JOURNAL OF THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

December 1988 VOLUME 78, No. 191

A taxonomic revision of the grasshopper genus *SPATHOSTERNUM* (ORTHOPTERA, ACRIDIDAE)

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ABSTRACT

The highly wing-polymorphic, Afro-Oriental grasshopper genus *Spathosternum* Krauss 1877, Hemiacridinae is revised. Keys are provided to the males of the species. Seven species, *prasiniferum, abbreviatum, curtum, malagassum, nigrotaeniatum, brevipenne* and *pygmaeum* are now recognised. Three species *brevicorne, beninense, medium* and one subspecies *prasiniferum sinense* are newly synonymised.

INTRODUCTION

This paper is the second of two revisions of hemiacridine grasshopper genera due to be included in a future handbook and field key to the grasshoppers of Eastern Africa. Reference to current assessments of the systematic problems associated with the sub-family Hemiacridinae Dirsh (1961, 1965 and 1975) were given in the first paper Grunshaw (1986), and are not discussed here. The recently published "Locust and Grasshopper Agricultural Manual" (Centre for Overseas Pest Research, 1982), provides a comprehensively annotated reference guide to much of what has been previously written concerning the biology, distribution and economic importance of the genus. Reference will be made throughout the text to this manual where applicable.

The genus *Spathosternum* was erected by Krauss (1877) to accommodate *Tristria nigro-taeniata* Stål (1876) as its type species, being separated principally from "Oxyae and Tristriae" on the shape of the prosternal process. In 1910 Kirby considered that the genus belonged to a group of the Cyrtacanthacridinae and it had by then grown to include the species *S. nigrotaeniatum*, Stål (1876), *pygmaeum* Karsch (1893), *venulosum* Stål (1878) and *caliginosum* Walker (1871). Four years later Kirby (1914) reassigned it to the sub-family Catantopinae without giving any reason for doing so. Since then the genus has oscillated between the Cyrtacanthacridinae and Catantopinae. Tinkham (1940), for example, allocated it to the group Spathosterni of the Cyrtacanthacridinae. It was returned to the Catantopinae by Johnston (1956) as part of the group "Leptacres", which also contained most of the present Hemiacridinae and Tropidopolinae. In the same year, Dirsh (1956), assigned the genus to the newly erected sub-family Hemiacridinae, on the basis of its divided endophallus and its sound-producing mechanism. In his study, Australian Acrididae, Rehn (1957) subsequently gave the genus tribal status by erecting the tribe Spathosternini, which also included the East Australian genus *Laxabilla*. More recently Dirsh (1975) erected the Spathosterninae as a sub-family of the family Hemiacrididae, but this decision has found little support amongst contemporary workers in the Acridoidea.

The genus is of biogeographical interest since its representatives are Afro-Oriental in distribution. There are four species in Africa, one of which extends into Saudi Arabia. One species is restricted to Madagascar, another to India, and a last widespread and variable species extends from Pakistan through India, Sri Lanka and Burma to South East China. Most species favour marshy habitats in which grasses predominate, typically cohabiting with *Oxya* spp.

Abbreviations used in figures

a, length of a midline drawn between the anterior and posterior edges of the lophal interspace; ad, apical diverticulum; ap, apical penis valves; b, width between the outer extremities of the lophus; cv, cingular valves; lpc, lateral process of cingulum; pd, preapical diverticulum.

Abbreviations for depositories

BMNH, British Museum (Natural History), London; MNHN, Muséum National d'Histoire Naturelle, Paris; MNHU, Museum für Naturkunde der Humboldt-Universität, Berlin; NR, Naturhistoriska Riksmuseet, Stockholm; ODNRI, Overseas Development Natural Resources Institute, London.

PRESENTATION

The preparation and treatment of the male genitalia in this study are the same as those described by Dirsh (1956). Female spermathecae were examined by removal of posterior abdominal segments and maceration in 5 [potassium hydroxide solution. The nomenclature of the female spermatheca used in this study is that of Dirsh (1957). Separation of taxa is based mainly on male genital morphology. A key is given for the males of all species and subspecies in the genus, based mainly on external characteristics. Females can only be identified reliably by association with sympatric males. Descriptions are given in the form of differential diagnoses. Main diagnostic characters together with the male genitalia, are illustrated. Three views of the aedeagus and two of the epiphallus are given. The former was drawn from dorsal, lateral and posterior aspects, each drawn at right angles to the plane of the aedeagus. The epiphallus was drawn from a dorsal aspect with the plane of the lophi at right angles to the line of sight of the observer and from a posterior view, giving maximum depth to the epiphallic bridge. In the majority of cases the oval sclerite has been omitted. Where types have been examined this is indicated. Measurements (in mm), together with ranges and means are given for the material examined. Total length is measured from the tip of the vertex to the apex of the folded posterior femur.

Key to species of *Spathosternum* (males)

1 Fastigium of vertex with median dorsal carinulae present (Figs. 20-23). 2
— Fastigium of vertex with median dorsal carinulae absent (Figs. 17-19). 5
2(1) Tegmina fully-winged or brachypterous with (35-50) densely packed stridulatory veinlets (Figs. 42-43). Supra-anal plate comparatively large (Fig. 11), with median transverse groove. (Indo-Oriental). . . . . *S. prasiniferum*
— Tegmina brachypterous or micropterous (Figs. 4-6). Stridulatory file present or absent, if present then vestigial and situated near apex of tegmen, usually with less than 30 stridulatory veinlets. Supra-anal plate comparatively small (Figs. 13-15), with or without median transverse groove. . . .3
3(2) Stridulatory veinlets present. Apical penis valves broad with divergent apices (Fig. 53). (India). . . . . *S. abbreviatum*
— Stridulatory veinlets absent. Apical penis valves slender with divergent apices (Fig. 60), or broad with sub-parallel apices (Fig. 112). 4
4 Small micropterous species (Fig. 6). Supra-anal plate without median transverse groove (Fig. 14). Tegmina touching dorsally. Apical penis valves very slender with divergent tips (Fig. 60). (Angola) . . . . . *S. curtum.*
— Small micropterous species (Fig. 4). Supra-anal plate with weakly impressed median transverse groove (Fig. 15). Tegmina not touching dorsally. Tips of apical penis valves not divergent (Fig. 112). (Madagascar). . . . . *S. malagassum*
5(1) Supra-anal plate trilobate with preapical teeth or projections (Fig. 9). (Africa, S. Arabia). . . . . *S. nigrotaeniatum*
— Supra-anal plate not trilobate, preapical teeth or projections absent (Figs. 10-12. 6
6(5) Supra-anal plate triangular with median transverse groove (Fig. 10). Fully winged or brachypterous species (Fig. 3). (W. Africa). . . . . *S. brevipenne*
— Supra-anal plate parabolic or triangular without median transverse groove (Figs. 12, 16). Fully-winged or with slightly shortened wings (Figs. 66, 83). (Africa south of 15° N latitude). . . . . *S. pygmaeum*

Spathosternum Krauss, 1877

Spathosternum Krauss, 1877:45. Type species: *Tristria nigro-taeniata* Stål, 1876:233.

The genus *Spathosternum* forms a natural grouping of closely related taxa assigned to the subfamily Hemiacridinae. Within the confines of this somewhat heterogeneous assemblage of genera, *Spathosternum* can be readily differentiated by a combination of characters. These are the conical, opisthognathous shape of the head, the two distinctive sinuate facial carina, the shape of the prosternal process, the conspicuous longitudinal, lateral stripe markings and by the internal male genitalia. Brachypterous and micropterous species, notably *S. curtum, S. malagassum* and *S. abbreviatum,* can be separated from *Paraspathosternum,* which might be considered to be their nearest relative, by the shape of the fastigium verticis (Fig. 1), posterior margin of the pronotum and by the male genitalia (Figs. 51-52, 58-59). The female differs from the male in being larger and more robust.

Note that species in the genus display a widespread incidence of intra- and inter-population wing polymorphism, perhaps implying that many are in a state of active evolution towards flightlessness. This characteristic explains why earlier authors found it difficult to make precise species diagnoses based upon purely external morphology. The genus *Chrotogonus* presented similar problems to Kevan (1957, 1959).

Spathosternum nigrotaeniatum (Stål, 1876)
(Figs. 2, 9, 17, 31-32, 24-26, 27-30, 94, 64)

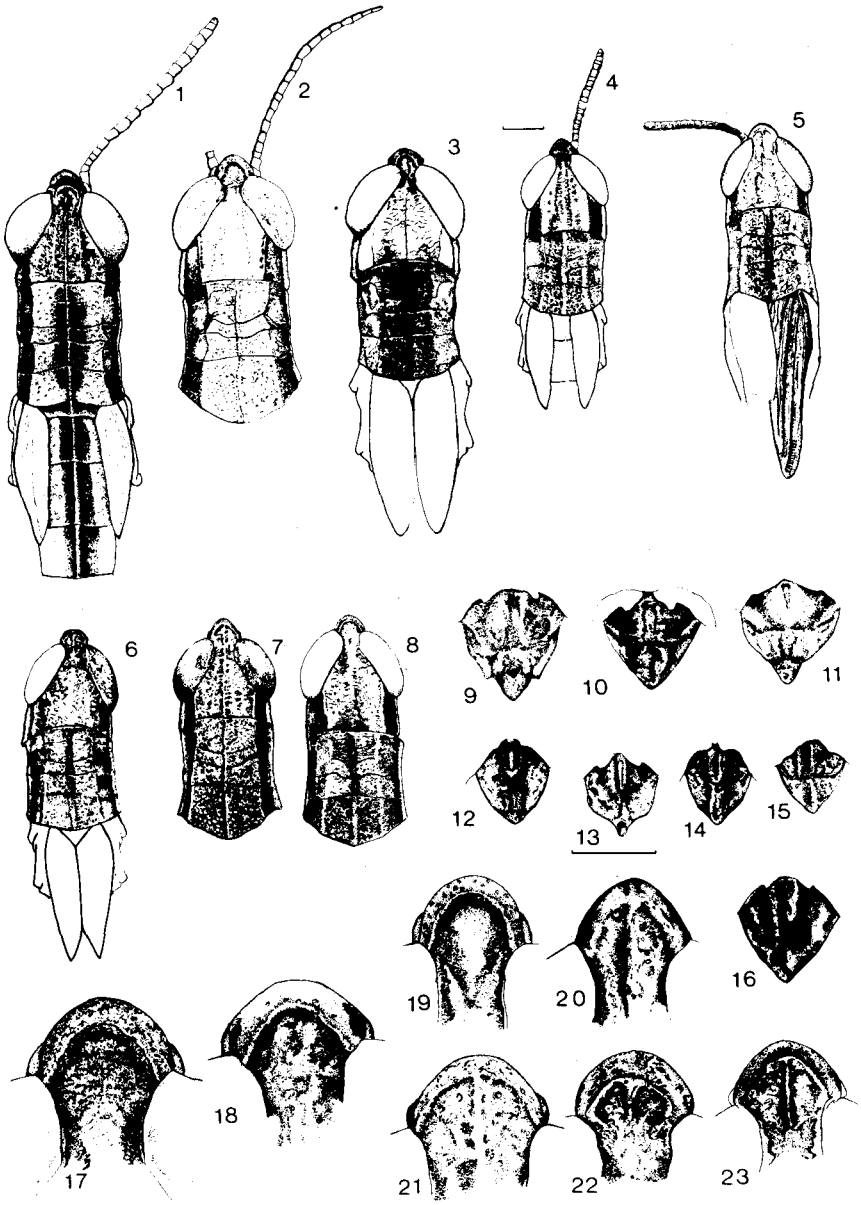
Tristria nigro-taeniata Stål, 1876:233. Holotype ♂, S.W. Africa, (NR) [examined].
Spathosternum nigrotaeniatum (Stål) Krauss 1877:45

Diagnosis. Male. Small, integument very finely rugose, almost smooth. Head conical; fastigium of vertex (Fig. 17) parabolic, surface concave. Antennae filiform, shorter than head and pronotum together. Frons in profile strongly oblique; frontal ridge (Fig. 31) sulcate, marginal carina well developed, thickened, slightly narrowing below apex of vertex. Face with two distinct sinuate carinae. Eyes large, oval elongate. Dorsum of pronotum flattened; median dorsal pronotal carina well developed, sometimes intersected by second and third sulci, always intersected by principal sulcus; lateral pronotal carina (Fig. 2) becoming sinuate between second and principal sulci, slightly divergent posteriorly. Metazona shorter than prozona; posterior margin of pronotal disc obtuse-angulate. Lateral pronotal lobes more densely pitted in metazona than prozona, with two large smooth areas in upper part of prozona. Prosternal process (Fig. 32) shallowly bilobate, flattened, inclined backwards. Mesosternal interspace strongly constricted, with mesosternal lobes almost confluent, widening posteriorly. Tegmen fully developed, always surpassing apex of folded hind knees. Radian area of tegmen with series of regular parallel veinlets. Posterior femur of normal shape; external apical spine of hind tibia present. Supra-anal plate (Fig. 4) trilobate with pre-apical projections or teeth. Last abdominal tergite with pair of small, widely spaced projections. Subgenital plate obtusely conical. Cercus, unmodified simple, acute straight. Endophallus divided, with slightly elongate aedeagus. Apical penis valves protruding subapically beneath encircling cingular valves. Apices of apical penis valves narrow, divergent. Cingular valves viewed anterodorsally (Figs. 24-26) appearing as a thin membraneous, sub-circular structure, forming sub-acute, inwardly curling, slightly thickened apices, flanked by lateral, inflated processes of cingular origin. Epiphallus (Figs. 27-30) bridge-shaped with median area of adjoining lateral plates less sclerotised, almost giving a divided-bridge appearance; oval sclerites present. Ventral edge of bridge forming a small; median, upcurved projection anteriorly. Ancorae small, down-curving with acute apices. Sides of epiphallus incurved. Lophi blunt, triangular, flat, slightly upcurved.

General colouration variable, often expressing green-brown polymorphism. Face light brown, stramineous or green. Dorsal surface of head, pronotum and tegmen same colour as face, or sometimes with darker medial area. A narrow, dark longitudinal stripe extends from below eye to coxae of middle legs, sometimes incomplete; above this a paler stripe extends to abdomen, marginated by a broad dark brown stripe, which continues from behind compound eye, across upper part of lateral pronotal lobes before merging with tegmen. Posterior femur light brown or dull yellow. Knee lunules dark brown. Posterior tibia light brown or grey yellow.

Female. Anterior margin of vertex rounded triangular. Supra-anal plate elongate, triangulate, with raised median ridge; shallowly sulcate along its length and bisected by a median transverse sulcus; pre-apical teeth absent. Spermatheca (Fig. 94) with apical diverticulum becoming bulbous distally, apex bent and obtusely rounded; preapical diverticulum in form of a slender tube expanded proximally.

General colouration green or brown with similar longitudinal lateral markings as male. Posterior femur uniformly green or brown, often showing light green on upper face.



Figs 1-23. *Paraspathosternum* and *Spathosternum* species.
1, *Paraspathosternum pedestris,* dorsal aspect of male head and pronotum. 2-23, *Spathosternum* spp. 2-8, 2, *nigrotaeniatum;* 3, *brevipenne;* 4, *malagassum:* 5, *abbreviatum;* 6, *curtum:* 7, *prasiniferum;* 8, *pygmaeum.* Scale line represents 1mm. 9-16, *Spathosternum* spp., male supra-anal plates; 9, *nigrotaeniatum;* 10. *brevipenne;* 11, *prasiniferum:* 12, *pygmaeum;* 3, *abbreviatum;* 14, *curtum;* 15, *malagassum;* 16, *pygmaeum* (Dikwa, N. Nigeria). Scale line represents 1mm. and also applies to Figs. 17-23. 17-23. *Spathosternum* spp., dorsal aspect of male fastigium verticis; 17, *nigrotaeniatum;* 18, brevipenne; 19, *pygmaeum;* 20, *abbreviatum;* 21, *prasiniferum;* 22, *curtum,* 23, *malagassum.*

TABLE 1. *Spathosternum nigrotaeniatum:* measurements.

	Males			Females		
	n.	mean	range	n	mean	range
Interocular distance	(29)	0.43	(0.21-0.64)	(24)	0.77	(0.60-0.95)
Head width	(29)	3.06	(2.60-3.35)	(24)	3.71	(3.21-4.58)
Pronotal width	(29)	2.88	(2.46-3.63)	(24)	3.64	(3.08-4.27)
Pronotal length	(29)	3.55	(2.97-4.23)	(24)	4.30	(3.69-4.84)
Posterior femur length	(29)	9.54	(8.40-11.46)	(23)	11.93	(9.73-13.93)
Posterior femur depth	(29)	2.26	(1.91-2.54)	(23)	2.60	(1.85-3.02)
Antennal length	(6)	7.91	(6.65-8.7)	(6)	7.13	(5.52-8.3)
Tegminal length	(23)	16.14	(12.83-20.33)	(24)	17.55	(12.34-21.77)
No. of stridulatory veinlets	(23)	17.08	(15-20)	(13)	17.92	(16-21)
Stridulatory file length	(23)	3.94	(3.18-5.27)	(13)	4.67	(4.01-6.28)
Total length	(29)	19.18	(16.33-22.18)	(18)	23.00	(19.19-26.54)

Discussion. Despite the highly variable nature of this species particularly in relation to tegminal length and epithallic morphology (see figs. 27-30 for variation in epiphallus shape), it is nevertheless easily differentiated from all other members of the genus by the unique possession of preapical teeth or projections, which arise from the supra-anal plate.

Populations from West Africa, particularly the Sahelian region, are generally larger than their East African equivalents, which approach *pygmaeum* in size.

The available data on the life history, distribution, ecology and economic importance of this species have been reviewed elsewhere (Centre for Overseas Pest Research, 1982).

Type-material examined. Holotype ♂, S.W. AFRICA: Damaraland (NR)

Additional material examined. SAUDI ARABIA: 1♂, Asir, Wadi Jowra, 22-25.xii.1947 *(Popov)* (BMNH).

YEMEN ARAB REP.: 1♂, Suaid, nr. Beit el Fagih, 23-24.vi.1951 *(Tillin)* (BMNH). NIGER: 6♂, 5♀, Niamey, *(Popov)* (ODNRI). MALI: 3♂, 1♀ Diaferabé, i.1957 *(Davey)* (BMNH), 3♂, 2♀, Tilembeya, 10-12.xii. 1956 *(Popov)* (ODNRI). GHANA: 1♂, 1♀, Elmina, 20.iii. 1969 *(Richards)* (TDRI); 1♂, E. of Shai Hills, 19.xi.1961 *(Jago)* (BMNH); 1♂, Accra Plain, 23 km. W. of Accra, 18.x. 1959 *(Jago) (BMNH).* *NIGERIA:* 1♂, Gadau, vi.1923 *(Luxton & Lewis)* (BMNH); 1♀, 50 km. S. of Bama, 14.xi.1970 *(Popov)* (ODNRI); 2♂, 2♀, Żaria, Samaru, IAR farm, 11-14.xi.1970 *(Jago & Hollis)* (ODNRI); 1♂, 1♀, Zaria, 4-14.ix.1970 *(Popov)* (ODNRI). ZAMBIA: 1♂, 1♀, Mweru-wa-Ntipa, Kangiri Plain, 23.x.1957 *(Fitzgerald)* (BMNH). REP. S. AFRICA: 1♂, Cape Prov., Queenstown, 16.1-10.ii.1923 *(Turner)* (BMNH).

Spathosternum abrreviatum Uvarov, 1929
(Figs. 5, 13, 20, 53-55, 56-57, 94, 64)

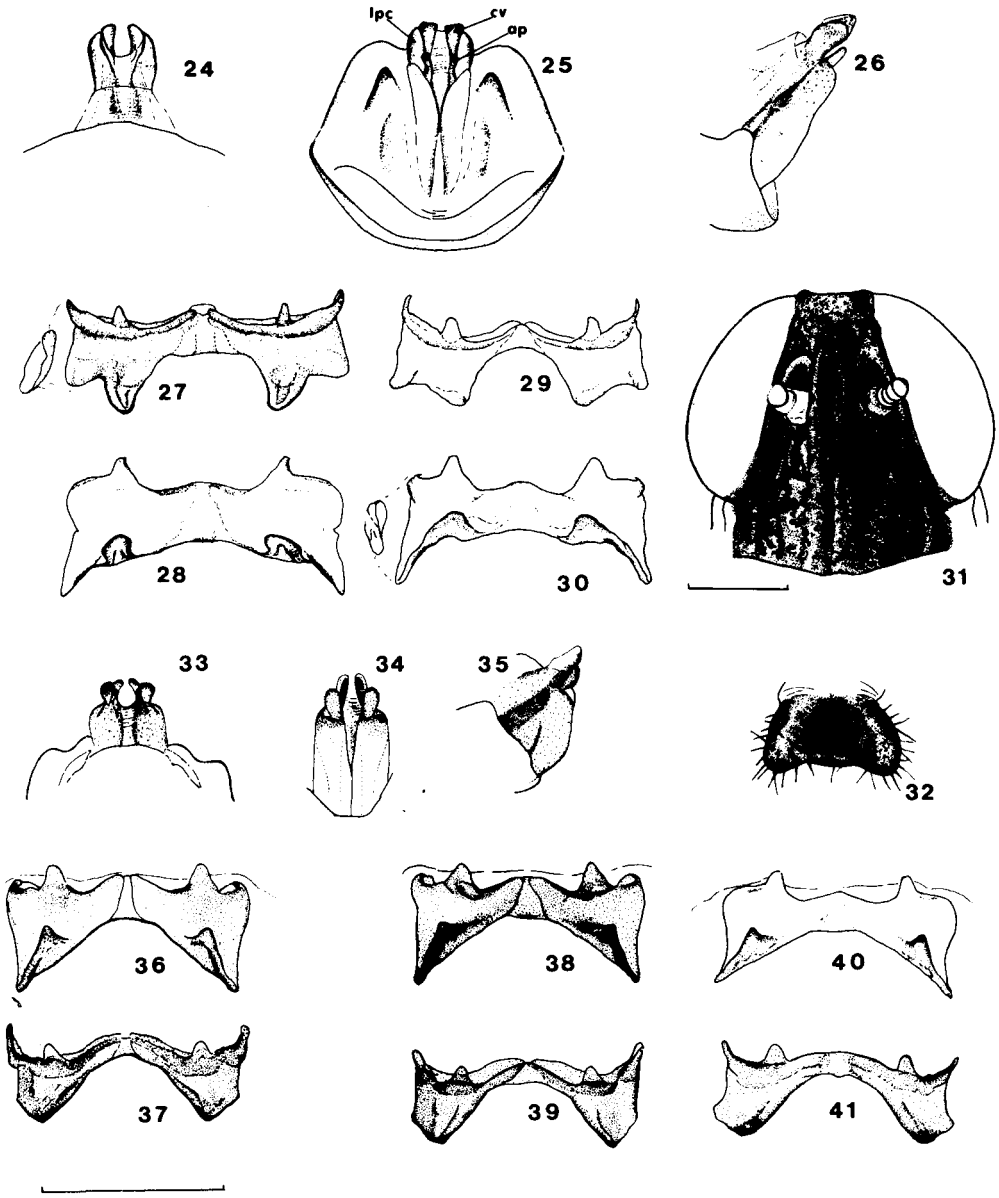
Spathosternum abbreviatum Uvarov, 1929:556. Holotype ♂, INDIA, (BMNH) [examined]. *Spathosternum medium* Uvarov, 1929:558. Holotype ♂, S. INDIA, Masinigudi, 900-1000m., dry bush, 29.i.1927. **Syn. nov.**

Diagnosis. Male. Antennae (Fig. 5) much shorter than combined length of head and pronotum together, thick, distally flattened and widened. Fastigium of vertex (Fig. 20) with concave surface, divided into two by median carinulae, similar to both *malagassum* and *curtum.* Pronotum relatively short, lateral pronotal carina almost straight; posterior margin of disc rounded, angular.

Tegmen shortened, reaching to middle of posterior femur; stridulatory veinlets vestigial, few in number, located toward apex of tegmen. Posterior femur short, stocky. Supra-anal plate (Fig. 13) with raised, median ridge, variably sulcate along its length; posterior margin forming small elongate apex, cuticular sculpture similar to that in *curtum.* Genitalia (Figs. 53-55) with apices of apical penis valves divergent, like those of *nigrotaeniatum* and *curtum,* but proportionally longer and broader. Inflated lateral processes of cingular valves showing distinctive spicule-like sclerotization. Epiphallus (Figs. 56-57) similar to that of *curtum,* but differing in having diminutive, knob-like lophi.

General colouration brown, with pale buff longitudinal lateral stripe; pattern typical for genus.

Female. Antennae somewhat shorter proportionally than in male. Supra-anal plate elongate, triangular.



Figs. 24-41, *Spathosternum* spp.

24-32, *S. nigrotaeniatum*. 24, male aedaegus, view from above; 25, same, posterior aspect; 26 same, lateral aspect; 27, male epiphallus, dorsal aspect 28, same, posterior aspect; 29, same, showing variation in epiphallus shape, dorsal aspect; 30, same, posterior aspect; 31, frontal aspect of male head; 32, male prosternal tubercle. 33-41, *S. brevipenne*. 33, male aedaegus, view from above; 34, same, posterior aspect; 35, same. lateral aspect; 36, male epiphallus, shortened-wing form, posterior aspect; 37, same, dorsal aspect; 38, same, long-wing form, posterior aspect; 39, same, dorsal aspect; 40, same, brachypterous form, posterior aspect; 41, same, dorsal aspect. Scale line under Fig. 31 represents 1mm. Scale line under Fig. 37 represents 1mm and applies to all figs except fig. 31.

Spermatheca (Fig. 97) similar to that of *pygmaeum,* but without accessory vesicles of preapical diverticulum; apex of apical diverticulum more bulbous, otherwise like males.

TABLE 2. *Spathosternum abbreviatum:* measurements.

	Males		Females	
	n		n	
Interocular distance	(2)	0.40,0.51	(2)	0.85,0.84
Head width	(2)	2.13,2.27	(2)	2.75,2.83
Pronotal width	(2)	2.09,2.32	(2)	3.03,3.20
Pronotal length	(2)	2.26,2.38	(2)	2.93,3.09
Posterior femur length	(1)	6.44	(2)	7.13,8.61
Posterior femur depth	(1)	1.78	(2)	2.42,2.54
Antennal length	(1)	2.58	(1)	2.44
Tegminal length	(1)	4.10	(2)	5.01,5.44
No. of stridulatory veinlets	(1)	21	(1)	17
Stridulatory file length	(1)	1.38	(1)	1.40
Total length	(1)	12.27	(2)	15.05,16.29

Discussion. The affinity between African and Indian representatives is most clearly illustrated by this species, which is externally very similar to *curtum* and *malagassum* in appearance. Internally the aedeagus shares some characters with that of both *nigrotaeniatum* and *curtum,* such as the divergent apical penis valves (compare Figs. 25, 53 and 60).

In Uvarov (1929) a description of a new species *medium* was also given but unfortunately no mention of the intended depository for the type of this species was cited. As attempts to locate this type for further study have failed, this species has subsequently not been included in the key to species, although the existence of that description is acknowledged here. Curiously Uvarov (1953) made no mention of this species in his list of the species of *Spathosternum.* From Uvarov's description it can be gathered that *medium* appeared to be nearer to *prasiniferum* than to *abbreviatum.* The wings were shorter than *prasiniferum* but longer than *abbreviatum;* the hind femora were short and thick like *abbreviatum* and not thin like *prasiniferum.* It is deduced from the above that *medium* is probably a wing-polymorph of *abbreviatum,* and it is here synonymised.

Type material examined. Holotype ♂, INDIA: Nilgiris, Snowdon Peak (2426m), 6.IX.1917 *(Rao)* (BMNH), Paratypes, 1♂, 1♀, same data as holotype; 1♀, Nilgiris, Snowdon Peak (2500m), 2.X.1921 *(Nathan)* (BMNH).

Spathosternum brevipenne Chopard, 1958
(Figs. 3, 10, 18, 33-35, 36-41, 95, 64)

Spathosternum brevipenne Chopard, 1958: 131, Fig. 3. Holotype ♂, GUINEA, (MNHN) [examined].
Spathosternum beninense Popov, 1980:45. Holotype ♂, BENIN (BMNH) [examined].

Diagnosis. Male. Antennae, about as long as head and pronotum together. Fastigium verticis (Fig. 18) parabolic, shallowly concave with moderately raised margins. Occiput, relatively convex. Prosternal process very broad, flat, weakly spathulate. Tegmen, shortened with wing tips just surpassing third abnominal tergite (Fig. 3), or fully developed with wing tips just reaching knee of folded hind femur. Last abnominal tergite with diminutive furculi. Supra-anal plate (Fig. 10), broadly triangular in outline with a median transverse sulcus. Genitalia (Figs. 33-35) with apices of penis valves expanded and divergent, showing spicule-like sclerotization, reminiscent to that of *abbreviatum.* Epiphallus (Figs. 36-41) similar in shape to *prasiniferum* but with ancorae more widely spaced and area of lophal interspace curvilinear.

General colouration brown, stramineous, with longitudinal lateral stripes typical of genus. Posterior femur uniformally brown yellow, with outer median area sometimes being more darkly expressed. Upper lobe of hind knee black; lower lobe without black, but sometimes tinged with red.

Female. Antennae, shorter than combined lengths of head and pronotum. Supra-anal plate more

elongate than male; projections of last abdominal tergite absent. Spermatheca (Fig. 95) with apical diverticulum tapering proximally and distally; preapical diverticulum expanded proximally, apex slightly inflated, otherwise like male.

TABLE 3. *Spathosternum: brevipenne* measurments

	Males			Females		
	n	mean	range	n	mean	range
Interocular distance	(8)	0.41	(0.37-0.45)	(3)	0.94	(0.81-1.05)
Head width	(8)	2.92	(2.80-3.05)	(3)	3.81	(3.65-3.89)
Pronotal length	(8)	3.12	(2.85-3.24)	(3)	4.10	(3.95-4.23)
Posterior femur length	(8)	8.92	(8.02-9.42)	(3)	12.12	(11.53-12.37)
Posterior femur depth	(7)	1.99	(1.76-2.09)	(3)	2.57	(2.38-2.39)
Antennal length	(4)	6.71	(5.37-7.7)	(1)	6.2	
Tegminal length	(5)	10.84	(8.92-13.47)	(3)	7.77	(5.59-11.63)
No. of stridulatory veinlets	(5)	21	(17-25)	(2)	18.5	(18-19)
Stridulatory file length	(5)	3.24	(2.62-3.86)	(2)	3	(2.74-3.24)
Total length	(7)	17.23	(15.53-18.18)	(3)	22.65	(22.02-23.03)

Discussion. The species *brevipenne,* originally described from brachypterous specimens, was found to be represented by a complex of wing polymorphic populations. A single long-winged male specimen found within a collection of material, lent by M. Donskoff (MNHN), had been previously identified by Dirsh (on external morphology) as *S. pygmaeum.* Subsequent examination of the genitalia has shown this specimen to be a long-winged variant of *brevipenne* (compare epiphalli Figs. 38-41). It is also of interest to note that this specimen was collected from Nimba, Guinea (Mt. Nimba being the type locality for *brevipenne).* The extreme brachypterous form may be associated with adaptation to montane conditions.

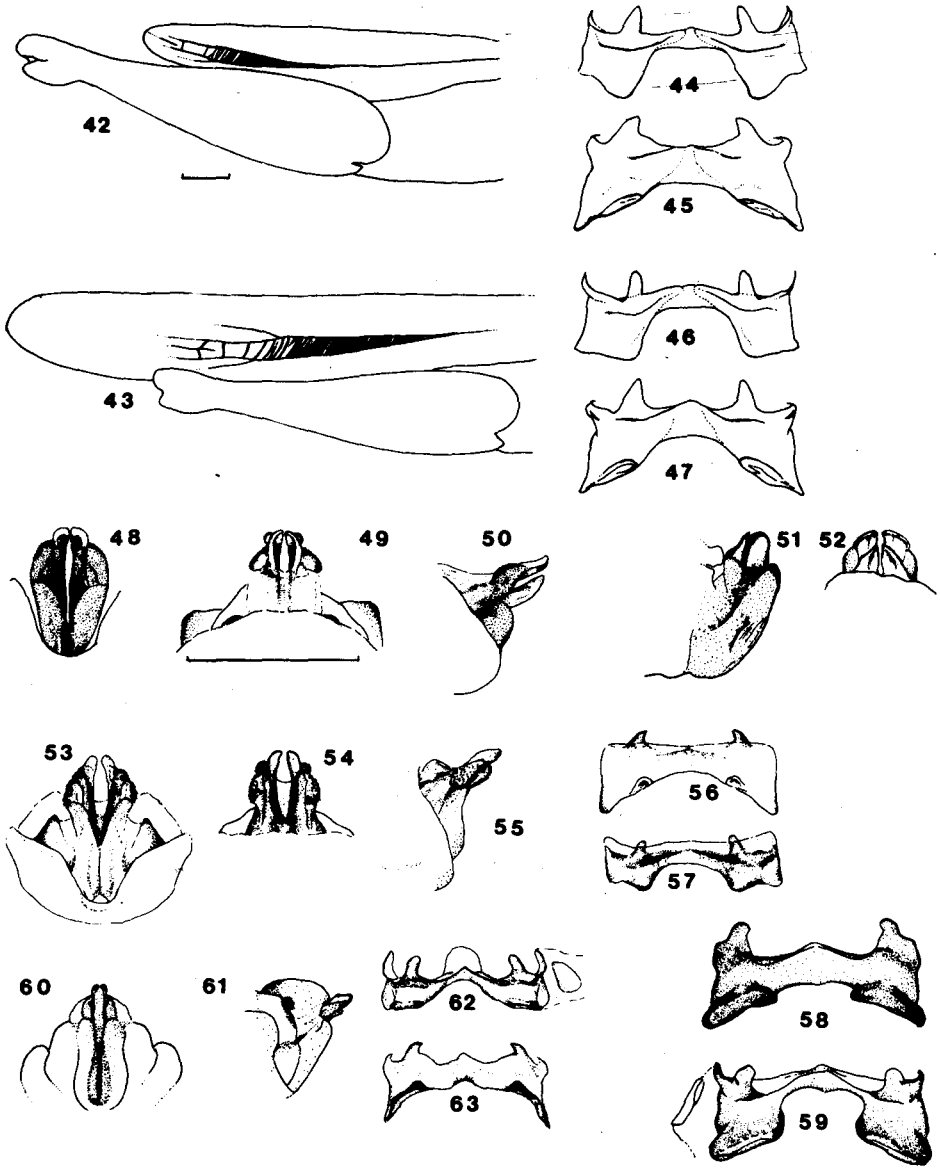
In addition, the recently described species *beninense* (Popov, 1980) was found also to be conspecific with *brevipenne,* this decision being based upon the following criteria; similarity in respective male genital morphology, similarity in shape and cuticular structure of the male supra-anal plates, both being broadly triangular, obtusely pointed with a transverse median sulcus. Other characters common to both include, the possession of two small projections on the last abdominal tergite and a similar red tinge of the posterior knee lunules. A further long-winged variant was collected by Popov and Jago from the Cameroons. The distribution of *brevipenne,* in the light of the above, is now known to be wider than was first thought.

The brachypterous form lacks stridulatory venation. It is not known whether the two forms have similar song or whether song is lacking in this morph. Nor is it known whether the faculty for song recognition has also been lost in brachypterous morphs. It is conceivable that the emission of song from a long-winged individual (still retaining stridulatory venation) could still initiate courtship with brachypterous females.

Type-material examined. Spathosternum brevipenne Chopard, holotype ♂, GUINEA: Mt. Nimba, Grand Nimba, 10.xi.1951 *(Lamotte & Roy)* (MNHN).
Spathosternum beninense Popov, holotype ♂, BENIN: Parakou, xii.1977-i.1978 *(Popov)* (BMNH).
Paratypes. BENIN: 3♂. 2♀, same data as holotype, 1♂, 2, 15.i.1977 *(Popov & Fishpool);* 4♂, 3♀, 20 km. w of Parakou, 25.xii.1977, *(Popov).* The male holotype, five males and five female paratypes in (BMNH); remaining paratypes in (ODNRI) collection.
Additional material examined. GUINEA: 1♂,1♀, Nimba, xii.1956-v.1957p (*Lamotte, Amiet & Vanderplaetsen*) (BMNH); 1♂, Nimba 2.vi.1942 *(Lamotte)* (MNHN). CAMEROON: 1♂, 20 km. w. of Tibati, 20.xi.1980 *(Jago & Popov)* (ODNRI).

Spathosternum curtum Uvarov, 1953
(Figs. 6, 1, 22, 60-61, 99, 64)

Spathosternum curtum Uvarov 1953:66. Holotype ♂, ANGOLA (BMNH) ♂ [examined].
Diagnosis. Male. Antennae, shorter than head and pronotum together. Fastigium of vertex (Fig. 22) similar to those of *malagassum* and *abbreviatum,* but with apex more abtusely rounded. Pronotum (Fig. 6) short with excurved posterior margin. Prosternal process broad, flat, weakly spathulate. Tegmen,



Figs. 42-63. *Spathosternum* spp. and *Paraspathosternum* sp.

42-50, *S. prasiniferum*. 42, lateral aspect of male tegmen, short-wing form; 43, same, long-wing form; 44, male epiphallus, short-wing form, dorsal aspect; 45, same, posterior aspect; 46, same, long-wing form, dorsal aspect; 47, same, posterior aspect; 48â, male aedaegus, posterior aspect; 49, same, view from above; 5â0, same, lateral aspect. 51-52, *Paraspathosternum pedestris*. 51, male aedeagus, lateral aspect; 52, same, view from above; 53-57, *S. abbreviatum*. 53, male aedaegus, posterior aspect; 54, same, view from above; 55, same, lateral aspect; 56, male epiphallus, posterior aspect; 57, same, dorsal aspect. 58-59. *Paraspathosternum pedestris*. 58â, male epiphallus, posterior aspect; 59, same, dorsal aspect. 60-63, *S. curtum*. 60, male aedaegus, posterior aspect; 61, same, lateral aspect: 62, male epiphallus, dorsal aspect; 63, same, posterior aspect. Scale line under Fig. 42 represents 1mm and applies to Figs. 42-43. Scale line under Fig. 49 represents 1mm and applies to Figs. 44-63.

shortened, just reaching beyond second abdominal tergite, overlapping dorsally in basal two thirds; stridulatory venation absent. Posterior femora short, stocky. Supra-anal plate (Fig. 14) similar to that of *pygmaeum*, but slightly more angular, elongate. Genitalia (Figs. 60-61) with apices of apical penis valves divergent, like those of *nigrogaeniatum* but considerably more slender. Inflated lateral processes of cingular valves absent. Epiphallus as depicted in Figs. 62-63.

General colouration dark brown from above, with longitudinalâ lateral stripes typical for genus. Outer surface of posterior femur stramineous, with darker brown in median area.

Female. Like male but larger and more robust. Fastigium of vertex somewhat rounded, triangular in shape; median dorsal carinula present as in male. Spermatheca (Fig. 99) small with reduced preapical diverticulum, apex bulbous.

General colouration predominantly green and brown; from above, head, dorsum of pronotum and dorsal area of tegmen light green yellow. Longitudinal lateral stripe markings typical for genus.

TABLE 4. *Spathosternum curtum:* measurements

	Males		Females	
	n		n	
Introcular distance	(2)	0.28,0.4	(1)	0.60
Head width	(2)	2.21,2.31	(1)	2.79
Pronotal width	(2)	2.10,2.33	(1)	2.88
Pronotal length	(1)	2.64	(1)	2.99
Posterior femur length	(2)	6.95,7.39	(1)	8.89
Posterior femur depth	(2)	1.84,1.89	(1)	22.39
Antennal length	—	—	—	—
Tegminal length	(2)	3.14,3.45	(1)	3.20
No. of stridulatory veinlets		ABSENT		ABSENT
Stridulatory file length		—		—
Total length	(2)	13.30,14.21	(1)	16.17

Discussion. This species appears to be restricted in its distribution to the upland Moxico district of Angola. The type locality, River Munhango, was described by Malcolm Burr (1930) as a shallow depression in sandy forest, filled with bogs and uncommonly well watered. Such a scenario may favour the wing reduction seen in this species.

Type material examined. Holotype ♂, ANGOLA: Moxico District, R. Munhango, 10.viii.1927 *(Burr)* (BMNH). Paratypes, 1 ♀ (nymph), same data as holotype; 1♂, District of Bihé, Cohemba, 31.viii.1927 *(Burr)* (BMNH).

Spathosternum malagassum Dirsh, 1962
(Figs. 4, 15, 23, 64, 90, 91-92, 98, 112-113)

Spathosternum malagassum Dirsh, 1962-6:278. Holotype ♂, MADAGASCAR, (MNHN) [examined].

Diagnosis. Male. Antennae short, about as long as head, Fastigium of vertex (Fig. 23) with median dorsal carinulae. Pronotum short (Fig. 90), posterior margin of disc straight. Tegmen reduced to laterally lying scales reaching mid-way between second and third abdominal tergites; not touching dorsally (Fig. 4) stridulatory venation absent. Supra-anal plate (Fig. 15) similar in outline to that of *pygmaeum;* raised median ridge bisected by transverse median sulcus. Genitalia (Figs. 91-92, 112-113) see under discussion *pygmaeum* and *malagassum*.

General colouration brown with longitudinal lateral stripes typical for genus.

Female. Spermatheca (Fig. 98) with apical diverticulum bulbous, tapering distally and proximally; preapical diverticulum, slender, elongate. Otherwise similar to male.

General colouration similar to that of male.

Discussion. This species is found only in Madagascar, and generally resembles *S. curtum* in appearance, microptery and lack of stridula, but is closer to *pygmaeum* in the male genitalia, the only difference being the shape of the lophus and the outer lateral indentation of the lophal plate. The latter attribute is seen to become less distinct when variation is studied.

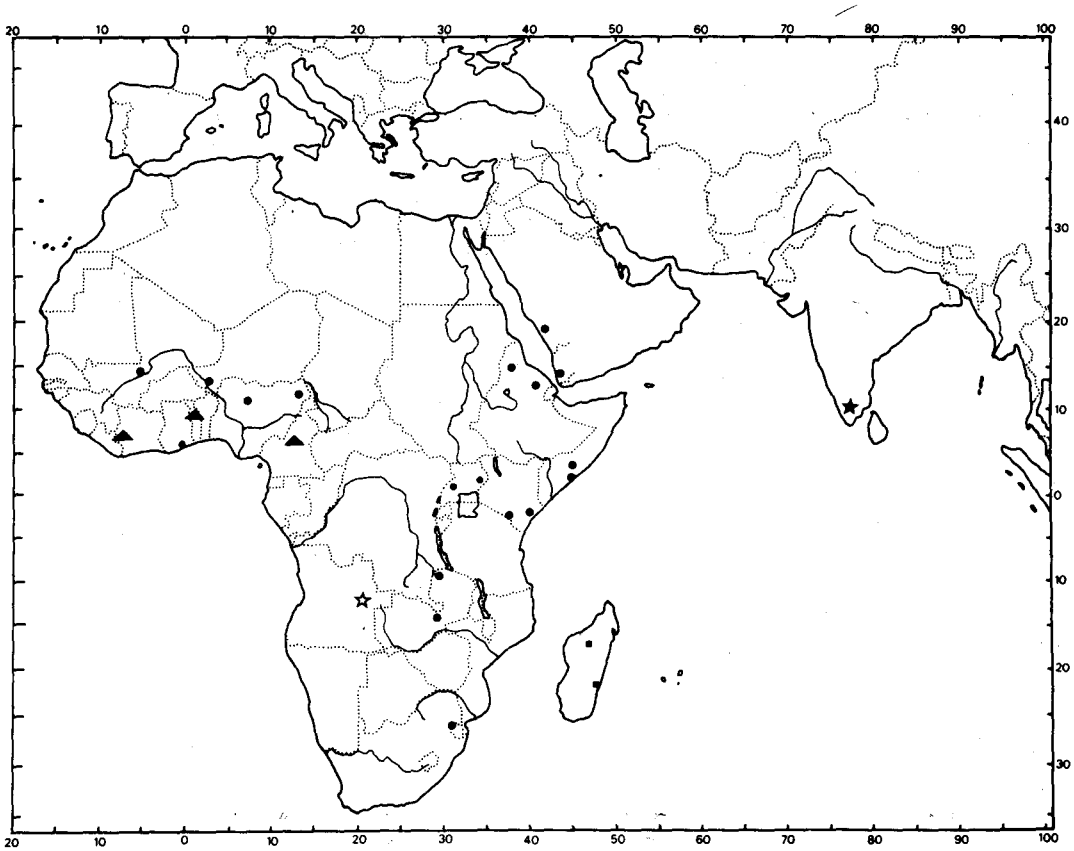


Fig. 64. Distribution of *Spathosternum* spp. circles, *nigrotaeniatum;* squares, *malagassum;* solid star, *abbreviatum;* triangles, *brevipenne;* open star, *curtum.*

TABLE 5. *Spathosternum malagassum:* measurements

		Males			Females
	n	mean	range	n	
Interocular distance	(3)	0.41	(0.35-0.52)	(1)	0.85
Head width	(3)	2.23	(2.11-2.46)	(1)	3.31
Pronotal width	(3)	2.21	(2.02-2.39)	(1)	3.56
Pronotal length	(3)	2.33	(2.68-2.71)	(1)	3.45
Posterior femur length	(3)	6.68	(6.06-766)	(1)	9.43
Posterior femur depth	(3)	1.78	(1.56-2.08)	(1)	2.54
Antennal length	(2)	2.33,2.78		(1)	2.59
Tegminal length	(3)	2.58	(2.21-3.05)	(1)	3.83
No. of stridulatory veinlets		ABSENT			ABSENT
Stridulatory file length		—			—
Total length	(3)	13.17	(11.99-14.86)	(1)	19.14

These similarities suggest that *malagassum* and *pygmaeum* are derived from a macropterous common ancestor.

Type material examined. Holotype ♂, MADAGASCAR: Ambohitantely For., 28.ii.1948 *(Cachan)* (MNHN). Paratype ♂, MADAGASCAR, Manankaka Inst.Sci.Statn., 6.ii.1948 *(Cachan)*(BMNH).

Additional material examined. MADAGASCAR: 1♂,1♀, Ankaratra (2400m), 4.vi.1967 *(Wintrebert)* (MNHN).

Spathosternum prasiniferum Walker, 1871
(Figs. 7, 21, 21, 42-43, 48-50, 65, 96)

Heteracris prasinifera Walker, 1871: 61. Holotype ♀, INDIA (BMNH) [examined].
Caloptenus caliginosus Walker, 1871: 61. Holotype♂, INDIA (BMNH) [examined].
Stenobothrus strigulatus Walker, 1871: 82. Holotype ♀, INDIA (BMNH) [examined]. Synonymised under *caliginosum* by Walker, 1910: 400.
Stenobothrus simplex Walker, 1871: 82. Holotype ♀, INDIA (BMNH) [examined].
Stenobothrus rectus Walker, 1871: 83. Holotype ♀, no label data (BMNH) [examined].
Spathosternum venulosum Stål, 1878: 97. Holotype ♀, INDIA (NR) (not located) Synonymised by Uvarov 1953: 63.
Phlaeoba simplex (Walker) Kirby, 1910: 138.
Rodunia recta (Walker) Kirby, 1910: 140.
Spathosternum caliginosym (Walker) Kirby, 1910: 400.
Spathosternum prasiniferum (Walker) Kirby, 1914: 208.
Spathosternum sinense Uvarov, 1931: 220. Holotype ♀, CHINA (BMNH) [examined].
Spathosternum prasiniferum sinense (Uvarov) Tinkham, 1936: 48. Holotype ♂, S. CHINA (Lingnan Nat. Hist. Mus.) (not located). **Syn.nov.**
Spathosternum prasiniferum prasiniferum (Walker) Tinkham, 1936: 51.

Diagnosis. Male. Fastigium of vertex (Fig. 21) with median carinula continuing faintly along dorsal surface of head. Pronotum (Fig. 7) with roundly arcuate posterior margin. Tegmen well developed or abbreviated, with numerous closely spaced, parallel, stridulatory veinlets in radial area (Figs. 42-43). Supra-anal plate (Fig. 11) broad; lateral margins broadly rounded forming two small lobes from which a small elongate, angular apex arises posteriorly; broadly raised median ridge bisected by transverse sulcus. Genitalia (Figs. 48-51) with broad, slightly excurved apical penis valves, similar to *pygmaeum*. Inflated lateral processes of cingular valves present. Epiphallus as depicted in Figs. 44-47.

General colouration brown with longitudinal lateral stripe markings showing a departure from usual pattern, where lighter stripe of lateral pronotal lobes continues more obliquely onto mesothorax, then sometimes forming a discrete oblique stripe down epimeron and episternum of mesothorax. Tegmen brown with radial area interspersed with lighter blotches. Posterior femur light brown or yellow, sometimes with darker outer median area.

Female. Like male but larger and more robust. Supra-anal plate elongate, triangular, apex obtuse with a transverse median sulcus. Spermatheca (Fig. 96) similar to that of *brevipenne* and *nigrotaeniatum*.

General colouration, variable, predominantly green and brown. Viewed from above, head, dorsum of pronotum and dorsal field of tegmen green or brown, delineated by a thin brown line running from behind eye and continuing to run along lateral pronotal carina, before merging with brown lateral field of tegmen: radial area expressing similar markings to that of male. Postocular area and lateral pronotal lobes green or light brown, interspersed by a longitudinal white or buff stripe which extends from behind eye to coxae of middle legs, marginated below by a darker brown stripe. Pleura light brown, yellow, marginated above by a black stripe confined to leading edge of tegmen, in thoracic region; corresponding oblique markings of males are less obviously portrayed, or sometimes merge with pleural coloration.

TABLE 6. *Spathosternum prasiniferum:* measurements

	Males			Females		
	n	mean	range	n	mean	range
Interocular distance	(18)	0.51	(0.44-0.64)	(12)	0.79	(0.75-1.00)
Head width	(18)	2.65	(2.26-2.97)	(12)	3.33	(2.92-4.12)
Pronotal width	(18)	2.61	(2.31-2.87)	(12)	3.41	(2.94-3.64)
Pronotal length	(17)	3.13	(2.55-3.93)	(12)	3.81	(3.28-4.44)
Posterior femur length	(18)	8.29	(7.22-8.80)	(12)	10.48	(9.23-12.74)
Posterior femur depth	(18)	2.06	(1.81-2.26)	(12)	2.50	(2.31-2.70)
Antennal length	(4)	5.01	(4.3.5.8)	(6)	4.83	(4.6-5.2)
Tegminal length	(12)	10.71	(7.48-13.13)	(9)	12.79	(8.82-14.44)
No. of stridulatory veinlets	(12)	41.58	(35-53)	(9)	44.33	(35-52)
Stridulatory file length	(12)	3.25	(2.10-3.88)	(9)	4.49	(3.07-5.64)
Total length	(18)	16.10	(14.33-17.61)	(12)	20.10	(17.57-25.18)

Discussion. In 1931, Uvarov differentiated *sinense* from *prasiniferum* on the basis of the former being larger, more robust and having abbreviated tegmina. Tinkham (1936) gave a vivid account of his encounters with wing-polymorphic populations of *sinense,* and concluded that the two species were in fact "races" (i.e. subspecies) of the same species. Examination of the male genitalia has shown that these wing-polymorphs are conspecific (compare epiphalli Figs. 44-47) and subspecies are not involved.

Apart from some slight variation in specimens collected from South East China, in which the lateral lophal margins were slightly indented (Fig. 44), respective aedeagi were the same.

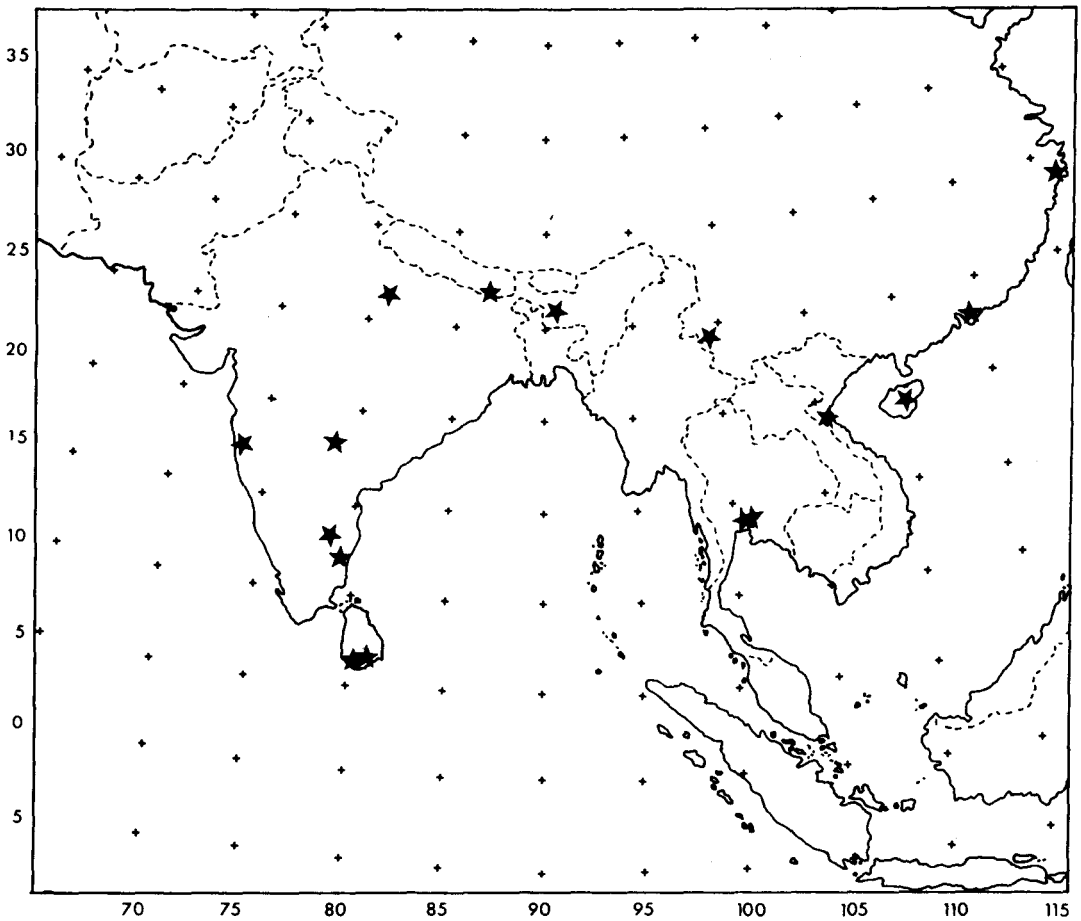


Fig. 65. Distribution of *S. prasiniferum* (stars)

Careful comparisons of the female holotype with all available females and sympatric males, formed the basis of the above diagnoses. The compact array of numerous, closely spaced, stridulatory veinlets, readily distinguishes this species from all other members of the genus.

The available data on the life history, distribution, ecology and economic importance of this species have been reviewed elsewhere (Centre for Overseas Pest Research, 1982).

Type material examined. Spathosternum prasiniferum Walker, holotype ♀, India: Bombay, no data (BMNH). *Caloptenus calliginosus* Walker, holotype ♂, no locality data, (BMNH). *Stenobothrus strigulatus* Walker, holotype ♀, India, Bombay, no data, (BMNH) (abdomen missing). *Stenobothrus*

simplex Walker, holotype ♀, India, Bombay, no data (BMNH). *Stenobothrus rectus* Walker, holotype ♀, no label data, (BMNH) (abdomen missing). *Spathosternum sinense* Uvarov, holotype ♀, China, Nainan Dao, S.W. of Dan Xian, 28.vi.1929 *(Hoffmann)* (BMNH).

Additional material examined. INDIA: 1♂, 1♀, Lucknow, 2.xii.1904 (*Brunetti)* (BMNH): 2♂, Assam, Kahao, Lonit Valley, 15-20.x.1926 (*Kingdon-Ward)* (BMNH); 1♂, N.E. Madras, lake Chilka, 4.iii.1910 *(Annandale)* (BMNH); 1♂, 2♀, Assam, Shillong, Khasi Hills, 20.ix.26 (*Sewell*) (BMNH); 2♂, Bihar Prov., Dusi *(Agaruala)* (BMNH); ♂, Madras, Coimbatore, vi.1967 *(Nathan)* (BMNH); 1♀, Pondicherry, St., Karika, xi.1966 *(Nathan)* (ODNRI); 2♂, 2♀, Andra Pradesh, Patanchem, ICRISAT farm, viii.82 *(Bernays)* (ODNRI). NEPAL: 1♀, Taplejung Distr., forest above Sangu, 17.x-1.xi.1961 *(Coe)* (BMNH); 1♂, 1♀, Phewa Tal, nr. Pokhara, 10.v.1954 *(Quinlan)* (BMNH); 2♂, 2♀, Chitwan Nat. Park, Sauraka, viii-ix.1982 *(Feistner)* (BMNH). SRI LANKA: 1♂, Kalatuwawa, malaise trap, 7-8.viii.1975 *(Huang)* (ODNRI); 1♂, Gal Distr., Kanneliya, black light, 15-17.x.1976 *(Hevel)* (ODRNI); 2♂, 2♀, Maskeliya, S.W. of Hatton 18.iii.62 *(Brinck&Andersson)* (ODNRI); 1♀, China Bay, blacklight, 9-11.x.76 *(Hevel)* (ODNRI); 1♀, Denijaga, Forest, ii.1982 *(Helfert)* (BMNH). BURMA: 1♂, Bangkok, 1928 *(Hillman)* (BMNH); ♂, Wat Salak, Menam Chao, Phya, 21.vi.1926 *(Ladell)* (BMNH); 2♂, Ban Phu Khae, 6.vii. 1968 *(Roffey)* (ODNRI). N. VIETNAM: 1♀, Annam, Phuc-Son, 1902 *(Fruhstorfer)* (BMNH). CHINA: 4♂, 4♀, S. Chekiang, Tien Tai Shan, 20.ix.1933 *(Chang)* (BMNH); 1♂, Yunnan, Tengyeh to Nan Tien, 1909-10 *(Brown)* (BMNH); 1♂, Kiangsu Prov., Ibing, 10.vii.33 *(Loubou)* (BMNH); ♀, Hainan Is., S.W. of Nodoa, 28.vi.1929 *(Hoffman)* (BMNH); 1♀, Canton, Honam Is., 27.ix.1931 *(Hoffman)* (BMNH).

Spathosternum pygmaeum Karsch, 1893

(Figs. 8, 12, 16, 69-89, 100-102, 103-107, 108-111, 114-115, 116)

Spathosternum pygmaeum Karsch, 1893:110. Holotype ♂, TOGO (MNHU) [examined].

Spathosternum pygmaeum rammei Roy, 1962: 120. Holotype ♀, BENIN (BNHN) [examined]. Syn. by Dirsh, 1970: 93.

Spathosternum brevicorne Uvarov, 1953: 64. Holotype ♂, UGANDA (BMNH) [examined]. **Syn. nov.**

Diagnosis. Male. Highly variable species, small to very small. Pronotum (Fig. 8), with angulate posterior margin, similar to *prasiniferum.* Supra-anal plate (Figs. 12, 16) rounded, triangular in shape, bearing median longitudinal ridge, variably sulcate along its length, similar to *malagassum* but lacking median transverse sulcus; preapical teeth absent. Small projections of last abdominal tergite narrowly or widely spaced apart. Length of antennae variable (Figs. 103-107), never longer than combined length of head and pronotum together. Tegmen well developed or shortened (Figs. 71, 83). Genitalia (Figs. 108-111, 114-115) with aedeagus similar to that of *malagassum,* but differring from *nigrotaeniatum* in that apices of apical penis valves are broader and more parallel, and lateral inflated processes of cingular valves are absent. For variation in epiphallic morphology see Figs. 69-89.

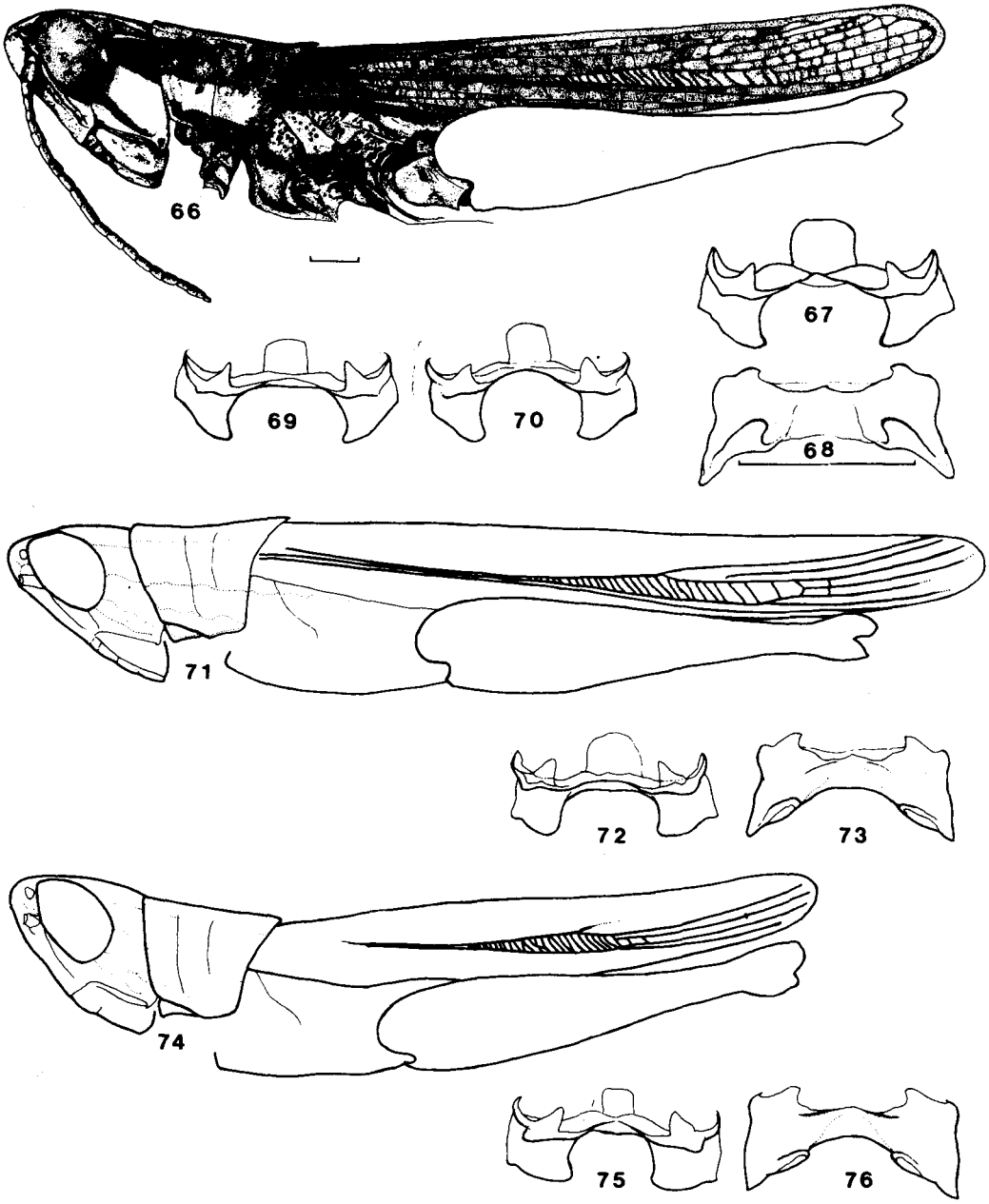
General colouration brown, longitudinal lateral stripe markings typical for genus. Posterior femur yellow or light brown; knee lunules usually dark brown on all surfaces.

Female. Like male but larger and more robust. Spermatheca (Figs. 100-102) with apical diverticulum tapering proximally and distally; preapical diverticulum with accessory vesicles arising proximally. Supra-anal plate similar to that of *nigrotaeniatum.*

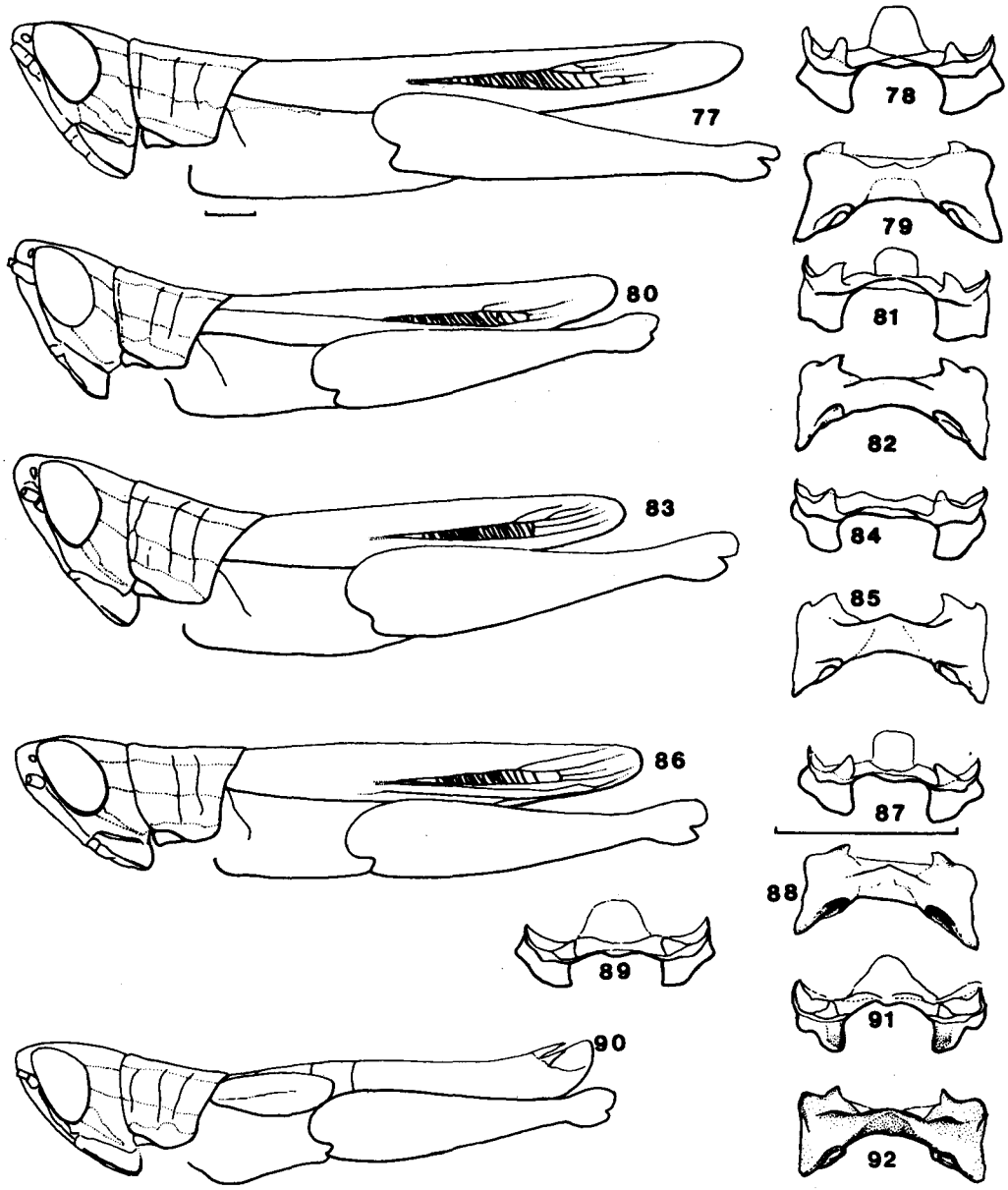
General colouration same as male. Tegmen sometimes with dispersed lighter markings in costal and radial area, similar to *prasiniferum* but less obtrusive.

Discussion. During examination of material of *S. pygmaeum* and *S. brevicorne,* it became increasingly apparent that wing length was very variable. This suggested, as in the case of *brevipenne,* that *pygmaeum* was represented by a web of heterogeneous populations as collated in Figs. 66-89. By superimposing drawings of the male genitalia on the above figures, it can be seen that the aedeagal apparatus has remained relatively unchanged, while the epiphallus is variable. It is possible that the opposite ends of this range of variation are genetically incompatible and may represent subspecific groupings, but clearly more work with live material is needed.

Because of the highly variable nature of this species no one definitive character or combination of characters, apart from the size and shape of the epiphallus and supra-anal plate (in the case of populations from near Dikwa, N. Nigeria, see Figs. 16, 66-68) could be used successfully to differentiate between



Figs. 66-76. *S. pygmaeum.* Wing polymorphic forms showing variation in epiphallic shape. 66, Dikwa, N. Nigeria, lateral aspect of male; 67, same, male epiphallus, dorsal aspect; 68, same, posterior aspect; 69â, Budongo For. Res., Uganda, male epiphallus, dorsal aspect; 70, same, Yei, S. Sudan; 71, long wing form, lateral aspect of male; 72, same, male epiphallus, dorsal aspect; 73, same, posterior aspect; 74, Lateral aspect of male, Kandi, Benin; 75, same, male epiphallus, dorsal aspect; 76, same, posterior aspect. Scale line under Fig. 66 represents 1mm. and applies to Figs. 66, 71, 74. Scale line under Fig. 68 represents 1mm. and applies to Figs. 67-70, 72-73, 75-76.



Figs. 77-89. *S. pygmaeum.* Wing polymorphic forms showing veriation in epiphallic shape. 77, Lateral aspect of male, Brazzaville, Congo; 78, same, male epiphallus, dorsal aspect; 79, same, posterior aspect; 80, lateral aspect of male, Maska, Nigeria; 81, same, male epiphallus, dorsal aspect; 82, same, posterior aspect; 83, shart-wing form, Bugishu, Uganda, lateral aspect of male; 84, same, male epiphallus, dorsal aspect; 85, same, posterior aspect; 86, *brevicorne* syn.n., lateral aspect of male; 87, same, male epiphallus, dorsal aspect; 88, same, posterior aspect; 89, same, type species.

Figs. 90-92. *S. malagassum.* 90, lateral aspect of male; 91, male epiphallus, dorsal aspect; 92, same, posterior aspect. Scale line under Fig. 77 represents 1mm. and applies to all lateral aspect Figs. Scale line under Fig. 87 represents 1mm. and applies to all epiphallic Figs.

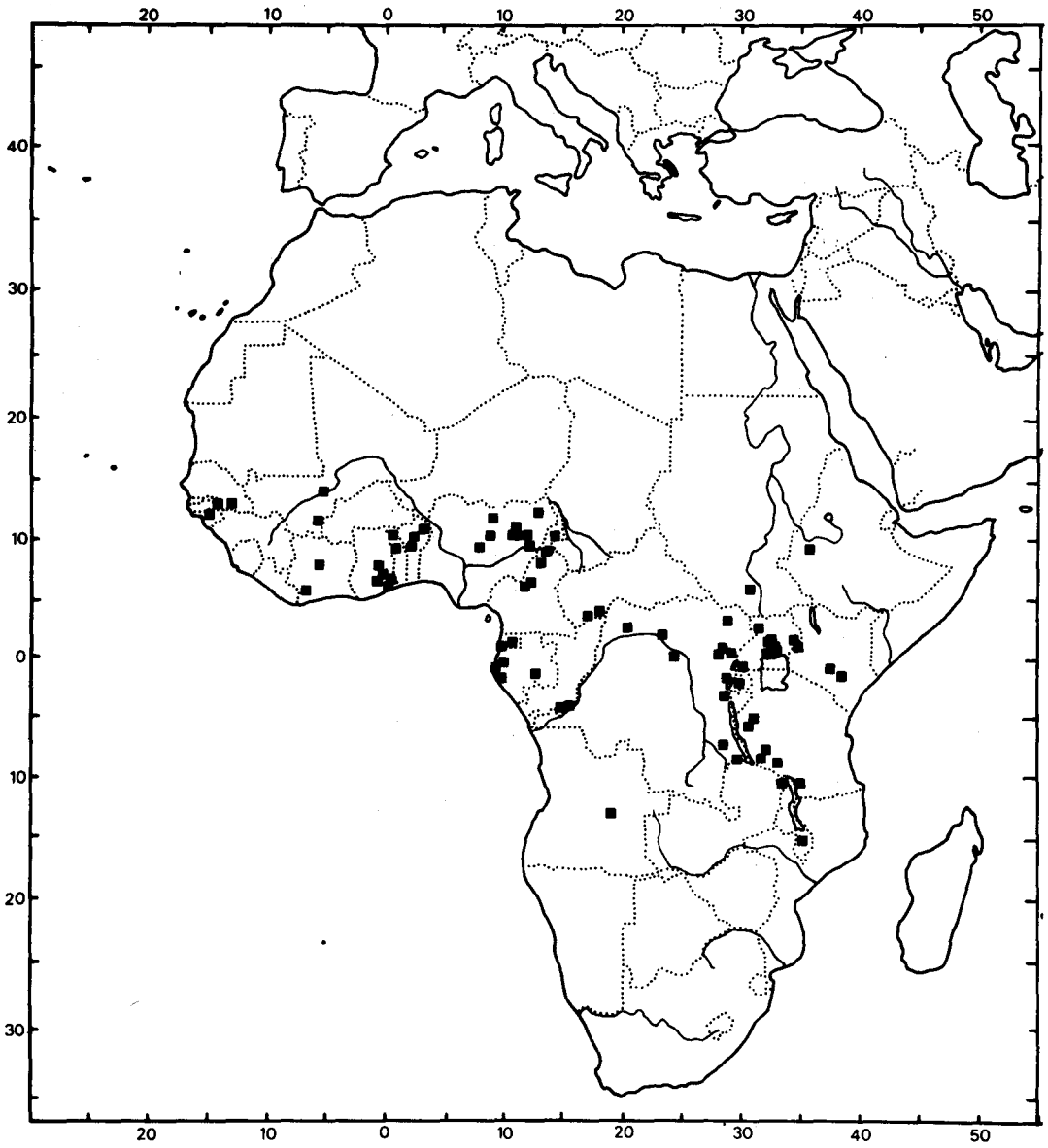
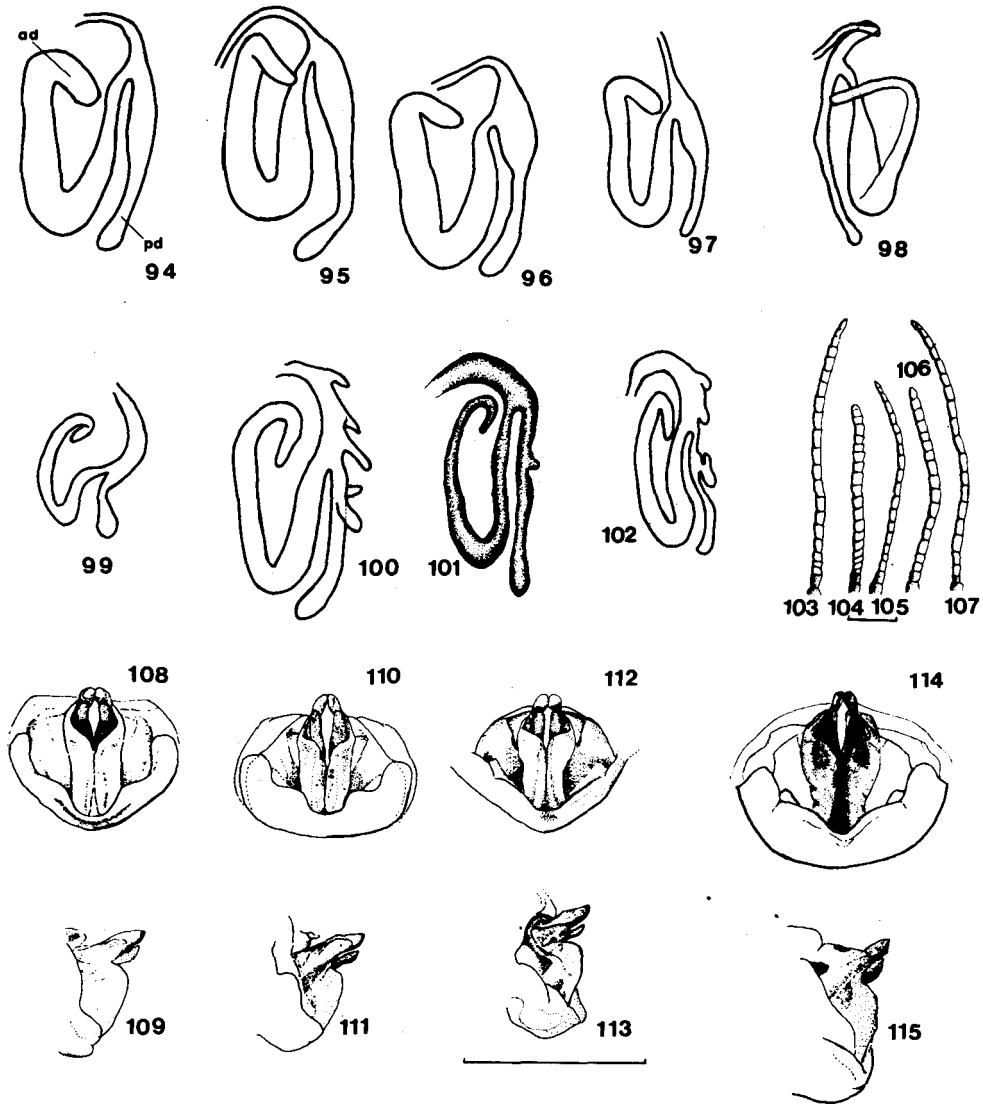


Fig. 93. Distribution of *S. pygmaeum* (squares)

brevicorne and *pygmaeum* on external morphology alone. In overall size *pygmaeum* was generally larger than *brevicorne*, but this alone offered no measure of guarantee, as overlap in size was commonly encountered. For these reasons *brevicorne* is here synonomised under *S. pygmaeum*.



Figs. 94-115. *Spathosternum* spp. 94-102, female spermatheca.
94, *nigrotaeniatum;* 95, *brevipenne;* 96, *prasinferum;* 97, *abbreviatum;* 98, *malagassum,* 99, *curtum;* 100, *pygmaeum,* Dikwa, N. Nigeria; 101, *pygmaeum,* Maska, Nigeria; 102, *brevicorne* syn.n. 103-107, *S. pygmaeum, male antennae. 103, long-wing form; 104, short-wing form, Bugishu, Uganda; 105, Maska, Nigeria; 106, brevicorne* syn.n.; 107, Kandi, Benin. 108-115, *Spathosternum* spp., male aedeagus. 108, *pygmaeum,* posterior aspect; 109, same, lateral aspect; 110, *brevicorne* syn.n, posterior aspect; 111, same, lateral aspect; 112, *S. malagassum,* posterior aspect; 113, same, lateral aspect; 114, *pygmaeum,* Dikwa, N. Nigeria, posterior aspect; 115, same, lateral aspect. All scale lines represent 1mm, that under Figs. 103-107 applies only to those figures.

In 1970, Dirsh synonymised the subspecies *pygmaeum rammei* (Roy, 1962), which differed principally in having longer wings than the nominate subspecies (see Fig. 71), and concluded that the long-winged form represented one of the variants of this species appearing in certain ecological conditions. This view is reaffirmed by the present study. In West Africa, the long-winged form appears to be fairly wide ranging and is commonly found in association with water courses and seasonally flooded grasslands in the South Sudanian zone and interzone between the Sudan and Guinea savanna. It likely that increased flight capacity has been necessary as a response to the climatic fluctuations of this region, enabling dispersion and colonisation of more favourable habitats.

The moist woodland biotype of the Guinea savannah is preferred by the more sedentary shorter-winged form, where it is commonly found around marshes (Golding, 1948), flood plains, and along edges of creeks in *Cynodon—Chloris* associations (Davey et al, 1959). Chapman (1962) also noted the presence of both long-and short-winged populations in Ghana. More recently Popov (1980) reported that *beninense* (here synonymised with *brevipenne*) was sympatric with the longer-winged form in two localities near Parakou, Benin. The former appeared to be restricted to the wettest region of the habitat.

The available data on the life history, distribution, ecology and economic importance of this species have been reviewed elsewhere (Centre for Overseas Pest Research, 1982).

Type material examined. Spathosternum pygmaeum Karsch, holotype ♂, TOGO: Bismarckburg (MNHU). *Spathosternum pygmaeum rammei* Roy, holotype ♀, BENIN: Kouand», cercle de Djougou, 1908 *(Brot)* (MNHN). *Spathosternum brevicorne* Uvarov, holotype ♂, UGANDA, Kepeka, 2-5.vii.1933 *(Johnston)* (BMNH). Paratypes. UGANDA: 2♂, same data as holotype (BMNH); 2♀, Bugoma For., vi.1933 *(Johnston)* (BMNH); 1♂, Hoima, 14.vi.1933 *(Johnston)* (BMNH); 3♂. R. Kizibiki, 4.vii.1933 *(Johnston)* (BMNH); 1♂, Bombo, 26.iii.1933 *(Johnston)* (BMNH).

Additional material examined. SENEGAL: 1♂, Diebering, 1-9.ix.62 *(Farrow)* (MNHN); 1♂, 2♀, Tabi, Signona, 12.xi.1961, IFAN (MNHN). MALI: 3♂, 6♀, Sikasso, Klela, 21.x.1963 *(Descamps)* (MNHN), 2♂, 2♀, Diafarab», i.1959 (Davey) (BMNH). IVORY COAST: 2♂, 3♀, Tai, 20.ii.1979 *(Couturier)* (MNHU). GHANA: 1♂, 1♀, Legon, 9-12.iii.1969 *(Richards)* (ODNRI); 3♂, 1♀, Bunru, forest clearing, 24.iii.1969 (Richards) (ODNRI); 1♀, Atewa, 20.ii.1969 *(Richards)* (ODNRI); 1♂, Yeji, 27.iii.69 *(Norris)* (ODNRI); 1♂, 2♀, Ankasa For. Res., 8-9.iv.1969 *(Richards)* (ODNRI); 1♀, Akosombo, 25.i.1969 *(Richards)* (ODNRI). TOGO: 2♂, 5km of S. of Lama-Kara, 13.6.79 *(Cheke)* (ODNRI). REP. BENIN: 1♂, Malanville, 25.ix.1983 *(Popov)* (ODNRI); 10♂, 4♀, Parakou, 13.1.1977 *(Popov)* (ODNRI); 1♂, 1♀, Birni *(Popov)* (ODNRI); 4♂, 2♀, Kandi, 12.i.1977 *(Popov)* (ODNRI). NIGERIA: 1♂, 1♀, L. Alo nr. Maiduguri, ii.xi.1970 *(Popov)* (ODNRI); 1♂, Deba Habe, nr. Gombe, 23-30.x.1970 *(Popov)* (ODNRI); 2♂, 4♀, nr. Yola, 17.x.1970 *(Popov)* (ODNRI); 2♂, 2♀, Gombe 17-25.x.1970 *(Popov)* (ODNRI); 1♂, 1♀, Zaria, Samaru, 20.vii.1970 *(Oyidi)* (ODNRI); 2♂, 1♀, Zaria, Samaru, IAR farm, 11-14.xi.1970 *(Jago & Hollis)* (ODNRI); 10♂, 3♀, Maska fish farm, 15.xi.1970 *(Jago & Hollis)* (ODNRI); 6♂, 6♀, Maska fish farm, 6.xii.1970 *(Popov & Hollis)* (ODNRI); 1♂, Zambuk, 21.ix.1970 *(Popov)* (ODNRI); 1♀, Bauchi, airstrip, 8-19.xi.1970 *(Jago & Hollis)* (ODNRI); 1♀, Shika, IAR farm, 16.xi.1970 *(Jago & Hollis)* (ODNRI); 4♂, 8♀, 4.3 km J.E. of Dikwa, 4.x.71 *(Jago)* (BMNH); 1♂, 2.4 km S.W. of Aliyas market, 17-8 km S.E. of Mongonu, 27.ix.71 *(Jago)* (ODNRI); 3♀, 4.3 km N.E. of Dikwa, 4.x.71 *(Jago)* (TDRI); 2♀, 5.5km W. of Gulumba, 9.x.71 *(Jago)* (BMNH); 3♀, 4.3km N.E. of Dikwa, 4.x.71 *(Jago)* (BMNH). CAMEROON: 4♀, 20km W. of Tibati, 20.xi.1980 *(Jago & Popov)* (ODNRI); 3♂, 3♀, 31km N.W. of Bongo, 10.xi.1980 *(Jago & Popov)* (ODNRI); 6♂, 6♀, Mamydu, in forest, 19.ix.65 *(Poole)* (ODNRI); 1♂, 24.2km Bango to Tibati, 19.xi.1980 *(Jago & Popov)* (ODNRI); 1♂, Mayo Taram, 11.29km S. of Bango, 17.xi.1980 *(Jago & Popov)* (ODNRI); 1♀, 27.4km N.W. of Bango, 18.xi.1980 *(Jago & Popov)* (ODNRI); 1♂, Kalfou, Yagoua to Garoua Rd., 11.xi.1980 *(Jago & Popov)*; 41♂, 4♀, 32.2km S. of Garoua, Caroua-Yola rd., 27.xi.1980 *(Jago & Popov)* (ODNRI); 2♀, above Wak Plateaux on Garoua-Ngaoundere rd., 14.xi.1980 *(Jago & Popov)* (TDRI). REP. CEN. AFRICA: 2♂, 2♀, Bangui, 23km rd. to Damara, 20-28.ix.1963 *(Pajol)* (MNHN); 2♀, la Maboke, xii.1968 *(Teocchi)* (MNHN). GABON: 4♂, 4♀, Komo, 1-15.x.1969 *(Villiers)* (MNHU); 1♀, Franceville, 17.vi.1974 *(Donskoff & Breton)* (MNHN); 2♂, 3♀, Muni, 15-31.x.1969 *(Villiers)* (MNHN). ZAIRE 2♂, 2♀, Yalikanda, 20.ii.1971 *(Isy-Schwart)* (MNHN); 2♂, 2♀, Ekoli, 22.11.1971 *(Isy-Schwart)* (MNHN); 2♂, Epulu, 28-29.i.1971 *(Isy-Schwart)* (MNHN); 2♂, 2♀, Lisala, 25.i.1971 *(Isy-Schwart)* (MNHU); 2♂, 2♀, Ruzizi, 20km S. of Bukavu, 16.iii.1971 *(Isy-Schwart)* (MNHN); 2♀, Pweto, 23.iii.1971 *(Isy-Schwart)* (MNHN);

2♂, 2♀, Kisangani, 19.ii.1971 *(Isy-Schwart)* (MNHN); 1♂, Kahuzi-Biega Nat. Park, 16.iii.1971 *(Isy-Schwart)* (MNHN); 1♂, Kinshasa, i.1971 *(Isy-Schwart)* (MNHN); 2♂, Ngoma, nr. L. Kivu 2-6-ii.63 *(Damas)* (MNHN). RWANDA: 2♂, 2♀, Kigali (1400m), 21-24.ix.1957 *(Heintz)* (MNHN); 4♂, 6♀, Astrida (1700m), ix-x.1957 *(Heintz)* (MNHN); 1♀, Chyanika, 170km N.W. of Astrida (2000m), 10-x.1957 *(Heintz)* (MNHN); 1♂, ♀, Chapelle a la Vierge 30km N. of rd. Kisengi-Kibuge (2000m), 15.x.1957 *(Heintz)* (MNHN). S. SUDAN: 2♂, ♀, Yei, 1.iv.1963 *(Carter)* (ODNRI). ETHIOPIA: 1♂, ♀, 6.4 km of Ghimbi, 1935m., 16.ix.76 *(Jago)* (ODNRI). UGANDA: 1♂, Bunyoro, W. of Masindi, Budongo For. Res., 25-27.viii.1964 *(Jago)* (ODNRI); 1♂, Kigezi, Mafuga For. Res., 3.ix.64 *(Jago)* (ODNRI); 5♂, ♀, Bugisu, Mt. Elgon, 22.viii.1964 *(Jago)* (ODNRI); 2♂, ♀, Kigezi, 25.8km Kabale-Kisoro rd., 4.ix.64 *(Jago)* (ODNRI); 4♂, ♀, W. of Mt. Elgon, abv. Bumasifwa For. Res., 22.viii.1964 *(Jago)* (ODNRI); KENYA: 2♂, 5♀, Kitito coffee estate, (1500), 30.v.1975 *(Robertson)* (ODNRI); 15♂, 14 ♀, Nendugai (1500m), 24.iii.1975 *(Robertson)* (ODNRI); 3♂, Kakamega For. Res., 13.12.1969 *(Brown)* (ODNRI). TANZANIA: 2♂, 3♀, Tabora region, Usinge, 4.viii.1973 *(Tunstall)* (ODNRI); 2♀, 33.6km. S. of Kisulu, 8km E. of main rd., 19.ix.1964 *(Jago)* (ODNRI); 1♂, 4♀, Ufipa plateau 25.6 km NNW of Sumbawanga, 16-27.v.1966 *(Jogo)* (ONDRI); 2♀, Tukugu, ix.1923 *(Miller)* (BMNH). ANGOLA: 2♂, ♀, Moxico Distr., Villa Luso, 8.vi.1927 *(Burr)* (BMNH). N ZAMBIA: 4♂, Mbala, L. Chila, 5.i.1952 *(Backlund)* (BMNH), 5♂, Mbala, 16-18.v.1960 *(Jago)* (ODNRI). MALAWI: 2♀, Zomba, 25.xii.74 (ODNRI), 1♂, Nkata Bay, 21.2.61 *(Fitzgerald)* (BMNH).

ACKNOWLEDGEMENTS

I would like to thank Dr. N.D. Jago for his supervision and criticism of this work, and to acknowledge my gratitude to the following individuals for the loan of specimens and other assistance: Dr. M. Donskoff (Paris), Dr. K.K. Gunther (Berlin), Dr. T. Kronestedt (Stockholm), Mrs. J. Marshall (London).

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Received January 1988
Editor: H.J. Beentje