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***Graphipterus vignai* new species from Zambia**
(Coleoptera Carabidae, Cyclosomini)

Abstract: *Graphipterus vignai* n. sp. from Kafue River, Lusaka, Zambia, is described. This new species belongs to the “*Graphipteri diversitarsi*” section (sensu Basilewsky, 1977) and seems closely related to *G. lineolatus* (Boheman, 1848), sharing part of its distribution area. It can be distinguished by the dorsal side of pygidium completely pubescent and the structure of the aedeagus.

Riassunto: *Graphipterus vignai* nuova specie dello Zambia (Coleoptera Carabidae, Cyclosomini).

Gli autori descrivono *Graphipterus vignai* n. sp. proveniente da Kafue River, Lusaka, Zambia. La nuova specie appartiene alla sezione dei ‘*Graphipteri diversitarsi*’ (sensu Basilewsky, 1977) ed è apparentemente vicina a *G. lineolatus* (Boheman, 1848), con il quale condivide parte dell’areale. Da questo si distingue per il lato superiore del pigidio completamente pubescente e per la forma dell’edeago.

Key words: new species, *Graphipterus vignai* n. sp., Africa, Zambia, Kafue river.

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INTRODUCTION

After the first monograph devoted to the genus *Graphipterus* Latreille, 1802 by Chaudoir (1870), where 56 species were recognized, we had to wait more than 50 years before the genus was monographically treated again (Burgeon, 1929) and then almost 50 more (Basilewsky, 1977). After that, only a few contributions were devoted to these beautiful ground beetles. Indeed, Basilewsky himself successively published two additional papers, describing four other taxa (one species and three subspecies) from Zaire (now Democratic Republic of Congo) and Somalia (Basilewsky, 1981), as well as seven further new species from South Africa (Basilewsky, 1986). After Basilewsky, few other authors carried out taxonomic research concerning this genus: Werner (2003) described a new species from Kenya, then (2007) described three new species from Zambia; Mawdsley (2012) reviewed the group of *G. ancora* Dejean, 1831 (sensu Basilewsky, 1977), but without describing any new taxa; Maquet & Bouyer (2013) dealt with the distribution of *G. dymorphus dymorphus* Burgeon 1928 and the morphological differences distinguishing the

subspecies of *G. ellipticus* Burgeon, 1928; eventually Renan *et al.* (2018) reviewed the group of *G. serrator* (Forskål, 1775) (sensu Basilewsky, 1977), describing five new species and proposing to raise many subspecies or synonyms, many of which are sympatric, to the rank of valid species.

Among the entomological materials collected in Zambia during 1986 by Franco Ferrero from Turin, one of the authors (PMG) identified a probable new species of *Graphipterus* from Kafue River, Zambia. Discussing this discovery with the late Augusto Vigna Taglianti, PMG became aware of the fact that, in a similar batch of material from the collections of Franco Ferrero, he had also identified the presence of the same probable new species. This information halted PMG’s intention to proceed with the research, while awaiting the description by Vigna Taglianti, which unfortunately never appeared. Now, more than thirty years after these events, the availability of the materials of the Vigna Taglianti Collection, now donated to MCSNG, makes the description of this new species possible, also thanks to the courtesy of the Honorary Curator Roberto Poggi.

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MATERIALS AND METHODS

Morphological analysis was carried out through the examination of habitus with a stereomicroscope Wild M3. Dried male genitalia were glued on a card fixed to the same pin as the adult specimen.

The images of habitus and male genitalia were made using a Leica DFC295 camera mounted on a Leica M205 C Stereomicroscope, using the software Leica Application System V4.0.

The material studied is deposited in the following Museums and private collections:

- MCSNG: Museo Civico di Storia Naturale “Giacomo Doria”, Genova, Italy
 CAI: Gianni Allegro Collection, Moncalvo (Asti), Italy
 CCa: Achille Casale Collection, Torino, Italy
 CFa: Leonardo Falletti Collection, Buttigliera Alta (Torino), Italy
 CGi: Pier Mauro Giachino Collection, San Martino Canavese (Torino), Italy
 CMa: Niccolò Massimo Collection, Manerbio (Brescia), Italy
 CSc: Riccardo Sciaky Collection, Milano, Italy
 CVi: Augusto Vigna Taglianti Collection, now in MCSNG

***Graphipterus vignai* n. sp.**

(Figs. 1, 2, 4, 8)

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LOC. TYP.: Zambia, Lusaka, Kafue River, m 1300.

TYPE SERIES: HT♂ Zambia, Lusaka, Kafue River, I.1998, F. Ferrero legit (CGi). PTT: 5 ♂♂ 6 ♀♀ same data as HT (CAI, CVi); 6 ♂♂ 5 ♀♀, Zambia, Kafue, I.1998, F. Ferrero leg. (CGi); 14 ♂♂ 7 ♀♀ Zambia, Lusaka, Kafue, Kafue River, m 1200, XII.1986, F. Ferrero legit (CVi); 2 ♂♂ 6 ♀♀ Zambia, Lusaka, Kafue, Kafue River, XII.1986, F. Ferrero legit (CGi, CVT); 50 ♂♂ 44 ♀♀ Zambia, Lusaka, Kafue River, m 1300, XII.1986, F. Ferrero legit (CAI, CCa, CFa, CGi, CSc, CMa); 1 ♀, Zambia, Kafue River, XII.1986 (CGi); 8 ♂♂ 7 ♀♀ Zambia, Lusaka, Kafue City, Kafue River, m 1200, 22.XI-2.XII.1987, R. Mourglia legit (CGi, CSc, CVi); 2 ♂♂ Zambia, Kafue, XII.1989, F. Ferrero legit (CVi); 2 ♂♂ Zambia, Lusaka, Kafue City, Kafue River, m 1200, 21.XII.1989, F. Ferrero legit (CVi); 1 ♀ Zambia, Lusaka, Kafue City, Kafue River, m 1200, I.1996, F. Ferrero legit (CVi); 2 ♀♀ Zambia, Lusaka, Kafue City, Kafue River, m 1200, 4.I.1996, F. Ferrero

legit (CVi); 2 ♂♂ 1 ♀ Zambia, Lusaka, Kafue City, Kafue River, m 1200, 5.I.1996, F. Ferrero legit (CVi); 4 ♂♂ Zambia, Lusaka, Kafue City, Kafue River, m 1200, 6.I.1996, F. Ferrero legit (CVi); 2 ♀♀ Zambia, Lusaka, Kafue City, Kafue River, m 1200, 7.I.1996, F. Ferrero legit (CVi); 3 ♂♂ 2 ♀♀, Zambia, Kafue River, I.2000, F. Ferrero leg. (CGi); 7 ♂♂ 11 ♀♀, Zambia, Lusaka, Mazabuka, m 1400, XII.1986, F. Ferrero leg. (CFa, CGi, CMa, CSc).

DIAGNOSIS. A species of the “*Graphipteri diversitarsi*” section (sensu Basilewsky, 1977), belonging to the “*G. circumcinctus* species-group”, and in particular close to *G. lineolatus* (Boheman, 1848) (Fig. 9) on account of the general body morphology and of the elytral vestiture, consisting of seven complete longitudinal bands of pale scaly pubescence and a wider lateral pale band, as well as on account of the vestiture of pronotum, showing a disk sparsely covered by blackish



Fig. 1. *Graphipterus vignai* n. sp.: habitus of HT.

scales and two wide lateral bands of pale scales. It differs from *G. lineolatus*, however, in the dorsal side of pygidium completely covered by pale pubescence (Fig. 2) (only two pale lateral triangular bands in *G. lineolatus*) (Fig. 3), in the vertex of head with distinct longitudinal wrinkles (usually simply punctate in *G. lineolatus*), as well as in the morphology of the median lobe of the aedeagus: in particular, in lateral view it shows a different shape and appears completely smooth at sides and underneath, while it is wrinkled in all the specimens of *G. lineolatus* we examined; in dorsal view, it shows a broadly rounded apex with very narrow apical lamella (Fig. 4) (more or less pointed and triangular in *G. lineolatus*) (Figs. 5-7).

DESCRIPTION. Body entirely black with head, pronotum and elytra showing pale bands of scaly pubescence (Fig. 1). Total body length (from apex of labrum to apex of elytra): ♂♂ 9.7-14.4 mm, ♀♀ 9.0-14.0 mm.

Head black, with two wide curved longitudinal bands of white-yellowish scales; eyes large but hardly bulging; mandibles elongate. Clypeus anteriorly bor-

dered and with a setigerous pore on each side placed well before anterior angles; anterior margin hardly concave; labrum subquadrate, provided with 6 setae at anterior margin; tempora and frons densely punctate. Supraorbital area depressed and distinctly longitudinally striolate (such as vertex). Neck not narrowed. Antennae long, reaching the basal fourth of elytra, pubescent, flattened and strongly elongated from 4th antennomere; the second and third antennomeres flattened and glabrous; the second 1/3 as long as the third; the first 1.5 times as long as the second, not flattened but dorsally depressed; antennomeres 2-11 keeled on inner side.

Pronotum black, cordiform, with obtuse and widely rounded basal angles; fore angles with prominent subtriangular lobes; anterior margin bordered; base slightly concave and unbordered; sides regularly rounded forward and delicately sinuated before basal angles; disk wholly punctate, almost pockmarked, sparsely covered with blackish scales on centre of disk, and with two wide pale lateral bands formed by dense whitish scales, occupying the entire lateral groove and the external part of the disk. Lateral groove closely joined with basal impressions, which seamlessly extend over the entire base, so that the whole basal edge appears raised. Pro-, meso- and metasterna brownish-black. Prosternum, front of mesosternum and metepimera provided with sparse whitish pubescence.

Legs black; pro-, meso- and metatibiae externally furrowed; external metatibial spur spoon-shaped; protarsomeres of males not dilated, but inferiorly with dense yellowish pubescence.

Elytra ovoid and convex, coarctate (brachypterous species), almost gibbous at base of elytral suture, with completely obliterated shoulders, slightly truncate in preapical area and separately rounded. Elytral disk entirely, strongly and irregularly punctate, with striae relatively distinct and depressed; disk completely covered by white-yellowish and brownish scales, alternating so as to form seven complete and biseriate pale longitudinal bands, plus an eighth much wider external band occupying the elytral edge. The general appearance of the pale bands can vary, especially in old specimens, due to wear and tear with relative loss of scales, both pale and dark. Pygidium blackish brown, dorsally entirely covered by dense yellowish-white pubescence and provided with a distinct median keel in both sexes. Sternites glabrous, blackish brown; last sternite without keel and equipped with two pairs of apical setae in both sexes.



Figs. 2-3. Pygidium of *Graphipterus vignai* n. sp. from Kafue River, Zambia (2) and of *G. lineolatus lineolatus* from Maun, Botswana (3).

Median lobe of aedeagus small, regularly curved and dorsally completely open, totally smooth at sides and underneath; in lateral view stocky, with a blunt apex; in dorsal view the apex is broadly rounded, asymmetrical, with very short apical lamella (Fig. 4); parameres stout, slightly elongated, the right one truncate at apex, the left one rounded.

ETYMOLOGY. It is a pleasure for us to dedicate this new species to our late friend and colleague Augusto Vigna Taglianti, who had already many years ago suspected it was a new species, as a token of our esteem and friendship and with deep regret for his untimely death.

ECOLOGY AND GEOGRAPHICAL DISTRIBUTION. *G. vignai* n. sp. is currently known only from a restricted area along Kafue River (Lusaka, Mid-Southern Zambia), where it was collected at 1,200-1,300 m a.s.l (Fig. 8). Most specimens were collected at night, attracted to light in a savannah habitat at about 1 km from the banks of the Kafue River.

REMARKS. Following the key provided by Basilewsky (1977) to the *Graphipterus* species-groups, *G. vignai* n. sp. would key out to the group of '*G. michaelsoni*', mainly because of the character of the complete (instead of incomplete) pale pubescence of pygidium (Figs. 2-3), (couplet n. 22 at page 22). On the other hand, not considering this character, this species easily fits in the group of '*G. circumcinctus*', which includes *G. lineolatus* (externally almost indistinguishable) and 6 more species morphologically very similar to *G. vignai* n. sp. Among these, the new species appears particularly close to *G. lineolatus* in the external morphology and elytral vestiture, being distinguished mainly by the feature of the pygidial pubescence and by the morphology of aedeagus.

For these reasons, we consider the character 'complete/incomplete pygidial pubescence' as not significant to discriminate among species-groups, at least in this case. This consideration opens the discussion regarding the lack of use by Basilewsky (1977, 1981, 1986) and other authors (Mawdsley, 2012; Werner, 2003, 2007) of the morphological characters of the aedeagus, which was considered extremely homogeneous and therefore inadequate for

taxonomic purposes (Basilewsky, 1977, p. 12). It is true that the features presented by this organ are rather subtle and maybe less evident than in other carabid groups, mainly compared to other very evident diagnostic external characters like those concerning the colour of the vestiture, but they are anyway useful for a specific distinction. Actually, as highlighted by Renan *et al.* (2018) within the group of '*G. serrator*', the aedeagi of different species, although rather homogeneous, are very suitable for taxonomic purposes. In the case of the taxon described here, the morphology of the aedeagus is decisive for its attribution to a new species.

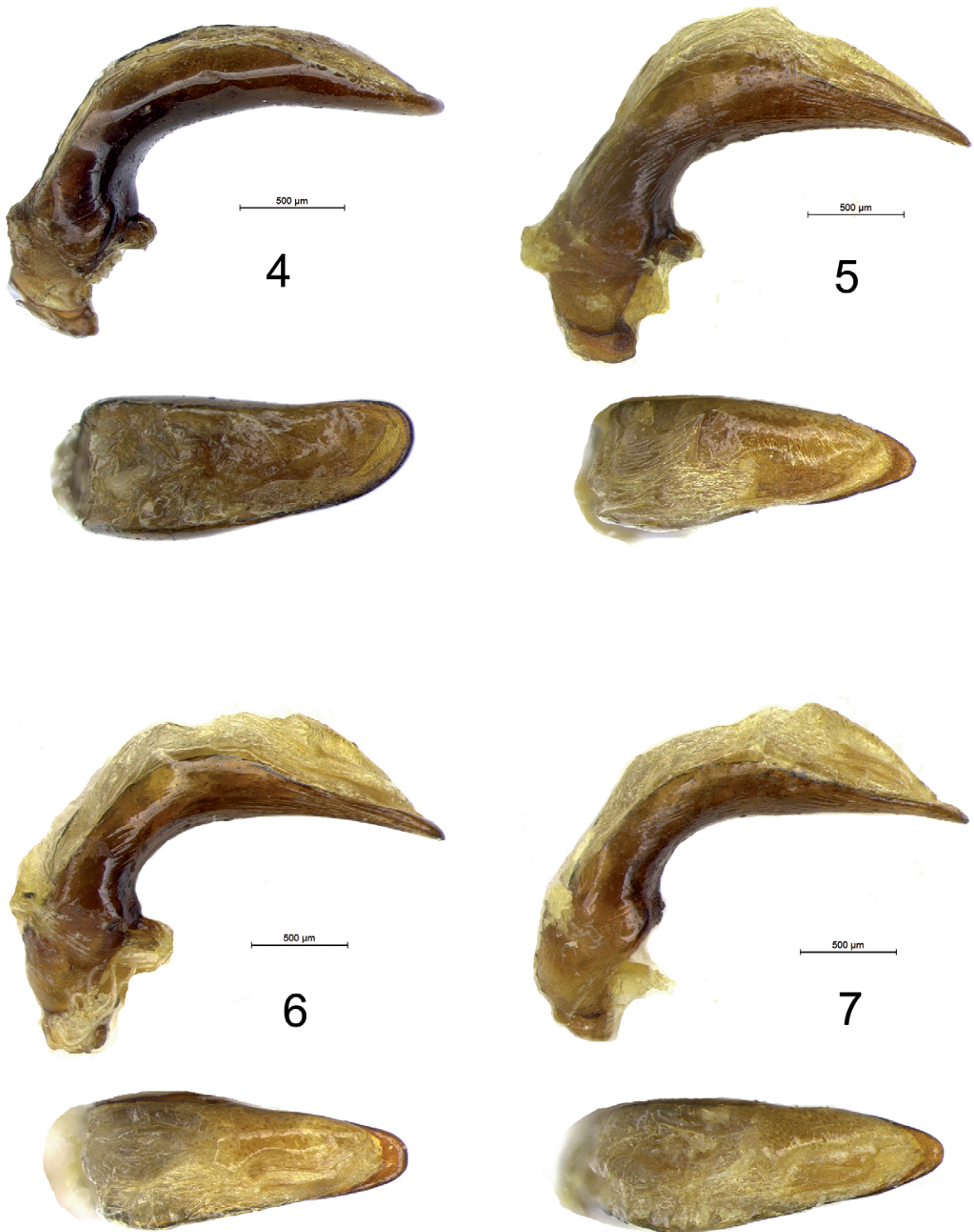
Graphipterus lineolatus (Boheman, 1848)
(Figs. 3, 5-9)

This species was described with the type-locality "Ad Montes Makkalienses". Its distribution has been extensively studied by Basilewsky (1977), who found that it occupies Namibia, Botswana, Zimbabwe, Zambia and the Republic of South Africa. Within this large distribution area Peringuey (1896) described a "var. *geminatus*" from "Salisbury (Zambezia)" and "Zambeze River". The original description described this variety as follows: "Shape, size and colouring of *G. lineolatus*, but the seven white lines on the elytra, instead of being equidistant, have three sets of duplicate lines set close to each other, with the intervals, of course, broader between the duplicated line". Later, Burgeon (1929) treated this form as a "var. or ssp.", while Basilewsky (1977) definitely accepted it as a valid subspecies, but limited its distribution to the region of Zimbabwe around Harare and Umvuma. We think that probably it is a variety occurring together with the nominotypical subspecies but prevalent in some zones, but only the direct study of material from different areas will shed light on this matter.

G. lineolatus, except for this particular form, is not very variable, considering the extension of its distribution area; only the size can vary from 9 to 14 mm. The aedeagal shape can vary slightly, as can be observed in the illustrations 5-7, but the fundamental characters (thickness of apex in lateral view, shape of apical lamella, etc.) remain constantly different from those of *G. vignai* n. sp.

ZOOGEOGRAPHIC NOTES

In Zambia many species of *Graphipterus* are known, but probably many other species remain to be



Figs. 4-7. Aedeagus in lateral and dorsal view of *Graphipterus vignai* n. sp. (HT) (4); *G. lineolatus lineolatus* from Bulawayo, Zimbabwe (5); *G. lineolatus lineolatus* from Maun, Botswana (6, 7).

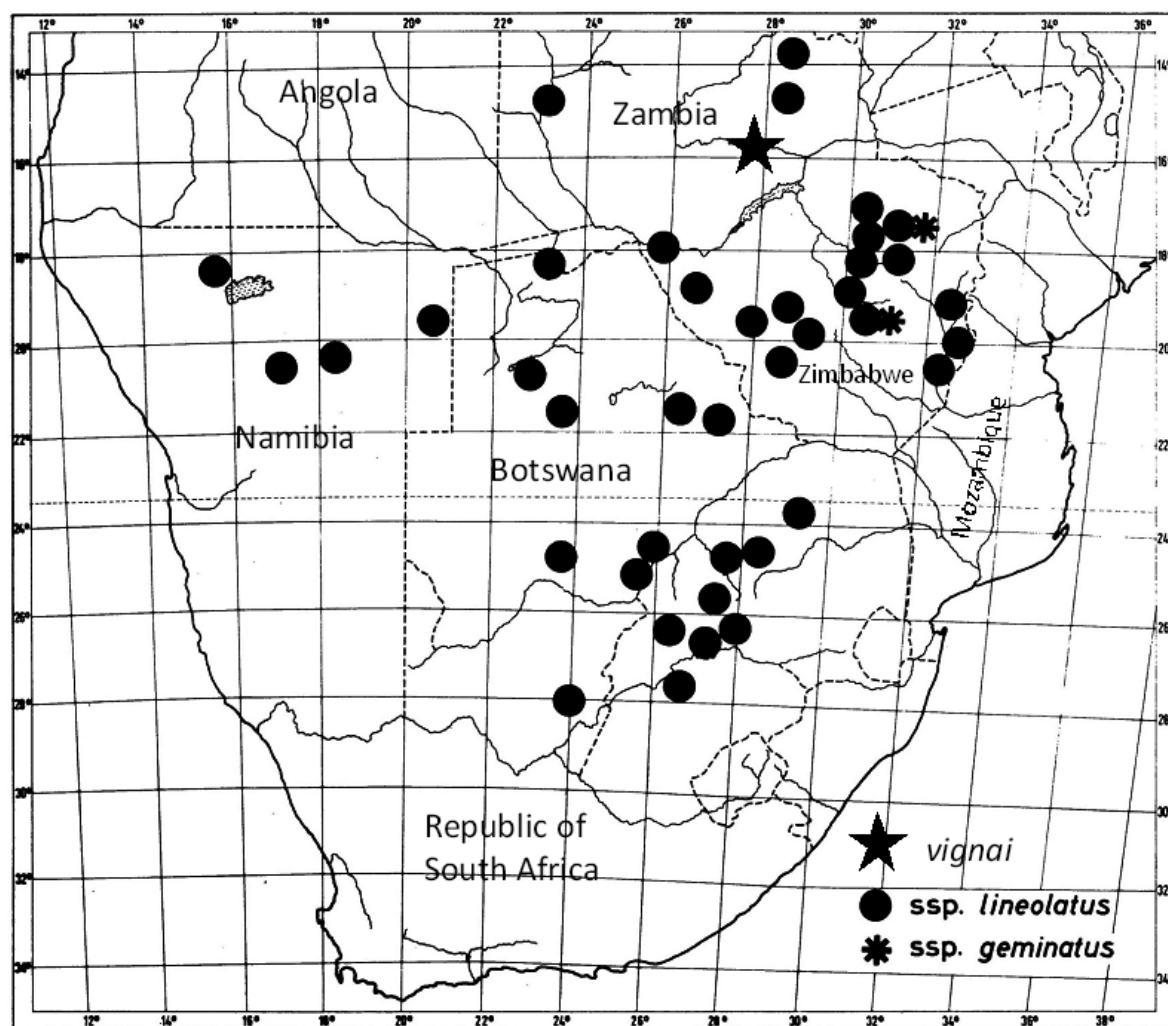


Fig. 8. Distribution map of *Graphipterus vignai* n. sp., *G. lineolatus lineolatus* and *G. lineolatus geminatus* (modified from Basilewsky, 1977).

reported for the country. Among the “*Graphipteri similatarsi*” we know from this country: *G. amabilis* Boheman, 1860, *G. cordiger* ssp. *zambeziensis* Peringuey, 1892, *G. ornatus* ssp. *dollmani* Burgeon, 1829, *G. salinae* ssp. *paratibialis* Basilewsky, 1977, *G. vittiger* Peringuey, 1888, while among the “*Graphipteri diversatarsi*” there are: *G. albolineatus* (Wallengren, 1881), *G. atrimediis* Chaudoir, 1870, *G. basilewskyi* Werner, 2003, *G. duvivieri* Burgeon, 1929, *G. ellipticus* Burgeon, 1928, *G. katangae* Burgeon, 1929, *G. limbatus* Castelnau, 1840, *G. lineolatus*

(Boheman, 1848), *G. lorenzi* Werner, 2007, *G. marshalli* Burgeon, 1928, *G. nanniscus* Peringuey, 1896, *G. neavei* Burgeon, 1928, *G. nyassicus* ssp. *zambiensis* Basilewsky, 1977, *G. rhodesianus* Burgeon, 1928, *G. snizeki* Werner, 2007, *G. tichyi* Werner, 2007, *G. tristis* Klug, 1855, *G. upembanus* Basilewsky, 1953. Therefore, there are 22 species known for this country so far, three of which belong to the same group as *G. vignai*. This seems to show a pattern of distribution of this genus extremely complicated and difficult to reconstruct.

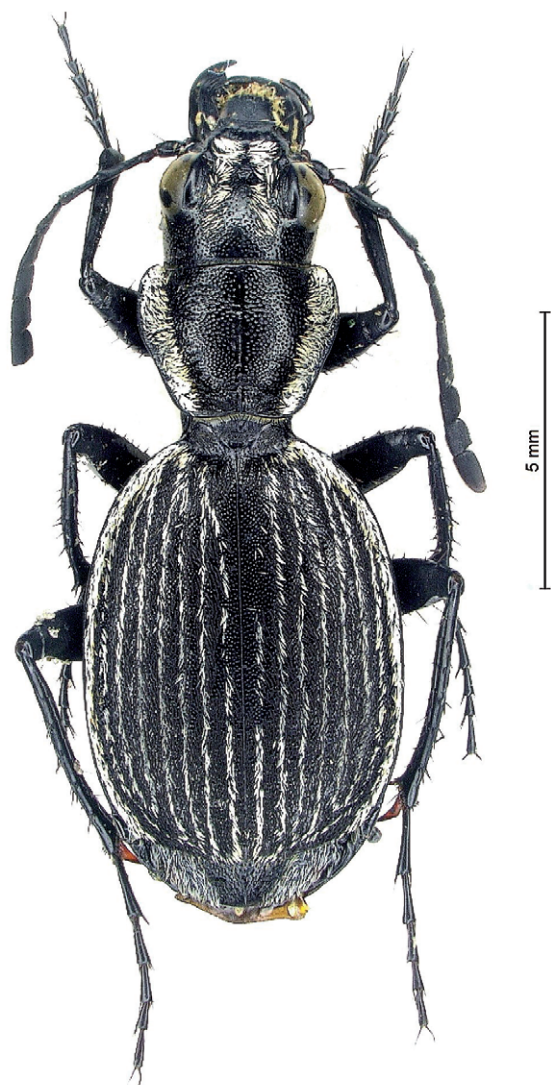


Fig. 9. Habitus of *Graphipterus lineolatus lineolatus* from Maun, Botswana.

CONCLUSIONS

The fact that the distribution area of *G. vignai* n. sp. is entirely within that of *G. lineolatus* suggests that it is a valid species and cannot be a subspecies (see fig. 8, from Basilewsky, 1977, modified). A doubt can arise concerning *G. lineolatus* ssp. *geminatus*, another taxon whose distribution area is completely within that of *G. lineolatus*; after more complete studies this taxon may either prove to be a good species, or a variety with no nomenclatorial value.

Moreover, by examining some (unfortunately still too few) specimens of *G. lineolatus* from different localities of its wide distribution area, we noticed a certain variability in male genitalia (Figs. 5-7). Therefore, we suspect that a study of the numerous populations of *G. lineolatus*, also taking into account the formerly neglected characters of the median lobe of aedeagus as well as of the parameres, may lead to discover that it is a complex of various species.

We can only confirm the statement of Mawdsley (2012): “The results of the study presented here suggest that it may be time for a broader re-evaluation of the genus *Graphipterus*, starting in particular with a review of the taxa recognized as subspecies by Burgeon (1929) and Basilewsky (1977). It is possible that many of these taxa will prove to be separate species ... or synonyms of a single species”.

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