

On some Palaearctic Carpacorini (Hemiptera: Pentatomidae: Pentatominae)

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Abstract

A number of contributions are made to the knowledge of the genera *Carpocoris*, *Codophila*, *Holcostethus* (and *Peribalus*) and *Palomena* within the framework of the studies on Euromediterranean Carpacorini (Hemiptera: Pentatomidae). *Carpocoris* (*C.*) *coreanus* is redescribed and an identification key to the species of *purpureipennis* group is provided. Concerning the genus *Codophila*, the synonymy *Codophila varia* (Fabricius, 1787) = *C. varia longicornis* de la Fuente, 1972 **n. syn.** is proposed, *Codophila maculicollis* (Dallas, 1851) is recorded from Morocco for the first time, and a new character of external morphology is illustrated, which allows a quick separation of the genera *Carpocoris* and *Codophila*. Several issues are discussed with regard to the generic complex of *Holcostethus*, the genus *Enigmocoris* Belousova, 2007 **n. stat.** is raised from subgeneric status, with *E. fissiceps* (Horváth, 1906) **n. comb.** The distribution of *Palomena angulata*, *P. formosa*, *P. prasina* and *P. viridissima* in the Iberian Peninsula and northern Africa is clarified and an identification key to the five Euromediterranean species of *Palomena* is provided.

Key words: Pentatomidae, Carpacorini, *Carpocoris* (*C.*) *coreanus* Distant, 1899, *Codophila varia* (Fabricius, 1787) = *C. varia longicornis* de la Fuente, 1972 **n. syn.**, *Holcostethus* Fieber, 1860, *Peribalus* Mulsant & Rey, 1866, *Enigmocoris* Belousova, 2007 **n. stat.**, *Palomena* Mulsant & Rey, 1866.

Resumen

Acerca de algunos Carpacorini paleárticos (Hemiptera: Pentatomidae: Pentatominae)

Se realizan diversas aportaciones al conocimiento de los géneros *Carpocoris*, *Codophila*, *Holcostethus* (y *Peribalus*) y *Palomena* en el marco del estudio de los Carpacorini euromediterráneos (Hemiptera: Pentatomidae). Se redescribe *Carpocoris* (*C.*) *coreanus* y se ofrece una clave de identificación para las especies del grupo de *purpureipennis*. Dentro del género *Codophila*, se propone la sinonimia *Codophila varia* (Fabricius, 1787) = *C. varia longicornis* de la Fuente, 1972 **n. syn.**, se cita *Codophila maculicollis* (Dallas, 1851) por primera vez de Marruecos y se ilustra un nuevo carácter de morfología externa para la rápida separación de los géneros *Carpocoris* y *Codophila*. Se discuten algunos aspectos del complejo genérico de *Holcostethus* y se propone elevar de subgénero a género *Enigmocoris* Belousova, 2007 **n. stat.**, resultando *E. fissiceps* (Horváth, 1906) **n. comb.** Se presenta una síntesis esclarecedora de la distribución de *Palomena angulata*, *P. formosa*, *P. prasina* y *P. viridissima* en la Península Ibérica y el norte de África y se incluye una clave de identificación para las cinco especies euromediterráneas de *Palomena*.

Palabras clave: Pentatomidae, Carpacorini, *Carpocoris* (*C.*) *coreanus* Distant, 1899, *Codophila varia* (Fabricius, 1787) = *C. varia longicornis* de la Fuente, 1972 **n. syn.**, *Holcostethus* Fieber, 1860, *Peribalus* Mulsant & Rey, 1866, *Enigmocoris* Belousova, 2007 **n. stat.**, *Palomena* Mulsant & Rey, 1866.

Laburpena

Carpacorini paleartiko batzuei buruz (Hemiptera: Pentatomidae: Pentatominae)

Carpacorini (Hemiptera: Pentatomidae) euromediterraneanarrei buruzko ikerketa-lerroa dela eta, *Carpocoris*, *Codophila*, *Holcostethus* (eta *Peribalus*) eta *Palomena* generoen ezaguerari hainbat ekarpen egiten zaizkio. *Carpocoris* (*C.*) *coreanus* berdeskribatzen da eta *purpureipennis* taldeko espezieen identifikazio-klabea aurkezten da. *Codophila* generoarean barruan, *Codophila varia* (Fabricius, 1787) = *C. varia longicornis* de la Fuente, 1972 **n. syn.** sinonimia proposatzen da, *Codophila maculicollis* (Dallas, 1851) lehenengo aldiz aipatzen da Marokorako eta *Carpocoris* eta *Codophila* generoak

modu azkarrean bereizteko ezaugarri morfologiko berri bat irudiztatzen da. *Holcostethus* genero-multzoaren zenbait alderdi eztabaidatzen dira eta *Enigmocoris* Belousova, 2007 **n. stat.** subgenerotik generora igotzea proposatzearen ondorioz, *E. fusciceps* (Horváth, 1906) **n. comb.** suertatzen da. *Palomena angulata*, *P. formosa*, *P. prasina* eta *P. viridissima* espezieen Iberiar Penintsulako eta Afrikaren iparraldeko banaketaren sintesi argigarria aurkezten da, bai eta *Palomena* generoko bost espezie euromediterraneanren identifikazio-klabea ere.

Gako-hitzak: Pentatomidae, Carpocorini, *Carpocoris* (*C.*) *coreanus* Distant, 1899, *Codophila varia* (Fabricius, 1787) = *C. varia longicornis* de la Fuente, 1972 **n. syn.**, *Holcostethus* Fieber, 1860, *Peribalus* Mulsant & Rey, 1866, *Enigmocoris* Belousova, 2007 **n. stat.**, *Palomena* Mulsant & Rey, 1866.

Introduction

The studies on Euromediterranean Carpocorini for the corresponding volume of Faune de France by J.R. have resulted in the clarification of several taxonomic and faunistic problems concerning the genera *Carpocoris* Kolenati, 1846, *Codophila* Mulsant & Rey, 1866, generic complex of *Holcostethus* Fieber, 1860 and *Palomena* Mulsant & Rey, 1866.

The present paper is conceived as a further step in a series of contributions to the knowledge of Euromediterranean Carpocorini (J. Ribes and Gapon, 2006; J. Ribes *et al.*, 2006, 2007).

The results are arranged according to four main sections, one for each of the genera (or generic complex) dealt with.

also been made in support of the arguments by J. Ribes *et al.* (2007). Among the Caucasian, Iranian and middle Asian material (E. Heiss leg. and/or coll.) kindly lent us by Prof. Dr. E. Heiss, the specimens from Azerbaijan are «typical *fuscispinus*» (Fig. 1a [«Azerbaijan / Talysh Mts. / Lenkoran env. / 17 VIII 1999 V.DOLIN»]) similar to those from central and northern Europe, whereas the specimens from Kirghizstan (Fig. 1b [«Kyrgyzstan / Issyk-Kul south shore / Kadzhi – Say env. / 30 VI 1999, V.DOLIN»]) show the hemelytra (or only a single hemelytron!) with vermicular areas and with the shape of the humeral angles very variable. Since the number of Asian localities and specimens examined is smaller than European ones, interpretative extrapolations are undoubtedly a risky matter, although some kind of geographical dilution of the «typical *fuscispinus*» phenotype could also be thought to occur eastwards in Asia, probably showing a certain parallelism with the southwestern (Mediterranean) case (J. Ribes *et al.*, 2007).

On the other hand, we have had the opportunity to examine the thorough study by Kammerschen (1988) on the taxonomy and distribution of several genera of western Palaearctic Pentatomidae. Concerning the genus *Carpocoris*, she accurately follows Tamanini's concepts of *fuscispinus* and both subspecies of *mediterraneus*. The morphometric evidences provided are quite weak in our opinion, and the discussion on speciation patterns, even being quite interesting, is *a priori* based on the presumption of validity of the Italian author's taxonomic ideas.

Concerning the characters used in the identification key below (section 1.2):

- (a) The shape of the inflated conjunctiva of the aedeagus was illustrated by Belousova (2004: Figs. 8-9) for *C. coreanus* and by J. Ribes *et al.* (2007: Figs. 5a-b and 5c-d) for *C. purpureipennis* and *C. fuscispinus*.

Results

1. On the species of *Carpocoris* (*C.*) *purpureipennis* group

1.1. New data

After the synonymies recently proposed by J. Ribes *et al.* (2007), the examination of abundant material of *Carpocoris* (*C.*) *coreanus* Distant, 1899 allows us to propose a key to the species of *Carpocoris* belonging to the group of *purpureipennis* (*i.e.* with the hypophysis of parameres bearing two teeth), and to provide a brief redescription of *C. (C.) coreanus* itself.

Additional observations on the high intraspecific variability of *C. (C.) fuscispinus* (Boheman, 1851) have

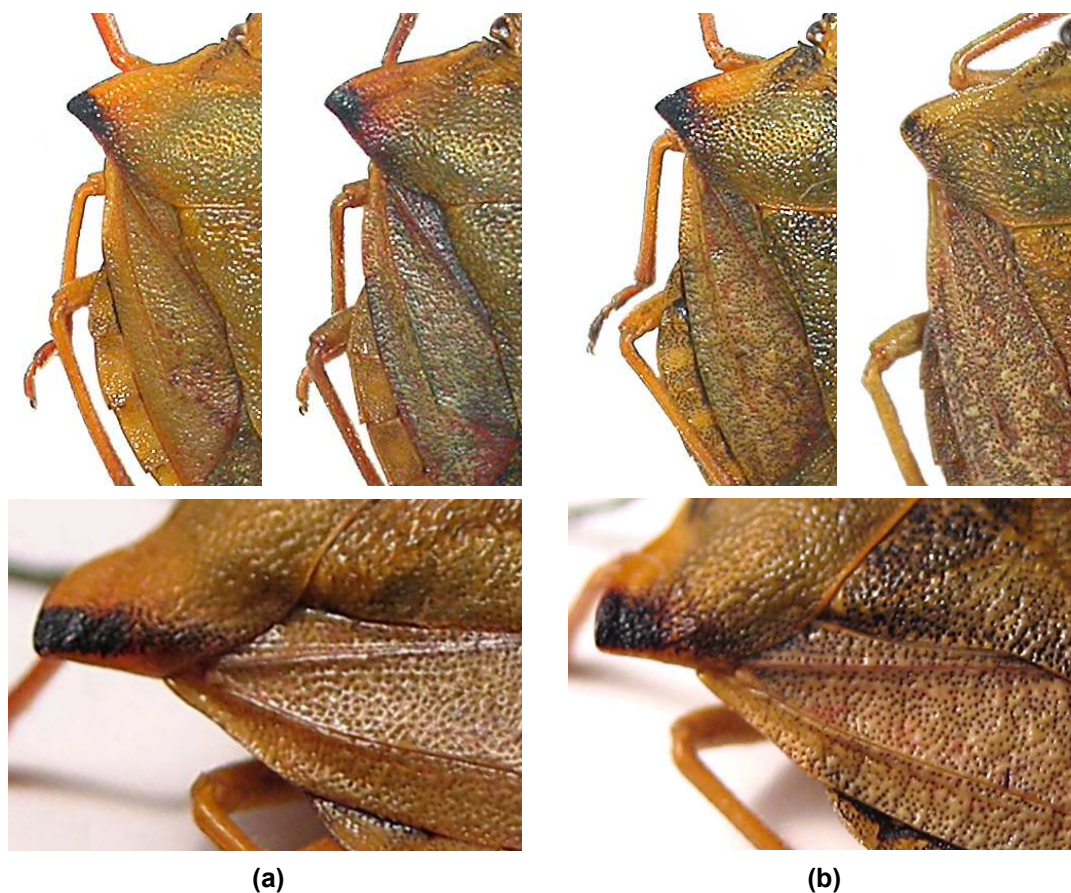


FIGURE 1. *Carpocoris fuscispinus* from Caucasus and middle Asia: (a) Two specimens from Azerbaijan, with detail (below) of the hemelytral punctation; (b) Two specimens from Kirghizstan, with detail (below) of the hemelytral punctation.

- (b) A comparative study of the parameres of *C. coreanus* (Fig. 2a) and *C. fuscispinus* (J. Ribes *et al.*, 2007: Fig. 4)⁽¹⁾ has confirmed an interesting character previously noted by Tamanini (1959), and now illustrated in our Fig. 5.
- (c) Nevertheless, the present key largely relies on a few, easy characters of pronotal morphology, illustrated in Figs. 3-4 for *C. coreanus* and previously by J. Ribes *et al.* (2007: Figs. 1a-b, Fig. 3) for *C. fuscispinus* and *C. purpureipennis*.

⁽¹⁾It must be noticed that Fig. 4 in J. Ribes *et al.* (2007) presents an error of minor importance: The setae should be interpreted as viewed by transparency from the back side.

1.2. Key to species

See next page.

1.3. Redescription of *Carpocoris (C.) coreanus* Distant, 1899

Thanks to the kindness of Prof. Dr. E. Heiss, we have had the opportunity to examine about thirty specimens of *Carpocoris coreanus* from Iran and middle Asia collected in recent expeditions by himself or by some colleagues. As a result, the following redescription of the species is proposed.

Head. Narrowed anteriorly. Jugae marginated externally and slightly concave. Vertex 3.2–4.0 x eye width.

Key to the species of *Carpocoris* (C.) *purpureipennis* group

- 1 (2) The black spot on the humeral angles of pronotum with its internal edge concave, semilunar or near semilunar. Anterolateral margins of pronotum more largely covered by the black spot than posterolateral ones. Inflated conjunctiva of the aedeagus with the ventro-lateral lobes very long *Carpocoris* (C.) *purpureipennis* (De Geer, 1773)
- 2 (1) The black spot on the humeral angles of pronotum differently shaped. Anterolateral margins of pronotum less covered by the black spot than posterolateral ones. Inflated conjunctiva of the aedeagus with the ventro-lateral lobes short
- 3 (4) Humeral angles of pronotum short and usually sharply pointed. Generally one elongated, black spot, always parallel to the posterolateral free margin. Parameres with the superior (= outer) tooth of the hypophysis well separated from the anterior and superior margins (Fig. 5a) *Carpocoris* (C.) *coreanus* Distant, 1899
- 4 (3) Humeral angles of pronotum sharply pointed or rounded, protruding more or less (depending on the whole eco-geographical phenotype). The black spot on them, massive, with its internal edge convex. Parameres with the superior (= outer) tooth of the hypophysis near to the anterior edge and very near to the superior edge (Fig. 5b) *Carpocoris* (C.) *fuscispinus* (Boheman, 1851)
 [= *Carpocoris* (C.) *mediterraneus atlanticus* Tamanini, 1958
 = *Carpocoris* (C.) *mediterraneus mediterraneus* Tamaninni, 1958
 (J. Ribes *et al.*, 2007)]

Jugae slightly longer than clypeus. Pale, of the general body colour, with longitudinal, black spots on the external margins of jugae and on the posterior half of clypeus-jugae sutures, these prolonged as irregularly marked, progressively widened spots towards the posterior margin of head. Antennae mainly black;

segment I pale and usually with a black ring distally and a longitudinal, black spot externally; segment II black and sometimes with a pale ring basally, prolonged in a longitudinal, pale spot dorsally.

Pronotum (Figs. 3-4). Humeral angles short, sharply pointed, only rarely with the apex blunt. Antero-

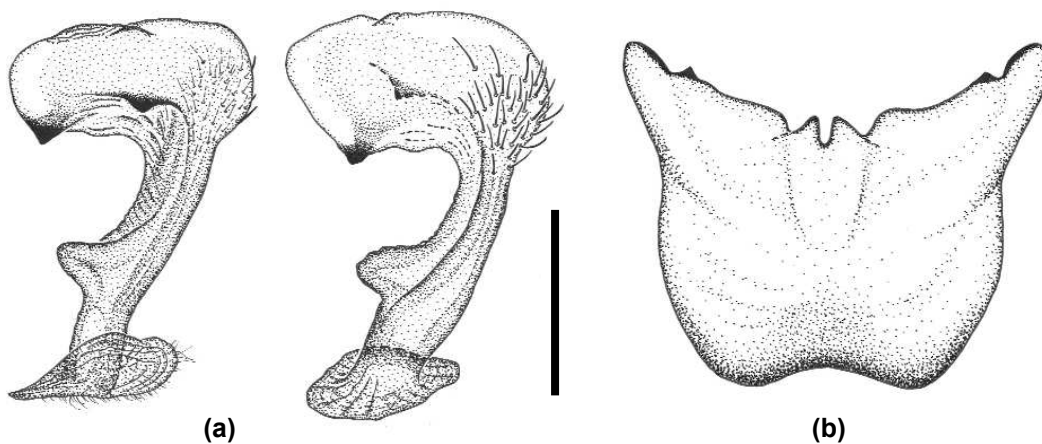


FIGURE 2. Male genitalia of *Carpocoris coreanus*: (a) Paramere, two different lateral views: on the left, external side; on the right, internal side (Scale bar = 0.5 mm); (b) Pygophore, ventral view of the ventral edge.

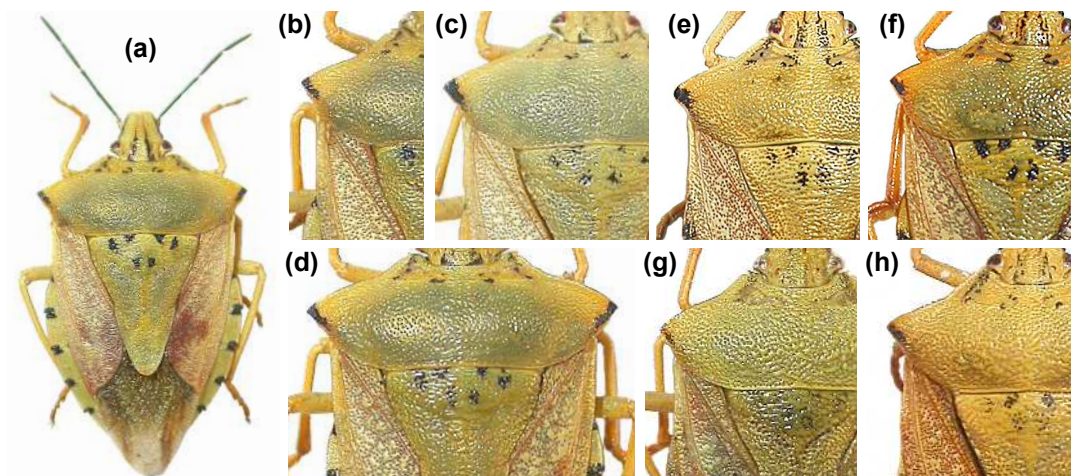


FIGURE 3. *Carpocoris coreanus*: (a) Habitus of a specimen from Iran; (b)-(h) Pronotum, scutellum and anterior region of hemelytra of specimens from: (b)-(d) Iran; (e) Kazakhstan; (f) Turkmenistan; (g) Uzbekistan; (h) Tadjhikistan.

lateral margins straight, posterolateral ones slightly sinuated. One black, usually elongated spot, parallel to, but not contacting, the posterolateral free margin (Fig. 4b), and always reaching the anterolateral margin anteriorly. Four black spots on the anterior region of pronotum, without contacting the anterior margin; those spots are usually roundish, «C»- or «U»-shaped and frequently also segmented.

Scutellum (Fig. 3). Anterior region with four black spots adjacent to the margin and further two black spots posterior to the former ones.

Hemelytra and abdomen (Figs. 3-4). Hemelytral punctuation shallow, irregular; interspaces sometimes with irregular, ivory-like, vermicular areas (Fig. 4a). Paratergites black on anterior and posterior edges; in some specimens the black colouration is reduced or only faintly distinct in a number of segments. The distal edge of the corium is of the «*Carpocoris*-type» (see section 2.2 below and Fig. 6d).

Legs. Pale, of the general body colour. Tibiae usually darker distally, turning orange, like the tarsi. Tibiae with only minute black spots at basis of hairs, but not always, and almost never on femora. Sometimes an antero-ventral, small, black spot at 2/3 of length of femora.

Pygophore and genitalia. Pygophore as in Fig. 2b, with a small, approximately «U»-like, ventral indentation. Paramere as in Fig. 2a, with the hypophysis oval, convex posteriorly, and bearing two teeth, the superior (= outer) one well separated from the anterior and superior margins (Fig. 5a).

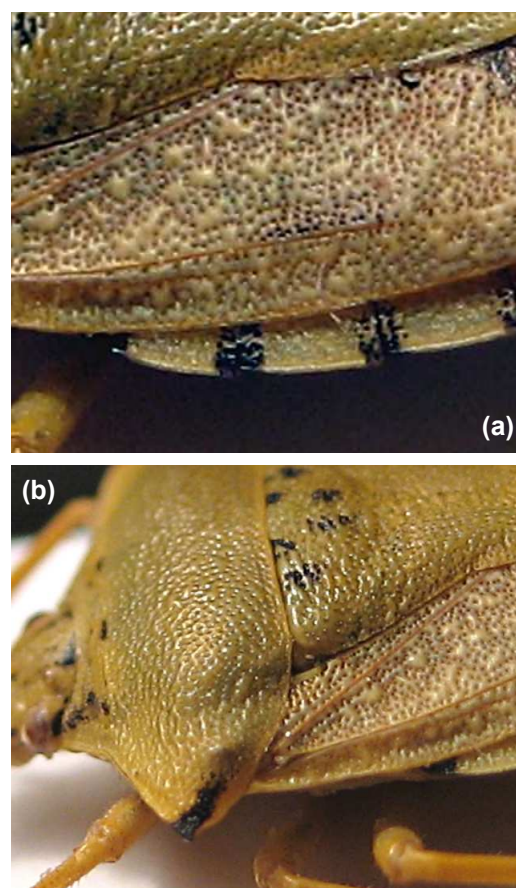


FIGURE 4. *Carpocoris coreanus* (specimen from Iran). Detail of: (a) Hemelytral punctuation; (b) Humeral angle of pronotum in dorso-lateral view.

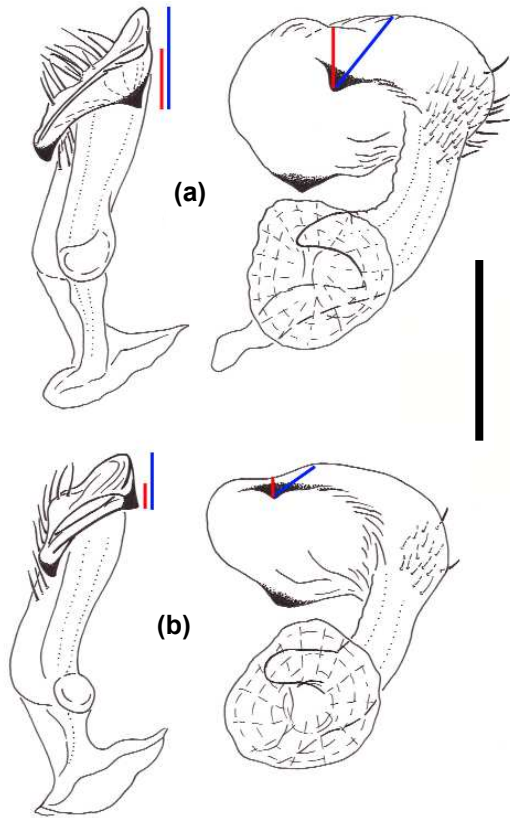


FIGURE 5. Schematic representation of the most important difference (size of red segments rather than that of blue ones) between paramere of: (a) *C. coreanus*, and (b) *C. fuscispinus*. On the left, anterior view. On the right, ventro-lateral (external) view, with hypophysis «resting» on its greatest surface (Scale bar = 0.5 mm).

Full data (labels) of the specimens in Figs. 3-4:

Figs. 3a, 3d and 4a-b: «N-IRAN - GolestanProv / Lake Ala Gol, Salsola+ / andere Halophyten / 37°22 N, 54°35 E, 29 m / 10-11 VI 2007 E.HEISS».

Fig. 3b: «N-IRAN - GolestanProv / Lake Ala Gol, Tamarix / 37°22 N, 54°35 E, 29 m / 10-11 VI 2007 E.HEISS».

Fig. 3c: «N-IRAN - GolestanProv / Lake Ala Gol, Tamarix / 37°22 N, 54°35 E, 29 m / 10-11 VI 2007 E.HEISS».

Fig. 3e: «KAZAKHSTAN W. / Gurjev-Emba / 10.-18.vi.1991 / A.Putschkov lgt.».

Fig. 3f: «TURKMENIA S. / Chaek, 24.-25.vi / A.Putschkov lgt. 1991».

Fig. 3g: «Uzbekistan W / Khiva “/” Urgench / nied. Vegetation gestr. / 1 VII 2006 E. HEISS».

Fig. 3h: «TAJIKISTAN / Tigrovaya Balka / Reserve 31. VII / 2000 Rybak lgt.».

2. On the genus *Codophila*

2.1. Synonymization of the subspecies of *Codophila varia* (Fabricius, 1787)

Codophila varia is a highly variable species concerning colour and size. We have observed specimens ranging between 8.7–14 mm and showing colorations from pale yellow or greyish tinged to dark blood-red, including a wide spectrum of oranges.

De la Fuente (1972) described the subspecies *longicornis* for those individuals of *Codophila varia* (Fabricius, 1787) showing the following characters:

- Segment II of antennae longer than twice the length of segment III.
- Overall colour of the body yellow.
- Ventral side of the humeral angles of pronotum lacking black spot.
- «Láminas transversales»⁽²⁾ of the male pygophore showing a deep inflexion on their superior margins.

Later on, de la Fuente (1974) proposed a key to both subspecies, including the comparison for the mentioned characters (in *C. varia varia*: ratio of antennal segments II/III equal to 2, body colour red, black spot on the underside of humeral angles, «láminas transversales» curved) and providing illustrations of pygophore and parameres.

Subsequently to the description and revision by de la Fuente (1972, 1974), which were based on several Spanish specimens, the subspecies has not been further recorded from Spain or from any other country (Rider, 2006).

We have examined the holotype and two paratypes deposited at the Faculty of Biological Sciences (Departamento de Zoología y Antropología Física) of the Universidad Complutense de Madrid (Madrid, Spain)⁽³⁾, as well as about one hundred of mostly Iberian and Moroccan specimens from our Mu-

⁽²⁾In Spanish as in the original, due to the impossibility to find out its morphological interpretation.

⁽³⁾Holotype, male, with the following data: Three labels: 1st label, white: «Casa de Campo / Madrid (España) [printed] / 27-III-(19)57 [handwritten]»; 2nd label, white: «S.V. Peris [printed] / 10 152/13»; 3rd label, red: «Codophila / varia longi- / cornis nov. sub.sp. / Tipo [handwritten]». One male from Ciruelos (Guadalajara) and another one from San Lorenzo del Escorial (Madrid) were published as being part of the type series, but they do not bear any label of paratype.

seums and own collections. We reach the conclusion that no separation into two subspecies is actually tenable, since the characters of external morphology provided by de la Fuente (1972, 1974) overlap in almost all possible combinations and degrees, even among type material. As an example, the ratio of antennal segments II/III ranges between 1.41–2.38 and yellow, greyish, orange or dark red specimens are found in all that range. Moreover, most specimens (showing any body colour and antennal proportions) lack any black spot on the underside of humeral angles. On the other hand, the characters of male genitalia do not allow either the separation of specimens into two different entities.

Hence, the following synonymy is proposed:

Codophila varia (Fabricius, 1787)

= *Codophila varia longicornis* de la Fuente, 1972 n. syn.

2.2. A new character for a quick separation of *Codophila* and *Carpocoris*

Having devoted extensive efforts to examining hundreds of specimens belonging to the species placed in *Codophila* Mulsant & Rey, 1866 and *Carpocoris* Kolenati, 1846, one constant, obvious, external character has been found by one of us (S.P.-C.), which can be used to separate those two genera. The distal edge of

the corium shows a clear indentation at the level of $(Sc + R) + M$ veins (following Derzhansky and Péricart, 2005) in *Codophila* (Fig. 6a), whereas only a concavity or inflection (more or less pronounced) is exhibited by *Carpocoris* (Figs. 6b-e). As far as known, the usefulness of this character remained unpublished in the keys to Palearctic genera of Carporini.

2.3. First record of *Codophila maculicollis* (Dallas, 1851) from Morocco

Codophila maculicollis (Dallas, 1851) is distributed from the Ethiopian and Oriental Regions to the Palearctic across the eremian belt which reaches northern Africa, including the countries of Algeria, Egypt, Libya and Tunisia (Rider, 2006). In the collection of J.R. there are two specimens with the following data: 1 male: «7 Km E de Boumalne / Ouarzazate (Maroc) / 11-IV-1972 J. Mateu leg.» [handwritten]; 1 male: «Zagora (Maroc mérid.) / IV-1980 [V] Olivella leg.» [handwritten] which represent the first and second records of the species from Morocco. Hence, the following addition has to be made in the Catalogue of the Heteroptera of the Palearctic Region 5:

Codophila maculicollis (Dallas, 1851):

Add: NA: MO

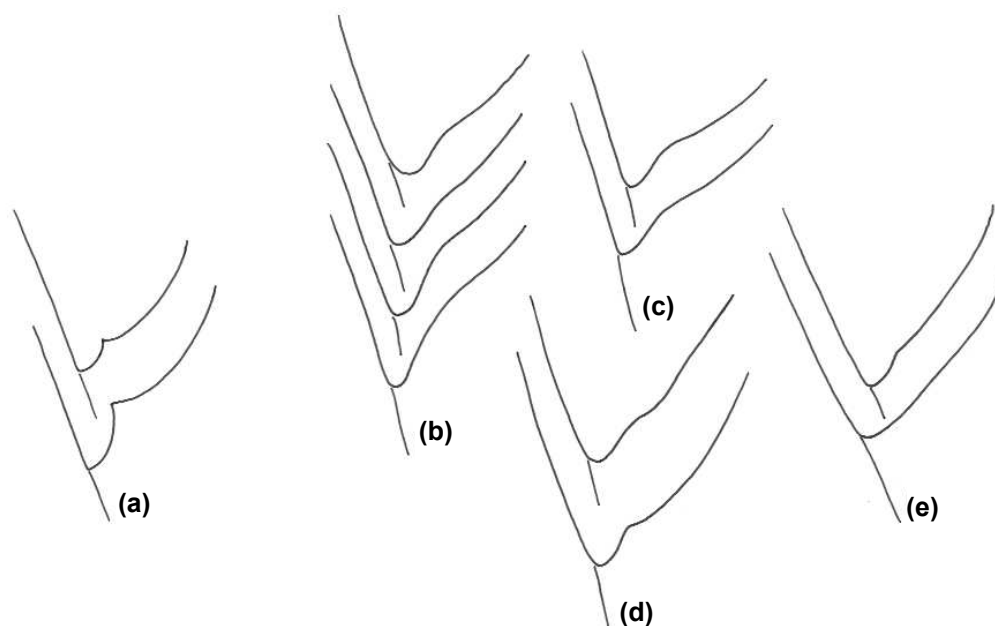


FIGURE 6. Schematic distal edge of the corium of: (a) *Codophila varia*; (b) *Carpocoris* (*C.*) *fuscispinus*; (c) *C.* (*C.*) *purpureipennis*; (d) *C.* (*C.*) *coreanus*; (e) *C.* (*C.*) *pudicus*.

3. Revisiting the generic complex of *Holcostethus*

3.1. On *Holcostethus* and *Peribalus*

Holcostethus Fieber, 1860 and *Peribalus* Mulsant & Rey, 1866 are two closely related taxa with a long history of taxonomic and nomenclatural changes. A synthesis of that history can be found in the introduction of the recent revision by Belousova (2007), who refers to the complex as the «*Holcostethus* group». This author follows J. Ribes and Schmitz (1992) in separating both genera according to the character of clypeus open (*Holcostethus*) or closed (*Peribalus*), as firstly did Mulsant and Rey (1866), who created the new and unnecessary name *Dryocoris* instead of *Holcostethus* (for more details see J. Ribes and Schmitz, 1992). Moreover, the generic name *Dryocoris* was erroneously used by J. Ribes and Schmitz (1992) and by Josifov and Simov (2004) instead of *Peribalus*, as was shown by Dolling (1995) in a brief note in square brackets at the end of Nau's «Notes on *Holcostethus vernalis*» work, which is followed by some authors (e.g. Rus, 2004).

Rider and Rolston (1995) also consider *Dryocoris* as not valid and argue that the distinguishing character «clypeus open vs. closed by jugae» for *Holcostethus* and *Peribalus*, respectively, is not a reliable one due to its high variability. Therefore, they synonymize both genera. The same criterion is followed by Dusoulie and Lupoli (2006).

Like Belousova (2007), we agree to the division *Hol-*

costethus / *Peribalus*, which is reflected in our key to the western Palaearctic fauna (see section 3.3 below), since other characters in addition to the form of jugae are also taken into account. The subgeneric division of *Peribalus* (*Asioperibalus* / *Peribalus*) proposed by the Russian author is also accepted here. In contrast to her, however, we consider the species *vernalis* (Wolff, 1804) as a synonym of *Peribalus* (*P.*) *strictus* (Fabricius, 1803), after the critical study by J. Ribes et al. (2006).

In addition, it must be noted that the genus *Dryadocoris* Kirkaldy, 1909, of similar spelling, is not related with «*Dryocori*». In fact, it belongs to the tribe Antestiini Distant, 1902 and not to Carpocorini Mulsant & Rey, 1866 (Rider, 2006), although the genus with its single species *D. apicalis* (Herrich-Schaeffer, 1842) has been included in the *Holcostethus* complex of genera by Belousova (2007). In the present paper, the criterion of the Palaearctic Catalogue (Rider, 2006) is followed in that respect.

3.2. What about the singularity of *Holcostethus fissiceps* (Horváth, 1906)?

A thorough study of this Asian Turkish species was made by Seidenstücker (1975), mainly based on further material collected sixty/seventy years after the original description by Horváth (1906). Belousova (2007) considers that the larger paramere resembling those of the genus *Carpocoris*, the longer jugae and the non-

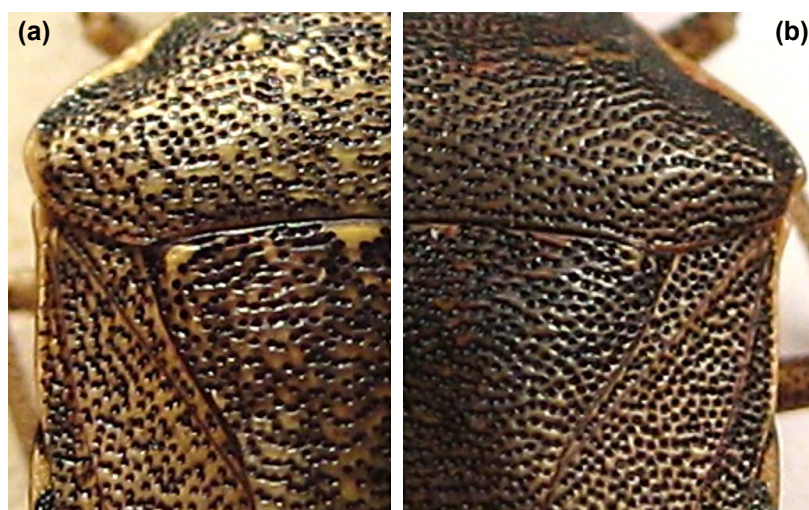


FIGURE 7. Partial view of the dorsum (pronotum, scutellum and corium) showing the different punctuation of: (a) *Holcostethus albipes*; (b) *Holcostethus sphaclatus*.

sclerotized apices of the conjunctive processes of the aedeagus deserve the creation of a new subgenus, *Enigmocoris* Belousova, 2007, whereas the open clypeus and the structure of the aedeagus show the clear relationship of the subgenus with the other species of *Holcostethus*, within which it should be placed.

In our opinion, the singularity of *H. fissiceps* concerning the three characters argued by Belousova (2007) as well as the shape of pygophore (see Seidenstücker, 1975: Fig. 8a) are of such importance that generic status is needed. The similarities mentioned are

not sufficient to support its inclusion in *Holcostethus*. Hence we propose:

Genus *Enigmocoris* Belousova, 2007 **n. stat.**

with the single included species:

Enigmocoris fissiceps (Horváth, 1906) **n. comb.**

3.3. Key to genera and to western Palaearctic species

Key to the genera and western Palaearctic species of the generic complex of *Holcostethus*

- 1 (8) Clypeus free. Paramere with one granulate tubercle at base of rough area (J. Ribes, 1988: Fig. 4a) or with one preapical, blunt tooth (Seidenstücker, 1975: Fig. 3). Spermathecal bulb⁽⁴⁾ short and wide, with 2-3 basal, digitiform processes backwards directed, of variable length, and sometimes branching (Fig. 8a)
- 2 (7) Clypeus (free) approximately as long as jugae. Base of scutellum with 3-5 small, pale callosities. Parasternites with anterior and posterior corners black. Pygophore in dorsal view without middle processus on ventral indentation (Seidenstücker, 1975: Fig. 7a). Paramere in lateral view with the hypophysis flat, more or less rectangular, and with one granulate tubercle at base of rough area (J. Ribes, 1988: Fig. 4a) gen. *Holcostethus* Fieber, 1860
- 3 (4) Pygophore *in situ* and in posterior view with a «V»-like, ventral indentation (J. Ribes, 1988: Fig. 2). Paramere with the granulate tubercle of the hypophysis robust; rough area not reaching the angle hypophysis-body of the paramere (J. Ribes, 1988: Fig. 4a). Theca, in antero-superior view, with irregular trapezoid shape, with external angles largely rounded and basal angles provided with one processus upwards directed; lateral edges indented; distal margin with a wide, convex, middle platform *H. evae* J. Ribes, 1988
- 4 (3) Pygophore *in situ* and in posterior view with the ventral indentation as a very obtuse angle, sometimes no more than a crack (J. Ribes, 1988: Fig. 12). Paramere with the granulate tubercle of the hypophysis smaller and located at base of rough area, which reaches the angle hypophysis-body of the paramere. Theca, in antero-superior view, clearly hexagonal, with external angles slightly blunt and basal angles provided with one denticle downwards directed
- 5 (6) Punctuation of pronotum, scutellum and corium dense, regular (Fig. 7b). Antero-lateral margins of pronotum quite straight. Ventral indentation of pygophore, in dorsal view, forming an angle very obtuse, with its margins slightly curved. Paramere strongly sclerotized, with the apex of hypophysis widened backwards, lobe-like (J. Ribes, 1988: Fig. 9) *H. sphaecelatus* (Fabricius, 1794)
- 6 (5) Punctuation of pronotum, scutellum and corium sparser, irregular (Fig. 7a). Antero-lateral margins of pronotum concave, sometimes weakly concave. Ventral indentation of pygophore, in dorsal view and from outside inward, with a wide elevation at each postero-external angle, followed by a sudden slope

⁽⁴⁾This female character is unknown in *E. fissiceps*.

- and an almost horizontal margin in the middle. Paramere weakly sclerotized, with the apex of hypophysis square (J. Ribes, 1988: Fig. 14) *H. albipes* (Fabricius, 1781)
- 7 (2)** Clypeus (free) shorter than jugae. Base of scutellum lacking any distinct callosity. Parasternites with only posterior corners black. Pygophore in dorsal view with one transverse, concave, middle processus on ventral indentation (Seidenstücker, 1975: Fig. 8a). Paramere in lateral view with the hypophysis non-flat, posteriorly convex, oval, resembling those of the genus *Carpocoris*; rough area with one preapical, blunt tooth (Seidenstücker, 1975: Fig. 3) gen. *Enigmocoris* Belousova, 2007 **n. stat.**
E. fissiceps (Horváth, 1906) **n. comb.**
- 8 (1)** Clypeus covered by jugae (in western Palaearctic species). Paramere, in lateral view, with roughly conical or cylindrical hypophysis; lacking granulate tubercle at base of rough area or preapical tooth (Figs. 9a-b). Spermathecal bulb elongate, with 2-3 basal, digitiform processes backwards directed, generally shorter or even minute (Fig. 8b)
- 9 (12)** Aedeagus with one pair of curved conjunctive processes with sclerotized apices. Theca without lateral processes. Parameres with smoothed sensory lobe and with rough area rounded at base. Spermathecal bulb elongate and with sclerotized duct spherically widened at base gen. s. str. *Peribalus* Mulsant & Rey, 1866
- 10 (11)** Head, in dorsal view, black. Ocular index = 4.0. Rostrum reaching beyond posterior coxae. Scutellum with subrectilinear margins *P. (P.) lodosi* (Ahmad, Zaidi & Kamaluddin, 1986)
- 11 (10)** Head, in dorsal view, not black. Ocular index = 4.25–5.5. Rostrum not surpassing posterior coxae. Scutellum with concave margins on the middle region *P. (P.) strictus* (Fabricius, 1803)
[= *Holcostethus vernalis* (Wolff, 1804)
(J. Ribes et al., 2006)]
- 12 (9)** Aedeagus forming more than one pair of conjunctive processes with unsclerotized apices. Theca with small lateral processes (Belousova, 2007: Fig. 23). Parameres usually (exc. *hoberlandti*) with noticeable sensory lobe; rough area of inner surface of paramere pointed at base. Spermathecal bulb rather weakly, if at all, elongate; sclerotized duct not widened at base; occasionally with bulb spherical and sclerotized duct widened at base to varying extent subgen. *Asioperibalus* Belousova, 2007
- 13 (14)** Lateral margins of pronotum distinctly convex, with a totally punctuated flange. Parameres with the hypophysis distinctly curved in the middle, showing a clear indentation posteriorly *P. (A.) hoberlandti* (Lodos & Önder, 1980)
- 14 (13)** Lateral margins of pronotum straight, slightly concave, rarely slightly convex, always with a callous-like, yellow, narrow, unpunctuated flange. Parameres with the hypophysis straight in almost all its length
- 15 (16)** Head 1.07–1.17 times wider than long. Ocular index = 6.4–6.9. Parasternites with anterior and posterior corners black. Pygophore, in dorsal view, showing a ventral indentation very sinuous and with a small concavity in the middle; in ventral view, that concavity is clearly marginated. Parameres with the hypophysis straight, its apex straight and concolor; basal processus quite short (Fig. 9a). Sclerotized median plates slightly widened *P. (A.) inclusus* (Dohrn, 1860)
- 16 (15)** Head 1.15–1.25 times wider than long. Ocular index = 4.32–4.86. Parasternites with only anterior corners black. Pygophore, in dorsal view, showing a great ventral concavity in the middle, its lateral sides being scarcely sinuous; in ventral view, that concavity is not marginated. Parameres with the hypophysis straight, but slightly bent forward, its apex darkened; basal processus quite long (Fig. 9b). Sclerotized median plates strongly widened *P. (A.) congenitus* (V.G. Putshkov, 1965)

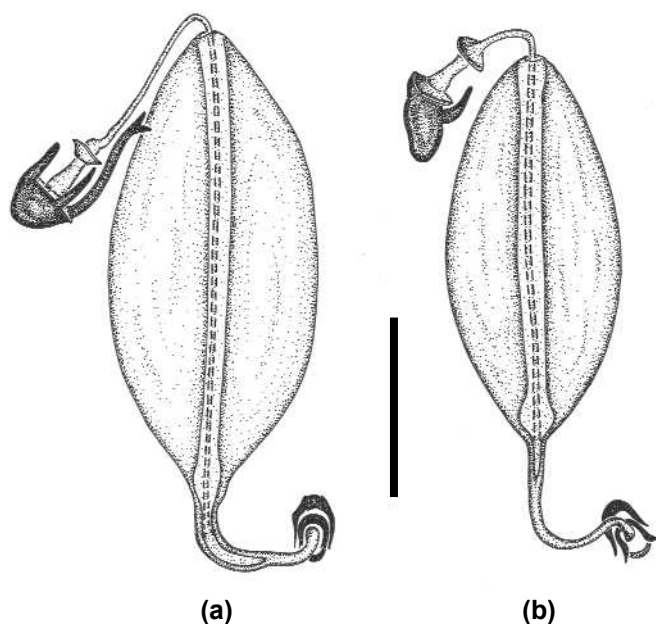


FIGURE 8. Spermathecal bulb of: (a) *Holcostethus sphaelatus*; (b) *Peribalus (P.) strictus* (Scale bar = 2 mm).

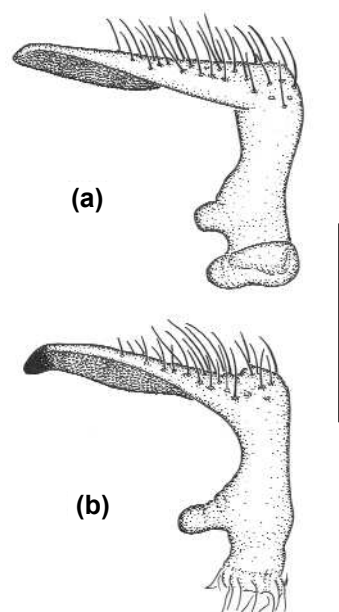


FIGURE 9. Paramere of: (a) *Peribalus (A.) inclusus*; (b) *Peribalus (A.) congenitus* (Scale bar = 0.5 mm).

4. Checked data on the Euromediterranean species of *Palomena*

4.1. On the Iberian and northern African species of *Palomena*

The genus *Palomena* Mulsant & Rey, 1866 is represented in the Palaearctic Region by 15 species, only three of them currently known to live in Europe: *P. prasina* (Linnaeus, 1761), *P. viridissima* (Poda, 1761) (Rider, 2006), and *P. formosa* Vidal, 1939 (Baena, 2006; Pérez Valcárcel and Prieto Piloña, 2008).

In the Iberian Peninsula, *P. prasina* is widespread all over the northern and middle part. Our attempts to find specimens or reliable records of *P. viridissima* have become unsuccessful, in spite of the ancient records by several authors and those from Madrid by de la Fuente (1974) and from Portugal and Spain in the Palaearctic Catalogue (Rider, 2006); for instance, de Seabra (1925) had already stated that the species did not live in Portugal. We have examined the specimens from northern Spain determined as *P. viridissima* in several collections or even published under that name (de la Fuente, 1974), all of them proving

to be *P. prasina*. In fact, this author noted that «it is almost impossible, in most cases, to separate these two species which were established according to a very confusing morphological criterion» (de la Fuente, 1974: 156).

Likewise, several hundreds of specimens examined from the authors' and other private (D. Fernández, À. Lagar, J. Pérez Valcárcel, I. Ugarte San Vicente) and public collections (Universidad Complutense de Madrid, Museo Nacional de Ciencias Naturales de Madrid (= MNMS), Museu de Ciències Naturals de Barcelona (=MZBS) undoubtedly belong to *P. prasina*. In the Catàleg of Sánchez (1920) can be read: «*Palomena viridissima* Poda / Vallvidrera 8-VI-(18)92 Bofill i Pichot leg.) [Puton det.]». This specimen, a female of *P. prasina*, is deposited in the MZBS, mounted on card and with three labels pinned below, written as follows: 1st label, handwritten = «Vallvidrera / 8 junio 92 / det. Puton»; 2nd label, handwritten = «*Palomena prasina* / Puton det.»; 3rd label, printed = «Ex Col. / BOFILL / I PITXOT». This proves Sánchez's mistake of changing *prasina* by *viridissima*. In addition, Dusoulier and Lupoli (2006) indicate that *P. viridissima* is a certainly rare species in

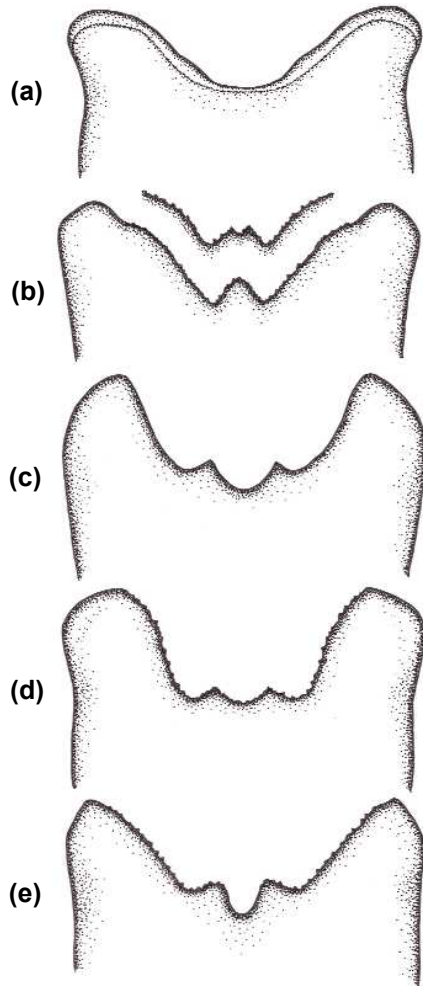


FIGURE 10. Ventral view of the ventral edge of pygophore of: (a) *Palomena angulata* (Edough, northern Algeria); (b) *P. formosa* (Huétor-Santillán, Granada, Spain [middle ventral edge] and Hauta Kasdir, Rif, Morocco [full ventral edge]); (c) *P. mursili* (Iraq; redrawn from Linnavuori, 1984); (d) *P. prasina* (Vidrà, Catalonia, Spain); (e) *P. viridissima* (Opole, western Poland).

France and that all published records for that country should be checked.

On the other hand, all the specimens examined from southern Iberian Peninsula (Spanish provinces of Albacete, Almería, Córdoba, Granada and Málaga) belong to *P. formosa* Vidal, 1939 [Full data: Castilla-La Mancha: Albacete prov., Sierra de Alcaraz, Venta Mendoza, 5-VIII-1995, C. Martín leg., 1 male, MNMS (as *P. prasina*); Andalusia: Almería prov., Bayarcal, 1250 m, 2-VI-2005, R. Lupoli leg. et coll.; Granada

prov., Huétor-Santillán, VI-1956, J. Vives leg., 1 male, J. Ribes coll.; Málaga prov., Jubrique, 6-V-1991, G. Bastazo & J.M. Vela leg., 1 male, J. Ribes coll. (ex coll. M. Baena); Córdoba, surroundings of the city, M. Baena det. et coll.]. Their pygophore (see Vidal, 1939, 1950) is identical to that of other males from the Rif, Morocco, deposited at the MZBS [Full data: Hauta Kasdir (Rif), 1750 m, 29-VI-1932, one couple, MZBS; 15-27-VII-1932, 2 males, M. Ferrer Bravo leg., MZBS (as *P. prasina*)]. Baena (2006) and Pérez Valcárcel and Prieto Piloña (2008) have recently recorded this species in Andalusia, the former without providing any precise locality, the latter providing it [Full data: Province of Jaén: Puente de la Sierra, 13-VIII-1997, male, C. Pérez Valcárcel leg.]. We agree with Baena (pers. comm.) that *P. formosa* replaces *P. prasina* in the Iberian southern third.

Having received on loan an important series of *Palomena* from Morocco, Algeria and Tunisia from the Muséum National d'Histoire Naturelle de Paris (=MNHN), we have only found one single female (15.5 mm long) of *P. formosa* from Morocco, the remaining specimens belonging to *P. angulata* [Full data: D(jebel). Toubkal, Ait Souka, 1550 m / Maroc, 15-31-Aout.? / *angulata* (Put.) / Ribaut det. / MNHN(EH) / 3704] but a number of specimens from Algeria [Full data: Teniet-el-Hâad, Desbrochers, 1889/MNHN(EH) / 3694 / large specimen lacking terminal segments of abdomen; Edough, 1886 / MNHN(EH) / 3693 / 1 female; Algérie / MNHN(EH) / 3695 / 1 male; Edough / MNHN(EH) / 3696 / 1 female; Mt.-Edough, Algérie, A. Théry, 1902 / MNHN(EH) / 3699 / 1 male; Edough, Coll E. Licent (peu lisible) / 3698 / 1 female; Algérie, Ste.-Croix de l'Edough & env., 700 à 1000 m, Ed. Chevreux 1917 / MNHN(EH) / 3700 / 1 male; *idem* / MNHN(EH) / 3701 / 1 hembra; *idem* / pygophore on independent card (JR) / MNHN(EH) / 3702 / 1 male; *idem* / MNHN(EH) / 3703 / 1 female / one female in coll. Noualhier without locality and date: MNHN(EH) / 3697] as well as one record from Tunisia [Full data: Djebel Feidja, Tunisie, Hannotiaux coll., *angulata* Pt. (MNHN(EH) / 3705)], already recorded by Carapezza (1997). The length range of *P. angulata* is higher than previously assumed and should be corrected as follows: 10.4–12.0 mm (males); 11.7–13.2 mm (females). It can be accepted that *P. angulata* and *P. formosa* are the main members of the genus *Palomena* living in northern Africa, with a secondary presence of *P. prasina* in Morocco and with *P. viridissima* absent from the whole Maghreb. In fact, de Bergevin (1921) already stated not to have ever found any of those species in Algeria and Vidal (1950) did

not record them either from northern Africa.

As a result, the following changes are proposed to be made in the Catalogue of the Heteroptera of the Palearctic Region 5:

Palomena prasina (Linnaeus, 1761):

Delete: AG from **NA**

Palomena formosa Vidal, 1939:

Add: **EU**: SP ⁽⁵⁾

Palomena viridissima (Poda, 1761):

Delete: PO and SP from **EU**

Delete: AG and MO from **NA**

In order to clarify not only the distribution but also the morphological separation of the five Euromediterranean species of *Palomena*, the ventral edge of pygophore of all them is illustrated in Fig. 10. As we have not examined any specimen of *P. mursili* Linnavuori, 1984, its illustration (Fig. 10c) has been redrawn from Linnavuori's (1984) paper including the original description.

4.2. Key to the Euromediterranean species of *Palomena*

Key to the Euromediterranean species of *Palomena*

- 1 (2) Segment II of antennae much longer than segment III. Antero-lateral margins of pronotum distinctly convex; humeral angles clearly rounded. Male: Ventral edge of pygophore bearing a pair of median processes forming a deep concavity in the middle (Fig. 10e) *P. viridissima* (Poda, 1761)
- 2 (1) Segment II of antennae usually shorter than segment III, sometimes as long as, or slightly longer than it. Antero-lateral margins of pronotum straight or concave; humeral angles sharper and more protruding, not clearly rounded. Male: Ventral edge of pygophore differently shaped (Figs. 10a-d)
- 3 (4) Punctuation of paratergites concolorous, ochraceous; dark points only on the edges of connexivum *P. mursili* Linnavuori, 1984
- 4 (3) Punctuation of paratergites black
- 5 (8) Apex of scutellum concolorous, narrowly or indistinctly yellowish. Humeral angles of pronotum more or less rounded. Ventral edge of pygophore bearing medially a pair of short processes (Fig. 10d) or a single, robust, even bifurcate process (Fig. 10b)
- 6 (7) Humeral angles quite rounded and not very protruding (free region of the postero-lateral margin: less than 0.7 mm). Male: Ventral edge of pygophore bearing medially a pair of short, triangular processes, forming a shallow concavity in the middle (Fig. 10d) *P. prasina* (Linnaeus, 1761)
- 7 (6) Humeral angles not very rounded and quite protruding (free region of the postero-lateral margin: 0.7–0.9 mm). Male: Ventral edge of pygophore bearing medially a single, robust, triangular process, even bifurcate at apex (Fig. 10b) *P. formosa* Vidal, 1939
- 8 (5) Apex of scutellum distinctly yellowish or reddish. Humeral angles of pronotum usually sharp and protruding. Ventral edge of pygophore without any remarkable character (Fig. 10a) *P. angulata* (Puton, 1871)

⁽⁵⁾In the Iberian Peninsula, *Palomena prasina* and *P. formosa* seem to have vicariant distributions. The former only lives in the northern and middle parts and the latter only in the southern part. In the three Maghreb countries only *P. angulata* and *P. formosa* live.

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