SYSTEMATICS AND PHYLOGENY

Revision of the *Aphthona cookei* species group in Sub-Saharan Africa: pests of *Jatropha curcas* L. in biodiesel plantations (Coleoptera, Chrysomelidae, Galerucinae, Alticini)

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Abstract

The *Aphthona cookei* species-group from Sub-Saharan Africa, comprising some pests of *Jatropha curcas* L., is herein analyzed and revised. This species-group includes: *Aphthona cookei* (Gerstaecker, 1871), *A. dilutipes* Jacoby, 1906, *A. nigripes* (Allard, 1890), *A. thikana* Bryant, 1940, *A. usambarica* Weise, 1902, *A. weisei* (Jacoby, 1899b), *A. whitfieldi* Bryant, 1933 and the new species *A. namibiana* sp. n. from Namibia. The following new synonymies are proposed: *Aphthona cookei* (Gerstaecker, 1871)=*Aphthona weisei abokana* Bechyné, 1959 syn. n.; *Aphthona dilutipes* Jacoby, 1906=*Aphthona damarorum* Weise, 1914 syn. n.; *Aphthona nigripes* (Allard, 1890)=*Pseudeugonotes vannutellii* Jacoby, 1899a syn. n. A key to the species, micrographs of male and female genitalia, scanning electron micrographs of peculiar morphological characters, and distributional and ecological data are supplied. Finally, the results of a discriminant analysis using six morphological characters are also reported.

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Key words: Afrotropical region, *Aphthona*, Coleoptera Chrysomelidae, discriminant analysis, flea beetles, *Jatropha curcas*, new species, new synonymies.

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Introduction

Jatropha curcas L., commonly known as *Physic Nut* or *Purging Nut*, is a bush or small tree (up to 5 m height) belonging to the Euphorbiaceae family and native to Central America. From Central America, this plant was probably spread by Portuguese seafarers via the Cape Verde Islands and former Portuguese Guinea (now Guinea Bissau) to other countries in Africa and Asia (Achten *et al*., 2008). *J. curcas* is planted as a protection hedge around fields (living fence) by farmers all over the tropical world, because it is not browsed by animals. Seeds are also used to make soap and as a medicinal plant. However, in recent years, plantations of *J. curcas* have been promoted worldwide to produce biodiesel from oil extracted from pressed seeds (Jongh & van der Putten, 2010). *Jatropha curcas* represents new opportunities as cash crop for farmers and rural entrepreneurs and as sustainable energy source for communities. In addition, *J. curcas* seed cake, a by-product of the biodiesel trans-esterification process can be used as a rich organic fertilizer (Srinophakun *et al*., 2012).

In Africa, the most important *J. curcas* plantations are located in Egypt, Ethiopia, Sudan, Ghana, Mali, Tanzania, Mozambique and Republic of South Africa (Robinson & Beckerlegge, 2008). However, its cultivation is often hampered by pests, one of the most important in Sub-Saharan Africa being leaf beetle species (Coleoptera Chrysomelidae) belonging to the alticine genus *Aphthona* Chevrolat, 1836 (Gagnaux, 2009; Nielsen, 2009; Anitha & Varaprasad, 2012). *Aphthona* is a widespread flea beetle genus found in Australian, Nearctic, Oriental and Palaearctic regions (Biondi & D'Alessandro, 2012). In Sub-Saharan Africa and Madagascar, it consists of about 100 known species but may likely include many other undescribed taxa (Biondi & D'Alessandro, 2012; Biondi, personal communication). Members of *Aphthona* are found in different environments and associated mainly with plants of Euphorbiaceae but also of Geraniaceae, Cistaceae, Rosaceae, Linaceae, Iridaceae, Malvaceae and Lythraceae (Jolivet & Hawkeswood, 1995; Biondi & D'Alessandro, 2012).

In this paper, we propose a taxonomical revision of the eight species of *Aphthona* attributed to the *cookei* group, *Aphthona cookei* (Gerstaecker, 1871), *A. dilutipes* Jacoby, 1906, *A. nigripes* (Allard, 1890), *A. thikana* Bryant, 1940, *A. usambarica* Weise, 1902, *A. weisei*

(Jacoby, 1899b), *A. whitfieldi* Bryant, 1933 and the new species *A. namibiana* sp. n.

At least three species, *A. cookei, A. dilutipes* and *A. whitfieldi*, are recognized pests for *Jatropha curcas* in the Afrotropical region.

These species, known also as *golden flea beetles*, are closely related to some Palaearctic species such as *A. cyparissiae* (Koch), *A. flava* Guillebeau, *A. nigriscutis* Foudras and, especially, *A. illigeri* Bedel. However, the Afrotropical species are easily distinguishable mainly for having: hind femora always at least partially strongly blackened; antennae, especially in male, longer and more robust; claw segment of all tarsi shorter and more thickset; pronotal punctation nearly absent; external margin of hind tibiae generally more deeply and regularly dentate. The species attributed to the *cookei* group are often wrongly or roughly identified (Gagnaux, 2009); correct identifications are instead important not only for taxonomic and biogeographic purposes, but also for developing and implementing control measures against these insects.

All eight the species considered share the following characters: pronotal punctation nearly absent; elytral punctation confuse, very weakly impressed; frontal tubercles well delimited (Figure 1A-C); antennae comparatively short, just reaching half of the elytra [length of antennae /(length of elytra + length of pronotum): ♂♂ ≤0.70; ♀♀ ≤0.64]; first tarsomere of protarsi and mesotarsi not or very weakly enlarged in male; median lobe of aedeagus without any evident ventral sulcus (Figure 2); spermatheca with moderately elongate and uncoiled ductus and well developed distal part (Figure 3). In addition, the species of this group share also: medium or large size (usually 2.50-4.00 mm); dorsal integuments yellowish, pale brown or reddish, never black or metallic; posterior femora at least distally distinctly blackened (Figure 4).

Materials and Methods

Material consisted of dried pinned specimens preserved in the institutions listed below. Specimens were examined and dissected using WILD MZ12.5 and LEICA M205C binocular microscopes. Photomicrographs were taken using a Leica DFC500 camera and the Auto-Montage Pro 2006 software (license number: 15224*syn2459*153a2112maurizio266836). Scanning electron micrographs were taken using a HITACHI TM-1000. Morphometric measures were taken using the image analysis software Image-Pro Insight 8.0 (license number: 03080000-5385). Statistical analyses and graphics were performed using the package NCSS version 8.0.5 for Windows (license number: Z8B8-P3M3-H8Q5-Q4G9-H6V9). Discriminant function analysis (Tabachnick & Fidell, 1989) was used to establish appropriate functions separating the species using morphometric characters as predictors. Geographical coordinates of the localities are reported in degrees and minutes (DMD-WGS84 format); those included in square brackets were added by the authors.

Abbreviations

LAED, length of median lobe of aedeagus; LAN, length of antennae; LB, total body length; LE, length of elytra; LP, length of pronotum; LSP, length of spermatheca; WE, width of elytra; WP, width of pronotum.

Collections and depositories

BAQ: collection of M. Biondi, Department of Health, Life and Environmental Sciences, University of L'Aquila, Italy; BMNH: The

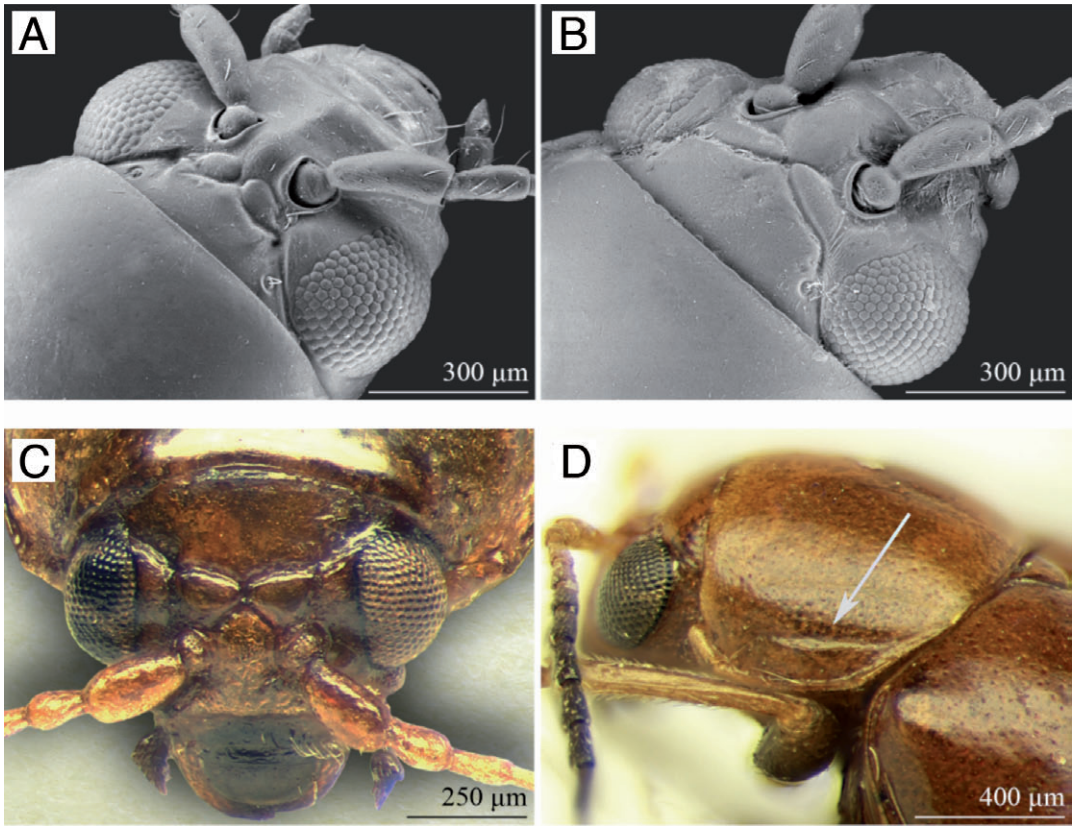

Figure 1. Morphological characters. A) Head of *Aphthona cookei* (Gerstaecker); B) Ditto of *A. nigripes* (Allard); C) Ditto of *A. usambarica* Weise; D) Pronotum in lateral view of *A. cookei*.

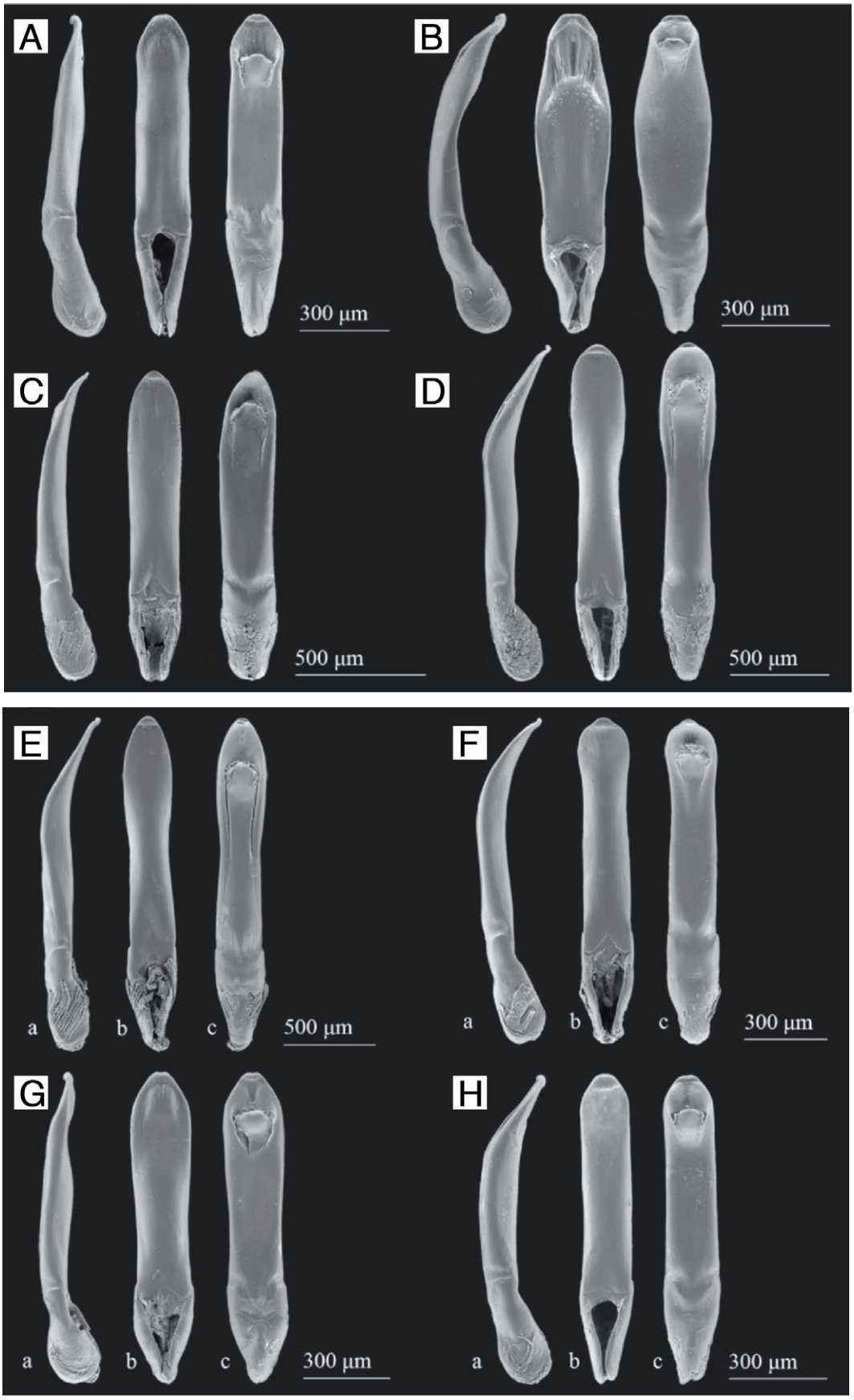

Figure 2. Median lobe of aedeagus in lateral, ventral and dorsal view. A) *Aphthona cookei* (Gerstaecker); B) *A. dilutipes* Jacoby; C) *A. namibiana* sp. n.; D) *A. nigripes* (Allard) (Tanzania); E) *A. nigripes* (Allard) (Guinea); F) *A. thikana* Bryant; G) *A. weisei* (Jacoby); H) *A. whitfieldi* Bryant.

Natural History Museum, formerly British Museum (Natural History), London, Great Britain; IRSN: Institut Royal des Sciences Naturelles de Belgique, Bruxelles, Belgium; JMBG: collection Joachim Mauser, Ballrechten-Dottingen, Germany; MCZ: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA; MDAG: collection Manfred Döberl, Abensberg, Germany; MNHN: Muséum National d'Histoire Naturelle, Paris, France; MHNB: Muséum d'Histoire Naturelle de Basel, Switzerland; MRAC: Musée Royal de l'Afrique Centrale, Tervuren, Belgium; MSNG: Museo Civico di Storia Naturale di Genova, Italy; MZLU: Lund Zoological Museum, Lund University, Sweden; NHRS: Naturhistoriska Riksmuseet, Stockholm, Sweden; UASG: collection Ulf Arnold, Schöneiche, Germany; MNHUB: Museum für Naturkunde der Humboldt-Universität, Berlin, Germany.

Results

Key to species

This key identifies the 8 known *Aphthona* species attributed to the *cookei*-group. Only males can be surely identified through examination of the median lobe of the aedeagus. However, this key can be useful also for females since some species show reliable diagnostic characters (*e.g.* shape of spermatheca, and body size and color).

1. Frontal tubercles (Figure 1C) large and wide, sub-triangular. Spermatheca (Figure 3D) larger (LSP=30 mm in the single type specimen), with clearly more thickset ductus. Male unknown ....*A. usambarica* Weise (Figure 4G)
- Frontal tubercles (Figure 1A,B) small, sub-elliptical or roundish. Spermatheca smaller (18.5 ≤LSP ≤28.0 mm), with thinner ductus (Figure 3A-C, E-H) 2
2. Scutellum yellowish 3
- Scutellum clearly blackened 7
3. Frontal carina (Figure 1B) apically rounded; interantennal space about as wide as first antennomere length. Pronotum sub-trapezoidal, comparatively smaller (LE/LP: ♂♂ ≥3.10; ♀♀ ≥3.20), with maximum width at base. Median lobe of aedeagus (Figure 2D,E) very elongate (LAED >1.30 mm; LE/LAED <1.95). Spermatheca (Figure 3E) larger (LSP >0.24 mm) ....*A. nigripes* (Allard) (Figure 4D,E)
- Frontal carina (Figure 1A) apically sub-acute; interantennal space clearly narrower than first antennomere length. Pronotum sub-rectangular, comparatively larger (LE/LP: ♂♂ <3.10; ♀♀ <3.20), with maximum width in middle. Median lobe of aedeagus (Figure 2A,B,G,H) less elongate (LAED ≤1.30 mm; LE/LAED ≥1.95). Spermatheca (Figure 3A-C,F) smaller (LSP ≤0.24 mm).....4
4. All femora, metathorax and abdomen generally strongly blackened, often also tibiae and tarsi. Median lobe of aedeagus (Figure 2B) thickset, in ventral view distinctly enlarged in middle part. Spermatheca (Figure 3A) with shorter distal part ....*A. dilutipes* Jacoby (Figure 4B)
- Anterior and middle femora, tibiae, metathorax and abdomen always yellowish or reddish never blackish. Median lobe of aedeagus (Figure 2A,G,H) slender, in ventral view sub-parallel in middle part. Spermatheca (Figure 3B,C,F) with longer distal part.....5
5. Median lobe of aedeagus (Figure 2A,G) longer (generally LAED >1.00 mm), in lateral view straight. Spermatheca (Figure 3B,C) gen-

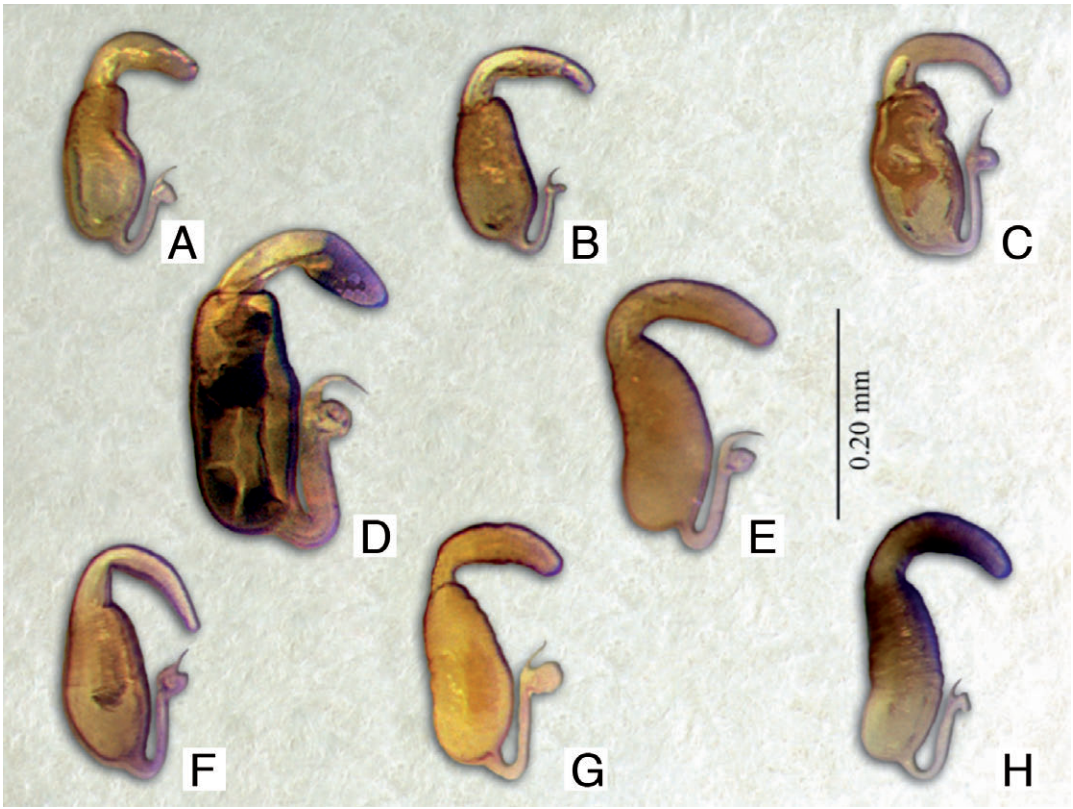

Figure 3. Spermatheca. A) *Aphthona dilutipes* Jacoby; B) *A. cookei* (Gerstaecker); C) *A. weisei* (Jacoby); D) *A. usambarica* Weise (type); E) *A. nigripes* (Allard); F) *A. whitfieldi* Bryant; G) *A. namibiana* sp. n.; H) *A. thikana* Bryant.

erally with basal part thickset and distinctly separated from distal part.....6

- Median lobe of aedeagus (Figure 2H) shorter (generally LAED ≤1.00 mm), in lateral view clearly bent in ventral direction at apical fourth. Spermatheca (Figure 3F) generally with basal part more slender and weakly separated from distal part ....*A. whitfieldi* Bryant (Figure 4I)

6. Pronotum (Figure 1D) generally with well visible sub-lateral longitudinal sulcus. Antennomere 2-3 longer; antennomere 4 just little

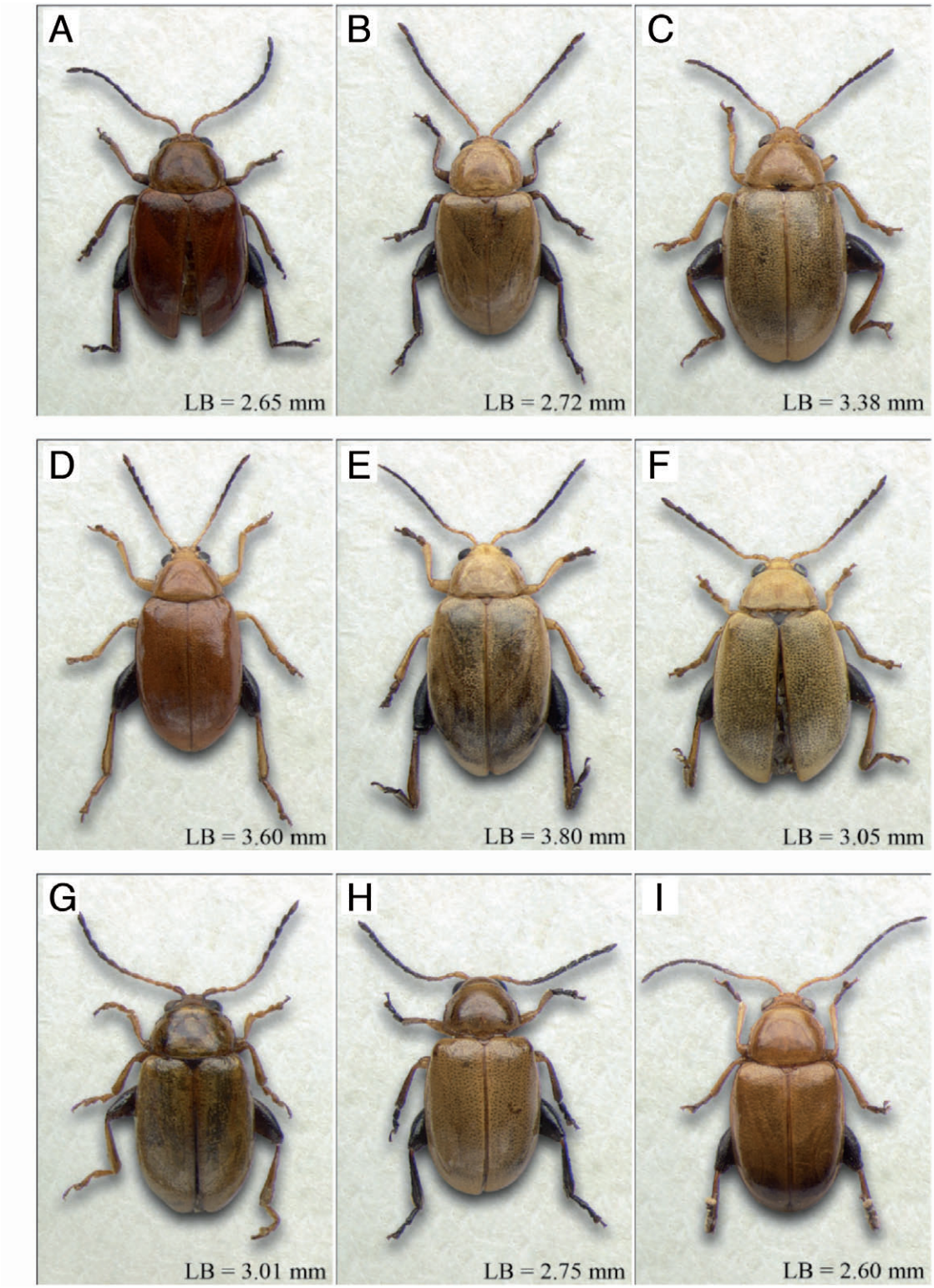

Figure 4. Habitus. A) *Aphthona cookei* (Gerstaecker); B) *A. dilutipes* Jacoby; C) *A. namibiana* sp. n.; D-E) *A. nigripes* (Allard); F) *A. thikana* Bryant; G) *A. usambarica* Weise; H) *A. weisei* (Jacoby); I) *A. whitfieldi* Bryant.

longer than antennomere 3. Median lobe of aedeagus (Figure 2A) in ventral view slender, sub-parallel in whole length; in lateral view, distally not sinuous. Spermatheca in Figure 3B..... .....*A. cookei* (Gerstaecker) (Figure 4A)

- Pronotum generally with just visible or incomplete sub-lateral longitudinal sulcus. Antennomere 2-3 shorter; antennomere 4 clearly longer than antennomere 3. Median lobe of aedeagus (Figure 2G), in ventral view more thickset, enlarged in distal third; in lateral view, distally slightly sinuous. Spermatheca in Figure 3C..... .....*A. weisei* (Jacoby) (Figure 4H)

7. First tarsomere of metatarsi distinctly enlarged in male. Median lobe of aedeagus (Figure 2C) in ventral view thickset, laterally sub-parallel, apically acute; in lateral view distally weakly bent ventrad. Spermatheca (Figure 3G) more thickset, with pear-shaped elongate basal part, distinctly separated from distal part. ....*A. namibiana* sp. n. (Figure 4C)

- First tarsomere of metatarsi not distinctly enlarged in male. Median lobe of aedeagus (Figure 2F) in ventral view slender, laterally narrowed in middle part, apically more rounded; in lateral view strongly curved in distal third ventrad. Spermatheca (Figure 3H) slender, with sub-reniform basal part, not well separated from distal part..... .....*A. thikana* Bryant (Figure 4F)

List of species

Aphthona cookei (Gerstaecker)

Haltica (Aphthona) cookei Gerstaecker, 1871: 85; 1873: 287-288.
=*Aphthona weisei abokana* Bechyné, 1959: 15 syn. n.
Aphthona whitfieldi Bryant: Bryant, 1957: 359 (misidentification); Scherer, 1972: 6 (misidentification).

Material examined

KENYA: Zanzibar [6°10‘03“S 39°20‘26“E], C. Cooke leg., type 7412 (MCZ). OMAN: env. Tawi Attair [17°07‘25“N 54°34‘50“E], 700-800 m, 23-25.iv.2003, R. Červenka leg., 5 specimens leg. (MDAG). YEMEN: 20 km S of Ta’izz, 13°30‘N 43°57‘E, 24.x.2005, J. Halada leg., 2 specimens (BAQ); Suk ad Dabab, SW Ta’izz, 13°32‘N 43°57‘E, 1208 m, 26.x.2005, P. Kabátek leg., 1 specimen (MDAG); Jabal al Fatk, Hawf NE Al Ghaydah, 16°40‘N 53°05‘E, 759 m, 1.iv.2007, M. Rejcek leg., 3 specimens (UASG); 20 km W Lawdar, 1101 m, 13°53‘N 45°48‘E, 27.iii.2007, 1 spec. lgt. M. Rejcek [16] (UASG); ditto, 26-27.iii.2010, 1 specimen (UASG); Wadi Zabid [14°07‘53“N 43°31‘46“E], 1970, L. Szalay-Marzsó leg., 1 specimen (MDAG). UGANDA: Kasenyi [0°01‘60“S 30°07‘60“E], xii.1938, P. Lefèvre leg., 1 ♂ (MRAC); Madi [=Madi Opei: 3°40‘21“N 33°05‘49“E], v.1927, G.D.H. Carpenter leg., 1 specimen (BMNH). KENYA: Kilifi Mavueni [3°40‘40“S 39°48‘04“E], 10.ix.2007, on *Jatropha curcas*, B. Kivyatu leg., 8 specimens (BAQ). DEMOCRATIC REPUBLIC OF THE CONGO: Mahagi, Abok [2°00‘N 31°00‘E], 12.ii.1929, A. Collart leg., type and 13 paratypes of *Aphthona weisei abokana* Bechyné (IRSN).

Other records from literature

YEMEN: Usaifira [13°34‘52“N 44°00‘53“E], 1 mile N Ta’izz, c. 4500 ft (Bryant 1957: 359 as *A. whitfieldi*); SOMALIA: between Hargeisa and Berbera [10°00‘29“N 44°46‘30“E] (Scherer, 1972 as *A. whitfieldi*); KENYA: Mombasa [4°02‘36“S 39°40‘05“E] (Gerstaecker 1871: 85); TANZANIA: Usambara Mountains, Nguela [~4°45‘23“S 38°30‘07“E] (Bechyné, 1960: 12).

Morphological remarks

♂ (*n*=10; mean and standard deviation): LE=2.16±0.08 mm (2.03 ≤LE ≤2.28 mm); WE=1.56±0.08 mm (1.44 ≤WE ≤1.69 mm); LP=0.77±0.04 mm (0.72 ≤LP ≤0.84 mm); WP=1.06±0.05 mm (0.97 ≤WP ≤1.13 mm); LAN=1.83±0.10 mm (1.69 ≤LAN ≤2.00 mm); LAED=0.99±0.02 mm (0.97 ≤LAED ≤1.03 mm); LB=2.88±0.10 mm (2.72 ≤LB ≤3.04 mm); LE/LP=2.79±0.09 (2.68 ≤LE/LP ≤3.00); WP/LP=1.37±0.03 (1.33 ≤WP/LP ≤1.43); WE/WP=1.47±0.06 (1.39 ≤WE/WP ≤1.61); WE/LE=0.72±0.03 (0.67 ≤WE/LE ≤0.77); LAN/(LE + LP)=0.62±0.01 (0.59 ≤LAN/(LE + LP) ≤0.64); LE/LAED=2.18±0.06 (2.10 ≤LE/LAED ≤2.32). ♀ (*n*=10): LE=2.25±0.12 mm (2.09 ≤LE ≤2.47 mm); WE=1.65±0.11 mm (1.53 ≤WE ≤1.88 mm); LP=0.78±0.03 mm (0.75 ≤LP ≤0.84 mm); WP=1.09±0.05 mm (1.02 ≤WP ≤1.17 mm); LAN=1.74±0.12 mm (1.56 ≤LAN ≤1.91 mm); LSP=0.19±0.01 mm (0.19 ≤LSP ≤0.20 mm); LB=3.02±0.11 mm (2.84 ≤LB ≤3.16 mm); LE/LP=2.87±0.11 (2.58 ≤LE/LP ≤2.96); WP/LP=1.39±0.06 (1.25 ≤WP/LP ≤1.46); WE/WP=1.52±0.11 (1.38 ≤WE/WP ≤1.70); WE/LE=0.73±0.05 (0.66 ≤WE/LE ≤0.81); LAN/(LE + LP)=0.57±0.02 (0.53 ≤LAN/(LE + LP) ≤0.62); LE/LSP=11.63±0.57 (11.02 ≤LE/LAED ≤12.83).

Dorsal integuments entirely reddish brown (Figure 4A), sometimes paler on pronotum. Ventral parts from pale brown to reddish brown, often partially blackened. Legs with obscured anterior and middle femora and black hind femora; anterior and middle tibiae yellowish; hind tibiae distinctly darkened. Male with very weakly enlarged first tarsomere of protarsi and mesotarsi. Median lobe of aedeagus (Figure 2A) elongate, in ventral view laterally sub-parallel, apically widely rounded; a small, elongate and weakly depressed longitudinal hollow on preapical area; in lateral view, aedeagus straight, slightly sinuous in apical third. Spermatheca (Figure 3B) with pear-shaped elongate basal part; distal part distinctly elongate, well separated from basal part; ductus very thin, moderately elongate and uncoiled.

Distribution

Oman, Yemen, Somalia, Uganda, Democratic Republic of Congo, Kenya and Tanzania (Figure 5A). Northern-Eastern Afrotropical chorotype (NEA) with extensions in Arabian Peninsula (Biondi & D’Alessandro, 2006).

Ecological notes

This species was collected in Kenya (Kilifi Mavueni) in *Jatropha curcas* plantations.

Aphthona dilutipes Jacoby

Aphthona dilutipes Jacoby, 1906: 12; Scherer, 1962a: 9, 1963: 657
=*Aphthona damarorum* Weise, 1914: 269 syn. n.

Material examined

REPUBLIC OF SOUTH AFRICA: KwaZulu-Natal, Estcourt [29°00‘21“S 29°52‘32“E], G.A.K. Marshall leg., type (BMNH). BURUNDI: Plaine de la Ruzizi [2°36‘59“S 28°57‘01“E], i-iii.1966, S. N’Dani leg., 32 specimens (MRAC); Ditto, iv.1966, 89 specimens (MRAC). DEMOCRATIC REPUBLIC OF THE CONGO: Tanganyka-Moero, Nyunzu [5°56‘49“S 28°00‘52“E], i-ii.1934, H. De Saeger leg., 5 specimens (MRAC); Kabinda [6°08‘14“S 24°28‘56“E], 1930, Ph. Allaer leg., 2 specimens (MRAC); Lomami, Kamina [8°44‘08“S 24°59‘42“E], 1930, R. Massart leg., 8 specimens (MRAC); Manyema, Kindu [2°57‘00“S 25°56‘60“E], 26.iii.1918, R. Mayné leg., 4 specimens (MRAC); ditto, i.1924, H. Lebeau leg., 2 specimens (MRAC); Gandajika [6°44‘58“S 23°57‘10“E], 7.xi.1950, P. de Francquen leg., 1 specimen (MRAC); ditto, 2.i.1970, on *Arachis*, 3 specimens (BAQ); Lokandu [2°31‘53“S 25°45‘41“E], iii.1939, Capt. Marée leg., 1 specimen (MRAC); Nyangwe [4°13‘00“S 26°10‘60“E], iv.1918, R. Mayné leg., 1 specimen (MRAC); Tanganyka, Moba [7°02‘23“S 29°45‘58“E], 780 m, i.1953, H. Bomans leg., *à la lumière*, 1 specimen (MRAC); ditto, xi.1953, 1 specimen (MRAC); Ditto, 23.iii.1954, 1 specimen (MRAC). MALAWI: Balaka env. [14°59‘08“S 34°57‘22“E], 19-20.xii.2001, J. Bezděk leg., 2 specimens (BAQ). MOZAMBIQUE: Southern Mozambique, Inhambane Province, near Panda [23°52‘24“S 35°23‘17“E], 5.xi.2011, P. Weintraub leg., 9 specimens (BAQ). NAMIBIA: Farm Okosongomingo am kleinen Waterberg

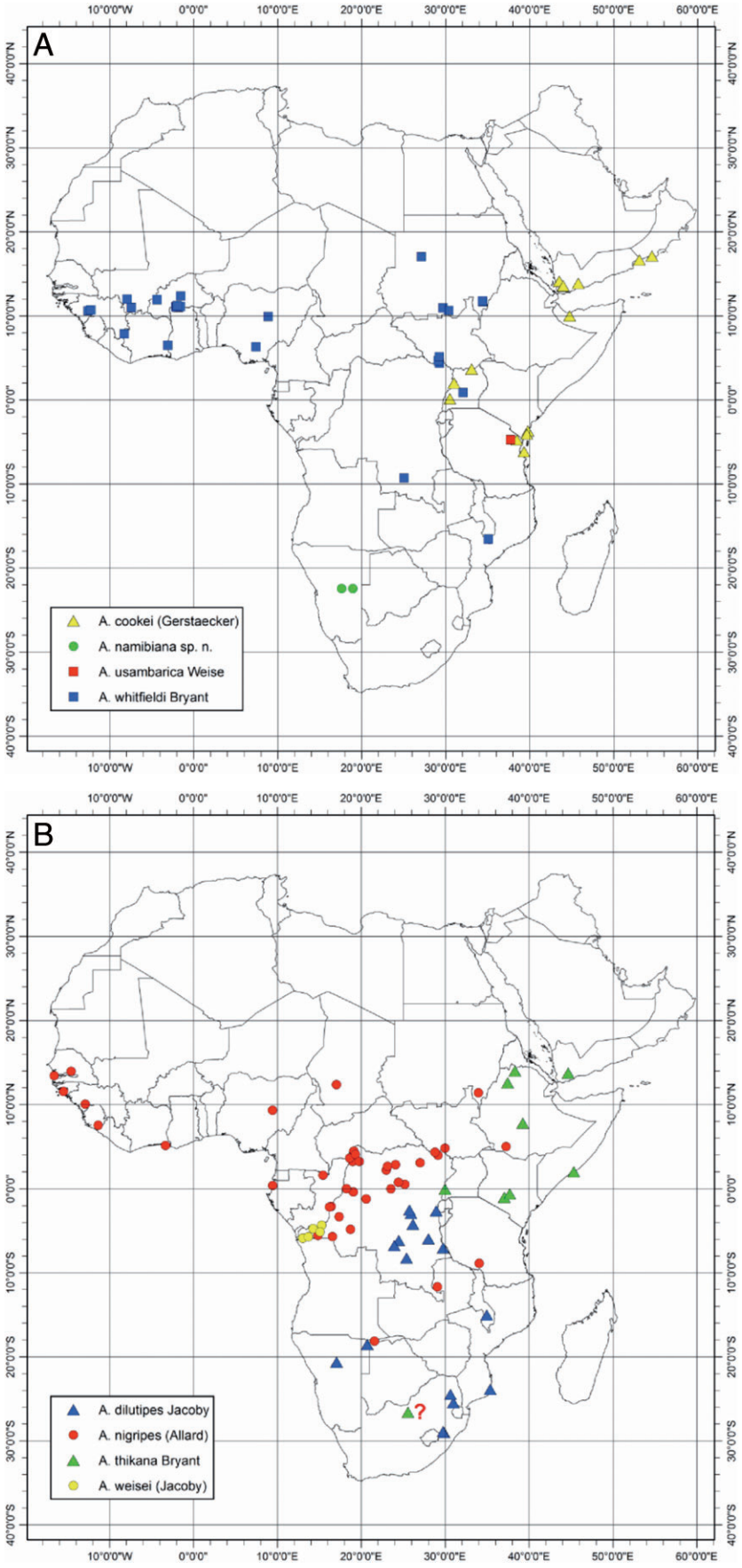

Figure 5. A) Map of distribution of *Aphthona cookei* (Gerstaecker), *A. namibiana* sp. n., *A. usambarica* Weise and *A. whitfieldi* Bryant; B) Map of distribution of *Aphthona dilutipes* Jacoby, *A. nigripes* (Allard), *A. thikana* Bryant and *A. weisei* (Jacoby).

[20°38‘03“S 17°04‘08“E], vii-viii. 1912, H. Thomsen leg., type of *Aphthona damarorum* Weise (NHRS-JLKB 000020829); Kaudom Game Reserve, Kaudom Camp, 18°30‘S 20°44‘E, 22-25.ii.1992, *light trap*, E. Marais & M. Pusch leg., 1 specimen (MNHUB); Kaudom Game Reserve, near Kaudom Camp, 18°31‘S 20°43‘E, *lux*, 22-25.ii.1992, M. Uhlig leg., 3 specimens (MNHUB). REPUBLIC OF SOUTH AFRICA: Mpumalanga, Nelspruit [25°27‘57“S 30°59‘07“E], xi.1959, E. Haaf leg., 2 specimens (BAQ); Northern Province, Abel Erasmus Pass (N slope), 24°29‘S 30°39‘E, m 1050, hill slope, 16.xii.1995, M. Biondi leg., 2 specimens (BAQ); KwaZulu-Natal, Frere [28°53‘12“S 29°46‘03“E], x.1892, G.A.K. Marshall leg., 1 specimen (BMNH).

Morphological remarks

♂ (n=10; mean and standard deviation): LE=2.06±0.15 mm (1.78 ≤LE ≤2.28 mm); WE=1.51±0.09 mm (1.38 ≤WE ≤1.66 mm); LP=0.82±0.05 mm (0.75 ≤LP ≤0.91 mm); WP=1.04±0.07 mm (0.94 ≤WP ≤1.14 mm); LAN=1.89±0.10 mm (1.75 ≤LAN ≤2.09 mm); LAED=0.90±0.04 mm (0.84 ≤LAED ≤0.97 mm); LB=2.75±0.20 mm (2.40 ≤LB ≤3.04 mm); LE/LP=2.51±0.08 (2.38 ≤LE/LP ≤2.62); WP/LP=1.27±0.06 (1.21 ≤WP/LP ≤1.40); WE/WP=1.46±0.04 (1.40 ≤WE/WP ≤1.51); WE/LE=0.73±0.03 (0.69 ≤WE/LE ≤0.77); LAN/(LE + LP)=0.66±0.03 (0.60 ≤LAN/(LE + LP) ≤0.70); LE/LAED=2.30±0.14 (2.11 ≤LE/LAED ≤2.56). ♀ (n=10): LE=2.14±0.20 mm (1.72 ≤LE ≤2.34 mm); WE=1.53±0.14 mm (1.22 ≤WE ≤1.72 mm); LP=0.80±0.08 mm (0.63 ≤LP ≤0.91 mm); WP=1.04±0.10 mm (0.84 ≤WP ≤1.16 mm); LAN=1.79±0.18 mm (1.34 ≤LAN ≤2.00 mm); LSP=0.21±0.01 mm (0.19 ≤LSP ≤0.21 mm); LB=2.81±0.29 mm (2.28 ≤LB ≤3.28 mm); LE/LP=2.68±0.09 (2.59 ≤LE/LP ≤2.88); WP/LP=1.30±0.06 (1.23 ≤WP/LP ≤1.42); WE/WP=1.48±0.04 (1.41 ≤WE/WP ≤1.53); WE/LE=0.72±0.02 (0.69 ≤WE/LE ≤0.75); LAN/(LE + LP)=0.61±0.02 (0.57 ≤LAN/(LE + LP) ≤0.64); LE/LSP=10.37±0.73 (9.17 ≤LE/LSP ≤11.06).

Species very variable in color. Dorsal integuments from yellowish to pale brown (Figure 4B). Ventral parts usually with pale prosternum, partially darkened mesosternum and clearly blackened metasternum and abdomen; sometimes ventral parts entirely yellowish. Anterior and middle legs from partially obscured to completely black; hind legs mostly blackened, very rarely entirely pale. Male with very weakly enlarged first tarsomere of protarsi and mesotarsi. Median lobe of aedeagus (Figure 2B) thickset, in lateral view medially strongly widened and narrowed in distal half; apically sub-truncate; ventral sulcus absent but distally with a short longitudinal groove, distinctly impressed; in lateral view, aedeagus clearly curved, sinuous in distal third. Spermatheca (Figure 3A) with nearly pear-shaped basal part; distal part generally moderately elongate, distinctly separated from basal part; ductus thin, short and uncoiled.

Distribution

Burundi, Democratic Republic of the Congo, Malawi, Mozambique, Namibia and Republic of South Africa (Figure 5B). Central Afrotropical chorotype (CAT) with extensions in Southern Africa (Biondi & D’Alessandro, 2006).

Ecological notes

A. dilutipes is reported as harmful to the *Jatropha curcas* plantations by Gagnaux (2009) and Nielsen (2009) in Mozambique, but this identification has to be confirmed.

Aphthona namibiana sp. n.

Type material

Holotype ♂, NAMIBIA, Gobabis [22°27‘19“S 18°57‘47“E], 4.vii.1978, M.-L. Penrith & S. Louw leg. (MNHUB). Paratype: NAMIBIA, Windoek, 22°27‘S 17°38‘E, 1-21.vii.1978, S. Louw & M.-L. Penrith leg., 1 ♀ (MNHUB).

Diagnosis

The new species shows the closest affinities with *A. thikana*, from which it can be easily distinguishable by: first tarsomere of metatarsi distinctly enlarged in male; median lobe of aedeagus (Figure 2C) in ventral view more thickset, laterally sub-parallel, apically acute, and in lateral view distally just weakly bent ventrad; spermatheca (Figure 3G) more thickset, with pear-shaped elongate basal part, distinctly separated from distal part.

Description

Holotype ♂. Dorsal integuments pale brown without metallic reflection (Figure 4C); elytra slightly paler than head and pronotum; scutellum distinctly blackish. Body shape oval elongate (LB=3.44 mm), moderately convex. Maximum pronotal width at base (WP=1.25 mm); maximum elytral width at middle (WE=1.81 mm).

Frons and vertex with sub-smooth surface, laterally with a setiferous puncture near ocular margin; frontal tubercles small, elliptical elongate, well delimited; frontal grooves clearly impressed; interantennal space about as wide as first antennomere length; frontal carina wide, apically rounded; labrum sub-rectangular, distally rounded, blackish; palpi strongly darkened; eyes sub-elliptical, normally sized; antennae clearly shorter than body length [LAN=1.88 mm; LAN/(LE+LP)=0.55] with yellowish antennomeres 1-4 and gradually darkened antennomeres 7-11; length of each antennomere proportional to numerical sequence 20:11:14:12:17:14:17:16:16:15:18 (left antenna; 1=0.01 mm).

Pronotum sub-trapezoidal, anteriorly narrower, moderately transverse (LP=0.78 mm; WP/LP=1.60), laterally straight, basally narrower than elytra; lateral and basal margin finely bordered; punctation very superficially impressed, apparently absent. Scutellum hemispheric with smooth surface.

Elytra elongate (LE=2.63 mm; WE=1.81 mm; LE/LP=3.36; WE/WP=1.45), entirely covering pygidium, laterally weakly rounded, apically almost jointly rounded; punctation entirely confuse, very finely impressed on smooth surface; humeral calli evident; macropterous metathoracic wings.

Legs mostly pale brown with clearly darkened hind femora; hind tibiae slightly curved, distally gradually enlarged; apical spur small, dark brown. First tarsomere of protarsi, mesotarsi and metatarsi slightly but distinctly enlarged.

Ventral parts light-brown but with blackened metathorax; last abdominal sternite without special preapical impressions.

Median lobe of aedeagus (Figure 2C) elongate (LAED=1.17 mm; LE/LAED=2.24), in ventral view laterally sub-parallel, apically acute but finely rounded; ventral sulcus absent; dorsal ligula short, wide, apically rounded; in lateral view, aedeagus slightly curved ventrad.

Paratype: ♀ (n=1): LE=2.88 mm; WE=2.00 mm; LP=0.81 mm; WP=1.30 mm; LAN=1.78 mm; LSP=0.24 mm; LB=3.58 mm; LE/LP=3.54; WP/LP=1.60; WE/WP=1.54; WE/LE=0.70; LE/LSP=12.11.

Paratype similar in color and sculpture to the holotype. Female distinguishable by not enlarged first tarsomere of protarsi, mesotarsi and metatarsi; spermatheca (Figure 3G) with pear-shaped elongate basal part; distal part distinctly enlarged and elongate, distinctly separated from basal part; ductus very thin, moderately elongate and uncoiled.

Etymology

The name of this new species refers to the country where it was found, *i.e.* Namibia.

Distribution

It can be found in Namibia (Figure 5A).

Ecological notes

No information is available about the autoecology of this flea beetle species.

Aphthona nigripes (Allard, 1890)

Thyamis nigripes Allard, 1890: 556; Bechyné, 1960: 12, 1968: 1694
=*Pseudeugonotes vannutellii* Jacoby, 1899a: 531 syn. n.
=*Aphthona senegalensis* Jacoby, 1903 (synonymized by Bechyné, 1960: 12): Bechyné, 1955: 516; Scherer, 1962a: 9, 1962b: 6, 1972: 6
=*Aphthona kindia* Bechyné, 1955: 516 (synonymized by Scherer, 1963: 656): Scherer, 1959: 188 (as *A. kindia*)

Material examined

IVORY COAST: Assinie [5°08‘23“N 3°19‘25“W], C. Alluaud leg., type of *Thyamis nigripes* Allard (MNHN). GAMBIA: Barthurst [=Banjul] [13°26‘48“N 16°34‘36“W], i.1968, T. Palm leg., 2 specimens (MZLU). GUINEA-BISSAU: Bolama, vi-xii.1899, L. Fea leg., 1 specimen (MSNG). GUINEA: Kindia Region, Mt. Gangan [10°03‘23“N 12°53‘10“W], 18.v.1951, J. Bechyné leg., type ♂ of *Aphthona kindia* Bechyné, 1955 (MRAC). SIERRA LEONE: Southern Province, Tiwai Island, Sanctuary [7°32‘39“N 11°20‘56“W], 8-10.i.1989, V. Rossi leg., 1 specimen (BAQ). CHAD: Bokoro [12°22‘34“N 17°03‘27“E], 20.iii.1915, R. Mayné leg., 2 specimens (MRAC). SOUTH SUDAN: Parc National de la Garamba, Mission H. Saeger, Tori/9 (Soudan) 20.iii.1952, loc. 3201 [4°49‘13“N 29°59‘30“E], H. De Saeger leg., 1 specimen (MRAC). ETHIOPIA: from Sancurar to Monti Amarr [~5°04‘57“N 37°16‘33“E], ii-iv.1896, V. Bottego leg., type ♀ of *Pseudeugonotes vannutellii* (MSNG). GABON, Libreville [0°23‘30“N 9°26‘50“E], 1-12.i.1931, A. Tinant leg., 1 specimen (MRAC). DEMOCRATIC REPUBLIC OF THE CONGO: Lolo (Itimbiri) [2°12‘56“N 22°59‘55“E], Dr. Rodhain leg., 11 specimens (MRAC); Parc National de la Garamba, Mission H. De Saeger, II/fd/15, 15.ii.1952, loc. 3129 [4°22‘02“N 29°15‘11“E], H. De Saeger leg., 1 specimen (MRAC); Parc National de la Garamba, Mission H. De Saeger, II/gd/4, 8.v.1952, loc. 3449 [4°21‘58“N 29°15‘11“E], H. De Saeger leg., 2 specimens (MRAC); Parc National de la Garamba, Mission H. De Saeger, II/gd/4, 27.v.1952, loc. 3547 [4°21‘58“N 29°15‘11“E], H. De Saeger leg., 1 specimen (MRAC); Kunungu (N’Kele) [2°06‘S 16°26‘E], 1938, Dr. H. Schouteden), 14 specimens (MRAC); Kisantu [5°08‘13“S 15°06‘15“E], 1919, P. Vanderijst leg., 3 specimens (MRAC); ditto, viii.1920, 2 specimens (MRAC); ditto, 1925, 2 specimens (MRAC); ditto, xii.1927, 3 specimens (MRAC); ditto, 1927, 4 specimens (MRAC); ditto, 1928, 4 specimens (MRAC); ditto, 1931, 4 specimens (MRAC); ditto, 1932, 31 specimens (MRAC); Libenge, Vallèe Liki-Bavula [4°29‘09“N 19°07‘09“E], 26.ii.1948, R. Cremer & M. Neuman leg., 16 specimens (IRSN); ditto, 28.ii.1948, 11 specimens (IRSN); Libenge, Savane Liki-Bembe [3°14‘36“N 18°59‘17“E], 29.i.1948, R. Cremer & M. Neuman leg., 3 specimens (IRSN); ditto, 26.ii.1948, 6 specimens (IRSN); ditto, 27.xi.1948, 15 specimens (IRSN); Libenge [3°38‘60“N 18°37‘60“E], 28.ii.1948, Mission Mawuya, 15.x.1947, R. Cremer & M. Neuman leg., 30 specimens (IRSN); ditto, 23.ii.1948, 1 specimen (IRSN); Tshuapa river, Flandria [0°22‘37“S 19°04‘22“E], 18.x.1946, Rév. P. Hulstaert leg., 1 specimen (MRAC); Thysville [=Mbanza-Ngungu] [5°15‘07“S 14°52‘08“E], i.1953, J. Sion leg., *récolté dans l’humus*, 1 specimen (MRAC); Léopoldville [=Kinshasa] [4°19‘54“S 15°18‘50“E], 15-16.iii.1911, Dr. Mouchet leg., 3 specimens (MRAC); Léopoldville-Kalina [4°19‘54“S 15°18‘50“E], iv-v.1945, M.me Delsaut leg, 1 specimen (MRAC); Yakuluku [4°21‘45“N 23°48‘31“E], iv.1927, F.S. Patrizi leg., 1 specimen (MSNG); Mobwasa [2°40‘45“N 23°08‘24“E], 30.xi.1912, R. Mayné leg., 2 specimens (MRAC); Libenge [3°38‘60“N 18°37‘60“E], 7.xii.1931, H. J. Brèdo leg., 1 specimen (MRAC); Terr. Libenge, M’Paka [4°05‘27“N 19°18‘52“E], vii-viii.1959, M. Pecheur leg., 1 specimen (MRAC); Equateur, Bokuma [3°05‘13“N 27°02‘01“E], vii.1952, R. P. Lootens leg., 2 specimens (MRAC); Tshuapa river, Bokuma [3°05‘13“N 27°02‘01“E], i-ii.1954, R. P. Lootens leg., 2 specimens (MRAC); Tshuapa river, Bamania [=Mbandaka] [0°00‘01“N 18°15‘05“E], iii.1953, R. P. Hulstraert leg., 1 specimen (MRAC); Kwango, Popokabaka [5°41‘34“S 16°35‘05“E], xii.1951, L. Pierquin leg., 2 specimens (MRAC); ditto, ii.1952, 1 specimen (MRAC); Moyen Kwilu, Leverville [=Lusanga] [4°49‘60“S 18°43‘60“E], 1920, P. Vanderijst leg., 2 specimens (MRAC); Ubangi, La Molenge [1°12‘30“N 20°35‘50“E], i.1930, H. J. Brédo leg., 1 specimen (MRAC); Bas-Uele, Djamba [2°52‘N 24°06‘E], 25.xii.1924, Dr. H. Schouteden leg., 1 specimen (MRAC); Itoka [0°00‘53“S 23°33‘01“E], x.1912, R. Mayné leg., 1 specimen (MRAC); Ubangi: Gemena [3°15‘10“N 19°46‘38“E], 16.ix.1937, C. Léontovitch leg., 1 specimen (MRAC); Bolobo, Makamandelu (N’Kele) [2°10‘00“S 16°13‘60“E], 1938, Dr. H. Schouteden leg., 1 specimen (MRAC); Wombali [3°19‘26“S 17°22‘18“E], 17.vii.1913, P. Vanderijst leg., 2 specimens (MRAC); Congo da Lemba [5°42‘00“S 13°41‘60“E], i-ii.1913, R. Mayné leg., 2 specimens (MRAC). TANZANIA: Ruaha National Park [8°51‘23“S 34°04‘38“E], 800-1000 m, 2.xii.1989, R. Mourglia leg., 1 ♂ (BAQ). ZAMBIA: Welgelegen [11°40‘27“S 29°04‘46“E], 16.vi.1912, Dr. Bequaert leg., 1 ♀ (MRAC). NAMIBIA: Okavango banks, Popa Falls [18°07‘16“S 21°34‘51“E], *papyrus and reed sievings*, M. Uhlig leg., 1 specimen (MNHUB).

Other records from literature

SENEGAL [13°59‘18“N 14°35‘42“E] (locus typicus of *A. senegalensis* Jacoby, 1903: 10-11). SUDAN: Blue Nile, Ingessana Hills [11°24‘36“N 33°59‘00“E] (Scherer, 1972 as *A. senegalensis*). NIGERIA: Pankshin [9°19‘40“N 9°25‘52“E] (Scherer, 1972 as *A. senegalensis*). DEMOCRATIC REPUBLIC OF THE CONGO: Haute-Sangha [~1°35‘50“N 15°27‘21“E] (Bechyné, 1968); Kisangani [0°31’09“N 25°11’46“E] (Scherer, 1972 as *A. senegalensis*); Yangambi [0°46’02“N 24°26’29“E] (Scherer, 1972 as *A. senegalensis*).

Morphological remarks

♂ (n=10; mean and standard deviation): LE=2.73±0.21 mm (2.53 ≤LE ≤3.09 mm); WE=1.87±0.17 mm (1.56 ≤WE ≤2.06 mm); LP=0.82±0.05 mm (0.75 ≤LP ≤0.91 mm); WP=1.25±0.09 mm (1.09 ≤WP ≤1.38 mm); LAN=2.03±0.11 mm (1.81 ≤LAN ≤2.19 mm); LAED=1.53±0.10 mm (1.39 ≤LAED ≤1.73 mm); LB=3.50±0.24 mm (3.18 ≤LB ≤3.90 mm); LE/LP=3.33±0.16 (3.15 ≤LE/LP ≤3.67); WP/LP=1.52±0.05 (1.46 ≤WP/LP ≤1.62); WE/WP=1.50±0.04 (1.43 ≤WE/WP ≤1.55); WE/LE=0.68±0.03 (0.62 ≤WE/LE ≤0.72); LAN/(LE + LP)=0.57±0.03 (0.52 ≤LAN/(LE + LP) ≤0.63); LE/LAED=1.78±0.07 (1.66 ≤LE/LAED ≤1.88). ♀ (n=10): LE=2.93±0.13 mm (2.78 ≤LE ≤3.13 mm); WE=2.08±0.08 mm (1.97 ≤WE ≤2.19 mm); LP=0.85±0.03 mm (0.81 ≤LP ≤0.88 mm); WP=1.34±0.08 mm (1.25 ≤WP ≤1.52 mm); LAN=1.98±0.07 mm (1.84 ≤LAN ≤2.06 mm); LSP=0.26±0.01 mm (0.24 ≤LSP ≤0.28 mm); LB=3.69±0.19 mm (3.40 ≤LB ≤4.08 mm); LE/LP=3.46±0.12 (3.21 ≤LE/LP ≤3.59); WP/LP=1.58±0.10 (1.43 ≤WP/LP ≤1.73); WE/WP=1.55±0.08 (1.42 ≤WE/WP ≤1.65); WE/LE=0.71±0.01 (0.69 ≤WE/LE ≤0.73); LAN/(LE + LP)=0.52±0.02 (0.49 ≤LAN/(LE + LP) ≤0.56); LE/LSP=11.35±0.69 (10.22 ≤LE/LSP ≤12.44). Species very variable in color. Dorsal integuments from yellowish to reddish (Figure 4D,E); ventral parts from pale brown to blackish; hind femora blackened; anterior and middle femora sometimes basally weakly darkened. Male with first tarsomere of protarsi and mesotarsi slightly but distinctly more dilated than female. Median lobe of aedeagus (Figure 2D,E) very elongate, in ventral view distinctly lance-shaped in distal third and apically rounded, not pointed; ventral sulcus absent; in lateral view, aedeagus straight in basal 2/3s and distinctly bent in ventral direction in distal third. Spermatheca (Figure 3E) with sub-reniform basal part; distal part generally clearly elongate and not distinctly separated from the basal part; ductus thin, moderately elongate and uncoiled.

Distribution

Senegal, Gambia, Guinea-Bissau, Guinea, Sierra Leone, Ivory Coast, Nigeria, Chad, Sudan, South Sudan, Ethiopia, Gabon, Democratic Republic of the Congo, Southern Tanzania, Zambia and Namibia (Figure 5B). Afro-Intertropical chorotype (AIT) (Biondi & D’Alessandro, 2006).

Ecological notes

No information is available about the host-plants of this flea beetle species.

Aphthona thikana Bryant

Aphthona thikana Bryant, 1940: 44; Bryant, 1957: 359; Bryant, 1959: 214

Material examined

KENYA: Thika District, Chania Falls [1°01‘24“S 37°04‘06“E], i.1921, 5050 ft, A.F.J. Gedye leg., type (BMNH). ETHIOPIA: Begemdir Province, Gondar, banks of Angereb river [12°35‘60“N 37°28‘00“E], 2.xii.1974, G. de Rougemont leg., 5 specimens (MRAC); Abyssinia, Katere River [=Katar River: ~ 7°48‘16“N 39°16‘13“E], 5.xi.1926, J. Omer-Cooper leg., 1 specimen (BAQ); Tigray, near Aksum, 14°00‘N 38°20‘E, 2000 m, 23.iii.1996, M. v. Tschirnhaus leg., 2 specimens (BAQ). SOMALIA: Mogadiscio [2°01‘60“N 45°20‘60“E], iii.1974, J. Mauser leg., 1 specimen (JMBG); ditto, i.1987, S. Bambi leg., 1 specimen (BAQ). UGANDA: Kazinga, Queen Elizabeth National Park [0°03‘02“S 29°59‘38“E], 1.xi.2002, V. Šilha leg., 1 specimen (BAQ).

Other records from literature

YEMEN: Jabal (reported as *Jebel*) el Jihaf [13°45‘39“N 44°40‘36“E], c. 7700 ft (Bryant, 1957). KENYA: Kinangop [0°36‘47“S 37°42‘23“E] (Bryant, 1940).

Questionable records

REPUBLIC OF SOUTH AFRICA: North-West Province, Barbespan [26°35‘51“S 25°35‘06“E], 45 miles SW Lichtenburg (Bryant, 1959) (locality to be confirmed).

Morphological remarks

♂ (*n*=6; mean and standard deviation): LE=2.50±0.06 mm (2.44 ≤LE ≤2.56 mm); WE=1.77±0.06 mm (1.66 ≤WE ≤1.81 mm); LP=0.72±0.03 mm (0.69 ≤LP ≤0.75 mm); WP=1.15±0.02 mm (1.13 ≤WP ≤1.19 mm); LAN=1.73±0.07 mm (1.66 ≤LAN ≤1.81 mm); LAED=1.17±0.06 mm (1.09 ≤LAED ≤1.27 mm); LB=3.12±0.05 mm (3.04 ≤LB ≤3.16 mm); LE/LP=3.48±0.15 (3.33 ≤LE/LP ≤3.73); WP/LP=1.61±0.04 (1.57 ≤WP/LP ≤1.68); WE/WP=1.53±0.04 (1.47 ≤WE/WP ≤1.57); WE/LE=0.71±0.02 (0.68 ≤WE/LE ≤0.73); LAN/(LE + LP)=0.54±0.02 (0.52 ≤LAN/(LE + LP) ≤0.56); LE/LAED=2.13±0.07 (2.02 ≤LE/LAED ≤2.23). ♀ (*n*=5): LE=2.75±0.15 mm (2.56 ≤LE ≤2.88 mm); WE=1.93±0.08 mm (1.84 ≤WE ≤2.03 mm); LP=0.78±0.03 mm (0.75 ≤LP ≤0.81 mm); WP=1.24±0.05 mm (1.16 ≤WP ≤1.28 mm); LAN=1.79±0.01 mm (1.78 ≤LAN ≤1.81 mm); LSP=0.25±0.01 mm (0.24 ≤LSP ≤0.26 mm); LB=3.41±0.10 mm (3.28 ≤LB ≤3.52 mm); LE/LP=3.51±0.23 (3.23 ≤LE/LP ≤3.83); WP/LP=1.58±0.10 (1.42 ≤WP/LP ≤1.69); WE/WP=1.55±0.04 (1.51 ≤WE/WP ≤1.59); WE/LE=0.70±0.01 (0.68 ≤WE/LE ≤0.72); LAN/(LE + LP)=0.51±0.02 (0.48 ≤LAN/(LE + LP) ≤0.54); LE/LSP=11.13±0.83 (10.00 ≤LE/LSP ≤11.84). Dorsal integuments yellowish with finely darkened elytral suture and blackish scutellum (Figure 4F). Ventral parts with partially blackened meso- and metasternum; prosternum and abdomen pale brown. Legs yellowish with distally blackened hind femora. Male with very weakly enlarged first tarsomere of protarsi and mesotarsi. Median lobe of aedeagus (Figure 2F) slender, laterally sub-parallel and apically widely rounded; in lateral view, aedeagus straight in basal 2/3s and distinctly curved in ventral direction in distal third. Spermatheca (Figure 3H) elongate, with sub-reniform basal part; distal part elongate, scarcely separated from basal part; ductus thin, moderately elongate and uncoiled.

Distribution

Yemen, Ethiopia, Somalia, Kenya, Uganda and Republic of South Africa (?) (Figure 5B). Northern-Eastern Afrotropical chorotype (NEA) (Biondi & D’Alessandro, 2006).

Ecological notes

No information is available about the host-plants of this flea beetle species.

Aphthona usambarica Weise

Aphthona usambarica Weise, 1902: 173

Material examined

TANZANIA: Usambara Mountains, Kwai [4°43‘50“S 38°20‘50“E], Paul Weise leg., type (MNHUB).

Morphological remarks

♀ (*n*=1): LE=2.59 mm; WE=1.72 mm; LP=0.78 mm; WP=1.25 mm; LAN=2.03 mm; LSP=0.30 mm; LB=3.28 mm; LE/LP=3.32; WP/LP=1.60; WE/WP=1.38; WE/LE=0.66; LAN/(LE + LP)=0.60; LE/LSP=8.65.

Only one known female (Figure 4G) with pale brown dorsal integuments, finely darkened elytral suture and scutellum; ventral parts blackened; legs yellowish with hind femora blackish. Spermatheca (Figure 3D) large with sub-cylindrical basal part; distal part moderately elongate; ductus very thickset, moderately elongate and uncoiled.

Distribution

Tanzania (Figure 5A). Northern-Eastern Afrotropical chorotype (NEA) (?) (Biondi & D’Alessandro, 2006).

Ecological notes

No information is available about the autoecology of this flea beetle species.

Aphthona weisei (Jacoby)

Jamesonia weisei Jacoby, 1899b: 348-349
Gabonia weisei (Jacoby): Scherer, 1959: 215
Aphthona weisei (Jacoby): Bechyné, 1959: 15

Material examined

DEMOCRATIC REPUBLIC OF THE CONGO: Boma [5°52‘32“S 13°02‘00“E], M. Tschoffen leg., lectotype of *Jamesonia weisei* Jacoby (Bechyné 1959 des.) (IRSN); Congo da Lemba [5°42‘00“S 13°41‘60“E], i-iii.1913, R. Mayné leg., 38 specimens (MRAC); Léopoldville [=Kinshasa] [4°19‘54“S 15°18‘50“E], 13.x.1935, J. Ghesquière leg., 1 specimen (MRAC); Mayumbe Lemba [4°45‘S 14°17‘E], 13.vii.1917, R. Mayné leg., 11 specimens (MRAC); Kisantu [5°08‘13“S 15°06‘15“E], 1932, P. Vanderijst leg., 1 specimen (MRAC).

Morphological remarks

♂ (*n*=10; mean and standard deviation): LE=2.28±0.13 mm (2.06 ≤LE ≤2.41 mm); WE=1.68±0.13 mm (1.47 ≤WE ≤1.91 mm); LP=0.83±0.04 mm (0.77 ≤LP ≤0.89 mm); WP=1.11±0.07 mm (1.00 ≤WP ≤1.20 mm); LAN=1.90±0.14 mm (1.69 ≤LAN ≤2.13 mm); LAED=1.03±0.03 mm (1.00 ≤LAED ≤1.06 mm); LB=3.08±0.16 mm (2.84 ≤LB ≤3.36 mm); LE/LP=2.74±0.05 (2.67 ≤LE/LP ≤2.85); WP/LP=1.34±0.03 (1.29 ≤WP/LP ≤1.38); WE/WP=1.51±0.13 (1.38 ≤WE/WP ≤1.85); WE/LE=0.74±0.06 (0.69 ≤WE/LE ≤0.90); LAN/(LE + LP)=0.61±0.03 (0.58 ≤LAN/(LE + LP) ≤0.66); LE/LAED=2.21±0.10 (2.06 ≤LE/LAED ≤2.33). ♀ (*n*=10): LE=2.46±0.10 mm (2.22 ≤LE ≤2.59 mm); WE=1.81±0.10 mm (1.63 ≤WE ≤1.97 mm); LP=0.84±0.03 mm (0.78 ≤LP ≤0.91 mm); WP=1.17±0.04 mm (1.08 ≤WP ≤1.22 mm); LAN=1.85±0.07 mm (1.75 ≤LAN ≤2.00 mm); LSP=0.21±0.01 mm (0.20 ≤LSP ≤0.22 mm); LB=3.18±0.17 mm (2.80 ≤LB ≤3.36 mm); LE/LP=2.93±0.11 (2.78 ≤LE/LP ≤3.12); WP/LP=1.39±0.03 (1.34 ≤WP/LP ≤1.44); WE/WP=1.55±0.05 (1.50 ≤WE/WP ≤1.63); WE/LE=0.74±0.03 (0.68 ≤WE/LE ≤0.79); LAN/(LE + LP)=0.56±0.03 (0.53 ≤LAN/(LE + LP) ≤0.61); LE/LSP=11.78±0.36 (11.09 ≤LE/LSP ≤12.34).

Dorsal integuments and ventral parts entirely pale brown (Figure 4H). Anterior and middle legs with yellowish femora, usually distally darkened tibiae and strongly blackened tarsi; hind legs black but with

basally reddish tibiae. Male with slightly but distinctly enlarged first tarsomere of protarsi and mesotarsi. Median lobe of aedeagus (Figure 2G) little elongate, thickset, in ventral view slightly tapered from basal third to apical fifth; distal part sub-triangular, apically sub-truncate; ventral sulcus absent; in lateral view, aedeagus almost straight, slightly sinuous in apical third. Spermatheca (Figure 3C) with sub-cylindrical basal part, sometimes slightly curved; distal part moderately elongate and clearly separated from basal part; ductus little elongate, thin and uncoiled.

Distribution

Democratic Republic of the Congo (Figure 5B). Afro-Equatorial chorotype (AEQ) (Biondi & D'Alessandro, 2006).

Ecological notes

No information is available about the host-plants of this flea beetle species.

Aphthona whitfieldi Bryant

Aphthona whitfieldi Bryant, 1933: 253; Bryant, 1957: 359; Pollard, 1957: 76-77; Scherer, 1963: 657

Aphthona senegalensis Bechyné, 1955: 516 (misidentification corrected by Scherer, 1963: 657)

Material examined

SUDAN: Kadugli [10°57'42"N 29°41'27"E], 13.ii.1931, on *Vicia sinensis*, F.G.S. Whitfield leg., type (BMNH). MALI: Garalo [10°59'24"N 7°26'13"W], 7.ix.2011, on *Jatropha curcas*, M. Kenis leg., 9 specimens (BAQ); Ouelessebougou [12°00'00"N 7°55'00"W], N'Piebougou, 2.ix.2011, on *Jatropha curcas*, M. Kenis leg., 6 specimens (BAQ); Ouelessebougou [12°00'00"N 7°55'00"W], N'Tintoukoro, 2.ix.2011, on *Jatropha curcas*, M. Kenis leg., 8 specimens (BAQ). BURKINA FASO: Léo [11°05'52"N 2°08'18"W], 1.v.2012, on *Jatropha curcas*, M. Kenis leg., 7 specimens (BAQ); Léo, Biéha [11°01'21"N 1°47'59"W], 7.v.2012, on *Jatropha curcas*, M. Kenis leg., 11 specimens (BAQ); Léo, Onliassan [11°01'46"N 2°01'47"W], 27.ix.2012, on *Jatropha curcas*, M. Kenis leg., 7 specimens (BAQ); Léo, Worou [11°07'51"N 1°34'14"W], 20.ix.2012, on *Jatropha curcas*, M. Kenis leg., 6 specimens (BAQ); Léo,Yalé [11°14'02"N 1°58'00"W], 3.v.2012, on *Jatropha curcas*, M. Kenis leg., 5 specimens (BAQ); Léo, Mouna [11°55'05"N 4°20'18"W], 19.ix.2012, on *Jatropha curcas*, M. Kenis leg., 12 specimens (BAQ); Ouagadougou [12°21'52"N 1°32'01"W], i.1971, P. C. Fernandez leg., 2 specimens (MRAC). GHANA: Bia National Park [6°30'17"N 3°04'41"W], 25-27.iv.1984, V. Rossi leg., 45 specimens (BAQ). NIGERIA: Jos [9°55'60"N 8°52'60"E], 7.v.1955, Expedition Museum G. Frey, J. Bechyné leg., 1 specimen (MHNB). DEMOCRATIC REPUBLIC OF THE CONGO: Parc National de la Garamba, Mission H. De Saeger, I/0/1, 27.ix.1950, loc. 849 [4°22'00"N 29°15'11"E], G. Demoulin leg., 1 specimen (MRAC); Katanga, Kinda [9°17'58"S 25°03'19"E], Don Cercle Z.C. leg., 1 specimen (MRAC). MALAWI: Masenjere env. [16°33'47"S 35°04'52"E], 80 km S of Blantyre, 21-22.xii.2001, J. Bezděk leg., 1 specimen (BAQ).

Other records from literature

GUINEA: Fouta Djalon [10°36'40"N 12°34'25"W], Dalaba, 1200 m (Scherer, 1963); Dalaba [10°41'30"N 12°15'00"W] (Bechyné, 1955 as *A. senegalensis*); Mount Nimba NE [7°51'09"N 8°15'32"W], 500-700 m (Bechyné, 1955 as *A. senegalensis*). NIGERIA: District Udi [6°19'04"N 7°24'32"E], Akpasha (Scherer, 1963). UGANDA: Muyenje [0°53'32"N 32°04'01"E] (Scherer, 1963). SUDAN: Jebel el Jihaf [17°01'60"N 27°06'00"E], c. 7700 ft (Bryant, 1957); Ibba [4°41'07"N 29°08'14"E] (Pollard, 1957); El Kharabah [11°42'19"N 34°25'55"E] (Pollard, 1957); Talodi [10°38'10"N 30°22'46"E] (Pollard, 1957); Roseires [11°46'36"N 34°23'49"E] (Pollard, 1957). SOUTH SUDAN: Meridi [5°08'47"N 29°14'11"E] (Pollard, 1957).

Erroneous records

YEMEN: Usaifira [13°34'52"N 44°00'53"E], 1 mile N Ta'izz, c. 4500 ft (Bryant, 1957: 359) (see above *A. cookei*). SOMALIA: between Hargeisa and Berbera [10°00'29"N 44°46'30"E] (Scherer, 1972: 6) (see above *A. cookei*).

Morphological remarks

♂ (*n*=10; mean and standard deviation): LE=2.10±0.24 mm (1.75 ≤LE ≤2.50 mm); WE=1.50±0.20 mm (1.25 ≤WE ≤1.78 mm); LP=0.80±0.10 mm (0.69 ≤LP ≤1.00 mm); WP=1.05±0.12 mm (0.91 ≤WP ≤1.25 mm); LAN=1.88±0.19 mm (1.63 ≤LAN ≤2.25 mm); LAED=0.90±0.08 mm (0.78 ≤LAED ≤1.03 mm); LB=2.85±0.31 mm (2.32 ≤LB ≤3.20 mm); LE/LP=2.62±0.07 (2.50 ≤LE/LP ≤2.73); WP/LP=1.31±0.03 (1.25 ≤WP/LP ≤1.36); WE/WP=1.43±0.05 (1.36 ≤WE/WP ≤1.50); WE/LE=0.71±0.02 (0.67 ≤WE/LE ≤0.75); LAN/(LE + LP)=0.65±0.02 (0.61 ≤LAN/(LE + LP) ≤0.69); LE/LAED=2.33±0.09 (2.19 ≤LE/LAED ≤2.43). ♀ (*n*=10): LE=2.23±0.14 mm (2.00 ≤LE ≤2.44 mm); WE=1.56±0.11 mm (1.36 ≤WE ≤1.75 mm); LP=0.83±0.06 mm (0.73 ≤LP ≤0.91 mm); WP=1.07±0.07 mm (0.95 ≤WP ≤1.17 mm); LAN=1.85±0.13 mm (1.66 ≤LAN ≤2.00 mm); LSP=0.22±0.01 mm (0.20 ≤LSP ≤0.24 mm); LB=2.98±0.27 mm (2.60 ≤LB ≤3.32 mm); LE/LP=2.69±0.06 (2.59 ≤LE/LP ≤2.79); WP/LP=1.29±0.03 (1.24 ≤WP/LP ≤1.35); WE/WP=1.45±0.07 (1.39 ≤WE/WP ≤1.60); WE/LE=0.70±0.03 (0.67 ≤WE/LE ≤0.75); LAN/(LE + LP)=0.61±0.02 (0.56 ≤LAN/(LE + LP) ≤0.64); LE/LSP=10.17±0.41 (9.65 ≤LE/LSP ≤11.03).

Species very variable in size and color. Dorsal integuments and ventral parts from yellowish to reddish brown (Figure 4I), never partially blackened. Anterior and middle legs yellowish with darkened tarsi; hind femora mostly distinctly blackened; hind tibiae and metatarsi generally distinctly obscured. Male with very weakly enlarged first tarsomeres of protarsi and mesotarsi. Median lobe of aedeagus (Figure 2H) thickset, in ventral view laterally sub-parallel and apically widely sub-rounded; ventral sulcus absent; in lateral view, aedeagus very weakly curved. Spermatheca (Figure 3F) with pear-shaped elongate basal part; distal part very elongate not distinctly separated from basal part; ductus thin, moderately elongate and uncoiled.

Distribution

Mali, Burkina Faso, Guinea, Ghana, Nigeria, Sudan, South Sudan and Democratic Republic of the Congo and Malawi (Figure 5A). Afro-Intertropical chorotype (AIT) (Biondi & D'Alessandro, 2006).

Ecological notes

Pollard (1957) reported this species associated with Anacardiaceae (*Mangifera indica* and *Pistacia* sp.), Cucurbitaceae (*Cucumis melo*), Euphorbiaceae (*Ricinus communis*), Fabaceae (*Cassia occidentalis* and *Vigna sinensis*), and Solanaceae (*Nicotiana tabacum*), but these records must be considered with caution since the specimens of Pollard (1957) have not been verified. Recently (2011-2012), *A. whitfieldi* was collected abundantly in Mali and Burkina Faso in *Jatropha curcas* plantations (Marc Kenis, pers. comm.).

Discriminant analysis

A forward stepwise discriminant function analysis, considering separately males and females, was perfomed using six morphometric variables as predictors. The main aim of this analysis was to determine morphometric characters to aid in the identification of the species included by us in the *A. cookei* group [*A. cookei* (10 ♂♂ and 10 ♀♀), *A. dilutipes* (10 ♂♂ and 10 ♀♀), *A. nigripes* (10 ♂♂ and 10 ♀♀), *A. thikana* (6 ♂♂ and 5 ♀♀), *A. weisei* (10 ♂♂ and 10 ♀♀) and *A. whitfieldi* (10 ♂♂ and 10 ♀♀)]. *A. namibiana* sp.n. and *A. usambarica* were not considered in this analysis because of the low number of specimens available (1 ♂ and 1 ♀ and 1 ♀, respectively). Predictor variables used in the analysis were: length of elytrae (LE), width of elytrae (WE), length of pronotum (LP), width of pronotum (WP), length of

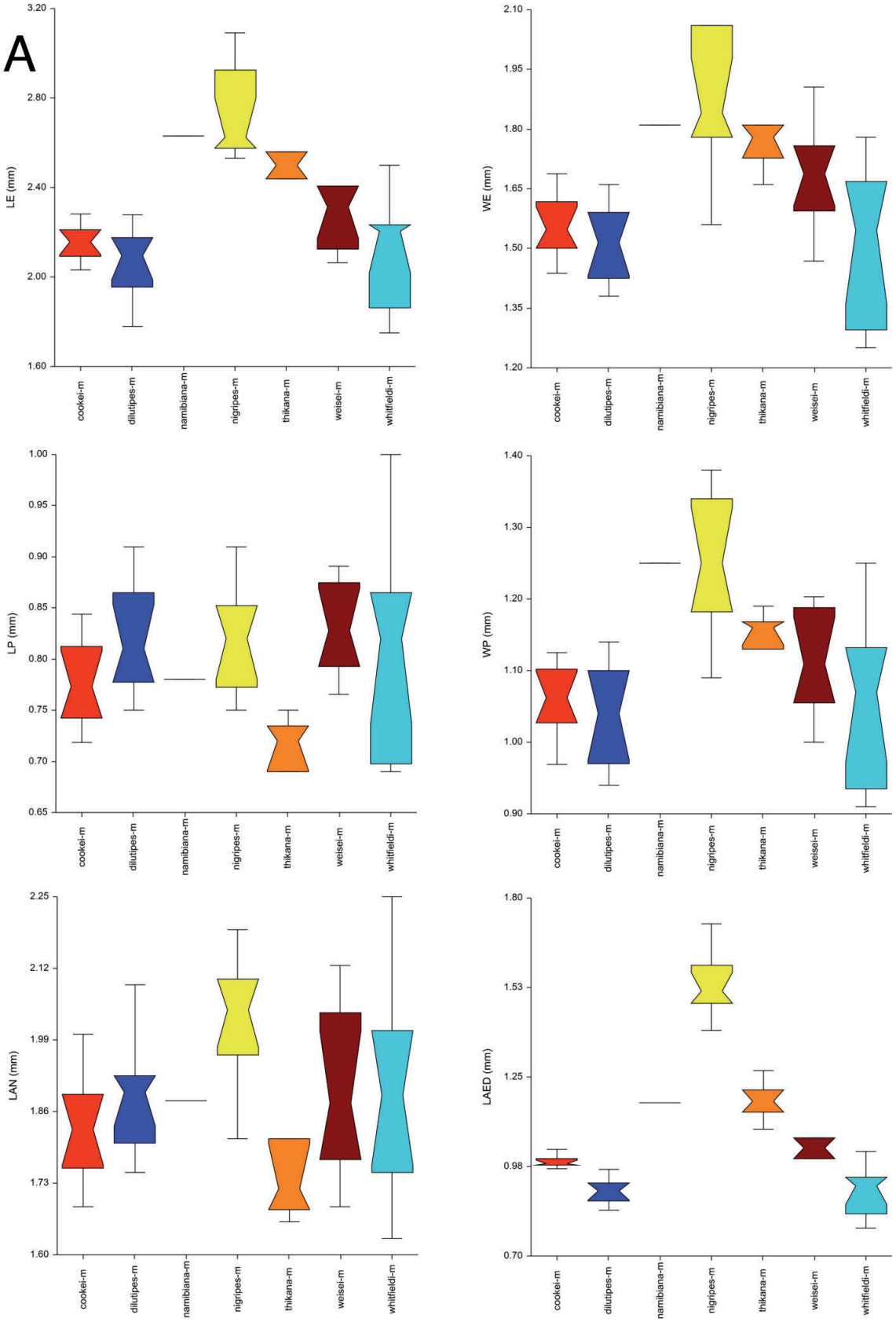

Figure 6. A) Box-wiskers plots (mean and range) for the variables LE, WE, LP, WP, LAN and LAED in males of the *Aphthona cookei* species-group: *A. cookei* (Gerstaecker) (10 ♂♂), *A. dilutipes* Jacoby (10 ♂♂), *A. namibiana* sp. n. (1 ♂), *A. nigripes* (Allard) (10 ♂♂), *A. thikana* Bryant (6 ♂♂), *A. usambarica* Weise (no ♂♂), *A. weisei* (Jacoby) (10 ♂♂) and *A. whitfieldi* Bryant (10 ♂♂).

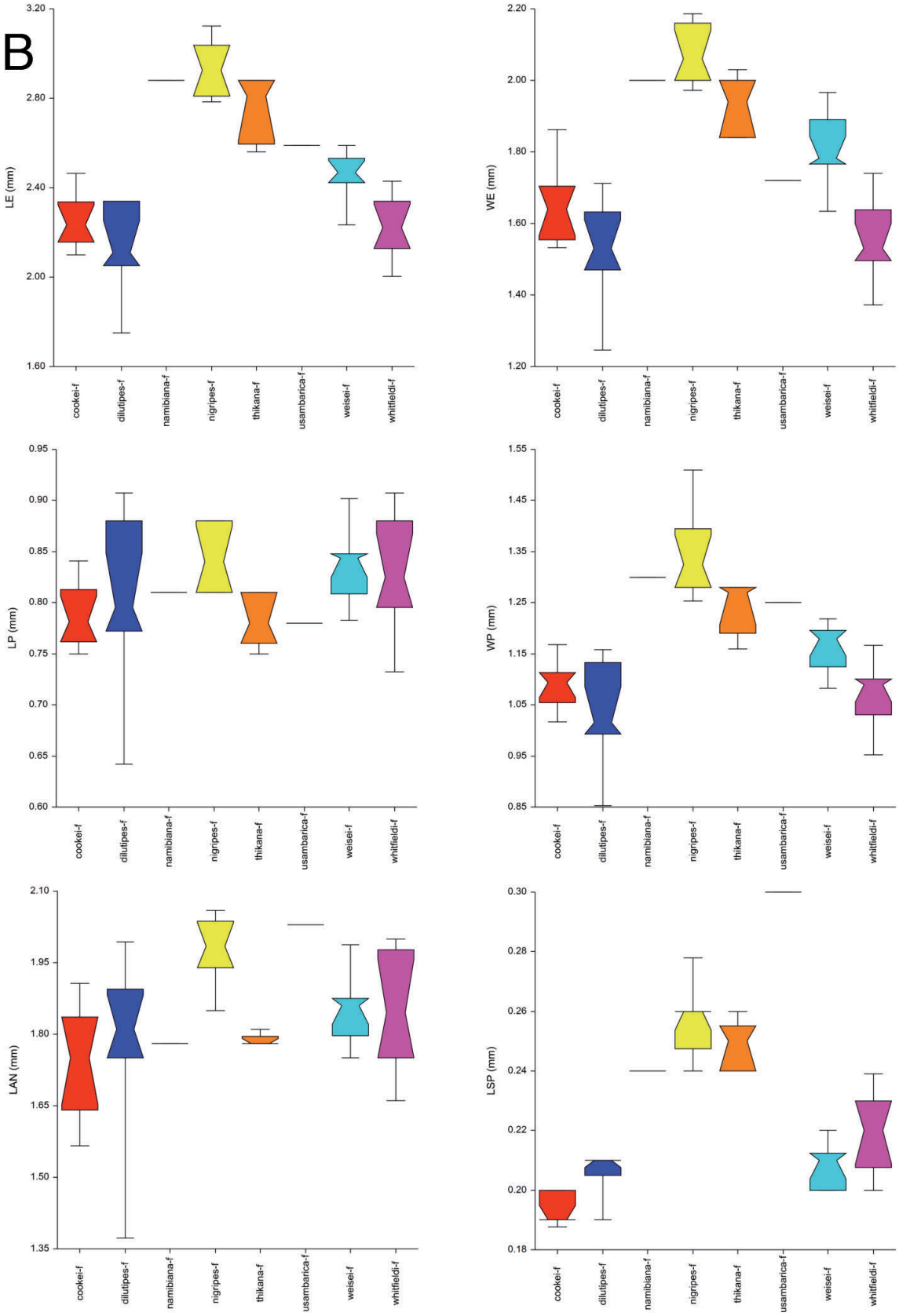

Figure 6. B) Box-wiskers plots (mean and range) for the variables LE, WE, LP, WP, LAN and LSP in females of the *Aphthona cookei* species-group: *A. cookei* (Gerstaecker) (10 ♀♀), *A. dilutipes* Jacoby (10 ♀♀), *A. namibiana* sp. n. (1 ♀), *A. nigripes* (Allard) (10 ♀♀), *A. thikana* Bryant (5 ♀♀), *A. usambarica* Weise (1 ♀), *A. weisei* (Jacoby) (10 ♀♀) and *A. whitfieldi* Bryant (10 ♀♀).

antennae (LAN), length of median lobe of aedeagus (LAED) and length of spermatheca (LSP). No data standardization or normalization were performed for these measures. *Box and wisker* plots showing median, inter-quartile range and range of every variable considered are reported for both sexes in Figure 6 (in this case *A. usambarica* and *A. namibiana* sp. n. were also included).

The analysis carried out on the males shows that the variables LAED, LP and LE highly significantly discriminate between males of the different species (Table 1). Also WE show a good discriminating power, while WP and LAN are not significant (Table 1). The *classification matrix* relative to males (Table 2) shows a high percentage, between 70-100%, of corrected attributions for every species analyzed. In addition, *squared Mahalanobis distances matrix* (SMD) (Table 3) suggests that the following couples of species can be well discriminated: *nigripes-dilutipes* (SMD=204.568), *nigripes-whitfieldi* (SMD=202.112), *nigripes-cookei* (SMD=141.738), *nigripes-weisei* (SMD=137.268), *nigripes-thikana* (SMD=98.904), *dilutipes-thikana* (SMD=94.926), *thikana-whitfieldi* (SMD=78.612). In contrast, the couples *cookei-weisei* (SMD=1.323) and *dilutipes-whitfieldi* (SMD=1.985) are very weakly discriminated.

To see how the six morphometric variables considered discriminate the different six groups (species) analyzed and to compute the relative discriminant functions, a Canonical Analysis was performed. The first three functions (CVM1, CVM2 and CVM3), representing 99.9% of total explained variance, were considered. Their respective raw coefficients,

Table 1. Discriminant Stepwise Analysis for males and females: *variables in the model*, *F to enter*, degrees of freedom (df1, df2), P level and Wilk's Lambda values.

	Step	F to enter	df1 ♂♂	df2	P	Lambda
LAED	1	157.92	5	50	0.000000	0.059553
LP	2	13.37	5	49	0.000000	0.025192
LE	3	18.07	5	48	0.000000	0.008741
WE	4	4.04	5	47	0.003916	0.006112
WP	Out	0.98	-	-	0.440697	-
LAN	Out	0.82	-	-	0.539645	-
	Step	**F to enter**	**df1 ♀♀**	**df2**	**P**	**Lambda**
LSP	1	59.39	5	49	0.000000	0.141642
WE	2	16.49	5	48	0.000000	0.052113
LP	3	10.377	5	47	0.000001	0.024784
LE	4	3.77	5	46	0.006051	0.017579
LAN	Out	2.19	-	-	0.072165	-
WP	Out	0.59	-	-	0.710762	-

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

	%	*cookei*	*dilutipes*	*nigripes* ♂♂	*thikana*	*weisei*	*whitfieldi*
cookei	80	8	0	0	0	2	0
dilutipes	70	0	7	0	0	1	2
nigripes	100	0	0	10	0	0	0
thikana	100	0	0	0	6	0	0
weisei	70	3	0	0	0	7	0
whitfieldi	80	0	2	0	0	0	8
	%	***cookei***	***dilutipes***	***nigripes*** ♀♀	***thikana***	***weisei***	***whitfieldi***
cookei	90	9	0	0	0	1	0
dilutipes	100	0	10	0	0	0	0
nigripes	80	0	0	8	2	0	0
thikana	100	0	0	0	5	0	0
weisei	90	1	0	0	0	9	0
whitfieldi	70	0	3	0	0	0	7

eigenvalues and cumulative percentage of explained variance (%EV) are reported in Table 4; their group centroids are reported in Table 5. The first discriminant function accounts for 87.8% of EV and allows to easily discriminate males of *A. nigripes* and *A. thikana* from those of the other species considered, and the couple *dilutipes-whitfieldi* from the couple *cookei-weisei*; the second function (11.7% of EV) is mainly useful to discriminate *A. thikana*, while the third function (0.4% of EV) is not significant (Tables 4 and 5; Figure 7A).

The discriminant analysis carried on females has also supplied significant results (Table 1). In this case, the variables with higher discriminating power are LSP, WE, LP and LE, while LAN and WP (Table 1) are not significant. In the *classification matrix* of females (Table 2), the percentage of corrected attributions is equal to 100% only for *A. dilutipes* and *A. thikana*, while it is 90% for *A. cookei* and *A. weisei*, 80% for *A. nigripes* and 70% for *A. whitfieldi*. For females, *squared Mahalanobis distances matrix* (SMD) (Table 3) suggests that the following couples of species are well discriminated: *dilutipes-nigripes* (SMD=95.996), *dilutipes-thikana* (SMD=89.398), *cookei-nigripes* (SMD=87.296), *cookei-thikana* (SMD=80.799), *thikana-whitfieldi* (SMD=76.182), *nigripes-weisei* (SMD=60.304) and *thikana-weisei* (SMD=58.061); in contrast, the couples *dilutipes-whitfieldi* (SMD=2.324), *nigripes-thikana* (SMD=3.381) and *cookei-weisei* (SMD=3.721) are very weakly discriminated.

Using a Canonical Analysis, three functions (CVF1, CVF2 and CVF3)

Table 3. Discriminant Stepwise Analysis: squared Mahalanobis distances matrix for males and females.

	cookei	*dilutipes*	*nigripes*	*nhikana*	*weisei*	*whitfieldi*
			♂♂			
cookei	0.000	10.046	141.738	44.336	1.323	6.648
dilutipes	10.046	0.000	204.568	94.926	9.537	1.985
nigripes	141.738	204.568	0.000	98.904	137.268	202.112
thikana	44.336	94.926	98.904	0.000	48.573	78.612
weisei	1.323	9.537	137.268	48.573	0.000	8.174
whitfieldi	6.648	1.985	202.112	78.612	8.174	0.000
			♀♀			
cookei	0.000	6.588	87.296	80.799	3.721	13.245
dilutipes	6.588	0.00	95.996	89.398	11.066	2.324
nigripes	87.296	95.996	0.000	3.381	60.304	81.261
thikana	80.799	89.398	3.381	0.00	58.061	76.182
weisei	3.721	11.066	60.304	58.061	0.000	13.810
whitfieldi	13.245	2.324	81.261	76.182	13.810	0.00

Table 4. Discriminant Stepwise Analysis: canonical variables: raw coefficients, constants, eigenvalues and cumulative percentages of explained variance (%EV) of the canonical variables considered for males and females.

♂♂	CVM1	CVM2	CVM3	♀♀	CVF1	CVF2	CVF3
LAED	-23.937	-17.429	1.463	LSP	68.640	89.282	-1.960
LP	10.931	-37.492	-3.568	WE	2.494	-9.022	-3.972
LE	0.443	11.778	4.314	LP	-24.441	8.897	-20.625
WE	2.162	8.279	-10.445	LE	6.880	-0.966	3.421
Constant	12.587	8.277	8.496	Constant	-16.217	-8.800	15.867
Eigenvalue	28.474	3.826	0.115	Eigenvalue	14.867	1.822	0.257
%EV	87.8	11.7	0.4	%EV	87.7	10.7	1.5

Table 5. Discriminant Stepwise Analysis: group centroids for males and females.

♂♂	CVM1	CVM2	CVM3	♀♀	CVF1	CVF2	CVF3
cookei	1.688	0.321	0.230	*cookei*	-2.481	-1.557	0.477
dilutipes	4.245	-1.380	-0.001	*dilutipes*	-3.113	0.813	0.168
nigripes	-9.890	-1.514	0.070	*nigripes*	6.064	0.121	-0.324
thikana	-2.820	4.957	0.009	*thikana*	5.375	0.301	0.984
weisei	1.602	-0.141	-0.637	*weisei*	-0.947	-1.447	-0.611
whitfieldi	4.045	-0.259	0.333	*whitfieldi*	-2.211	1.920	-0.201

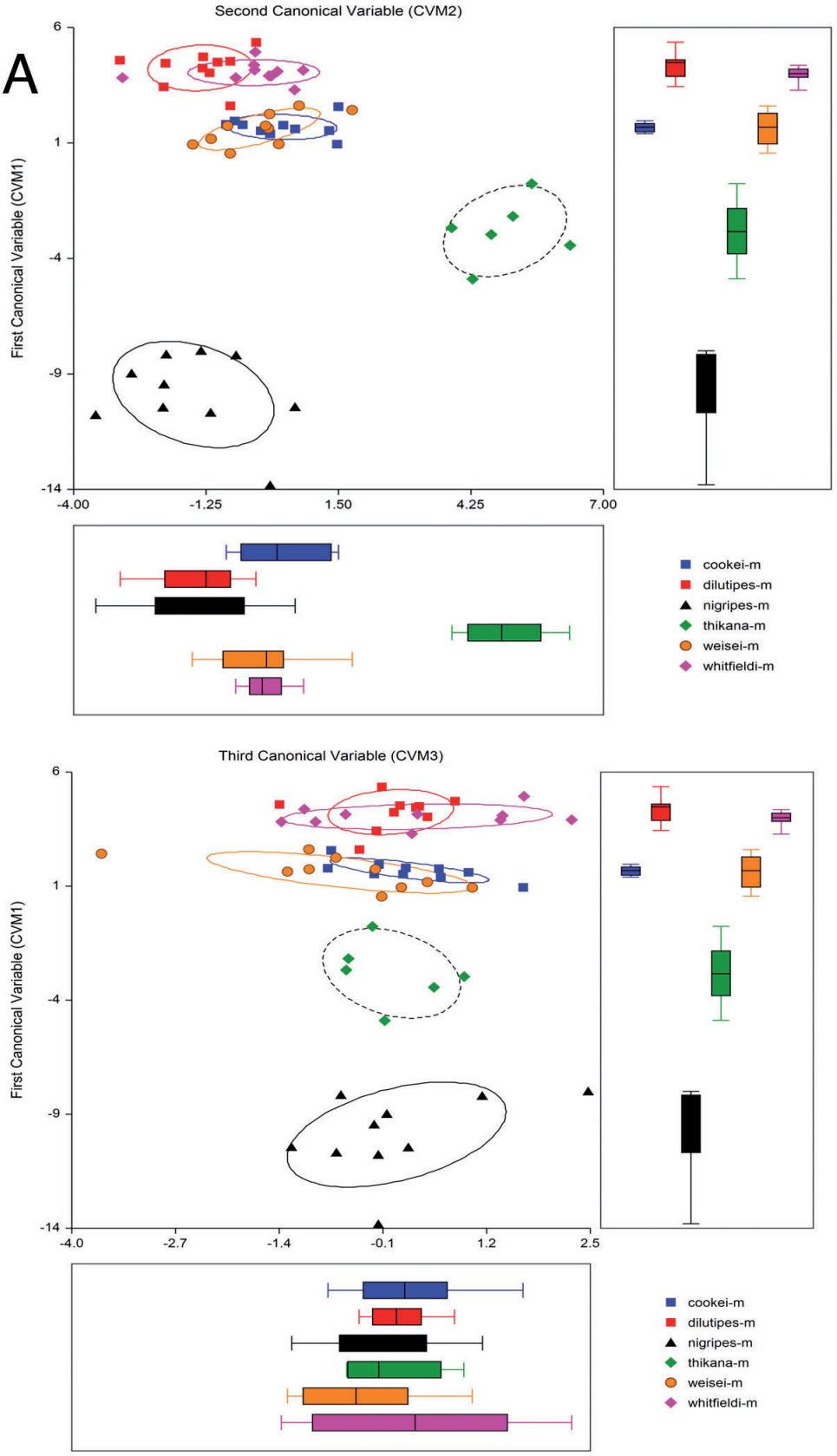

Figure 7. A) Discriminant Stepwise Analysis: scatterplots (CVM1 by CVM2; CVM1 by CVM3) of the Canonical Variates Analysis for males: *A. cookei* (Gerstaecker) (10 ♂♂), *A. dilutipes* Jacoby (10 ♂♂), *A. nigripes* (Allard) (10 ♂♂), *A. thikana* Bryant (6 ♂♂), *A. weisei* (Jacoby) (10 ♂♂) and *A. whitfieldi* Bryant (10 ♂♂). *A. namibiana* sp. n. and *A. usambarica* Weise were not considered in this analysis.

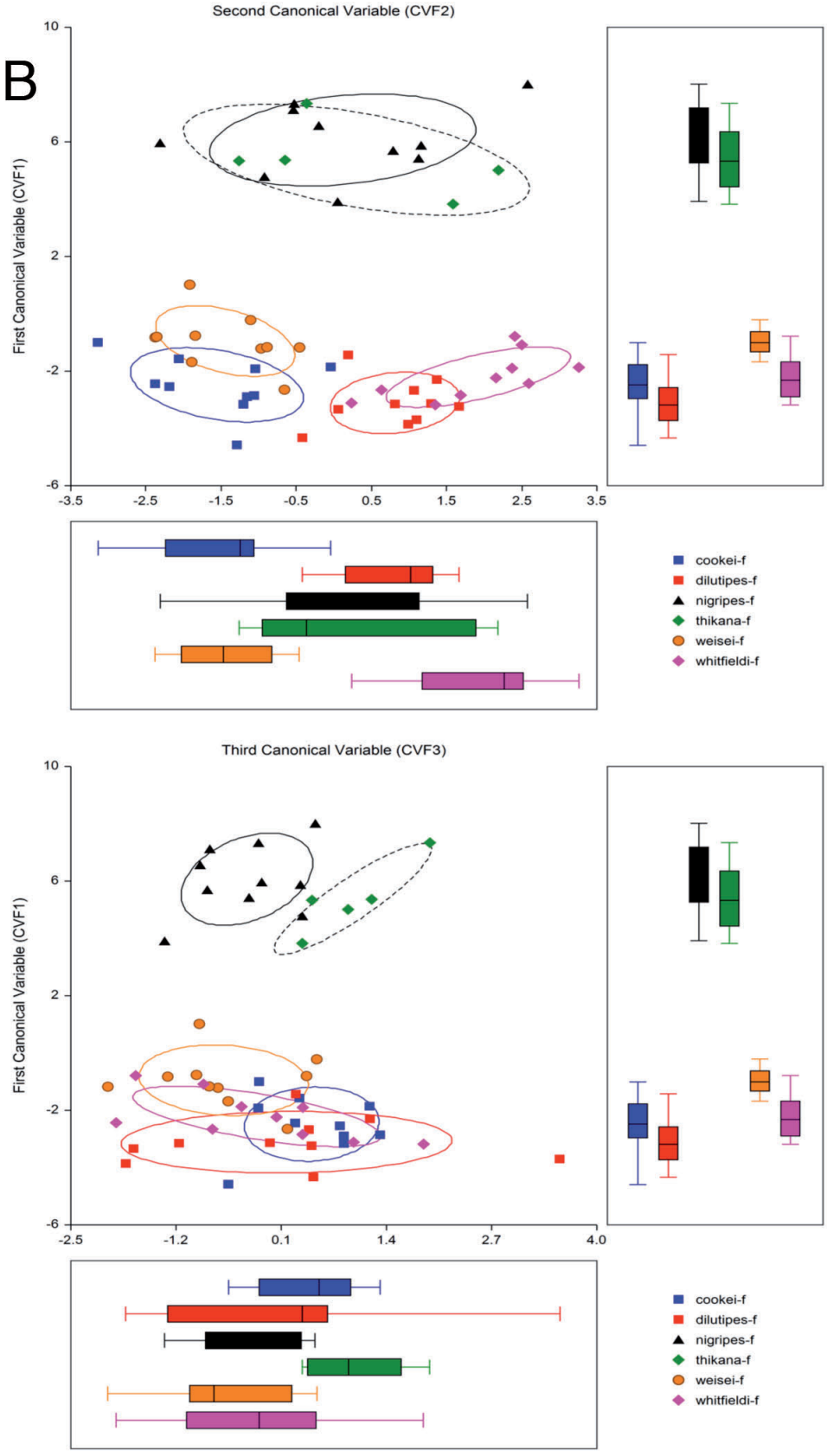

Figure 7. B) Discriminant Stepwise Analysis: scatterplots (CVF1 by CVF2; CVF1 by CVF3) of the Canonical Variates Analysis for females: *A. cookei* (Gerstaecker) (10 ♀♀), *A. dilutipes* Jacoby (10 ♀♀), *A. nigripes* (Allard) (10 ♀♀), *A. thikana* Bryant (5 ♀♀), *A. weisei* (Jacoby) (10 ♀♀) and *A. whitfieldi* Bryant (10 ♀♀). *A. namibiana* sp. n. and *A. usambarica* Weise were not considered in this analysis.

were extracted (Tables 4 and 5). The first function (87.7% of EV) is mainly useful to separate respectively the couples *nigripes-thikana*, *cookei-weisei* and *dilutipes-whitfieldi*; the second function (10.7% of EV) shows also an high discriminating power for the couple *cookei-weisei* from the other four compared species; finally the third function (1.5% of EV) is particularly useful to discriminate *nigripes* from *thikana* (Tables 4 and 5; Figure 7B).

Conclusions

The *Aphthona cookei* species-group, widespread in the most part of Sub-Saharan Africa and Southern Arabian Peninsula, comprehends eight species, *Aphthona cookei* (Gerstaecker, 1871), *A. dilutipes* Jacoby, 1906, *A. namibiana* sp. n., *A. nigripes* (Allard, 1890), *A. thikana* Bryant, 1940, *A. usambarica* Weise, 1902, *A. weisei* (Jacoby, 1899b) and *A. whitfieldi* Bryant, 1933. The highest species diversity (7) for this group is occurring in the Equatorial belt comprised between latitudes 10° North and 10° South. All eight species are very probably associated with Euphorbiaceae and three of them, *A. cookei*, *A. dilutipes* and *A. whitfieldi*, are recognized pests in biodiesel plantations of *Jatropha curcas* in the Afrotropical region, where they represent a real problem in the development of this activity in many African countries.

The flea beetle species of the *cookei*-group are very similar in morphology and in color. Anyway, the shape of the median lobe of aedeagus always allows a sure identification at specific level. In addition, the discriminant analysis perfomed by us have also supplied an useful tool for the identification of some species on the basis of morphometric variables: LAED for males, LSP for females, while other variables, such as LP, LE and WE, are significant for both sexes.

To meet the requirements by the International Code of Zoological Nomenclature (ICZN), this article was registered at ZooBank (28 October 2013) under the ZooBank Life Science Identifier (LSID): AF5038DC-73A9-4B84-A58E-FDC30F8FD29B.

References

ACHTEN W.M.J., VERCHOT L., FRANKENC Y.J., MATHIJSD E., SINGHE V.P., AERTSA R., MUYS B., 2008 - Jatropha bio-diesel production and use. - Biomass Bioenerg. 32: 1063-1084.

ALLARD E., 1890 - Voyage de M. Ch. Alluaud dans le territoire d'Assinie (Afrique occidentale) en juillet et août 1886. Chrysomélides. - Ann. Soc. Entomol. Fr. 1890: 555-558.

ANITHA K., VARAPRASAD K.S., 2012 - Jatropha pests and diseases, an overview. In: CARELS N., SUJATHA M., BAHADUR B., (eds), Jatropha, challenges for a new energy crop. - New York, Springer: 175-218.

BECHYNÉ J., 1955 - Über die Westafrikanischen Alticiden (Col. Phytophaga). - Entomol. Arbeiten aus dem Museum G. Frey 6: 486-568.

BECHYNÉ J., 1959 - Observations sur les Alticides recueillis au Congo Belge par M.A. Collart (Coleoptera, Phytophaga). - Bull. Inst. R. Sci. Nat. Belg. 35: 1-36.

BECHYNÉ J., 1960 - Notes sur les Alticides Africains des collections de l'Institut Royal des Sciences Naturelles de Belgique (Coleoptera, Phytophaga). Bull. Inst. R. Sci. Nat. Belg. 36: 1-32.

BECHYNÉ J., 1968 - Contribution a la faune du Congo (Brazzaville). Mission A. Villiers et A. Descarpentries. LXXXI. Coleopteres Alticidae. - Bull. Inst. Fr. Afr. Noire. Ser. A 30: 1687-1728.

BIONDI M., D'ALESSANDRO P., 2006 - Biogeographical analysis of the flea beetle genus Chaetocnema in the Afrotropical Region: distribution patterns and areas of endemism. - J. Biogeogr. 33: 720-730.

BIONDI M., D'ALESSANDRO P., 2012 - Afrotropical flea beetle genera: a key to their identification, updated catalogue and biogeographical analysis (Coleoptera, Chrysomelidae, Galerucinae, Alticini). - Zookeys 253: 1-158.

BRYANT G.E., 1933 - Some new Phytophaga from Africa. - Stylops 2: 250-255.

BRYANT G.E., 1940 - New species of African Phytophaga (Coleopt.). - P. Roy. Entomologic. Soc. London Ser. B 9: 41-48.

BRYANT G.E., 1957 - Coleoptera: Chrysomelidae of South-West Arabia. - Ann. Mag. Natl. Hist. Ser. 12 10: 353-363.

BRYANT G.E., 1959 - Coleoptera: Chrysomelidae I. - South Afr. Anim. Life 6: 194-226.

CHEVROLAT L.A.A.,1836 - In: DEJEAN P.F.M.A. (ed), Catalogue des Coleopteres de la collection de M. le Comte Dejean. Deuxieme edition, revue, corrigee et augmentee, livr. 5. Librairie Mequignon-Marvis Pere et Fils, Paris: 361-442.

GAGNAUX P.C., 2009 - Entomofauna associada à cultura da Jatrofa (Jatropha curcas L.) em Moçambique. Faculdade de Agronomia e Engenharia Florestal Mozambique, Universidade Eduardo Mondlane, Maputo. Available from: http://www.fact-foundation.com/en?cm=204%2C 166&mf_id=261 .

GERSTAECKER A., 1871 - Beiträge zur Insektenfauna von Zanzibar. III. Coleoptera. - Archiv für Naturgeschicht 37: 42-86.

GERSTAECKER A., 1873 - Gliederteiere (Insekten, Arachniden, Myriopoden und Isopoden. In: Baron Carl Claus von der Decken's Reisen in Ost-Afrika in den Jahren 1859-1865. Wissenschaftlicher Theil, Band 3, Abtheilung 2. C.F. Winter'sche Verlaghandlung, Leipzig und Heidelberg, pp 1-542, xviii pls.

JACOBY M., 1899a - Some new genera and species of phytophagous Coleoptera Collected during Captain Bottego's last expedition. - Annali del Museo Civico di Storia Naturale di Genova (serie 2a) 19 (1898): 521-535.

JACOBY M., 1899b - Additions to the knowledge of the phytophagous Coleoptera of Africa. Part II. - P. Roy. Entomologic. Soc. London 1899: 339-380.

JACOBY M., 1903 - A further contribution to our knowledge of African phytophagous Coleoptera. Part II. - T. Entomologic. Soc. London 1903: 1-38.

JACOBY M., 1906 - Descriptions of new genera and species of African Halticinae and Galerucinae. - T. Entomologic. Soc. London 1906: 11-52.

JOLIVET P., HAWKESWOOD T.J., 1995 - Host-plants of Chrysomelidae of the World. An essay about the relationships between the leaf-beetles and their food-plants. - Backhuys Publishers, Leiden.

JONGH J.A., VAN DER PUTTEN E., 2010 - The Jatropha Handbook. From Cultivation to Application - FACT Foudation, Eindhoven.

NIELSEN F., 2009 - Jatropha curcas oil production for local development in Mozambique. Afr. Crop Sci. Conf. Proc. 9: 71-75.

POLLARD D.G., 1957 - Halticinae of the Sudan. Bull. Entomologic. Res. 47: 73-87.

ROBINSON S., BECKERLEGGE J., 2008 - Jatropha in Africa Economic Potential - Bio Diesel Fuels Incorporation. Available from: http://www.jatropha.pro/PDF%20bestanden/Jatropha_in_Africa_Economic_Potential-2008.pdf.

SCHERER G., 1959 - Die Alticiden-Ausbeute der Expedition des Museums G. Frey nach Nigeria-Kamerun 1955/56 (Col. Phytoph.). Entomol. Arbeiten aus dem Museum G. Frey 10: 177-265.

SCHERER G., 1962a - Beitrag zur Kenntnis der Alticiden-fauna Zentral-Afrikas (Coleoptera Chrysomelidae Alticinae). - Ann. Musée Roy. Afrique Centrale Tervuren, Belgique, Ser. 8°, Sci. Zoologiq. 113: 7-82.

SCHERER G., 1962b - Alticinae (Coleoptera, Phytophaga) Fam. Chrysomelidae. Exploration du Parc National de la Garamba. Mission H. De Saeger (1949-1952). - Inst. Parcs Nationaux du Congo et du Rwanda (Bruxelles) 31: 3-86.

SCHERER G., 1963 - Beitrag zur Kenntnis der Alticidenfauna Afrikas (Coleoptera, Chrysomelidae, Alticinae). - Entomol. Arbeiten aus dem Museum G. Frey 14: 648-684.

SCHERER G., 1972 - Coleoptera aus Nordostafrica. Chrysomelidae: Alticinae. Notulae Entomologicae 52: 1-17.

SRINOPHAKUN P., TITAPIWATANAKUN B., SOOKSATHAN I., PUNSUVON V., 2012 - Prospect of Deoiled Jatropha curcas Seedcake as fertilizer for vegetables crops. A case study. - J. Agricult. Sci. 4 (3): 211-226.

TABACHNICK B.G., FIDELL L.S., 1989 - Using multivariate statistics. Harper Collins, New York..

WEISE J., 1902 - Afrikanische Chrysomeliden. - Archiv für Naturgeschichte 68: 119-174.

WEISE J., 1914 - Coleoptera 1: Chrysomelidae und Coccinellidae. In: MICHAELSEN W., (ed), Beiträge zur Kenntnis der Land-Süsswasserfauna Deutschsüdwestafrikas: Ergebnisse der Hamburger deutsch-südoestafrikaanischen Studienreise 1911. Vol. 1. Friederichson L. & Co., Hamburg: 253-275.