

**Research article**Submitted: June 9<sup>th</sup>, 2020 - Accepted: August 18<sup>th</sup>, 2020 - Published: November 15<sup>th</sup>, 2020**Revision of the *Calothea nigrotessellata* species group from southern Africa, with description of two new species (Coleoptera: Chrysomelidae, Galerucinae, Alticini)**Paola D'ALESSANDRO <sup>1,\*</sup>, Mattia IANNELLA <sup>1</sup>, Elizabeth GROBBELAAR <sup>2</sup>, Maurizio BIONDI <sup>1</sup><sup>1</sup> Department of Health, Life and Environmental Sciences, University of L'Aquila - Via Vetoio, I-67100 L'Aquila, Italy  
paola.dalessandro@univaq.it; mattia.iannella@univaq.it; maurizio.biondi@univaq.it<sup>2</sup> Biosystematics Division, ARC-Plant Protection Research Institute - Private Bag X134, Queenswood, Pretoria 0121, Republic of South Africa - GrobbelaarB@arc.agric.za

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**Abstract**

*Calothea* Heyden is a mostly sub-Saharan flea beetle genus, comprising twenty-seven species previously included in *Blepharida* Chevrolat. The examination of new material is revealing a high species richness, as there is high intraspecific variability. *Calothea luteomaculata* **sp. nov.** from Zimbabwe and the Republic of South Africa, and *C. luteotessellata* **sp. nov.** from the Republic of South Africa are here described and attributed to the *C. nigrotessellata* (Baly) species group, mainly based on genitalic characters. Photographs of the main diagnostic characters are supplied, including the median lobe of the aedeagus and spermatheca. A forward stepwise discriminant function analysis, using morphometric variables, has been performed. It supports the attribution of the examined specimens to the three species here considered, thus adding characters useful for their identification. Information on geographical distribution and host plants are also provided.

**Key words:** *Calothea luteomaculata* **sp. nov.**, *C. luteotessellata* **sp. nov.**, *C. nigrotessellata*, leaf beetles, flea beetles, Afrotropical region, discriminant analysis.

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**Introduction**

Alticini (Coleoptera, Chrysomelidae, Galerucinae) are the largest and most diverse tribe of leaf beetles, comprising over 540 genera and about 8000 extant species (Nadein 2012; Nadein & Bezdek 2014), occurring all over the world. Adult and larval stages feed mainly on stems, leaves or roots, and rarely on flowers of almost all the higher plant families, generally with high levels of specialization and in different environments (Biondi et al. 2015; D'Alessandro et al. 2018b; Jolivet & Verma 2002; Urbani et al. 2015). The Afrotropical flea beetle fauna includes about 1600 known species in 103 genera. However, the steady rise in the number of genera and species described during the last 10 years, and the amount of unidentified material preserved in public collections and depositories, show that the taxonomic and species richness of the region are still far from being fully known (Biondi, unpublished data; Biondi 2017; Biondi & D'Alessandro 2010a,b, 2012, 2013a,b, 2015, 2016, 2017, 2018; Biondi et al. 2017, 2019, 2020; D'Alessandro & Biondi 2018; D'Alessandro et al. 2012, 2014, 2018a, 2019; Döberl 2010). *Calothea* Heyden, 1887 is a flea beetle ge-

nus widespread in the sub-Saharan Africa, with some records for Israel and Arabian Peninsula (Biondi et al. 2017). Members of this genus are particularly common in the eastern and southern parts of the distribution range, mainly in forest and savannah environments (D'Alessandro et al. 2018b). Its taxonomic status was recently clarified by Biondi et al. (2017, 2019) and D'Alessandro et al. (2018a, 2019), who unravelled the problematic supraspecific taxonomy of the genus *Blepharida* Chevrolat in the Afrotropical Region. Main diagnostic characters for the genus are the sinuate and deeply impressed frontal grooves, extending from the dorsal ocular margin to the interantennal space; and the punctate lateral striae on the pronotum, running from the anterior margin to the disc – in some species L- or C-shaped; some species also have short lateral longitudinal furrows or small dimples close to pronotal base. Based on Biondi et al. (2017), *Calothea* includes twenty-seven species, previously attributed to *Blepharida* Chevrolat. However, new material under examination is revealing the occurrence of several undetermined species, along with high variability within the already known species (Biondi, unpublished data).

In this paper, we describe *Calothea luteomaculata* **sp. nov.** from Zimbabwe and the Limpopo-, Gauteng-, and North West provinces of the Republic of South Africa (RSA); and *C. luteotessellata* **sp. nov.** from Limpopo (RSA). The new species share unique colour pattern, very different from the typical *Calothea* species, and are attributed to the *C. nigrotessellata* (Baly, 1865) species group, based mainly on the genitalia and pronotal features. An additional forward stepwise discriminant function analysis, using morphometric variables, has been performed to support the attribution of the examined specimens to the three species here considered, and to add more useful characters for their identification.

## Material and methods

Material examined consists of 653 dried pinned specimens preserved in the institutions listed below. The specimens were examined, measured and dissected using a Leica M205C stereomicroscope. Photographs were taken using a Leica DFC500 camera and composed using Zerene Stacker software version 1.04. Scanning electron micrographs were taken using a Hitachi TM-1000. Terminology follows D'Alessandro et al. (2016) for the median lobe of aedeagus, and Furth & Suzuki (1994) for the spermatheca. Geographical coordinates for the localities were reported in degrees and minutes (WGS84 format); coordinates and geographical information that are included in square brackets were added by the authors using information from the Google Earth website. The internationally recognized acronyms of the depositories follow the list on The Insect and Spider Collections of the World Website (Evenhuis 2020). Chorotypes follow Biondi & D'Alessandro (2006). Discriminant stepwise analysis was performed using the package NCSS version 11 for Windows.

## Abbreviations

<b>spec.</b>	specimen
<b>specs</b>	specimens
<b>LA</b>	numerical sequence proportional to the length of each antennomere
<b>LAED</b>	length of aedeagus
<b>LAN</b>	length of antennae
<b>LB</b>	total length of body (from apical margin of head to apex of elytra)
<b>LE</b>	length of elytra
<b>LP</b>	medial length of pronotum
<b>LSP</b>	maximum length of spermatheca, including ductus
<b>WE</b>	maximum width of elytra combined
<b>WP</b>	maximum width of pronotum

## Provinces of the Republic of South Africa (RSA)

<b>EC</b>	Eastern Cape
<b>FS</b>	Free State

<b>GAU</b>	Gauteng
<b>KZN</b>	KwaZulu-Natal
<b>LIM</b>	Limpopo
<b>MPU</b>	Mpumalanga
<b>NC</b>	Northern Cape
<b>NW</b>	North West
<b>RSA</b>	Republic of South Africa
<b>WC</b>	Western Cape

## Depositories

<b>BAQ</b>	Italy, University of L'Aquila, Collection of M. Biondi
<b>MHNB</b>	Switzerland, Bâle, Musée d'Histoire Naturelle
<b>MNHW</b>	Poland, University of Wrocław, Museum of Natural History
<b>NHMUK</b>	United Kingdom, London, The Natural History Museum
<b>NHRS</b>	Sweden, Stockholm, Naturhistoriska riksmuseet
<b>NMPC</b>	Czech Republic, Prague, National Museum (Natural History)
<b>SANC</b>	South Africa, Pretoria, South African National Collection of Insects
<b>ZMHB</b>	Germany, Berlin, Museum für Naturkunde der Humboldt-Universität
<b>ZSM</b>	Germany, Munich, Zoologische Staatssammlung

## Results

### *Calothea luteomaculata* **sp. nov.**

(Figs 1-4, 15-17)

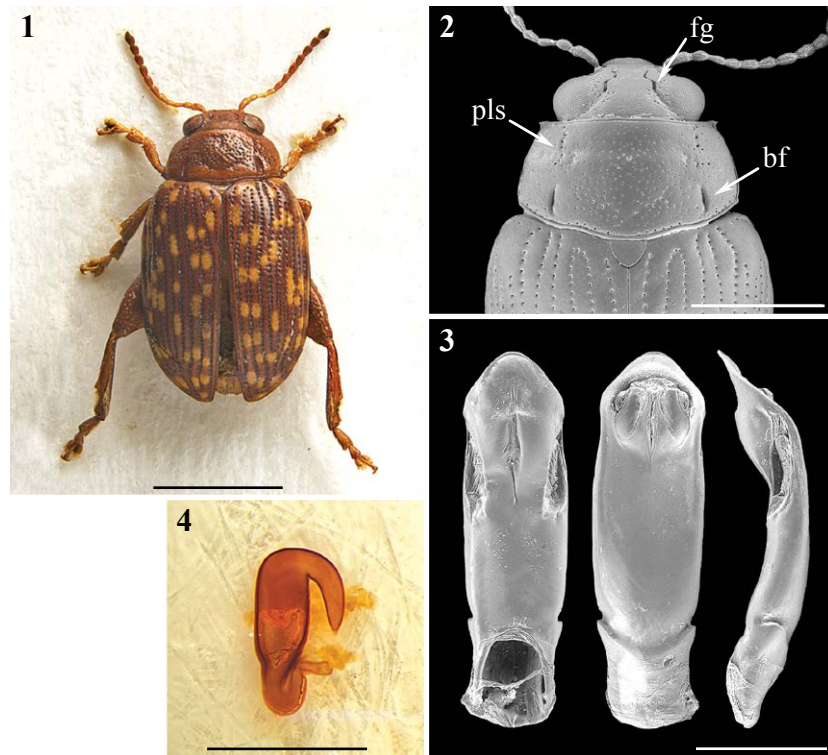
**Diagnosis.** *Calothea luteomaculata* **sp. nov.** is easily recognizable from all other *Calothea* species by its colour pattern, small size, and unique shape of the median lobe of the aedeagus. A similar colour pattern and comparable size are only found in *C. luteotessellata* **sp. nov.** from northern Limpopo (RSA). However, *C. luteomaculata* **sp. nov.** can also be distinguished by: eyes more ovate (more elongate in *C. luteotessellata* **sp. nov.**); antero-lateral part of pronotum barely sloping downward (clearly sloping downward in *C. luteotessellata* **sp. nov.**); basal margin of pronotum indistinctly sinuate (projecting medially towards scutellum in *C. luteotessellata* **sp. nov.**); pronotal punctation more distinct and homogenous (shallow and of varying size in *C. luteotessellata* **sp. nov.**); basal pronotal furrow elongate and more deeply impressed than punctate lateral stria (both clearly impressed and short basal furrow in *C. luteotessellata* **sp. nov.**); elytral punctures close to each other (clearly distanced in *C. luteotessellata* **sp. nov.**); elytral interstriae moderately carinate (flat on elytral disc in *C. luteotessellata* **sp. nov.**); median lobe of aedeagus with sub-triangular distal part and rounded apex,

and with a couple of wide, short and wrinkled deep depressions on ventrolateral surface (distal part gradually narrowed to an almost acute median tooth, and longer, shallow ventrolateral wrinkled depression in *C. luteotessellata* **sp. nov.**). Spermatheca is similar in the two species, but less sclerotized and with a slightly longer ductus in *C. luteomaculata* **sp. nov.**

**Description of the holotype** (♂). Body elliptical in dorsal view, moderately convex in lateral view; total length of body (LB) = 4.32 mm; maximum pronotal width at middle (WP = 1.68 mm); maximum width of elytra at middle (WE = 2.44 mm). Dorsal integuments reddish-brown, with several small yellow patches on elytra (Fig. 1); labrum, basal half of antennae, and tarsi little paler.

Head with rough micropunctate surface, a few setiferous punctures near medial ocular margin and the dorsal part of frontal grooves (Fig. 2); frontal grooves deeply impressed, sinuate, extending from dorsal ocular margin to inter-antennal space; inter-antennal space wide, about 1.5 times the length of the first antennomere; eyes ovate, moderately elongate; dorsal interocular space about 1.5 times the width of eye; antennae shorter than half-body length (LAN = 1.80 mm; LAN/LB = 0.42); LA: 100:50:70:60:65:70:75:70:80:70:100. Pronotum (Figs 1-2) slightly convex, sub-rectangular, distinctly transverse (LP = 0.92 mm; WP/

LP = 1.83), with moderately rounded sides; surface rough, micropunctate, with additional rather dense, small, evenly distributed punctation; punctate stria straight, with a few moderately impressed punctures; basal furrows elongate and deeply impressed; basal and apical margins finely bordered; lateral margins only slightly expanded, barely visible in dorsal view; anterior angles prominent and laterally pointed; posterior angles obtuse. Scutellum sub-triangular, apically rounded. Elytra (Fig. 1) moderately elongate and convex (LE = 3.28 mm; WE/LE = 0.74; LE/LP = 3.57), sub-parallel laterally, jointly rounded apically; lateral margin narrow, barely visible in dorsal view; elytral punctation arranged in single regular rows formed by dense and distinctly impressed punctures; interstriae moderately carinate, with finely microreticulate and micropunctate surface; humeral calli slightly raised. Basal pro- and mesotarsomeres distinctly enlarged, sub-triangular. Macropterous. Underside reddish-brown; apical abdominal ventrite without preapical sculpture or impressions. Aedeagus (Fig. 3) (LAED = 1.44 mm; LE/LAED = 2.28) with softly curved sides in ventral view, sub-triangular distally, with rounded apex; surface smooth, with a narrow, irregular median sulcus in the apical half ventrally, and a couple of deep wide wrinkled ventrolateral depressions in the apical half; ventral surface distinctly bulbous sub-apically; median lobe moderately and evenly curved in lateral view; dorsal ligu-



**Figs 1-4** – *Calothecha luteomaculata* **sp. nov.** 1, dorsal view of the holotype, ♂, Mogol Nature Reserve (RSA); 2, pronotum of ♂ from Wonderboom (RSA); 3, median lobe of aedeagus, from left to right in ventral, dorsal and lateral view, spec. from Wonderboom (RSA); 4, spermatheca, spec. from Melodie (RSA). bf: basal furrow; fg: frontal grooves; pls: punctate lateral stria. Scale bar: 1 mm (Figs 1-2); 0.5 mm (Figs 3-4).

la short and wide, formed by two narrow wrinkled medial lobes and two slightly wider smooth lateral lobes.

**Variation.** Males (n = 6; mean ± standard deviation, range): LE = 3.27 ± 0.04 mm (3.20 ≤ LE ≤ 3.32 mm); WE = 2.38 ± 0.04 mm (2.32 ≤ WE ≤ 2.44 mm); LP = 0.91 ± 0.01 mm (0.90 ≤ LP ≤ 0.92 mm); WP = 1.71 ± 0.03 mm (1.68 ≤ WP ≤ 1.76 mm); LAN = 1.87 ± 0.06 mm (1.80 ≤ LAN ≤ 1.92 mm); LAED = 1.43 ± 0.03 mm (1.40 ≤ LAED ≤ 1.48 mm); LB = 4.08 ± 0.15 mm (3.92 ≤ LB ≤ 4.32 mm); LE/LP = 3.58 ± 0.08 (3.48 ≤ LE/LP ≤ 3.69); WE/WP = 1.39 ± 0.04 (1.35 ≤ WE/WP ≤ 1.45); WP/LP = 1.88 ± 0.03 (1.83 ≤ WP/LP ≤ 1.91); WE/LE = 0.73 ± 0.01 (0.71 ≤ WE/LE ≤ 0.74); LAN/LB = 0.46 ± 0.03 (0.42 ≤ LAN/LB ≤ 0.49); LE/LAED = 2.28 ± 0.05 (2.22 ≤ LE/LAED ≤ 2.34). Females (n = 5; mean ± standard deviation, range): LE = 3.74 ± 0.18 mm (3.42 ≤ LE ≤ 3.84 mm); WE = 2.71 ± 0.14 mm (2.50 ≤ WE ≤ 2.74 mm); LP = 0.94 ± 0.06 mm (0.86 ≤ LP ≤ 1.02 mm); WP = 1.90 ± 0.11 mm (1.72 ≤ WP ≤ 2.02 mm); LAN = 1.70 ± 0.13 mm (1.56 ≤ LAN ≤ 1.84 mm); LSP = 0.53 ± 0.03 mm (0.48 ≤ LSP ≤ 0.56 mm); LB = 4.52 ± 0.21 mm (4.16 ≤ LB ≤ 4.68 mm); LE/LP = 3.97 ± 0.12 (3.76 ≤ LE/LP ≤ 4.04); WE/WP = 1.42 ± 0.04 (1.37 ≤ WE/WP ≤ 1.46); WP/LP = 2.02 ± 0.03 (1.98 ≤ WP/LP ≤ 2.04); WE/LE = 0.72 ± 0.02 (0.70 ≤ WE/LE ≤ 0.75); LAN/LB = 0.38 ± 0.02 (0.34 ≤ LAN/LB ≤ 0.40); LE/LSP = 7.10 ± 0.54 (6.58 ≤ LE/LSP ≤ 7.92). Paratypes very similar in shape, sculpture and color to the holotype. Females with basal pro- and mesotarsomeres less enlarged, antennae generally shorter (males: LAN/LB = 0.46 ± 0.03, 0.42 ≤ LAN/LB ≤ 0.49; females: LAN/LB = 0.38 ± 0.02, 0.34 ≤ LAN/LB ≤ 0.40) and body generally larger (males: LB = 4.08 ± 0.15 mm, 3.92 ≤ LB ≤ 4.32 mm; females: LB = 4.52 ± 0.21 mm, 4.16 ≤ LB ≤ 4.68 mm). Spermatheca (Fig. 4) elongate and broadly sub-cylindrical basally, distinctly narrower and bent apically, with a very short appendix; ductus U-shaped, uncoiled, basally inserted, thickset and moderately elongate.

**Type material.** Holotype ♂: **Republic of South Africa:** N.W. TVL. [LIM], Mogol Nature Reserve, Ellisras Dist., 23.58S 27.45E [23°35'S 27°27'E], 19-23.xi.1979, S.J. van Tonder & C. Kok leg. (SANC). Paratypes. **Republic of South Africa:** Transvaal [NW], Melodie, 25°44' S 27°51' E, 29-31.xii.1985, C.L. Bellamy leg., D.G. Furth Coll., 1 ♀ (BAQ); ditto, 2.xi.1985, beating: *Acacia*, *Rhus* & *Ziziphus*, 4 ♂♂ and 1 ♀ (BAQ); S. Africa, [GAU], Wonderboom, nr Pretoria [25°41'S 28°11'E], x.1931, T.D.A. Cockerell leg., 1 ♂ (NHMUK); Tvl. [NW], Kranskloof, SSE Rustenburg, 25°46'S 27°24'E, 24.ii.1993, adults, larvae and oothecae collected on *Rhus leptodictya* (Anacardiaceae), E. Grobbelaar & R. Urban leg., 1 ♀ (SANC); LIM, Thabazimbi, SE 24 27 Cb [24°37'S 27°23'E], 13.xi.1993, E. Holm leg. 1 ♀ (SANC); **Zimbabwe:** C Zimbabwe, Gweru, Nalatale Ruins [19°52'S, 29°32'E], 3.xii.1998, M Snižek leg., 1 ♀ (BAQ).

**Etymology.** The specific epithet is due to the small yellow spots on the elytra.

**Type locality.** The Republic of South Africa, LIM, Mogol Nature Reserve.

**Distribution.** Zimbabwe; the Republic of South Africa (GAU, LIM, NW) (Fig. 17).

**Chorotype.** Southern-Eastern African chorotype (SEA).

**Host plant.** Collected on *Acacia* (Fabaceae), *Rhus* [now *Searsia*] (Anacardiaceae), and *Ziziphus* (Rhamnaceae).

**Habitat.** Not available.

**Phenology.** Collected in February and from October to December.

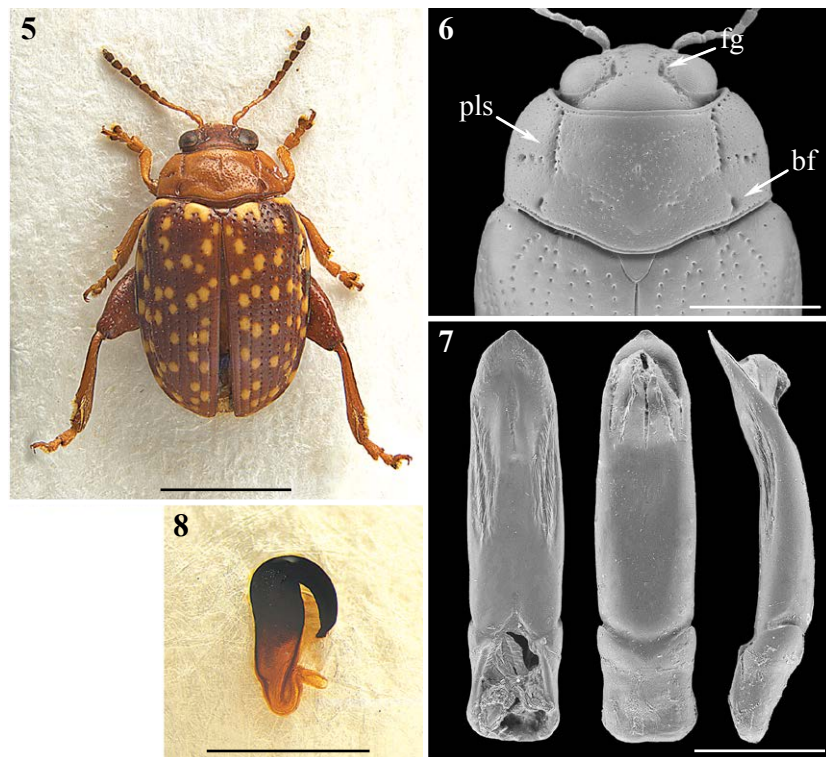
**DNA data.** Not available.

***Calotheca luteotessellata* sp. nov.**  
(Figs 5-8, 15-17)

**Diagnosis.** *Calotheca luteotessellata* sp. nov. shares a unique colour pattern with *C. luteomaculata* sp. nov. among *Calotheca* species. However, these two new species can be distinguished by several characters. *Calotheca luteotessellata* sp. nov. has: eyes more elongate (ovate in *C. luteomaculata* sp. nov.); antero-lateral part of pronotum clearly sloping downward (barely sloping downward in *C. luteomaculata* sp. nov.); basal margin of pronotum projecting medially towards scutellum (indistinctly sinuate in *C. luteomaculata* sp. nov.); pronotal punctation shallow and of irregular size (more evident and homogeneous in *C. luteomaculata* sp. nov.); pronotal basal furrow short (elongate in *C. luteomaculata* sp. nov.); pronotal punctate stria clearly impressed and L-shaped (shallow and straight in *C. luteomaculata* sp. nov.); elytral punctures sparse (dense and evenly distributed in *C. luteomaculata* sp. nov.); elytral interstriae flat on elytral disc (moderately carinate in *C. luteomaculata* sp. nov.); median lobe of aedeagus with distal part narrowing gradually to terminate in an almost acute median tooth, and long, shallow ventrolateral wrinkled depressions (with sub-triangular distal part and rounded apex, and a couple of wide, short and wrinkled deep depressions on ventrolateral surface in *C. luteomaculata* sp. nov.). Spermatheca is similar in the two species, but more distinctly sclerotized in apical half and with a slightly shorter ductus in *C. luteotessellata* sp. nov. Both aedeagus and spermatheca of *C. luteotessellata* sp. nov. are very similar to *C. nigrotessellata*, a variable species in size, sculpture and colour. The two species are distinguishable by the unique colour pattern of *C. luteotessellata* sp. nov. and some differences in biometry (see forward stepwise discriminant function

analysis): WP and WE in males, LP, WE, LAN and WP in females.

**Description of the holotype** (♂). Body elliptical in dorsal view, moderately convex in lateral view; total length of body (LB) = 4.70 mm; maximum pronotal width at middle (WP) = 1.95 mm; maximum width of elytra at apical third (WE) = 2.70 mm). Dorsal integument reddish-brown, elytra slightly darker, with several small yellow patches (Fig. 5). Head surface micropunctate, with setiferous punctures near medial ocular margin and some along frontal grooves (Fig. 6); frontal grooves sinuate, deeply impressed in dorsal part, extending from dorsal ocular margin to inter-antennal space; inter-antennal space wide about 1.5 times the length of first antennomere; eyes elliptical, distinctly elongate; dorsal interocular space about twice the width of eye; antennae shorter than half the body length (LAN = 1.90 mm; LAN/LB = 0.40); LA: 100:50:70:60:70:75:80:80:80:70:110. Pronotum (Figs 5-6) slightly convex, sub-rectangular, distinctly transverse (LP = 1.00 mm; WP/LP = 1.95), with moderately rounded sides; anterolateral part clearly sloping downward; surface with shallow depressions, micropunctate, with additional small irregular punctation that is not uniform in size; punctate striae L-shaped, with punctures also lining the anterior margin; basal furrows short and deeply impressed; anterior, lateral, and basal margins finely bordered; anterior angles prominent and laterally pointed, not visible in dorsal view; posterior angles obtuse. Scutellum sub-triangular, acute apically. Elytra (Fig. 5) moderately elongate and convex (LE = 3.60 mm; WE/LE = 0.75; LE/LP = 3.60), slightly rounded laterally, jointly rounded apically; lateral margin narrow, barely visible in dorsal view; elytral punctation arranged in single regular rows formed by clearly impressed and clearly spaced punctures; interstriae on elytral disc flat, with finely microreticulate and micropunctate surface; humeral calli slightly raised. Basal pro- and mesotarsomeres distinctly enlarged, sub-triangular. Macropterous. Underside reddish-brown; apical abdominal ventrite without preapical sculptures or impressions. Aedeagus (Fig. 7) (LAED = 1.50 mm; LE/LAED = 2.40) with softly curved sides in ventral view, sub-triangular distally, narrowing gradually to an almost acute median tooth; surface smooth, with a narrow, irregular median sulcus in the apical half of ventral surface, and long, shallow ventrolateral wrinkled depressions; aedeagus moderately and evenly curved in lateral view; dorsal ligula short and wide, formed by two smooth narrow medial lobes, and two smooth narrow lateral lobes.



**Figs 5-8** – *Calothecha luteotessellata* sp. nov. **5**, dorsal view of the holotype, ♂, Thengwe (RSA); **6**, pronotum of ♂ from Mphaguli Natural Reserve (RSA); **7**, median lobe of aedeagus, from left to right in ventral, dorsal and lateral view, spec. from Thengwe (RSA); **8**, spermatheca, spec. from Mphaphuli Cycad Reserve (RSA). bf: basal furrow; fg: frontal grooves; pls: punctate lateral stria. Scale bar: 1 mm (Figs 5-6); 0.5 mm (Figs 7-8).

**Variation.** Males (n = 15; mean ± standard deviation, range): LE = 3.70 ± 0.15 mm (3.40 ≤ LE ≤ 3.90 mm); WE = 2.75 ± 0.10 mm (2.60 ≤ WE ≤ 2.93 mm); LP = 1.04 ± 0.04 mm (0.98 ≤ LP ≤ 1.10 mm); WP = 2.03 ± 0.07 mm (1.95 ≤ WP ≤ 2.15 mm); LAN = 1.96 ± 0.09 mm (1.78 ≤ LAN ≤ 2.08 mm); LAED = 1.54 ± 0.03 mm (1.50 ≤ LAED ≤ 1.60 mm); LB = 4.64 ± 0.20 mm (4.35 ≤ LB ≤ 5.10 mm); LE/LP = 3.56 ± 0.09 (3.39 ≤ LE/LP ≤ 3.71); WE/WP = 1.35 ± 0.03 (1.30 ≤ WE/WP ≤ 1.39); WP/LP = 1.95 ± 0.05 (1.84 ≤ WP/LP ≤ 2.03); WE/LE = 0.74 ± 0.01 (0.72 ≤ WE/LE ≤ 0.77); LAN/LB = 0.42 ± 0.02 (0.37 ≤ LAN/LB ≤ 0.44); LE/LAED = 2.40 ± 0.07 (2.27 ≤ LE/LAED ≤ 2.52). Females (n = 15; mean ± standard deviation, range): LE = 4.19 ± 0.18 mm (3.90 ≤ LE ≤ 4.55 mm); WE = 3.12 ± 0.13 mm (2.90 ≤ WE ≤ 3.30 mm); LP = 1.08 ± 0.05 mm (1.03 ≤ LP ≤ 1.20 mm); WP = 2.25 ± 0.09 mm (2.08 ≤ WP ≤ 2.40 mm); LAN = 2.00 ± 0.06 mm (1.90 ≤ LAN ≤ 2.10 mm); LSP = 0.57 ± 0.03 mm (0.53 ≤ LSP ≤ 0.60 mm); LB = 5.21 ± 0.31 mm (4.80 ≤ LB ≤ 5.85 mm); LE/LP = 3.87 ± 0.09 (3.64 ≤ LE/LP ≤ 4.00); WE/WP = 1.39 ± 0.02 (1.36 ≤ WE/WP ≤ 1.42); WP/LP = 2.07 ± 0.04 (2.00 ≤ WP/LP ≤ 2.14); WE/LE = 0.75 ± 0.01 (0.72 ≤ WE/LE ≤ 0.76); LAN/LB = 0.38 ± 0.02 (0.34 ≤ LAN/LB ≤ 0.41); LE/LSP = 7.38 ± 0.30 (6.78 ≤ LE/LSP ≤ 7.82). Paratypes very similar in shape, sculpture and colour to the holotype. Labrum, basal half of antennae, and tarsi little paler in some specimens. Females with less enlarged basal pro- and mesotarsomeres, and generally larger in size (males: LB = 4.64 ± 0.20 mm, 4.35 ≤ LB ≤ 5.10 mm; females: LB = 5.31 ± 0.31 mm, 4.80 ≤ LB ≤ 5.85 mm). Spermatheca (Fig. 8) with most of basal and entire apical section dark brown, strongly sclerified, yellowish-brown and less sclerified basally and yellowish-brown ductus; elongate and sub-conical basally, distinctly narrower and bent apically, about as long as half-length of basal part, with appendix; ductus short, U-shaped, uncoiled, basally inserted.

**Type material.** Holotype ♂: **Republic of South Africa:** Limpopo, Thengwe, 5 km NNE, 700 m, 22°40'S 30°34'E, 06.ii.1994, adults collected from *Rhus magaliesmontana* subsp. *coddii* (Anacardiaceae), E. Grobbelaar leg. (SANC). Paratypes. **Republic of South Africa:** Same data as holotype, 9 ♂♂ and 6 ♀♀ (SANC); [LIM] Mphaphuli Cycad Reserve, 750 m, 22°48'S 30°41'E, 9.ii.1994, adults collected from *Rhus magaliesmontana* subsp. *coddii* (Anacardiaceae), E. Grobbelaar leg., 5 ♂♂ and 9 ♀♀ (SANC).

**Etymology.** The specific epithet is after the small yellow patches on elytra.

**Type locality.** The Republic of South Africa, LIM, Thengwe.

**Distribution.** The Republic of South Africa (LIM) (Fig. 17).

**Chorotype.** Southern-Eastern African chorotype (SEA).

**Host plant.** Adults collected on *Rhus* [now *Searsia*] *magaliesmontana* subsp. *coddii* (Anacardiaceae).

**Habitat.** Not available.

**Phenology.** Collected in February.

**DNA data.** Not available.

***Calotheca nigrotessellata* (Baly, 1865)**

(Figs 9-17)

*Podontia nigrotessellata* Baly, 1865: 404

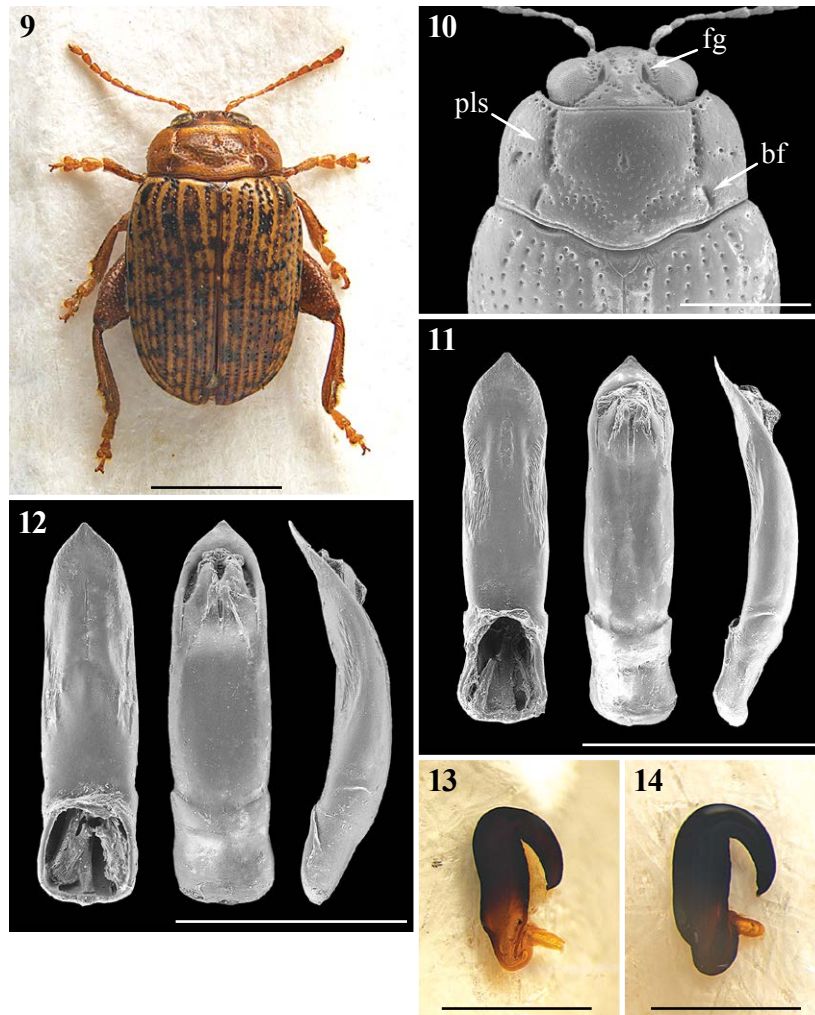
= *Blepharidella rubrosignata* Bryant, 1945: 339 synonymized by Biondi et al. 2017

= *Blepharidella variabilis* Bryant, 1945: 337 synonymized by Biondi et al. 2017

*Calotheca nigrotessellata* (Baly) new combination by Biondi et al. 2017; Biondi et al. 2017: 122 (pars)

**Taxonomic remarks.** Head generally slightly darker than pronotum. Legs and antennae of the same colour as head or pronotum, antennae sometimes darkened towards apex. Elytral colour from yellow to pale brown; elytral striae, or each single puncture, always darkened or black; elytra variable: without patches, or with some darker hues, or with small irregular dark or black patches on interstriae. Pronotum dark yellow to pale brown, sometimes with some darker hues, but no patches (Fig. 9). Pronotal punctate lateral stria clearly marked compared to the small and irregular pronotal punctation, straight, with a few additional and slightly distant medio-lateral punctures on disc (Fig. 10); in some specimens, a line of punctures joined with pronotal stria runs against the anterior margin up to the anterior angle of pronotum; a small dimple can be present in the centre of pronotal disc. Basal furrows of pronotum short, and deeply impressed. Median lobe of aedeagus (Figs 11-12) with sub-parallel sides in ventral view, sometimes slightly sinuate; distal part narrowing gradually to terminate in an acute median tooth; surface sub-smooth, laterally wrinkled; dorsal ligula short, formed by two shorter medial lobes and two longer lateral lobes, both sets tapering towards the apex; median lobe smoothly curved in lateral view, ventral surface slightly bulbous in sub-apical part. Spermatheca (Figs 13-14) elongate and sub-cylindrical basally, distinctly narrower and bent apically, about as long as half-length of basal part, generally with a short appendix; ductus thickset, short and uncoiled; spermatheca generally strongly sclerotized, at least in distal half. Despite variation in size and colour, the combination of shape and pronotal sculpture allows species identification even without examination of the aedeagus or spermatheca.

**Variation.** Males (n = 20; mean ± standard deviation, range): LE = 3.28 ± 0.23 mm (3.00 ≤ LE ≤ 3.65 mm); WE



**Figs 9-14** – *Calothea nigrotessellata* (Baly, 1865). **9**, dorsal view of ♂ from Ezemvelo Natural Reserve (RSA); **10**, pronotum of a ♂ from Shilouvane (RSA); **11**, median lobe of aedeagus, from left to right in ventral, dorsal and lateral view, spec. from Swellendam (RSA); **12**, ditto, spec. from Okonjima (Namibia); **13**, spermatheca spec. from Mwengwa (Zambia); **14**, ditto, spec. from 20 km N of Peddie (RSA). bf: basal furrow; fg: frontal grooves; pls: punctate lateral stria. Scale bar: 1 mm (Figs 9-22); 0.5 mm (Figs 13-14).

=  $2.39 \pm 0.18$  mm ( $2.10 \leq WE \leq 2.68$  mm); LP =  $0.95 \pm 0.06$  mm ( $0.85 \leq LP \leq 1.05$  mm); WP =  $1.80 \pm 0.12$  mm ( $1.63 \leq WP \leq 1.90$  mm); LAN =  $1.94 \pm 0.11$  mm ( $1.75 \leq LAN \leq 2.15$  mm); LAED =  $1.49 \pm 0.06$  mm ( $1.35 \leq LAED \leq 1.58$  mm); LB =  $4.25 \pm 0.20$  mm ( $3.88 \leq LB \leq 4.55$  mm); LE/LP =  $3.45 \pm 0.09$  ( $3.24 \leq LE/LP \leq 3.78$ ); WE/WP =  $1.33 \pm 0.03$  ( $1.28 \leq WE/WP \leq 1.38$ ); WP/LP =  $1.89 \pm 0.05$  ( $1.78 \leq WP/LP \leq 1.98$ ); WE/LE =  $0.73 \pm 0.02$  ( $0.66 \leq WE/LE \leq 0.78$ ); LAN/LB =  $0.46 \pm 0.02$  ( $0.40 \leq LAN/LB \leq 0.50$ ); LE/LAED =  $2.20 \pm 0.11$  ( $2.03 \leq LE/LAED \leq 2.34$ ). Females (n = 20; mean  $\pm$  standard deviation; range): LE =  $3.69 \pm 0.34$  mm ( $3.13 \leq LE \leq 4.25$  mm); WE =  $2.69 \pm 0.24$  mm ( $2.40 \leq WE \leq 3.18$  mm); LP =  $1.00 \pm 0.09$  mm ( $0.85 \leq LP \leq 1.15$  mm); WP =  $1.98 \pm 0.17$  mm ( $1.70 \leq WP \leq 2.28$  mm); LAN =  $1.86 \pm 0.13$  mm ( $1.70 \leq LAN \leq 2.10$  mm); LSP =  $0.54 \pm 0.04$  mm ( $0.48 \leq LSP \leq 0.60$  mm); LB =  $4.62 \pm 0.51$  mm ( $3.85 \leq LB \leq 5.35$  mm); LE/LP =  $3.70 \pm 0.09$  ( $3.54 \leq LE/LP \leq 3.95$ ); WE/WP =  $1.36 \pm 0.04$  ( $1.28$

$\leq WE/WP \leq 1.41$ ); WP/LP =  $1.99 \pm 0.04$  ( $1.89 \leq WP/LP \leq 2.09$ ); WE/LE =  $0.73 \pm 0.01$  ( $0.70 \leq WE/LE \leq 0.76$ ); LAN/LB =  $0.41 \pm 0.03$  ( $0.35 \leq LAN/LB \leq 0.47$ ); LE/LSP =  $6.82 \pm 0.50$  ( $5.83 \leq LE/LSP \leq 7.90$ ).

**Type material examined.** Lectotype ♀ (*Podontia nigrotessellata*): **Republic of South Africa**: [KZN], Port Natal [Durban,  $29^{\circ}51'S$ ,  $31^{\circ}01'E$ ] (M. Biondi des. 2017) (NHMUK). Paralectotypes (*P. nigrotessellata*): same data as lectotype, 1 ♂ and 1 ♀ (NHMUK). Lectotype ♂ (*Blepharidella rubrosignata*): **Zambia**: 'N.W. Rhodesia', Mwengwa,  $27^{\circ}40'E$   $13^{\circ}S$ , 14.viii.1914, H.C. Dollman (M. Biondi des. 2017) (NHMUK). Paralectotypes (*Blepharidella rubrosignata*): same data as lectotype, 1 ♀ (NHMUK). Lectotype ♀ (*Blepharidella variabilis*): **Republic of South Africa**: KZN, Frere [ $28^{\circ}53'S$ ,  $29^{\circ}46'E$ ], xii.1894, G.A.K. Marshall (M. Biondi des. 2017) (NHMUK).

**Other material examined. Botswana:** Serowe, 22°25'S 26°44'E, ix.1985, P. Forchhammer leg., 2 specs (SANC). **Namibia:** Grootfontein, Askavolt Farm, 20 km E Otavi, 19°40'S 17°33'E, 18.xi.1992, U. Göllner leg., 1 spec. (ZMHB); Okonjima 128, SE 2016 Dc Otjiwarongo [20° 48'S 16°40'E], 19-23.i.1980, H40556, M-L. Penrith leg., 2 specs (BAQ); Otavi [19°37'S 17°20'E], 14.iii.1961, 1 spec. (ZSM); Caprivi, Lusikili, Zambesi River, 900 m, 17° 33'S 24°28'E, 06.iii.1992, R.[G.] Oberprieler, 1 spec. (SANC); Caprivi, Katima Mulilo, 17°29'S 24°17'E, 1000 m, 04.iii.1992, R.[G.] Oberprieler leg., 2 specs (SANC); Katima Mulilo, E. Caprivi Zipfel [17°52'S 23°34'E], 22-26.x.1970, H.D. Brown leg., 7 specs (SANC); Boom River Canyon, 4km N of Orange River (ESE of Rosh Pinah), 200m, 28°05'S 17°03'E, 25-30.x.1996, swept off, yellow flowers, in dry river bed, M&A Wedd Expedition, 1 spec. (SANC); ditto, 01-03.xi.1996, beating from vegetation, 1 spec. (SANC); 'South West Africa', Tsumeb, 19°14'S 17° 42'E, ii.1978, S.J. v. Tonder leg., 1 spec. (SANC). **RSA. WC,** between Akkedisberg Pass and Stanford (R326), m 50-150, 34°25'13''S 19°31'43''E, fynbos, 20.xi.1994, P. Audisio, M. Biondi & M.A. Bologna leg. 13 specs (BAQ). **Republic of South Africa:** WC, Swellendam, Marloth Nat. Res., m 260-300, 33 59'59''S 20°26'24''E, low damp fynbos, 16-19.ix.1994, P. Audisio, M. Biondi & M. A. Bologna leg., 6 specs (BAQ); WC, Ladysmith, Seweweekspoort, Swartberge Mt. [33°25'48''S 21°18'25''E], 15.vii.2002, M. Snižek leg., 39 specs (BAQ); WC, Swellendam (N env.), 150 m, near Marloth Nat. Res., 34° 00.607'S 20°25.874'E [34° 00' 39''S 20° 25' 59''E], 3-11.xii.2007, Martin Řiha leg., 176 specs (BAQ); Cape Province [EC], Queenstown, 3500 ft. [31°57'25''S 26°44'59''E], 16.i-10.ii.1923, Brit. Mus. 1923-140, R.E. Turner leg., 1 spec. (NHMUK); Cape Province [EC], Huguenot [31°05'43''S 26°36'40''E], ii.1932, J. Ogilvie leg., 1 spec. (NHMUK); MPU, 1300 m, -25.7152S/28.9840E [25°42'54''S 28°59' 02''E], Ezemvelo Nat. Res., nr bridge on Wilge River, 1.xi.2013, M. Wanat leg., 2 specs (MNHW); Cape Province [EC], Somerset East [32°43'S 25°35'E], 1-9.xii.1930, Brit. Mus. 1931-12, R.E. Turner leg., 1 spec. (NHMUK); GAU, 8 km S of Rust de Winter, 25.17,1S 28.35,8E [25° 17'03''S 28°35'48''E], c. 1100 m, 18.xii.1996, collected (with DVAC suction machine) from *Acacia nilotica* (Mimosoideae), E. Grobbelaar, R. Stals, Stiller leg., 1 spec. (SANC); FS, 2 km W Pretorius Nat. Res., m 1350, 28°17'S 27°08'E, river edge, 2.xii.1995, M. Biondi leg., 2 specs (BAQ); MPU, SW slope Nelshoogte Pass, S25 51.264 E30 45.406 [25°51'16''S 30°45'24''E], 1460 m, rocks, 16.ii. 2007, P. Audisio & M. Biondi leg., 1 spec. (BAQ); Cape Province [WC], Bontebok NP, 34°04'S/20°27'E, 22.iv. 1995, J. Deckert leg., 1 spec. (ZMHB); KZN: Hluhluwe NP, 28°02'S/32°05'E, U. Göllner, 1 spec. (ZMHB); WC, SW, Greyton env. [34°02'56''S 19°36'40''E], 22.x.1999, M. Snižek leg., 1 spec. (BAQ); Transvaal [LIM], Waterberg Mts., Rankin's Pass, m 1150-1500, 24°31'48''S 27° 54'57''E, 10.xi.1993, P.A. Audisio leg. 15 specs (BAQ); ditto, M.A. Bologna leg. 10 specs

(BAQ); LIM, Modimolle [24°41'56''S 28°24'11''E], 30. xii.2008, M. Snižek leg., 8 specs (BAQ); EC, Elliot, 1100 m, 31.19.35 S 27.50.24 E [31°19'35''S 27°50'24''E], 11.xi.2006, E. Colonnelli leg. 1 spec. (BAQ); EC, Elliot, Thompson Dam, 1170 m, S 31°12.80', E 28°10.17' [31°12'48''S 28° 10'10''E], 11.xi.2006, G. Osella leg., 1 spec. (BAQ); WC S, Knysna Natures Valley [33°58'50''S 23°33'33''E], 13. xii.2002, 1 spec. (BAQ); CP [WC], Knysna, 34°02'S 23° 03'E, i.1979, S.J. van Tonder leg., 1 spec. (SANC); Transvaal, ex coll. Fruhstorfer, 1 spec. (BAQ); C.P. [WC], 10 km SW Swartberg Pass, 1000 m, 33.20'S 22.05'E [33° 20'S 22 05'E], 2.xi.1988, E. Colonnelli leg., 1 spec. (BAQ); Tvl. [MPU], Waterval Boven, m 1400 [Emgwenya, 25°38 24''S 30°19'44''E], 11.xi.1988, E. Colonnelli leg., 1 spec. (BAQ); Transvaal [NW], Olifants Nek [25°47' 24''S 27°14 24''E], 1938, Dr. Baum leg., 2 spec. (NMPC); Transvaal [NW], Rustenburg [25°36'54''S 27°13'48''E], xi.1938, Dr. Baum leg., 2 spec. (NMPC); TVL. [NW], Rustenburg Nature Res., 25°40'S 27°12'E, 17-20.iii.1980, C.G.E. Moolman, 1 spec. (SANC); Transvaal, [LIM], Shilouvane [24°02'24''S 30°16'48''E], 1906-1907, H.A. Junod leg., 4 specs (BAQ); RSA, O.F.S. [FS], Colesberg, Orange riv. Vall., road N1 [30°38'24''S 25°13'41''E], 25.xi. 2002, M. Snižek leg., 1 spec. (BAQ); Transvaal [NW], Melodie, 25°44'S 27°51'E, 2.xi.1985, beating: *Acacia, Rhus & Ziziphus*, C.L. Bellamy leg., D. G. Furth Coll'n, 3 specs (BAQ); Transvaal [LIM], Nylsvley, "Sericea" Farm [24°39'S 28°40'E], 12-13.xii.1985, C.L. Bellamy leg., D. G. Furth Coll'n, 2 specs (BAQ); S. Zululand [KZN], Gingindhlovu [29°01'S 31°35'E], 22.v.1926, R.E. Turner leg., 1 spec. (NHMUK); Natal [KZN], Estcourt [29°00'S 29° 53'E], xi.1892, on willow, G.A.K. Marshall leg., 1 spec. (NHMUK); [KZN] Howick [29°29'21''S, 30°12'60''E], 1901, J.P.C. leg., 2 specs (BAQ); [KZN] Malvern [29°53'S 30°55'E], 1899, J.P. C. leg., 1 spec. (BAQ); Cap., 1899, Ex Musæo E. Allard, 1 spec. (BAQ); Cap. B. Spei [WC], Victorin [34°21'24''S 18°28'26''E], NRS, NHRS-JLKB 000023202, 1 spec. (NHRS); [WC] Seven Weeks Poort, Ladysmith Distr. [33°24'S 21°24'E], xii.1968, R.H. Jones & J.H. Potgieter leg., 10 specs (MHNB); W.Tvl. [NW] Swartruggen Dam [25°39'51''S 26 41'32''E], iii.1970, L. Schulze & R. Jones leg., 1 spec. (MHNB); EC, 175 m, -33. 0659S/27.2098E [33°03'57''S 27°12'35''E], N2 Rd side 20 km N of Peddie, karoo vegetation, 18.xi.2013, M. Wanat leg., 9 specs (MNHW); C.P. [NC], Campbell [28°47'S 23°43'E], 30.xii.1953, J.C. Boman leg., 5 specs (SANC); Tvl. [LIM], Groenfontein, SW Naboomspruit, 24°38'S 28°31'E, 02.ii.1993, V.M. Uys leg., 8 specs (SANC); TP. [LIM], Nylstroom [24°43'S 28°24'E], 4.xi.1969, HAD van Schalkwyk leg., 2 specs (SANC); ditto, 30.i.1970, 1 spec. (SANC); ditto, 9.iii.1971, E. Holm leg., 1 spec. (SANC); TP. [LIM], Middelfontein (Nylstroom) [24°41'S 28°33'E], 16.xii.1953, D.W. Rorke leg., 1 spec. (SANC); Tvl [LIM], between Nylstroom and Warmbaths, 24°43'S 28°18'E, 18.i.1991, V.M. Uys leg., 1 spec. (SANC); Tvl [LIM], between Nylstroom and Die



- Oog, 24°29'S 28°35'E, 18.i.1991, M. Harney leg., 1 spec. (SANC); Tvl. [LIM], 10km NE Nylstroom, 24°38'S 28°29'E, iii.1973, E. Holm leg., 1 spec. (SANC); Tvl. [LIM], Pienaarsrivier [25°13'S 28°18'E], 1.ii.1968, HAD van Schalkwyk leg., 8 specs (SANC); ditto, 4.xi.1969, 1 spec. (SANC); MPU, Presidentsrus, 13.5km NW Middelburg, 25°41'S 29°22'E, 20.i. 1989, E. Grobbelaar leg., 4 specs (SANC); C.P. [EC], Middelburg [25°46'S 29°29'E], 18.x.1972, malaise trap, E. Holm leg., 4 specs (SANC); Tvl. [LIM], Ben Alberts Nat. Res., Thabazimbi, 24°37'S 27°23'E, 24-28.xi.1980, S.J. van Tonder leg., 7 specs (SANC); ditto, C. Kok leg., 1 spec. (SANC); Tvl [LIM], Leeupoort, 24°54'S 27°44'E, 15.i.1991, M. Harney leg., 3 specs (SANC); Tvl [GAU], Witpoortjie Botanical Garden, 26°07'S 27°50'E, 11.ii.1989, E. v.d. Linde leg., 2 specs (SANC); CP [WC], Meiringspoort, Groot Swartberge, 33°33'S 22°19'E, 30.xi.1988, R. Oberprieler leg., 7 specs (SANC); WC, Clanwilliam, 32°10'S 18°52'E, 16.iv.1997, R. Sals leg., 12 specs (SANC); Tvl. [LIM], Vaalwater [24°18'S 28°07'E], 2.ii.1968, HAD van Schalkwyk, 2 specs (SANC); CP [EC], Baviaanskloof, 33°32'S 25°50'E, 22.xi.1973, E. Holm leg., 1 spec. (SANC); ditto, 23-24.xi.1983, G.L. Prinsloo, N.C. Grobbelaar leg., 2 specs (SANC); [NC] Kimberley [ 28°42'S 24°46'E], 17.ix.1912, Bro. Powerleg., 4 specs (SANC); ditto, ii.1913, 2 specs (SANC); LIM, Lapalala Nature Reserve, Melkrivier, 12km NW, 23°56'S 28°20'E, 10.i.1991, Collected by beating, E. Grobbelaar leg., 12 specs (SANC); EC, Grahamstown, Mountain Drive, 33°19'E 26°32'E, collected by sweeping, 22.xi.1988, E. Grobbelaar leg., 1 spec. (SANC); Tvl. [LIM], Doorndraai Dam Nature Res.[erve], 24°18'S 28° 44'E, 4-7.ii.1980, W.A. Harrop leg., 1 spec. (SANC); Tvl. [LIM], Buysdorp, 23°01'S 29°22'E, 16.i.1980, G.L. Prinsloo leg., 1 spec. (SANC); [NC], Richmond [31°21'S 23° 55'E], 5.xi.1960, H. v.Ark leg., 4 specs (SANC); O.F.S. [FS], Tus-sen-die-Riviere Res. near Bethulie, 30°30'S 26° 12'E, 01.iv.1987, E. Grobbelaar leg., 1 spec. (SANC); ditto, 21.i.1994, J.S. Donaldson leg., 1 spec. (SANC); ditto, 30.iii-3.iv.1987, B.[=E.] Grobbelaar leg., 1 spec. (SANC); C.P., [NC], Kalahari Gemsbok Nat. Park, Twee Rivieren, 750 m, 26°28'S 20°37'E, 14.ii.1988, light trap, E. Grobbelaar leg., 1 spec. (SANC); ditto, 13.ii.1988, G.D. Butler leg., 2 specs (SANC); K.P. [NC], Kuruman (17 myl van) [17 miles from] [27°27'S 23°27'E], 14.xi.1961, HAD v. Schalkwyk leg., 1 spec. (SANC); Tvl. [MPU], 20km SE Loskopdam, 25°22'S 29°35'E, 9-13.ii.1981, S.J. van Tonder, C. Kok leg., 3 specs (SANC); Tvl. [MPU], 6 km E Loskop Dam, 25°26'S 29°26'E, 26.i.1993, V.M. Uys leg., 1 spec. (SANC); Tvl. [MPU], Loskopdam Nature Res., 25° 25'S 29°20'E, 9-13.ii.1981, S.J. van Tonder, C. Kok leg., 1 spec. (SANC); Tvl. [MPU], Loskop Dam, 25°25'S 29° 23'E, 25.i.1993, from *Rhus* [now *Searsia*] *pyroides* (Anacardiaceae), V.M. Uys leg., 16 specs (SANC); MPU, Mapoch's Caves, c.4 km ENE Roossenekal, 25°11'S 29° 58'E, 16.i.1989, collected from *Rhus* sp. (Anacardiaceae), E. Grobbelaar leg., 4 specs (SANC); MPU, Mapoch's Caves, nr Roossenekal, 25°11'S 29°58'E, 16.i.1989, V.M. Uys leg., 5 specs (SANC); ditto, N. Verheijen leg., 3 specs (SANC); CP [WC], George, 33°58'S 22°28'E, i.1979, S.J. van Tonder leg., 2 specs (SANC); K.P. [NW], Vryburg (Armoedevlakte [near Somerset Strand, 26°57'S 24° 45'E]), 10.xi.1962, HAD v. Schalkwyk leg., 1 spec. (SANC); K.P. [NW], Vryburg (Damplaats) [27°51'S 23° 34'E], 9.xi.1961, HAD v. Schalkwyk leg., 1 spec. (SANC); CP [WC], 10 km N of Garcia's Pass, 33°56'S 21°13'E, 17. xi.1973, E. Holm leg., 1 spec. (SANC); OFS [FS], Bloemfontein [29°05'S 26°11'E], ii.1918, 1 spec. (SANC); Tvl. [NW], Buffel-spoort, 25°47'S 27°28'E, 15-16.x.1988, E. v.d. Linde leg., 1 spec. (SANC); Natal [KZN], Weenen [28°50'S 30°05'E], ii.1924, H.P. Thomasset leg., 1 spec. (SANC); KP [WC], Stormsvlei [34°05'S 20°06'E], 1.ii.[19]71, M.W. Strydom leg., 8 specs (SANC); LIM, D'Nyala Nat. Res., Ellisras District, c. 850 m, 23°45'S 27° 49'E, 19.xii.1987, malaise trap, B.[=E.] Grobbelaar leg., 1 spec. (SANC); ditto, 18-20. xii.1987, collected by beating, E. Grobbelaar leg., 8 specs (SANC); ditto, 08-12.xii.1989, collected at light, C.D. Eardley leg., 3 specs (SANC); 18. xii.1989, collected at light, E. Grobbelaar leg., 6 specs (SANC); ditto, 10-14. xi.1986, adults and larvae collected from *Rhus pyroides* Burch. var. *pyroides* (Anacardiaceae), E. Grobbelaar leg., 4 specs (SANC); N.W.TVL. [LIM], Mogol Nature Reserve, Ellisras Dist, 23°58'S 27°45'E, 19-23.xi.1979, S.J. van Tonder, C. Kok leg., 1 spec. (SANC); Tvl. [LIM], Ellisras [23°39'S 27°44'E], 29.i. 1970, HAD van Schalkwyk leg., 2 specs (SANC); TVL [NW], Magaliesberg nr Oliviershoek, 25°50'S 27°20'E, 11.x.1987, I.M. Millar leg., 10 specs (SANC); TVL [GAU], Roodeplaat, Pretoria, 25°36'S 28°12'E, 16.iii. 1988, B.[=E.] Grobbelaar leg., 1 spec. (SANC); TVL [GAU], Roodeplaat dam nr Pretoria, 24°41'S 28°18'E, 1.x.1986, J.S. Donaldson leg., 1 spec. (SANC); GAU, Vegetable & Ornamental Plant Institute, Roodeplaat, NE Pretoria, 25°35'S 28°22'E, 26.x.2003, E. Breytenbach leg., 4 specs (SANC); ditto, 8.i.2003, adults and larvae collected from *Rhus leptodictya* (Anacardiaceae), E. Breytenbach leg., 1 spec. (SANC); WC, Bloukrans River Bridge, c. 10km E of Nature's Valley, 33°57'S 23°09'E, 31.xii. 1996, R. Stals leg., 4 specs (SANC); KZN, Isandlwana Nature Res., hillside, c. 45 km ESE Dundee, 28°21'32''S 30° 38'28''E, 13.iii.2012, beaten on *Searsia ?rehmanniana* (Anacardiaceae), E. Grobbelaar leg., 2 specs (SANC); ditto, hillside and dry river verges, 28°21'34''S 30°38'22''E, 14.iii.2012, beating and sweeping, E. Grobbelaar leg., 6 specs (SANC); LIM, Mphaphuli Cycad Reserve, 750m, 22°48'S 30°41'E, 9.ii.1994, adults and larvae collected from *Rhus magaliesmontana* [Sond.] subsp. *cod-dii* [(R. & A.Fern.) Moffett] (Anacardiaceae), E. Grobbelaar leg., 6 specs (SANC); EC, Old Thomas River, 20 km S Cathcart, 32°28'S 27°20'E, 25.xi.1988, beating, E. Grobbelaar leg., 8 specs (SANC); LIM, Farm Twee Kansen 624, 20 km NE Tuinplaas, 1000 m, 24°49'S 28°57'E, beating, 26.ii.2003, 4 specs (SANC); ditto, 29.i.2003, 3 specs (SANC); ditto, 07.xii.2000, 2 specs (SANC); ditto, 06.

xii.2001, 2 specs (SANC); ditto, 09.i.2002, 4 specs (SANC); ditto, 05.iii.2001, 1 spec. (SANC); ditto, 20.xii.2002, 2 spec. (SANC); ditto, sweeping, 07.xii.2000, 1 spec. (SANC); ditto, unbaited pitfall trap, 17.ix-16.x.2002, 1 spec. (SANC); ditto, sweeping, 29.i.2003, voucher spec. ARC-PPRI Quelea Research Unit: Eco-toxicological Survey, 1 spec. (SANC); LIM, Farm Twee Kansen 619, 20 km NE Tuinplaas, 1000 m, 24°50'S 28°51'E, sweeping, 19.ii.2002, 3 specs (SANC); [LIM] Deelkraal, Naboomspruit [=Mookgophong, 24°30'S 28°42'E], SE 24 28 Da, 17.xi.1982, S.L. Chown leg., 1 spec. (SANC); Tvl. [LIM], Percy Fyfe Nature Res., 24°03'S 29°09'E, 10-12.iii.1980, sweeping, C. Kok leg., 1 spec. (SANC); [GAU], [Pretoria], S.E. 25 28 Ca [25°57'S 28°34'E], 17.iii.[19]76, C. Thornton leg., 1 spec. (SANC); [NW], Saartjiesnek, 30km W. Pta. [=Pretoria] [25°45'S 27°56'E], 17-23.ix.1971, malaise trap, E. Holm leg., 1 spec. (SANC); [GAU], R-514, 25km W Pretoria [25°42'S 28°07'E], 11.i.1995, on *Acacia*, K.W.R. Zwart leg., 1 spec. (SANC); Tvl. [GAU], Tierpoort, [25°53'21"S 28°24'37"E], 31.i.1984, V.M. Swain leg., 1 spec. (SANC); Tvl. [LIM], 15km E. Bulge River, N.-Waterberg [23°55'S 28°18'E], 22.xi.1972, E. Holm leg., 1 spec. (SANC); C.P. [EC], Gamtoos, 33°58'S 25°04'E, 22.xi.1983, G.L. Prinsloo & N.C. Grobbelaar leg., 1 spec. (SANC); Natal mer. [KZN] Oribi Gorges [30°42'25"S 30°16'34"E], 21.xi.1991, Richter leg. (BAQ). **Zambia:** Senanga [Modimolle, 16°07'S 23°17'E], 10.xi.2006, Z. Jindra leg., 1 spec. (BAQ); 'N. Rhod.', Senanga [Modimolle, 16°07'S 23°17'E], 29.vii-5.viii.[19]52, Carp Exp: Munro, 1 spec. (SANC). **Zimbabwe:** Matopos NP, 20°33'S 28°30'E, 30. xi.1993, F. Koch leg., 2 specs (ZMHB); Kyle Recr. Park at Lake Mutirikwi, 20°13'S 31°00'E, 4.xii.1993, J. Deckert, 1 spec. (ZMHB). [Unknown locality] 1899, Ex Musæo E. Allard, 1 spec. (BAQ). [Unknown locality], 1902, J.P.C. leg., 1 spec. (BAQ).

**Distribution.** Botswana; Namibia; the Republic of South Africa (EC, FS, GAU, KZN, LIM, MPU, NC, NW, WC); Zambia; Zimbabwe (Fig. 17).

**Chorotype.** Southern African chorotype (SAF).

**Host plants.** *Acacia* sp., *A. nilotica* (Fabaceae), *Ziziphus* (Rhamnaceae). *Rhus* [now *Searsia*] *leptodictya*, *S. pyroides*, *S. pyroides* var. *pyroides*, *S. magalismontana* subsp. *coddii*, *S. ?rehmanniana* (Anacardiaceae). Reported also on willow [*Salix* sp.] (Salicaceae).

**Habitat.** Collected in rocks, fynbos, karoo vegetation, low damp, river edge, dry riverbed.

**Phenology.** Collected from January to May and from July to December, mostly from January–March and October–December.

**DNA data.** Not available

### Discriminant analysis

Considering males and females separately, a forward stepwise discriminant function analysis (Tabachnick & Fidell 1989) with a P-level to enter = 0.05 was performed, using seven morphometric variables as predictors. The main aim of this analysis was to determine morphometric characters to aid in the identification of three species here discussed: *Calotheca nigrotessellata* (20 ♂♂ and 20 ♀♀), *C. luteotessellata* **sp. nov.** (15 ♂♂ and 15 ♀♀), and *C. luteomaculata* **sp. nov.** (6 ♂♂ and 5 ♀♀). Predictor variables used were: length of elytrae (LE), width of elytrae (WE), length of pronotum (LP), width of pronotum (WP), length of antennae (LAN), total length of body (LB), length of aedeagus for males (LAED) and length of spermatheca for females (LSP).

The analysis carried on the males shows as the variables WP and WE are highly significant to the discrimination between males of the three species compared (Table 1). However also LB, LAED and LAN show a good discriminating power, while LE and LP are not significant (Table 1). The “classification matrix” relative to males shows a high percentage, between 90-100%, of corrected attributions for every species analysed (Table 2). To see how the seven morphometric variables considered discriminate males of the species analysed and to compute the relative discriminant functions, a Canonical Analysis was performed. The two functions (CVM1, CVM2), for 100% of total explained variance, were considered. Their respective raw coefficients, eigenvalues and percentage of explained variance (%EV) are reported in Table 3. The first discriminant function accounts for 69.7% of EV and allows mainly to discriminate easily *C. luteomaculata* **sp. nov.** from *C. luteotessellata* **sp. nov.** and *C. nigrotessellata* from *C. luteotessellata* **sp. nov.**; the second function (30.3% of EV) is instead useful to separate *C. luteomaculata* **sp. nov.** from *C. nigrotessellata* (Table 3; Fig. 15).

The discriminant analysis carried on females shows that the variables with higher discriminating power are LP, WE, LAN and WP and, to a lesser extent, LB; not significant are instead LE and LSP (Table 1). In the “classification matrix” of females (Table 2), the percentage of corrected attributions is equal to 100% for *C. luteotessellata* **sp. nov.** and *C. luteomaculata* **sp. nov.**, while it is 85% for *C. nigrotessellata*. By Canonical Analysis, also for females, two functions (CVF1, CVF2) were extracted (Tables 3). The first function (67.9% of EV) is mainly useful to separate *C. nigrotessellata* from *C. luteotessellata* **sp. nov.** and *C. luteomaculata* **sp. nov.**; the second function (32.1% of EV) is instead useful to discriminate *C. luteomaculata* **sp. nov.** from *C. nigrotessellata* and *C. luteotessellata* **sp. nov.** (Table 3; Fig. 16).

Finally, Mahalanobis distances (MD) suggest that *C. luteotessellata* **sp. nov.** are very well discriminated from *C. luteomaculata* **sp. nov.** (MD males = 19.575; females = 18.580) and, to a lesser extent, *C. nigrotessellata* from *C. luteotessellata* **sp. nov.** (MD males = 8.505; females =

**Table 1** – Discriminant Stepwise Analysis for males and females. Variables in the model, F to enter and P-level.

♂♂	Step	F to enter	P level
<b>WP</b>	1	39.15	0.00000
<b>WE</b>	2	8.10	0.00120
<b>LB</b>	3	4.34	0.02053
<b>LAED</b>	4	3.71	0.03446
<b>LAN</b>	5	3.68	0.03615
<b>LE</b>	6	out	0.08845
<b>LP</b>	7	out	0.56648
♀♀	Step	F to enter	P level
<b>LP</b>	1	21.18	0.00000
<b>WE</b>	2	20.12	0.00000
<b>LAN</b>	3	6.78	0.00324
<b>WP</b>	4	5.44	0.00893
<b>LB</b>	5	4.21	0.02375
<b>LE</b>	6	out	0.05946
<b>LSP</b>	7	out	0.34208

8.702) and *C. nigrotessellata* from *C. luteomaculata* **sp. nov.** (MD males = 6.380; females = 8.005).

**Discussion**

The three species here discussed can be attributed to the same species group mainly based on genitalic and pronotal features: spermatheca elongate basally, narrowing distinctly apically and bent towards basal part, generally with a short appendix and ductus thickset, short or moderately elongate, U-shaped, uncoiled (Figs 4, 8, 13-14); median lobe of aedeagus with wrinkled ventro-lateral surface and short dorsal ligula formed by two medial and two lateral lobes acute to obtuse apically (Figs 3, 7, 11-12); pronotal surface generally irregular, with shallow depressions, punctation not homogenous; pronotal line of punctures straight, generally with some slightly distant medio-lateral punctures, sometimes with an additional line of punctures lining the anterior margin; basal furrows of pronotum deeply impressed (Figs 1-2, 5-6, 9-10).

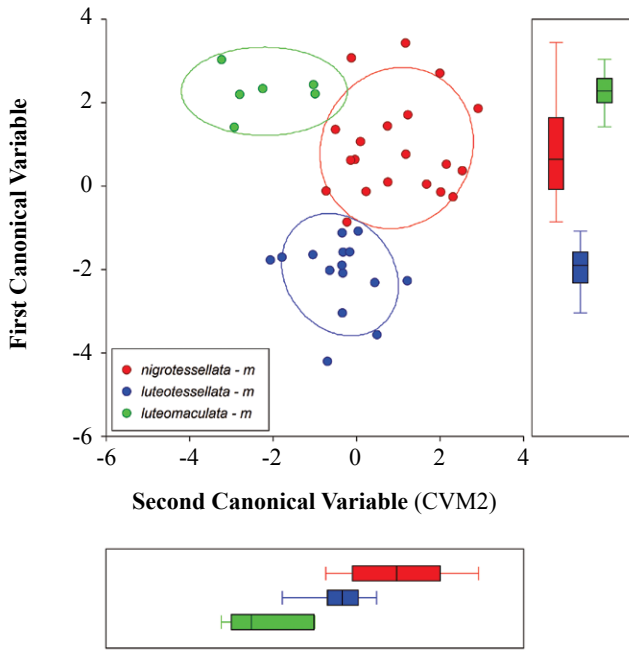
They display remarkable crossed morphological similarities, such as: unique colour in *C. luteomaculata* **sp.**

**Table 2** – Discriminant Stepwise Analysis. Classification matrix for males and females. Rows: observed classifications; columns: predicted classifications.

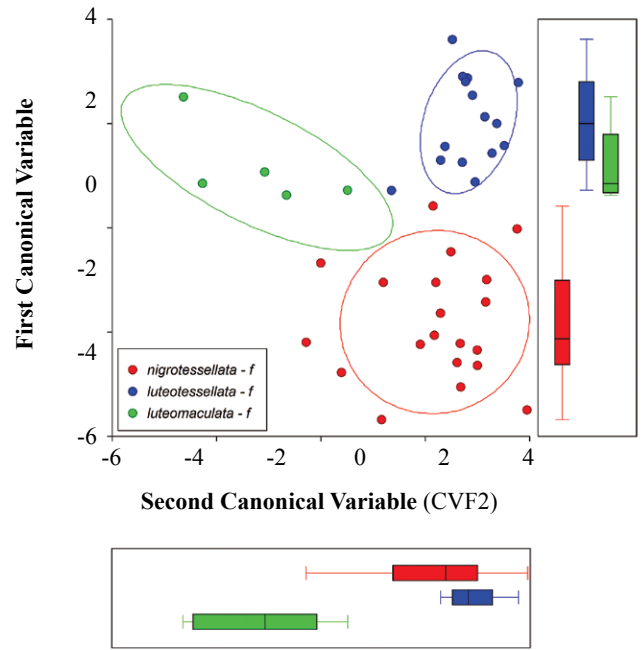
♂♂	%	<i>nigrotessellata</i>	<i>luteotessellata</i>	<i>luteomaculata</i>
<i>nigrotessellata</i>	90	18	1	1
<i>luteotessellata</i>	100	0	15	0
<i>luteomaculata</i>	100	0	0	6
♀♀	%	<i>nigrotessellata</i>	<i>luteotessellata</i>	<i>luteomaculata</i>
<i>nigrotessellata</i>	85	17	2	1
<i>luteotessellata</i>	100	0	15	0
<i>luteomaculata</i>	100	0	0	5

**Table 3** – Discriminant Stepwise Analysis. Raw coefficients, constants, eigenvalues and percentages of explained variance (%EV) of the canonical variables considered for males and females.

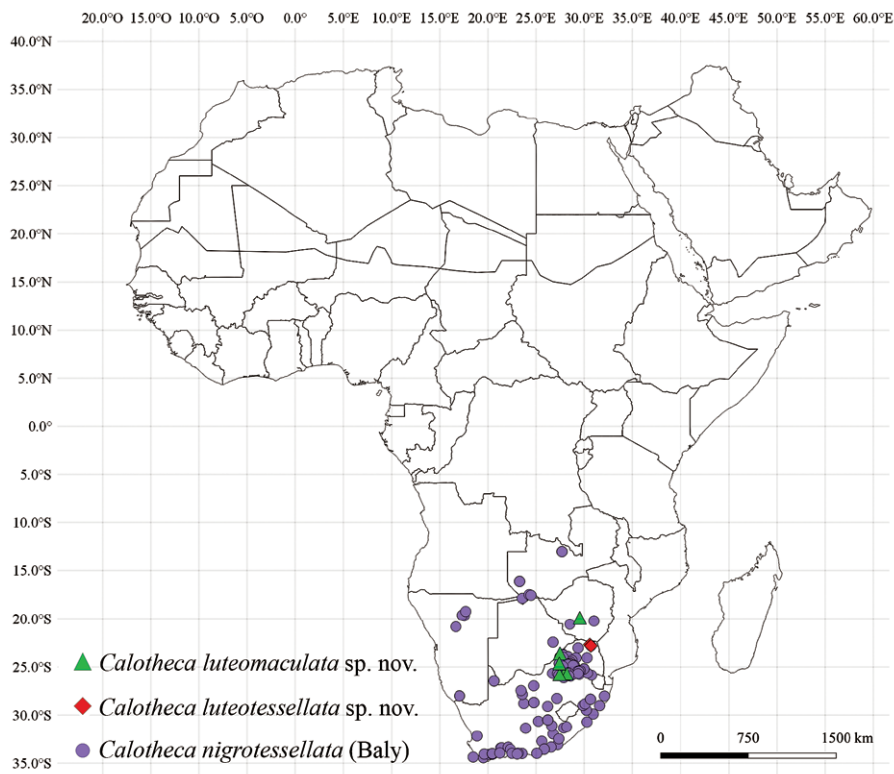
♂♂	CVM1	CVM2	♀♀	CVF1	CVF2
<b>WP</b>	-17.28360	15.47829	<b>LP</b>	-39.13794	-10.78765
<b>WE</b>	3.27140	-8.07202	<b>WE</b>	13.13583	-1.79825
<b>LB</b>	-2.85712	4.39987	<b>LAN</b>	-3.94688	11.65396
<b>LAED</b>	6.05651	0.93924	<b>WP</b>	7.37205	16.04171
<b>LAN</b>	3.08107	7.90263	<b>LB</b>	-2.59577	2.34720
<b>Constant</b>	17.34441	-28.28328	<b>Constant</b>	-4.47257	-13.33877
<b>Eigenvalue</b>	3.03159	1.31620	<b>Eigenvalue</b>	3.61026	1.70557
<b>%EV</b>	69.70	30.30	<b>%EV</b>	67.90	32.10



**Fig. 15** – Discriminant Stepwise Analysis. Scatterplots (CVM1 by CVM2) of the Canonical Variates Analysis for males. *C. nigrotessellata* (20 ♂♂), *C. luteotessellata* sp. nov. (15 ♂♂) and *C. luteomaculata* sp. nov. (6 ♂♂). Box and whiskers plots: median, inter-quartile range and range of the First and Second Canonical Variable for the three species. Ellipse: limit of the 95% probability distribution of the three species in the space of the First and Second Canonical Variables.



**Fig. 16** – Discriminant Stepwise Analysis. Scatterplots (CVF1 by CVF2) of the Canonical Variates Analysis for females. *C. nigrotessellata* (20 ♀♀), *C. luteotessellata* sp. nov. (15 ♀♀) and *C. luteomaculata* sp. nov. (5 ♀♀). Box and whiskers plots: median, inter-quartile range and range of the First and Second Canonical Variable for the three species. Ellipse: limit of the 95% probability distribution of the three species in the space of the First and Second Canonical Variables.



**Fig. 17** – Geographical distribution of *Calothecha luteomaculata* sp. nov., *C. luteotessellata* sp. nov., *C. nigrotessellata* (Baly, 1865).

**nov.** and *C. luteotessellata* **sp. nov.**; very similar median lobe of aedeagus and spermatheca in *C. luteotessellata* **sp. nov.** and *C. nigrotessellata*. In addition, *C. nigrotessellata* is highly variable, and the two new species occur within its wide distributional range, even in sympatry, synchrony and on the same host plants. Based on external morphology and genitalic shape, *C. luteomaculata* **sp. nov.** was unequivocally considered a species new to science. The taxonomic status of *C. luteotessellata* **sp. nov.** appeared more problematic, due to the striking similarities with *C. nigrotessellata*, in both the aedeagus and spermatheca. We attributed it to a different species based on: the lack of any intermediate forms with *C. nigrotessellata* in sculpture, colour, and pronotal shape, this despite the high variability of the latter; and based on the combined results of the discriminant analysis, which significantly separated between the three species analysed. Future research based on molecular data, may confirm the taxonomic status of the new species here described and supply a deeper insight on the variability of *C. nigrotessellata* within its wide geographic distributional range.

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