigia of the vertex and frons, however, and the male cerci, appear to be quite different, and there can be little doubt as to the validity of the species. It would be very interesting to know whether *Ph. cretacea* Uvarov has the four apical hind tibial spurs of *Ph. albida* Walker or the six found in the rest of the genus. In the former case *Ph. cretacea* Uvarov would probably represent a comparatively recent modification of *Ph. albida* Walker, arising at the eastern end of the latter's range.

Ph. cretacea Uvarov is the only species of the genus so far recorded from Persia.

Distribution

Known only from Persia, where it is probably widely distributed.

12. *PHANEROPTERA GRACILIS* Burmeister, 1838

Phaneroptera gracilis Burmeister, 1838, Handbuch der Entomologie, p. 690. 1 ♂ cotype and 2 ♀ cotypes, JAVA. Possibly in the Zoologisches Institut of the Martin-Luther-Universität, Halle.

Phaneroptera roseata Walker, 1869, Catalogue of Dermaptera Saltatoria, p. 343 ; Uvarov, 1924, *Bull. Minist. Agric. Egypt* **41**, 9. Holotype ♀, N. INDIA. In the British Museum (Natural History). **Syn. n.**

Phaneroptera marginalis Brunner, 1878, Monographie der Phaneropteriden, p. 214. Holotype ♀, SOUTH AFRICA. In the Zoologisches Museum of the Humboldt-Universität, Berlin. **Syn. n.**

Phaneroptera indica Brunner, 1878, op. cit., p. 215. 1 ♂ cotype and 1 ♀ cotype, INDIA : Himalayas (Hügel). In the Naturhistorisches Museum, Vienna.

Phaneroptera elongata Brunner, 1878, op. cit., p. 217. Lectotype ♀, JAVA (Meyer-Dürr) ; in the Naturhistorisches Museum, Vienna. Co-type ♀, AMBOINA (Felder) ; in the Zoologisches Museum of the Humboldt-Universität, Berlin. **Syn. n.**

Phaneroptera subcarinata Bolivar, 1900, *Ann. Soc. ent. Fr.* **68**, 764. Holotype ♂, INDIA : Madura (Castets). In the Instituto Español de Entomología, Madrid.

Diagnosis

♂. Lateral pronotal lobes longer than deep (Fig. 64). Hind femora very slender, as in Fig. 50. Cerci very long, widening subapically before suddenly tapering to point (Fig. 22). Supra-anal plate as in Figs. 78 & 79. Subgenital plate elongate, as in Fig. 38. Precostal and costal areas of fore wings sometimes translucent, with comparatively sparse venation.

♀. As male except for genitalia.

Measurements

Males	Females
Total length (20) : 29·4–39·0, mean 34·42.	Total length (20) : 31·9–40·2, mean 36·02.
Median length of pronotum (20) : 3·0–4·0, mean 3·56.	Median length of pronotum (20) : 3·3–4·3, mean 3·57.
Length of hind femur (20) : 17·2–22·6, mean 20·26.	Length of hind femur (20) : 18·8–25·2, mean 21·44.
Maximum vertical width of hind femur (20) : 1·3–1·8, mean 1·53.	Maximum vertical width of hind femur (20) : 1·3–1·9, mean 1·51.
Length of fore wing (20) : 15·7–24·2, mean 21·28.	Length of fore wing (20) : 20·1–25·7, mean 22·56.
Length of exposed part of hind wing (20) : 8·3–11·1, mean 9·64.	Length of exposed part of hind wing (20) : 8·5–11·2, mean 9·92.
	Length of ovipositor (20) : 4·3–5·3, mean 4·68.

Discussion

This species is characterized by its elongate form, which is most noticeable in the hind femora and lateral pronotal lobes. The male is easily recognized by the long cerci and subgenital plate.

Ph. gracilis Burmeister has a remarkably extensive range : from Africa, across India and the East Indies, to Australia and the Solomon Is. Not surprisingly, it shows slight geographical variation, and has been given no less than six different names in different parts of its range. The type specimens of all the synonyms listed above have been examined and there is no doubt that they are all conspecific. Karny (1927) found what he believed to be Burmeister's male cotype of *Ph. gracilis* in the Zoologisches Institut of the Martin-Luther-Universität at Halle, but an attempt to unearth this specimen (through the kindness of Mr. L. Kampfe) was not successful ; it is possible that all three cotypes have by now been lost, but, of all the species of *Phaneroptera* Serville known from the type locality, the measurements given by Burmeister agree only with the present one.

It may later be possible to delimit subspecies, but inadequate material makes this inadvisable at present. As in *Ph. nana* Fieber the fore wings tend to decrease in length as the tropics are approached. The fore wing-length/hind femur-length ratio is smallest in tropical Africa and parts of the East Indies, and in the former locality the degree of attenuation reaches a peak. A comparison between the *fw/hf* ratios of male specimens shows a joint non-overlap of about 86 per cent (coefficient of difference : 1·132—see Mayr, Linsley & Usinger, 1953, p. 146) between tropical African material and specimens from the rest of the range (eleven tropical African and twenty-eight others measured).

It is of particular interest that the African material from south of the Sahara is polymorphic. In addition to the normal form there is a form (which will be referred to here as " marginate") with the precostal and costal areas of the fore wing largely or entirely translucent with comparatively sparse venation and whitish in colour. Of the twenty-four specimens examined from Ethiopian Africa, thirteen were marginate and eleven normal ; some of the normal ones showed a tendency towards margination and doubtless every intermediate stage occurs. The holotype of *Ph. marginalis* Brunner is marginate.

I have selected and marked a lectotype from the two female cotypes of *Phaneroptera elongata* Brunner.

Material examined

♀ holotype of *Ph. roseata* Walker. ♀ holotype of *Ph. marginalis* Brunner. ♂ cotype and ♀ cotype of *Ph. indica* Brunner. ♀ lectotype and ♀ cotype of *Ph. elongata* Brunner. ♂ holotype and ♀ paratype (same data and depository as holotype) of *Ph. subcarinata* Bolivar.

FRENCH WEST AFRICA : French Sudan, Middle Niger, Diafarabe, ix. 1932 (Lean) (1 ♂) ; NIGERIA : Matyoro Lakes, 25 miles north of Gombe, iii. 1928 (Lloyd) (1 ♀) ; BELGIAN CONGO : Boma, 1937 (Schlesser) (3 ♂♂, 2 ♀♀) (2 ♂♂, 2 ♀♀ in Mus. Congo Belge) ; P. N. A., Ruindi, 18.vi.1937 (Brédo) (1 ♂) ; Banana, 2.viii.1920 (Schouteden) (1 ♂) (Mus. Congo Belge) ; Luki, Mayumbe (Englebert) (1 ♂) (Inst. Sci. Nat. Brux.) ; Kinchassa, v.1899 (Waelbroeck) (1 ♂, 1 ♀) (Inst. Sci. Nat. Brux.) ; Uélle region (Hinthel) (1 ♂) (Inst. Sci. Nat. Brux.) ; Gety, upland grass association, 29.viii.1935 (Johnston) (1 ♂) ; Kasenyi, viii.1935 (Brédo) (1♀) (Mus. Congo Belge) ; ———, 1931–32 (Worthington) (1 ♀) ; Ruanda, Gabiro, 22.iv.1937 (Brédo) (2 ♀♀) ; Bas. Congo, Vista, 1933 (Dartevelle) (1 ♀) (Mus. Congo Belge) ; KENYA : Nairobi, 23.iii.1906 (Sclater) (1 ♂) ; ANGOLA : Loanda, 19.iv.1927 (Burr) (1 ♂) ; Ouirimbo, v.1934 (Jordan) (1 ♀) ; NORTHERN RHODESIA : Mukupa, 21.i.1938 (Brédo) (2 ♂♂) (1 ♂ in Mus. Congo Belge) ; EGYPT : Heluan, 20.ix.1930 (Roszkowski) (1 ♂) ; Minia (1 ♀) ; Meadi, vi–viii.1916 (1 ♂, 1 ♀) ; Belbeis, 1901 (Naire) (1 ♀) (Mus. Hist. Nat. Paris) ; INDIA : Bengal, vii–ix.1909 (1 ♂, 3 ♀♀) ; Bihar, 30.vii.1924 (Mukerjee) (1 ♂) ; Bihar, 9.x.1925 (Saran) (1 ♂) ; Bihar, 28.vi.1915 (Boy) (1 ♀) ; Bengal, Chapra (Mackenzie) (3 ♂♂, 5 ♀♀) ; Pusa botanical area, on tobacco, 11.xii.1934 (Ranji) (1 ♂) ; United Provinces, Fyzabad, 1922 (Hingston) (2 ♂♂, 1 ♀) ; Assam, Lohit Valley, 4,000–5,000 ft., 18.xi.1926 (Kingdon Ward) (1 ♂, 1 ♀) ; Chenat Nair Forest, Palghat, 16.vi.1937 (1 ♂) ; Dohnavur, Tinnevelly distr., 7.iii.1936 (1 ♂) ; Mussoorie, 7,000 ft., viii.1906 (1 ♂) ; Simla, 3,500–5,500 ft., xi–xii.1925 (Jones) (1 ♀) ; Mysore, Shimoga, 1,865 ft., at light, 20.ii.1938 (Nathan) (1 ♂) (coll. Willemse) ; Tanjore distr., Nedungdu, 12.iv.1938 (Nathan) (1 ♀) (coll. Willemse) ; Kumaon, Muktesar, 7,500 ft., vii.1924 (Sen) (1 ♂) ; MALDIVE IS. : Minikoy, 20.vi.1900 (Gardiner) (2 ♂♂, 6 ♀♀) (1 ♂, 5 ♀♀ in Univ. Camb.) ; CEYLON : Colombo, vii–viii. 1928 (2 ♀♀) ; Colombo, 17.iii.1908 (Chopard) (1 ♀) (Mus. Hist. Nat. Paris) ; ———, vi.1889 (Fruhstorfer) (4 ♂♂, 1 ♀) (Zool. Mus. Berlin) ; SIKKIM : ——— (Staudinger) (1 ♂) (Nat. Mus. Vienna) ; BURMA : Mishmi Hills, Minutang, 3,900 ft., 20.ii.1935 (Steele) (2 ♂♂) ; Mishmi Hills, 1935 (Steele) (1 ♂) ; Hmawbi, 14.ii.1918 (Ras) (1 ♂) ; CHINA : Foochow, 1936–37 (Yang) (2 ♂♂, 1 ♀) ; INDO-CHINA : Annam, Phuc-Son (Fruhstorfer) (1 ♂, 1 ♀) (Nat. Mus. Vienna) ; FORMOSA : ——— (Staudinger) (1 ♂, 1 ♀) (Nat. Mus. Vienna) ; MALAYA : Penang, viii.1889 (Fruhstorfer) (4 ♂♂, 1 ♀) (Zool. Mus. Berlin) ; SUMATRA : Tatengon Atjeh, 18.vi.1929 (Prince Léopold) (1 ♂) (Inct. Sci. Nat. Brux.) ; SUMBA : Baing, 24.vi.1949 (Bühler & Sutter) (1 ♂) (Nat. Mus. Basel) ; Waikarudi, 3.ix.1949 (Bühler & Sutter) (1 ♀) (Nat. Mus. Basel) ; Baing, Wai Lekabe, 26.vi. 1949 (Bühler & Sutter) (1 ♀) (Nat. Mus. Basel) ; CELEBES : Tornia Is. (Kühne) (1 ♀) (Nat. Mus. Vienna) ; KAI IS. : ——— (Kühne) (1 ♀) (Nat. Mus. Vienna) ; DUKE OF YORK I. : ——— (Staudinger) (1 ♀) (Nat. Mus.

Vienna); AUSTRALIA: N. Queensland, vi–viii.1917 (Veitch) (1 ♂); SOLOMON IS.: Tulagi, in room, 19.vii.1933 (Pagden) (1 ♀); Tulagi (Lever) (1 ♀); Guadalcanal, viii.1954 (Brown) (2 ♀♀).

All in the British Museum (Natural History) unless otherwise stated.

Distribution (Fig. 101)

Ph. gracilis Burmeister covers the Ethiopian, Oriental, and Australasian regions, and intrudes into the Palaearctic region in Egypt. It has not yet been found south of Rhodesia in Africa or east of the Solomon Is.

13. *PHANEROPTERA FALCATA* (Poda, 1761)

Gryllus (Tettigonia) falcata Poda, 1761, Insecta Musei Graecensis, p. 52. Type locality unknown. Type material lost.

Phaneroptera sinensis Uvarov, 1934, *Ark. Zool.* **26A**, 7. Holotype ♂, CHINA: S. Kansu, 13.x.1930 (Hummel). In the Naturhistoriska Riksmuseum, Stockholm. **Syn. n.**

Diagnosis

♂. Cerci curved both in horizontal and vertical planes, apex directed upwards, sometimes with minute recurved tip (Fig. 23). Supra-anal plate very broad, as in Fig. 80. Subgenital plate very broad with spreading lobes, as in Fig. 39. Lateral pronotal lobes as long as or slightly longer than deep, shaped as in Fig. 65. Hind femora usually extending at least to tip of flexed fore wings, rather attenuate, as in Fig. 51. Left fore wing usually with dark mark in region of Cu_2 and 1A, and both fore wings usually with dark mark at distal end of stridulatory organ.

♀. As male except for genitalia and fore wing-bases. Dorsal margin of ovipositor rather sharply obtusangulate near base.

Measurements

Males	Females
Total length (20): 32·1–36·6, mean 34·29.	Total length (20): 33·0–37·8, mean 35·56.
Median length of pronotum (20): 3·3–4·0, mean 3·57.	Median length of pronotum (20): 3·3–4·0, mean 3·67.
Length of hind femur (20): 17·8–21·1, mean 19·74.	Length of hind femur (20): 18·1–23·7, mean 20·94.
Maximum vertical width of hind femur (20): 1·4–1·8, mean 1·65.	Maximum vertical width of hind femur (20): 1·6–2·4, mean 1·84.
Length of fore wing (20): 19·9–23·2, mean 21·67.	Length of fore wing (20): 20·3–24·3, mean 22·64.
Length of exposed part of hind wings (20): 9·0–10·7, mean 9·62.	Length of exposed part of hind wing (20): 8·7–10·6, mean 9·54.
	Length of ovipositor (20): 4·9–5·4, mean 5·16.

Discussion

This species may be easily distinguished from *Ph. n. nana* Fieber, whose range it overlaps in Europe, by the lateral pronotal lobes, which are at least as long as deep, the long and rather attenuate hind femora, and the genitalia and stridulatory organ of the male. At the eastern end of its range *Ph. falcata* (Poda) probably overlaps *Ph. gracilis* Burmeister in central China and possibly on Formosa; the genitalia again enable the males to be separated, but the females

are in this case more difficult, as *Ph. gracilis* Burmeister also has long, attenuate hind femora. The pronotum is probably the best character for distinguishing this sex from *Ph. gracilis* Burmeister, but variation makes a certain diagnosis very difficult in some cases. In the list given below, therefore, oriental records of females only should be regarded as tentative.

Examination of the holotype of *Ph. sinensis* Uvarov leaves no doubt that this name is synonymous with *Ph. falcata* (Poda).

Material examined

♂ holotype of *Ph. sinensis* Uvarov.

PORTUGAL: Snaidu Hora, 17.vii.1932 (1 ♂); SPAIN: ———, 1864 (1 ♂) (Nat. Mus. Vienna); FRANCE: Fontainebleau, (1 ♂); Broût-Vernet (Buysson) (1 ♂) (coll. Willemse); Paris (Brisout) (1 ♂) (Inst. Sci. Nat. Brux.); Fontainebleau, ix.1886 (2 ♀♀) (Inst. Sci. Nat. Brux.); Savoie, Col de Fortclaz, 12.ix.1949 (Willemse) (1 ♂) (coll. Willemse); GERMANY: Tübingen, 6.vii. 1925 (Zeuner) (1 ♂); Stuttgart, 13.ix.1929 (Zeuner) (1 ♂, 1 ♀); Kaiserstuhl, Freiburg, 23.x.1932 (Zeuner) (1 ♀); SWITZERLAND: ——— (1 ♂) (Inst. Sci. Nat. Brux.); ——— (1 ♂, 1 ♀) (Zool. Inst. Lund); HUNGARY: ——— (1 ♂) (Zool. Inst. Lund); YUGOSLAVIA: Croatia, Plitvice, 9.ix.1955 (Ragge) (1 ♂); Fruška Gora, 300 m. (1 ♂) (coll. Willemse); Serbia, Rakovitsa (Burr) (1 ♂, 1 ♀); ——— (Gradojević) (1 ♂); Krain, 1894 (Krauss) (2 ♂♂) (Nat. Mus. Vienna); Serbia, Rakovitsa, viii.1919 (Burr) (1 ♂, 2 ♀♀); Resnik, nr. Belgrade, viii.1938 (Grebenchikoff) (3 ♀♀); ALBANIA: Luzh, 29.viii.1918 (Karny) (1 ♀) (coll. Ebner); AUSTRIA: Persenburg, viii.1942 (1 ♂) (coll. Ebner); Lainzer Tiergarten, 8.viii.1949 (Ebner) (1 ♂) (coll. Ebner); RUSSIAN SOVIET FEDERATED SOCIALIST REPUBLIC: Siberia (1 ♂, 1 ♀) (coll. Ebner); Transbaikal, Chitta distr., Ust Ilich, 14.viii.1925 (Engelhardt) (1 ♂, 1 ♀); nr. Lake Balkhash, Kara-Chagan, Lussi Nos, old bed of river, vii.1926 (1 ♀); nr. Lake Balkhash, Kara-Chagan, 2.vii.1926 (1 ♂); nr. Lake Balkhash, Kara-Chagan, Romanovsky, 17.viii.1926 (1 ♀); Krasnaja Rjetschka, nr. Khabarovsk, 1916–17 (Babiz) (1 ♀) (coll. Ebner); CHINA: ——— (1 ♂) (coll. Ebner); Chusan Is. (Walker) (1 ♂, 1 ♀); Hai-Ring (Walker) (1 ♀); Manchuria, region of Lake Hanka, 1900 (Bohnhof) (1 ♂) (Mus. Hist. Nat. Paris); Manchuria, Charbin, 1930 (Jettmar) (1 ♀) (Nat. Mus. Vienna); Shanghai (Staudinger) (1 ♀) (Nat. Mus. Vienna); KOREA: Douglas Inlet, 2.vii.1897 (Fletcher) (1 ♂); JAPAN: ——— (1 ♂); ———, 1891 (Deyrolle) (1 ♂) (Mus. Hist. Nat. Paris); FORMOSA: Takao (Sauter) (3 ♀♀) (Nat. Mus. Vienna) (?).

All in the British Museum (Natural History) unless otherwise stated.

Distribution (Fig. 101)

Ph. falcata (Poda) ranges from central and southern Europe across central Asia to China and Japan. It has not yet been found south of Formosa, but extends further north than any other species of *Phaneroptera* Serville.

14. **PHANEROPTERA MYLLOCERCA** sp. n.

Holotype ♂, N. INDIA: Kathgodam, on *Lantana*, 12.xii.1918. In the British Museum (Natural History).

Diagnosis

♂. Cerci terminating in upwardly directed spine with minute recurved tip, as in Fig. 24. Subgenital plate with almost contiguous lobes (Fig. 40). Supra-anal plate quadrate (Fig. 81). Fore wings usually with reddish brown or dark brown stripe along posterior margin. Hind femora usually extending at least to tip of flexed fore wings.

♀. As male except for genitalia. Differs from *Ph. falcata* (Poda) only by reddish brown or dark brown posterior margin of fore wings, and dark-coloured antennae ; these characters, however, are not always present.

Description

♂. Fastigium of vertex long, fairly strongly compressed, sulcate above, concave in profile, not raised at apex.

Pronotum without lateral carinae, lateral lobes shaped as in Fig. 66. Spine of fore coxae well-developed. Fore tibiae with 3–5 external spurs, including 1–2 apical ones. Mid tibiae with about 7–10 external spurs. Hind femora unarmed. Hind tibiae with 40–55 external dorsal spines, and 3 apical spurs on each side. Fore wings with distinct bifurcate or occasionally three-branched R_s, which is free from MA. Hind wings extending beyond fore wings by between third and half length of latter.

Tenth abdominal tergite unmodified. Supra-anal plate quadrate, as in Fig. 81. Cerci terminating in upwardly directed spine with minute recurved tip, as in Fig. 24. Subgenital plate elongate with almost contiguous lobes, as in Fig. 40.

Coloration green, usually with dark spots on pronotum and femora. Antennae usually dark-coloured except for basal two segments. Tibial spines and spurs black or black-tipped. Fore wings usually with reddish brown or dark brown posterior margin. Cerci darkened towards tip, which is black.

♀. As male except for genitalia. Ovipositor crenulate along most of dorsal margin and along distal extremity of ventral margin ; dorsal margin rather sharply angled near base.

Measurements

Males	Females
Total length (3) : 34·9–37·3, mean 36·33.	Total length (5) : 35·5–40·4, mean 38·02.
Median length of pronotum (3) : 3·7–3·8, mean 3·78.	Median length of pronotum (5) : 3·8–4·0, mean 3·90.
Length of hind femur (3) : 20·1–22·8, mean 21·60.	Length of hind femur (3) : 21·3–23·1, mean 22·30.
Maximum vertical width of hind femur (3) : 1·5–1·8, mean 1·64.	Maximum vertical width of hind femur (5) : 1·7–2·0, mean 1·84.
Length of fore wing (3) : 22·1–24·1, mean 23·37.	Length of fore wing (5) : 22·8–26·2, mean 24·98.
Length of exposed part of hind wing (3) : 9·6–10·3, mean 9·90.	Length of exposed part of hind wing (5) : 9·0–10·3, mean 9·70.
	Length of ovipositor (5) : 4·9–5·3, mean 5·11.

Variation

The spine of the fore coxae varies slightly in size. The spurs of the fore and mid tibiae and the spines of the hind tibiae vary in number. The distal, upwardly directed, part of the male cerci varies slightly in length.

Discussion

This species is closely allied to *Ph. falcata* (Poda). The male is easily distinguished by the genitalia and the lack of a dark mark in the region of Cu_2 and 1A on the left fore wing, but the females of the two species are almost identical, the usual red-brown coloration along the posterior margin of the fore wings in *Ph. myllocerca* sp. n. apparently providing the only diagnostic character. As in *Ph. falcata* (Poda) the pronotum can usually be used in separating females of this species from *Ph. gracilis* Burmeister, but a certain diagnosis in the absence of males is only sometimes possible. In the list given below, therefore, records of females only should be regarded as tentative.

Material examined

♂ holotype ; 1 ♂ and 1 ♀ paratype, N. INDIA: Pedong, 1938 ; 1 ♂ paratype, BURMA : Mishmi Hills, Dingliang, 2,450 ft., iii.1935 (Steele) ; 1 ♂ paratype, BURMA : Mishmi Hills, Pange, 1,650 ft., 28.i.1935 (Steele).

INDIA : south, Inupadi [?], 17.xii.1917 (Rao) (1 ♂) ; Kumaon, Muktesar, 7,500 ft., ix.1922 (Fletcher) (1 ♀) ; KASHMIR : river Kishengunga, Gurez, 8,000 ft., 1926 (Mitchell) (1 ♀) ; SIKKIM : ——— (Staudinger) (1 ♀) (Nat. Mus. Vienna) ; CHINA : Yunnan, Be-t-a, 7,000 ft., 21.vi.1922 (Gregory) (2 ♀♀).

All in the British Museum (Natural History) unless otherwise stated.

Distribution

The known range of this species is limited to India and Burma. Female specimens probably referable to *Ph. myllocerca* sp. n., however, are known from Kashmir, Sikkim, and south-west China. From the material examined there is a suggestion that a preference exists for high ground.

15. *PHANEROPTERA NIGRO—ANTENNATA* Brunner, 1878

Phaneroptera nigro-antennata Brunner, 1878, Monographie der Phaneropteriden, p. 215. Holotype ♂, JAPAN. In the Zoologisches Museum of the Humboldt-Universität, Berlin.

Diagnosis

♂. Stridulatory organ large, almost as broad as long (Fig. 86), with dark brown anterior patch. Cerci as in Fig. 25. Supra-anal plate quadrate, with concave margins (Fig. 82). Subgenital plate elongate, as in Fig. 41. Antennae usually black, sometimes with widely spaced, narrow, white bands. Lateral pronotal lobes shaped as in Fig. 67. Veins and veinlets of fore wings green, cells mostly dark brown.

♀. As male except for genitalia and fore wing-bases.

Measurements

Male

Total length : 32·9.
Median length of pronotum : 3·6.
Length of hind femur : 22·1.
Maximum vertical width of hind femur : 1·7.
Length of fore wing : 19·5.
Length of exposed part of hind wing : 9·4.

Discussion

The male of this species may be easily distinguished from *Ph. falcata* (Poda) by the genitalia and the large, broad, stridulatory organ, this being relatively long and narrow in *Ph. falcata* (Poda). The only other species recorded so far from Japan is *Ph. nakanoensis* Matsumura & Shiraki ; remarks relating to its status and diagnosis are given in the discussion under that species.

Material examined

♂ holotype.

Distribution (Fig. 101)

This species is recorded from Wakayama, Sapporo, Kagoshima, and Tokyo, in Japan, and Shoka in Formosa.

16. *PHANEROPTERA NAKANOENSIS* Matsumura & Shiraki, 1908

Phaneroptera nakanoensis Matsumura & Shiraki, 1908, *J. Coll. Agric. Tokyo* **3**, 22. 1 ♂ cotype and 1 ♀ cotype, JAPAN : Toyko, vii. In the collection of S. Matsumura.

Original description (translated from German)

Body stout, dark green, black-spotted. Head reddish brown above, with a narrow black longitudinal line in the middle. Vertex very short, pointed, laterally compressed, reddish brown. Eye large, circular, very convex, shiny blackish brown. Antennae with fairly broad whitish rings, the basal segments reddish brown. Pronotum saddle-shaped, yellow or green, with numerous reddish brown spots, and a blackish brown longitudinal stripe in the middle which reaches to the end of the hind wing ; lateral lobes of the pronotum yellow or whitish green, spotted with reddish brown, rounded at the front and rear angles. Legs slim and long, fore femur reddish brown, tibiae blackish brown, the last having a broad whitish space near the front end ; tarsi blackish brown. Fore wings leathery, strong, tapering towards the tip, rounded at the end. Tympanal field broad, almost circular, black in the front half, dark brown in the rear half ; dividing vein with a large branch which lies between the folded veins. The mediastinal vein of the fore wing is not developed ; radial vein with 2 branches, of which the first has 2 small branches. Hind wings distinctly longer than the fore wings. Abdomen red-brown above, sometimes black-spotted, yellow-green below. Cerci long in the male, cylindrical, pointed, bent sharply inwards ; in the female yellow-brown and pointed. Subgenital plate long in the male with a short incision at the end, thus forming 2 angulate lobes, with a deep angulate furrow underneath at the base ; in the female almost angulate, scarcely curved at the tip. Ovipositor as in *P. nigro-antennata*.

Measurements (given with original description)

Male	Female
Length of body : 15·0.	Length of body : 17·0.
Length of pronotum : 3·5.	Length of pronotum : 4·0.
Median width of pronotum : 1·8.	Median width of pronotum : 2·2.
Length of fore wing : 18·5.	Length of fore wing : 23·0.
Median width of fore wing : 3·1.	Median width of fore wing : 3·7.
Length of hind wing : 22·5	Length of hind wing : 31·5.

Measurements (given with original description) (*contd.*)

Male	Female
Length of fore femur : 6·0.	Length of fore femur : 7·3.
Length of mid femur : 9·0.	Length of mid femur : 10·0.
Length of hind femur : 21·0.	Length of hind femur : 24·5
Length of subgenital plate : 2·1.	Length of subgenital plate : 1·5.
Length of cercus : 2·0.	Length of cercus : 1·5.
	Length of ovipositor : 5·8.
	Median depth of ovipositor : 2·3.

Discussion

The type material of this species was not available for study and no definite conclusions are therefore possible. The fact that the genitalia of both sexes appear to be very similar to that of *Ph. nigro-antennata* Brunner suggests the possibility of *Ph. nakanoensis* Matsumura & Shiraki being based on rather unusual variants of that species. Beneath the original description is the following comment : " Diese Art steht der *P. nigro-antennata* sehr nahe an, unterscheidet sich aber durch den schmalen Vorderflügel, die schwärzlichen Hinterchienen, und den rotbraunen, mit grossen Netzaugen versehenen Kopf ". In the key to species *Ph. nakanoensis* Matsumura & Shiraki is separated from *Ph. nigro-antennata* Brunner by the " circular " tympanal field of the left fore wing, this being " elliptical " in *Ph. nigro-antennata* Brunner.

Distribution

Recorded only from Japan and Korea.

17. *PHANEROPTERA BREVIS* Serville, 1839

Phaneroptera brevis Serville, 1839, Insectes Orthoptères, p. 418. 5 cotypes, JAVA. Probably lost.

Phaneroptera subnotata Stål, 1860, Eugenes Resa, Orthoptera, p. 318. Holotype ♂, PHILIPPINE IS.: Manila. In the Naturhistoriska Riksmuseum, Stockholm.

Phaneroptera gracilis Burmeister, Kirby, 1906, A synonymic Catalogue of Orthoptera **2**, 436.

Diagnosis

♂. Cerci with conspicuous bulge towards distal end, as in Fig. 26. Tenth abdominal tergite produced posteriorly, forming hood over supra-anal plate, its posterior margin smoothly rounded (Fig. 10). Subgenital plate robust, very elongate, each margin of distal incision with inwardly directed tooth, as in Fig. 42. Lateral pronotal lobes shaped as in Fig. 68. Left fore wing usually with dark mark in region of Cu_2 ; fore wings usually with dark spot at posterior end of stridulatory organ. Cells along hind margin of fore wings dark-coloured.

♀. As male except for genitalia and fore wing-bases. Tenth abdominal tergite slightly produced posteriorly, its posterior margin either smoothly curved or going to very slight point.

Measurements

Males	Females
Total length (20) : 24·4–28·9, mean 26·22.	Total length (20) : 27·2–32·5, mean 29·80.
Median length of pronotum (20) : 2·9–3·5, mean 3·11.	Median length of pronotum (20) : 2·8–3·3, mean 3·06.
Length of hind femur (20) : 14·0–17·2, mean 15·74.	Length of hind femur (20) : 15·6–19·7, mean 17·15.

Measurements (contd.)

Males	Females
Maximum vertical width of hind femur (20): 1·5–1·9, mean 1·68.	Maximum vertical width of hind femur (20): 1·6–2·1, mean 1·84.
Length of fore wing (20): 14·1–16·9, mean 15·44.	Length of fore wing (20): 16·5–20·0, mean 18·18.
Length of exposed part of hind wing (20): 7·6–8·7, mean 8·01.	Length of exposed part of hind wing (20): 7·8–9·7, mean 8·82.
Length of subgenital plate (20): 2·4–3·6, mean 3·17.	Length of ovipositor (20): 4·0–5·1, mean 4·28.

Discussion

This species may be distinguished from the rest of the genus by the rounded posterior extension of the tenth abdominal tergite. This is developed in both sexes but is much less well-marked in the female. A rather similar condition is shown by *Ph. celebica* Haan, but in this case the tenth abdominal tergite has an acute median projection in the male and goes to a blunt point in the female.

Ph. brevis Serville is the most common and widespread of the species of *Phaneroptera* Serville confined to south-east Asia and Australasia, thus having in this respect the same status as *Ph. n. nana* Fieber in south Europe and Palaearctic Africa, and *Ph. n. sparsa* Stål in Ethiopian Africa and the islands of the Indian Ocean.

The female paratype of *Ph. curvata* (Willemse) was found on examination to be a specimen of *Ph. brevis* Serville.

Material examined

♂ holotype of *Ph. subnotata* Stål.

MALAYA: Bukit Charakah, 19.vi.1932 (Miller) (1 ♀); Serdung, on leaf of *Theobroma cacao* L., 19.xii.1951 (1 ♀); Singapore (5 ♂♂, 2 ♀♀); Pasar Rd., on flowers of *Ipomola purpurea*, 24.ix.1935 (1 ♂); Singapore (1 ♂); Frasers Hill, on *Dahlia* flowers, 21.ix.1935 (1 ♀); Bukit Kutu, 3,457 ft., 15.ix.1930 (Miller) (1 ♀); The Gap, 23.v.1928 (Miller) (1 ♀); Nicotian Tab, 16.xii.1931 (1 ♀); Penang, viii.1889 (Fruhstorfer) (5 ♂♂, 4 ♀♀) (Zool. Mus. Berlin); Singapore (Deschamps) (1 ♀); Bukit Kutu, 3,458 ft., 27.iii.1932 (Miller) (2 ♂♂); Klang Gates, 17.vii.1932 (Miller) (1 ♂); Kuala Lumpur, 2.x.1939 (1 ♂); Jerantut, 11.viii.1928 (Miller) (1 ♀); Kelantan (Rolle) (1 ♀) (Nat. Mus. Vienna); Malacca (Weber) (1 ♀) (Zool. Mus. Berlin); SUMATRA: Siolak Daras, Korinchi Valley, 3,100 ft., iii.1914 (1 ♂, 2 ♀♀); Fort de Kock, 920 m., 1925 (Jacobson) (1 ♂, 1 ♀); ———, 4,300 ft., 19.xii.1929 (Pagden) (1 ♀); NORTH BORNEO: Sandakan, 10.i.1893 (1 ♀); SARAWAK: foot of Mr. Dulit, junction of rivers Tinjar and Lejok, cultivated land now waste, viii.1932 (Hobby & Moore) (5 ♂♂, 6 ♀♀); foot of Mt. Dulit, junction of rivers Tinjar and Lejok, in reed bed, 3.viii.1932 (Hobby & Moore) (1 ♀); foot of Mt. Dulit, junction of rivers Tinjar and Lejok, recent clearing in old secondary forest, 29.viii.1932 (Hobby & Moore) (1 ♂); river Kapah, tributary of river Tinjar, clearing, 9.x.1932 (Hobby & Moore) (1 ♀); 1909 (Brooks) (1 ♂); JAVA: Selabintanah, ii-iii.1938 (Walsh) (2 ♂♂) (Zool. Inst. Lund); Perbawattee, Mt. Gedé, 4,000–5,000 ft., iii.1938 (Walsh) (1 ♂, 1 ♀) (Zool. Inst. Lund); Perbawattee, Mt. Gedé, 4,000–5,000 ft., x.1937 (Walsh) (1 ♀) (Zool. Inst. Lund); Buitenzorg, 17.iv.1908 (Cordier) (1 ♂) (Mus. Hist. Nat. Paris); Batavia, Tanah-Abang,

1904 (Serre) (2 ♂♂) (Mus. Hist. Nat. Paris); Karang-nongko, xii.1931 (1 ♀) (coll. Willemse); Buitenzorg, 1924 (Heurn) (1 ♀) (coll. Willemse); Buitenzorg, 1922 (1 ♂) (coll. Willemse); BALI: Prapetagoeng, 1,500 ft., v.1935 (1 ♂, 1 ♀ paratype of *Ph. curvata* (Willemse)) (coll. Willemse); Batoeriti, 3,500 ft., vi.1935 (2 ♀♀) (coll. Willemse); SUMBAWA: vii.1936 (Björklund) (1 ♂) (Zool. Inst. Lund); SUMBA: Waimangura, 17.viii.1949 (Bühler & Sutter) (1 ♀) (Nat Mus. Basel); Langgaliru, 8.x.1949 (Bühler & Sutter) (1 ♂) (coll. Willemse); CELEBES: Manado, 27.viii.1929 (1 ♀) (Rijksmus. Nat. Hist. Leiden); AMBOINA: ——— (Suyckerbuyk) (2 ♂♂) (Inst. Sci. Nat. Brux.); NEW GUINEA: Kubuna (2 ♀♀) (Mus. Hist. Nat. Paris); Siwi Forest, 6.iii.1929 (Prince Leopold) (1 ♂) (Inst. Sci. Nat. Brux.); AUSTRALIA: N. Queensland, Redlynch, 2–10.ix.1938 (Wind) (2 ♀♀); Northern Territory, Darwin, vii.1922 (Wilson) (1 ♀).

All in the British Museum (Natural History) unless otherwise stated.

Distribution (Fig. 103)

Ph. brevis (Serville) ranges from Malaya, across Indonesia and New Guinea, to Australia. It has not apparently been recorded yet from north of latitude 8° N.

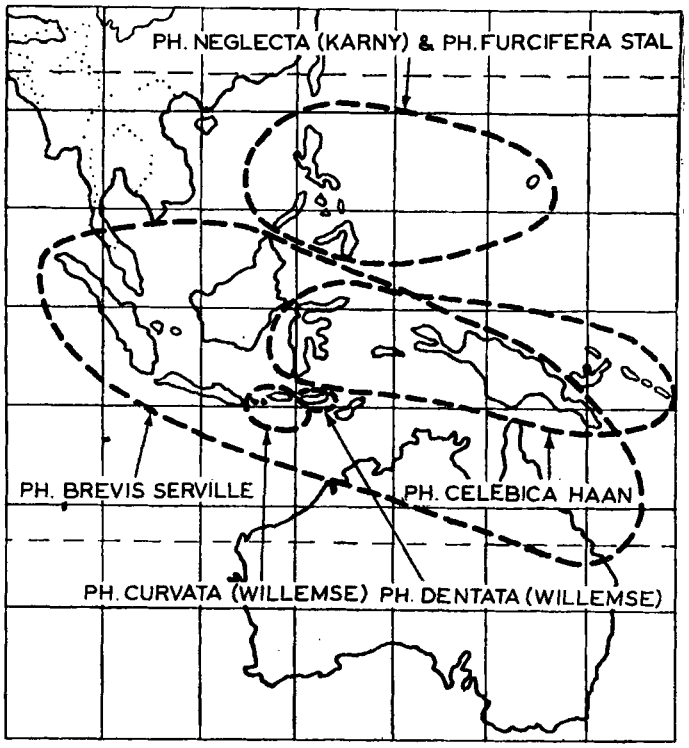


Fig. 103.—Map showing the approximate distribution of *Phaneroptera brevis* Serville, *Ph. celebica* Haan, *Ph. curvata* (Willemse), *Ph. neglecta* Karny, *Ph. furcifera* Stål, and *Ph. dentata* (Willemse). The ranges of *Ph. curvata* (Willemse) and *Ph. dentata* (Willemse) probably extend a little beyond the boundaries shown here.

18. *PHANEROPTERA CELEBICA* Haan, 1842

Locusta (*Phaneroptera*) *celebica* Haan, 1842, in Temminck, *Verh. nat. ges. Ned. overz. bezitt.*, Zool. (Ins.), p. 193. 1 ♂ Lectotype and 3 ♀ cotypes, N. CELEBES : Tondano. In the Rijksmuseum van Natuurlijke Historie, Leiden.

Euanerota spinifera Willemse, 1953, *Bull. Inst. Sci. nat. Belg.* **29** (7), 7. Holotype ♂, SOLOMON IS. : Bougainville, Buin. In the Institut Royal des Sciences Naturelles de Belgique, Brussels. **Syn. n.**

Diagnosis

♂. Subgenital plate robust, enormously elongate, cymbiform; its distal lobes contiguous or nearly so, with small emargination on each inner face, near apex, as in Fig. 43. Tenth abdominal tergite much enlarged, with acute median posterior projection (Fig. 11). Cerci spatulate apically, bearing, in this region, small rounded tooth on inner margin, as in Fig. 27. Membranous part of hind wings slightly infumate except near base. Base of anal area of fore wings darkened.

♀. As male except for genitalia. Tenth abdominal tergite produced posteriorly, going to point in centre (Fig. 96).

Measurements

Males	Females
Total length (10) : 23·1–26·0, mean 24·79.	Total length (13) : 26·6–28·9, mean 27·67.
Median length of pronotum (12) : 2·4–2·7, mean 2·53.	Median length of pronotum (12) : 2·5–2·9, mean 2·72.
Length of hind femur (8) : 13·7–16·9, mean 15·40.	Length of hind femur (13) : 16·3–18·4, mean 17·11.
Maximum vertical width of hind femur (9) : 1·5–1·8, mean 1·66.	Maximum vertical width of hind femur (12) : 1·7–2·0, mean 1·79.
Length of fore wing (11) : 13·1–15·0, mean 14·09.	Length of fore wing (13) : 15·4–16·8, mean 16·32.
Length of exposed part of hind wing (10) : 8·0–8·9, mean 8·59.	Length of exposed part of hind wing (13) : 8·6–9·6, mean 9·11.
Length of subgenital plate (12) : 4·0–4·7, mean 4·42.	Length of ovipositor (13) : 3·7–4·1, mean 3·84.

Discussion

The unusual male genitalia of this species makes this sex easily recognizable. The female may be distinguished by the posterior extension of the tenth abdominal tergite, which goes to a blunt point, and by the black mark at the base of each fore wing.

I have selected and marked as a lectotype the male cotype of this species. Examination of the holotype of *Euanerota spinifera* Willemse has made it quite clear that it is a male specimen of *Ph. celebica* Haan with the distal part of the subgenital plate broken off.

Material examined

♂ lectotype and 1 ♀ cotype. ♂ holotype and ♀ paratype (same data and depository as holotype) of *Euanerota spinifera* Willemse.

CELEBES : Manado, 27.viii.1929 (10 ♂♂, 11 ♀♀) (7 ♂♂ and 8 ♀♀ in Rijksmus. Nat. Hist. Leiden) ; W. Kaudern, Gjverepahi, iii.1917 (1 ♀) (Rijks-

mus, Nat. Hist. Leiden); Karor, 120 m., 8.vii.1941 (2 ♂♂) (coll. Willemse); Kinawang, 11.vii.1941 (1 ♀) (coll. Willemse).

In the British Museum (Natural History) unless otherwise stated.

Distribution (Fig. 103)

This species has hitherto been recorded only from Celebes. The discovery that *E. spinifera* Willemse is a synonym of *Ph. celebica* Haan, however, proves that it also occurs on Bougainville, in the Solomon Is. As a fair amount of material of *Phaneroptera* Serville from western Indonesia has been available for study and none of it has been of this species, it is quite likely that *Ph. celebica* Haan does not extend west of Celebes. On the other hand, very few specimens from New Guinea were available and none from the Moluccas, so that it is quite possible that the species will be found in these intervening localities.

19. *PHANEROPTERA CURVATA* (Willemse, 1942), **comb. n.**

Euanerota curvata Willemse, 1942, *Natuurh. Maandbl.* **31**, 109. Holotype ♂, W. BALI: Prapetagoeng, v.1935. In the collection of Dr. C. Willemse, Arts, Eygelshoven Z.L., Netherlands.

Diagnosis

♂. Cerci abruptly incurved at apex, as in Fig. 28. Subgenital plate robust, elongate; margins of distal incision concave, without teeth (Fig. 44). Supra-anal plate as in Fig. 83. Tenth tergite unmodified. Lateral pronotal lobes shaped as in Fig. 70.

♀. As male except for genitalia. Tenth abdominal tergite not produced posteriorly. Ovipositor with protruding flap at base of dorsal margin of each lower valve, beneath basal plates, as in Fig. 94.

Measurements

Males	Females
Total length (6): 25·5–31·5, mean 27·47.	Total length (2): 30·2–34·4, mean 32·30.
Median length of pronotum (7): 3·0–3·4, mean 3·10.	Median length of pronotum (2): 3·0–3·4, mean 3·20.
Length of hind femur (6): 15·4–17·7, mean 16·27.	Length of hind femur (2): 18·6–21·1, mean 19·85.
Maximum vertical width of hind femur (6): 1·6–2·0, mean 1·73.	Maximum vertical width of hind femur (2): 2·0–2·4, mean 2·20.
Length of fore wing (7): 14·1–17·1, mean 15·11.	Length of fore wing (2): 18·1–20·0, mean 19·05.
Length of exposed part of hind wing (7): 8·7–10·4, mean 9·07.	Length of exposed part of hind wing (2): 9·0–10·4, mean 9·70.
	Length of ovipositor (2): 4·5–4·8, mean 4·65.

Discussion

Both sexes of this species may be recognized by the genitalia. In the specimens examined from Sumba the bases of the fore wings were blackened in a similar way (though more extensively) to those of *Ph. celebica* Haan; this feature was quite lacking in the rest of the material.

Material examined

♂ holotype; 4 ♂ paratypes, same data as holotype, all in coll. Willemse except for 1 ♂ paratype in the British Museum (Natural History).

SUMBAWA :—, vii. 1936 (Björklund) (1 ♂, 1 ♀) (♂ in Zool. Inst. Lund) ; SUMBA : Melolo, Laiwuhi, 19.vi.1949 (Bühler & Sutter) (1 ♂) (Nat. Mus. Basel) ; Rua, 30.viii.1949 (Bühler & Sutter) (1 ♀) (Nat. Mus. Basel).

Distribution (Fig. 103)

This species is known only from three islands : Bali, Sumbawa, and Sumba. It is likely to occur on Java, Lombok, Flores, and Timor, but quite possibly extends no further than this.

20. *PHANEROPTERA NEGLECTA* (Karny, 1926), **comb. n.**

Paranerota neglecta Karny, 1926, *Treubia* **9**, 138. 1 ♂ lectotype and 1 ♂ cotype, PHILIPPINE IS. : Siargao (Staudinger) ; in the Rijksmuseum van Natuurlijke Historie, Leiden. 1 ♂ cotype, PHILIPPINE IS.: Mindanao, Davao ; in " Coll. Baker ".

Diagnosis

♂. Subgenital plate robust, elongate, very depressed ; distal lobes smoothly rounded (Fig. 45). Cerci as in Fig. 29. Supra-anal plate with rather extended posterior angles, as in Fig. 84. Tenth abdominal tergite unmodified. Antennae pale with dark bands near the base, becoming dark distally. Fore wings with black mark in region of Cu_2. Base of left fore wing with black patch. Lateral pronotal lobes shaped as in Fig. 71. Spine of anterior coxae rather small.

♀. As male except for genitalia and fore wing-bases.

Measurements

Males	Females
Total length (8) : 23·3–26·3, mean 24·78.	Total length (7) : 26·3–30·7, mean 28·17.
Median length of pronotum (8) : 2·5–2·9, mean 2·76.	Median length of pronotum (7) : 2·8–3·2, mean 2·96.
Length of hind femur (6) : 15·7–18·2, mean 16·90.	Length of hind femur (5) : 16·5–19·8, mean 17·92.
Maximum vertical width of hind femur (6) : 1·7–1·9, mean 1·78.	Maximum vertical width of hind femur (6) : 1·8–2·1, mean 1·93.
Length of fore wing (9) : 13·1–15·1, mean 14·23.	Length of fore wing (8) : 16·2–18·7, mean 16·91.
Length of exposed part of hind wing (8) : 7·5–7·9, mean 7·65.	Length of exposed part of hind wing (7) : 8·3–8·8, mean 8·41.
	Length of ovipositor (8) : 4·1–4·7, mean 4·41.

Discussion

This species is very closely allied to *Ph. furcifera* Stål. The male is easily distinguished by the genitalia, but there appears to be no constant difference between the females of the two species. I have separated the females of the available material by associating them with males bearing identical data, and have found that the basal region of the antennae usually has dark bands in *Ph. neglecta* (Karny) and is usually uniformly pale in *Ph. furcifera* Stål. This character should, however, be regarded as merely suggestive.

I have selected and marked a lectotype from the three male cotypes of this species.

Materal examined

♂ lectotype.

PHILIPPINE IS.: Mindanao, Zamboanga, ii.1875 (3 ♂♂, 2 ♀♀); Camiguin, 26.i.1875 (1 ♀); ——— (1 ♀); ——— (Thoray) (2 ♂♂, 2 ♀♀) (Nat. Mus. Vienna); Luzon (2 ♂♂, 2 ♀♀) (Zool. Mus. Berlin).

In the British Museum (Natural History) unless otherwise stated.

Distribution (Fig. 103)

Known only from the Philippine Is.

21. *PHANEROPTERA FURCIFERA* Stål, 1874

Phaneroptera furcifera Stål, 1874, Recensio Orthopterorum **2**, 29. Holotype ♂, PHILIPPINE IS.: Manila. In the Naturhistoriska Riksmuseum, Stockholm.

Diagnosis

♂. Supra-anal plate deeply bifid, as in Fig. 85. Subgenital plate robust, elongate, sulcate medially both above and below; apex sharply truncate with short median slit (Fig. 46). Cerci as in Fig. 30. Tenth abdominal tergite more or less enlarged, its posterior margin somewhat emarginate medially. Lateral pronotal lobes as in Fig. 72.

♀. As male except for genitalia.

Measurements

Males	Females
Total length (8): 24·9–28·8, mean 26·74.	Total length (5): 26·9–31·5, mean 29·38.
Median length of pronotum (7): 2·7–3·1, mean 2·90.	Median length of pronotum (4): 2·8–3·1, mean 2·95.
Length of hind femur (7): 15·5–18·2, mean 17·07.	Length of hind femur (5): 15·2–20·4, mean 17·92.
Maximum vertical width of hind femur (7): 1·7–2·0, mean 1·83.	Maximum vertical width of hind femur (5): 1·8–2·1, mean 1·96.
Length of fore wing (8): 14·6–16·6, mean 15·59.	Length of fore wing (5): 16·1–19·7, mean 17·84.
Length of exposed part of hind wing (8): 8·0–9·0, mean 8·40.	Length of exposed part of hind wing (5): 8·0–8·8, mean 8·44.
	Length of ovipositor (5): 4·2–4·6, mean 4·38.

Discussion

Males of this species are easily recognized by their genitalia; the deeply bifid supra-anal plate is only approached by *Ph. neglecta* (Karny), in which this structure often has a deeply bifid appearance due to shrinkage and folding. Females of these two species appear to be practically indistinguishable (see remarks under *Ph. neglecta* (Karny)).

Material examined

♂ holotype.

PHILIPPINE IS.: Luzon, Baguio, Benguet (Baker) (1 ♀); Luzon, Mt. Makiling (Baker) (1 ♂); ——— (Ledyard) (1 ♂); Mindoro (1 ♂) (coll. Willemse); Mindoro (Staudinger) (2 ♂♂, 1 ♀) (Nat. Mus. Vienna); Palawan, Binaluan, xi–xii.1913 (Boetcher) (1 ♀) (coll. Willemse); S. Palawan (Staudinger) (1 ♀) (Nat. Mus. Vienna); GUAM: ——— (Rosenberg) (1 ♂, 1 ♀) (Nat. Mus. Vienna).

In the British Museum (Natural History) unless otherwise stated.

The short cerci make it unlikely that *Ph. longicauda* (Willemse) is a mere polymorph of one of the other Indonesian species.

Material examined

FLORES : Rana Mese, 20.xi.1949 (Bühler & Sutter) (1 ♀) (coll. Willemse) ; TUKANGBESI IS.: Binongko, Besi Eil, 7–10.iii.1930 (1 ♀) (Rijksmus. Nat. Hist. Leiden).

Distribution

This species is so far known only from Flores and Binongko, but doubtless its range includes Celebes and other parts of western and southern Indonesia.

EULIOPTERA gen. n.

Type species : *Phaneroptera reticulata* Brunner, 1878.

Diagnosis

Cells of fore wings transparent with shiny surface. Hind tibiae with 2 external and 2 internal apical spurs (Fig. 8). Fastigium of vertex compressed, narrow. Mid tibiae only slightly swollen in basal half. Lateral pronotal lobes fairly smoothly rounded.

Description

Fastigium of vertex compressed, narrow, sulcate above.

Lateral pronotal lobes fairly smoothly rounded, not forming angle with disc. Fore coxae with spine. Fore tibiae with oval tympanic opening on both sides. Mid tibiae only slightly swollen in basal half. Hind tibiae with 2 external and 2 internal apical spurs (Fig. 8). Cells of fore wings transparent with shiny surface.

Abdominal tergites without median carina. Apex of male cerci often dark-coloured but not black. Ovipositor without strongly developed basal folds ; basal plates approximately oval, unmodified.

Discussion

This genus is easily distinguished from *Phaneroptera* Serville by the two apical spurs on each side of the hind tibiae, and the transparent cells and shiny surface of the fore wings. It differs from *Nephoptera* Uvarov by the mid tibiae being much less swollen in the basal half and the fastigium of the vertex being narrow.

Eulioptera gen. n., as it stands at present, shows two distinct types of male genitalia: the thin, relatively membranous, subgenital plate and unmodified tenth abdominal tergite of *E. reticulata* (Brunner) and *E. longicerca* sp. n., and the much more robust, elongate, subgenital plate and posteriorly produced tenth abdominal tergite of *E. spinulosa* sp. n. and *E. breviala* sp. n. It is quite likely that intermediate species exist, as is the case with *Phaneroptera* Serville, in which two similar types occur.

Distribution

Eulioptera gen. n. is confined to Ethiopian Africa.

1. *Key to the species*

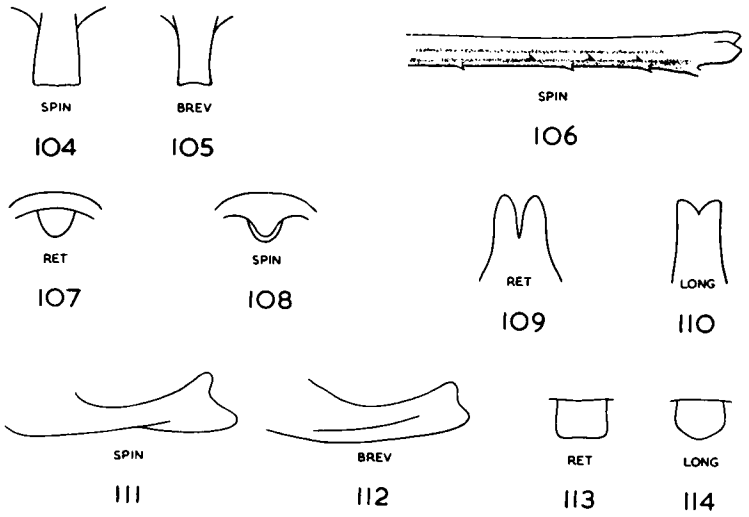
MALES

1. Tenth abdominal tergite with a large median posterior projection (Figs. 104 & 105). Subgenital plate very robust, as in Figs. 111 & 112 2
–. Tenth abdominal tergite unmodified. Subgenital plate relatively membranous, as in Figs. 109 & 110 3
2. Hind wings extending beyond the fore wings by less than a quarter of the length of the latter (Fig. 116). Hind tibiae usually with less than 20 external dorsal spines. Cerci shaped as in Fig. 120..... *E. breviala* sp. n. (p. 277)
–. Hind wings extending beyond the fore wings by more than a quarter of the length of the latter (Fig. 115). Hind tibiae usually with more than 20 external dorsal spines. Cerci shaped as in Fig. 119..... *E. spinulosa* sp. n. (p. 274)
3. Hind femora with 3 or more ventral spinules in the apical half (similar to Fig. 106). Cerci shaped as in Fig. 118..... *E. longicerca* sp. n. (p. 273)
–. Hind femora unarmed (rarely with 1 or 2 ventral spinules). Cerci shaped as in Fig. 117..... *E. reticulata* (Brunner) (p. 268)

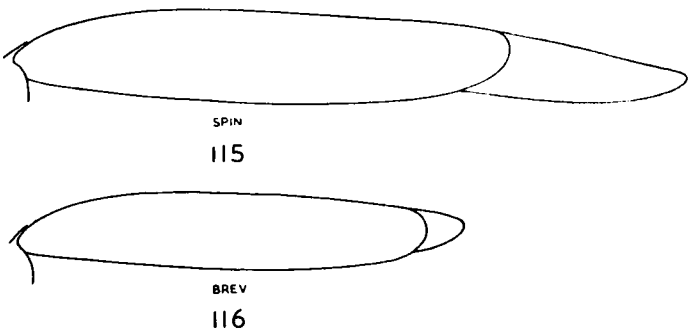
FEMALES

E. longicerca sp. n. is not included in this key as the female sex is not yet known.

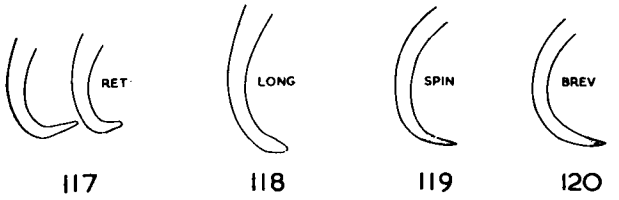
1. Tenth abdominal tergite with a median posterior projection (Fig. 108). Hind femora with a number of ventral spinules in the distal half (Fig. 106)..... 2
–. Tenth abdominal tergite unmodified (Fig. 107). Hind femora unarmed (rarely with 1 or 2 ventral spinules)..... *E. reticulata* (Brunner) (p. 268)



Figs. 104–114.—*Eulioptera* gen. n. (104) Dorsal view of the projection from the male tenth abdominal tergite of *E. spinulosa* sp. n. (105) *Id.* of *E. breviala* sp. n. (106) Ventro-lateral view of the distal part of the left hind femur of *E. spinulosa* sp. n. (107) Dorsal view of the supra-anal plate and part of the tenth abdominal tergite of the female of *E. reticulata* (Brunner). (108) *Id.* of *E. spinulosa* sp. n. (109) Ventral view of the male subgenital plate of *E. reticulata* (Brunner). (110) *Id.* of *E. longicerca* sp. n. (111) Lateral view of the male subgenital plate of *E. spinulosa* sp. n. (112) *Id.* of *E. breviala* sp. n. (113) Dorsal view of the male supra-anal plate of *E. reticulata* (Brunner). (114) *Id.* of *E. longicerca* sp. n.



Figs. 115 & 116.—Lateral view of the flexed wings of (115) *Eulioptera spinulosa* sp. n.; (116) *E. breviala* sp. n.



Figs. 117–120.—Dorsal view of the left male cercus of (117) *Eulioptera reticulata* (Brunner); (118) *E. longicerca* sp. n.; (119) *E. spinulosa* sp. n.; (120) *E. breviala* sp. n.

2. Hind wings extending beyond the fore wings by less than a quarter of the length of the latter (Fig. 116). Hind tibiae usually with less than 20 external dorsal spines..... *E. breviala* sp. n. (p. 277)

–. Hind wings extending beyond the fore wings by more than a quarter of the length of the latter (Fig. 115). Hind tibiae usually with more than 20 external dorsal spines..... *E. spinulosa* sp. n. (p. 274)

2. *Descriptions of the species*

1. *EULIOPTERA RETICULATA* (Brunner, 1878), **comb. n.**

Phaneroptera reticulata Brunner, 1878, Monographie der Phaneropteriden, p. 213. Holotype ♀, SOUTH AFRICA: Cape Province, Grahamstown (Higgins). In the Naturhistorisches Museum, Vienna.

Diagnosis

♂. Cerci very variable but usually rather suddenly bent inwards near apex, as in Fig. 117. Subgenital plate with deep apical incision, as in Fig. 109. Supra-anal plate subquadrate, as in Fig. 113, rarely showing tendency to form three posterior angles. Hind femora usually unarmed, but occasionally with 1 or 2 ventral spinules near apex. Sc of fore wings strongly thickened near base, much thicker than R in this region. Lateral pronotal lobes as in Fig. 121.

♀. As male except for genitalia, fore wings, and pronotum. Sc of fore wings hardly thickened near base, about same thickness as R in this region. Lateral pronotal lobes rather more rounded posteriorly than in male.

Discussion

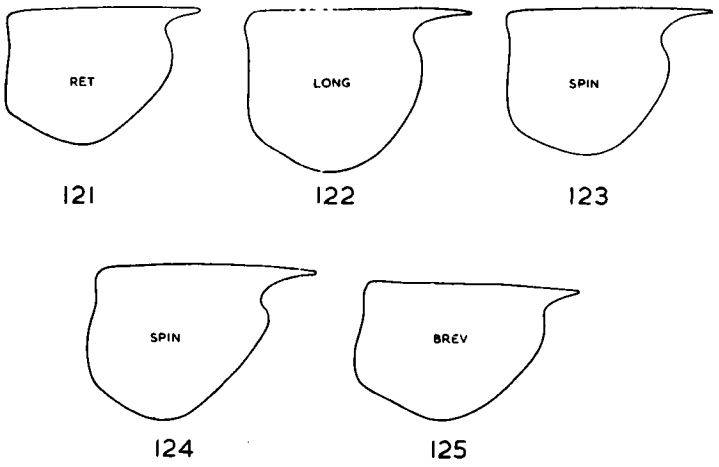
The male of this species is easily recognized by the cerci and subgenital plate. The female may be distinguished from *E. spinulosa* sp. n. and *E. breviala* sp. n.

by the unmodified tenth abdominal tergite, and from *E. longicerca* sp. n. (assuming the female of this species agrees with the male in this character) by having less than 3 ventral spinules on the hind femora (usually none at all).

E. reticulata (Brunner) is of particular interest in that it shows well-marked geographical variation, material from south-east South Africa differing structurally from the typical form, which ranges over the whole of the rest of Ethiopian Africa. It is rather unfortunate that the holotype of *E. reticulata* (Brunner) comes from Grahamstown, so that the nominate subspecies is not the widespread one.

Distribution (Fig. 102)

E. reticulata (Brunner) covers the whole of Africa south of the Sahara, except for the desert area of South-West Africa and the western part of South Africa.



Figs. 121–125.—Lateral view of the pronotum of (121) *Eulioptera reticulata* (Brunner), male; (122) *E. longicerca* sp. n., male; (123) *E. spinulosa* sp. n., female; (124) *E. spinulosa* sp. n., male; (125) *E. breviala* sp. n., male.

Key to the subspecies

Only the males can be satisfactorily diagnosed on the bases of the material available at present, and the key given here refers to this sex only. For a possible method of separating the females see p. 00.

1. Cu_2 of the left fore wing very prominent, as in Fig. 126, its raised part more than 1·8 mm. in length..... *E. reticulata reticulata* (Brunner) (p. 269)
–. Cu_2 of the left fore wing not particularly prominent, as in Fig. 127, its raised part less than 1·8 mm. in length..... *E. reticulata leptomorpha* subsp. n. (p. 271)

1. *EULIOPTERA RETICULATA RETICULATA* (Brunner, 1878), **stat. n.**

Phaneroptera reticulata Brunner, 1878, Monographie der Phaneropteriden, p. 213.

Diagnosis

♂. Cu_2 of left fore wing very prominent, as in Fig. 126, its raised part more than 1·8 mm. in length.

♀. Broader than *E. r. leptomorpha* subsp. n. but inadequate material for exact diagnosis.

Measurements

Males

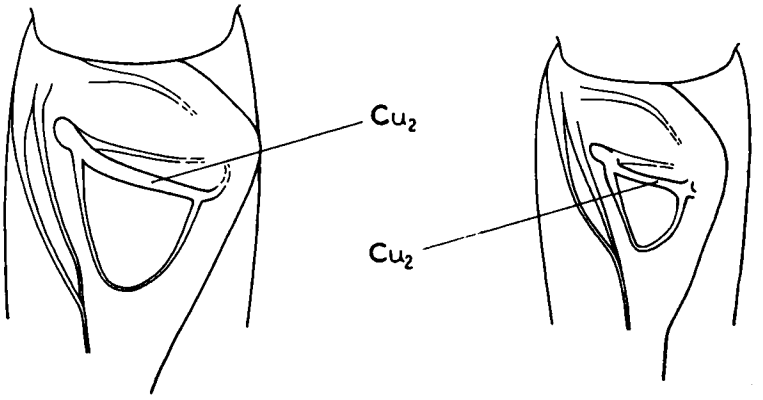
Total length (6) : 25·9–27·9, mean 26·98.
Median length of pronotum (6) : 3·3–3·7, mean 3·51.
Length of hind femur (6) : 13·2–15·5, mean 14·60.
Maximum vertical width of hind femur (6) : 1·4–1·8, mean 1·64.
Length of fore wing (6) : 16·4–18·1, mean 17·58.
Length of raised part of Cu_2 in fore wing (6) : 1·9–2·1, mean 2·01.
Length of exposed part of hind wing (6) : 5·9–6·9, mean 6·27.

Females

Total length (2) : 25·2–26·3, mean 25·75.
Median length of pronotum (2) : 3·3–3·4, mean 3·35.
Width of posterior lobe of pronotal disc (2) : 2·4–2·5, mean 2·45.
Length of hind femur (2) : 14·7–17·4, mean 16·05.
Maximum vertical width of hind femur (2) : 1·8–1·9, mean 1·85.
Length of fore wing (2) : 17·8–19·5, mean 18·65.
Length of exposed part of hind wing (2) : 4·8–5·0, mean 4·90.
Length of ovipositor (2) : 4·9–5·1, mean 5·00.

Discussion

Males of this subspecies may be easily recognized by the broad stridulatory organ, and in particular by the length of the prominently raised part of Cu_2 (Fig. 126). The only two females of *E. r. reticulata* (Brunner) available were of a more robust appearance than any of the females of *E. r. leptomorpha* subsp. n.; the widths of the posterior lobes of their pronotal discs were 2·4 mm. and 2·5 mm., compared with an average figure of 2·18 mm. (2·0–2·4 mm.) for females of *E. r. leptomorpha* subsp. n.



Figs. 126 & 127.—Dorsal view of the stridulatory organ of (126) *Eulioptera reticulata reticulata* (Brunner) ; (127) *E. r. leptomorpha* subsp. n.

Material examined

♀ holotype.

SOUTH AFRICA: Natal, Nqutu, 1952 (1 ♀); Natal, Tongaat (Burnup) (1 ♂); Natal, Port Natal (1 ♂); Natal, Durban, i.1890 (Bowker) (1 ♂) (S. A. Mus.); Winkle Spirit [?], xii.1916 (Akerman) (1 ♂); Cape Province, Pondoland, Port St. Johns, v.1924 (Turner) (1 ♂); Cape Province, Fort Brown (Walton) (1 ♂); ——— (1 ♂) (Nat. Mus. Vienna).

In the British Museum (Natural History) unless otherwise stated.

Distribution (Fig. 102)

The distribution of this subspecies is extremely interesting. On the basis of the material available it appears to be confined to the south-eastern coastal fringe of temperate savannah and temperate and sub-tropical forest stretching from Lake St. Lucia to Port Elizabeth. It seems, therefore, that this subspecies represents an adaptation of *E. reticulata* (Brunner) to the rather more temperate climate and vegetation of this south-eastern region of South Africa. It is probable that the species has not yet extended into the Mediterranean type of vegetation found in the more westerly part of the Cape.

2. EULIOPTERA RETICULATA LEPTOMORPHA subsp. n.

Holotype ♂, NORTHERN RHODESIA: Mporokoso distr., Mweru Wa Ntipa, 8–13.vii. 1952 (Uvarov). In the British Museum (Natural History).

Diagnosis

♂. Cu_2 of left fore wing not particularly prominent, as in Fig. 127, its raised part less than 1·8 mm. in length.

♀. More slender than *E. r. reticulata* (Brunner), but inadequate material of latter for exact diagnosis.

Measurements

Males	Females
Total length (20): 23·8–29·5, mean 26·07.	Total length (20): 27·3–34·2, mean 30·37.
Median length of pronotum (19): 2·9–3·6, mean 3·26.	Median length of pronotum (20): 2·9–3·8, mean 3·34.
Length of hind femur (20): 12·2–16·5, mean 13·82.	Width of posterior lobe of pronotal disc (20): 2·0–2·4, mean 2·18.
Maximum vertical width of hind femur (20): 1·3–1·8, mean 1·48.	Length of hind femur (20): 13·6–18·5, mean 15·24.
Length of fore wing (20): 15·2–21·8, mean 17·08.	Maximum vertical width of hind femur (20): 1·4–1·9, mean 1·68.
Length of raised part of Cu_2 in fore wing (20): 0·9–1·6, mean 1·33.	Length of fore wing (20): 17·7–24·6, mean 20·90.
Length of exposed part of hind wing (20): 5·2–7·0, mean 6·20.	Length of exposed part of hind wing (20): 5·5–7·1, mean 6·08.
	Length of ovipositor (20): 4·5–7·8, mean 5·07.

Discussion

This subspecies is the widespread and typical form of *E. reticulata* (Brunner); it may be distinguished from the nominate subspecies by its more slender form, and in particular by the comparatively narrow stridulatory organ of the male (Fig. 127). As mentioned before, only two females specimens of *E. r. reticulata*

(Brunner) were available, and an exact diagnosis of this sex of either species is therefore at present impossible; in females of *E. r. leptomorpha* subsp. n., however, the width of the posterior lobe of the pronotal disc is usually less than 2·3 mm., which is probably not the case in the nominate subspecies.

E. r. leptomorpha subsp. n. shows considerable individual variation. The general coloration may be either green or brown, and there may or may not be a large dark brown patch on the stridulatory organ. The male cerci are very variable in shape (two examples are shown in Fig. 117) and there is great variation in absolute size. The unusual extent of this variation suggests the possibility that sibling species are involved, but the available material is at present inadequate for settling questions of this sort.

Three of the Nigerian females examined, and one from French West Africa, had considerably longer ovipositors than usual (over 7 mm.). These specimens may represent a new species but in the absence of males they are not described as such here. The possibility of polymorphism cannot be ruled out at present, especially as the Nigerian females had exactly the same data as three normal females which they resembled very closely except for the ovipositor and slightly greater general size.

Material examined

♂ holotype; 1 ♂ and 5 ♀ paratypes, same data as holotype.

FRENCH WEST AFRICA: Soudan, Dioura, at light, x–xi.1953 (Davey) (1 ♀); Soudan, Dioura, x.1953 (Davey (1 ♀); Soudan, Dioura, Fa Koroba, Kako, 14.xi.1953 (Davey) (1 ♀); Dahomey, Bismarckburg, i.1891 (Büttner) (2 ♀♀) (Zool. Mus. Berlin); Dahomey, Bismarckburg, vii–ix.1890 (Büttner) (2 ♀♀) (Zool. Mus. Berlin); Senegal, Bambey, viii.1939 (Risbec) (3 ♀♀); Guinea, nr. Kindia, Friguiagbé, 1908 (Prins) (1 ♀) (Mus. Hist. Nat. Paris); ANGLO-EGYPTIAN SUDAN: Lomo, Imatong Mountains, 2,700 ft., xii.1933 (Steele) (1 ♀); NIGERIA: Minna, xi.1954 (Crosskey) (2 ♂♂); Minna, 14–16.ii.1955 (Crosskey) (1 ♀); Benue Province, Gboko, 27.i.1955 (Crosskey) (2 ♂♂); Gombe, Matyoro Lakes, i.1929 (Lloyd) (3 ♂♂, 3 ♀♀); Azare, Gadau, iii.1933 (Buxton) (3 ♀♀); Azare, 1924–25 (Lloyd) (1 ♀); Gadau, ii.1933 (Buxton & Lewis) (1 ♂); BELGIAN CONGO: Katanga, Biano, 8–11.viii.1931 (Mackie) (1 ♂); Katanga, Biano, 8–11.viii.1931 (Ogilvie) (1 ♀); Lake Albert, Kawa, plains bordering lake, short grass, viii.1935 (Johnston) (1 ♂, 1 ♀); Gety, upland grass association, 4,500 ft., 29.viii.1935 (Johnston) (1 ♂); Lake Albert, Kawa, plains between lake and forest, 22.viii.1935 (Johnston) (1 ♀); Katanga, Kansenia, ix–x.1930 (Witte) (2 ♀♀) (Mus. Congo Belge); Elizabethville, ii.1938 (Brédo) (3 ♀♀) (Mus. Congo Belge); Elizabethville, 6.iii.1935 (Seydel) (1 ♂) (Mus. Congo Belge); Sankuru, Gandajika, 1950 (Francquen) (4 ♀♀) (Mus. Congo Belge); Gandajika, xii.1950 (Francquen) (2 ♀♀) (Mus. Congo Belge); Ituri, Wetsa (Costerman) (1 ♀) (Mus. Congo Belge); Pweto, L. Moero, 23.i.1938 (Brédo) (1 ♀) (Mus. Congo Belge); Semliki Valley, Geti Falls, open bush, x.1935 (Johnston) (1 ♀); Kinchassa, iv–v.1899 (Waelbroeck) (5 ♂♂, 4 ♀♀) (Inst. Sci. Nat. Brux.); UGANDA: Masaka, Kalisizo, open bush, short grass, 18.v.1935 (Johnston) (1 ♂); Bugwere, 30.x.1933 (Johnston) (1 ♂); Kiyunga, 8.ii.1924 (Johnston) (1 ♂); Kepeka, 5.vii.1933 (Johnston) (1 ♀); Karamaja,

at light, 5.xi.1933 (Johnston) (1 ♀); Lango, Kigaa, short grass-bush, i.1933 (Johnston) (2 ♀♀); KENYA: Marsabit, N.F.D., upland grassland, 26.ii.1944 (Kevan) (1 ♂); Eb Urru, iv–v.1900 (Betton) (1 ♂); TANGANYIKA: Milepa Plain, ii.1949 (Burnett) (1 ♂); Kilimanjaro, ix.1905 (Sjöstedt) (1 ♂) (Zool. Mus. Berlin); ANGOLA: Ebanga, viii. (Suisse) (1 ♂); east, on train, 22.vii.1931 (Ogilve) (1 ♀); ———, 25.viii.1949 (Gradwell & Snow) (1 ♀); NORTHERN RHODESIA: N'Changa (Macnamara) (1 ♀); SOUTHERN RHODESIA: Salisbury distr., Widdecombe Park, 8–10.ii.1949 (Whellan) (1 ♂, 1 ♀); Salisbury distr., Hatfield, 5.iii.1953 (Whellan) (1 ♀); MOZAMBIQUE: Busi R., xii.1906 (Swynnerton) (1 ♂, 1 ♀); Mount Malenga region, nr. Vila Pery, iii.1928 (Lesne) (1 ♀); SOUTH-WEST AFRICA: Kung-Buschmannland (Lübbert) (1 ♀) (Zool. Mus. Berlin); Okahandja, 19–29.iii.1928 (Turner) (1 ♀); Kaokoveld, Anabib, 100 miles west of Ohopoho, 12–13.vi.1951 (Brinck & Rudebeck) (1 ♂) (Zool. Inst. Lund); BECHUANALAND: Gaberones, ix.1915 (Ellenberger) (1 ♀) (Mus. Hist. Nat. Paris); SOUTH AFRICA: Transvaal, Louis Trichardt, i–ii.1928 (Lawrence) (1 ♂) (S.A. Mus.); Transvaal, Barberton (Rendall) (1 ♀).

All in the British Museum (Natural History) unless otherwise stated.

Distribution (Fig. 102)

This subspecies covers all tropical Africa. It extends south as far as Transvaal, beyond which it is replaced by *E. r. reticulata* (Brunner); to the west the southern extent of its range is probably limited by the Kalahari Desert.

2. EULIOPTERA LONGICERCA sp. n.

Holotype ♂, BELGIAN CONGO: Léopoldville, 2.xii.1925 (Hulstaert). In the Musée du Congo Belge, Tervuren.

Diagnosis

♂. Cerci long, extending well beyond subgenital plate (Fig. 118). Subgenital plate with rather shallow apical incision, as in Fig. 110. Hind femora with about 4–7 ventral spinules near apex. Posterior spines of hind tibiae rather long. Supra-anal plate as in Fig. 114, showing tendency to form three posterior angles.

♀ unknown.

Description

♂. Fastigium of vertex somewhat compressed, sulcate above, not raised at apex.

Pronotum without lateral carinae, lateral lobes shaped as in Fig. 122. Spine of fore coxae long. Fore tibiae with 1 or 2 external spurs, with or without 1 apical one. Mid tibiae with about 6 external spurs, with or without 1 apical one. Hind femora with about 4–7 ventral spinules near apex. Hind tibiae with 20–30 rather long external dorsal spines, and 2 apical spurs on each side. Fore wings with distinct bifurcate R_s, which is free from MA. Hind wings extending beyond fore wings by almost third length of latter.

Tenth abdominal tergite unmodified. Supra-anal plate as in Fig. 114, showing tendency to form three posterior angles. Cerci long, as in Fig. 118. Subgenital plate with rather shallow apical incision, as in Fig. 110.

General coloration green, with red-brown spots on vertex, pronotum, femora, proximal parts of tibiae, and more distal abdominal tergites. Femoral spinules and tibial spines and spurs with dark tips. Left fore wing with dark brown patch in region of Cu_2; cells along posterior margin of fore wings dark brown. Remaining cells of fore wings and exposed part of hind wings hyaline with shiny surface; remainder of hind wings hyaline.

♀ unknown.

Measurements

Male

Total length: 30·5.
Median length of pronotum: 3·7.
Length of hind femur: 15·7.
Maximum vertical width of hind femur: 1·8.
Length of fore wing: 20·4.
Length of exposed part of hind wing: 6·3.

Discussion

This species may be distinguished from *E. reticulata* (Brunner) by the long male cerci and the ventral spinules on the distal part of the hind femora, and from *E. spinulosa* sp. n. and *E. breviala* sp. n. by the unmodified tenth abdominal tergite.

Material examined

The holotype is unique.

3. EULIOPTERA SPINULOSA sp. n.

Holotype ♂, BELGIAN CONGO: Kasenyi, sparse bush next to savannah grass plain, 18.viii.1935 (Johnston). In the British Museum (Natural History).

Diagnosis

♂. Tenth abdominal tergite with large median posterior projection of very variable form, usually similar to Fig. 104. Subgenital plate very variable, but robust and usually similar to Fig. 111. Cerci rather long, acuminate, as in Fig. 119. Hind femora with about 2–7 ventral spinules near apex. Sc of fore wings slightly thickened near base, slightly thicker than R in this region.

♀. As male except for genitalia. Tenth abdominal tergite with median posterior projection, as in Fig. 108.

Description

♂. Fastigium of vertex somewhat compressed, sulcate above, not or slightly raised at apex.

Pronotum without lateral carinae, lateral lobes shaped as in Fig. 124. Spine of fore coxae well-developed. Fore tibiae with 1–3 external spurs, with or without 1 apical one. Mid tibiae with about 3–5 external spurs, apical one usually absent. Hind femora with about 2–7 ventral spinules near apex. Hind tibiae with very variable number of external dorsal spines, but usually between 20 and 40, and 2 apical spurs on each side. R_s of fore wings usually bifurcate, often rather indistinct, occasionally fused with part of MA. Hind wings extending beyond fore wings by about third length of latter, though occasionally by considerably less.

Tenth abdominal tergite with large, downwardly curved, median posterior projection of variable length and very variable form, usually similar to Fig. 104. Supra-anal plate rather small, oblong. Cerci rather long, usually acuminate, as in Fig. 119. Subgenital plate robust, of very variable length and shape but usually similar to Fig. 111.

General coloration green, with red-brown spots on vertex, pronotum, femora, basal parts of tibiae, all or some of abdominal tergites, and sometimes some of thoracic pleurites. Femoral spinules and tibial spines and spurs with dark tips. Left fore wing with dark brown patch in region of Cu_2. Cells along posterior margin of fore wings dark brown. Remaining cells of fore wings and exposed part of hind wings hyaline with shiny surface ; remainder of hind wings hyaline. Cerci darkened near apex.

♀. As male except for pronotum, genitalia, and fore wing-bases. Lateral pronotal lobes more rounded posteriorly than in male (Fig. 123). Tenth abdominal tergite with median posterior projection (Fig. 108). Ovipositor sometimes with protruding flap at base of dorsal margin of lower valves, beneath each basal plate. Dorsal margin of ovipositor rather sharply obtusangulate near base ; part beyond this angle crenulate or denticulate, as is distal fifth of ventral margin. Subgenital plate with right-angled or slightly acute apex.

Measurements

Males	Females
Total length (12) : 26·2–30·9, mean 28·25.	Total length (11) : 25·0–31·1, mean 29·81.
Median length of pronotum (12) : 3·2–3·6, mean 3·43.	Median length of pronotum (11) : 3·3–3·7, mean 3·47.
Length of hind femur (12) : 13·2–16·9, mean 14·83.	Length of hind femur (11) : 13·8–17·2, mean 15·93.
Maximum vertical width of hind femur (12) : 1·6–1·8, mean 1·69.	Maximum vertical width of hind femur (11) : 1·7–2·0, mean 1·89.
Length of fore wing (12) : 15·8–20·5, mean 18·24.	Length of fore wing (11) : 16·9–21·3, mean 20·10.
Length of exposed part of hind wing (12) : 4·7–8·5, mean 6·69.	Length of exposed part of hind wing (11) : 3·6–7·5, mean 6·49.
	Length of ovipositor (11) : 4·9–5·2, mean 5·08.

Variation

The lateral pronotal lobes vary in shape, but the female always has a more rounded posterior margin than the male. The spurs of the fore and mid tibiae and the ventral spinules of the hind femora vary in number, and there is great variation in the number of hind tibial spines. Though usually projecting beyond the fore wings by just over a third of their length, the hind wings occasionally protrude by considerably less than this, sometimes by less than a quarter of the length of the fore wings. The subgenital plate and the posterior projection from the tenth abdominal tergite in the male vary enormously in size and shape. The latter structure usually widens towards its extremity, but is sometimes parallel-sided and occasionally tapers ; the ventral apical lobe of the male subgenital plate sometimes projects further than the dorsal one (as in Fig. 111), sometimes has equal prominence, and is occasionally shorter. The male cerci vary in length and shape. The lobe at the base of the

dorsal margin of each ventral valve of the ovipositor is only sometimes present, and then very variable in size and shape. There is variation in the extent of the maculation.

Discussion

This species may be easily distinguished from *E. reticulata* (Brunner) and *E. longicerca* sp. n. by the projection from the tenth abdominal tergite. The normal relative length of the hind wings and the unmodified hind tibial spines serve to separate it from *E. breviala* sp. n.

E. spinulosa sp. n. shows as much variation as *E. reticulata* (Brunner). Although this is chiefly of an individual nature, it is likely that further material will show that the species is polytypic. The male specimen examined from Southern Rhodesia had a subgenital plate differing very substantially from all the more northern specimens; this variant will probably prove to be geographical rather than individual.

Material examined

♂ holotype; 1 ♂ paratype, BELGIAN CONGO: Nyangwe (Mayné); 1 ♂ and 2 ♀ paratypes, BELGIAN CONGO: Kasongo, 25.vi.1918 (Mayné) (the 2 ♀♀ in Mus. Congo Belge); 2 ♂ paratypes, BELGIAN CONGO: 345 Km. from Kindu (Russo) (1 in Mus. Congo Belge); 1 ♂ paratype, BELGIAN CONGO: Kamina, i.1951 (Buls); 1 ♂ paratype, BELGIAN CONGO: Mabende, xii.1935 (Brédo) (Mus. Congo Belge); 1 ♀ paratype, BELGIAN CONGO: 311 Km. from Kindu (Russo); 2 ♀ paratypes, BELGIAN CONGO: Gandajika, 11–17.viii.1950 (Francquen) (1 in Mus. Congo Belge); 1 ♀ paratype, BELGIAN CONGO: Sankuru, Gandakija, 15.ix.1950 (Francquen); 1 ♂ paratype, UGANDA: Entebbe, 19.viii.1911 (Gowdey); 1 ♀ paratype, UGANDA: Entebbe, viii.1912 (Gowdey); 1 ♀ paratype, UGANDA: Entebbe, 20–31.viii.1912 (Wiggins); 1 ♀ paratype, UGANDA: Teso distr., *Cynodon* association, 26.vii.1934 (Johnston); 1 ♂ paratype, FRENCH EQUATORIAL AFRICA: Middle Congo, M'Boko Songho, 1919 (Chopard) (Mus. Hist. Nat. Paris).

BELGIAN CONGO: Rutshuru, i.1937 (Ghesquière) (1 ♂, 3 ♀♀) (Mus. Congo Belge); Baraka, vii.1918 (Mayné) (1 ♂); Dibaya, Kamponde, 1945 (Allaer) (1 ♂); Sankuru, Gandajika, 17–23.x.1950 (Francquen) (2 ♀♀) (Mus. Congo Belge); Ituri, Gardin, 16.ii.1930 (Collart) (1 ♀) (Mus. Congo Belge); Kasongo, 25.vi.1918 (Mayné) (1 ♀) (Mus. Congo Belge); FRENCH EQUATORIAL AFRICA: Oubangui-Chari, between Fort Sibut and Fort Crampel, i.1904 (Decorse) (1 ♀) (Mus. Hist. Nat. Paris); GOLD COAST: Tafo, v–vi.1954 (Williams) (1 ♀); UGANDA: Namanne, 7.x.1934 (Ford) (1 ♂); Kampala, 26.i.1909 (Gowdey) (1 ♂); Nakasongola, Buruli, 28.vii.1911 (Gowdey) (1 ♂); SOUTHERN RHODESIA: Salisbury (Marshall) (1 ♂); SOUTH AFRICA: Transvaal, Barberton (Rendall) (1 ♀).

All in the British Museum (Natural History) unless otherwise stated.

Distribution

Though probably most common in equatorial Africa, this species appears to extend southwards through Rhodesia into Transvaal; the South African record

should be regarded with some doubt, however, as the specimen had no abdomen. The discontinuous records listed above suggest inadequate collecting, and it is probable that *E. spinulosa* sp. n. covers all tropical and parts of southern Africa.

4. EULIOPTERA BREVIALA sp. n.

Holotype ♂, BELGIAN CONGO : Kivu, Kibumba, 7.ix.1932 (Burgeon). In the Musée du Congo Belge, Tervuren.

Diagnosis

♂. Hind wings extending not more than 20 mm. from hind margin of pronotal disc, projecting beyond fore wings by less than quarter length of latter. Dorsal spines of hind tibiae large and widely spaced, external ones usually less than 20 in number. Lateral pronotal lobes longer than deep, shaped as in Fig. 125. Tenth abdominal tergite with large median posterior projection, as in Fig. 105. Cerci tapering only near apex, as in Fig. 120. Subgenital plate robust, shaped as in Fig. 112. Hind femora usually with 2–5 ventral spinules near apex.

♀. As male except for genitalia and pronotum, lateral lobes of which are more rounded posteriorly. Tenth abdominal tergite with median posterior projection.

Description

♂. Fastigium of vertex somewhat compressed, sulcate above, slightly raised at apex.

Pronotum without lateral carinae, lateral lobes longer than deep, shaped as in Fig. 125. Spine of fore coxae usually small. Fore tibiae usually with 2 external spurs, including 1 apical one. Mid tibiae with about 4–6 external spurs, including 1 apical one. Hind femora usually with 2–5 ventral spinules near apex. Hind tibiae with 10–25, usually about 15, large, widely spaced, external dorsal spines, and 2 apical spurs on each side. R_s of fore wings usually indistinct ; when clear, usually bifurcate and free from MA. Hind wings extending 15–20 mm. from hind margin of pronotum, protruding beyond fore wings by less than quarter length of latter.

Tenth abdominal tergite with large median posterior projection, as in Fig. 105. Supra-anal plate wider than long, posterior angles lobiform, spreading. Cerci as in Fig. 120, tapering only near apex. Subgenital plate robust, shaped as in Fig. 112.

General coloration green, often with red-brown spots on vertex, pronotum, femora, basal parts of tibiae, thoracic pleurites, and abdominal tergites. Femoral spinules and tibial spines and spurs with dark tips. Left fore wing with dark brown or black patch in region of stridulatory organ. Cells along posterior margin of fore wings dark brown or black. Cells of fore wings and exposed part of hind wings translucent or hyaline with shiny surface ; remainder of hind wings hyaline. Cerci slightly darkened at apex.

♀. As male except for pronotum, genitalia, and fore wing-bases. Pronotum with lateral lobes more rounded posteriorly than in male. Tenth abdominal tergite with median posterior projection (similar to Fig. 108). Ovipositor with

about distal three-quarters of dorsal margin and about distal quarter of ventral margin crenulate or denticulate. Subgenital plate usually obtuse, sometimes subtruncate. Cells of posterior part of left fore wing-base often dark brown.

Measurements

Males	Females
Total length (4) : 20·0–22·6, mean 21·43.	Total length (2) : 20·5–22·4, mean 21·45.
Median length of pronotum (4) : 3·4–3·7, mean 3·57.	Median length of pronotum (2) : 3·6–3·7, mean 3·65.
Length of hind femur (4) : 13·4–14·1, mean 13·75.	Length of hind femur (2) : 14·2–14·8, mean 14·50.
Maximum vertical width of hind femur (4) : 1·8–1·9, mean 1·88.	Maximum vertical width of hind femur (2) : 1·9–2·4, mean 2·15.
Length of fore wing (4) : 13·9–15·4, mean 14·75.	Length of fore wing (2) : 15·3–16·2, mean 15·75.
Length of exposed part of hind wing (4) : 2·4–3·3, mean 2·81.	Length of exposed part of hind wing (2) : 2·0–2·1, mean 2·05.
	Length of ovipositor (2) : 5·0–5·2, mean 5·10.

Variation

The lateral pronotal lobes vary slightly in length. The spine of the anterior coxae is usually rather small and poorly developed, but is occasionally longer. There is variation in the number of ventral spinules on the hind femora and in the number of tibial spurs and spines. The longitudinal veins of the fore wings vary in distinctness. The subgenital plate varies somewhat in shape in both sexes. The degree of transparency shown by the cells of the fore wings is variable.

Discussion

This species may be easily distinguished from *E. reticulata* (Brunner) and *E. longicerca* sp. n. by the projection from the tenth abdominal tergite, the relatively short hind wings, and the long, rather sparsely distributed, spines on the hind tibiae. The latter two characters also serve to separate it from *E. spinulosa* sp. n.

Material examined

♂ holotype ; 1 ♂ paratype, BELGIAN CONGO : Kivu, Kgoma, 3.x.1932 (Burgeon) ; 2 ♂ and 2 ♀ paratypes, BELGIAN CONGO : Rutshuru, iii.1937 (Ghesquière) (1 ♀ in Mus. Congo Belge) ; 1 ♂ paratype, BELGIAN CONGO : Masasi-Kisheryo, Kivu, 1935 (Herman) (Mus. Congo Belge) ; 1 ♀ paratype, BELGIAN CONGO : Ruanda, Kayove, terr. Kisenyi, 2,000 m., 14.ii.1953 (Basilewsky) (Mus. Congo Belge) ; 1 ♀ paratype, UGANDA : Kigezi, Kashenji, 7,000 ft., hill scrub, xi.1935 (Johnston).

In the British Museum (Natural History) unless otherwise stated.

Distribution

All the known specimens of this species are from the grassland and temperate forest associated with the relatively high ground in the region of Lakes Kivu and Edward, and, in view of the rather isolated nature of this region, it is possible that the species is confined to it.

NEPHOPTERA Uvarov, 1929.

Nephoptera Uvarov, 1929, *Annu. Mus. zool. Acad. St. Pétersb.* **31**, 630. Type, by original designation, *Nephoptera tibialis* Uvarov, 1929.

Pseudanerota Bei-Bienko, 1951, *Trud. vsesoyuz. ent. Soc.* **43**, 134. Type, by original designation, *Phaneroptera persica* Uvarov, 1929. **Syn. n.**

Diagnosis

Fastigium of vertex hardly compressed, broad, as in Fig. 2. Mid tibiae strongly swollen in basal half (Figs. 5 & 6). Lateral pronotal lobes with distinct angle in antero-ventral region of margin, as in Figs. 128 & 129. Hind tibia with two apical spurs on each side (similar to Fig. 8).

Discussion

The vertex, with its broad fastigium, and the strongly swollen mid tibiae serve to distinguish this genus from *Phaneroptera* Serville and *Eulioptera* gen. n.

The genus *Pseudanerota* Bei-Bienko was erected for the two species *Phaneroptera persica* Uvarov and *Pseudanerota robusta* Bei-Bienko on the basis of the very small fore coxal spine, the relative size of the legs, and small differences in the shape and serration of the ovipositor. These characters are in my opinion

Figs. 128 & 129.—Lateral view of the pronotum of (128) *Nephoptera tibialis* Uvarov; (129) *N. persica* (Uvarov).

quite inadequate for a generic separation ; these two species and *Nephoptera tibialis* Uvarov form a homogeneous group, united by such characters as the broad fastigium of the vertex, the basally swollen mid tibiae, and the comparatively large ovipositor with strongly developed basal folds.

Distribution (Fig. 102)

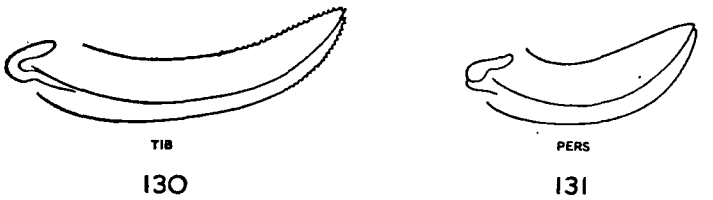
Nephoptera Uvarov is so far known only from the southern part of Persia.

1. *Key to the species*

No material of *N. robusta* (Bei-Bienko) was available, but, for the sake of completeness, this species has been included in the key on the basis of the original description.

1. Hind femora more than 15 mm. in length in the male and 17 mm. in the female. Ovipositor shaped as in Fig. 130. General coloration brown or grey ..... *N. tibialis* Uvarov (p. 280)
–. Hind femora less than 15 mm. in length in the male and 17 mm. in the female. Ovipositor not shaped as in Fig. 130. General coloration green..... 2

2. Costal area of the fore wings with a more sparse venation than the remaining areas ..... *N. persica* (Uvarov) (p. 281)
–. Costal area of the fore wings of the same texture as the remaining areas ..... *N. robusta* (Bei-Bienko) p. 282)



130 131

Figs. 130 & 131.—Lateral view of the ovipositor of (130) *Nephoptera tibialis* Uvarov ; (131) *N. persica* (Uvarov).

2. *Descriptions of the species*

1. *NEPHOPTERA TIBIALIS* Uvarov, 1929

Nephoptera tibialis Uvarov, 1929, *Annu. Mus. zool. Acad. St Pétersb.* **31,** 631. Holotype ♂, S. E. PERSIA : Makran, Ghé country, Kaguraka, 27.iii.1901 (Zarudnyj). In the Zoological Museum of the U.S.S.R. Academy of Sciences, Leningrad.

Diagnosis

♂. Spine of fore coxae very small or absent. Archedictyon of costal area of fore wings exactly similar to that of other fore wing-areas. Fore wings more than 20 mm. in length. Hind femora more than 15 mm. in length. Lateral pronotal lobes shaped as in Fig. 128. General coloration brown or grey.

♀. As male except for size. Fore wings more than 22 mm. in length. Hind femora usually more than 17 mm. in length. Ovipositor as in Fig. 130, more than 8 mm. in length. Seventh abdominal sternite unmodified.

Measurements

Males	Females
Total length (2) : 31·3–32·7, mean 32·00.	Total length (8) : 33·3–36·8, mean 35·01.
Median length of pronotum (2) : 2·9–3·2, mean 3·05.	Median length of pronotum (7) : 2·9–3·3, mean 3·14.
Length of hind femur (3) : 15·6–16·1, mean 15·93.	Length of hind femur (8) : 16·3–18·6, mean 17·31.
Maximum vertical width of hind femur (3) : 2·0–2·1, mean 2·05.	Maximum vertical width of hind femur (8) : 2·0–2·3, mean 2·20.
Length of fore wing (3) : 22·3–23·4, mean 22·80.	Length of fore wing (8) : 23·4–26·4, mean 24·98.
Length of exposed part of hind wing (3) : 5·6–6·7, mean 6·23.	Length of exposed part of hind wing (8) : 6·0–6·9, mean 6·51.
	Length of ovipositor (8) : 8·7–9·2, mean 9·02.

Discussion

If invariable, the coloration of this species readily enables it to be distinguished from the other two species of *Nephoptera* Uvarov, which are green. Structurally, it may be separated from *N. persica* (Uvarov) by its large size, the regular archedictyon of the costal area of the male fore wings, and the length and shape of the ovipositor.

Material examined

1 ♂ paratype, PERSIA : south-east, Kutche, Kambil, 8.iii.1901 (Zarudnyj) ; 1 ♂ paratype, PERSIA : south-east, Bambur, Razy, 9.iv.1901 (Zarudnyj) ; 1 ♀ paratype, PERSIA : south-east, Makran, Ghé country, Kaguraka, 27.iii. 1901 (Zarudnyj) ; 1 ♀ paratype, PERSIA : south-east, Bampur, Karvandar, 25.iv.1901 (Zarudnyj).

PERSIA : Gew, Baluchistan, iv.1951 (Popov) (5 ♀♀) ; Saravan, Bamposcht, 4.v.1950 (Salvatian) (1 ♂, 1 ♀).

All in the British Museum (Natural History).

Distribution

Known only from south-east Persia.

2. *NEPHOPTERA PERSICA* (Uvarov, 1929), **comb. n.**

Phaneroptera persica Uvarov, 1929, *Annu. Mus. zool. Acad. St Pétersb.* **31,** 628. Holotype ♂, S.E. PERSIA : S. Kirman, Bazman, 23.vi.1898 (Zarudnyj). In the Zoological Museum of the U.S.S.R. Academy of Sciences, Leningrad.

Pseudanerota persica (Uvarov), Bei-Bienko, 1954, Fauna of the U.S.S.R., *Fauna Rossii* (New Series), Orthoptera **2** (2), 81.

Diagnosis

♂. Spine of fore coxae present. Costal area of fore wings with more sparse venation than remaining areas. Fore wings less than 20 mm. in length. Hind femora less than 15 mm. in length. Lateral pronotal lobes shaped as in Fig. 129. General coloration green. Fore wings 4·5–5·5 times longer than their maximum width.

♀. As male except for size. Fore wings less than 22 mm. in length. Hind femora less than 17 mm. in length. Ovipositor as in Fig. 131, less than 8 mm. in length. Seventh abdominal sternite unmodified.

Measurements

Male (paratype)

Total length : 25·4.
Median length of pronotum : 2·6.
Length of fore wing : 17·7.
Length of exposed part of hind wing : 5·6.

Females

Total length (2) : 29·4–30·2, mean 29·80.
Median length of pronotum (2) : 2·9–3·0, mean 2·95.
Length of hind femur (2) : 16·1–16·2, mean 16·15.
Maximum vertical width of hind femur (2) : 1·8–2·0, mean 1·90.
Length of fore wing (2) : 20·1–21·9, mean 21·00.
Length of exposed part of hind wing (2) : 5·4–5·9, mean 5·65.
Length of ovipositor (2) : 6·0–6·2, mean 6·10.

Discussion

This species is characterized by the relatively sparse venation of the costal area of the fore wings. The two females available agreed well with the male paratype examined, and fitted the original description exactly except for their size, which was rather greater ; it is just possible, though unlikely, that they represent a different, undescribed, species.

Material examined

1 ♂ paratype, PERSIA : south-east, Makran, Ghé country, Kishi, 28.iii.1901 (Zarudnyj).

PERSIA : Sarkhum, Bandar Abbas, 1.v.1950 (Popov) (2 ♀♀).

Distribution

Known only from south Persia.

3. *NEPHOPTERA ROBUSTA* (Bei-Bienko, 1951), **comb. n.**

Pseudanerota robusta Bei-Bienko, 1951, *Trud. vsesoyuz. ent. Soc.* **43,** 135. Holotype ♀, PERSIA : Luristan, Khurramabad. In the Zoological Musuem of the U.S.S.R. Academy of Sciences, Leningrad.

Diagnosis

♀. Spine of fore coxae present. Archedictyon of costal area of fore wings exactly similar to that of other fore wing-areas. Seventh abdominal sternite considerably broadened. General coloration green. Fore wings only 4 times longer than their maximum width.

♂ unknown.

Original description (translated from Russian)

♀. Resembling *Ps. persica* Uv. in the pale green coloration of the body, long ovipositor, shape of pronotum and mid tibiae, general structure of subgenital plate, and differing from it in the following characters. More robust and slightly larger. Apex of vertex weakly convex, moderately oblique, triangular, but broader, with the sulcus broadened posteriorly, somewhat obtuse at the apex and not completely touching the apex of the frons, being separated from it by a deeper sulcus. Elytra considerably broader, only 4 times longer than their maximum width, costal area with the same dense net of veinlets as the remainder. Posterior femora broader in basal part, their width equal to maximum width of ovipositor. Spines on the upper side of posterior tibiae begin almost from the base and do not reach the middle of the lower side. Supra-anal plate in the form of an elongated downcurved process, sulcate above, located between cerci. Seventh abdominal sternite considerably broadened. Subgenital plate similarly narrow and tongue-shaped, but the basal part of the ovipositor has strong convexities. Ovipositor weakly curved, slightly broadened in the apical half, its lower margin straight from the base to further than the middle. Length of body 14 (abdomen slightly shrunk), pronotum 3·3, elytron 21·5, wing 27, hind femur 14, ovipositor 7·5 mm.

♂ unknown.

Discussion

The unique holotype of this species was not available for study, but according to the original description it may be recognized by the broadened seventh abdominal sternite and the relatively broad fore wings.

Distribution

Known only from the type locality in south-west Persia.

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