

## New *Phlugidia* species (Orthoptera: Tettigoniidae: Meconematinae, Phlugidini) from the Eastern Arc Mountains of Tanzania, Africa

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### Abstract

Two new species of *Phlugidia* (Orthoptera: Tettigoniidae: Meconematinae) are described from the Eastern Arc Mountains of Tanzania. *P. planicercus* Hemp n. sp. occurs in lowland forest at the foothills of the Uluguru Mountains, while *P. obtusicercus* Hemp n. sp. was collected in the Nguru Mountains. A key to *Phlugidia* species is provided.

**Key words:** species, description, Phlugidini, East Africa

### Introduction

The genus *Plugidia* was erected on *P. africana* by Kevan & Jin (1993) occurring on the Kenyan coast south of Mombasa. Another species was detected in the East Usambara Mountains of northern Tanzania and described as *P. usambarica* by Hemp (2002). *Phlugidia* is the only representative of Phlugidini in Africa.

*Phlugidia* has short tegmina, covered for most of its length by the pronotum. The posterior ends of the tegmina are rounded or almost square lobes. The pronotal sterna are unarmed, the fore coxa bears a spine. *Phlugidia* is characterized by the male genitalia where the supra-anal plate has a median, v-shaped notch. The cerci are stout and provide the easiest characters to distinguish the species. Females have a rather short, but slender and moderately up-curved ovipositor.

When alive *Phlugidia* species are conspicuous because of their iridescent pattern of blue-green and reddish-orange colours. *Phlugidia* species are found on broad leaved bushes and trees in coastal and lowland evergreen forest.

Aim of this paper is to describe two new *Phlugidia* species and provide some ecological data on *P. usambarica*.

### Methods

**Samples.** Specimens of *P. obtusicercus* Hemp n. sp. were observed in the Nguru Mountains of central Tanzania but only one male specimens was captured. Ecological data on *P. usambarica* were gained by evaluating samples obtained by canopy fogging project by S. H. McKamey et al. in July and December 1995 in the Kwamgumi forest reserve, Muheza District, Tanga Province of Tanzania. Detailed information about this fogging project focusing on Homoptera is published in McKamey (1999). The extensive insect material of this fogging project is stored in the entomological collection of the Zoological Museum of Copenhagen. One male of *P. planicercus* Hemp n. sp. labelled Kimboza forest reserve was discovered in the alcohol collection of the Danish Zoological Museum, Copenhagen (ZMUC) as well.

**Measurements.** Measurements of body length include male genitalia but not the ovipositor of the female.

**Images.** Photographs were taken either with a Canon 450 D digital camera or with a Leica multifocus camera at the entomological department of the Zoological Museum, Copenhagen, Denmark.

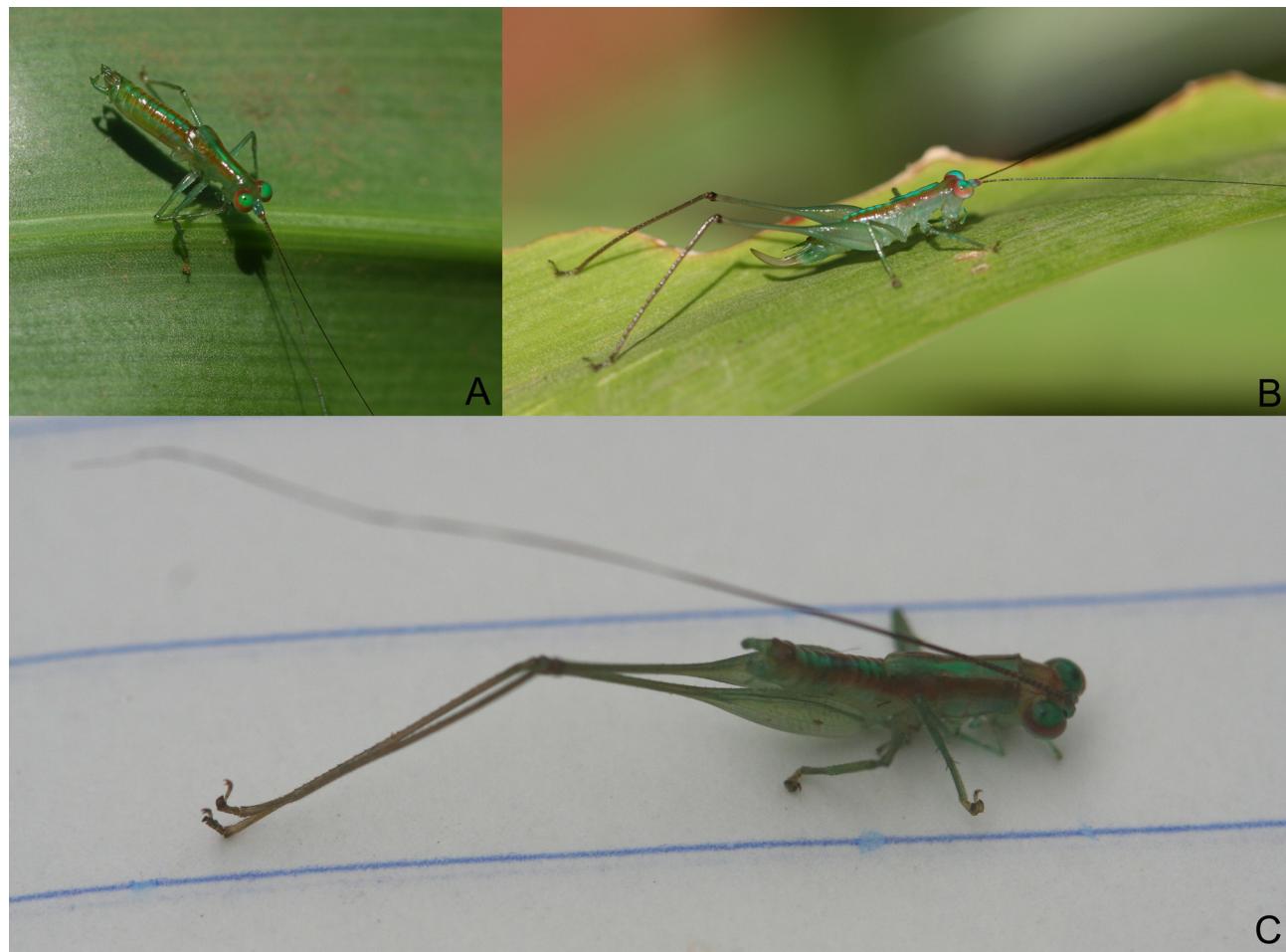
**Depositories.** ZMHB: Museum für Naturkunde, Zentralinstitut der Humboldt-Universität zu Berlin; ZMUC: Zoological Museum, Copenhagen, Denmark.

## Results

### *Phlugidia obtusicercus* Hemp n. sp.

**Type.** Holotype male: Tanzania, Mhonda, Nguru Mountains, herbaceous vegetation bordering cacao plantation, 650 m, July 2007. Depository: ZMHB.

**Description.** Male. Head: Fastigium of vertex short; first antennal segments nearly touching medially. Eyes prominent and globular. Antenna about three times as long as body length (Fig. 1 C). Thorax: Pronotum elongate, convex, more than two times as long as wide as seen from above; without carinae or median furrow; surface smooth and shiny. Area covering elytra inflated, pronotum thus raised in this area. Wings: Tegmina fully covered by pronotum, round lobes. Wings absent. Legs: Front coxa with spine. Femora without spines. Fore tibiae with three outer spines of which first one located just below tympanal organ, and one short inner spine. Area of tympanal organ not inflated, open on both sides. Mid tibiae with a single small spine midway, hind tibiae with dorsally a single row of numerous small and stout spines. Abdomen: 9th tergite unmodified. 10<sup>th</sup> tergite with v-shaped notch (Fig. 2 D, E). Cerci stout, with stout inner depression near the base. Tips of cerci not branched but globose, rounded tips oriented to each other (Fig. 2 D, E). Subgenital plate broad with short styli and incurved posterior margin.



**FIGURE 1.** *Phlugidia* species. **A.** *P. usambarica* male, Zigi trail, East Usambara Mountains Tanzania (with lost hindlegs) December 2011; **B.** *P. usambarica* female, same locality as male. **C.** Freshly killed *P. obtusicercus* n. sp., Nguru Mountains Tanzania 650 m, herbaceous vegetation at edge of cacao plantation.



**FIGURE 2.** Morphological details of *Phlugidia* species; A–C. *P. usambarica*, dorsal aspect on male abdominal apex (A), lateral view of male abdominal apex (B), head and pronotum (C). D–F. *P. obtusicercus* n. sp., dorsal aspect on male abdominal apex (D), lateral view of male abdominal apex (E), head and pronotum (F). G–I. *P. planicercus* n. sp., dorsal aspect on male abdominal apex (G), lateral view of male abdominal apex (H), head and pronotum (I).

*Measurements (mm) males (n=1)*

Length of body 7.9 mm, median length of pronotum 3.4 mm, length of hind femur 9.5 mm.

*Coloration.* Legs and part of abdomen green; on head through the eyes a pair of reddish fasciae running along the pronotum to the end of the abdomen, bordering a median turquoise blue median fascia (Fig. 1 C). Preserved insect tawny to yellowish with faint reddish parallel fasciae medially (Fig. 2 F).

Female: unknown.

**Habitat.** Herbaceous vegetation at 650 m a.s.l.

***Phlugidia planicercus* Hemp n. sp.**

**Type.** Holotype male: Tanzania, Kimboza forest reserve, Morogoro District, M'gara region,  $34^{\circ} 48' E$   $7^{\circ} 01' S$ , January–March 1994. Depository: ZMUC.

**Description.** Male. Head: Fastigium of vertex short; first antennal segments nearly touching medially. Eyes prominent and globular. Thorax: Pronotum elongate, convex, more than two times as long as wide as seen from above; without carinae or median furrow; surface smooth and shiny. Area covering elytra inflated, pronotum thus

raised in this area. Wings: Tegmina protruding a few millimeters below posterior margin of pronotum, posterior margin of tegmina almost straight (Fig. 2 I). Legs: Front coxa with tender and slightly downward curved spine. Fore femora with three minute spines, fore tibiae with three outer spines and three much smaller inner spines. Of the three inner spines first spine near foramen more stout and not stretched away from tibia but vertically attached to tibia. Mid tibiae with one tender spine midway. Hind legs missing. Abdomen: 9th tergite unmodified but with median groove at posterior end with scattered hairs (Fig 2 G). 10<sup>th</sup> tergite with raised lateral margins and large median v-shaped notch (Fig. 2 G, H). Posterior margin of the v-shaped notch elongated and down-curved. Cerci slender, branched near their ends into a stout outer branch and a flat, expanded inwardly curved inner branch (Fig. 2 G, H). Subgenital plate almost square with short styli and incurved posterior margin.

*Measurements (mm) males (n=1).*

Length of body 13.2 mm, median length of pronotum 3.8 mm, visible part of tegmina 1.5 mm.

*Coloration.* Specimen stored in alcohol, therefore of milky white colour.

Female: unknown.

**Habitat.** Lowland forest (290 m a.s.l.).



**FIGURE 3.** *Phlugidia africana*, male abdominal apex, dorsal view, holotype NHM London.

#### Distribution and ecological data on *Phlugidia usambarica* Hemp

*P. usambarica* (Fig. 1 A, B) was described from the Zigi Trail in the East Usambara Mountains at around 450 m a.s.l. Here it is a frequent species from November to about March, preferring broad leaves. *P. usambarica* is day

active and seems mainly optical orientated, being easily disturbed when approached and seeking hide under leaves or running or jumping away readily disappearing in more dense vegetation. The song of *P. usambarica* is in the ultrasonic range and thus not perceivable to the unaided human ear. The individual recorded (Heller, unpubl.) performed its song in the early morning hours. Individuals of this species were recorded between elevations of 450 to over 1000 m in the East Usambara Mountains. At higher elevations individuals seem to prefer forest clearings or forest edge along roads where the iridescent coloured insects bask in the sun on broad leaves of understory vegetation.

In alcohol samples collected by McKamey et al. in the Kwamgumi forest reserve at elevations between 150–220 m in July and December 1995 numerous adults and nymphs of *P. usambarica* were found. Thus *P. usambarica* also occurs on the foothills of the East Usambara Mountains and obviously inhabits also higher trees in lowland forest communities.

### Key to male *Phlugidia* species

- |    |   |                               |
|----|---|-------------------------------|
| 1  | Male cerci differentiated into two branches near their posterior ends; 10 <sup>th</sup> tergite posteriorly enlarged and medially with large v-shaped notch . . . . .   | 2                             |
| 1' | Male cerci not divided into two branches at their posterior ends; 10 <sup>th</sup> tergite posteriorly not enlarged, v-shaped notch situated between divided margins of 10 <sup>th</sup> abdominal tergite. . . . .   | 3                             |
| 2  | Posterior ends of male cerci of about same length, stout and short; 9 <sup>th</sup> tergite with median elevated dent; East Usambara Mountains . . . . .  | <i>P. usambarica</i> Hemp     |
| 2' | Posterior ends of male cerci divided into outer blunt branch and inner elongated and expanded branch; lowland forest central Tanzania, Morogoro region. . . . .   | <i>P. planicercus</i> n. sp.  |
| 3  | V-shaped notch of 10 <sup>th</sup> tergite partly covered by posterior margin of 9 <sup>th</sup> tergite; posterior margin of 10 <sup>th</sup> tergite forming notch broadly tongue-like; inner depressions at base of cerci small; Nguru Mountains . . . . .   | <i>P. obtusicercus</i> n. sp. |
| 3' | V-shaped notch of 10 <sup>th</sup> tergite not covered by posterior margin of 9 <sup>th</sup> abdominal tergite but merely formed by median division of 10 <sup>th</sup> tergite; posterior part of notch narrow, not broadly tongue-like as in <i>P. obtusicercus</i> ; inner depressions at base of cerci large; Kenyan coast . . . . . | <i>P. africana</i> Kevan      |

### Diagnosis

One of the generic characters given for *Phlugidia* noted by Kevan & Jin (1993) is the v-shaped notch on the 10<sup>th</sup> abdominal tergite of males. Also in the here newly described species *P. planicercus* n. sp. and *P. obtusicercus* n. sp. this v-shaped notch is present.

Differences between *Phlugidia* species are seen in the outer male genitalic apparatus. While *P. africana* and *P. obtusicercus* n. sp. have comparatively small v-shaped notches on the 10<sup>th</sup> abdominal tergites, formed by a median division of the tenth tergites, *P. usambarica* and *P. planicercus* n. sp. have large v-shaped notches formed by a posterior enlargement of the median part of the 10<sup>th</sup> tergite. *P. africana* may be distinguished from *P. obtusiformis* n. sp. by the shape of the notch. In *P. usambarica* the notch is small and the posterior margin of this depression narrow, while the notch is larger in *P. obtusicercus* n. sp. and the posterior margin broadly tongue-like. Differences are also seen in the inner cercal dents. *P. africana* bears large depressions, while they are smaller in *P. obtusicercus* n. sp. *Phlugidia usambarica* and *P. planicercus* n. sp. may easily be identified when comparing the male cerci. These are divided into two almost equal shaped short and thick branches in *P. usambarica*, while in *P. planicercus* n. sp. the inner branch is expanded and flat as well as elongated.

Another major difference between the two morphological groups is seen in the tegmina. While *P. usambarica* and *P. planicercus* n. sp. have fully developed tegmina and sing in the ultrasonic range which was recorded for *P. usambarica*, *P. africana* and *P. obtusicercus* n. sp. have lobe-like tegmina. No veins or a stridulatory file could be detected and thus these species are very likely not able to produce songs. Whether this is a reduction or whether last instar nymphs were obtained cannot be answered from the material available. Last instar nymphs of *P. usambarica* are not as colourful as adults and easily recognizable as nymphs, while the individual of *P. obtusicercus* n. sp. from the Nguru Mountains seemed to be an adult from its colouration, size and the slightly elevated posterior part of the pronotum (Fig. 1 C, 2 F).

The coloration of the live insects was recorded only for *P. usambarica* and *P. obtusicercus*. Both species show

a very similar colour pattern of a generally green body with reddish parallel median fasciae from head to abdomen (Fig 1). Medially a vivid iridescent turquoise blue band stretching over head, pronotum and abdomen is very conspicuous. This colour pattern quickly faded after the death of the insects.

## Discussion

*Phlugidia* obviously is a genus with species restricted to coastal and lowland forest of Kenya and Tanzania. From their morphology *P. africana* and *P. obtusicercus n. sp.* are closely related as seen by the shape of the notch of the 10<sup>th</sup> abdominal male tergite and the unbranched male cerci. *P. usambarica* and *P. planicercus n. sp.* form the other morphological related pair as seen in the very similar notch of the 10<sup>th</sup> tergite that is formed by an enlargement medially of the 10<sup>th</sup> tergite and the branched male cerci. Biogeographically this pattern may not be explained well since *P. africana* occurs in southern Kenya along the coast, *P. usambarica* in the East Usambara Mountains further south, *P. obtusicercus n. sp.* in the Nguru Mountains further inland in central Tanzania and *P. planicercus n. sp.* in lowland forest in the Morogoro region also in central Tanzania. Thus the morphologically related sister pairs are geographically far separated (Fig. 4).



FIGURE 4. Distribution of *Phlugidia* species in East Africa.

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