

This article was downloaded by: [University of Bath]

On: 13 February 2014, At: 12:05

Publisher: Taylor & Francis

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Journal of Natural History

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/tnah20>

Monolepta Chevrolat, , the most speciose galerucine taxon: redescription of the type species *Monolepta bioculata* (Fabricius,) and key to related genera from (Chrysomelidae, Coleoptera)

Thomas Wagner ^a

^a Universität Koblenz-Landau , Institut für Integrierte Naturwissenschaften - Biologie , Koblenz, Germany

Published online: 16 Mar 2007.

To cite this article: Thomas Wagner (2007) *Monolepta Chevrolat, , the most speciose galerucine taxon: redescription of the type species Monolepta bioculata* (Fabricius,) and key to related genera from (Chrysomelidae, Coleoptera) , *Journal of Natural History*, 41:1-4, 81-100, DOI: [10.1080/00222930601127384](https://doi.org/10.1080/00222930601127384)

To link to this article: <http://dx.doi.org/10.1080/00222930601127384>

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden. Terms &

Conditions of access and use can be found at <http://www.tandfonline.com/page/terms-and-conditions>

Monolepta* Chevrolat, 1837, the most speciose galerucine taxon: redescription of the type species *Monolepta bioculata* (Fabricius, 1781) and key to related genera from (Chrysomelidae, Coleoptera)

THOMAS WAGNER

Universität Koblenz-Landau, Institut für Integrierte Naturwissenschaften – Biologie, Koblenz, Germany

(Accepted 12 November 2006)

Abstract

Monolepta Chevrolat, 1837 is the most speciose galerucine genus, with about 600 described nominal species mainly from tropical and subtropical regions, including 180 species from continental Africa. In the past, the generic delimitation of other taxa based on typological concepts was very inconsistent, and needs to be redefined. To ensure the correct generic placement of species, based on phylogenetic principles, a comprehensive knowledge of the morphology of the type species, *Monolepta bioculata* (Fabricius, 1781) is necessary, which is presented herein. External and genital characters are figured, and data on distribution and ecology are provided. A phylogenetic analysis of some crucial taxa, and an identification key to all genera of afrotropical galerucines with elongated basi-metatarsus are provided. *Chimporia* Laboissière, 1931a (=syn. nov.) is synonymized with *Monolepta*.

Keywords: *Galerucinae*, taxonomy, phylogeny, redescription, synonymy, lectotype, identification key, Africa, Afrotropical region

Introduction

Monolepta: mega diversity in *Galerucinae*

The *Galerucinae* are one of the most diverse group of the *Chrysomelidae* (leaf beetles). About 6300 nominal species are currently described, most of them from tropical regions (Wagner 1999a). The genus *Monolepta* was described in 1837 by Chevrolat. Until now about 600 nominal species have been described, which is more than in any other galerucine genus. Most species have been described from tropical Africa, Asia and Australia, and few also from the southeastern Palaearctic region, and from the Neotropics (Wilcox 1973). All these species have one peculiar, easily recognizable character in common: the strongly

Correspondence: Thomas Wagner, Universität Koblenz-Landau, Institut für Integrierte Naturwissenschaften – Biologie, Universitätsstr. 1, D-56070 Koblenz, Germany. Email: thwagner@uni-koblenz.de

* 23rd contribution to the taxonomy, phylogeny and biogeography of afrotropical *Galerucinae*.

Published 16 February 2007

ISSN 0022-2933 print/ISSN 1464-5262 online © 2007 Taylor & Francis

DOI: 10.1080/00222930601127384

elongated first tarsomere of the hind-leg. But the question arises if this character is apomorphic or has evolved convergently in several subgroups? When a taxonomic and phylogenetic revision of Afrotropical *Monolepta*, and some additional taxa traditionally affiliated to this genus, was started (Wagner 1999b) it became clear that *Monolepta* as traditionally delimited is a non-monophyletic group (Wagner 2004). In more recent studies of Afrotropical *Monolepta*, phylogenetic relationships have been taken into account (Wagner 2000, 2001a, 2002, 2003b, 2005). Some of the Oriental, Australian and Neotropical species described in *Monolepta* have also been studied recently: few of them are congeneric with *Monolepta*, but most are not (Wagner, unpublished data). Thus, a comprehensive redescription of the type species of this most speciose galerucine genus is essential. This will allow an assignment of both previously and subsequently described species from all zoogeographic regions to *Monolepta* as a monophyletic taxon.

Historical aspects

One of the oldest compilations of insects was written by Fabricius (1781) where he described some hundreds of insects in his *Species Insectorum*. At that time, most larger Chrysomelidae were assigned to only two genera: *Chrysomela* for broad-bodied, and *Crioceris* for slender-bodied species. In Fabricius's work, material in the collection of Joseph Banks was included. Although is better known as a botanist, Banks was also an enthusiastic collector of insects, beetles in particular. His collection contains two beetle specimens from the Cape of Good Hope, which are remarkable due to their large eye-like elytral spots. Since there were two spots on each elytron Fabricius named it *Crioceris bioculata*. Twenty-four years later, the same conspicuous beetle was described again as *Chrysomela quadrimaculata* in the doctoral thesis of Georg August Goldfuß (1805) also from a small collection from the Cape of Good Hope. While the two type specimens of Fabricius are available in the Banks collection at the Natural History Museum, London, Goldfuß's material, which was presumably deposited in an ancient collection at the University of Erlangen, Germany, is most likely destroyed. However, there is no doubt about the species identity, since a coloured figure of *Chrysomela quadrimaculata* was provided in the original publication. In 1837 Chevrolat re-examined the extensive beetle material in the collection of the Comptes de Dejean, and introduced many new generic names. One of these was *Monolepta*, to which he assigned Galerucinae with strongly elongated basi-metatarsi. The generic name refers to this character, since it is derived from the greek "mono"=one, and "leptos"=thin, slender. Chevrolat (1837) assigned 21 species from Africa and 18 species from tropical Asia and New Guinea to this new genus. In 1849 he designated *Crioceris bioculata* Fabricius, 1781, as the type species of *Monolepta*. Erichson (1843) was the first author who adopted the name for a new species, *Galeruca (Monolepta) pauperata*.

Chapuis (1875) introduced "Monoleptites" as a supra-generic name and transferred to this group additional Galerucinae with an elongated basi-metatarsus, which had been described meanwhile, e.g. *Luperodes* Motschulsky, 1858. He later established *Candezea* Chapuis, 1879 for Monoleptites with long antennae and tarsi, elongate epipleura and the third antennomere much longer than the second. *Monolepta occipitalis* Reiche, 1847, a species described from Ethiopia, was designated as the type species of *Candezea*, and a further 38 species from tropical Africa were subsequently described in this genus. Another genus traditionally placed in Monoleptites is *Barombia* Jacoby, 1903, with *Barombia metallica* Jacoby, 1903 from Cameroon as type species. The name is a junior homonym and was substituted by *Barombiella* Laboissière, 1931a. Seno and Wilcox (1982) placed

Barombiella as a junior synonym of *Bonesioides* Laboissière, 1925, the type species of which is *Ootheca coerulea* Allard, 1889. Recent studies of Allard's type material have shown that these species are not congeneric (Freund & Wagner 2003; Wagner & Freund 2003). Species of *Barombiella* were defined as Monoleptites with an anteriorly strongly narrowed (trapezoidal) prothorax and an extremely narrow and carinate prosternum (Laboissière 1925). A further genus introduced by Laboissière is *Chimporia* with *Chimporia monardi* Laboissière, 1931a as type species, which was established for Monoleptites with an exceptionally wide pronotum. Apart from the type species, only one further species, *Monolepta ciliata* Weise, 1909 was transferred to this genus (Laboissière 1931a).

The structure of the procoxal cavities has been used as an important character for the delimitation of galerucine genera in the past. For *Monolepta*, the procoxal cavities have been described as closed (Chapuis 1875, Weise 1923), while Weise (1892) previously described *Monolepta* as having open coxal cavities. The type species of *Barombiella* has closed procoxal cavities, but Laboissière (1919) described many of the 42 species described until now in this genus as having "incompletely closed cavities". There remain therefore, many inconsistencies in the supraspecific taxonomy of these beetles, and the question arises again: what is *Monolepta*?

Taxonomic phylogenetic revision of afrotropical Monolepta and related taxa

Galerucinae without significant pronotal depressions, the pronotum being nearly rectangular, and the second and third antennomere of the same length, have traditionally been assigned to *Monolepta*. Most Afrotropical species were described between 1890 and 1950, while between 1965 and 2000 no data on the African species have been published.

Wilcox (1973) was especially aware of the many inconsistent allocations of species to *Monolepta*. In his *Coleopterorum Catalogus* on the Galerucinae he commented about the list of "group not determined" *Monolepta* species: "This group needs revision. Many of these species should be transferred to other genera. Probably some species belong to *Candezea*. However, most of the species previously placed in *Candezea* do not". He was completely correct in this observation, and the taxonomic revision of several taxa has led to many changes (Hasenkamp & Wagner 2000; Middelhaue & Wagner 2001; Wagner 2000, 2001a, 2002, 2003b, 2005; Freund & Wagner 2003, Schmitz & Wagner 2001; Stapel & Wagner 2000, 2001; Wagner & Scherz 2002; Bolz & Wagner 2004; Steiner & Wagner 2005; Wagner & Kurtscheid 2005). In particular, on the basis of studying the genital structures for the first time, it became necessary to exclude many species originally described in *Monolepta* from a monophyletic "core group" of species including *Monolepta bioculata*.

In Wilcox's (1973) catalogue, 180 African species are listed, which were originally described in *Monolepta*. Some of these were earlier transferred to *Candezea* and *Barombiella* by preceding authors (Weise 1924; Wilcox 1973), but the delimitation of these genera was inconsistent. In their earlier works, Weise and Bryant used *Candezea* only as a subgenus of *Monolepta* (Weise 1924; Bryant 1938), and Bryant (1953) did not accept the previous "generic concept" of *Barombiella*. During the recent revision of Afrotropical *Monolepta*, about 90 species had to be transferred to other genera and about 40 names were found to be synonyms. In addition to the 50 remaining valid species, about 50 species have been newly described (Wagner 2000, 2001a, 2001b, 2002, 2003b, 2005) or await description.

Methods

Morphometric measurements were made for external characters. Absolute measurements are: total length from the clypeus to apex of the elytron, length of elytron, maximal width of

both elytra (usually in the middle or posterior third of the elytra), and width of pronotum. Relative measurements are: length to width of pronotum, maximal width of both elytra to length of elytron, length of the second to third antennomeres, and length of third to fourth antennomere. Fifteen specimens were measured: minimum, maximum values and means are given. Figures include illustrations of the colour pattern (dorsal view), with right antenna. Genital structures are given in detail, including an overview of male and female genitalia and details. The redescription of *Monolepta bioculata* is based on 369 specimens from the following collections. Acronyms used, responsible persons and number of specimens in brackets: Bishop Museum, Honolulu (BPBM; A. Samuelson; $n=4$); Natural History Museum, London (BMNH; S. Shute, M. Brendell, M. Cox; $n=64$); Deutsches Entomologisches Institut, Müncheberg (DEI; L. Behne, L. Zerche; $n=43$); Hungarian Natural History Museum, Budapest (HNHM; O. Merkl; $n=1$); Institute Royal des Sciences Naturelles de Belgique, Brussels (IRSN; M. Cludts, D. Drugmand; $n=18$); The Manchester Museum (MMUE; C. Johnson; $n=9$); Musée National d'Histoire Naturelle, Paris (MNHN; N. Berti; $n=21$); Museum für Naturkunde der Humboldt Universität, Berlin (MNHU; J. Frisch, H. Wendt; $n=39$); Musée Royal d'Afrique Centrale, Tervuren (MRAC; M. de Meyer; $n=11$); Hope Collection of Insects, Oxford (OUMNH; G. McGavin; $n=6$); Naturhistorisches Museum Basel (NHMB; M. Brancucci, E. Sprecher; $n=8$); Naturhistorisches Museum, Wien (NHMW; H. Schönmann; $n=8$); Naturhistoriska Riksmuseet, Stockholm (NHRS; B. Viklund; $n=16$); Nationaal Natuurhistorisch Museum, Leiden (RMNH; $n=29$); South African Museum, Cape Town (SAMC; M. Cochrane; $n=9$); National Collection of Insects, Pretoria (SANC; B. Grobbelaar; $n=83$); Transvaal Museum of Natural History, Pretoria (TMSA; S. Endrödy-Younga, S. Gussmann; $n=8$); Zoologisches Forschungsinstitut und Musuem Alexander Koenig, Bonn (ZFMK; K. Ulmen, M. Schmitt; $n=2$); Zoological Institute St. Petersburg (ZISP; A. Kirejtshuk; $n=3$); Zoological Museum, University of Copenhagen (ZMUC; M. Hansen; $n=12$).

Results

Monolepta Chevrolat, 1837, p. 407
 = *Chimporia* Laboissière, 1931a, p. 413, syn. nov.

Redescription of *Monolepta bioculata* (Fabricius, 1781)

Crioceris bioculata Fabricius, 1781, p. 154.

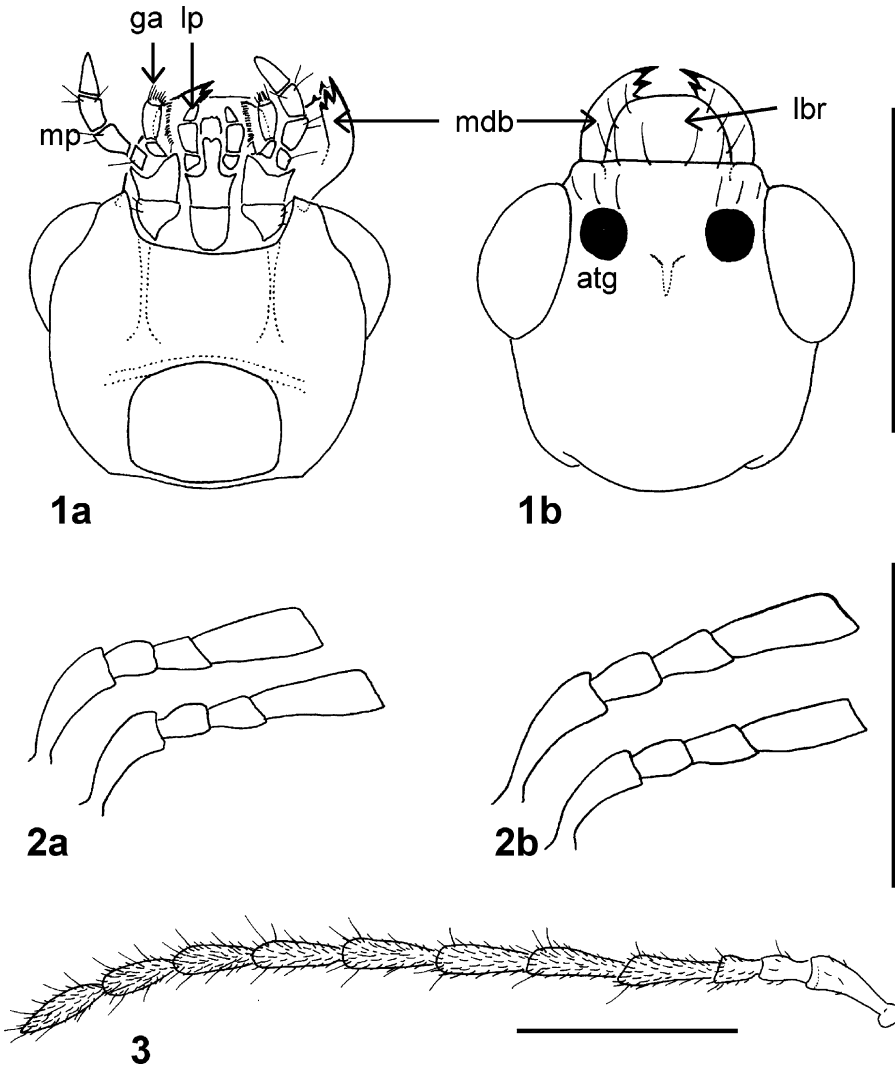
Chrysomela quadrimaculata Goldfuß, 1805, p. 42; Gemminger & Harold (1876, p. 3593); Wilcox (1973, p. 533).

Monolepta bioculata (Fabricius, 1781): Chevrolat (1837, p. 407).

Monolepta tricolor Fairmaire, 1888, p. 222; Weise (1902, p. 404), Wilcox (1973, p. 533).

Total length. 4.8–6.2 mm (0: 5.50 mm; $n=16$).

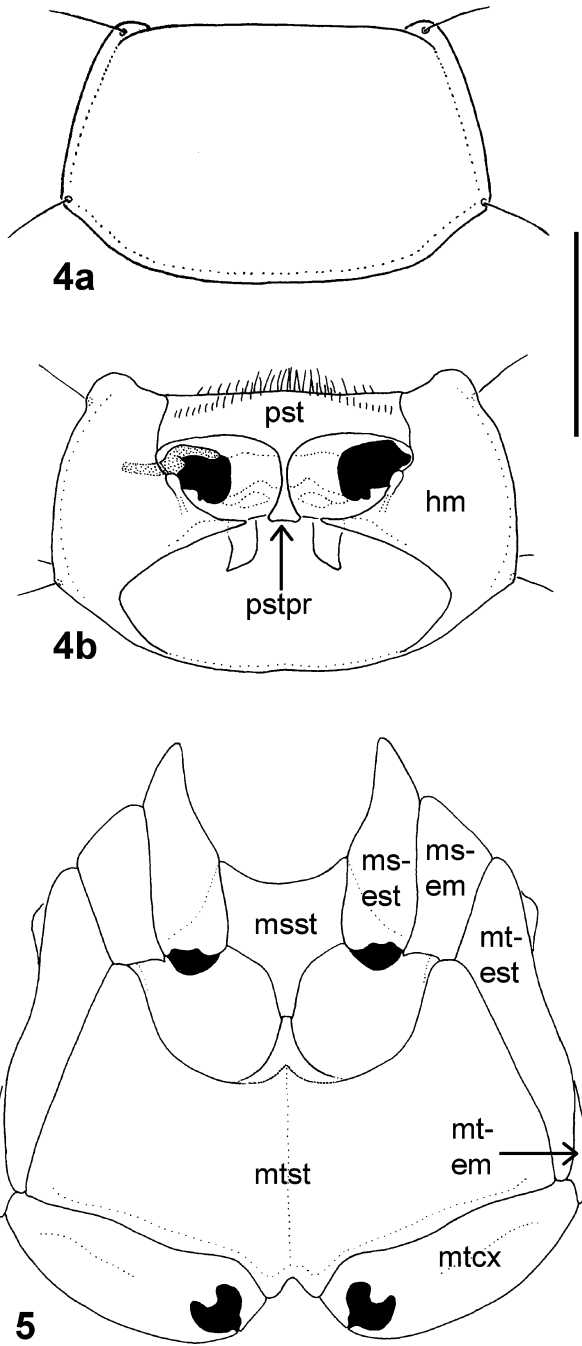
Head. Red to reddish-yellow, palpi brown to black, maxillary palpi slender, labial palpi very short (Figure 1a). Distance of antennal grooves to each other much larger than distance to eye (Figure 1b). Second and third antennomere short, approximately of same length, in males short (Figure 2a) in females more elongated (Figure 2b), antennomeres 4–11 about 2.5 times longer than broad at apex (Figure 3). Length of second to third



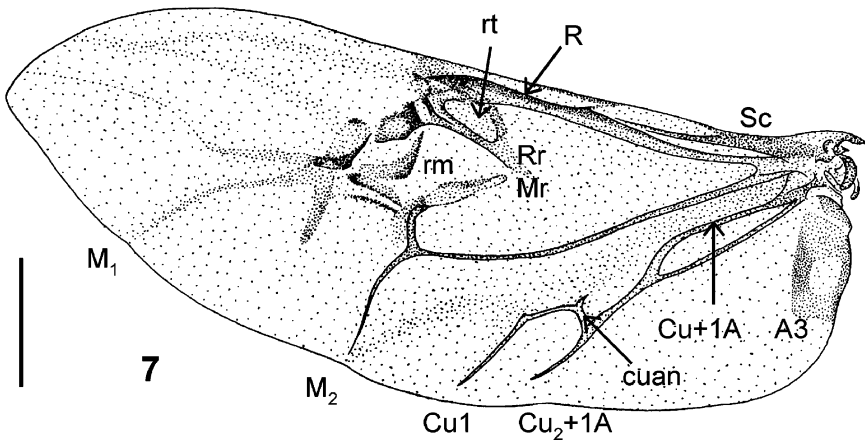
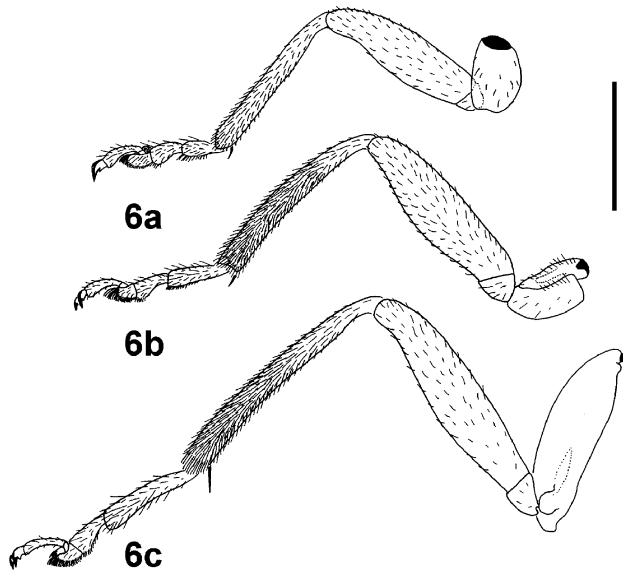
Figures 1–3. External morphology of *Monolepta bioculata* (Fabricius, 1781). (1) Head; a: ventral, showing mouthparts (ga: galea, lp: labial palpus, mdb: mandible, mp: maxillary palpus); b: dorsal (atg: antennal grooves, lbr: labrum). Scale bar: 1 mm (same for all following figures). (2) Basal antennal articles; a: two different males; b: two different females. (3) Antenna (left, female) showing hairs and bristles.

antennomere 0.83–1.00 (0: 0.93), length of third to fourth antennomere 0.36–0.46 (0: 0.42). Antennomeres 1–3 yellowish-red to red (Figure 8a), sometimes also proximal half of fourth antennomere red (Figure 8b), other antennomeres dark brown to black (Figure 8).

Thorax. Yellowish-red to red, pronotum broad, posteriorly slightly enlarged (Figure 4a). Pronotal width 1.80–2.10 mm (0: 1.94 mm), pronotal length to width 0.51–0.55 (0: 0.53). Prosternal processus posteriorly widened, prothoracic coxal cavities open (Figure 4b). Mesosternum slender, metasternum very broad (Figure 5). Scutellum yellow to brownish-red (Figures 8 and 9). Basi-metatarsomere about two times longer than second and third tarsomere of metatarsus together (Figure 6c). Legs yellowish-red, in about 30% of material

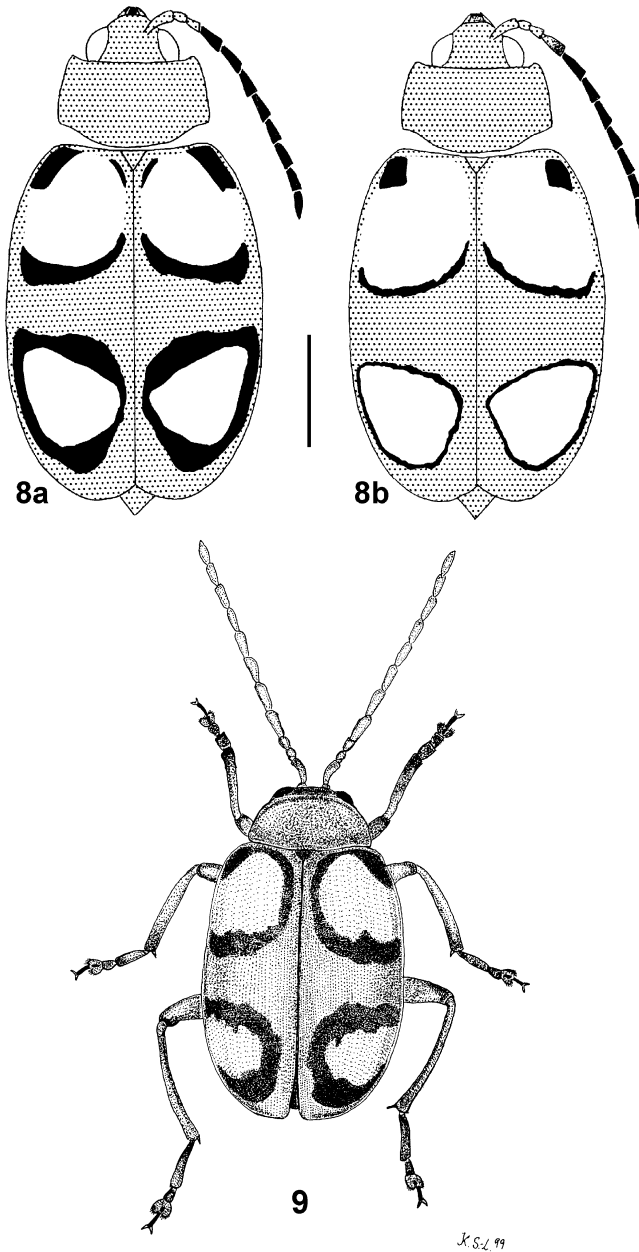


Figures 4–5. External morphology of *Monolepta bioculata* (Fabricius, 1781). (4) Prothorax; a: dorsal; b: ventral (hm: hypomeron, pst: prosternum; pstpr: prosternal processus). (5) Meso- and metathorax, ventral view (msem: mesepimeron, msep: mesepisternum, msst: mesosternum, mtcx: metacoxa, mtem: metepimeron, mtep: metepisternum, mtst: metasternum).



Figures 6–7. External morphology of *Monolepta bioculata* (Fabricius, 1781). (6) Legs; a: prothoracic, b: mesothoracic, c: metathoracic. (7) Hindwing, left, dorsal view (A: analis, Cu: cubitus, M: media, R: radius, Sc: subcosta, rt: radial triangle, rm: cross vein).

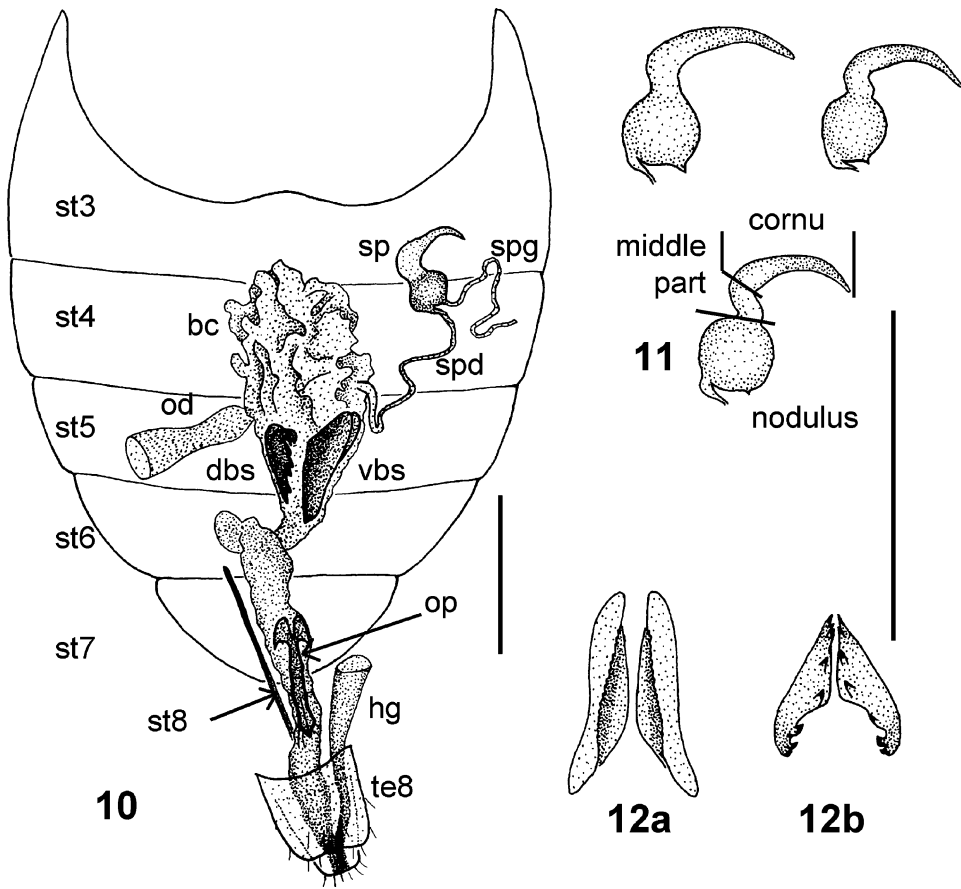
examined, tibia black. Hindwings fully developed, venation like Figure 7. Elytra ovate, broad (Figure 8); elytral length 4.10–4.70 mm (0: 4.43 mm), maximal width of both elytra 2.90–3.30 mm (0: 3.09 mm), maximal width of elytra to length of elytron 0.67–0.72 (mean: 0.70), greatest elytral width in the middle. Elytra yellow to brownish-red, each with two large yellow spots which usually have (in 70% of material examined) broad black margins which are incomplete at the basal spot (Figure 8a); in some specimens the black margins are very narrow (Figure 8b) but at least at the humerus with a significant black spot (Figures 8 and 9).



Figures 8–9. External morphology of *Monolepta bioculata* (Fabricius, 1781). (8) Dorsal colour patterns (white: yellow, dot-shaded: red, black: black). (9) Habitus.

Abdomen. Reddish-brown, rarely dark brown to black.

Female genitalia (overview Figure 10). Spermathecal cornu slender, slightly curved, middle part short, nodulus spherical, large (Figure 11). Ventral part of bursa sclerites slender, finely undulate at outer margins (Figure 12a), dorsal pair triangular, hooked at base



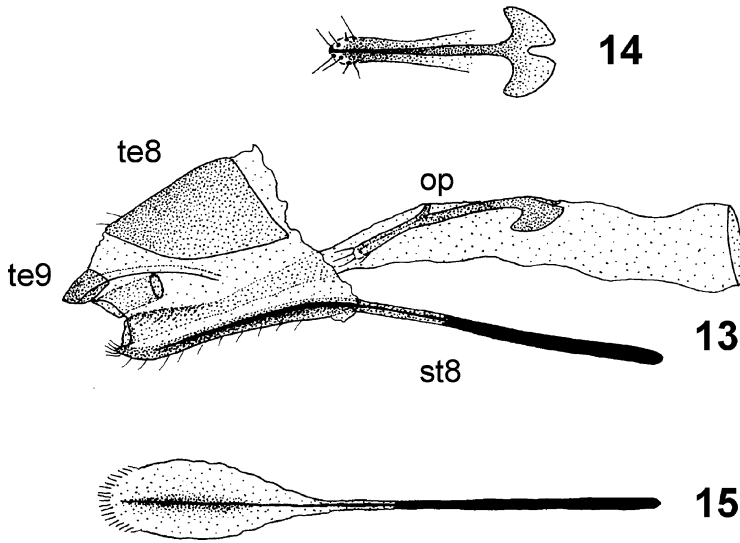
Figures 10–12. Genital morphology of *Monolepta bioculata* (Fabricius, 1781), female. (10) Overview, from dorsal, tergites 1–7 removed (bc: bursa copulatrix, dbs: dorsal bursa sclerite, hg: hind gut, op: ovipositor, sp: spermatheca, spd: spermathecal duct, spg: spermathecal gland, st3–8: sternites, te8: 8th tergite, vbs: ventral bursa sclerite. (11) Spermatheca of three different females showing variation. (12) Bursa sclerites, view from inner side; a: ventral, b: dorsal.

(Figure 12b), ovipositor with slender vaginal palps (Figures 13 and 14), eighth sternite spatula-like with a row of bristles at apex (Figures 13 and 15).

Male genitalia (overview Figure 16). Seventh sternite with two deep incisions at apex (Figure 17). Median lobe straight, slightly conical, rounded at apex (Figure 18a), dorso-ventrally compressed (Figure 18b). Tectum broad, short, not reaching the apex of the median lobe (Figure 18a). Endophallus with three distinct types of spiculae: ventral endophallic spiculae small, comb-like; median spiculae long, slender, straight; lateral spiculae slender, with claw-like small spine medially. During copulation the endophallic sac is extruded outside the median lobe and spiculae turned inside out (Figure 19).

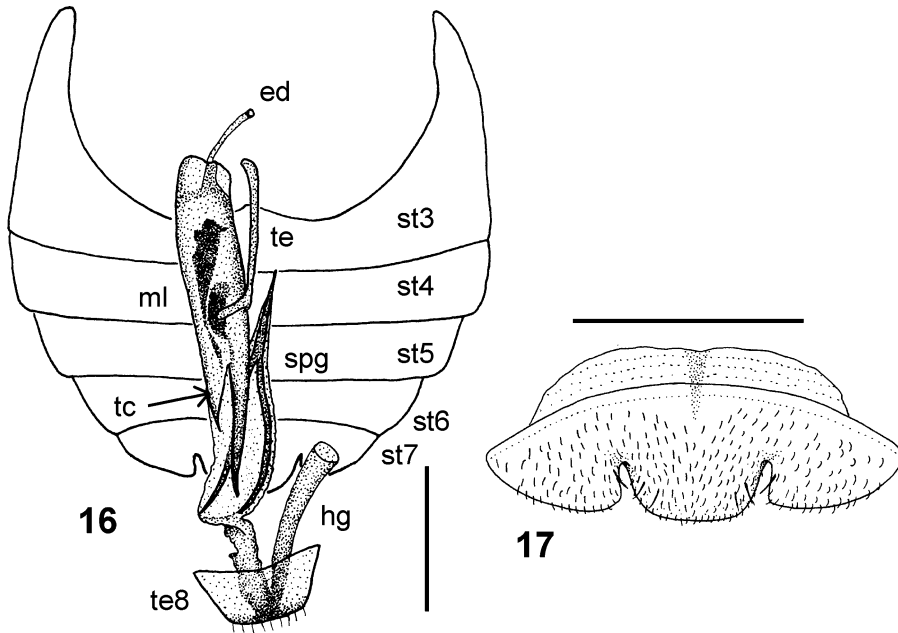
Diagnosis

Monolepta bioculata can be easily distinguished from all other *Monolepta* species by its peculiar colour pattern of two ovate eye-like, yellow, black margined spots on each elytron.

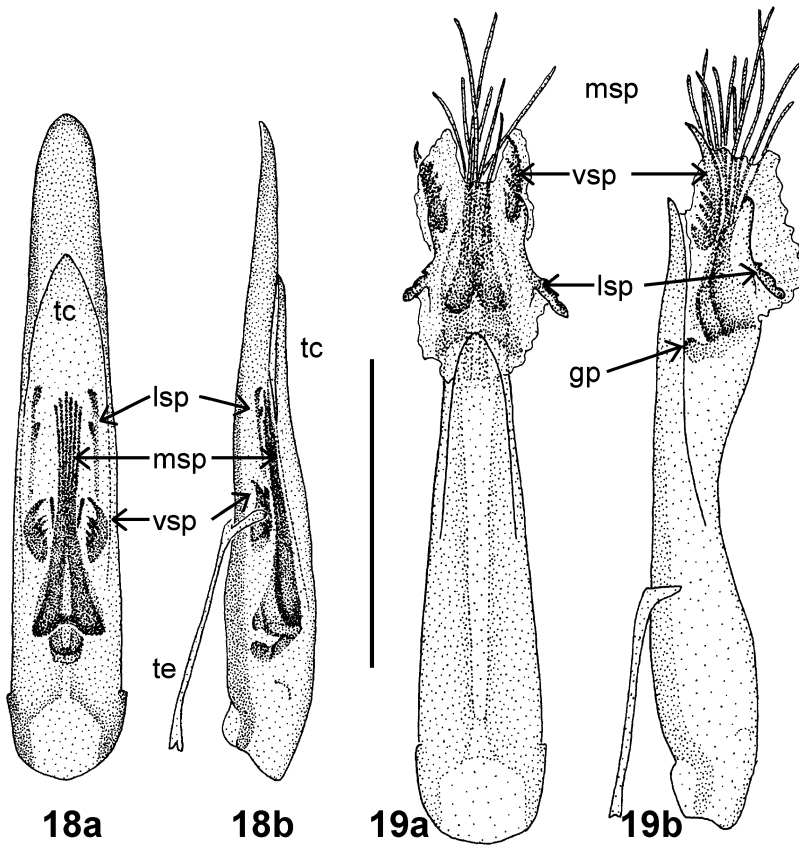


Figures 13–15. Genital morphology of *Monolepta bioculata* (Fabricius, 1781), female. (13) Abdominal tip in lateral view (abbreviations see Figure 10). (14) Opivisor, view from inner side. (15) Eighths sternite, view from inner side.

It could be confused with two other species: *M. zambesiana* Jacoby, 1906 occurring sympatrically with *M. bioculata* in northern South Africa. This species also has yellow, black margined elytral spots, but those are elongated or stripe-like. Furthermore, this species has



Figures 16–17. Genital morphology of *Monolepta bioculata* (Fabricius, 1781), male. (16) Overview from dorsal, tergites 1–7 removed (ed: ductus ejaculatorius, hg. hind gut, ml: median lobe, spg: Spiculum gastrale, tc: tectum, te: tegmen, te8: 8th tergite). (17) Seventh sternite.



Figures 18–19. Genital morphology of *Monolepta bioculata* (Fabricius, 1781), male. (18) Median lobe, endophallus inverted, a: dorsal, b: lateral (with tegmen); lsp: lateral endophallic spiculae, msp: median endophallic spiculae, vsp: ventral endophallic spiculae. (19) Median lobe, endophallus partly extruded, a: dorsal, b: lateral (with tegmen); gp: gonoporus, further abbreviations see Figure 18.

no black apical antennomeres, a more elongated third antennomere (length of second to third antennomere: 0.75–0.81; *M. bioculata*: 0.83–1.00), and a much narrower pronotum (pronotal length to width: 0.58–0.63; *M. bioculata*: 0.51–0.55). *Monolepta laboissierei* Wagner, 2001b is also similar, but allopatrically distributed in relation to *M. bioculata*, being known from northern Democratic Republic of Congo to Zambia. It also has two ovate, black margined spots on each elytron, but those spots are smaller and the margins broader than in *M. bioculata*, and it can be also distinguished by its very slender median lobe and the shape of the bursa sclerites. All the other approximately 100 known valid species of afrotropical *Monolepta* have very differently coloured elytra. They can be uniformly yellow, red or black, sometimes with the apex of a different colour, or the elytra can bear black or red transverse bands or a black suture, margins and a median transverse band forming a cross-like pattern.

Distribution

Only known from some parts of the Republic of South Africa, particularly abundant in the Cape Provinces (Figure 20).



Figure 20. Distribution of of *Monolepta bioculata* (Fabricius, 1781).

Ecology

Some specimens were collected when feeding on, sometimes “damaging”, lemon leaves (*Citrus spec.*, Rutaceae), in one case feeding on buds and flowers of *Rumex angiocarpus* (Polygonaceae), bud and flowers of *Cyclopia maculata* (Fabaceae), and flowers of *Sporobolus pyramidalis* (Poaceae) was recorded, a few others were collected on flowers without detailed plant identification.

Type material

Crioceris bioculata Fabricius, 1781

Lectotype: ♀ “*Crioceris 2-oculata*, Fabr. Sp. Ins. n. 27”, Banks coll. (BMNH); examined; herein designated. Paralectotype: a second female specimen without any original label from the Banks collection.

Chrysomela quadrimaculata Goldfuß, 1805

A type specimen is not available, but a colour illustration is provided in the original description which clearly indicates the species’ identity.

Monolepta tricolor Fairmaire, 1888

Holotype: ♀ “Ovambo, Schirn/Ex Museo L. Fairmaire 1883” (MNHN); examined.

Further material examined: South Africa: 2 ex., coll. Chevrolat (BMNH); 7, Süd-Afrika, Penther (NHMW); 17 ex., coll. Chapuis (IRSN); 29 ex., Cap, coll. Kraatz (DEI); 9 ex., Cap (MMUE); 5 ex., Cap bon. Sp. [Cap Bona Spei=Cape of Good Hope] (MNHN); 8 ex., Pr. B. Sp. [dto.] (MNHU); 3 ex., C. Bon. Spei, Baly coll. (BMNH); 4 ex., Cape (BMNH); 1 ex., C.G.H. (BMNH); 2 ex., Cap, Frisch, ex coll. J. Weise (MNHU); 8 ex., Pr. b. Sp., Lichtenst. (MNHU); 7 ex., C. Bon. Spei., Mus. Murray, Fry coll. (BMNH); 2 ex., Mus. Westermann, Cap. B. Sp. (ZMUC); 10 ex., Cap. B. sp., Severtsen (ZMUC); 1 ex., Prom. B. sp. (ZISP); 1 ex., Cap. B. Sp. (ZISP); 9 ex., Cap. B. Spei, Victorin (NHRS);

5 ex., Cap. B. Spei, Wahlberg (NHRS); 4 ex., Kapstadt, 33.56S/18.28E (MNHN); 1 ex., Kapstadt (NHMW); 7 ex., Kapstadt, Dr. Martin (3 ex. MNHN, 2 ex. SAMC, 2 ex. ZFMK); 1 ex., Kapstadt, Raffray (MNHN); 1 ex., Cape Town, Dr. Purchell (SAMC); 1 ex., Cape Town, H. Roberts coll. (BMNH); 1 ex., Cap, "*Luperodes bioculatus* F." (ZISP); 2 ex., Dicken (NHRS); 10 ex., Cap, v. Hosttolk (?) (RMNH); 1 ex., Capland, coll. Geitner (HNHM); 1 ex., Bredasdorp, Transvaal, coll. Veth (RMNH); 1 ex., H. R. Transvaal, coll. Veth (RMNH); 1 ex., Transvaal (MNHU); 1 ex., Natal (BMNH); 1 ex., Majuba, 32.48S/27.23E, Wattens & Donkaster (MNHU); 12 ex., Zoutpansburg, 28.10S/32.15E, Distant coll. (BMNH); 11 ex., East London, 33.00S/27.54E, ex coll. Breuning (MRAC); 2 ex., Hopefield, 33.05S/18.20E, 1885, F. Barkmann (MNHU); 1 ex., Bloemfontein, 29.07S/26.14E, VI.1896, Pöhl (IRSN); 2 ex., Karoo, X.1896, C. G. H. (SANC); 7 ex., Wynberg, 28.31S/27.01E, 1896, IX.1898, J. P. Ciegare (?) (MNHN); 2 ex., Talbagh (?), Lightfort, 1902 (SAMC); 1 ex., Kapstadt, Fischhoek, VII.1903, Vanhoffen (MNHU); 9 ex., Wynberg, XI.1904, Gakin (BMNH); 1 ex., Table Mts., VIII.1905, G. A. K. Marshall (BMNH); 3 ex., Table Mt., 1906–167, W. Bevins (BMNH); 6 ex., Stellenbosch, 33.56S/18.51E, 1908, L. C. Blundell (OUMNH); 2 ex., Wynberg, IV.1915, R. Smit (SANC); 14 ex., Noordhoek, 29.50S/26.14E, X.1914, Andreae (DEI); 1 ex., Witzenberg Vall., 33.19S/19.14E, 1000 m, I.1921, R. E. Turner (BMNH); 2 ex., Ceres, 33.23S/19.19E, 500 m, I.–II.1921, R. E. Turner (BMNH); 2 ex., Stellenbosch, VIII.1921, Ch. K. Brain (BMNH); 1 ex., George, 33.57S/28E, XI.1921, R. E. Turner (BMNH); 4 ex., George, XI.1931, J. Ogilvie (BMNH); 1 ex., Kirstenbosch, 33.59S/18.26E, XI.1931, Miss A. Mackie (BMNH); 1 ex., Ceres, II.1932 (BMNH); 3 ex., Huguenot, 31.05S/26.36E, II.1932, L. Ogilvie (BMNH); 3, Omgv. Kaapstad, IX.1939, Dr. L. D. Brongersma (RMNH); 2 ex., Cape Town, XI.1938, A. H. Newton pres. (BMNH); 2 ex., Cape, IX.1940, C. J. Joubert, S. E. Coll. Agric. (SANC); 14 ex., Cape Prov., Zeekoevlei Cape Flats, 34.40S/20.03E, XI.1949, R. A. Maas Geesteranus (RMNH); 1 ex., Wolseley, 33.24S/19.12E, III.1961, A. Boomzaaijer (SAMC); 1 ex., 5–10 miles NW of Seven weeks Poort, V.1964, SA Museum exp. (SAMC); 3 ex., Storms River Mouth, 33.59S/23.52E, X.1964, A. L. Capener (SANC); 1 ex., Bettysboa, IX.1969, D. J. Rust (SANC); 1 ex., Hout Bay, 34.03S/18.21E, V.1970, M. J. Russell (BMNH); 2 ex., Elim, 34.36S/19.45E, I.1971, M. W. Strydom (SANC); 2 ex., Stormsvlei, 34.05S/20.05E, II.1971, M. W. Strydom (SANC); 1 ex., Worcester, IX.1973, 33.39S/19.25E, "singled on flowers", L. Schulze (TMSA); 1 ex., Nuweberg, XI.1973, 34.00S/19.06E, "water plankton", S. Endrödy-Younga (TMSA); 2 ex., George, 33.58S/22.28E, I.1979, S. J. v. Tonder (SANC); 1 ex., Plettenbergbay, C.P., 34.03S/23.23E, I.1979, S. J. v. Tonder (SANC); 3 ex., Knyena, 34.02S/23.03E, I.1979, S. J. v. Tonder (SANC); 2 ex., Uniondale, 33.39S/23.07E, I.1979, C. Kok, S. J. v. Tonder (SANC); 1 ex., Kommetsie, VIII.1979, A. J. Prins (SAMC); 6 ex., Clarens, 28.32S/28.28E, II.1980, W. A. Harrop, C. Kok, S. J. v. Tonder (SANC); 4 ex., Natal, Nottingham Road, 29.22S/29.59E, I.1981, S. J. v. Tonder & C. Kok (SANC); 1 ex., Underberg, 29.47S/29.30E, XI.1981, S. J. v. Tonder & C. Kok (SANC); 1 ex., Knysna, 34.02S/23.03E, XI.1983, G. L. Prinsloo & N. C. Grobbelaar (SANC); 5 ex., Abrahamskraal, 33.14S/18.09E, XI.1983, gras netting, S. Endrödy-Younga (TMSA); 11 ex., Cape Town, 33.56S/18.28E, VI.1984, G. Tribe, "feeding on lemon leaves" (SANC); 2 ex., Sederberg, XI.1984, G. L. Prinsloo (SANC); 4 ex., Saasveld nr. George, 33.57S/22.35E, II.1985, W. Brytenbach (SANC); 9 ex., Vyeboom nr. Grabouw, 34.04S/19.07E, IX.1985, S. Nesor, feeding on buds and flowers of *Rumex angiocarpus* (SANC); 1 ex., Nieuwoudtville, 31.23S/19.06E, IX.1985, "flow. vegetation", S. Endrödy-Younga (TMSA); 10 ex., Stellenbosch, C. P., 30.56S/18.52E, II.1986, A. Schwartz, "damaging grape leaves" (SANC); 2 ex.,

Kirstenbosch Botanical Gardens, C. P., 33.59S/18.26E, V.1987, M. G. Wright (SANC); 7 ex., Tzitzikama Pt., Cape Provinz, VIII.1987, G. Minet (NHMB); 4 ex., Algeria Forest Res., 25 km NW of Cederberg, 32.11S/19.00E, IV.1989, J. Strazanac coll. (BPBM); 1 ex., Kirstenbosch, IX.1989, W. Wittmer (NHMB); 4 ex., Rietvlei, NW Cape Town, 33.50S/18.30E, III.1990, C. J. Ciliers (SANC); 3 ex., Kapstadt, Bot. Garten, X.1991, U. Göllner (MNHU); 4 ex., De Hoop NR, 34.27S/20.24E, XI.1993, J. Deckert, F. Koch, M. Uhlig (MNHU); 9 ex., Skaife, 34.16S/18.23E, IV.1995, U. Göllner (MNHU); 2 ex., Malmsbury Caravan Park, 33.28S/18.44E, IX.1999, A. Glanvill “collected on Asteraceae” (SANC); 1 ex., Genadendal, 34.02S/19.33S, VIII.2000, M. Knipe, “On Honeybush Tea shrubs in full bud, some flowering *Cyclopia maculata* (Fabaceae)” (SANC); 1 ex., Hermanus, 34.23S/19.13E, 76 m, II.2002, A. Witt & H. Oberholzer, “collected as adult (pootering) from flowering *Sporobolus pyramidalis* (Poaceae) (SANC); 2 ex., George, 33.59S/22.26E, 206 m, II.2002, A. Witt & H. Oberholzer, “collected as adult (pootering) from flowering *Sporobolus pyramidalis*” (Poaceae) (SANC).

Phylogenetic considerations

Following the completion of the taxonomic revision of several groups of afrotropical galerucines, first studies on their phylogenetic relationships have been carried out based on morphological characters (Wagner 2004). Forty-four species analysed with 14 genitalic characters and 20 characters based on external morphology are included in the analysis, using maximum parsimony (for details of character coding and matrix see Wagner 2004). About 10% of the valid afrotropical species of *Monolepta* and *Bonesioides* and about 50% of *Candezea*, *Afrocrania*, and *Afromaculepta* species have been included with species of other genera originally placed in “Monoleptites”. Furthermore, some short-legged Galerucinae, *Exosoma lusitanicum* (Linnaeus), *Exosoma politum* (Jacoby) and *Oides humeralis* Gahan, the latter as the outgroup, have been included. Results are presented as a strict consensus tree (Figure 21).

The traditional delimitation of *Monolepta*, *Candezea* and *Barombiella* has resulted in polyphyletic groups. Also “Monoleptites” is polyphyletic, since an elongated metatarsus has evolved more than once in the Galerucinae. Genitalic characters, in particular, reveal a much better generic delimitation. The monophyly of *Monolepta* s. str. is based on two synapomorphies, two pairs of strongly sclerotized bursa sclerites, and the presence of three distinct types of endophallic spiculae. Other important diagnostic genitalic characters are the large and spherical spermathecal nodulus, the short tectum of the median lobe, and the second and third antennomeres of approximately the same length. At least one external character, the relative length of the second and third antennomere, might be apomorphic for *Monolepta*, but until the revision is completed, this statement is preliminary. However, this character has a high diagnostic value. All taxa with significantly elongated third antennomeres (length of second to third antennomere: 0.45–0.80) need to be transferred to other genera, in particular all taxa with partly or entirely metallic dorsal colour (see identification key below).

The genus *Chimporia* was established for those “Monoleptites” having an exceptionally wide pronotum. However, despite this conspicuous character, the genitalic structures clearly reveal affiliation to *Monolepta*.

The number of Afrotropical species of *Candezea* was reduced from 39 to only eight valid species (Wagner & Kurtscheid 2005). In the cladogram the four species involved in the analysis cluster as a paraphyletic group together with *Afrocandezea* and *Afrocrania* as a

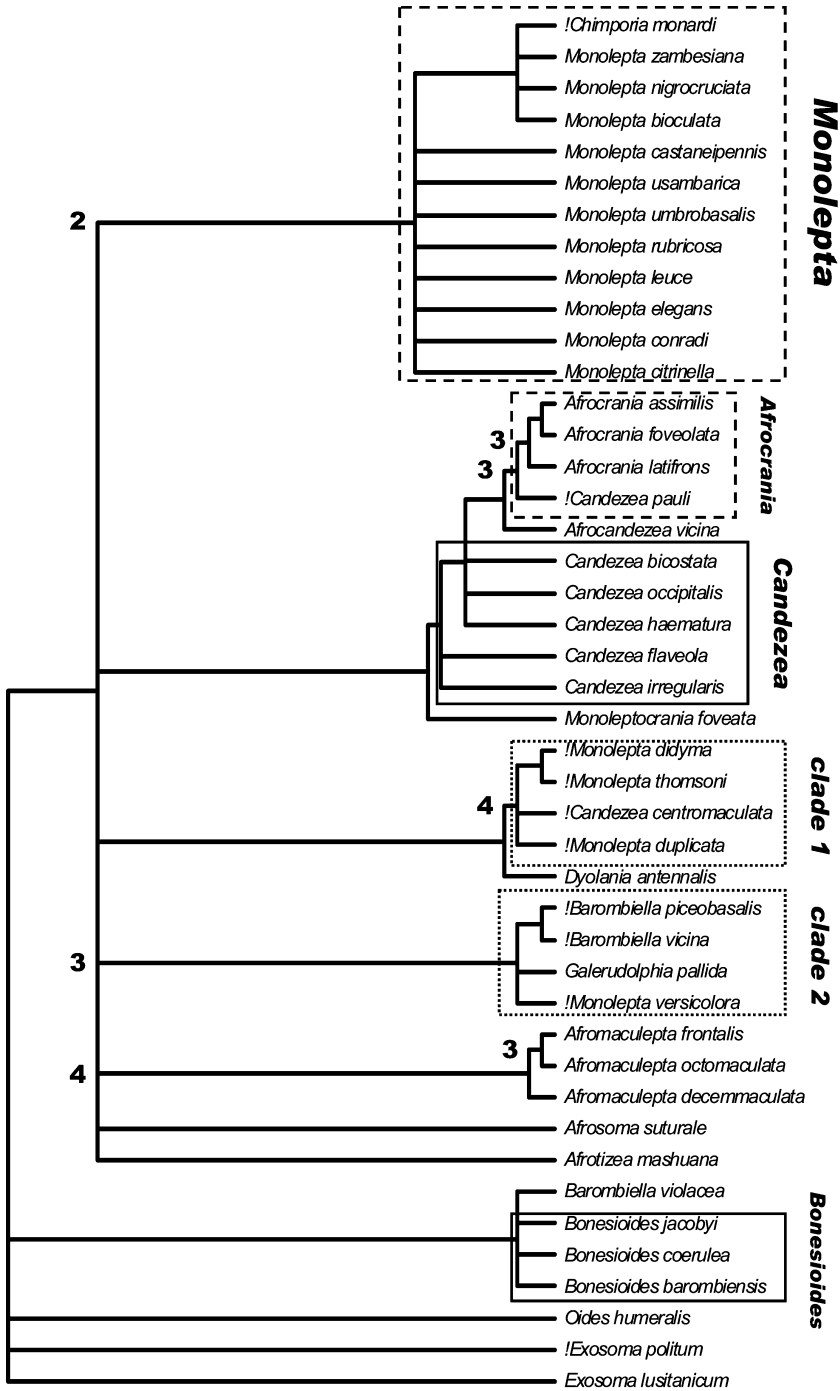


Figure 21. Strict consensus tree with Bremer support indices (>1); tree length: 274, CI: 0.33, RI: 0.70. Taxa which original generic allocations are not concordant with the phylogenetic relationships indicated by exclamation marks.

terminal taxon (Figure 21). These taxa are in particular characterized by an apically incised tectum of the median lobe, and the form of the endophallic armature. However, the phylogenetic position of *Candezea* cannot be fully resolved with the available data. The analyses of these groups need to be pursued with an extended set of characters when the taxonomic revision of all *Afrocrania* and *Afrocandezea* species is completed.

“Clade 1” comprises a well-supported group of species originally described in *Monolepta* and *Candezea*, which are phylogenetically very remote from the type species of those genera. This clade is characterised by several autapomorphies (see Wagner 2004) and the species will be redefined under a new genus name in the near future (Wagner in prep.). The character pattern is most similar to *Dyolania antennalis*, the type of *Dyolania* Laboissière 1931b, a genus which was synonymized with *Luperodes* Motschulsky, 1858 by Wilcox (1973), but is not congeneric and need to be re-established. A revision on this group is in preparation.

As well as recently described species, *Afromaculepta* includes additional taxa originally described in *Monolepta*. The introduction of this new genus (Hasenkamp & Wagner 2000) as a monophyletic group is well justified by several apomorphies, indicated by a high Bremer support index. Some of the apomorphic characters also have a high diagnostic value, such as the yellow and black elytra having small, symmetrically arranged spots, and the peculiar type of endophallic spiculae which bear rows of spines.

Bonesioides is not closely related to any other taxon named above. Species of this genus have a very different external appearance, metallic blue or metallic green head and thorax, and most species with metallic dorsum originally placed in *Monolepta* have been recently transferred to this genus (Freund & Wagner 2003). Species of this group show a wide variation in the form of the basi-metatarsus.

A further group, which is not yet named (“clade 2”), includes taxa with short- and long-legged Galerucinae. This clade comprises typical species of *Galerudolphia*, which has been revised recently (Bolz & Wagner 2005). One important external character of “clade 2” is the trapezoidal pronotum, which is typical for *Barombiella*. After revision, this genus turned out as monotypic, and since *Barombiella violacea* with its overall metallic colouration is closely related to *Bonesioides*, the non-metallic coloured species of *Barombiella* and several species formerly described in *Monolepta* which are also characterised by a strongly trapezoidal pronotum need to be excluded from these taxa.

Identification key for Afrotropical Galerucinae with elongated basi-metatarsus

The following key can be used for all recently revised or newly described genera of afrotropical Galerucinae with an elongate basi-metatarsus, including some species of *Bonesioides* and *Galerudolphia*, which have short basi-metatarsi. Since the revision of all species is not yet completed this key is provisional. Checking of genital characters of both sexes is usually necessary. Specimens having genitalia which do not fit to the structures mentioned below should be excluded.

- 1. At least parts of head, pronotum or elytra metallic blue or green; in most species dorsum entirely metallic blue or green; median lobe broad, less than 3.5x longer than broad at orifice 2
- Without any metallic colour; median lobe slender, more than 4x times longer than broad at orifice 3

Downloaded by [University of Bath] at 12:05 13 February 2014

2. Legs yellow to brownish-yellow, antennomeres very slender, pronotum very broad, strongly trapezoidal (pronotal length to width 0.39–0.49); endophallus without spiculae ***Barombiella*** (1 species)
 - Legs brown or black, antennomeres shorter, pronotum narrower (pronotal length to width 0.54–0.58), posterior pronotal angles less protruding; endophallus with two or three asymmetric endophallic spiculae ***Bonesioides*** (21 species)
3. Second and third antennomeres subequal in length (length of second to third antennomere 0.75–1.20); endophallus with three distinct types of spiculae (cf. Figures 18 and 19) or with two pairs of spiculae carrying rows of spines or two distinct types of spiculae in three separated portions 4
 - Third antennomere much longer than second (length of second to third antennomere 0.45–0.80); endophallus without or with spiculae, if spiculae present they are of one type only, or if two distinct types, but than spiculae are not arranged in three separated portions 6
4. Elytra with symmetrically arranged small black spots ***Afromaculepta*** (6 species)
 - Elytra without such symmetrically arranged spots 5
5. Endophallus with three distinct types of spiculae, median spiculae slender, second and third antennomeres subequal in length (length of second to third antennomere 0.80–1.20) ***Monolepta*** (ca. 100 species)
 - Endophallus with large claw-like median spiculae and two separate groups of bristle-like spiculae in the apical half, third antennomere slightly longer than second (length of second to third antennomere 0.75–0.95) ***Afronaumannia*** (5 species)
6. Very large, 8.8–9.9 mm ***Afromegalepta*** (1 species)
 - Total length less than 8.5 mm 7
7. Small, 2.4–4.9 mm, pronotum broad at base, trapezoidal, elytra usually slender (width of both elytra together to length of elytron 0.39–0.75), uniformly yellow, with or without black suture and margins, never with transverse black bands, legs short (length of basi-metatarsus to metatibia 0.34–0.50); median lobe without endophallic spiculae, deeply incised at apex ***Galerudolphia*** (15 species)
 - Total length 4.2–8.1 mm, pronotum rectangular or significantly narrowed in the basal third (heart-like), elytra usually broader (width of both elytra to length of elytron: 0.57–0.75), legs usually much longer (length of basi-metatarsus to metatibia more than 0.50); median lobe with endophallic spiculae, apex of median lobe not incised 8
8. Elytra very narrow (width of both elytra to length of elytron 0.57–0.62); males often with complex sexual dimorphic structures on frons, basal antennal articles or elytra; median lobe ventrally with one pair of spurs in the middle ***Afrocrania*** (16 species)
 - Elytra broader (width of both elytra to length of elytron 0.62–0.86); males without those complex sexual dimorphic structures at frons, antenna or elytra; median lobe ventrally without spurs 9
9. Tibiae and tarsi black, femora contrasting yellow; median lobe very slender, sigmoid in lateral view, endophallus with many small, short spiculae ***Afrotizea*** (1 species)

- Femora, tibiae and tarsi concolorous, if occasionally contrasting, femora black and tibiae yellow; endophallus with one to three pairs of strong spiculae 10
- 10. Larger, 5.7–8.1 mm; elytra comparatively slender (width of both elytra to length of elytron: 0.62–0.70) *Candezea* (8 species)
- Smaller, 4.2–6.7 mm, if total length more than 5.5 mm elytra much broader 11
- 11. Males with deep cavity on vertex; median lobe arrow-like at apex; with one pair of curved endophallic spiculae, without spiculae protruding outside the median lobe *Monoleptocrania* (1 species)
- Males without cavity on vertex; median lobe parallel-sided at apex; two or three pairs of endophallic spiculae, and one pair of fixed spiculae protruding outside the median lobe. *Afrocandezea* (15 species)

Acknowledgements

Many thanks to all colleagues, who are named in the material examined section, who made specimens available to me; Katharina Schmidt-Loske for the drawing of the habitus of *Monolepta bioculata* (Figure 9). Financial support for these studies was partly provided by Deutsche Forschungsgemeinschaft (Wa 1393/3–2).

References

- Allard E. 1889. Nouvelle note sur les Phytophages. *Compte Rendu de la Société Entomologie de Belgique* 33:102–117.
- Bolz H, Wagner T. 2005. Revision of *Galerudolphia* from tropical Africa (Coleoptera, Chrysomelidae, Galerucinae). *Insect Systematics and Evolution* 35:361–400.
- Bryant GE. 1938. Two new injurious Phytophaga from Nyasaland (Coleopt.) *Proceedings of the Royal Entomological Society of London (B)* 7:88.
- Bryant GE. 1953. New species of Chrysomelidae (Galerucinae) from East Africa. *Annals and Magazine of Natural History, Ser 16*:864–870.
- Chapuis F. 1875. Famille des Phytophages. In: Lacordaire JT, editor. *Histoire naturelle des insectes, Genera des Coléoptères*. Vol. 11, Paris.
- Chapuis F. 1879. Phytophages Abyssiniens du musée civique d'histoire naturelle de Gènes. *Annali di Museo Civico Storia Naturale Genova* 15:5–31.
- Chevrolat LAA. 1837. *Monolepta*. In: Dejean P, editor. *Catalogue des Coléoptères de la collection de M. le Comte Dejean*. Vol. 5, 3rd ed. Paris, p. 409.
- Chevrolat LAA. 1849. Galérucites. In: D'Orbigny Ch, editor. *Dictionnaire Universel d'Histoire Naturelle* 6, Paris, p 4–6.
- Erichson WF. 1843. Beitrag zur Insecten-Fauna von Angola. *Archiv für Naturgeschichte* 9:199–267.
- Fabricius JCh. 1781. *Species Insectorum I*, Hamburg & Kiel, p. 154.
- Fairmaire L. 1888. Enumération des Coléoptères recueillis par M le Dr Hans Schinz dans le sud d'Afrique. *Annales de la Société Entomologie de France* 8:173–202.
- Freund W, Wagner T. 2003. Revision of *Bonesioides* LABOISSIÈRE, 1925 (Coleoptera; Chrysomelidae; Galerucinae) from continental Africa. *Journal of Natural History* 37:1915–1976.
- Gemming M, Harold Ev. 1876. Chrysomelidae. In: *Catalogus Coleopterorum locusque descriptorum synonymicus et systematicus*, Monachus, Paris & London, p 3479–3676.
- Goldfuß GA. 1805. *Enumeratio Insectorum Eleutheratorum*, Erlangen, p. 42.
- Hasenkamp R, Wagner T. 2000. Revision of *Afromaculepta* gen. n., a monophyletic group of Afrotropical galerucinae leaf beetles (Coleoptera: Chrysomelidae). *Insect Systematics and Evolution* 31:3–26.
- Jacoby M. 1903. Descriptions of new genera and species of phytophagous Coleoptera. *Stettiner Entomologische Zeitung* 64:292–336.
- Jacoby M. 1906. Descriptions of new genera and species of African Halticinae and Galerucinae. *Transactions of the Entomological Society of London* 1906:25–51.

- Laboissière V. 1919. Descriptions d'espèces nouvelles de Galerucini de l'Afrique occidentale (Col., Chrysomelidae). *Annales de la Société Entomologique de France* 88:321–327.
- Laboissière V. 1925. Supplément au *Catalogus Coleopterorum*, pars 78 (Galerucinae), de J. Weise, précédé de remarques sur la classification des Galerucini. *Encyclopédie Entomologique* 1:33–62.
- Laboissière V. 1931a. Galerucini (Coleoptera, Chrysomelidae) d'Angola. *Revue Suisse de Zoologie* 38:405–418.
- Laboissière V. 1931b. Galerucini africains nouveaux ou peu connus de la collection du Deutsches Entomologisches Museum. *Wiener Entomologische Zeitung* 48:42–57.
- Middelhaue J, Wagner T. 2001. Revision of *Afrocrania* (Coleoptera: Chrysomelidae, Galerucinae). Part I: Species in which the males have head cavities or extended elytral extrusions. *European Journal of Entomology* 98:511–531.
- Motschulsky V. 1858. *Entomologie speciale. Insectes des Indes orientales. Etudes Entomologiques* 7:20–105.
- Reiche L. 1847. Voyage en Abyssinie par M. M. Ferret et Galinier. *Entomologie*, Paris, p 402–404.
- Schmitz J, Wagner T. 2001. *Afromegalepta* gen. nov. from tropical Africa (Coleoptera: Chrysomelidae, Galerucinae). *Entomologische Zeitschrift* 111:283–286.
- Seeno TN, Wilcox JA. 1982. Leaf beetle genera (Coleoptera: Chrysomelidae). *Entomography* 1:1–221.
- Stapel H, Wagner T. 2000. Revision of *Monoleptocrania* Laboissière, 1940 (Coleoptera, Chrysomelidae, Galerucinae). *Mitteilungen des Internationalen Entomologischen Vereins* 25:137–145.
- Stapel H, Wagner T. 2001. *Afrotizea* gen. n. from tropical Africa (Coleoptera, Chrysomelidae, Galerucinae). *Beiträge zur Entomologie* 51:365–373.
- Steiner I, Wagner T. 2005. *Afronaumannia* gen. nov., a new monophyletic group of leaf beetles from Africa (Coleoptera: Chrysomelidae, Galerucinae). *Entomologische Zeitschrift* 115:15–24.
- Wagner T. 1999a. Arboreal chrysomelid community structure and faunal overlap between different types of forests in Central Africa. In: Cox ML, editor. *Advances in Chrysomelidae Biology*. Leiden: Backhuys Publishers. p 247–270.
- Wagner T. 1999b. An introduction to the revision of afro-tropical *Monolepta* and related taxa (Chrysomelidae, Coleoptera). In: Waloßek D, editor. *Systematik im Aufbruch. Tagungsband zur ersten Jahrestagung der Gesellschaft für Biologische Systematik in Bonn vom 17–19 September 1998*, Courier Forschungsinstitut Senckenberg 215, Frankfurt, p 215–220.
- Wagner T. 2000. Revision of afro-tropical *Monolepta* species (Coleoptera, Chrysomelidae, Galerucinae). Part I: Species with red and black coloured elytra, pronotum and head, with description of new species. *Entomologische Zeitschrift* 110:226–237.
- Wagner T. 2001a. Revision of Afro-tropical *Monolepta* Chevrolat, 1837 (Coleoptera: Chrysomelidae, Galerucinae). Part II: Species with red elytra, pronotum and elytra, with descriptions of new species. *Bonner Zoologische Beiträge* 50:49–65.
- Wagner T. 2001b. New *Monolepta* species (Coleoptera, Chrysomelidae, Galerucinae) from Central and Southern Africa. *Entomologische Blätter* 96:199–210.
- Wagner T. 2002. Revision of Afro-tropical *Monolepta* species (Coleoptera, Chrysomelidae, Galerucinae). Part III: Species with red elytra and yellow prothorax, including description of new species. *Deutsche Entomologische Zeitschrift* 49:27–45.
- Wagner T. 2003a. Present status of a taxonomic revision of afro-tropical *Monolepta* and related groups (Galerucinae). In: Furth DG, editor. *Special Topics in Leaf Beetle Biology. Proceedings V. International Symposium on the Chrysomelidae, Foz do Iguacu 2000*. Sofia: Pensoft. p 133–146.
- Wagner T. 2003b. Revision of afro-tropical *Monolepta* Chevrolat, 1837 (Coleoptera, Chrysomelidae, Galerucinae) – Part IV: Species with red head and thorax and black elytra or black elytra with red apex, with description of new species. *Annales Sciences Zoologiques, Miscellanea* 49:37–89.
- Wagner T. 2004. Phylogeny of Afro-tropical *Monolepta* and related taxa (Galerucinae). In: Jolivet P, Santiago-Blay JA, Schmitt M, editors. *New Developments in the Biology of Chrysomelidae*. The Hague: Academic Publishing. p 75–84.
- Wagner T. 2005. Revision of the vincta Species-group of *Monolepta* Chevrolat, 1837 from Africa, Arabia and the near East (Coleoptera, Chrysomelidae, Galerucinae). *Bonner zoologische Beiträge* 53:255–282.
- Wagner T, Freund W. 2003. Revision of *Barombiella violacea* (Jacoby, 1984) (Coleoptera: Chrysomelidae, Galerucinae). *Entomologische Zeitschrift* 113:258–262.
- Wagner T, Kurtscheid A. 2005. Revision of *Candezee* from continental Africa (Coleoptera, Chrysomelidae, Galerucinae). *Journal of Natural History* 39:2591–2641.
- Wagner T, Scherz X. 2002. *Afrocandezee* gen. nov. from tropical Africa (Coleoptera: Chrysomelidae, Galerucinae). *Entomologische Zeitschrift* 112:357–362.
- Weise J. 1892. Chrysomeliden und Coccinelliden von der Insel Nias, nebst Bemerkungen über andere, meistens südostasiatische Arten. *Deutsche Entomologische Zeitschrift* 1892:385–400.

- Weise J. 1902. Synonymische Bemerkungen. *Deutsche Entomologische Zeitschrift* 1902 404.
- Weise J. 1909. Coleoptera. Chrysomelidae und Coccinellidae. In: Sjöstedt Y, editor. *Wissenschaftliche Ergebnisse der Schwedischen Zoologischen Expedition nach Kilimandjaro, dem Meru und den umgebenden Massaissteppen Deutsch-Ostafrikas 1905–1906 unter Leitung von Prof. Dr. Yngve Sjöstedt, Hos P. Palmquists Aktiebolag. Stockholm*, p 20–219.
- Weise J. 1923. Übersicht der Galerucinen. *Wiener Entomologische Zeitung* 40:124.
- Weise J. 1924. Chrysomelidae: Galerucinae. In: Junk W, editor. *Coleopterorum Catalogus* 78:1–225. s-Gravenhage.
- Wilcox JA. 1973. Chrysomelidae: Galerucinae: Luperini: Luperina. In: Junk W, editor. *Coleopterorum Catalogus Suppl* 78:433–664. s-Gravenhage.