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A new *Cryptocephalus* from Turkey of the *C. flavipes* Fabricius, 1781, species-group (Coleoptera, Chrysomelidae, Cryptocephalini)

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Abstract. – *Cryptocephalus* (*s. str.*) *flavipes* Fabricius, 1781, and related species form a group which is more precisely defined and to which is added a new species from Turkey, *C. cilicius* n. sp.

Résumé. – **Un nouveau *Cryptocephalus* de Turquie du groupe de *C. flavipes* Fabricius, 1781 (Coleoptera, Chrysomelidae, Cryptocephalini)**. *Cryptocephalus* (*s. str.*) *flavipes* Fabricius, 1781, et les espèces proches constituent un groupe qui est défini plus précisément et auquel est ajouté *C. cilicius* n. sp., nouvelle espèce de Turquie.

Keywords. – Cryptocephalinae, taxonomy, morphology, new species.

Cryptocephalinae is one of the largest and widespread subfamily of Chrysomelidae. Among its tribe Cryptocephalini, *Cryptocephalus* Geoffroy, 1762, is one of the most widely distributed genus including many species everywhere in the Palaearctic region (Schöller, 2010). Turkey is a large country and a transition area between Europe and Asia, showing both heterogeneous topography and climate features, with several vegetation types and ecosystems. Faunistic and taxonomic works on the Turkish leaf beetles are increasing. Sassi & Kismali (2000), reviewing the older check-list of Aslan & Özbek (1997), reported 66 species and 1 subspecies of *Cryptocephalus* in Turkey. Schöller (2010) also reported 67 taxa. The more recent works show that the Cryptocephalinae fauna of Turkey is one of the richest in the Palaearctic region: 75 taxa of *Cryptocephalus*, among which 9 are endemic species (Ekiz *et al.*, 2013; Özdikmen *et al.*, 2014; Özdikmen & Cihan, 2014).

Two species have been split from *Cryptocephalus flavipes* Fabricius, 1781: *C. alborzensis* Rapilly, 1980, described from Iran and *C. bameuli* Duhaldeborde, 1999, widely recorded in the Palaearctic region. After this last taxonomic addition, Lopatin & Nesterova (2002) included in the *C. flavipes* group, *C. signatifrons* Suffrian, 1847, *C. turcicus* Suffrian, 1847, *C. peyroni* Marseul, 1875, and published an identification key and some illustrations. Nonetheless, *C. quadripustulatus* Gyllenhal, 1813, which integrates the group according to my criteria, was not taken into account.

Very recently, Montagna *et al.* (2017) published a paper based on both molecular and morphological characters for the *Cryptocephalus flavipes* species-group, excluding *C. peyroni*. According to them, it could be sometimes difficult to resolve very closely-related species delimitation and identification when relying only on traditional morphological studies. Features like frons black-yellow markings and yellow stripes of the pronotum are too highly variable to perhaps consider several morphs of the same species. After our colleagues, the assignation of *C. peyroni* to the group was only justified in its habitus and colouring, which are common traits of other species within *Cryptocephalus*. The authors wanted to test the usefulness of DNA-based approaches for species delimitation and identification and have succeeded in obtaining the phylogeny of the species reported through both Bayesian phylogram and ultrametric tree.

Their analysis based on molecular markers confirms the close relationship between *C. flavipes* and *C. bameuli*, and consolidates their opinion, including *C. quadripustulatus* as sister species of the complex *C. signatifrons* - *C. turcicus*. Especially, an undescribed taxon from Turkey very close to *C. bameuli* was pointed out by the authors.

According to the chrysomelid specialists, the listed species are put into the *C. flavipes* group without giving a more formal taxonomic value to this combination (such as subgeneric level). Obviously, its limits were defined by considering several striking phenotypic characters.

MATERIAL AND METHODS

The studied beetles were lent to me by my European colleagues.

The dried adult specimens were dissected by separating the abdomen in water. The contents were soaked in KOH solution. All pieces (fig. 1-2, 9-17) were plunged into glycerin and mounted between slide and cover glass for examination through a compound microscope. Aedeagus was included into K-Y Gel, a water-soluble solution which thickens in some minutes and allows the unsteady objects to stiffen. Photographs were taken with a Digital Microscope Camera (MC3, OCS.tec GmbH & Co., Germany) mounted on the microscope and calibrated with a stage micrometre. Figures were drawn on tracing papers then scratched up using a scalpel blade to better restore depth and transparency effects. For the prepared and dissected insects, aedeagi and abdomens are glued with a water-soluble adhesive. Female genitalia are included into a drop of DMHF (Dimethyl Hydantoin Formaldehyde resin), near the corresponding abdomen, near or under the specimen. In the list of the studied specimens, data on the same label are separated by a single forward slash (/). A double one (//) separates labels.

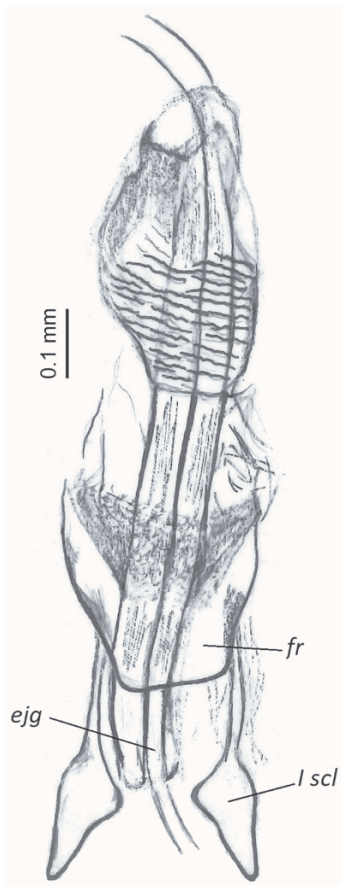

Fig. 1. – Endophallus of a *Cryptocephalus* of the *C. flavipes* group (*C. bameuli* Duhaldeborde from Central Bulgaria) (*l scl*: first sclerite; *fr*: fraenulum; *ejg*: ejaculatory guide).

Abbreviations. – **JB**, Jan Bezděk, Brno, Czech Republic; **FD**, Franck Duhaldeborde, Mérignac, France; **MM**, Matteo Montagna, Inverigo, Italy; **DS**, Davide Sassi, Castelmarte, Italy; **MS**, Matthias Schöller, Berlin, Germany; **ZU**, Miroslav Zúber, Kosmonosy, Czech Republic; **w**, white label; **r**, red label; **<…>** is reserved for the manual inscriptions; **σ**, estimated standard deviation.

TAXONOMY

DESCRIPTION OF THE *CRYPTOCEPHALUS FLAVIPES* SPECIES-GROUP

Small to medium-size beetles (2.7 to 5.0 mm). Rather stocky, with dorsum completely or almost completely black, glabrous and quite bright, usually without metallic sheen. Pronotum hardly less wide than elytra, sparsely and finely punctate (often only visible under a strong magnification), black with more or less complete and extensive lateral yellow marks and sometimes thin front edge margin yellow. Scutellum black and bright. Elytra entirely black or, more frequently, black with yellow epipleura often posteriorly narrowed. Above them, the yellow colour can extend in a more or less thick mark. Elytral punctation confused, generally arranged

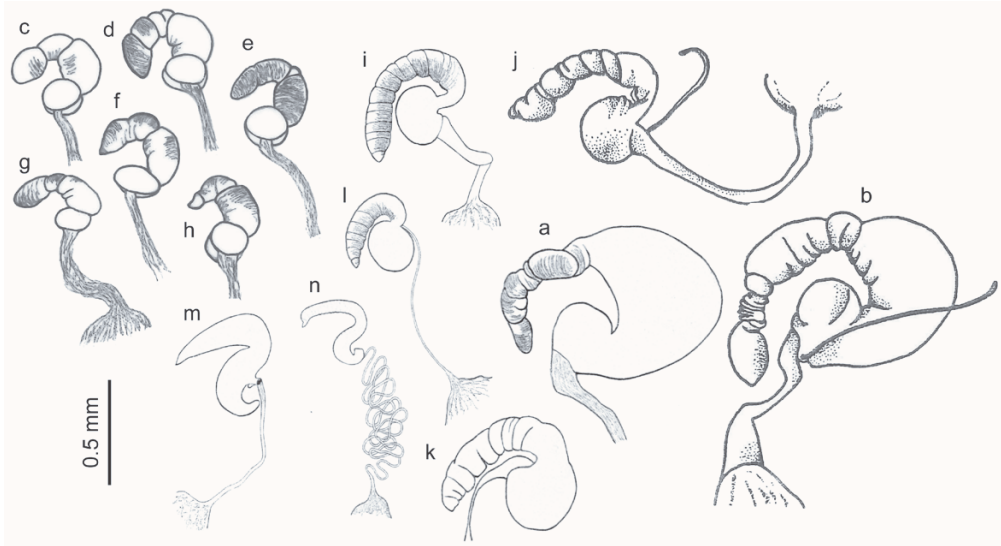

Fig. 2. – Spermathecae of *Cryptocephalus spp.* of the *C. flavipes* group. – **a-b**, *C. alborzensis* Rapilly; **c-h**, *C. bameuli* Duhaldeborde; **i-j**, *C. flavipes* Fabricius; **k**, *C. peyroni* Marseul; **l**, *C. quadripustulatus* Gyllenhal; **m**, *C. signatifrons* Suffrian; **n**, *C. turcicus* Suffrian; b and j from Rapilly (1980).

in irregular rows, sometimes more regular on the disk, rarely rows almost regular, separated by flat and bright intervals. Aedeagus fusiform, unique to the group: penis always parallel-sided with triangular apex [see schematic illustrations in Rapilly (1980), Lopatin & Nesterova (2002) and Warchalowski (2003)]. Apical orifice large. Endophallic structures simple (fig. 1), composed of two sclerites: first one made up of two elongated hemisclerites, each showing a variously shaped apical tooth, visible in dorsal view when endophallus is partly evaginated; second one is the fraenulum, looking like a short trapezoid plate, more or less curved on its shorter side bounded by variable roundness angles. Distal part of the spermatheca (cornu) very characteristic of each species, ductus and its insertion with the ampulla as well (fig. 2).

***Cryptocephalus* (*Cryptocephalus*) *cilicius* n. sp.** (fig. 3-17)

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Holotype: ♂, [w] Turkey SC / Erdemli / Aslanli / 31.5.2001 / lgt. M. Snížek // Collection M. Snížek / České Budějovice // *Cryptocephalus cilicius* n. sp. / F. Duhaldeborde des. 2017 // [r] Holotype. This specimen comes from Arslanli, near Erdemli, Mersin Province (see Discussion below). The holotype will be deposited in the Muséum national d'Histoire naturelle, Paris, France (MNHN).

Paratypes: 3 ♂, 10 ♀, *idem* holotype (JB, FD, MS, MNHN); 1 ♂, 2 ♀, Turkey mer. / Aslanll / V.1994 / D. Hauck lgt. // Collection / Jan Bezděk (JB, FD); 1 ♂, 1 ♀, TR – prov. Mersin / Çamliyayla, 1000-1200 m / 8.-9.6.1996 / M. Knížek lgt. // Collection / Jan Bezděk (JB); 1 ♀, Turkey SC / Tarsus, E of / Camliyayla / 30.5.2001 / lgt. M. Snížek // Collection M. Snížek / České Budějovice (JB); 1 ♂, 7 ♀, Turkey SE / Fevzipasa / Hasanbeyli / 4.6.2001 / lgt. M. Snížek // Collection / M. Snížek / České Budějovice (JB, FD, MS); 1 ♂, 1 ♀, Turkey 4.6.2001 / Fevzipasa / Hasanbeyli / M. Šárovec // Collection / M. Snížek / České Budějovice (JB); 1 ♂, Turkey SC / Osmaniye / Zorkun / 3.6.2001 / lgt. M. Snížek // Collection / M. Snížek / České Budějovice (JB); 1 ♂, TR mer. vil. Içel / Uzuncaburg / 10-11.V.1994, P. Průdek, / J. Kovalovský leg. // *Cryptocephalus* / <*flavipes* var. ?> / D. Sassi det. 2002 (DS); 1 ♂, Asia minor mer. / Nam run 5.67 / I. Dr. Schurmann // *Cryptocephalus* / <*flavipes* var. ?> / D. Sassi det. 2002 (DS); 1 ♂, 3 ♀, Syria VI/1996 / Anat. centralis / Hasanbeyl env. / Odvárka lgt. (1100m) // coll. Zúber (MZ, FD);

1 ♂, Turkey mer. c. / Camliyaya, pr. Icel / 29.VI.-3.VII.1997 / leg. F. Kantner // *Cryptocephalus bameuli* Duh. 1999 / Mir. Zúber det. 2001 // coll. F. Kantner / Lipí 90-CZ (MZ); 1 ♀, Anatolia merid. / Aydinlar (Icel) / M. 1000 L. Pad. Mal / 1.6.92 // *Cryptocephalus* / <*flavipes* var. ?> / D. Sassi det. 2002 (DS); 1 ♀, Tr. (Adana) 1.6.2002 / Nurdag geç. / Hasanbeyli Skoupý leg (MM); 1 ♂, <TR - W Sulek / Taurus Mts / 5.VI.2011 / Ampelini leg.> // <MS_0000592> (MM).

OTHER STUDIED SPECIMENS: 1 ♀, <TR - W Sulek / Taurus Mts / 5.VI.2011 / Ampelini leg.> // <P168/1> (MM); 1 ♀, <TR - E Göksun / Taurus Mts / 13.VI.2011 / Ampelini legt.> // <MS_0000945> (MM) [both with empty abdomen (genitalia lacking)]. These two specimens and the last-mentioned male paratype are part of the specimens studied by MONTAGNA *et al.* (2017).

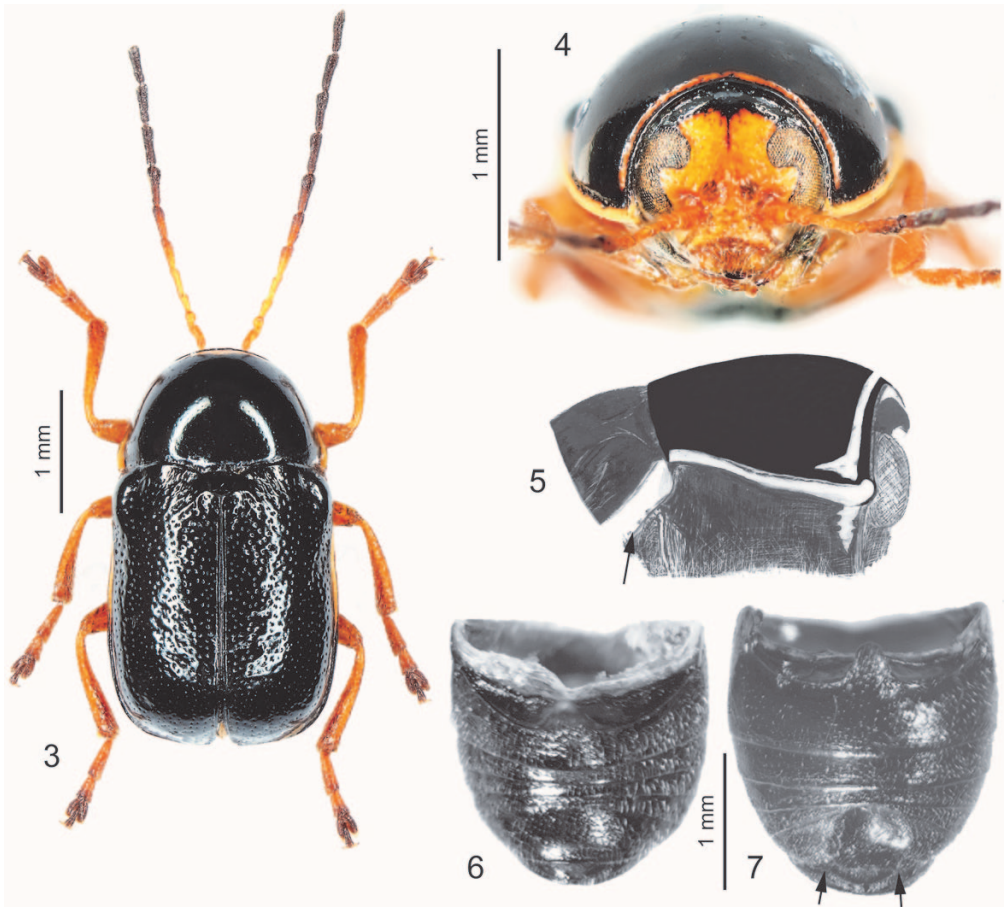

Fig. 3-7. – *Cryptocephalus cilicius* n. sp. – **3**, ♂ holotype, habitus *(Photography: Ph. Ponel)*. – **4**, ♂, head, same locality as holotype *(Photography: Ph. Ponel)*. – **5**, Pronotal and prosternal stripes pattern (seen slightly tilted). – **6-7**, Abdomens: **6**, ♂; **7**, ♀.

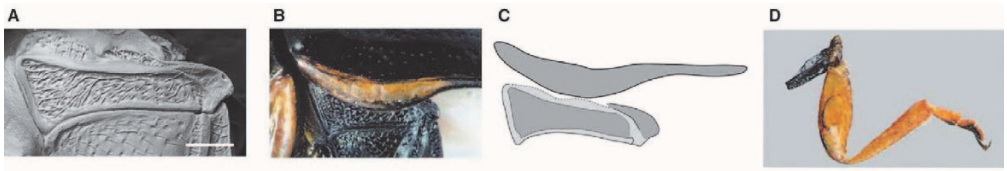

Fig. 8. – *Cryptocephalus cilicius* n. sp. – **A**, SEM micrograph of metaepisternum (scale bar: 200 µm, magnification 80×); **B**, photographs of metaepisternum and epipleura; **C**, schematic drawings of metaepisternum and epipleura; **D**, hind leg [from MONTAGNA *et al.* (2017)].

Description of males. – Length: 3.18 mm, σ = 0.16 mm (*n* = 14).

Head. Mainly yellow. Upper vertex black with a short line dividing the yellow frons along the coronal sulcus. Dark thin short lines also visible on the frons. Clypeus yellow. Fronto-clypeal sulcus darkened, rounded, concave beneath. A thin white pubescence between the insertions of antennae and on labrum. Eyes protruding. Middle of the frons, insertions of antennae and labrum slightly darkened. Mouthparts mainly yellow. Palpi yellow translucent with darkened tips. Mandibles darker on their fore edges. First to 4th antennal articles yellow, 5th darkened in second half, 6th to 11th dark.

Pronotum. Black, extremely finely punctate. From above, convex and semi-spherical in shape. Lateral margins yellow, thick with rounded ridges, a sulcus widening regularly from front angles to the acute hind angles. Yellow colour and widened border visible simultaneously from above and behind the pronotum. A thin yellow mark in a ring parallel to the fore edge, ending before the angles or continuing laterally without re-joining the lateral margins (fig. 4-5). Its outlines nearly parallel, sometimes very shortly enlarged in the disk direction, just perpendicularly to the middle of vertex. Sometimes, yellow colour extremely faint, nearly missing.

Scutellum. Trapeze-like, very prominent.

Elytra. Black with yellow epipleura (fig. 8B): dorsal edge slightly convex, ventral edge distinctly and regularly curved, fore apex rounded, posteriorly narrowed until half of elytral length. Humeral callus very prominent. Hence, fore edges distinctly marked. Confused punctation with rare slightly aligned points. Elytra deeply dug under the humeral callus above and along epipleura so that a thin hardly visible ridge-like is rising from the callus to the apex, sometimes visible from behind. Elytral edges entirely visible from above.

Underside. Prosternum black, sometimes with a yellow triangular mark at fore angle of hypomeron (fig. 5), rarely with a tiny yellowish dot behind. Brighter near the notosternal sutures, with wrinkles perpendicularly to the pronotal lateral edges. Prosternal process coarsely punctured and covered by long white pubescence. Coxal cavities dark. Yellow thick elytral epipleura also visible with a distinct short row of black punctures along their internal border (fig. 5, arrow). Metaepisternum strongly narrowed in middle, on both sides (figs. 8A-C).

Legs. Pro- and metacoxae as well as trochanters, yellow. Femora, tibiae and 1st tarsomere yellow (sometimes with distal part slightly darkened), 2nd with distal quarter darkened, 3rd, 4th and onychium darkened to black, claws clear with dark tips. Tibiae sometimes darkened beneath, near the insertion of tarsi. All tarsomeres with white erect setae. Hind legs as in fig. 8D.

Abdomen. Densely and strongly punctured. Pubescence made of close and erect setae (fig. 6).

Aedeagus (fig. 9-14). Conform to the groundplan of *C. flavipes* species-group. Endophallus (fig. 11-12): fraenulum squared with angles sometimes slightly rounded and prominent. First endophallic sclerite fairly symmetric, looking like pointed ballerina feet. Tegmen and spiculum gastrale: fig. 13-14.

Description of females. – Length: 3.83 mm, σ = 0.26 mm (*n* = 30).

More elongate-oval shaped than male. Often, the yellow patterns paler and/or more translucent. Other differences from male as follows.

Head. Antennomeres 3-4 more elongated, 5th very slightly darkened at tip (sometimes 4th too). Sometimes, under the upper lobes of eyes, a black crescent-like mark may be thickened so far as to cover the lower frons (see Discussion below).

Pronotum. More trapezoidal in shape, its sides narrowing more clearly toward fore angles. Side edges less regularly arcuate with possibly slightly pronounced angle. Sometimes, pronotal stripes pattern as in male. Often, thin fore yellow rim missing or obsolete.

Scutellum. Less projecting.

Elytra. Humeral callus less projecting too. Hence, fore depression less deep.

Legs. Yellow colour of coxae and trochanters paler. Tarsi, especially fore ones, may be paler. Rarely, hind femora slightly darkened on lower face and along front edge.

Abdomen (fig. 7). Brighter with thinner punctation. Pubescence lighter and shorter. Egg-hollow rather deep, rounded with a small narrowing distally. On sternite VII, two tubercles more or less visible, symmetrical and covered by a tuft of setae (fig. 7, arrows).

Kotpresse and genitalia. Kotpresse, *i.e.* rectal apparatus (SCHÖLLER, 2008) with two dorsal and one ventral sclerites, the latter in form of a crosswise band, ending in large apodemes, wider than the rectum and pointed upwards. Ventral sclerotised area present, less sclerotized (fig. 15). Dorsal sclerites sinuose,

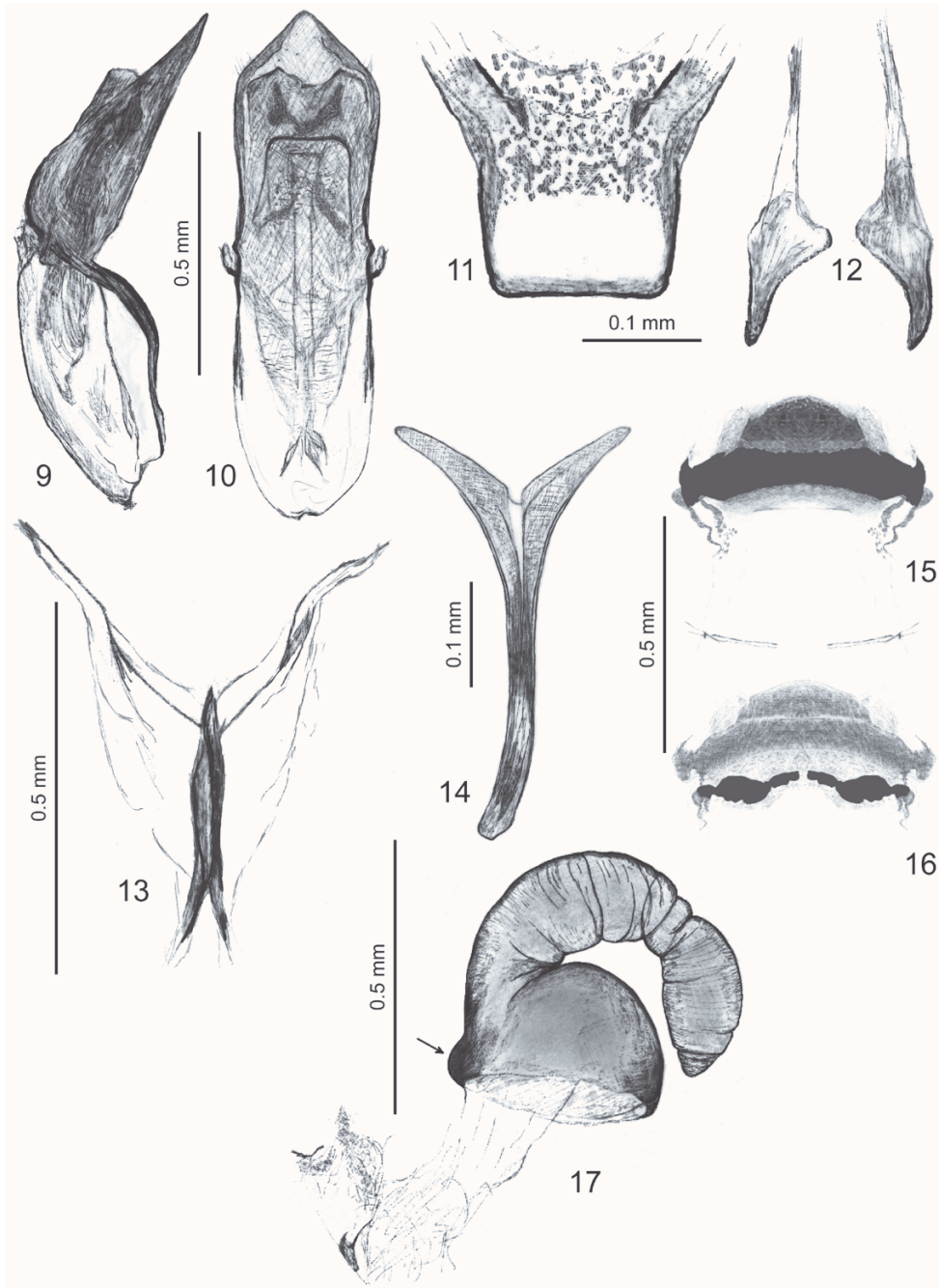

Fig. 9-17. – *Cryptocephalus cilicius* n. sp. – **9-10**, Aedeagus: **9**, lateral view; **10**, dorsal view. – **11**, Fraenulum. – **12**, First endophallic sclerite. – **13**, Tegmen. – **14**, Spiculum gastrale. – **15-16**, Kotpresse: **15**, ventral view; **16**, dorsal view. – **17**, Spermatheca.

constricted, with irregularly thickened edges (fig. 16). Spermatheca yellow-orange with irregularly strangled cornu, ampulla half sphere-like straightly truncated at base, with a more or less prominent outgrowth just above this section, at the opposite side of the cornu and in the same plane, with darker outline (fig. 17, arrow). Insertion of the spermathecal duct inside the ampulla and always at bottom. Duct thick and short, well delimited and curved until the bursa copulatrix (fig. 17).

Etymology. – The specific epithet refers to Cilicia, the old latin name of the region of most collecting sites.

Distribution. – South and South-East of Turkey. Mersin (formerly Içel), Karaman, Adana, Osmaniye and Gaziantep Provinces, Taurus Mountains (fig. 18).

Differential diagnosis. – A lot of specimens belonging to the *C. flavipes* group from different countries were studied. Some considerations only based on the colour are constant and reliable enough to separate the species. Moreover, and clearly, while aedeagi look very similar inside the group, spermathecae are distinctive, which is of great value for female identification (fig. 2). However, as we reported the variability of the spermatheca of *C. bameuli*, the cornu of *C. cilicius*' one may more or less be partly constricted. To separate males, it is easy to examine and to combine several external characters like length, pronotal markings, elytral punctation. A small male may often be attributed to *C. turcicus*, *C. bameuli* or *C. cilicius*. Measurements of the studied specimens (table I) can be compared to the previous biometric study (Duhaldeborde, 1999). An enlargement of the yellow lateral markings of the pronotum leads to *C. peyroni* or *C. turcicus*. The elytra of the later species have their yellow colour sometimes slightly extended above epipleura. The colour of hind femora is a character of great diagnostic importance.

A key based only on few external morphological characters is provided here, helping for male identification.

Identification key for males of the* Cryptocephalus flavipes *species-group

1. Elytra with epipleura yellow **2**
– Elytra entirely black ..... ***Cryptocephalus signatifrons*** Suffrian
2. Head with frons entirely or partially yellow or pale yellow **3**
– Frons black ..... ***C. quadripustulatus*** Gyllenhal
3. Large specimen (≤ 4.20 mm). Elytral rows regular at least on disk or sides **4**
– Smaller (≤ 3.50 mm). Elytral punctation confused, sometimes with irregular rows on disk **6**

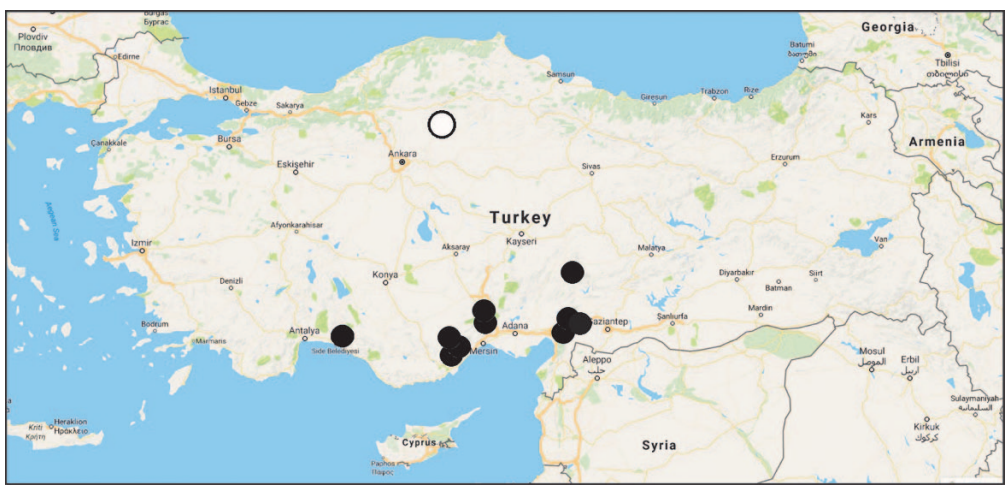

Fig. 18. – Distribution map of *Cryptocephalus cilicius* n. sp. from studied specimens; white dot: see Discussion.

4. Head yellow to pale yellow **5**
– Head black with heart-shaped yellow mark on frons; yellow margins of the pronotum narrow; hind femora black; often legs globally black; slightly elongated in shape (Iran) .... ***C. alborzensis*** Rapilly
5. Anterior and lateral yellow margins of the pronotum joining, the lateral margin enlarged at the fore angles and narrowing to the hind angles; hind femora yellowish with external flank sometimes darkened or limited to a dark line along its ridge ..... ***C. flavipes*** Fabricius
– Yellow lateral margins of the pronotum strongly widened toward the pronotal disk; hind femora yellow; slightly blue metallic sheen ..... ***C. peyroni*** Marseul
6. Pronotum smooth, with anterior yellow margin ending before the angles or continuing laterally without rejoining the lateral margins (fig. 4-5); head almost always yellow **7**
– Pronotum clearly punctate, with lateral yellow margins widened like a wave; head black with heart-shaped yellow mark on frons; hind femora dark ..... ***C. turcicus*** Suffrian
7. Hind femora black between procoxae and tibial insertions ..... ***C. bameuli*** Duhaldeborde
– Hind femora entirely yellow (fig. 8D) ..... ***C. cilicius*** n. sp.

Table I. – *Cryptocephalus cilicius* n. sp., measurements of the studied specimens. *n* = number; L = Length; W = Width; EL = Elytra; PR = Pronotum; x = mean; σ = estimated standard deviation [all in millimeters].

	L_{EL}	W_{EL}	L_{PR}	W_{PR}	Total L
♂ *n* = 14	min. = 2.03 max. = 2.43 x = 2.26 σ = 0.12	min. = 1.64 max. = 1.98 x = 1.81 σ = 0.11	min. = 0.79 max. = 1.02 x = 0.92 σ = 0.07	min. = 1.53 max. = 1.81 x = 1.65 σ = 0.08	min. = 2.83 max. = 3.39 x = 3.18 σ = 0.16
♀ *n* = 30	min. = 2.20 max. = 3.11 x = 2.82 σ = 0.19	min. = 1.75 max. = 2.49 x = 2.22 σ = 0.16	min. = 0.85 max. = 1.19 x = 1.02 σ = 0.08	min. = 1.58 max. = 2.15 x = 1.96 σ = 0.12	min. = 3.05 max. = 4.18 x = 3.83 σ = 0.26

DISCUSSION

The largest studied sample is labelled "Erdemli / Aslanli" (4 ♂, 10 ♀) and 3 specimens only "Aslanll". Erdemli is by the Mediterranean Sea, in the Mersin Province. The request to our colleagues reported that the nearby locality named "Arslanköy" (Arslan village) can either be written on maps "Arslanli" or "Aslanli" and Turkish people uses "Aslanli". The place is representative enough for the geographical distribution area of the new species and the mention of the coastal city allows to assert that these specimens were collected there. The labels "Syria VI/1996 / Anat. centralis / Hasanbeyl env." refer to Hasanbeyli (Osmaniye Prov.), already known locality for the new species. Hasanbeyli is also near Gaziantep, actually in Gaziantep Province, about 60 km far from the border with Syria, and formerly in a Turkish region named "Syria" and border to "Cilicia".

The geographical distribution areas for *C. alborzensis*, *C. peyroni* and *C. cilicius* n. sp. are limited and/or isolated, while the other species of the group are widely distributed. All species, except *C. alborzensis* and *C. quadripustulatus*, have been recorded in Turkey. The fact that some species who share close common lineages have non-overlapping distributions could be explained by old processes of allopatric speciations, caused by climatic or geological upheavals and then, subpopulations moves in search of new ecological niches.

Specimens attributed to *C. flavipes* and *C. cilicius* have been recorded together in Zorkun (Osmaniye Province) and Arslanli. *C. peyroni* is present in the Nur Mountains (Hatay Province), 50 km south of Osmaniye and *C. turcicus* at east of Antalya, not far from Sulek, which is a

locality for *C. cilicius*. Even if most of the studied specimens of *C. bameuli* come from north of Turkey, these species can be regarded as sympatric with overlapping distributions in the south of the country.

The white dot on the distribution map (fig. 18) indicates "Korgun" (Çankırı Prov.) written under a single female: „Turkey bor. / Korgun / 3.6.1996 / Petr Kresl lgt // *Cryptocephalus flavipes* F. / det. J. Bezdek 1997 // *Cryptocephalus bameuli* Duh. 1999 / Mir. Zúber det. 2001 // coll. F. Kantner / Lipí 90-CZ". This locality is very northward the area of the other collecting sites. I cannot exclude a mistake and so did not designate the specimen as a paratype. Of course, the geographical distribution area of *C. cilicius* will become more refined.

The female mentioned from Korgun and some others from the Hasanbeyli series show a variability in the colour pattern of the head, which may even be the same as in *C. bameuli*. This, added to the facts that differences in the shape of their spermathecae are subtle, their sister-species relationship now admitted, suggests a possible case of hybridization between the sympatric *C. cilicius* and *C. bameuli*, as suspected by Montagna *et al.* (2017) between *C. flavipes* and *C. bameuli* for the same reasons. High mountains ranges can constitute a natural barrier isolating several populations of very close species in a territory which is appropriate for their development. That could favour hybridization cases. The identification of doubtful females has been confirmed further by dissections.

This paper sounds like an introduction for a more taxonomic inclusive study of the *Cryptocephalus flavipes* species-group. The phylogenetic study of Montagna *et al.* (2017) shows the probable occurrence of several clusters within *C. flavipes* and *C. bameuli*. Their remarkable work creates opportunities for future investigations.

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