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G. H. SCHMIDT, R. STELZER, J. MARSHALL

Description of five new *Pantecphylus* species from Kivu, the East Province of Democratic Republic Congo (Ensifera: Tettigonioidea: Pseudophyllidae)

Abstract - Before the present studies were undertaken, two species of the genus *Pantecphylus* Karsch, 1891 were described, The genus type, *P. cerambycinus* Karsch, 1891, and *P. major* Griffini, 1909, the latter much bigger and more spiny than the former. *P. cerambycinus* is known from Cameroon and *P. major* was collected near the Congo delta. Recently, a second species, *P. kamerunus* Schmidt, 2003, was described from Cameroon. Examining the material of 12 specimens (5 males and 7 females) sampled in the Kivu Province (Democratic Republic Congo), mainly preserved in the African Museum Tervuren and the Natural History Museum of London, five further species were described. According to the sites of collection, the species were named *P. kivuensis, P. irangii, P. meshei, P. manyemai*, and *P. helleri*; the latter was dedicated to the collector. In most cases, the holotype was the only known one. Most of females could not surely be attached to one of the species described. For the separation of the species, the external male genitalia were most useful, besides the shape and width of the fastigium verticis. For the identification of females, their collection sites were helpful. However, no female was chosen, and should be used as species type, as happened for *P. cerambycinus*. For males, a key was presented. The unusual structures of the hind wings of both sexes may be important for further differentiation of the species, specially in females, regarding stridulation and communication.

Zusammenfassung - *Beschreibung von fünf* Pantecphylus-*Arten (Ensifera: Tettigonioidea: Pseudophyllidae) auf dem Kivu-Gebiet, der Ostprovinz der Demokratischen Republik Kongo.*

Vor dieser Studie waren zwei Arten der Gattung *Pantecphylus* Karsch, 1891, bekannt. Die Gattungsart *P. cerambycinus* Karsch, 1891 ist aus Kamerun und *P. major* Griffini, 1909, aus der Nähe des Kongo-Deltas bekannt. Als zweite Art aus Kamerun wurde kürzlich *P. kamerunus* Schmidt, 2003, beschrieben. Die vorliegende Arbeit ist das Ergebnis eingehender Untersuchungen von 12 *Pantecphylus*-Exemplaren (5 Männchen und 7 Weibchen) aus dem Afrika-Museum Tervuren und dem Natural History Museum of London. Sie wurden in der Kivu-Provinz (Demokratische Republik Kongo) gefangen und fünf neuen Arten zugeordnet: *P.*

kivuensis, *P. irangii*, *P. meshei*, *P. manyemai* und *P. helleri*. Die Neubeschreibungen sind meistens nach den Fundorten benannt, eine zu Ehren des Sammlers. In den meisten Fällen ist nur der Holotypus bekannt. Zur Differenzierung der Arten waren die äußeren männlichen Genitalien besonders geeignet, neben der Form auch die Breite des Fastigium verticis. Die Weibchen wurden nur anhand ihres Fundortes zugeordnet. Auf eine Designation als Holotypus wie bei *P cerambycinus* wurde aufgrund fehlender morphologischer Unterschiede verzichtet. Für die Männchen wird ein Bestimmungsschlüssel bis zur Art hinzugefügt. Auf die ungewöhnlichen Strukturen auf den Hinterflügeln beider Geschlechter wird hingewiesen. Sie sind möglicherweise für eine weitere Differenzierung der Arten wichtig, speziell der Weibchen im Hinblick auf Stridulation und Kommunikation.

Riassunto - *Descrizione di cinque nuove specie del gen.* Pantecphylus *(Ensifera: Tettigonioidea: Pseudophyllidae) raccolte nella Provincia del Kivu (Repubblica Democratica del Congo).*

Prima del presente studio erano descritte due specie appartenenti al genere *Pantecphylus* Karsch, 1891, precisamente *P. cerambycinus* Karsch, 1891 - specie tipo del genere - e *P. major* Griffini, 1909, quest'ultima molto più voluminosa e spinosa della precedente. *P. cerambycinus* è conosciuta dal Cameroon, mentre *P. major* venne raccolta nelle vicinanze del delta del fiume Congo. Recentemente è stata descritta una seconda specie del Cameroon, precisamente *P. kamerunus* Schmidt, 2003. Esaminando 12 esemplari (5 maschi e 7 femmine) raccolti nella Provincia di Kivu (Repubblica Democratica del Congo), conservati nell'African Museum di Tervuren e nel Natural History di Londra, è stato possibile descrivere 5 ulteriori specie, di cui 4 - *P. kivuensis*, *P. irangii*, *P. meshei*, *P. manyemai* - sono state denominate in relazione al luogo di ritrovamento, mentre *P. helleri* è stata dedicata al raccoglitore. Per la loro determinazione sono utilizzabili i genitali esterni maschili, in particolare l'aspetto e la larghezza del fastigium verticis. Per l'identificazione delle femmine è utile la conoscenza del luogo di raccolta. Tuttavia non è stata utilizzata alcuna femmina come tipo, contrariamente a quanto si è verificato per *P. cerambycinus*. E' stata predisposta una chiave di classificazione dei maschi. La particolare struttura delle ali anteriori negli individui dei due sessi può essere importante per una futura differenziazione delle specie, specialmente nel caso delle femmine, con riferimento alla stridulazione ed alla comunicazione.

Key words: *Pantecphylus*, Pseudophyllidae, Kivu Province, Central Africa, Democratic Republic Congo.

INTRODUCTION

The genus *Pantecphylus* was created by Karsch (1891). For the description, only one female and one male were available collected in different regions of Cameroon, from where *P. cerambycinus* Karsch, 1891 was described. The female was preserved as type in the Humboldt Museum of Natural History of Berlin. The male was given to the collector Dr Heinrich Dohrn and stored in the Museum of Stettin, from where

it moved to the Museum and Institute of Zoology, Polish Academy of Science, Warsaw (Liana, 1999).

Since the description by Karsch (1891) some morphological data were added by Griffini (1909) describing *P. major* from French Congo, as second species of the genus, but only females were available. Recently, a second species of the genus was described by Schmidt (2003) from Cameroon as *P. kamerunus*. About hundred years later of the first description, Heller (1996) studied two males of the genus, misidentified as *P. cerambycinus*, from East Belgish Congo (Zaire) and reported on two types of stridulatory mechanisms for communication and defence.

During the last century, more than hundred *Pantecphylus* specimens were sampled in West and Central Africa (more than 3500 km in diam) and preserved in various European museums. Thus, a revision of the genus was needed and performed by Schmidt (unpublish) basing on 60 specimens. Among this material, borrowed mainly from Belgish museums and the Natural History Museum of London, eleven individuals were found collected in the East Province of Zaire (Kivu) (Democratic Republic Congo), from where Heller (1996) recorded an unusual stridulation behaviour of a *Pantecphylus* male, belonging to an unknown species.

Most of the specimens preserved in the museums were misidentified as *P. cerambycinus*. From the genus-type, only one male was found in the Museum of Natural History of Vienna, except the female-type in the Humboldt-Museum of Berlin, and three males and three females were established in the Natural History Museum of London. These specimens made it possible to study some variability of the genus-type species for more reliable identification of the species (Schmidt & Stelzer, 2004). All these specimens were collected in Cameroon.

The shape of fastigium verticis and the structure of the male subgenital plate (SGP) were most important for reliable identification of the species. Basing on these species-specific characters, the aim of the present work was to compare the *Pantecphylus* material found in the Kivu province of Central Africa, which was preserved in the African Museum Tervuren and the Natural History Museum of London.

MATERIAL AND METHODS

Among the *Pantecphylus* specimens preserved in the African Museum Tervuren, Belgium, two males and seven females were found collected in Kivu Province, Democratic Republic Congo, mostly misidentified as *P. cerambycinus* Karsch, 1891. The material was sampled at various localities. Two females were labeled Bukavu (= Costermansville) [02°30' S, 28°52' E], 1939, leg. Dr. Hautmann, and IX.1951, leg. H. Bomans, numbered Ter 53 and Ter 52. Three females were collected in Kivu, near the road to Kavumu [02°18'10" S, 28°48'52" E] à Kabunga [01°42' S, 28°08' E], km 82 (Mingazi), VII and IX.1951, leg. H. Bomans (Ter 20, 39, 51). Additionally, two females were available from West Kivu: 1♀, Lubongola [02°30' S, 27°52' E], pr. Shabunda [02°42' S, 27°20' E], II.1939, leg. Dr. Hautmann (Ter 32) and 1♀, W Kivu, Matale

[02°39' S, 28°22' E], 1939, leg. Dr. Hautmann (Ter 26). The males were labeled Irangi [01°54' S, 28°27' E], IV-VI.1969, leg. S. Orts (Ter 31) and Cerr Nowengo, Kitutu Foom.[03°17' S, 28°05' E], 14.V.1950, leg. Dr. R. Laurent (Ter 54).

From the Natural History Museum of London, one male, Meshe, 1000 m [01°30' S, 28°26' E] 2-4.VI.1949, leg. Dr. R. Laurent (Lo 01) and one pair (male, female), Manyema, Congostaat [01°11' S, 28°37' E] (Lo 02, Lo 03) were lent for comparison. Additionally, one male was available from the collection of Dr. K.-G. Heller, Magdeburg (Germany), from which the auditorial communication was studied (Heller, 1996).

From the African Museum Tervuren, the localities of the sampling sites were received by the coordinates, determined by an internal geographical database.

For either individual, taxonomically important body parts were prepared and photographed. Measurements were taken from the length of body, elytron (tegmen), thorax, and hind femur to characterize the specimens. For further comparison, the size of charateristic abdominal body parts was calculated after magnification. Some difficulties appeared, when the inner organs were removed from the individuals and, by this, some external parts were damaged and could not be used.

Drawings were made by using a drawing apparatus and a WILD-binocular microscope. Photographs were taken by means of a STEMI 2000 C binocular [ZEISS] and a photocamera [MINOLTA] using KODAK-chrome EPY 64 film material.

GENERAL CHARACTERISTICS OF BOTH SEXES OF THE SPECIES

Antenna uniformly brown, longer than body, inclusively tegmina, often broken; base roundly elevated, located in front of complex eyes; bases of antennae did not touch another (ventral view); scape large bearing short and strong spine most distally, directing forward and inside; pedicel pear-shaped; little shorter than third segment (funicel); fourth segment about half as long as the latter. Mouthparts brillant blue in living insects (viewed by slides of K.-G. Heller, unpublished).

Pronotum saddle shaped, spiny and warty, divided into three parts by transverse sulci, metazona longer than pro- + mesozona, prozonal protruding elevation differently sized, sulcated in midline, sometimes two spines directing forward, covered with warts accumulated, bearing two long and strong spines directing obliquely up-, a bit fore-, and outward; mesozona short and restricted, bearing two upright warty humps on disk; hind part laterally keeled and vaulted upward, metazona rounded and dilated, raising up to behind, near hind sulcus on disk again two upright warty humps, almost forming a square with those on mesozona, hind margin bearing eight, in female sometimes ten, grey-brown spines, almost equally sized [4 or 5 pairs], outest strongest; paranotal spine brown, dark-brown or brown-black and more slender, directing straight outward on either side.

Fore and middle femora spuare-shaped and marginated; hind femur flattened with deep longitudinal furrow outside; coxa and trochanter of fore leg bearing short spine. Tibiae always short-haired. The auditorial foramen mussel-shaped, with split-forming

opening. Spination specimen dependent. Four tarsal limbs, crawled limb bearing large pulvillus.

Tegmina (elytra) grey-brown and tent-shaped, left overlapping right in all cases studied, covering fan-shaped and infumated alae, slightly shorter than tegmina; alae bearing strengthened anal veins, dorsally covered with rows of stridulatory ribs in both sexes (viewed in Fig. 8); either tegmen characterized by brilliant white spot on proximal costal area.

Abdomen dark-brown, often ringed, and ridged on distal half of tergites; distal tergites constricted and telescopically movable. In male, last tergite deep-roundly excised and largely brown lobated; in female, concavely rounded.

In female, SGP divided into two lateral-isometric parts by ovipositor, either part distally tipped and proximally rounded; ovipositor differently upcurved to behind and slightly serrated in distal fourth.

The species are mainly characterized by the shape of fastigium verticis, spination of femora, supra-anal plate (SAP) and its relation to cerci, and specially by the sclerotized subgenital plate (SGP) of male.

DESCRIPTION OF SPECIFIC CHARACTERS OF THE NEW SPECIES

Pantecphylus kivuensis sp. n.

MATERIAL EXAMINED: 1♂, holotype, Kivu, Cerr Nowengo, Kitutu Foom.[3°17' S, 28°05' E], 14.V.1950, leg. Dr. R. Laurent, 6814c, I.R.S.A.C. Mus. Congo (African Mus. Tervuren, no. 54).

Measurements: Body length (mm) 19, pronotum 8, tegmen 15, hind femur 11.5.

Fastigium verticis surpassing antennal bases, about as large as one elevated base wide, furrowed above, rounded at tip, ratio width of fastigium verticis to that of elevated base of antenna as 6:5; distance between scapes, directed parallel, as wide as one scape large (Fig. 1A); mouthparts grey in preserved position.

Distance between tips of strong spines of prozonal protuberance measuring 5.4 mm.

Spination of legs: fore femur with 4 ventro-anterior spines; fore tibia with 2-3 minute dorsal spines, exteriorly and interiorly, and with two small ventral spines interiorly; mid femur with 3-5 vewntro-lateral spines, (two of minute size, on one side); mid tibia with 2-3 dorsal spines interiorly; hind femur below, 10-11 spines, accumulated in distal half; hind tibia above, two rows of 6-8 spines.

SAP yellow-brown, short-haired almost as long as large, plate-like, folded back in Ter 54.

Cercus length 1.65 mm, yellow-brown, long-haired, longer than SAP, in situ reaching distal margin of SGP, conical, rounded at tip, and slightly incurved, black toothed most distally (Fig. 1D).

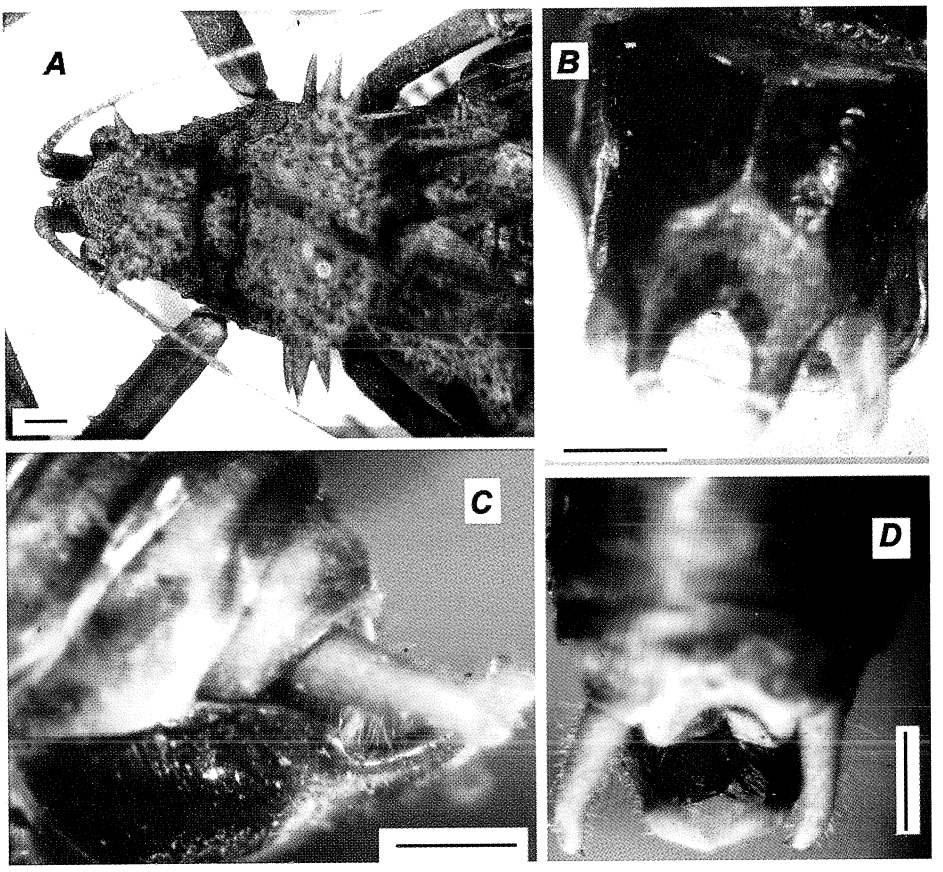

Fig. 1 - *Pantecphylus kivuensis* sp. n., male type Ter 54; A: head and pronotum, dorsal view, fastigium verticis prolonged, differences in colour of paranotal and metanotal spines; B: SGP and styli, ventral view; C: tip of abdomen, SGP and cercus, left lateral view; D: tip of abdomen, showing cerci, SAP folded back, and styli, dorsal view. Scale bar: 1 mm.

SGP length, from midth to side, 2.95-3.35 mm (Fig. 1B,C), brown-black sclerotized, at base broad and deep round-angularly excised (0.4 mm); proximal part rounded below and keeled, angularly connected with grey distal part pressed in, proximal part larger and slightly shorter in midth than latter, both parts constricted and slightly upraised, hind margin round-angularly excised (0.76 mm); side lobe dark and steeply sloped to behind, long-haired.

Styli incurved and upraised, at base broad, and constricted to acute tip (Fig. 1B), sickle-shaped, slightly longer than depth of SGP excision, length 0.86 mm, sandy-yellow, long-haired.

Female: unknown.

Pantecphylus irangii sp. n.

MATERIAL EXAMINED: 1♂, holotype, Kivu: Irangi [01°54' S, 28°27' E], IV-VI.1969, leg. S. Orts, Coll. Mus. Tervuren (African Mus. Tervuren, no. 31).

Measurements: Body length (mm) 24, pronotum 8.5, tegmen 14, hind femur 11.

Fastigium verticis slightly surpassing antennal bases, not furrowed, rounded at tip; a bit larger than width of elevated base of antenna (ratio 6.5:5); distance between scapes, directing parallel, slightly wider than scape large; mouthparts grey in preserved individuum.

Metanotal spines dark-brown, like paranotal spine. Cubito-anal area of tegmen basically 3.4 mm large. Elytra overlapping left over right (Fig. 2A).

Spination of legs: fore femur with 4 ventro-anterior spines; fore tibia with 2-3 small spines, exteriorly and interiorly, ventrally two small spines, interiorly; mid femur with 4 ventro-lateral spines; mid tibia with 2-3 spines, interiorly; hind femur below, 8 spines on right and 12 spines on left femur, accumulated in distal half; hind tibia above, two rows of 6-8 spines.

SAP yellow, as long as large (2.06 mm), plate-like, furry-haired, a bit notched behind (Fig. 2B).

Cercus length 2.06 mm, yellow, haired, as long as SAP, in Fig. 2B shown in defecating position (faeces removed), conically rounded and slightly incurved at tip, black toothed most distally.

SGP length, from midth to side, 3.32-4.10 mm, black sclerotized, at base broad and deep round-angularly excised (about 0.8 mm); proximal part below rounded and keeled, round-angularly connected with grey distal part pressed in, proximal part larger and slightly shorter in midth than latter, both parts constricted and slightly upraised to behind, hind margin circularly excised (0.8 mm) (Fig. 2C); side lobe dark and sloped to behind, long-haired (Fig. 2D).

Styli incurved and upraised, at base broad, constricted to acute tip (Fig. 2C), sickle-shaped, slightly longer than depth of SGP excision, length 1.06 mm, sandy-yellow, long-haired.

Female unknown.

Pantecphylus manyemai sp. n.

MATERIAL EXAMINED: 1♂, holotype (Lo 02), 1♀, allotype (Lo 03), Manyema, Kivu, Congostaat (Museé du Congo), 01°11' S, 28°37' E.

Measurements (mm), ♂/♀: length of body 20 / 27, tegmen 17 / 22, pronotum 8 / 10, hind femur12 / 15, hind tibia of ♀ 17.

In both sexes: fastigium verticis broad-conical, furrowed above, not surpassing bases of antennae (dorsal view, Fig. 4A), sloped at side, rounded at tip, as broad as elevated base of antenna; distance between scapes as wide as one scape large. The

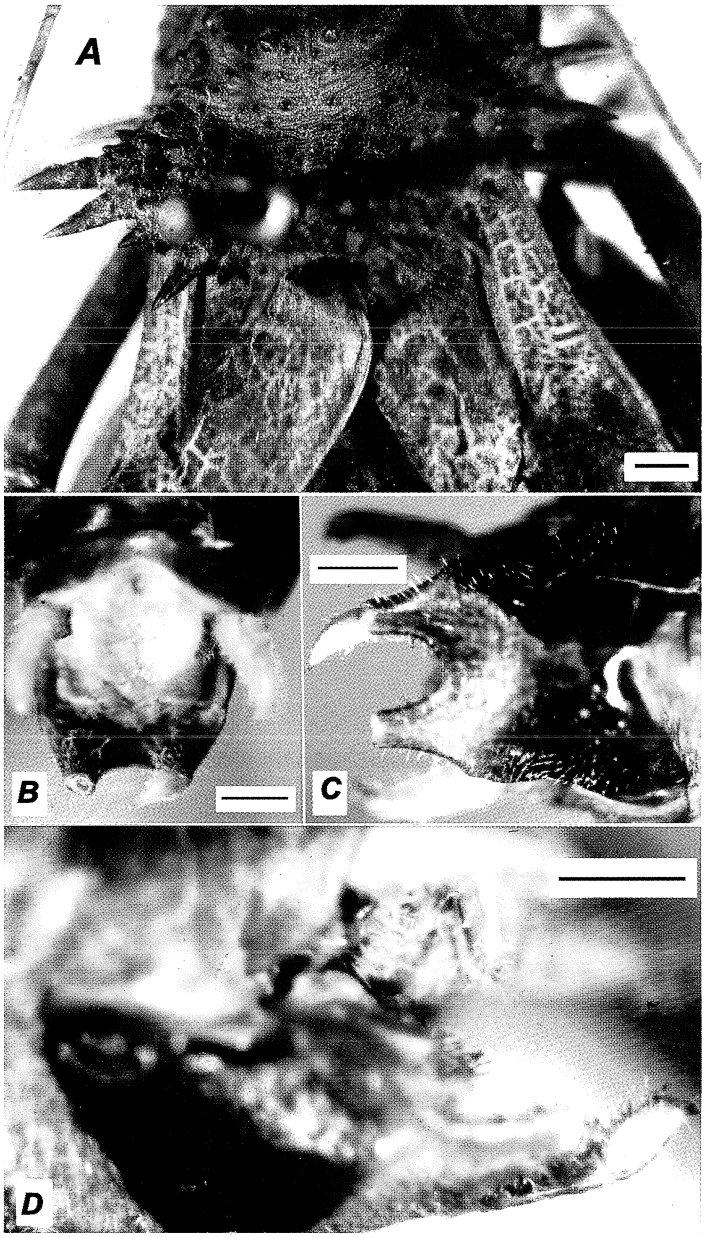

Fig. 2 - *Pantecphylus irangii* sp. n., male type, Ter 31; A: part of pronotum and base of elytra; B: SAP, cerci and tip of SGP with stylus, dorsal view; C: SGP with stylus, ventral view; D: SGP showing black lobe, right lateral view. Scale bar: 1 mm.

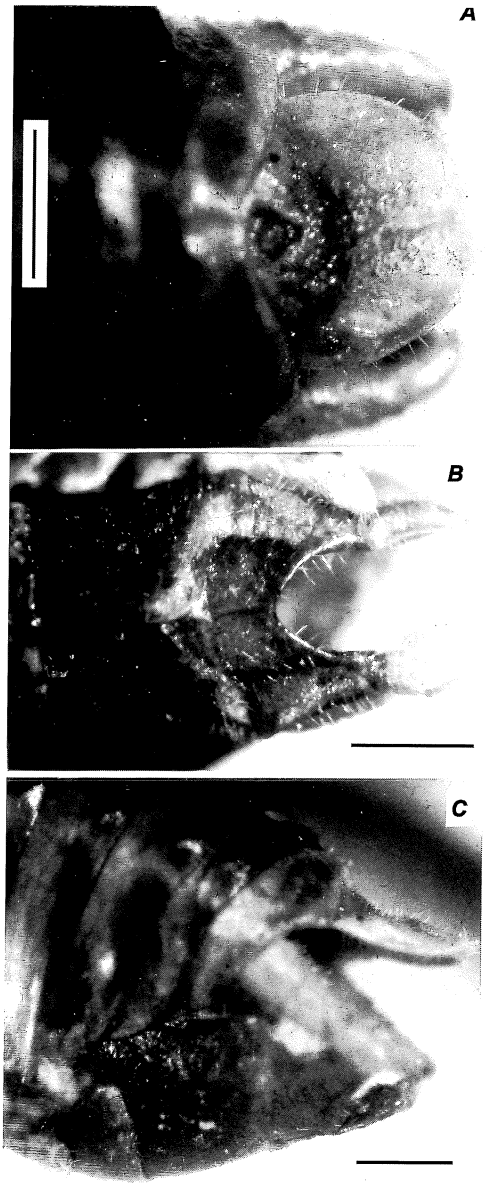

Fig. 3 - *Pantecphylus manyemai* sp. n., male type, Lo 02; A: SAP and cerci, dorsal view; B: SGP with styli, ventral view; C: SGP, cercus and SAP, left lateral view during defecation; the feces were removed, after dried-up at death. Scale bar: 1 mm.

dried-up brown individuals showed yellow-sandy, black bordered mouthparts.

Spination of legs: fore femur in male with 2-3, in female with 3-4 ventro-anterior spines and 2-3 small ventro-posterior spines; fore tibia with two rows of 4 spines dorsally, 2 small ventral spines moved distally; mid femur with 4-6 ventro-lateral spines; mid tibia above, two rows of 4 spines; hind femur below, 11-12 spines distally accumulated, proximally two warty spines; hind tibia above, two rows of 7 spines; pulvilli 3/4 as long as crawled limb.

In male: last tergite of abdomen round-concavely excised, lobes sandy-brown.

SAP sandy-brown, sparely haired, slightly larger than long (1.9 > 1.6 mm), plate-like, broadly rounded, a bit notched behind (Fig. 3A).

Cercus length 2.22 mm, longer than SAP, yellow-brown, strongly haired, truncated, at apex with dark tooth incurved (Fig. 3A, C).

SGP length 2.87 mm in midth and 3.04 mm at side, haired, at base almost straight to slightly concavely rounded (depth 0.17 mm), brown-black sclerotized; proximal part longer than distal part pressed in, below rounded and keeled; both parts angularly connected, constricted to behind; hind margin circularly excised, deeper than stylus length, depth of excision 0.89 mm (Fig. 4B), side lobe black, sloped to behind.

Stylus length 0.78 mm, light brown, long haired at base, roundly sickle-shaped, constricted to acute tip, like forceps, incurved at tip (Fig. 3B).

In female: SAP brown-marbled, slightly haired, larger than long (2.96 > 2.35 mm), plate-like, broadly rounded (Fig. 4B).

Cercus length 2.43 mm, slightly longer than SAP, yellow-brown, strongly haired, conical, constricted to apex, straight (Fig. 4B).

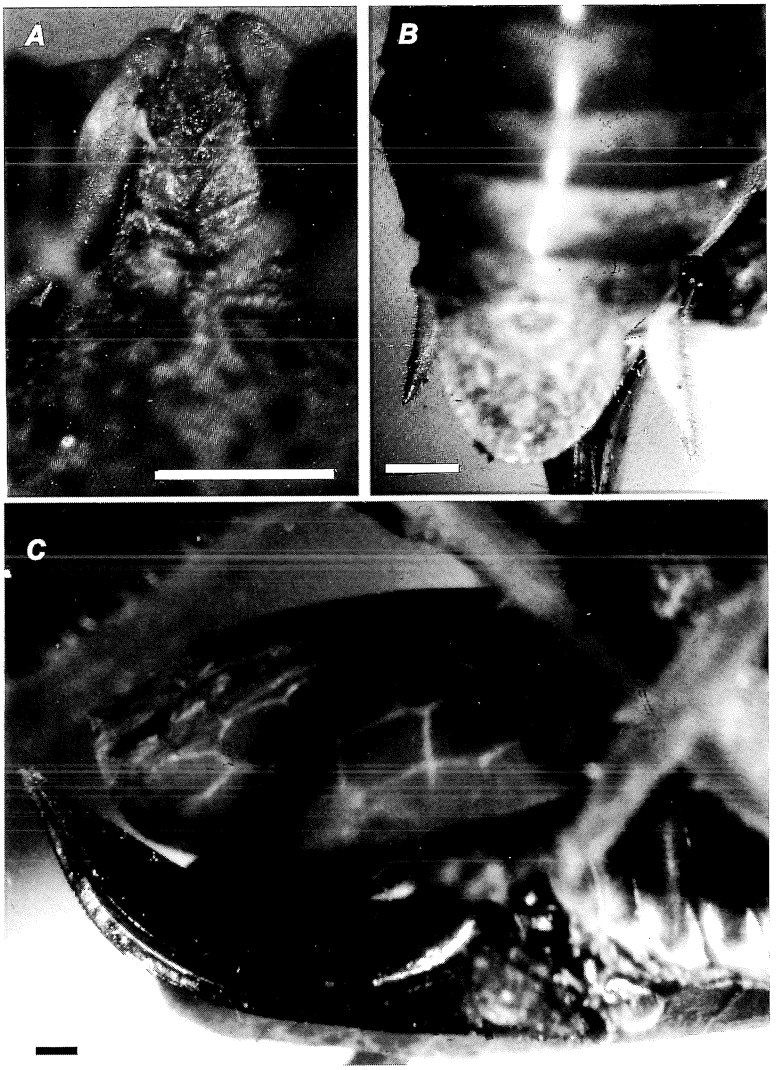

Fig. 4 - *Pantecphylus manyemai* sp. n., female allotype, Lo 03; A: fastigium verticis bordered by elevated lobes of antennae, dorsal view; B: SAP and cerci, dorsal view; C: ovipositor, right lateral view. Scale bar: 1 mm.

SGP divided in two parts by ovipositor, each part proximally largely rounded, distally pointed to behind; somewhat destroyed by removing inner organs.

Ovipositor robust, reddish-black, length 11.8 mm, width 2.78 mm, upcurved in distal half, lower valve distally finely serrated (Fig. 4C).

Pantecphylus meshei sp. n.

MATERIAL EXAMINED: 1♂, holotype ((Lo 01), Kivu: Meshe, 1000 m altitude [01°30' S, 28°26' E], 2-4.IV.1949, Dr. R. Laurent leg.

Measurements: Body length (mm) 22, tegmen 16, pronotum 9, hind femur 12.

Fastigium verticis broad-conical, plug-like, not furrowed above, surpassing bases of antennae (dorsal view, Fig. 5A), almost twice as large as elevated base of antenna (ratio about 9:5), laterally sloped, rounded at tip; distance between scapes slightly wider than one scape large. The dried-up brown individual showed sandy-black bordered mouthparts.

Spination of legs: fore femur with 3-4 ventro-anterior and 2-3 minute ventro-posterior spines; fore tibia with 4 small dorsal spines, exteriorly and interiorly, 2 small ventral spines moved towaards apex; mid femur with 4 ventro-lateral spines; mid tibia with each 4 dorso-external and dorso-internal spines; hind femur below, 9 spines distally accumulated; hind tibia above, two rows of 7 spines; pulvilli about 1/2 as long as crawled limb.

Last abdominal tergite almost right-angularly excised, largely lobated, lobes bordered with brushy hairs (Fig. 5E).

SAP yellow, slightly haired, as large as long (1.93 mm), plate-like, broadly rounded, a bit notched behind (Fig. 5C).

Cercus length 1.7 mm, shorter than SAP, yellow-brown, strongly haired, rhombic and slightly incurved, at apex with brown tooth incurved (Fig. 5E).

SGP length in midth 3.15 mm and on side 3.26 mm, haired, almost straight, brown-black sclerotized; proximal part basically a very bit concavely rounded (0.07 mm), below rounded and keeled, in midth as long as distal part pressed in, latter angularly connected with proximal part, constricted behind; hind margin circularly excised, depth of excision 0.93 mm (Fig. 5B); black side lobe sloped to behind (Fig. 5D).

Stylus shorter than SGP excision, yellow, roundly sickle-shaped, long haired, length 0.82 mm (Fig. 5B,E).

Female unknown.

Pantecphylus helleri sp. n.

MATERIAL EXAMINED: 1♂, holotype, (coll. Heller no. 4936), Zaire, Province Kivu: Irangi, about 100 km W Bukavu, Centre Rech. en Sci. Naturelles, 11.- 25.III.1990, K.-G. Heller & M. Volleth leg., stridulation was recorded and published by Heller (1996).

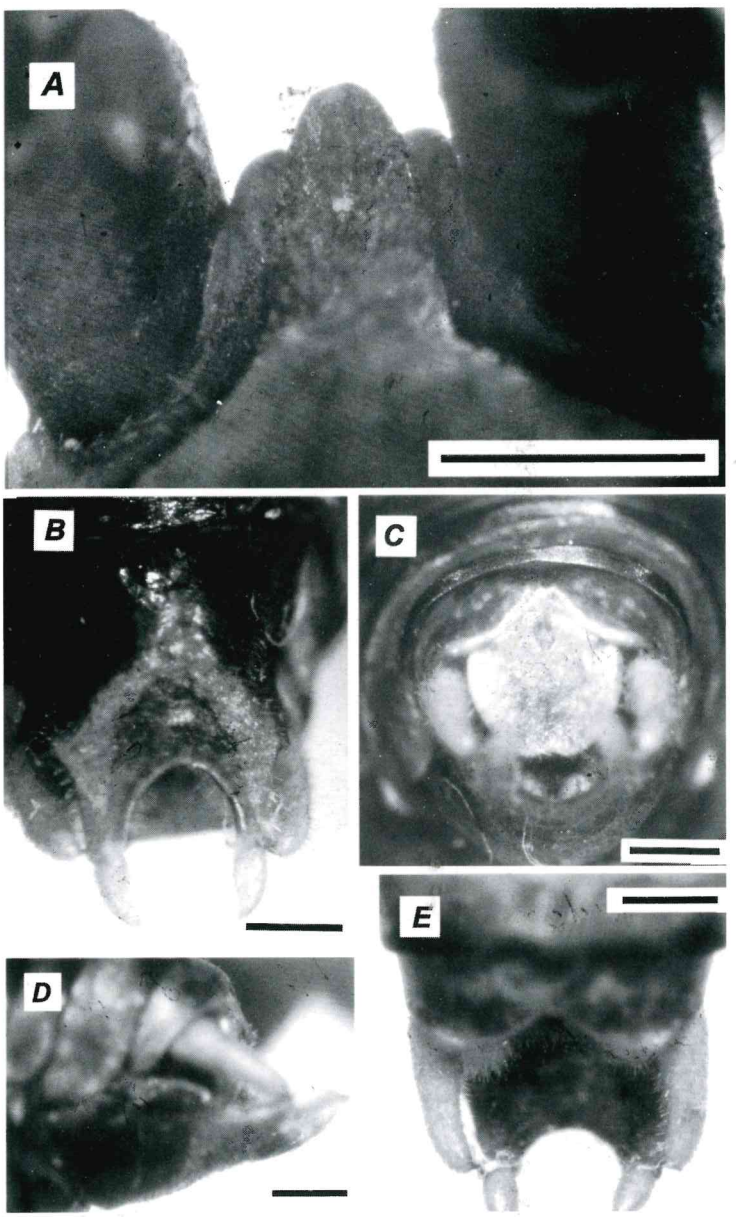

Fig. 5 - *Pantecphylus meshei* sp. n., male type, Lo 01; A: fastigium verticis, bordered by elevated valves of antennae and scapes, dorsal view; B: SGP with cerci, ventral view; C: SAP and cerci, viewed from behind; D: SGP, left lateral view, showing shape of black lobe; E: tip of abdomen with cerci and styli, showing brushy lobes of last tergite. Scale bar: 1 mm.

Measurements: Body length (mm) 23, tegmen 13, pronotum 7, hind femur 11.

Fastigium verticis conical, plug-shaped furrowed above, slightly surpassing bases of antennae (dorsal view, Fig. 6A), laterally sloped; ratio width of fastigium verticis to elevated base of antenna as 5:3; rounded at tip; distance between scapes as wide as one scape large. The dried-up brown individual showed bluish mouthparts.

Elytra overlapping left over right; each distorted ala bearing three to (four) strengthened weins (Fig. 7) with stridulatory ribs on dorsal surface (viewed also by Heller 1996); the ribs are distally located, on lower side of about three fourth of the veins, almost until their tip; distance between ribs measured mean of 168 µm (Fig. 8).

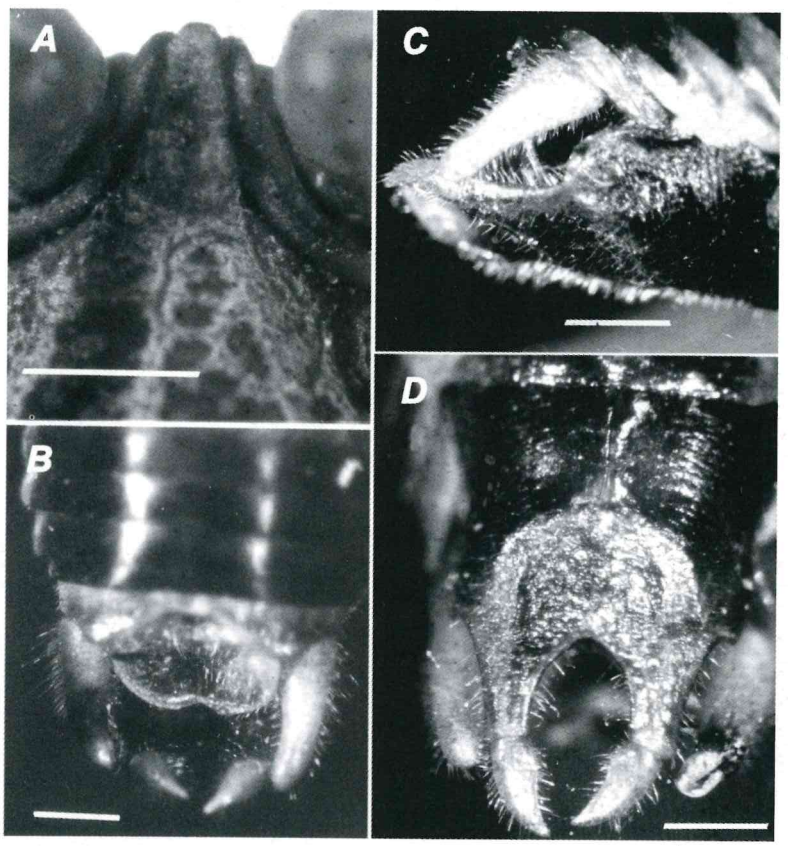

Fig. 6 - *Pantecphylus helleri* sp. n., male type; A: fastigium verticis, bordered by elevated valves of antennae, B: SAP and cerci, dorsal view, C: SGP with lobe and cercus, right lateral view, D: SGP with styli and cerci, ventral view. Scale bar: 1 mm.

Fig. 7 - *Pantecphylus helleri* sp. n., male type, showing shape of left fore and hind wing; tegmen with strengthened ulnar vein (vena ulnaris anterior), distorted ala showing three strengthened anal veins, developed for abdomino-alary stridulation (Heller 1996).

Spination of legs: fore femur with 4 ventro-anterior and 4 minute ventro-posterior spines; fore tibia, with some small dorsal spines, exteriorly and interiorly; mid femur with 3-4 ventro-lateral spines; mid tibia with each 2-4 dorso-external and dorso-internal spines; hind femur below, 10-11 spines distally accumulated; hind tibia above, two rows of spines, 6 exteriorly and 7 spines interiorly; pulvilli 3/4 as long as crawled limb.

Abdomen brilliant brown-black, last tergite and lobes light brown, round-concavely excised, hind lobes relatively small.

SAP yellow-brown, slightly haired, larger than long (width 1.85 mm) folded back, therefore length not measurable, broadly rounded and notched behind (Fig. 6B).

Cercus length 1.7 mm, longer than SAP, yellow-brown, strongly haired, rhombic, at apex with brown-black tooth incurved (Fig. 6D).

SGP length 3.24 mm, long-haired, almöst straight, black sclerotized; proximal part basically straight. rounded below and keeled, in midth slightly shorter than grey distal part pressed in, both parts broad-circularly connected, constricted behind, side lobe steeply sloped to behind (Fig. 6C), hind margin concavely rounded, depth of excision 0.94 mm (Fig. 6D).

Stylus length 0.86 mm, sickle-shaped, long-haired, broard base constricted to acute tip (Fig. 6D).

Female unknown.

KEY TO THE SPECIES

The main differences of the species were found in the shape of the fastigium verticis and the male SGP. Considering the characters of male, the species can be identified by following criteria:

1. Fastigium verticis prolonged, surpassing significantly elevated bases of antennae ...2
   – Fastigium verticis slightly prolonged, surpassing only a bit elevated bases of antennae 3
   – Fastigium verticis not surpassing elevated bases of antennae, base of male SGP almost straight, cercus longer than SAP..... ***manyemai***
2. SGP base deep-roundly excised, fastigium verticis about as broard as elevated base of antenna, cercus shorter than SAP .....***kivuensis***
   – SGP at base almost straight, fastigium verticis almost twice as broard as elevated base of antenna, last tergit brushy, cercus shorter than SAP.....***meshei***
3. SGP base deep-roundly excised, cercus as long as furry SAP .....***irangii***
   – SGP at base straight, cercus longer than SAP .....***helleri***

For comparison and easier identification, the male SGP of the species was presented in Fig. 9 as scheme, viewed ventrally and from side.

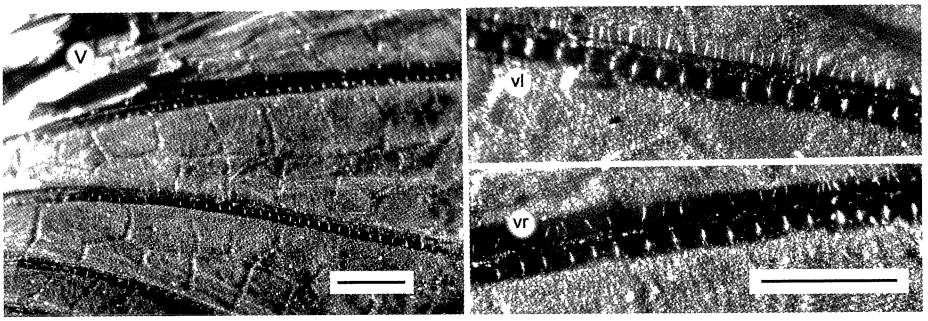

Fig. 8 - *Pantecphylus helleri* sp. n., male type; V: part of right hind wing with strengthened veins of dorsal anal region, showing ribs (light spots) at lower side; strengthened vein of left ala (VL) and right ala (vr), showing rows of spines on upper and rows of ribs on lower side (compare Heller, 1996). Scale bar: 1 mm.

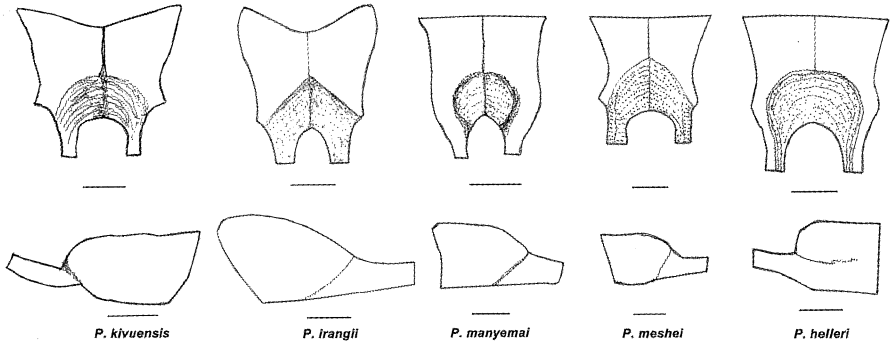

Fig. 9 - Male SGPs of *Pantecphylus* species described from Kivu Province; above: ventral view, below: right, resp. left lateral views. Scale bar: 1 mm.

VARIABILITY OF NOT SPECIFICALLY IDENTIFIED FEMALES

MATERIAL EXAMINED: 2♀, Kivu: Bukavu (= Costermansville) [2°30' S, 28°52' E], 1939, leg. Hautmann, R. Det 6814c, Ter 53; IX-1951, leg. H. Bomans, R. Det.6814c, Ter 52; 3♀, Kivu: Kavumu [2°18'10" S, 28°48'52" E] à Kabunga [1°42' S, 28°08' E], km 82 (Mingazi), VII-IX.1951, leg. H. Bomans, Ter 20, 39, 51 (African Mus. Tervuren); 1♀, W Kivu, Lubongola [2°30' S, 27°52' E], pr. Shabunda [2°42' S, 27°20' E], II.1939, leg. Dr. Hautmann (Ter 32) and 1♀, W Kivu, Matale [2°39' S, 28°22' E], 1939, leg. Dr. Hautmann (Ter 26).

Females of the genus *Pantecphylus* can only specifically be identified, if there is a male collected at the same place, as it was possible for Lo 03. The other females sampled in the Kivu region (about 300 km^2) could not clearly be attached to any species described. Body and tegmen length are similar.

In Ter 51-53, the fastigium verticis, as important character, was a bit furrowed, and slightly surpassed the bases of antennae, as in the male of *P. helleri* (collected less than 100 km apart); the width of fastigial tip was larger than the width of the elevated base of antenna and the distance between scapes slightly wider than one scape large. The cerci were also relatively short and mouthparts brown-black or yellow and black bordered, as found in males.

In Ter 26 and Ter 32, the fastigium verticis were prolonged and the cerci relatively short, as in the male of *P. kivuensis*, but the SAP a bit longer than large and notched behind. The distance to the site of male collection was about 180 km apart.

In Ter 20 and Ter 39, the fastigium verticis was not prolonged and furrowed, and the paranotal spine brown, similar as in *P. manyemai*, collected about 100 km apart. But, in the first the SAP was pyramidally shaped.

Prozonal protruding elevation was more prominent in females than in males, but variable; length of pronotum measured 9 mm in Ter 53, 52 and 32, 11 mm in Ter 51, 8.5 mm in smaller Ter 20, and 12 mm in Ter 39.

Spination of legs was variable and could not be used as reliable specific character.

Other female characters, which were compiled in Table 1, seem to be more useful for specific identification. In some cases, the sandy-grey SAP was as long as large, plate-like and only slightly haired. In Ter 39, the SAP was larger than long, like in Lo 03. The reverse was found in Ter 20, 26 and 32 (Table 1).

Table 1 - Variability of body and tegmen length, ovipositor length and width, shape of SAP, cercus length, and shape of SGP / 2 (half part of subgenital plate), isometrically divided by ovipositor, in females from southern Kivu Province. The width of ovipositor was measured at proximal third. The width-p of SGP / 2 length (l) was calculated at midth of rounded part, and width-d at pointed position; ? marked females of which the SGP was damadged and not measurable.

Specimen	Body	Tegmen	SAP	Cercus	Ovipositor (mm)		SGP / 2 (mm)		
number	Length (mm)	Length (mm)	size (mm)	Length (mm)	Length	Width	Length	Width-p	Width-d
Ter 53	27	20	2.4	2.25	12.8	3.4	2.29	1.08	1.37
Ter 52	28	20	2.7	2.38	13.8	3.4	2.53	1.35	1.76
Ter 51	28	22	2.25	2.0	11.8	3,0	2.13	1.40	1.42
Ter 39	30	23	3.0 > 2.64	2.52	15.7	3.2	2.54	1.11	1.40
Ter 20	26	20	2.32 < 2.57	2.38	13.8	3.4	2.33	1.25	1.58
Ter 32	27	17	2.51 < 2.61	1.99	13.0	2.7	2.35	1.10	1.30
Ter 26	27	21	2.70 < 2.82	2.28	12.6	2.6	?	?	?
Lo 03	27	22	2.96 > 2.35	2.43	11.8	2.78	?	?	?

The yellow-sandy cerci were straight-conical, roundly tipped and always long-haired, its length shorter than that of SAP, specially in Ter 26 and 32.

In all females, the ovipositor was brown-black to little reddish and distal half upcurved, but differently shaped (Fig. 10). The ovipositor of Ter 26 and 32 was smallest in width, at almost similar length (Tab. 1, Fig. 10 C). Both females were collected in West Kivu and their characters agreed with them of male *P. kivuensis*. The ovipositors, shown in Fig. 10 B, belonged to females which were found at the same place (at km 82, Mingazi, in Fig. 12 marked with z). The ovipositors have similar width, but differ in length between 11.8-15.7 mm, apparently belonging to different species. The ovipositors, shown in Fig. 10 A, belong to females collected near Bukavu showing similar characters as the male *P. helleri*.

The SGP / 2 of the females was principally similar shaped, but varied in size, shown in Fig. 11, and only slightly in shape, compared by numbers in Tab. 1. In all cases, the distally pointed part is longer in width than the rounded, proximal part, except in Ter 51.

DISCUSSION

In the genus *Pantecphylus*, morphological structures showed that the individuals of the species studied may not rapidly spread over large distances by flying. Due to the tent-forming tegmina and fan-shaped and distorted alae bearing strengthened anal veins with rows of stridulatory ribs or pegs, found in all individuals examined (Heller, 1996, Schmidt & Stelzer, 2004); a long active transfer by air will not be possible. Basing on low mobility, inbreeding became dominant and cross-breeding was hindered by the low capacity to disperse. The populations were isolated and geographical races and new species could evolve during the long period, in which the genus surely exists in Africa. Thus in Kivu, five species could be established from a mountainous area of about 300 km^2 (Fig. 12). The species developed different morphological features which justify the designation of new species showing similar split-shaped auditorial foramen, but differences of the length and width of fastigium verticis and the shape of male SGP, as most prominent and reliable speciies-specific characters.

From the few specimens collected in the Kivu region, only little can be suggested upon the evolution of the species. At time, only male features can be used for taxonomical studies, because females attached to species-specific males are rare. The evolution of the external genitalia led to specific structures. In females, the genitalia show also differences, which later on might become reliable, as in males, for a species-specific characterization, if there is more known upon the variability of the species. The shape of ovipositor varied only little. The spination of legs is very variable. No species-specific structures could be found in the enlarged and spiny thorax. In combination with the site of collection, some combined features may be helpful, if their variability is better known, for example, the SGP and stridulatory structures of the alae, also present in females.

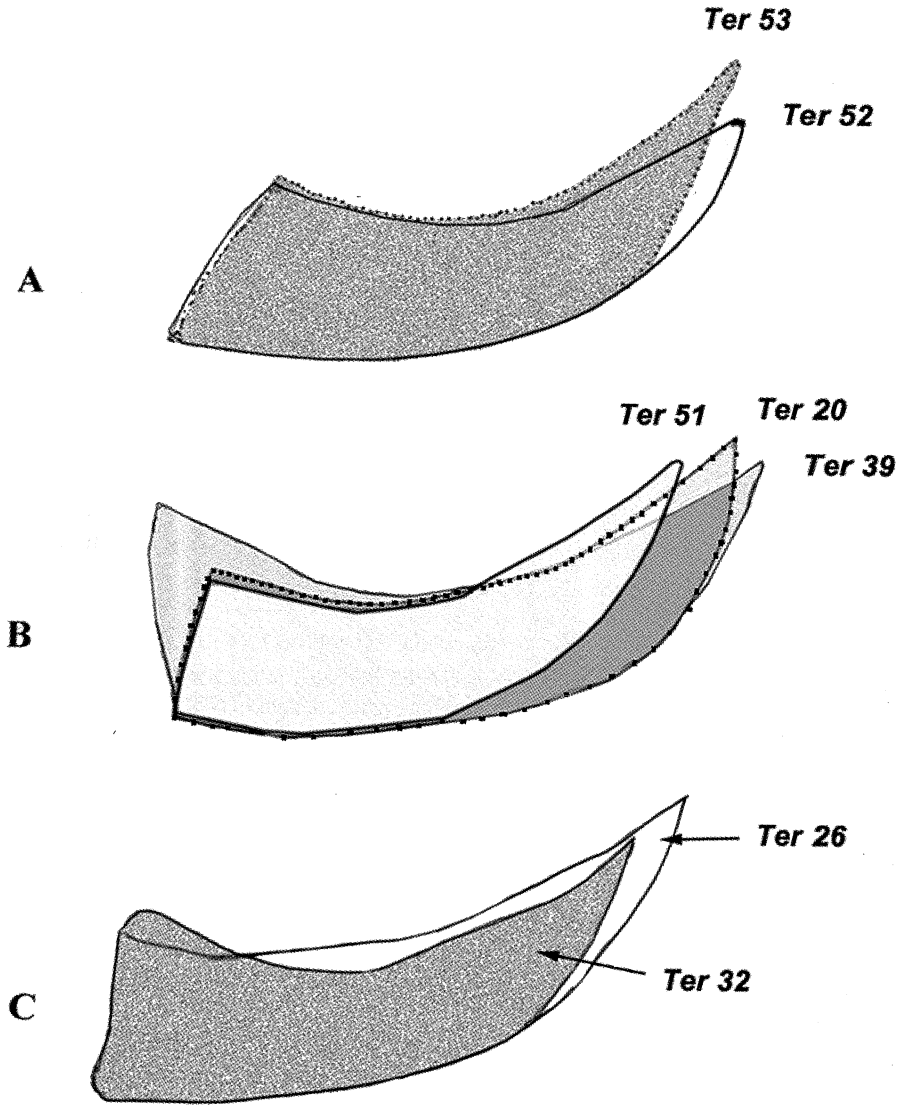

Fig. 10 - Variability of ovipositor shape in females from Kivu region; A: females collected near Bukavu; B: females collected at km 82 (Mingazi), location z in Fig 12; C: females collected in W Kivu, location v and w in Fig. 12; size of ovipositor compare in Tab. 1.

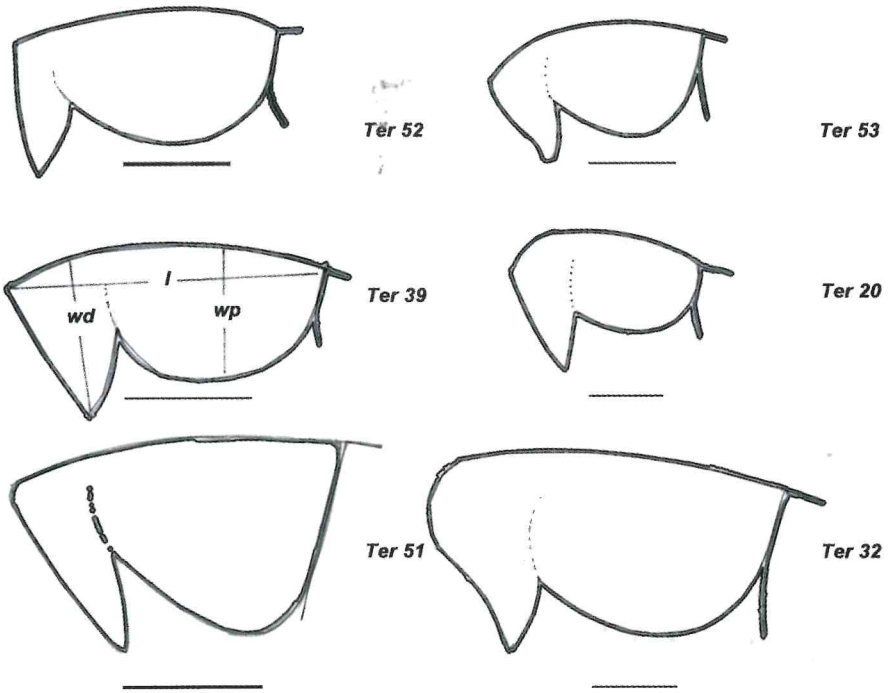

Fig. 11 - Varability of SGP/2 of female *Pantecphylus* collected in the Kivu region; wd: width of tipped distal part, wp: width of rounded proximal part, l: length of SGP/2, compare Tab. 1. Scale bar: 1 mm.

In the five species, described here, the tip of the conical fastigium verticis can be prolonged and rounded, or truncated short-rounded surpassing slightly, or not the elevated bases of antennae. Shape and width of the fastigium verticis were useful characters to separate species.

In both sexes, a regional separation is possible by using the colour of the paranotal spine (Schmidt, 2003). In the northern part till about 2° S, the paranotal spine is typically brown. Further to the South, it becomes brown-black to black, independent from the species. This interspecific character may be helpful to identify the region, from which the specimens were collected. The females, which could not be identified, because of lacking a male from the same locality, showed brown-black paranotal spines, except Ter 20 with brown paranotal spines. More structural information of the female SGP and the strengthened ala veins may allow a better specific discrimination, in both sexes.

The present study showed that the females, marked Ter 26 and Ter 32, were similar in length and width of fastigium verticis, shortened tegmina, and shape of SAP

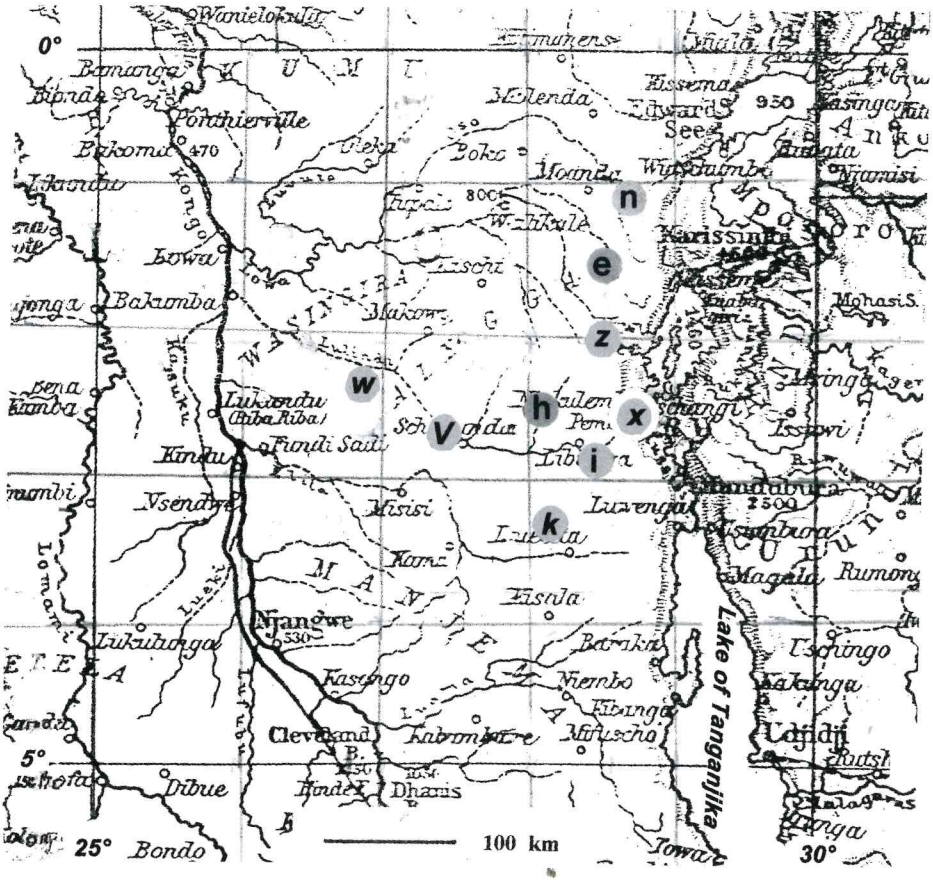

Fig. 12 - Map of the Kivu region, where the new species were collected; location **k**: *P. kivuensis*; **i**: *P. irangii*; **h**: *P. helleri*; **e**: *P. meshei*; **n**: *P. manyemai*; **x**: Bukavu; **v**: Matale [Ter 26]; **w**: Lubongola [Ter 32]; **z**: km 82 (Mingazi).

with the male of *P. kivuensis*. Ter 39 agreed with *P. manyemai* in shape of SAP, tegmen and cercus length, but body and ovipositor were longer than in Lo 03. Ter 53 and Ter 52 were most similar to P. helleri regarding fastigium verticis; both females showed similar characteristics in body size, tegmen length, SAP, cerci, ovipositor, except in SGP. From the male collecting places, more individuals are necessary to evaluate the reliable specific characters of females.

The spination of legs was only documented for the type material. This feature was variable, but showing some regional tendencies. Under the same point of view, the shape of the prozonal protuberance may be helpful.

The material studied showed that *Pantecphylus* Karsch is a polytypic genus. The specific characters are summarized and compared in Table 2.

Table 2 - Comparison of specific male characteristics of the new species; fastigium verticis: ∩ prolonged, ∧ slightly longer than bases of antennae, □ short, not surpassing bases of antennae; quotient ant / scape: distance between antennae to width of scape; SGP base: ∪ broad-concavely excised, ~ slightly excised, — straight.

Species	P. kivuensis	P. irangii	P. manyemai	P. meshei	P. helleri
male	Ter 54	Ter 31	Lo 02	Lo 01	Hel 4936
Body length	24	19	20	22	23
Tegmen	17	15	17	16	13
Fastigium shape	∧	∩	□	∧	∩
Quotient ant/scape	=->	>	=	>	=
Width fastigium / antennal base	6:5	6.5:5	1:1	9:5	5:3
Paranotal spine	brown-black	brown-black	brown	dark-brown	dark-brown
Last tergite excision	concavely rounded	concavely rounded	concavely rounded	right-angular	concavely rounded
SGP base	∪	∪	~	~	—
excision	0.40	0.37	0.17	0.11	0
length midth-side	2.95-3.35	3.32-4.10	2.87-3.04	3.15-3.26	3.24
prox to distal part	·	·	Ò	=	·
excision of hind margin (mm)	0.76, round-angular	0.8, almost circular	0.89, round-angular	0.93, about circular	0.94, round-angular
Styli length	0.98	0.92	0.78	0.82	0.86
colour	brown	brown	light-brown	yellow-brown	light-brown
shape	sickle	sickle	sickle	sickle	sickle
SAP shape, width in mm	circular large=long	plate large=long	circular, 1.9 > 1.6 mm	plate, 1.93 large=long	plate, a bit larger, 1.85
haired	slightly	furry	very little	slightly	very little
Cerci length	1.65	2.06	2.22	1.7	1.7

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PROF. DR GERHARD H. SCHMIDT - University of Hannover, FB. Biology, Section Entomology and Ecology, Herrenhäuser Strasse 2, D - 30419 Hannover, Germany.

DR RALF STELZER - Institute of Animal Ecology and Cell Biology, Section: Ultra-Microscopy and Botany, School of Veterinary Sciences, Bünteweg 17 d, D-30559 Hannover, Germany.

JUDITH MARSHALL I, B.S. - The Natural History Museum, Department of Entomology, Cromwell Road, London SW7 5BD, UK.

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