ACTA ENTOMOLOGICA MUSEI NATIONALIS PRAGAE
Published 15.xii.2014 Volume 54(2), pp. 645–655 ISSN 0374-1036
http://zoobank.org/urn:lsid:zoobank.org:pub:A21F7C65-F7B9-492A-B8D2-8A0936B422DA

Revision of the *Cryptocephalus vitellinus* species group (Coleoptera: Chrysomelidae: Cryptocephalinae)

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Abstract. The *Cryptocephalus vitellinus* species group is revised. *Cryptocephalus lucidus* Rapilly, 1980 is removed from synonymy with *C. vitellinus* Lopatin, 1980. *Cryptocephalus jirofti* sp. nov. is described from Iran (Kerman Province). All species are illustrated and an identification key is provided.

Key words. Coleoptera, Chrysomelidae, Cryptocephalinae, Cryptocephalini, taxonomy, key, Iran, Palaearctic Region

Introduction

The Cryptocephalinae of Iran are comparatively well studied, at present 82 species are known from the country, among which 51 are in the genus *Cryptocephalus* Geoffroy, 1762 (Lopatin 1984, 1985; Berti & Rapilly 1979; Rapilly 1980; Schöller & Nasserzadeh 2010). However, recent studies showed the biodiversity of the subfamily still not to be fully explored (Schöller 2010, 2012; Romantsov 2012). In this study, type specimens of *Cryptocephalus vitellinus* Lopatin, 1980 were re-examined, as well as those of *Cryptocephalus lucidus* Rapilly, 1980, latter species having been regarded as a synonym of *C. vitellinus* by Lopatin (2001) and Lopatin et al. (2010). This study suggests the presence of three different related species, including one new to science, all of which are described and illustrated below.

Material and methods

The exact label data are cited for each type specimen; a single forward slash (/) separates data on different rows and a double forward slash (//) separates labels. The data are printed if not mentioned otherwise, the author's remarks are presented in brackets and following shortcuts are used: [w] = white label, [r] = red label.

The dried adult specimens were dissected by separating the abdomen in water. Afterwards the contents were soaked in cold KOH solution and then washed in water. The eye length was measured in lateral view, the interocular space in frontal view. All measurements were made using an ocular scale mounted on the stereomicroscope (at 20× magnification for the body length and 40× to 70× magnification for the remaining measurements). Photographs were taken as separate layers with a Nikon D5100 mounted on the microscope and composed in the CombineZP software (http://www.hadleyweb.pwp.blueyonder.co.uk).

The specimens were deposited in the following collections:

MNHN Muséum national d'Histoire naturelle, Paris, France (Antoine Mantilleri, Thierry Deuve);
MESC Matthias Schöller personal collection, Berlin, Germany;
NMPC Národní muzeum, Praha, Czech Republic (Jiří Hájek);
ZMHB Museum für Naturkunde, Berlin, Germany (Johannes Frisch, Manfred Uhlig).

Taxonomy

Definition of the *Cryptocephalus vitellinus* species group

Medium sized (3.2–4.3 mm) species, dorsum yellow to yellowish brown, with narrowly black base of pronotum and elytra, blackish brown humeral spot, and sometimes preapical elytral spot. Eyes large. Pronotum glabrous, elongate, teeth at base homogenous, lateral margins narrowly bordered, punctures on pronotum shallow and dense. Elytra covered with short white setae on whole surface, elytral punctures small, arranged in regular rows. Half to 2/3 length of claw segment (metatarsomere V) projecting out of lobes of metatarsomere III, claws simple, male fore tibiae simple. Aedeagus with a pair of sickle-shaped endosclerites and a pair of triangular fraenula, apex triangular, tip with a denticle. Spermathecal duct narrow and densely coiled up close to spermatheca, its insertion on bursa copulatrix triangularly sclerotized. Kotpresse (i.e. rectal apparatus for forming the faecal pellets covering the eggs, see Schöller 2008) with dorsal sclerite transverse, ventrally bent part of dorsal sclerite present, ventral sclerite doubled.

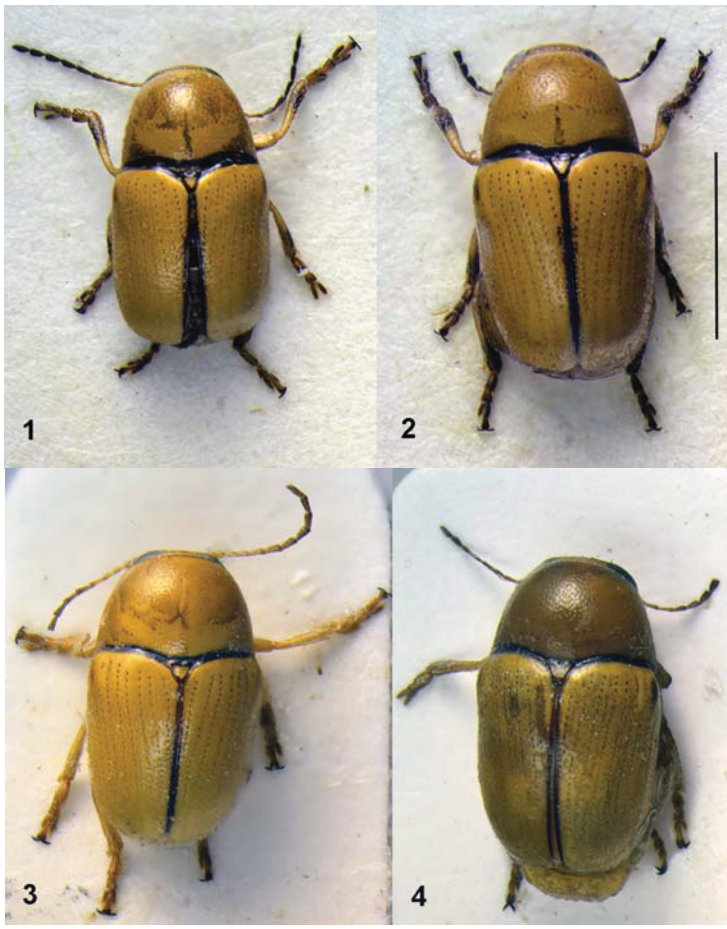
Key to the *C. vitellinus* species group

1 Male first pro- (Fig. 12) and mesotarsomere not strongly widened, female first mesotarsomere as wide as first metatarsomere; body smaller, length of male (Fig. 3) 3.2 mm and of female (Fig. 4) 3.8 mm. ..... ***C. vitellinus*** Lopatin, 1980

– Male first pro- (Fig. 19) and mesotarsomere strongly widened, female first mesotarsomere wider than first metatarsomere; body larger, male 3.4–3.9 mm, female 4.2 mm. 2

2 Pronotum yellowish-orange with lighter yellow transverse spot at base, elytra yellow (Fig. 5), black humeral marking distinct, a longitudinal blackish brown marking present in apical third of elytron, pro- and mesotibia with brown marking in apical half (Fig. 6). ..... ***C. lucidus*** Rapilly, 1980

– Pronotum uniformly yellow, elytra pale yellow with blurred brownish humeral marking, no additional markings present, all tibiae pale yellow (Figs 1–2). ..... ***C. jirofti* sp. nov.**



Figs 1–4. 1–2 – *Cryptocephalus jirofti* sp. nov. (1 – male, 2 – female); 3–4 – *C. vitellinus* Lopatin, 1980 (3 – male, 4 – female).

Cryptocephalus vitellinus Lopatin, 1980

(Figs 3–4, 7–15)

Cryptocephalus (*Asionus*) *vitellinus* Lopatin, 1980: 615 (original description).

Type locality. SE Iran, Sīstān-o Balūchestān Province, Chabahar, 25 km W of Qasr-e-Qand and 34 km east of Nik Shahr.

Type material examined. Holotype: ♂, 'SE Iran, 25 km / W. Ghasre-ghand / 9.-10.4.1973 [w] // Loc. no. 153 / Exp. Mus. Nat / Praha [w] // Holotype [r] // *Cryptocephalus* / *vitellinus* sp. n. [handwritten] / det.I.Lopatin, 19 [w]' (NMPC). Paratypes (20 spec.): 18 unsexed, 'SE Iran, 25 km / W. Ghasre-ghand / 9.-10.4.1973 [w] // Loc. no. 153 / Exp. Mus. Nat / Praha [w] // det.I.Lopatin, 19 [w]' (NMPC); 2 unsexed, 'SE Iran Bahu-Kalat / 3.-4.4.1973 [w] // Loc. no. 147 / Exp. Mus. Nat / Praha [w] // Paratype [r] // *Cryptocephalus* / *vitellinus* sp. n. [handwritten] / det.I.Lopatin, 19 [w]' (NMPC).

Additional specimens examined. IRAN: **Sīstān-o Balūchestān Province:** Rask vall r. Sarbáz, loc. no. 146, 3.–4. iv.1973, 3 spec., det. Lopatin 1983 (NMPC).

Figs 5–6. *Cryptocephalus lucidus* Rapilly, 1980 (5 – male dorsal, 6 – male lateral).

Redescription. Medium-sized, male 3.2 mm, female 3.8 mm; pronotum elongate, with narrowly black base of pronotum and elytra; pronotum glabrous; elytra pale yellow with blurred brownish humeral marking, no additional markings present, with short white setae and rows of small punctures; protibia with brown marking in apical half.

Male. First protarsomere strongly widened, half (Fig. 14) length of claw segment projecting out of lobes of metatarsomere III. Aedeagus regularly rounded in lateral view (Fig. 7), apex of aedeagus in dorsal view in the shape of equilateral triangle with tip forming a narrow denticle; a pair of transverse fraenula and a pair of narrow sickle-shaped endosclerites visible in ostium (Fig. 8); a pair of elongate semi-transparent windows visible in ventral view (Fig. 9).

Female. First mesotarsomere as wide as first metatarsomere, 2/3 length (Fig. 15) of claw segment projecting out of lobes of metatarsomere III. Spermathecal duct loosely coiled up at base (Fig. 13), yellowish brown in whole length. Kotpresse with dorsal sclerites transverse, ventrally bent part of dorsal sclerite present, with transverse rectangular sclerites fused to sclerotisation of the lateral fold (Fig. 10), ventral sclerite in form of a crosswise band, completely sclerotized at middle, apodemes slender, much wider than rectum, ventral sclerotised area present, i.e. ventral sclerite doubled, wide and long, ventral sclerotised area measuring half width of ventral sclerite, ventral sclerotisations of lateral fold present (Fig. 11).

Distribution. Iran (Sīstān-o Balūchestān Province).

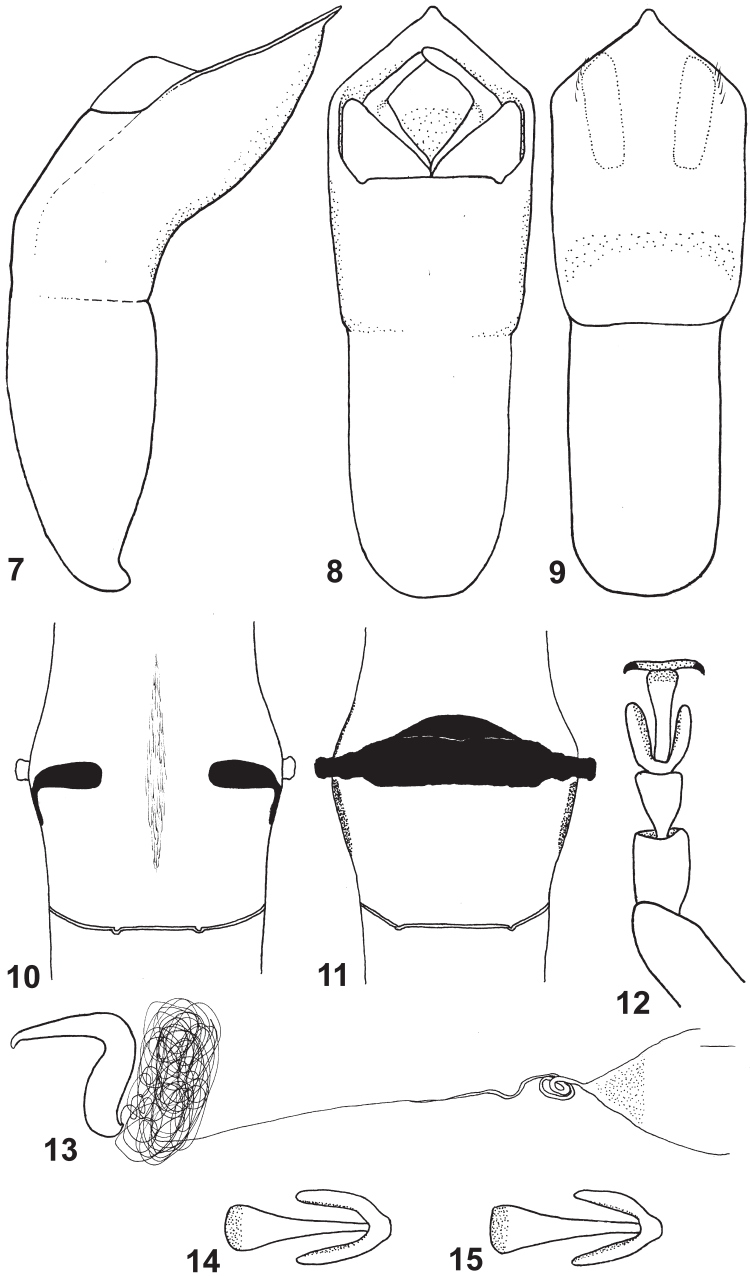
Cryptocephalus lucidus Rapilly, 1980

(Figs 5–6, 16–19)

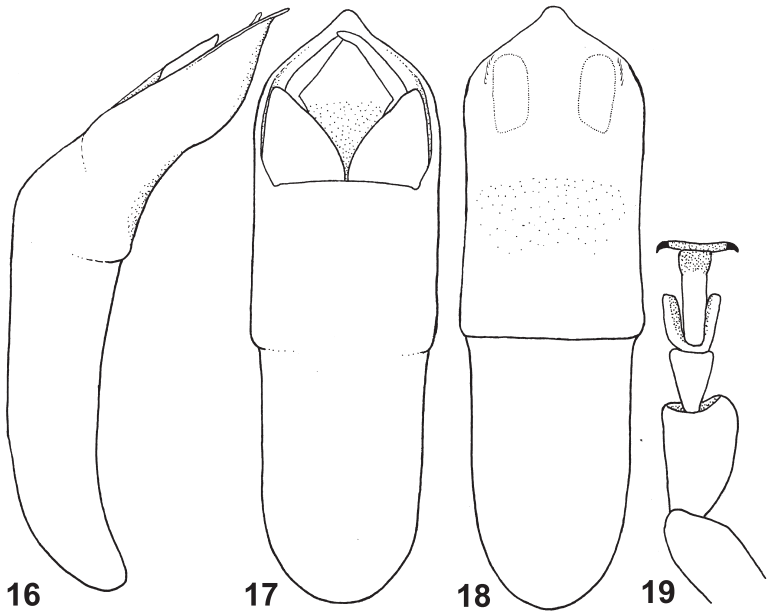
Cryptocephalus lucidus Rapilly, 1980: 80 (original description).

Type locality. Iran, Kermān Province, Delfar, Central mountain chain in the Sabzevarn Region (nowadays renamed to Jiroft Region).

Type material examined. Holotype: ♂, 'Iran Delfar (chai / ne centr.) 19.VI.73 / 1500 m. [handwritten] [w] // *Cryptocephalus lucidus* Rapilly [handwritten] / M. Rapilly dét. 1979 [w] // HOLOTYPE [r] // Museum Paris [w] // MNHN / EC4099 [w]' (MNHN). Paratypes (3 spec.): 2♂♂, 'IRAN Saqdar (chaî- / ne centrale) / 2200 m. 17VI.73 (ink) [w] // *Cryptocephalus lucidus* Rapilly [handwritten] / M. Rapilly dét. 1979 [w] // PARATYPE [r] // Museum



Figs 7–15. *Cryptocephalus vitellinus* Lopatin, 1980. 7–9 – aedeagus (7 – lateral view, 8 – dorsal view, 9 – ventral view); 10–11 – kotpresse (10 – dorsal view, 11 – ventral view); 12 – male right protarsus; 13 – spermatheca and spermathecal ductus; 14–15 – hind tarsal claw segment (14 – male, 15 – female).



Figs 16–19. *Cryptocephalus lucidus* Rapilly, 1980. 16–18 – aedeagus (16 – lateral view, 17 – dorsal view, 18 – ventral view); 19 – male right protarsus.

Paris [w] // MNHN / EC4101 [w] // [note: in one male, the endophallus is everted]' (MNHN); 1 ♂, 'IRAN Saqdar / 11.6.73 / RN [handwritten] [w] // *Cryptocephalus lucidus* Rapilly [handwritten] / M. Rapilly dét. 1979 [w] // PARATYPE [r] // Museum Paris [w] // MNHN / EC4100 [w]' (MNHN).

Redescription. Medium-sized, male 3.4–3.9 mm, female 4.2 mm long; pronotum elongate, with narrowly black base of pronotum and elytra; pronotum glabrous; elytra pale yellow with black humeral marking distinct and a longitudinal blackish brown marking present in apical third of elytron, with short white setae and rows of small punctures; pro- and mesotibia with brown marking in apical half.

Male. Both first pro- and mesotarsomeres strongly widened. In lateral view, aedeagus bulging in apical part (Fig. 16), apex of aedeagus in dorsal view triangular with apical denticle broader than in *C. vitellinus*; a pair of triangular fraenula and a pair of narrow sickle-shaped endosclerites visible in ostium (Fig. 17); a pair of short semi-transparent windows visible in ventral view (Fig. 18).

Spermathecal duct loosely coiled up at base (see Fig. 14 in Rapilly (1980)).

In male, half of claw segment projecting out of lobes of metatarsomere III.

Distribution. Iran (Kermān Province). Known from the localities given in the original description only.

Cryptocephalus jirofti sp. nov.

(Figs 1–2, 20–26)

Type locality. Iran, Kermān Province, Jiroft, 28°40′ N, 57°44′ E.

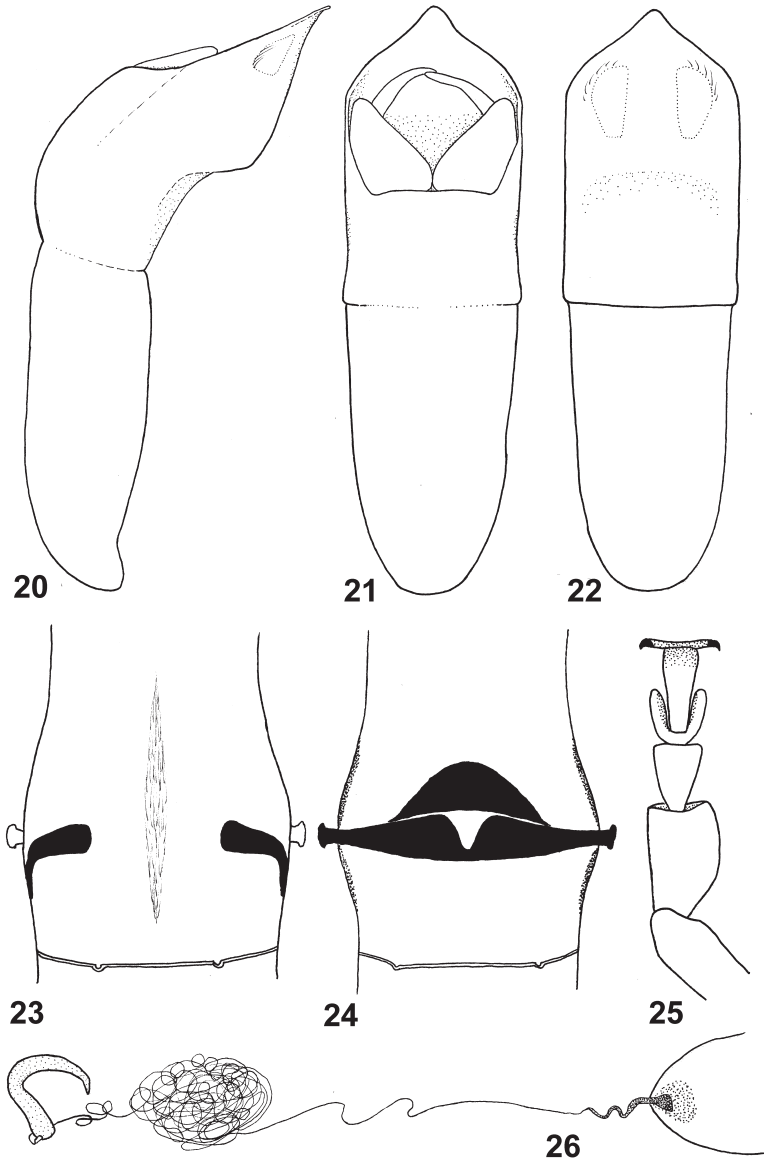
Type material. Holotype: ♂, 'IRAN, Jiroft, SW / 800 m, 21.V.1987 [w] // Holotypus *Cryptocephalus* / *jirofti* sp. nov., / des. Matthias Schöller [r]' (ZMHB). Paratypes: 3 ♂♂ 1 ♀, 'IRAN, Jiroft, SW / 800 m, 21.V.1987 [w] // Paratypus *Cryptocephalus* / *jirofti* sp. nov. / des. Matthias Schöller [r]' (No. 1 (♂) and No. 2 (♀) in MESC, No. 3 (♂) in NMPC, No. 4 (♂) in MNHN.

Description. Measurements (holotype): body length 3.75 mm, width of elytra at humeri 2.15 mm; length of elytra 2.50 mm; length of pronotum 1.40 mm and width 1.90 mm. Medium-sized, male 3.4–3.9 mm, female 4.2 mm; pronotum elongate, with narrowly black base of pronotum and elytra; pronotum glabrous; elytra pale yellow with blurred brownish humeral marking, no additional markings present, with short white setae and partly irregular rows of small punctures; scutellum yellow; in male first pro- and mesotarsomere strongly widened, in female first mesotarsomere wider than first metatarsomere.

Head shiny, yellow; surface without depressions or furrow, densely punctured with coarse punctures. Clypeus not distinctly separated from frons. Labrum light brown, short, transverse, almost impunctate, anterior angles rounded, anterior margin shallowly convex. Mandibles medium brown with dark brown tips. Last palpomere acute. Eyes large and upper lobes approached, therefore distance between upper lobes 0.53 times the eye length in lateral view; eyes evenly convex, canthus deep. Antennae inserted low on frons, 0.59× body length; antennomeres I–V shiny, medium brown, VI–XI dull, slightly darker brown; scape club-shaped; pedicel globular; antennomeres III and IV elongate, narrow, antennomere V similar to IV but more widened at apex and with longer setae, antennomeres VI to IX distinctly widened, antennomere XI with a pointed tip.

Prothorax. Pronotum yellow with black basal margin (Fig. 1); shiny and densely punctured, punctures very shallow, punctures deeper and more coarse laterally; transverse, 1.36 times as wide as long, widest at base, gradually narrowing towards anterior margin, moderately convex; basal margin only feebly sinuose, with 41 teeth of the same size except for a pair of larger teeth opposite to scutellum; posterior angles triangularly extended, acute; median lobe of basal margin with three large and two small teeth, truncate, not raised; lateral margins narrowly bordered, not visible in dorsal view (Fig. 1); anterior margin feebly convex in dorsal view, bordered, light brown, anterior angles rectangular. Prothorax ventrally yellow; intercoxal prosternal process elongate, relatively narrow, as wide as coxal cavity, posterior margin with a pair of blunt lobes, anterior margin regularly convex with a narrow carina; mat and densely punctured prothorax with short white setae, distinctly separated from smooth hypomeron.

Mesothorax and metathorax more brownish yellow compared to prothorax, epimeron of mesothorax whitish yellow. Scutellum triangular, with rounded apex, apically in plane with elytra, yellow with black basal margin, impunctate. Elytra subcylindrical, widest at humeri, 1.16 times as long as wide at humeral part, with short white setae, lustrous, pale yellow with a small blurred brown humeral spot, anterior elytral margin black, suture brown, darkened towards apex (Fig. 1); with nine regular rows of punctures plus scutellar and lateral rows in anterior part of elytra, in posterior part partly confused by extra-punctures and vanishing



Figs 20–26. *Cryptocephalus jirofti* sp. nov. 20–22 – aedeagus (20 – lateral view, 21 – dorsal view, 22 – ventral view); 23–24 – kotpresse (23 – dorsal view, 24 – ventral view); 25 – male right protarsus; 26 – spermatheca and spermathecal ductus.

punctures on clivus; rows of punctures not reaching basal margin, punctures blackish brown at base, interstices mat with many large punctures, setose with short white, erect setae, only laterally slightly convex; epipleuron 1/2 the length of the elytra, with a row of punctures.

Legs pale yellow, tarsi darker, i.e. light brown, external edge of tibiae simple, with a long fringe of setae; protibiae as long as metatibiae, straight, ratio of length of metatarsomeres as 2.0 : 1.1 : 1.5 : 2.2 (Fig. 25), half length of claw segment projecting out of lobes of metatarsomere III, claws simple.

Abdomen light brown, all margins pale yellow, with adherent short white setae, last ventrite with a shallow pit surrounded by short white erect setae, ventrites and pygidium with short white adherent setae, puncturation of ventrites fine, more coarse on pygidium; sclerotization of tergites moderately strong. Pygidium pale yellow, regularly vaulted. In lateral view, aedeagus strongly bulging in apical part (Fig. 20), apex of aedeagus in dorsal view triangular with tip forming a broad denticle; a pair of triangular fraenula and a pair of narrow sickle-shaped endosclerites visible in ostium (Fig. 21); a pair of short semi-transparent windows visible in ventral view (Fig. 22).

Female. Abdomen light brown except for pale yellow first and last ventrite, with adherent white setae of medium length. Egg-hollow elongate, twice as long as wide, its margins regular, surrounded by longer erect setae. Kotpresse with dorsal sclerite transverse, ventrally bent part of dorsal sclerite present, with transverse rectangular sclerites fused to sclerotisation of the lateral fold (Fig. 23), ventral sclerite in form of single crosswise band, incised at middle, apodemes slender, much wider than rectum, ventral sclerotised area present, wide and long, half width of ventral sclerite, ventral sclerotisations of lateral fold present (Fig. 24); spermatheca 0.30 × 0.30 mm, light brown, narrow, hook-shaped, pump as long as reservoir, spermathecal duct emerging from a stick-shaped extension of spermatheca, spermathecal duct light brown, narrow and densely coiled up close to spermatheca, but not spiral, getting wider at very base, base triangularly expanded and darker pigmented, emerging from blurred light brown area (Fig. 26).

Differential diagnosis. *Cryptocephalus jirofti* sp. nov. differs from *C. vitellinus* Lopatin in the widened first mesotarsomere in both sexes, in the male in having both the first pro- and mesotarsomeres strongly widened (only the first protarsomeres are strongly widened in *C. vitellinus*), in the female the first mesotarsomere is wider than the first metatarsomere (first pro- and mesotarsomeres of equal width in *C. vitellinus*). From *C. lucidus* Rapilly, *C. jirofti* sp. nov. differs in the pale yellow tibiae (pro- and mesotibia with brown marking in *C. lucidus*), the uniformly yellow pronotum (yellowish-orange with a lighter yellow transverse spot at the base in *C. lucidus*), and the pale yellow elytra with blurred brownish humeral marking (black humeral marking distinct and a longitudinal blackish brown marking present in apical third of elytron in *C. lucidus*). From both *C. vitellinus* and *C. lucidus*, *C. jirofti* sp. nov. differs in the shape of the aedeagus, which in lateral view is strongly bulging in the apical part, and in dorsal view the apex of the aedeagus is triangular with the tip forming a broad denticle.

Etymology. The specific epithet refers to the collecting site, Jiroft; noun in genitive case.

Distribution. Iran (Kermān Province).

Discussion

The species of the *C. vitellinus* species group are distributed in the southeast region of Iran, in the provinces Kermān (*C. lucidus* and *C. jirofti* sp. nov.) and Sīstān-o Balūchestān (*C. vitellinus*). *Cryptocephalus vitellinus* was collected from *Tamarix* sp. along riversides in a stony desert, where adults occurred in early April (Lopatin 1980). The group is known so far from a few specimens only. It is likely that the specimens cited in Borumand (2000) as *C. vitellinus* from Kermān labeled '16 km S.W. Jiroft, 820m, 19.V.1977, leg. Safavi & Pãzuki, det. I. Lopatin' belong to *C. jirofti* sp. nov., too.

Lopatin (2001) gave no reasons for the synonymy of *C. lucidus* with *C. vitellinus*, but listed this decision as a synonymic remark. The strongly widened first protarsomere in the male of *C. lucidus* was both described and figured by Rapilly (1980), a character that allows one to immediately differentiate between *C. lucidus* and *C. vitellinus*.

In the original description, Lopatin (1980) did not describe the aedeagus of *C. vitellinus*, but gave a figure of its dorsal and lateral views. Rapilly (1980) did not describe the aedeagus of *C. lucidus*, but gave a figure of its ventral and lateral views. The figures of the two aforementioned species in lateral view are quite different in the proportions of the apical parts of the lobes. Distinct differences in the shape of the aedeagi, namely in the shape of the apical denticle and the vaulting of the apical part in lateral view, of *C. lucidus* and *C. vitellinus* were confirmed in this study, as well as distinct differences compared to *C. jirofti* sp. nov. Differences in the aedeagal morphology have a well known and acknowledged value in species delimitation in the genus *Cryptocephalus* (e.g. Leonardi & Sassi 2001).

The paratype of *C. lucidus* with the reversed endophallus shows the pair of sickle-shaped endosclerites to be situated in a bent downward position, towards the aedeagal lobe (see Fig. 12 in Rapilly 1980). These sclerites could act as a clasping organ during copulation. The same position of the sickle-shaped endosclerites was found after reversing the respective endosclerites in a male of *C. jirofti* sp. nov. Similar sickle-shaped endosclerites can be found in *C. semiargenteus* Reitter, 1894, but in this species there are no triangular frenula but another pair of narrow endosclerites visible in the ostium. The relations of the *C. vitellinus* species group to other species of *Cryptocephalus* require further studies.

Acknowledgements

I would like to express my sincere thanks to the colleagues mentioned in material and methods for the possibility to study the specimens in their respective collections, and Jan Bezděk and Davide Sassi for valuable comments on an earlier version of the manuscript.

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