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The African genus *Taramassus*: taxonomy, reproduction and stridulation

(Saltatoria: Acrididae)

With 10 figures and 2 tables

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Abstract

The genus *Taramassus* and the six known species (*cervus, cunctator, phyllocerus, platycerus, zavattarii* and *dirshi*) are redescribed. For that, specimens of three species were collected in Somalia and Kenya and type material was available from five species. For *T. platycerus* the description of UVAROV (1953) was used. Comparative studies and differential analysis led to a key to the species. Rearing experiments were carried out successfully with *T. cunctator*: a pair was sufficient to establish a culture for comparative investigations. A new mode of sound production by the antennae is described in *T. zavattarii*.

Zusammenfassung

Die Gattung *Taramassus* sowie die sechs bekannten Arten (*cervus, cunctator, phyllocerus, platycerus, zavattarii* and *dirshi*) werden anhand von in Somalia und Kenya gesammelten Exemplaren dreier Arten neu beschrieben. Zusätzlich stand Typenmaterial von fünf Arten zur Verfügung. Für *T. platycerus* wurde die ausführliche Beschreibung von UVAROV (1953) verwendet. Anhand von vergleichenden morphologischen Untersuchungen und einer Differentialanalyse wird ein Bestimungsschlüssel für die Arten mitgeteilt. Mit *T. cunctator* wurden Zuchtversuche begonnen, die erfolgreich durchgeführt wurden; ein Paar reichte aus, um eine Zucht bis zu drei Generationen zu etablieren. Für *T. zavattarii* wird ein neuer Stridulationsmechanismus unter Verwendung der Antennen beschrieben.

Key words: *Taramassus* species, redescription, key of the species, bionomy and reproduction of *T. cunctator*, mode of sound production in *T. zavattarii*

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Introduction

The genus *Taramassus* (GIGLIO-TOS, 1907) belongs to the family Acrididae, subfamily Eyprepocnemidinae; six species are known; five are distributed in East-Africa, one occurs in Angola. Males of all species have several joints in the distal half of the antennae enlarged. The antennae are strongly pectinate, a character also found in the genus *Cyathosternum* and in a species of the genus *Heteracris* (from Madagascar), both belonging to the same subfamily (DIRSH 1962, 1965). Species descriptions were based on a few specimens only, and on a single one in *T. phyllocerus*. The species were rather poorly defined by DIRSH (1966), and in one only the male is known which did not allow the evaluation of the importance of taxonomic characters. UVAROV (1953) wrote that he had never seen an acridid species with strongly crenate male antennae. In the course of the present study it is known that the form of the antenna is one of the most important taxonomic characters to identify the species. Comparative taxonomic studies resulting in a key to the species were not yet presented. Furthermore, biology and behaviour of the conspicuously coloured species remained almost unknown. It appears difficult to collect sufficient numbers in the field.

In the last 20 years the author collected a large number of specimens of three *Taramassus* species in Somalia and Kenya. Males and females were found in the same biotope and transported alive to the universities of Würzburg and Hannover for various investigations. If nymphs were found they were reared to adults in the laboratory. The aim of the present paper is to revise the taxonomy of the genus *Taramassus*, redescribe the species and to present a key for their determination.

No paper has so far delt with the reproduction of *Taramassus* species. Therefore, a laboratory culture of *T. cunctator* was established with the main purpose of studying the reproduction and the courtship. It was possible to rear several generations and to obtain sufficient material to study the intraspecific variation in both sexes. In addition, further studies on the antennal sound production were done in *T. zarattarii*, reported for the first time by SCHMIDT (1978).

Material and methods

During a 5-week stay at Mogadishu/Somalia in February-March 1974, 5 ♂♂, 1 ♀, and 5 nymphs (3 ♂♂, 2 ♀♀) of *T. zavattarii* (SALFI) were collected in the destrict of Afgoi on irrigated fields near the river Uebi Shebelle. All specimens were taken alive to Würzburg University for further biological studies, and the nymphs were reared to adults. One female of *T. dirshi* BACCETTI, was also found.

T. cunctator (SJÖSTEDT) was collected in Nairobi/Kenya during two one-week stays. Ten males and ten females were found at the university campus in July 1986, and three males and one female in the park of the National Museum in July 1991.

For further biological studies, most individuals were taken alive to Hannover University. After studying the behaviour the insects were deep frozen, mounted, vacuum-dried (SCHMIDT 1966) and stored in the author's collection.

For comparison additional material was borrowed from the Museo Zoologico de 'La Specola' at Florence (1 ♂ *T. dirshi*, holotype, 1 ♂ *T. zavattarii*, 1 ♂ *T. cervus*, all det. B. BACCETTI), from the Naturhistoriska Riksmuseet, Stockholm (1 ♂ *T. cunctator sjöstedti* (RAMME), holotype, 2 ♂♂, 1 ♀ *T. cunctator flabellatus* (RAMME), holotype + 2 paratypes), and from the Zoo-

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logisches Museum der Humboldt-Universität, Berlin (1 ♂ *T. phyllocerus* (RAMME), holotype and 1 ♂, 1 ♀ *T. cunctator* (KARSCH), collected in Zanzibar).

Sound production in relation to sexual behaviour was registered at Würzburg and Hannover by means of an UHER 400-report monitor tape-recorder and UHER M 53 microphone; tape speed was always 19 cm/sec. For the experiments a male was placed together with a female in a net of nylon-gauze (30 cm diam.) under laboratory conditions. The registered songs were analysed by means of a Dualbeam oscillograph, type 502 A, in connection with a special photocamera. The film speed was 20 cm/sec at a tape speed of 9.5 cm/sec. A filter of 600 Hz was used to attenuate ambient noise. Song description was based on the oscillograms and behavioural observations.

Bionomic studies were carried out with *T. cunctator* under laboratory conditions at Hannover as described by SCHMIDT (1981, 1986). Rearings were done in 1986-1987 and 1991-1993.

Males, females and nymphs of both sexes were collected at Nairobi/Kenya and brought alive to Hannover. Like other grasshopper species, the adults obtained were reared in cages of plexiglass measuring 54x26 cm at the base and 33 cm in height, additional height was obtained by a 30 cm high wooden box with sides of nylon gauze and a door of plexiglass in front (SCHMIDT, 1981). Temperature throughout the experiments was 25±2°C at night. During the light period (L/D 12 h) a temperature gradient from 28-45°C was provided in the cage by an internal reflector bulb (Osram Concentra, 60 Watt) fixed at one third on the roof of the upper box. The bottom of the cage was covered with a 1- cm layer of coarse-grained dry sand.

A hydroculture box with seedlings of wheat, or barley, stood in the cage to supply food and humidity. The insects could obtain additional moisture from a Petri dish (about 10 cm diam.) filled with wet sand. The food plants were protected from heat damage by placing the bulb at a light angle of 35°. Directly under the bulb, on the bottom, the temperature reached 45°C and light intensity 8000 lux. The relative moisture gradient of the air inside the cage varied from less than 20%, directly under the bulb, to more than 95% between the seedlings.

As additional food lettuce, fruits, wheat bran, carrots, protein-rich dog food and a variety of wild plants were offered to the insects, because their feeding preferences are unknown.

For egg laying a plastic box (7.5x7.5x5 cm) was placed near the hydroculture box, filled up with sand of 0.34-0.43 mm grain size, containing 12% moisture, which was controlled daily; moisture losses were compensated by adding pure water.

After a 2-week period, the egg-pods were incubated *in situ* in the box, at 30°C. Hatching of nymphs was controlled daily over five weeks. The box with the egg pods was kept in a plastic bag, so that the substrate did not dry up. A piece of cellucotton inside the bag reduced the condensation of water on the walls. This was necessary, because the young nymphs can stick very easily to the water and die.

After an incubation period of five weeks the egg-pods and remaining eggs from which no nymphs hatched were counted. All the nymphs which hatched at 30°C and survived at least 24 h were reared in cages similar to those mentioned above, but the bottom was covered by a 2-cm layer of moist sand.

Mortality was relatively high for the first instar, as normally found in all grasshopper rearing experiments.

As reproductive parameters, the number of egg-pods deposited, number of eggs per pod, percentage of nymphs hatched and adult rate were recorded. Two to three generations could be obtained.

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Results

Generic description

1907.- *Taramassus* GIGLIO-TOS, Boll. Mus. Zool. Torino XXII, No. 554, p. 34 (*T. cervus*)
1910.- *Taramassus*, KIRBY, Syn. Catal. Orthoptera, Vol. 3, Part. II, p. 561
1929.- *Eucerohippus*, RAMME, Mitt. Zool. Mus. Berlin, 15, p. 478 (**syn. nov.**) (*E. cunctator*)
1929.- *Lindia*, RAMME, 1.c., p. 480 (**syn. nov.**) (*L. phyllocera*)
1931.- *Eucerohippus*, RAMME, 1.c., 16, p. 944 (*E. c. flabellatus*)
1939.- *Eucerohippus*, SALFI, Miss. Zool. Paese Borana p. 354 (*E. zavattarii*)
1940.- *Taramassus*, UVAROV, Ann. Mag. nat. Hist. (11) *5*, p. 176
1953.- *Taramassus*, UVAROV, Publ. Cult. Comp. Diam. Angola *21*, p. 90-91 (*T. platycerus*)
1956.- *Taramassus*, JOHNSTON, Ann. Catal. Afric. Grasshoppers, p. 409
1962.- *Taramassus*, BACCETTI, Redia, XLVII p. 86-91 (*T. dirshi*)
1965.- *Taramassus*, DIRSH, The African Genera of Acridoidea, p. 293
1966.- *Taramassus*, BACCETTI & HOLLIS, Monit. Zool. Ital. LXXIV, p. 275-276
1966.- *Taramassus*, DIRSH, Comp. Diam. Angola, Ser. Cult. Dundo, *74*, p. 204
1967.- *Taramassus*, KEVAN, J. nat. Hist. *1*, 86-87
1968.- *Taramassus*, JOHNSTON, Ann. Catal. Afric. Grasshoppers, Suppl., p. 217
1982.- *Taramassus*, JOHNSEN, Acridoidea of Zambia (3), p. 180
1982.- *Taramassus*, JOHNSEN & SCHMIDT, Mon. zool. ital. Suppl. *16*, p. 80, 105
1984.- *Taramassus*, BACCETTI, Redia LXVII, 383-386

RAMME (1929) decided that *Pareuprepocnemis cunctator* KARSCH,1900, should be excluded from this genus, because of the flabellate antennae of the male; he created the genus *Eucerohippus*. RAMME (1930) suggested that his genus *Lindia* should be regarded as a synonym of *Taramassus*. A decision was later made by UVAROV (1953). Now there is no doubt that all the species mentioned above belong to the same genus *Taramassus*.
Due to the fact that there are at least three generic descriptions based on three different species, it may be helpful to give a redescription of the genus which combines the taxonomic characters already published with those of the specimens newly collected in Somalia and Kenya.

Body mostly small in males and of medium size in females; Head thickend; eyes large, globular; antennae, in male, with 24-26 joints, in basal half filiform, compressed, in the apical half forming leaf-like joints expanded on external side, except for some narrow apical joints (Fig. 1); in female, antennae often thickend, filiform. Fastigium of vertex angular, with incurved apical sides and distinct lateral angles, in middle with slight depression; frons oblique and slightly excurved; frontal ridge flat, narrowing upwards, with constricted apex.
Pronotum tectiform or weakly tectiform; median carina sharp, lateral carinae weak, slightly excurved; three transverse sulci well developed, first sulcus nearer to second than latter to third; metazona shorter than prozona, with angularly rounded posterior margin. Prosternal process antero-posteriorly compressed. Mesosternal interspace slightly wider than its length. Tegmina present in both sexes.
Hind femur short, strongly incrassate at base; dorsal margin with hairy black teeth, nearly serrate; ventral margin rounded; hind femur with four apical spurs black tipped, inner spurs longer than outer.

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Abdomen of male slender, rounded and thickend in anal region; last abdominal tergite with a pair of small projections; male supra-anal plate slightly trilobate, with angular apical lobe. Subgenital plate short with rounded apex. Cercus strongly compressed, with apex rounded and down-curved. Abdomen of female laterally depressed, with a longitudinal dorsal ridge. Valves of ovipositor short, robust, curved at apices.

1. *Taramassus cervus* GIGLIO-TOS, 1907

Taramassus cervus GIGLIO-TOS, 1907, Ortotteri Africani, Part I: 35.
Taramassus cervus, KIRBY, 1910, Synon. Catal. Orth., Vol. 3, Part II: 561.
Taramassus cervus, RAMME, 1929, Mitt. zool. Mus. Berl. *15:* 479, pl. 16, f. 10,11, fig. 106b.
Taramassus cervus, RAMME, 1931, Mitt. zool. Mus. Berl. *16*: 945.
Taramassus cervus, UVAROV, 1940, Ann. Mag. nat. Hist. *5:* 176.
Taramassus cervus, UVAROV, 1953, Publ. Cult. Comp. Diam. Angola, no. 21: 90.
Taramassus cervus, JOHNSTON, 1956, Ann. Catal. African Grasshoppers: 409.

♂:

Antenna brown with 24-25 joints; five joints of second half with lamellar expansions; first half filiform, but thickend with advancing joint row; 14th joint slightly expanded; 15th joint with triangular lobes, as long as width of basal part; 16th to 18th joint with long triangular lobes; longest lobe (on 17th) less than four times longer than basal part of joint width; 19th joint with reduced lobe; six apical joints without lobes, shortened, but together longer than longest lobe (Figs 1.1 and 1.5).

Head: Face (vertex, frons, clypeus, labrum) light brown; genae dark spotted below eyes; frontal ridge broad, widened in distal part, without furrow, above insertion of antennae narrow, almost as broad as vertex between eyes. Fastigium nearly straight, more narrow ahead, vertex trapezoid, narrowed between eyes without furrow; behind the eyes two light brown bands (one on each side), these darker along sides.

Thorax: Pronotum with subtectiform discus, densely punctured; front margin truncate-convex; hind margin round-angulate; median carina well developed, sharp; lateral carinae distinct; straight, three transverse sulci crossing median and lateral carinae; first transverse sulcus nearer to second than latter to third; metazona shorter (about 2/5) than prozona. Disc with a wide brown band extending from front to hind margin, equally narrowed, divided by median carina, bordered by two broad light brown bands (one on each side), reaching lateral carinae. Lateral lobes of pronotum deeper than long, rugulose, dark spotted; lower margin wide, angulate-rounded. Metathorax with broad light brown band, extending obliquely to the coxa of hind leg. Prosternal process of male antero-posteriorly compressed at base, narrow, apically broader, truncate rounded. Mesosternal interspace broader than long, trapezoid, separated by a sulcus from mesosternal plate. Tegmina as long as abdomen, narrow, with many dark transverse spots, especially in the apical half; in male more narrowed apically. Alae hyaline, shorter than tegmina, apically infumated. Hind femora with dorsal carina terminating in a small spine, with two dark dotted bands outside dorsally in the middle and near the upper outer margin. Hind tibia orange; tarsi yellow, 8 outer tibial spines; 9 inner tibial spines apically black.

Abdomen: Dorsal sulci near the apex with dark stipples forming a prebasal dark line, in central part weaker. Supra-anal plate of male oval, pear-shaped, with a baso-longitudinal sulcus, apex in middle dimple-like impressed. Cerci of male flat, short compressed, apex down-curved, obtuse. Subgenital plate of male short, obtuse.

General colouration of body yellowish-brown spottet with black and with some green regions.

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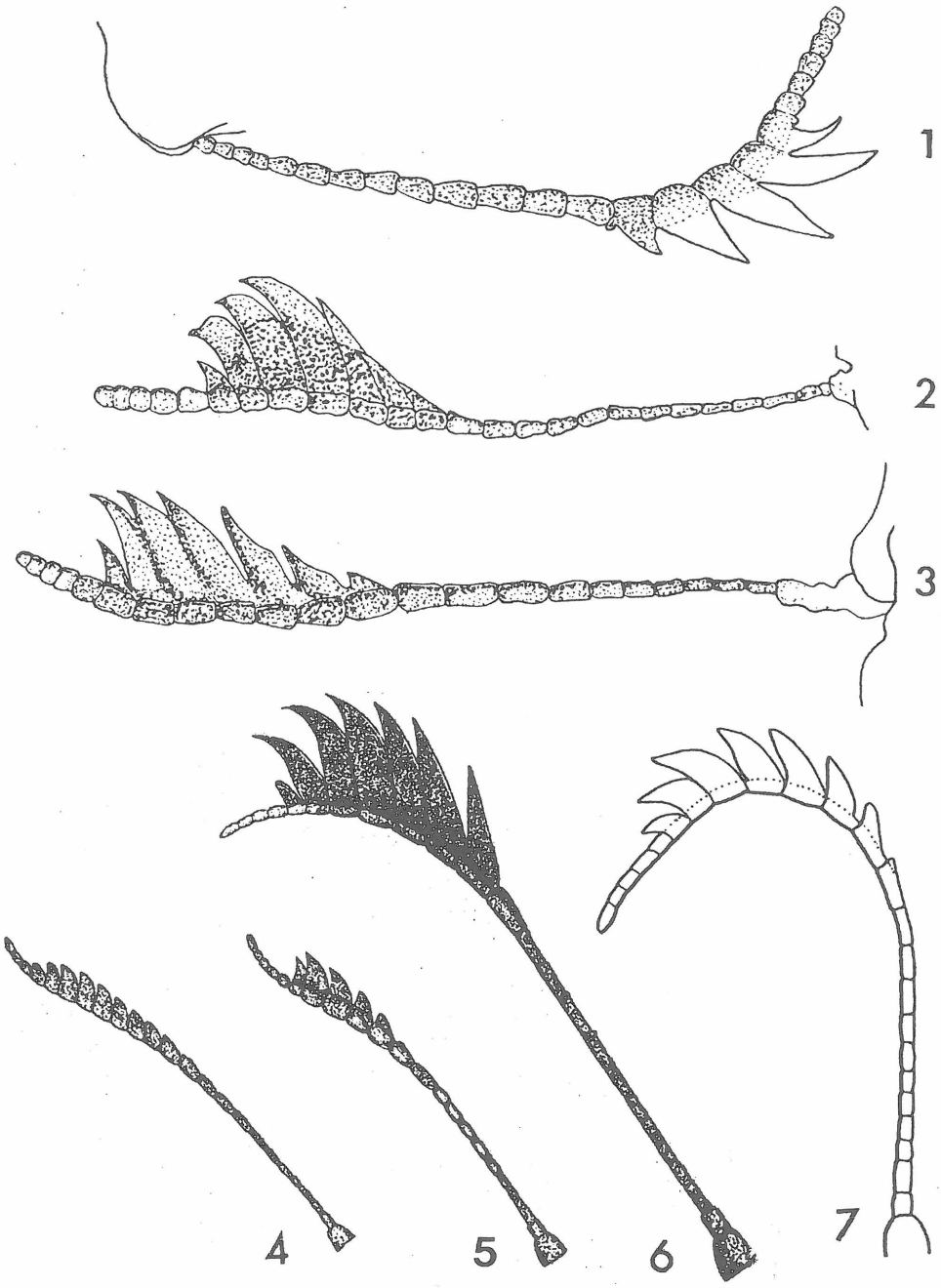

Fig. 1: Comparison of the flabellation of male antennae in *Taramassus* species (different magnifications): 1 - *T. cervus*, 2 - *T. dirshi*, 3 - *T. zavattarii*, 4 - *T. cunctator*, 5 - *T. cervus*, 6 - *T. phyllocerus*, 7 - *T. platycerus*, 1-3 from BACCETTI & HOLLIS (1966), 4-6 from RAMME (1929), 7 from UVAROV (1953).

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Occiput with dark dots forming a triangular figure, and with two light brown diverging stripes starting at hind margin of eyes and continuing along lateral carinae of pronotum, bordered with a dark brown stroke.

	♂	♀
Length of body	18.0 - 21 mm	23 - 29 mm
" " pronotum	4.0 - 6 mm	5 - 7 mm
" " tegmen	13.0 - 16 mm	19 - 23 mm
" " hind femur	10.5 - 13 mm	16 - 18 mm

The variation range is relatively large, also with regard to the antennal lobes.

Locus typicus: Somalia: Mogadishu, 1 ♂, 1 ♀, stored at Museo ed Istituto di Zoologia Sistimatica dell' Universita di Torino, Italy.
Other localities: Somalia: El Bur, 5.-9.IX.1962, 1 ♂; Shalambood, 7.IV.1984, 1 ♀; El Mugni (Merca), 25.III.1984, 2 ♂♂; 14.IV.1984, 2 ♂♂, 1 ♀; Merca, 13.VIII.1984, 1 ♂, 7 ♀♀.

2. *Taramassus cunctator* (KARSCH, 1900)
(Fig. 2)

Paraeuprepocnemis cunctator KARSCH, 1900, Berl. Ent. Nachr. *26:* 283.
Paraeuprepocnemis cunctator, BRUNN, 1901, Mitt. Naturhist. Mus. Hamburg *18:* 265.
Paraeuprepocnemis cunctator, KIRBY, 1910, Syn. Catal. Orth., Vol. 3, Orth. Salt., Part II:557.
Eucerohippus cunctator, RAMME, 1929, Mitt. Zool. Mus. Berl. *15:*478, 479; pl.16, f.7,9; fig. 106a.
Taramassus cunctator, UVAROV, 1940, Ann. Mag. nat. Hist. (11), *5:* 176.
Taramassus cunctator, KEVAN, 1950, J. E. Afr. nat. Hist. Soc. *19:* 216.
Taramassus cunctator, UVAROV, 1953, Publ. Cult. Comp. Diam. Angola, nr. 21: 91.
Taramassus cunctator, DIRSH, 1956, Trans. R. ent. Soc. Lond. *108:* 277, pl. 40, f. 11.
Taramassus cunctator, JOHNSTON, 1956, Ann. Catal. African Grasshoppers, p. 409
Taramassus cunctator, DIRSH, 1959, Riv. Biol. colon. *16:* 62
Taramassus cunctator, PHIPPS, 1959, Trans. R. ent. Soc. Lond. *111:* 32
Taramassus cunctator, DIRSH, 1965, The African Genera of Acridoidea, p. 294, fig. 226 (♂).
Taramassus cunctator, PHIPPS, 1966, Proc. R. ent. Soc. Lond. (A) *41:* 31
Taramassus cunctator, KEVAN, 1967, J. nat. Hist. *1:* 87
Taramassus cunctator, JOHNSTON, 1968, Ann. Catal. African Grasshoppers, Suppl., p. 217

♂:
Antenna with 24-26 joints, somewhat infumated, compressed; as long as head and pronotum; basal half filiform, 11th and 12th joint prolonged and enlarged; lobe forming from 13th (sometimes earlier) to 19th joint; lobes gradually enlarged, triangularly rounded, 17th and 18th joints with largest lobes, between one and two times as long as basal part wide; 6-7 apical joints shortened, decreasing in size to tip (Figs 1.4, 2 and 7).
Head: Frons, clypeus and labrum whitish, often with a brown band in the middle; genae blackish brown to brown; fastigium nearly horizontal, more narrow apically; vertex trapezoid; frontal ridge broad, widened in distal part, without furrow, above insertion of antennae narrow, half as broad as vertex between eyes; vertex with brown spots, behind eyes a broad converging pale stripe, bordered by dark brown, on either side.

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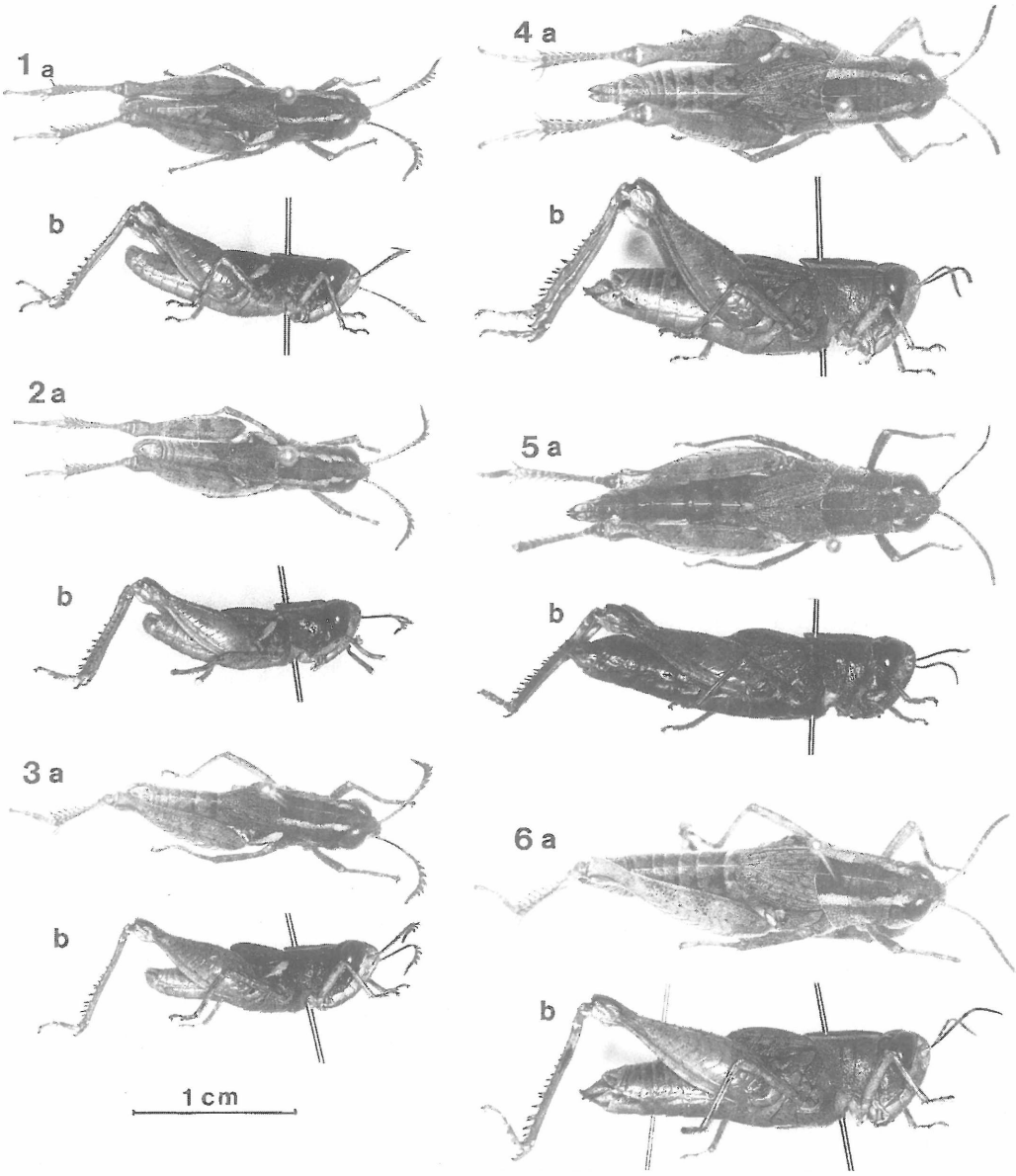

Fig. 2: *Taramassus cunctator* (3 ♂♂, left, and 3 ♀♀, right) collected at the same locality (University Campus, Nairobi) showing the variability of various characters; a: from dorsal, b: right side.

Thorax: Pronotum weakly tectiform, with sharp median carina, covered tightly with brown stipples; metazona shorter (about 4/10) than prozona; first transverse sulcus closer to second than latter to third, between 1st and 2nd sulcus two small black spots, symmetrically arranged; all transverse sulci cross median and lateral carinae; on disc a chestnut-brown to dark-brown

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wide band, extending from front to hind margin, divided by median carina, bordered by a broad irregular yellowish band (on either side), reaching the weak lateral carinae, slightly excurved; front and hind margin convex. Pronotal lobes dark-brown in front, light-brown in hind part, spotted, deeper than long. Disc and lateral lobes of pronotum tightly stippled, rugulose. Metapleuron with a broad pale band, extending obliquely to coxa of hind leg. Prosternal process antero-posteriorly compressed, with wide apex, rounded. Mesosternal interspace wide. Tegmina as long as pronotum, oval, slightly pointed at apex, with black spots; main veins subparallel irregular. Hind femur orange-beige, short, strongly incrassate basically; dorsal area with fine brown stipples irregularly distributed, near base a short black stripe on upper area of inner side; dorsal carina without apical spine; knee lobes with a white small spot near apex on both sides. Hind tibia orange-yellow, near knee an orange-light ring; outer margin with 8, inner one with 9 spines, spines with black tips.

Abdomen with a dorso-medial carina, yellow, all terga with an orange spot on each side and with brownish spots, symmetrically arranged. Supra-anal plate triangularly rounded and pointed at apex, divided by a transverse furrow into a basal and an apical area. Basal area with raised lateral margins; elevated in the middle, elevation with broad longitudinal furrow in proximal third of the plate (Fig. 7). Cerci short, compressed, apex down-curved, obtuse.

General colouration light yellow ventrally, brown spotted dorsally with distinct pale bands on head and thorax (Fig. 8.1b); pulvilli and arolium white or pale.

♀:

Antennae yellow, filiform, with 25 joints, distal half thickened, infumated, little shorter than head and pronotum; middle joints prolonged (Fig. 8.1a). Frontal ridge above insertion of antennae not so narrow as in male. Fastigium broad, widened towards clypeus, without furrow.

The smaller specimens from Nairobi are very similar to those found in Zanzibar; the description of Karsch (1900) fits well, with the exception that the latter have brown spotted hind femora, inner side light with a large black spot in middle and a small one on knee-lobe. Tegmina nearly as long as pronotum, oval, rounded at apex (Fig.8.1b). Fastigium wider than in male, of light brown colour. Face beige; lateral parts of head and pronotum light brown, with a black stripe behind eyes and on genae below eyes. Abdominal terga with a black oblique spot on both sides of median ridge, symmetrically arranged. Mesosternal interspace wider than long. Supra-anal plate short, triangular pointed. Ovipositor curved apically. Hind femora orange on ventral area, at base with a black spot dorsally (Fig. 3). Tibia with 8 spines on outer side, 9 on inner side, towards base gradually reduced in length; proximally a longitudinal black stripe outside. Ear with large oval opening. Pulvilli and arolia white or pale.

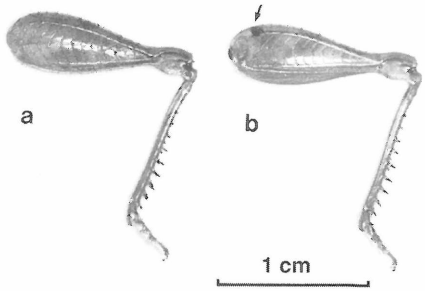

Fig. 3: Hind femora (outside and inside) of a female of *Taramassus cunctator*; with the finely serrated dorsal border and the black spot on internal area.

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	Zanzibar		Nairobi	
	♂	♀	♂	♀
Length of body	19.0 mm	25.2 mm	(n=13) 13.4 - 16.0 mm	(n=11) 23.0 - 28.0 mm
" pronotum	5.0 mm	5.8 mm	3.0 - 3.5 mm	4.6 - 5.2 mm
" tegmen	5.5 mm	7.0 mm	3.0 - 4.0 mm	4.6 - 6.0 mm
" find femur	12.0 mm	15.0 mm	9.0 - 10.0 mm	12.0 - 15.0 mm

Locus typicus: Zanzibar; Dana River ♂, ♀ (type material), stored at Zoologisches Museum der Humboldt-Universität, Berlin, Germany.
Other localities: Tanzania: Mbusini, 1 ♂; 1 ♀.; Kihenga, 4 ♂♂, 6 ♀♀, 3 ♂♂, 10 ♀♀ nymphs; Lewa, 2 ♀♀, 3 ♀♀, 2 ♀♀ nymphs, 28.VIII-25.IX.1888; East-Usambara Mountains (Magrotto), 2 ♂♂, 28.VII.1994 (A. HOCHKIRCH leg., in author's collection); Kenya: Shimba Hills, 350 m NN, ♂♂, ♀♀, VII.1939; coll. G. L. v. SOMEREN, Ngong; Stony Athi, 1 ♀, IX.1940; Teith Hills, 1 ♀.,25-27.XII.1945, 1500-1800 m NN, coll. Kevan; Ras Kiamboni, XII.1945, 1 ♀ (Mrs J. ADAMSON leg.); Nairobi, Univ. Campus, 18.VII.1986, 10 ♂♂, 9 ♀♀, 1 nymph last stage; National Museum Park, 5.VII.1991, 3 ♂♂, 2 ♀♀, all author leg., most of them in author's collection; 1 ♂ + 1 ♀ in Naturh. Riksmus.,Stockholm, 1 ♂ + 1 ♀ in Zool. Mus. Humboldt-Univ., Berlin, 1 ♂ in Mus. Zool. 'La Specola', Florence; Ethiopia: Caschei, 1 ♂, 7. VII.1939.

If specimens are not freshly prepared and dried up under freezing conditions, colour changes to dark and parts of the body can shrink.

2a. *Taramassus cunctator sjöstedti* (RAMME, 1929)

Pareuprepocnemis cunctator, SJÖSTEDT, 1909, Wiss. Ergebn. schwed. Zool. Exped. nach dem Kilimandjaro, dem Meru und den umgebenden Massaisteppen Deutsch-Ostafrikas, 1905-1906. 17. Orthoptera, 7. Acrididae: 185, 190, pl. 7, f. 12,13 (partim) (RAMME, 1929: 478).
Eucerohippus cunctator sjöstedti RAMME, 1929, Mitt. Zool. Mus. Berl. *15:* 478; pl. 16, f. 8.
Eucerohippus cunctator sjöstedti, SJÖSTEDT, 1933, Ark. Zool. *24*, A(1), p. 47.
Taramassus cunctator sjöstedti, UVAROV, 1940, Ann. Mag. nat. Hist. (11), *5:* 176.
Taramassus cunctator sjöstedti, UVAROV, 1953, Publ. Cult. Comp. Diam. Angola, nr. 21: 91.
Taramassus cunctator sjöstedti, JOHNSTON, 1956, Ann. Catal. African Grasshoppers, p. 410.
Taramassus cunctator sjöstedti, KEVAN, 1967, J. nat. Hist. *1:* 87.

♂:
Antennae similar to typical *T. cunctator*; 6 apical joints shortened decreasing in size to tip; 6 joints of second half with lobes similar shaped as in Fig. 1, longest lobe 1.5 times as long as width of basal part of joint.
Head: Face with ivory coloured broad bands separated by a brown stripe starting at median ocellus and reaching mouth parts as in typical *T. cunctator*; genae totally brown; behind eyes two (one on each side) broad light stripes with dark brown border.
Thorax: Pronotum similar to nominate form. Tegmina oval, slightly pointed at apex, as long as pronotum, not reaching hind margin of 1st tergite. Hind femora with brown outer side, ventral area orange; knee-lobes without light spot; hind tibiae orange, but without pale spot near the base; outer margin with 8, inner with 9 black tipped spines.

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Abdomen: Tergites with median carina; supra-anal plate heart-shaped, similar to nominate form. General colouration dark brown, dirty yellow ventrally.
Measurements of type (♂):
Length of body 16.2 mm, pronotum 3.8 mm, tegmen 3.8 mm, hind femur 9.6 mm.
Locus typicus: Tanzania: Mt. Kilimanjaro; Mt. Meru, lower part (♂-type)

The subspecies is very similar to *T. cunctator cunctator*; the length of the antennal lobes falls within the range of variation of the latter. Compared with the specimens collected at Nairobi the male collected at Meru is only slightly darker. Its size agrees well with the specimens from Nairobi. All other characters are within the range of typical *T. cunctator*. Also KEVAN (1967) had doubt if a new subspecies characterized by such small differences was relevant. It may be a mountain variety of the species, as RAMME (1929) already pointed out.

2b. *Taramassus cunctator flabellatus* (RAMME, 1931)

Eucerohippus cunctator sjöstedti, RAMME, 1929, Mitt. Zool. Mus. Berl. *15:* 478 (partim) (RAMME, 1931, p. 944).
Eucerohippus cunctator flabellatus RAMME, 1931, Mitt. Zool. Mus. Berl. *16:* 944, fig. 17.
Eucerohippus cunctator flabellatus, SJÖSTEDT, 1933, Ark. Mag. *24*, A(1): 47.
Taramassus cunctator flabellatus, UVAROV, 1940, Ann. Mag. nat. Hist. (11), *5:* 176.
Taramassus cunctator flabellatus, UVAROV, 1953, Publ. Cult. Comp. Diam. Angola, nr. 21: 91.
Taramassus cunctator flabellatus, JOHNSTON, 1956, Ann. Catal. African Grasshoppers, p. 409.
Taramassus cunctator flabellatus, KEVAN, 1967, J. nat. Hist. *1:* 87.

♂:
Antennae similar to typical *T. cunctator*; six apical joints shortened decreasing in size to tip; six joints of the second half with lobes similar shaped as in Fig. 1, but longest lobe 2.5 times as long as width of basic part of joint; one before and one behind of them show lobe forming.
Head: Two ivory-coloured spots on vertex, with dark brown borders. Face with two light-brown bands, separated by a darker band on frontal ridge, extending from vertex to labrum; genae dark brown.
Thorax: Pronotum without light-brown lateral stripes, unicoloured dark brown, which was found also in the specimens collected in the East-Usambara Mountains. Metapleura with a broad light band, extending obliquely to coxa of hind leg. Tegmina oval, with rounded and slightly pointed apex; a little shorter than pronotum, just reaching the distal border of first abdominal tergite; wings present. Femora with external area brown, ventral area orange-brown; knee-lobes without light spot. Tibia orange-brown, without light spot near the base; spine number reduced to 7 on outer and 8 on inner margin.
Abdomen: Supra-anal plate heart-shaped. Abdominal tergites with median carina; dark brown.

♀:
Body colouration lighter, with black spots on abdominal tergites and femora; dirty yellow stripes are present near the lateral carinae of pronotum as in typical *T. cunctator*. Antennae filiform, distal half thickened. On hind tibia inner margin with 8, outer margin with 9 black tipped spines; tibia dirty yellow ventrally.
General colouration of body dark brown.

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Measurements of holotype (♂), and paratype (1♀):

♂: Length of body	16.2 mm,	pronotum	3.9 mm,	tegmen	3.8 mm,	femur	9.7 mm
♀: " " "	20.0 mm,	"	4.5 mm,	"	4.4 mm,	"	12.5 mm

Locus typicus: Tanzania: Mt. Kilimanjaro, Kibonoto, 1000-1200 m NN, ♂-type.
Other localities: Mt. Kilimanjaro, 1300-1900 m NN (paratypes: 3 ♂♂, 3 ♀♀); Malindi (Kenya) (1♂)

The subspecies is also similar to typical *T. cunctator*, but the lobe length of the antennae of the male type material is significantly longer than that of the specimens from Nairobi. Holotype and paratypes are brown coloured like *T. c. sjöstedti*, but in males there are no light stripes near the lateral carinae of pronotum. In size the specimens from Mt. Kilimanjaro fall within the range of those from Nairobi. As in *T. c. sjöstedti*, there is no light spot on the knee-lobes of the hind femora and no light spot near the base of the tibiae.The number of spines is reduced. These are the most important characters in which the subspecies differs from typical *T. cunctator*.
More material is needed to decide the status of the subspecies and to clear up, wheather there are two different subspecies of *T. cunctator* on Mt. Kilimanjaro.

3. *Taramassus phyllocerus* (RAMME, 1929)

Lindia phyllocera RAMME, 1929, Mitt. Zool. Mus. Berl. *15:* 480-481.
Eucerohippus phyllocerus, RAMME, 1931, Mitt. Zool. Mus. Berl. *16:* 945.
Taramassus phyllocerus, UVAROV, 1940, Ann. Mag. nat. Hist. (11), *5:* 176.
Taramassus phyllocerus, UVAROV, 1953, Publ. Cult. Comp. Diam. Angola *21:* 91.
Taramassus phyllocerus, JOHNSTON, 1956, Ann. Catal. Afric. Grasshoppers, p. 410.

♂:
Antenna: 24 joints; first half filiform, compressed; 13th joint a little expanded; 14th-19th strongly flabellate, with oblong triangular pointed lobes; 20th joint with a similar, but much shorter lobe; the four apical joints normal, but compressed; joints 15-18 with the longest leaf-like lobes, about eight times longer than width of the basis of each joint (Fig. 1.6); antennae brownish-black, the three most distal joints light brown.
Head: Vertex roundly curved; fastigium oblong, trapezoid, and somewhat rounded in front of eyes; fastigium more than twice as wide as the distance between the eyes, weakly convex; frontal ridge without lateral carinae, but lamella like, elevated at the edge above the pit of the antenna, then weakly decreasing to the clypeus. Fastigium and vertex not sculptured, mat velvety; the other part of the head bright, finely tuberculated. Ocellus on the frontal ridge white, of same colour as two irregular formed spots near the border above and downwards. Clypeus whitish, margins bright yellow. Below compound eyes a round, citrus-yellow spot. An ivory coloured and gradually widened, laterally raised band runs from margin of fastigium along eyes to hind vertex.
Thorax: Pronotal disc mat, not shiny, laterally bordered by two narrow, ivory coloured bands converging a little in front and behind. Tegmina surpassing abdomen, but not reaching hind knees, brownish infumated, veins dark brown, some faded light spots in distal part.Wings transparent, somewhat infumated only distally. A rounded, light ochre-yellow spot on meta-

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pleura above base of hind femora. Hind femora with dorsal and external areas reddish-brown, internal part and ventral area bright meat-red, the same in hind tibiae and tarsi.
Abdomen light dirty-red. Cerci flat, wide, angularly pointed, curved downwards and compressed.

Colouration: Head, pronotum and thorax blackish-brown, abdomen light dirty red.

Length of body	30.0 mm	length of pronotum	6.3 mm
" " eyes	3.9 mm	" " tegmen	19.5 mm
width of eyes	2.7 mm	" " hind femur	17.5 mm
length of antenna	12.4 mm	" " tibia	14.2 mm

Locus typicus: Fülleborn at Lindi, Tanzania, East Africa, stored at Zool. Mus. A.v.H. Univ., Berlin, 1 ♂ (holotype).
♀: unknown

4. *Taramassus platycerus* UVAROV, 1953

Taramassus platycerus UVAROV, 1953, Publ. Cult. Comp. Diam. Angola, no. *21:* 91, fig. 108.
Taramassus platycerus, JOHNSTON, 1956, Ann. Catal. African Grasshoppers, p. 410.
Taramassus platycerus, DIRSH, 1966, Comp. Diam. Angola Dundo, Ser. Cult. *74:* 204.

♂:
Antenna little longer than head and pronotum together; 25 joints, eight of them have triangular, flattened lobes, increasing in the size to maximum and then rapidly declining; 12th joint slightly expanded; 13th with narrow lobe; 14th with lobe as broad as the joint; 15th with lobe twice as large as the 14th; 16th, 17th and 18th with lobes still larger, 10 times as long as the width of the basal part of joint; lobe of 19th about same length as the three previous joints, but more attenuated; 20th with shorter and narrow lobe; the remaining apical joints filiform, their combined length half that of longest antennal lobe (on the 18th joint) (Fig. 1.7).
Head: Frontal ridge thick, weakly convex, distinctly, but not coarsely, punctured, slightly narrowed at apex. Fastigium of vertex elongate-pentagonal with rounded angles; surface concave; margin broad, finely punctured. Vertex with a fine median carinula from behind fastigium and not reaching occiput.
Thorax: Pronotal disc slightly tectiform, densely rugulose laterally, matted along the middle. Median carina well raised, sharp. Transverse sulci at equal intervals, first two straight, third slightly obtuse-angular, placed at 0.6 of pronotal length. Lateral carina distinct in front of first transverse sulcus and almost obliterated backwards; metazona shorter than prozona, densely rugulose; its posterior margin widely obtuse-angular. Lateral lobe punctured except for two smooth spots in upper part of prozona; lower margin of lateral lobe, in middle excurved. Posternal process slightly antero-posteriorly compressed, with rounded and slightly inflated apex. Tegmina just reaching base of knees (almost end of abdomen).

General colouration dirty brown. Head and pronotum above with a blackish median stripe. Face with black subocular stripes. Tegmina with some small black spots. Hind femur thickened with scarcely indicated dark fasciae above, external medial area blackened apically; inner side faintly

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reddish, blackened in apical part. Hind tibia dirty-yellow, with some black spots near base outside.

♀:
Larger than male. Antennae longer than head and pronotum, only slightly widened in middle of apical half, without lateral lobes. Apical margin of subgenital plate obtuse-angular. Hind femur distinctly reddish-yellow on internal area near base; hind tibia reddish-yellow towards apex.

	♂	♀		♂	♀
Length of body	22 mm	28 mm	length of tegmen	13.00 mm	16 mm
" " pronotum	5 mm	6 mm	" " hind femur	12.15 mm	17 mm

Locus typicus: Cuanza sul district: Luanda/Angola, 19.IV.1927; 1 ♂ (holotype), 2 ♀♀, stored at Brit. Mus. Nat. Hist. London.
Other localities: Angola: Lobito, X.1949, 1 ♀ (leg. B. MALKIN); Onaga Xanga, IV.1962, 3 ♂♂; Catete, XI.1962, 2 ♀♀.

5. *Taramassus zavattarii* (SALFI, 1939)
(Fig. 4)

Eucerohippus zavattarii SALFI, 1939, Miss. biol. Paese Borana, Roma, *3:* 354, figs. 3,4.
Taramassus zavattarii, UVAROV, 1940, Ann. Mag. nat. Hist. (11) *5:* 176.
Taramassus zavattarii, UVAROV, 1953, Publ. Cult. Comp. Diam. Angola, nr. 21: 91.
Taramassus zavattarii, BACCETTI, 1962, Redia, XLII: 90.
Taramassus zavattarii, BACCETTI & HOLLIS, 1966, Mon. Zool. Ital., Suppl. LXXIV: 276.
Taramassus zavattarii, KEVAN, 1967, J. nat. Hist. *1:* 80.
Taramassus zavattarii, JOHNSEN & SCHMIDT, 1982, Mon. Zool. Ital., Suppl. XVI: 80.
Taramassus zavattarii, BACCETTI, 1984, Redia LXVII: 384.

♂:
Antenna with 25-26 joints, compressed; basal half filiform, 13/14th segments slightly, 14/15th - 19/20th strongly expanded on external side, 21st with small outer line, the most apical subcylindrically compressed; longest lobe (1mm) 5-6 times as long as width of basal part of joint; lobes of 13/14th - 15/16th joint almost triangular, lobes of 16/17th - 19/20th on the basal part with parallel sides, the apical part subtriangular curved and pointed. Antenna as long as head and pronotum (Figs 1.3, 5 and 7).
Head: Frontal ridge subconvex, broad, widened in distal part, with lateral carinulae, diverging almost to clypeus, light brown, broad band extending to the mouthparts, bordered by an ivory coloured or beige part reaching fascial carinae on both sides, strongly punctured, without furrow but faintly grooved around median ocellus; above insertion of antennae narrow, half as broad as vertex between eyes; ocelli arranged in almost a triangle. Fastigium of vertex almost pentagonal, flat. Vertex with brown spots, convex between eyes, narrow, about one third of eye-length; behind eyes a broad light stripe with dark borders, on either side.
Thorax (Fig. 7): Pronotum weakly tectiform, rugulose, front margin convex, hind margin rounded; median carina sharp, lateral carina weak, slightly convergent in prozona; first transverse sulcus nearer to second than latter to third; between first and second sulcus two small black spots, symmetrically arranged; all three sulci cross median and lateral carinae.

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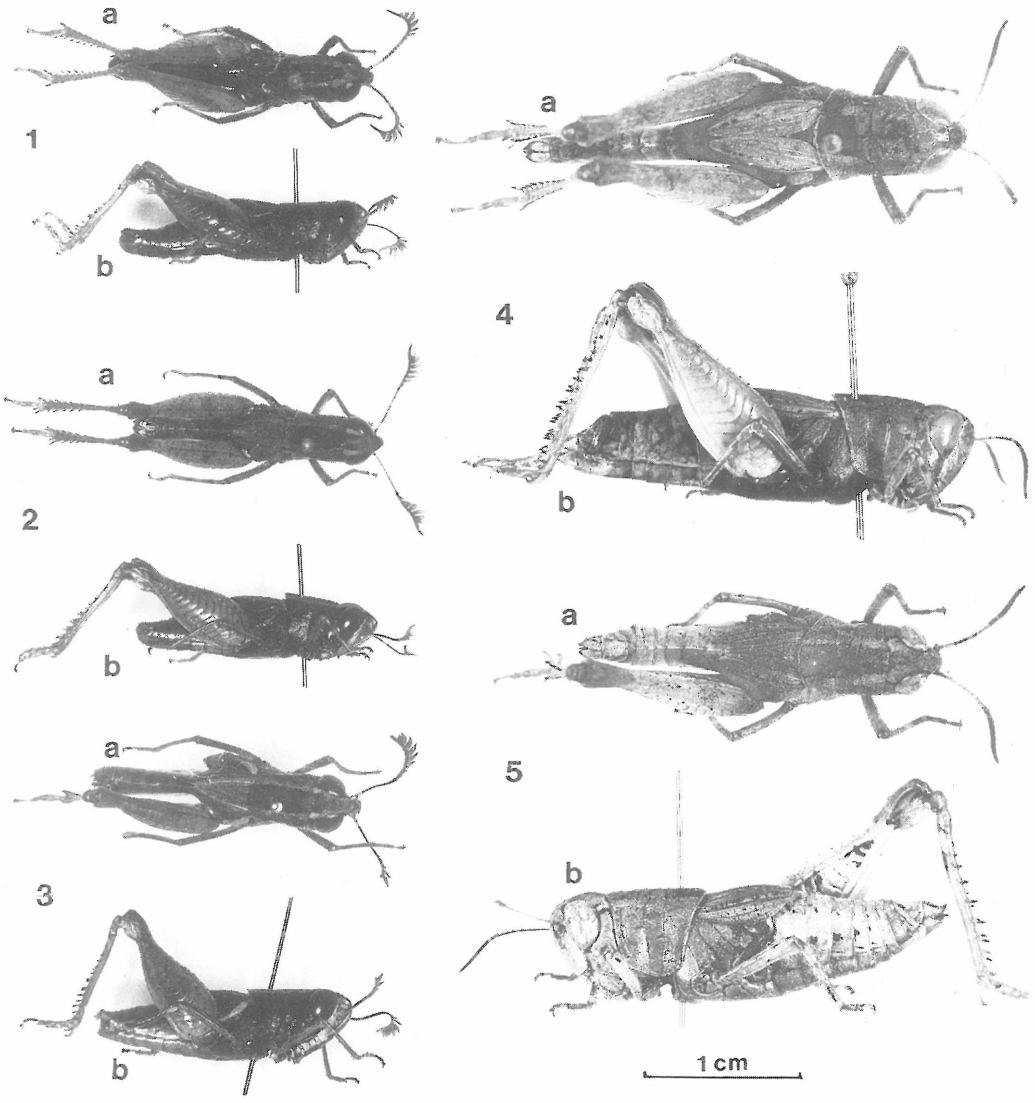

Fig. 4: *Taramassus zavattarii* (3 ♂♂, left, and 2 ♀♀, right) collected at the same locality (Afgoi, Somalia) showing the variability of various characters; a: from dorsal, b: right side, c: left side.

Metazona shorter than prozona, about 4/10 of pronotum length. Disc with a wide brown band, extending from front to hind margin, divided by median carina, bordered by a broad light band on either side reaching lateral carinae, slightly excurved. Lateral lobes rugulose, almost as deep as long, ventrally narrowed and rounded, brownish. Metathorax with a broad light band (in dried specimens often absent) extending obliquely to the coxa of hind leg. Prosternal process antero-posteriorly compressed, with wide apex, rounded. Mesosternal interspace longer than wide. Tegmina brown, as long as pronotum, apex rounded or more pointed, sometimes with

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dark spots in medial area, lighter in cubital area; wings reduced but present. Hind femur external area sandy-beige, infero-internal area yellow-orange, dorsal area with somewhat irregularly arranged brown stipples; near base a short black stripe on upper part of internal area; basal part strongly incrassate; dorsal carina terminating in a small apical spine. Hind tibia and tarsi bright orange, outer margin of tibia with 8, inner margin with 9 spines, all with black tips.

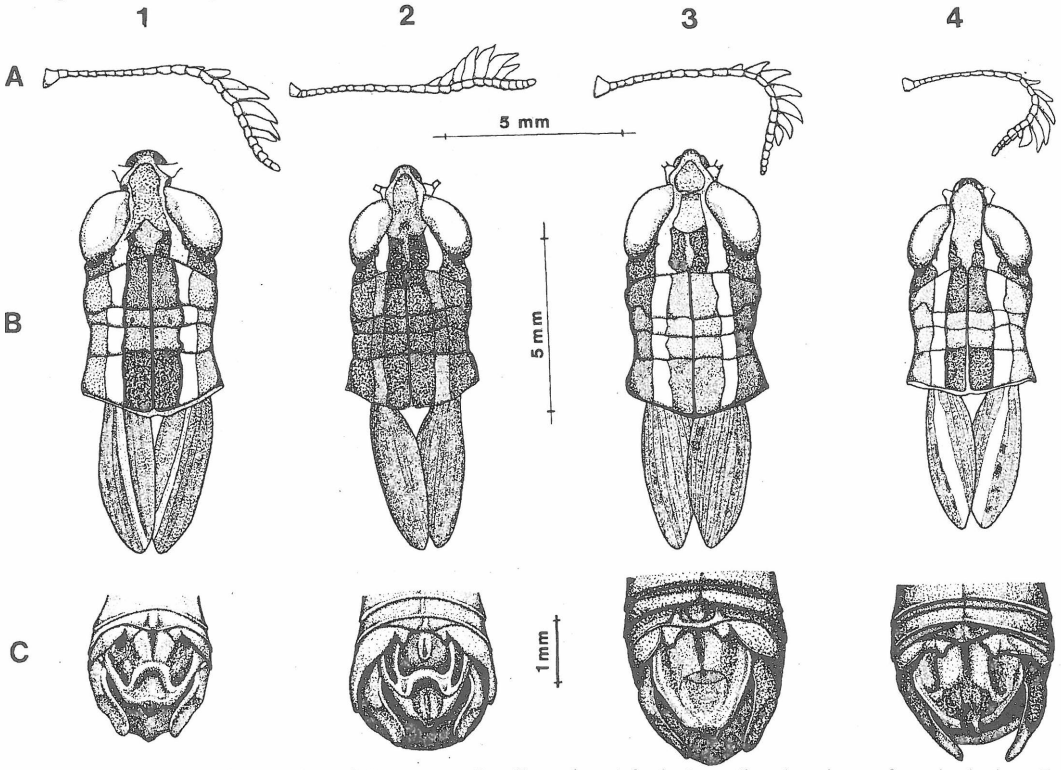

Fig. 5: Variability in four males of *T. zavattarii* collected at Afgoi, Somalia; drawings after air-drying; I: flabellation of antennae, II: dorsal view of head, pronotum and tegmina, III: apex of abdomen.

Abdomen: Sternites yellow; tergites brownish, laterally compressed with carinated midline. Cerci compressed, apex weakly downcurved, obtuse. Subgenital plate distally convex. Supra-anal plate triangular, apex pointed; distal part on each side slightly enlarged; sides slightly rounded, with margin raised; divided by a weak transverse angular line, before middle of plate, basal area with a central elevation, elevation with a broad longitudinal furrow in proximal fourth (Figs 5 and 7). Male genitalia compare BACCETTI (1962).
General colouration brown, ventrally yellowish, with distinct light bands on head and thorax.

♀:
Larger than male; more dull coloured. Antenna: 25-26 joints, yellow, filiform, distal part thickened, infumate, middle joints as long as wide, shorter than head and pronotum together (Fig. 8.3). Frontal ridge convex. Tegmina lobiform, with pointed but more rounded apex, short, hardly reaching proximal 1/5 of hind femur; as long as pronotum or shorter. Hind femora with ventro-internal area orange. Tibia with 8 outer and 9 inner spines, with black tips, towards base

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of tibia gradually reduced in length, tibia orange-yellow. Hind margin of supra-anal plate almost rounded. Ovipositor valves short, apically curved. Body brown-sandy coloured, with very weak yellow-white bands and marks.

	From SALFI (1939)	collected at Afgoi, in author's collection	
	♂	♂	♀
Length of body	21.0 mm	(n=7) 17.0 - 19.5 mm	(n=2) 24.0 - 28.5 mm
" " head	3.5 mm	3.0 mm	3.5 mm
" " pronotum	5.0 mm	4.0 - 5.0 mm	5.6 - 6.2 mm
" " tegmen	5.5 mm	4.8 - 5.0 mm	5.8 - 7.0 mm
" " hind femur	11.7 mm	10.0 - 12.0 mm	5.0 mm
" " antenna	-	7.5 mm	7.4 - 8.0 mm

Locus typicus: Moyale (Kenya), 14.V.1937, 2 ♂♂, type lost, neotype coll. BACCETTI, Siena/ Italy.

Further localities: Kenya: Mt. Kulal, X.1947, 1 ♀ (J.G. WILLIAMS leg.); Moyale, cultivation, 8.-10.VI.1947, 5 ♂♂, 1 ♀.; Yasere, thorn-bush country, 14.VI.1946, 1 ♀; Jubaland: Algada area, (nyika) bush, 4.X.1947, 2 ♂♂. Somalia: Kurtum Uaro, 14.VIII.1959, 1 ♂; Giohar (Mogadishu), 26.IX.1964, 1 ♂; Afgoi (Uebi Scebelle, III.1974, 7 ♂♂, two as nymphs, 2 ♀♀, both as nymphs, all in irrigated cultures, all author leg., most of them in author's collection; 5.III.1984, 1 ♀; Bardere, near Berdi cave, 15.III.1985, 1 ♀; Genale, irrigated cultures, 2.IV.1984, 1 ♀; Misciani, Uebi Scebelle, 5.V.1984, 1 ♀; Goluen, irrigated cultures, 10.V.1-984,1 ♂; Gelib, Shalamhood, 17.VI.1984, 1 ♂, 1 ♀, 1 ♂ nymph; Genale, rice paddy, 2.VIII.1984, 1 ♂.

The species was found mainly in irrigated and cultivated areas; most adults seem to be present in March-April. The species can only develop in moist areas. In permanent irrigated regions the species may produce two generations per year having no diapause but needs 3-4 months for larval development.

KEVAN (1967) pointed out the variation in the male antennae, body size and shape of tegmina even in a single locality as it was done here for Afgoi area (Somalia).

6. *Taramassus dirshi* BACCETTI, 1962

Taramassus dirshi BACCETTI 1962, Redia, *47:* 86.
Taramassus dirshi, BACCETTI & HOLLIS, 1966, Monit. Zool. Ital. *74:* 276.
Taramassus dirshi, KEVAN 1967, J. nat. Hist. *1:* 87.
Taramassus dirshi, JOHNSTON, 1968, Ann. Catal. African Grasshoppers, Suppl., p. 217.
Taramassus dirshi, BACCETTI, 1984, Redia, *67*: 385.

♂:

Antenna with 26 joints; until 13th joint filiform, in apical half with characteristic lamellar expansions of several joints; 14th joint slightly expanded apically; 15th with lobe a little broader than joint, 16th with lobe twice as large as the 15th and 17th with lobe twice as large as 16th; 15th-17th acute triangular; 18th joint with longest lobe, six times longer than basal part of joint; 19th and 20th with smaller lobes, more rounded apically; 21th joint with a strongly reduced lobe, only a little longer than width of joint; five joints apically normal, but shortened, together about as long as largest antennal lobe (Fig. 1.2).

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Head: Globular, frons straight and flat (in lateral view); vertex a little prominent. Fastigium of vertex subpentagonal dorsally, margins not elevated; dorsal surface flat. Fastigial foveolae absent, replaced by 3-4 blackish impressions. Eyes large, the front margin semicircular, strongly convex (seen from above).

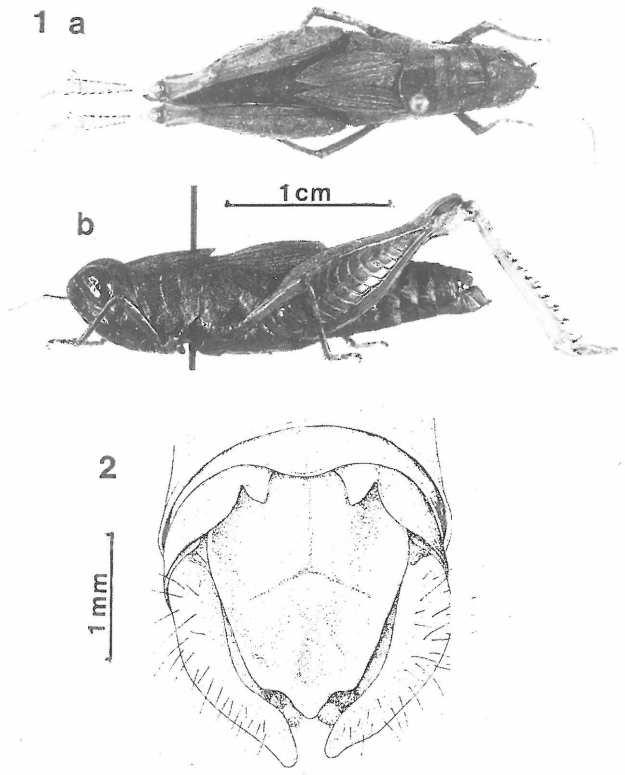

Fig. 6: *Taramassus dirshi*: female, collected at Afgoi, Somalia from above (a) and left side (b) and apex of a male abdomen (c), the latter from BACCETTI & HOLLIS (1966).

Thorax with tectiform discus; median carina well developed, sharp; lateral carinae almost absent. First transverse sulcus weaker than the other two and much nearer to the second than the latter to the third. Last transverse sulcus in about 3/5 length of discus; metazona punctured, shorter than prozona. Hind margin of pronotum subangularly rounded, front margin convex. Lateral lobes rugulose punctured with straight ascending margin, about as deep as long.
Tegmina short, overlapping dorsally in the middle, with acute apex, hardly reaching hind margin of first abdominal tergum.
Abdomen: Supra-anal plate triangular, basal area with a weak longitudinal furrow, terminated by a weak transverse angular line, lateral margin elevated, straight, apex lobated (Fig. 6). Cerci compressed, apex narrowed and curved downwards. Description of male genitalia see Baccetti (1962). General colouration yellowish. Antennae dark brown, genae different; median fascia of pronotum, meso- and metapleura black; external surface of hind femur blackish in the distal half, but variable.

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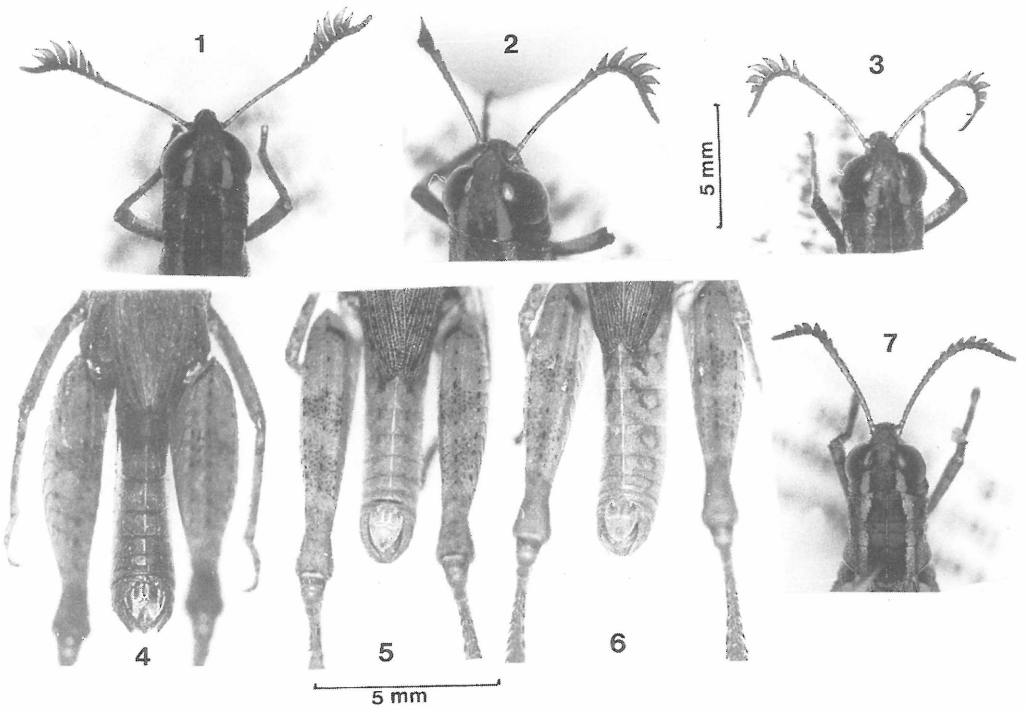

Fig. 7: Detailed photographs of males of *Taramassus* species to demonstrate the variability of various taxonomic characters: 1,2,3: *T. zavattarii*, flabellation of antennae and colouration of vertex, 4: *T. zavattarii,* apex of keeled abdomen and shape of tegmina; 5,6: *T. cunctator*: apex of keeled abdomen, shape of tegmina and femora (dorsal view), 7: *T. cunctator* dorsal part of head and pronotum and flabellation of antennae.

♀:

Larger than male; pronotum in dorsal view slender; first transverse sulcus of pronotum more distinct, nearer to the second sulcus than the latter to the third. Hind margin of pronotum subangularly rounded. Antennae filiform, apically little expanded, middle joints longer than wide (1.5 to 1). Tegmina with acute apex, short, little longer than pronotum, hardly reaching proximal fifth of hind femora. Female from Afgoi dark brown with orange hind tibiae. Antennae: 27 joints, yellow, dorsally infumated. No light bands and spots on body (Figs 6 and 8.2). Pronotal hind margin convex, on disc near front margin two black spots, symmetrically arran-

	From Baidoa		From Afgoi
	♂	♀	♀
Length of body	19.0 mm	26.0 mm	32.0 mm
" " pronotum	4.5 mm	6.0 mm	7.5 mm
" " antenna	8.0 mm	9.0 mm	11.0 mm
" " tegmen	5.3 mm	10.0 mm	9.0 mm
" " hind femur	-	14.0 mm	17.0 mm

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ged, disc and lateral lobes of pronotum rugulose. Hind margin of supra-anal plate rounded. Valves of ovipositor relatively short, but strong.

Locus typicus: Somalia: Badadda & Lac Baduna, 1 ♂ (holotype), stored in Mus. Zool. 'La Specola', Florence.

Other localities: Ola Uager, 15.IX.1964, 3 ♂♂; Alessandra Gelib, 15.XII.1964, 2 ♂♂; Afgoi (Mogadishu), III.1974, 1 ♀; Isl. Ciovai (Bagiuni), 2.III.1984, 3 ♂♂; Isl. Cuvumbi (Bagiuni), 3.III.1984, 2 ♀♀; El habro (Baidoa), 8.III.1984, 1 ♂, 1 ♀.

KEVAN (1967) mentioned that the ♂♂ collected in Jubaland, Algada area, 4.X.1947, may belong to *T. dirshi*; it was not possible for me to prove this.

Deviating from the description given for the female of *T. dirshi* collected at Afgoi, BACCETTI (1984) selected a female as allotype with rounded tegmina and not acute apex whilst the male holotype has an acute apex (BACCETTI, 1962). In all other *Taramassus* species so far as known, the shape of the tegmina is similar in both sexes. On the other hand, the selected allotype has long, not thickened antennae as shown in Fig. 8.2.

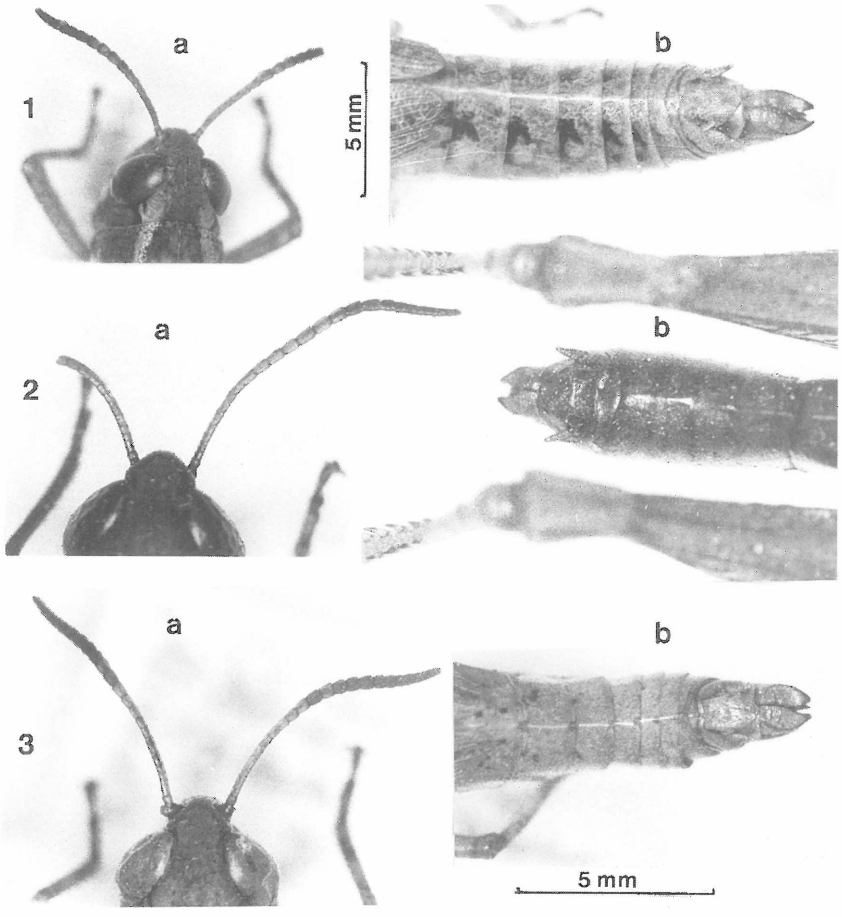

Fig. 8: Detailed photographs of females of *T. cunctator* (1), *T. dirshi* (2) and *T. zavattarii* (3); a: vertex and antennae, b: apex of keeled abdomen.

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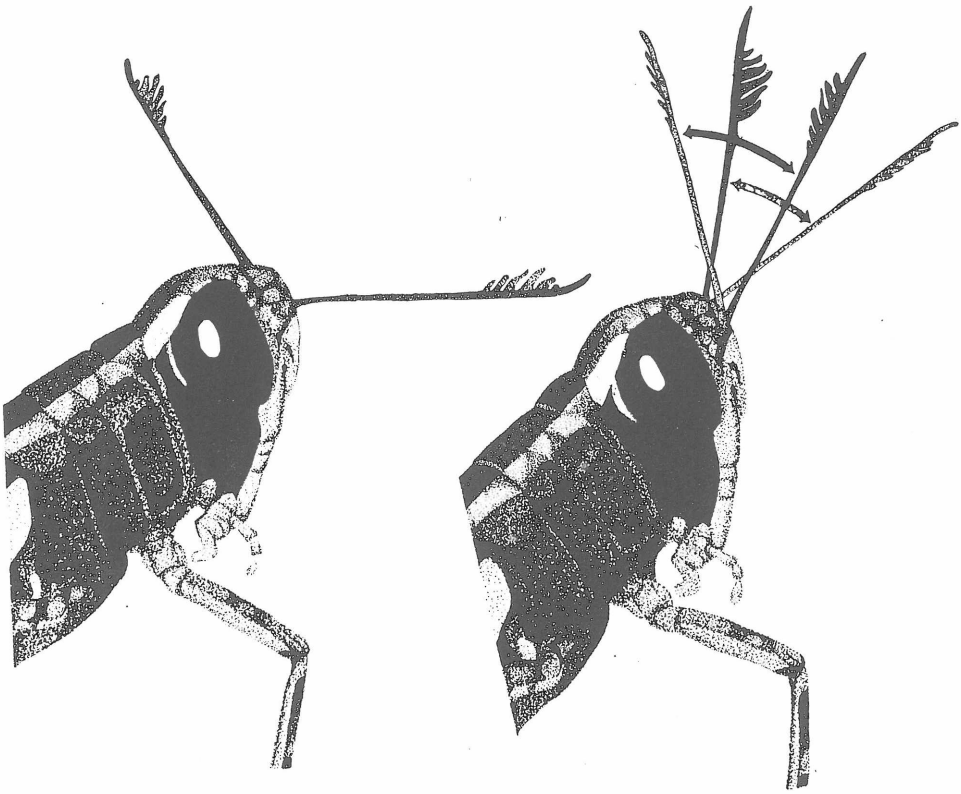

Fig. 9: Male of *T. zavattarii*: colouration of head + thorax and movement of antennae during stridulation.

Differential Diagnosis

For the determination of *Taramassus* species the peculiar flabellation of the male antennae in connection with the length of the tegmina is the most important character. The descriptions showed that only few characters together with the striking colouration of some parts of the body can be used for discrimination of the species. The female antennae are similar in five species, only those of *T. dirshi* females have filiform antennae as BACCETTI (1984) pointed out and lobiform tegmina with acute apex. For these characters the species can be distinguished from *T. cunctator* and its subspecies which have oval tegmina with rounded and only faintly pointed apex. In some cases the male supra-anal plate can be used as specific character. For example, males of *T. dirshi* have a supra-anal plate without a broad longitudinal furrow in the proximal third (BACCETTI, 1962), which is present in *T. cunctator* and *T. zavattarii*. In some dried up material it was difficult to use this and other much shrunken characters for discrimination of the species.

For *T. phyllocerus* only the maletype is known and no intraspecific comparison was possible. In many cases, the material stored in museums could not be used because the antennae had been broken off.

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Key to the species

1. Tegmen strongly shortened, shorter than 10 mm; almost as short as pronotum 2
- Tegmen nearly reaching apex of abdomen or surpassing it, longer than 12 mm 4

2. Antennal lobes of male at most three times as long as width of basal part of joint; tegmen ovoid, broadly rounded, only faintly pointed at apex . . . . *cunctator* (KARSCH, 1900)
- Antennal lobes of male 4-6 times as long as width of basal part of joint; tegmen leaf shaped, at apex somewhat pointed or acute 3

3. Tegmen with acute apex in both sexes, little longer than pronotum; female antennae quite filiform, middle joints: length to width 1.5:1 . . . . . *dirshi* BACCETTI, 1962
- Tegmen with rounded, but pointed apex in both sexes, as long as pronotum; antennae of female in second half thickened, middle joints: length to width 1:1 . . . . . *zavattarii* (SALFI, 1939)

4. Antennae of male with five lobated joints in distal half . . . . *cervus* GIGLIO-TOS, 1907
- Antennae of male with seven lobated joints in distal half 5

5. Tegmen surpassing apex of abdomen; lobes of male antennae about eight times longer than width of basal joint; largest species, body length of male 30 mm (female unknown) . . . . . *phyllocerus* (RAMME, 1929)
- Tegmen not reaching apex of abdomen; antennae longer than head and pronotum; smaller species, body length of male 22 mm . . . . . *platycerus* UVAROV, 1953

Reproduction of *T. cunctator* under laboratory conditions

In 1986, the P-generation was started with five females from which offspring was obtained. The hatching rate was low, and less than half of the eggs developed. In the F_1-generation egg-laying and hatching rate were considerably reduced, and in F_2 no development took place. It was striking that many egg-pods were laid into the very wet Petri dish and not in the box providing for egg-laying. This means that females need a high soil moisture for oviposition. Fecundity was considerably reduced from one generation to the next. In F_1 many of the females paired with males did not oviposite. It was also striking that either almost all eggs of an egg-pod developed or there was no hatch at all. The culture finished with F_2, because all egg-pods were laid in the Petri dish with very wet sand, thus egg development could not reach the hatching stage (Tab.1). In 1991 a second culture was started with only one female and two males. In this case seven egg-pods with 192 eggs were produced, but only one, which was laid first, resulted in offspring. All eggs of this pod developed and 24 nymphs hatched. A high adult rate of about 70% was obtained. Again in this culture the offspring of F_1 was drastically reduced, from ten females paired with males only 17 egg-pods were produced, the hatching rate was high (72.1%) than in the preceeding generation. However, adult rate was much lower, from 300 hatched nymphs only 8.7% became adults. In further generations fecundity became consistently lower. In the F_2-generation the hatching rate of nymphs was higher than in the F_1 and 27.4% became adults.

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Table 1: Breeding results of *T. cunctator* collected at Nairobi, University Campus in July 1986.

Reproduction of **T. cunctator** *from* **Nairobi**

Generation **P** *started from* **23.07.1986**
started with **5** *females* **4** *males*
died between 03.09.1986 *and* 29.09.1986 19.08.1986 *and* 15.09.1986
Lifespan 43-69 *days* 28-55 *days*

date laying		*egg-pods*	*eggs*	*eggs/pod*	*hatched nymphs*	*date between*	*and*
from 23.07.198	to 12.08.1986	8	231	29	126	26.08.1986	02.09.1986
12.08.1986	26.08.1986	6	138	23	0		
26.08.1986	11.09.1986	2	49	25	0		
11.09.1986	26.09.1986	1	25	25	25		on 13.10.1986
	total	17	443	26.1	151		

egg-pods/female: **3.4**
eggs/female: **88.6**
Hatching rate: **34.1**

Generation **F1** **42** *adults:* 21 *females and* 21 *males*
Eclosion period of adults from 03.11.1986 to 10.11.1986 *Adult rate:* **27.8**

Generation **F1** *started from* 10.11.1986
started with **16** *females* **16** *males*
died between 24.01.1987 *and* 23.02.1987 18.11.1986 *and* 23.02.1987
Lifespan 75-105 *days* 8-105 *days*

date laying		*egg-pods*	*eggs*	*eggs/pod*	*hatched nymphs*	*date*
from 10.11.198	to 24.11.1986	1	20	20	0	
15.12.1986	07.01.1987	1	28	28	27	on 02.02.1987
in the Petri-dish of wet sand:		7	138	19.7	0	
	total	9	186	20.7	27	

egg-pods/female: **0.6**
eggs/female: **11.6**
Hatching rate: **14.5**

Generation **F2** **14** *adults:* 4 *females and* 10 *males*
Eclosion period of adults from 10.03.1987 to 17.03.1987 *Adult rate:* **77.8**

Generation **F2** *started from* 17.03.1987
started with **4** *females* **10** *males*
died between 27.03.1987 *and* 23.07.1987 06.04.1987 *and* 23.07.1987
Lifespan 10-128 *days* 20-128 *days*

date laying		*egg-pods*	*eggs*	*eggs/pod*	*hatched nymphs*
in the petri-dish with wet sand					
from 17.03.198	to 23.07.1987	7	186	26.6	0
	total	7	186	26.6	0

egg-pods/female: **1.8**
eggs/female: **46.5**
Hatching rate: **0.0**

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Table 2: Results of culturing *T. cunctator* collected at Nairobi, Park of National Museum in July 1991.

Reproduction of **T. cunctator** *from* **Nairobi**

Generation **P** *started from* **11.07.1991**
started with **1** *female* **2** *males*
died on 03.10.1991 07.10.1991
Lifespan 85 days 89 days

date laying		egg-pods	eggs	eggs/pod	hatched nymphs	date
from 30.07.1991	to 13.08.199	1	24	24	24	on 30.08.1991
in the Petri-dish with wet sand						
on	26.08.1991	1	26	26	0	
on	11.09.1991	5	142	28.4	0	
	total	7	192	27.4	24	

egg-pods/female: **7**
eggs/female: **192**
Hatching rate: **12.5**

Generation **F1** **17** *Adults:* 10 *females and* 7 *males*
Eclosion period of adults from 07.10.1991 to 13.10.1991 *Adult rate:* **70.8**

Generation **F1** *started from* 07.10.1991 *to* 13.10.1991
started with **10** *females* **7** *males*
died between 11.12.1991 *and* 14.05.1992 10.12.1991 *and* 27.04.1992
Lifespan 66 - 220 *days* 65 - 203 *days*

date laying		egg-pods	eggs	eggs/pod	hatched nymphs	date between	and
from 10.10.1991	to 24.10.199	1	28	28	26	on	14.11.1991
07.11.1991	21.11.1991	1	28	28	27	on	06.12.1991
05.12.1991	19.12.1991	6	172	28.7	146	04.01.1992	13.01.1992
19.12.1991	06.01.1992	1	6	6	6	on	27.01.1992
06.01.1992	20.01.1992	1	26	26	20	on	05.02.1992
20.01.1992	03.02.1992	2	54	27	20	on	21.02.1992
03.02.1992	18.02.1992	3	66	22	55	05.03.1992	11.03.1992
17.03.1992	31.03.1992	2	36	18	0		
	total	17	416	24.5	300		

egg-pods/female: **1.7**
eggs/female: **41.6**
Hatching rate: **72.1**

Generation **F2** **28** *Adults:* 17 *females and* 11 *males*
Eclosion period of adults from 09.01.1992 to 29.06.1992 *Adult rate:* **9.3**

Generation **F2** *started from* 23.03.1992 *to* 16.07.1992
started with **17** *females* **11** *males*
died between 09.05.1992 *and* 30.10.1992 05.05.1992 *and* 30.10.1992
Lifespan 47 - 221 *days* 43 - 221 *days*

date laying		egg-pods	eggs	eggs/pod	hatched nymphs	date between	and
from 05.05.1992	to 19.05.199	1	23	23	0		
19.05.1992	02.06.1992	1	30	30	30	on	18.06.1992
02.06.1992	16.06.1992	1	23	23	22	on	07.07.1992
14.07.1992	28.07.1992	3	72	24	52	11.08.1992	18.08.1992
29.07.1992	12.08.1992	4	75	19	72	25.08.1992	31.08.1992
12.08.1992	26.08.1992	1	27	27	27	on	14.09.1992
09.09.1992	22.09.1992	1	22	22	9	06.10.1992	07.10.1992
	total	12	272	22.7	212		

egg-pods/female: **0.7**
eggs/female: **16.0**
Hatching rate: **77.9**

Generation **F3** **58** *Adults:* 29 *females and* 29 *males*
Eclosion period of adults from 27.07.1992 to 04.12.1992 *Adult rate:* **27.4**

Generation: **F3** *started from* 27.07.1992 *to* 09.11.1992
started with **26** *females* **26** *males*
died between 10.09.1992 *and* 25.01.1993 23.10.1992 *and* 06.01.1993
Lifespan 46 - 78 *days* 59 - 89 *days*

date laying		egg-pods	eggs	eggs/pod	hatched nymphs
from 12.08.1992	to26.08.1992	6	197	33	0
26.08.1992	09.09.1992	6	129	22	0
09.09.1992	22.09.1992	2	60	30	0
06.10.1992	20.10.1992	1	30	30	0
17.11.1992	01.12.1992	1	21	21	0
29.12.1992	12.01.1993	1	21	21	0
	total	17	458	26.9	0

egg-pods/female: **0.7**
eggs/female: **17.6**
Hatching rate: **0.0**

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These adult females were paired and showed the same fecundity rate as their mothers, but fertility was totally lost, no egg development to a nymph being observed. The culture was thus finished (Tab. 2).
In both breeding experiments, the number of eggs per pod was very similar in all generations. These preliminary studies showed the difficulties in rearing of *T. cunctator*. Many observations cannot be explained properly. The experiments demonstrate for the first time that a laboratory culture of *Taramassus* spp. may be successful for obtaining material to study intraspecific variation and behaviour.
The following data on the bionomics of *T. cunctator* were obtained: embryogenesis lasts 21-39 days, nymphal period 43-68 days; adult lifespan (♂,♀) may be possible up to more than 200 days; per female (in P-generation) up to seven egg-pods may be produced, with 20-30 eggs per pod.

Sound Production in *T. zavattarii*

Since males possess conspicuous antennae, the question on their function was raised. In males of *Heteracris coerulescens* (STAL, 1876) belonging to the same subfamily, rotative movements of the antennae were observed if a mature female was present. This observation initiated the study of the courtship behaviour of *Taramassus* spp.

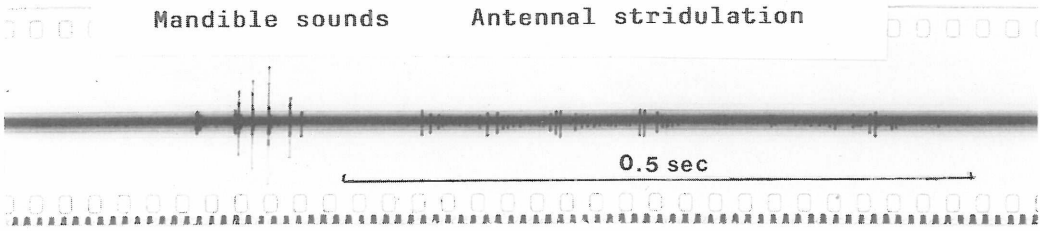

Fig. 10: Oscillogram of stridulation activity of a male of *T. zavattarii* (SALFI), collected at Afgoi, Somalia, April 1974; temperature 29°C, speed: 20 cm/sec., 600 Hz filter.

For the observations, one male of *T. zavattarii* was paired with one conspecific female in the terrarium, similarly arranged as reported by SCHMIDT (1986), or, the female was replaced by a much larger *H. coerulescens* female.
Depending on the sexual maturation of the *T. zavattarii* male, the antennae which are normally directed forwards, were oriented obliquely sideways, and moved up and down if a female became visible. Alternatively the male went round seeking for a female. When the male was successful in finding a female, the flabellate antennae were brought in a parallel position and intensive up and down movements were started (Fig. 9). The male was always sitting to the left or obliquely behind the female.
If copulation followed, sound production was very short (less than one second) (Fig. 10). But if the female was not receptive, stridulation could be prolonged for several seconds. This was mainly the case, when a *H. coerulescens* female was used which remained at the same place for a longer time. The *T. zavattarii* male often tried to copulate with the large female, but every

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time the latter moved slowly away, the male followed her, intensifying stridulation with the antennae and producing sounds with the mandibles until the female jumped away. With conspecific females the male was more successful in copulation. Otherwise the male left the female, if the latter was not mature or not receptive.
Also *T. cunctator* males showed movements of the antennae, but neither they were brought in a parallel position nor sound production could be observed. However, only conspecific females were available, thus precopulation time was very short (only some seconds).

Conclusions

The redescription of the genus *Taramassus* demonstrates that until now six species are known, all of them having males with flabellate antennae and striking colouration. There is also no problem to distinguish *Taramassus* females from those of other genera. On the other hand, it is far more difficult to determine the species of the genus *Taramassus*. A key which was elaborated, shows that only few characters are available for the identification of the species. The combination of antennal flabellation with the length and shape of the tegmina is most important. Females can often be determined only if males were found nearby in the same biotope.
Besides measurements of the often poor specific morphological characters, ethological studies were started to find out behavioural differences, especially in sound production. A new mode of stridulation was described which may be used as an additional specific character. When several *Taramassus* species are present in the same biotope, it can be assumed that the antennal stridulation is a suitable mechanism for sexual isolation of the species. The females have large tympana for the perception of the antennal sound produced by the males. On the other hand, the white-yellow coloured, brown striped face of the males and their light bands on the pronotum and metapleura, can be found in all species. Thus, such characters may be unsuitable for specific discrimination by the females.
In the subfamily Eyprepocnemidinae no sound is produced by using tegmina and hind femora as in other Acrididae, although many species have well developed wings. Only sounds of the mandibles are common.
In the closely related genus *Heteracris*, it was observed that males can smell a sexually mature female without optical perception. It was observed that in the terrarium the male found the female, going almost straight, from a distance of up to 50 cm. Permanent movements and rotations of the antennae were performed but no audible sound was produced. From the observations it can be concluded that chemical communication is present in both sexes. For the conspicuously coloured *Taramassus* males the optical sense may be more important than the chemical. Rotation movements of the antennae could not be observed. It is unknown wheather the form of the male antennal lobes is a specific character visible for the females.
Taramassus species were seldom found in the field and then only a few specimens were collected. For further studies of the behaviour and for cross-experiments more individuals are needed. Therefore, a rearing was started with *T. cunctator* to study the reproduction behaviour of the species. It was shown that there is no diapause as in many species of tropical regions and three consecutive generations could be produced successfully. The same was the case with all East-African acridids studied (SCHMIDT and MELBER 1980). Only a pair of insects is needed to start a culture and obtain enough offspring to allow for comparative investigations and cross-experiments to be performed. In this way further behavioural studies can be easily carried out with the various species, to find out more suitable taxonomic characters.

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Besprechungen

SEDLAG, U.: **Tiergeographie.** - Leipzig; Jena; Berlin: Urania Verl., 1995. - 447 S. - etwa 150 Fotos und 135 z.T. mehrteilige Zeichnungen. - 128.- DM

Das als 7. Band dem Urania Tierreich angeschlossene Buch vermittelt zunächst Fachterminologie und Grundbegriffe der Tiergeographie. Es wendet sich dann den evolutionären, erdgeschichtlichen und ökologischen Voraussetzungen der Tierverbreitung zu, wobei im wesentlichen auf den Zustand zur Zeit der Erforschung der Erde Bezug genommen wird. Ausführlich werden Möglichkeiten aktiver und passiver Ausbreitung einschließlich der Überwindung von Ausbreitungsschranken besprochen. Weitere Kapitel beschäftigen sich mit der neuzeitlichen Verschleppung und absichtlichen Einbürgerung faunenfremder Tiere und mit Tierwanderungen. Es folgt eine mehr ökologisch orientierte Besprechung einzelner Lebensräume (Gebirge, Höhlen, Städte, Binnengewässer, Inseln und Meer). Während beim Meer auf eine Regionengliederung verzichtet wurde, werden der Besprechung der terrestrischen Tierwelt, die etwa die Hälfte des Buches einnimmt, die klassischen tiergeographischen Regionen zugrunde gelegt. Abschließend wird kurz auf die rasante Verarmung der Faunen eingegangen. Sowohl im allgemeinen wie im speziellen Teil kommen immer wieder auch wirbellose Tiere, nicht zuletzt Insekten zur Sprache. Dem Charakter der Reihe entsprechend wendet sich das Buch zwar auch an interessierte Laien, nicht zuletzt an Fernreisende, die sich über die Faunen ihres Zielgebietes orientieren wollen. Es scheint aber auch geeignet, Studenten tiergeographische Kenntnisse zu vermitteln, die weit über das normale Angebot des Studienganges hinausgehen.

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