Asymmetry of the folded hind wings analyzed in members of the subfamily Staphylininae (Coleoptera Staphylinidae)

Note 01 (on the Staphylinoidea), released by Luigi De Marzo on July 2012 - Preliminaries to a research in progress. l.demarzo@alice.it

SUBJECTS

- Except for male Stylopidae and few instances more, beetles are used to crumple their hind wings beneath the elytra (Crowson, 1981).
- Starting from the pioneer studies of Forbes in the 1920s, this behaviour was analyzed by several workers referring to the equipment of veins, folding patterns and folding mechanisms.
- Literature on these subjects has been recently reviewed, improved and discussed by Hammond (1979), Kukalová-Peck & Lawrence (1993), Lawrence *et al*. (1995) and Fedorenko (2009);
- anyhow, it doesn't seemingly provide an explicit answer to the following question: *are folded Coleopteran hind wings always symmetrical in a single specimen*?
- The present note underlines a lack of specular symmetry does constantly occur in some members of the subfamily Staphylininae.

MATERIAL AND METHODS

- Specific names agree with Smetana (2004).
- List of examined species and number of specimens – Tribe Staphylinini: *Creophilus maxillosus* (Linnaeus) (n=4), *Ocypus olens* (O. Müller) (n=6), *Staphylinus medioximus* Fairmaire (n=3). Tribe Xantholinini: *Megalinus glabratus* (Gravenhorst) (n=19). Tribe Philonthini: *Cafius xantholoma* (Gravenhorst) (n=28), *Gabronthus maritimus* (Motschulsky) (n=20), *Philonthus concinnus* (Gravenhorst) (n=6), *P. discoideus* (Gravenhorst) (n=5), *P. fenestratus* Fauvel (n=4), *P. jurgans* Tottenham (n=5), *Remus filum* Kiesenwetter (n=9).
- Terminology is reported in Fig. 1.A referring to a common member of the tribe Staphylinini, *Creophilus maxillosus*.
- The following terms, "anal field", "cubital vein", "medial vein", "pterostigma", "radial bar", "radial spring" and "radial-vein branches", are reported by Kukalová-Peck & Lawrence (l.c.) referring to the congeneric species of Australian origin, *Creophilus erythrocephalus* (Fabricius).
- The terms "costal blade" and "setigerous lobe" have been defined in a more recent contribution (De Marzo, 2011).
- Wings were examined on slides in glycerol.

• Specimens were either obtained from dry collections or freshly killed with ethyl-acetate vapours; in any case, they were dissected after a bath of some hours in a mixture 1:1 of glycerol and ethanol 70%.
• Sex was verified looking at the genital apparatus.
• Therefore, because a doubtless identification of *Philonthus* spp. must be based on the morphology of aedeagus and parameres, only male specimens were analyzed for this genus.

RESULTS

----- Analysis of *Creophilus maxillosus*
• In this common member of the subfamily Staphylininae, the folded hind wings share features as follows: (a) the "anal field" tucks downwards, (b) the "radial spring" occupies the external-posterior corner; (c) the "cubital vein" directs obliquely towards the internal-posterior corner; (d) the "medial vein" gains the posterior margin and here tucks downwards forming an acute angle.
• Although these common features, wings of *Creophilus maxillosus* clearly lack specular symmetry in any single specimen.
• Referring to the figured specimen (Fig. 1.B-C), this lack of symmetry can be immediately appreciated by looking at the underground folded parts,
• as these are greatly protruding in the left wing, whereas they are mostly hidden at the right wing.
• Further two asymmetric features of the same specimen concern:
• the position of the wing apex, which directs either sideways or behind, respectively at the left and the right wing;
• the amplitude of the medial-vein angle, which is close to 30° in the left wing and close to 70° at right.

----- The opposite conditions A and B
• Altogether, the asymmetric features of the above specimen of *Creophilus maxillosus* concur to define the asymmetric "condition A" (Fig. 2.A).
• This has been detected in three, out to four, specimens of *Creophilus maxillosus* examined throughout.
• The same features are reversed in the fourth examined specimen of *Creophilus maxillosus*,
• and concur to define the opposite asymmetric "condition B" (Fig. 2.B).

----- Double folding mechanism
• When the hind wings of a single specimen of *Creophilus maxillosus* are brought to a moderate degree of extension, they show their folding mechanism to be clearly different, as either 4 or 5 folds are involved.

• If wings exhibit the asymmetric condition A (Fig. 3), there are 4 folds at the left wing and 5 folds at right,
• whereas there are 5 folds at left and 4 at right if the specimen shows the asymmetric condition B.
• In both cases, both wings of a single specimen share four folds: (I) the oblique "anal fold" related to the "anal field"; (II) the "longitudinal fold", which does extend starting from the region between the "radial bar" and the "medial vein"; (III) the "first transversal fold", which hinges at the "radial spring"; (IV) the "second transversal fold", whose hinge locates beyond the "pterostigma".
• The additional fold occurring at the right wing of the figured specimen (Fig. 3) is reported as "(V) third transversal fold", which virtually cuts the wing membrane about 4 mm far from the apex.
• Position of the hinge of the second transversal fold provides an evident cue of the doubled folding mechanism,
• as it occurs either about 2 mm far from the pterostigma or very close to the latter, or vice versa, according to the asymmetric conditions A or B respectively.

----- Occurrence of conditions A and B
• Both conditions A and B have been detected in every examined species.
• These included: a member of the nominal genus, *Staphylinus medioximus*, further two species of the tribe Staphylinini, *Ocypus olens* and *Ontholestes murinus*, a member of the tribe Xantholinini, *Megalinus glabratus*, and seven species of the tribe Philonthini.
• Every specimen showed the doubled folding mechanism, as reported above for *Creophilus maxillosus*
• and figured again for a specimen of *Megalinus glabratus* showing the asymmetric condition A (Fig. 4).

CONCLUSIVE REMARKS

• Literature provides a wide documentation of the asymmetry in Coleopteran wings by referring to the elytra,
• whose interlocking does usually lack specular symmetry within the Order.
• Fiori (1974) studied the elytral interlocking in several members of the families Carabidae, Melyridae, Tenebrionidae and Curculionidae;
• he concluded that asymmetry establishes at the emergence, when an adult joins its elytra for the first time,
• and acquires in a casual manner one or another "form of union".

• Seemingly, either the asymmetric condition A or the opposite condition B of the hind wings in the Staphylininae are acquired in a casual manner as well, when an adult folds its hind wings for the first time.
• Under an adaptive viewpoint, it may be that asymmetry evolved to conquer a suitable overlapping of the hind wings under the short elytra.

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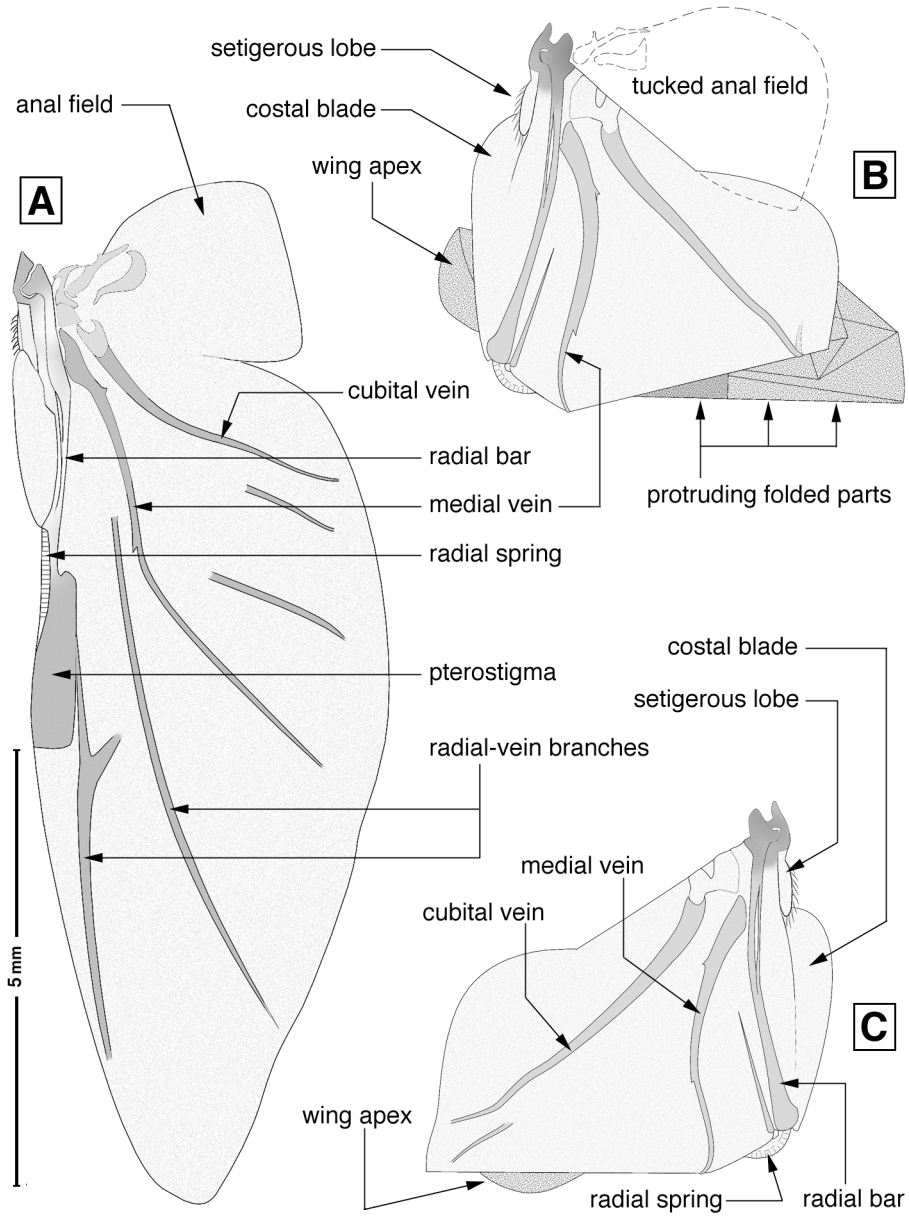

Fig. 1 - *Creophilus maxillosus* (Linnaeus): outlines of the hind wings in both extended and folded position in one of the examined specimens. Terms agree with Kukalová-Peck & Lawrence (1993) and De Marzo (2011).

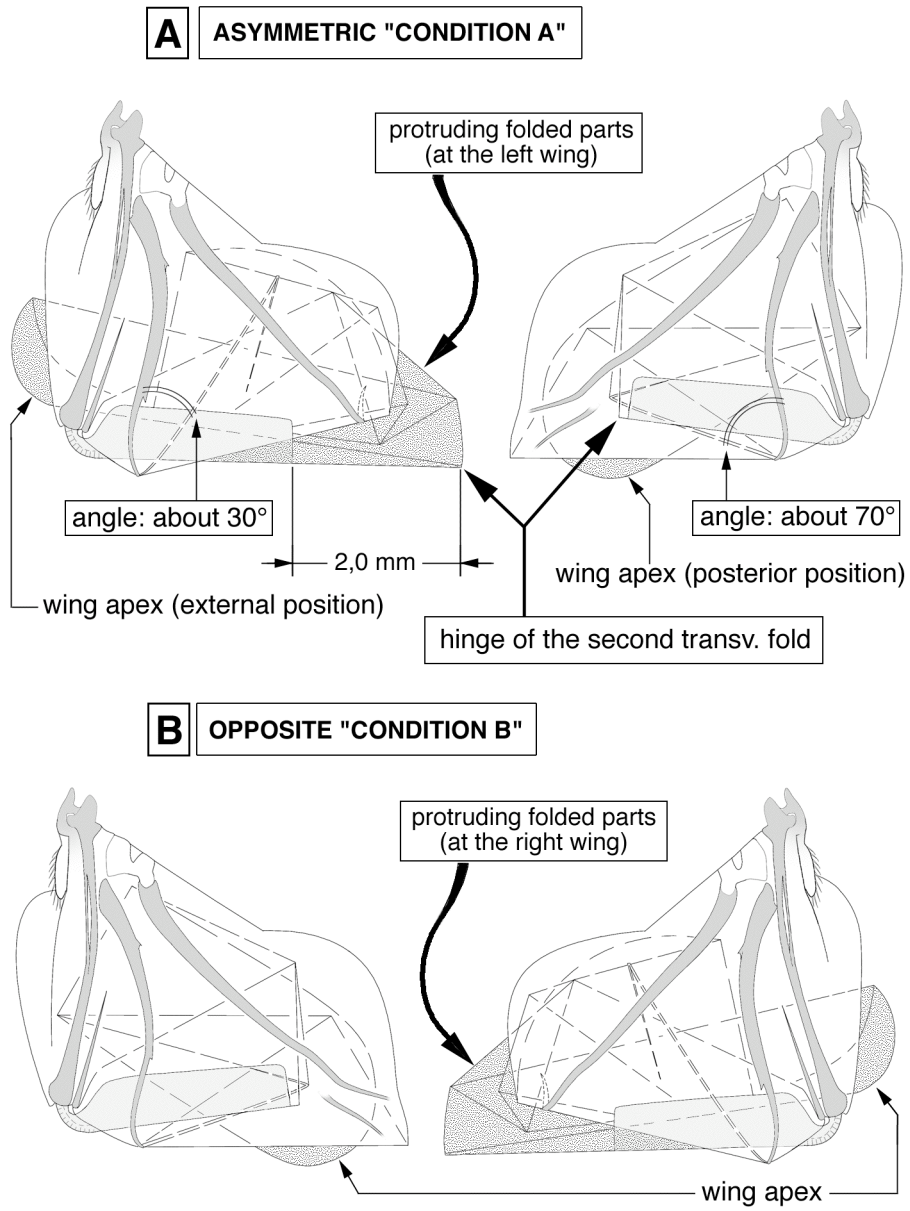

Fig. 2 - *Creophilus maxillosus* (Linnaeus): asymmetric “condition A” and opposite “condition B” detected in the examined specimens.

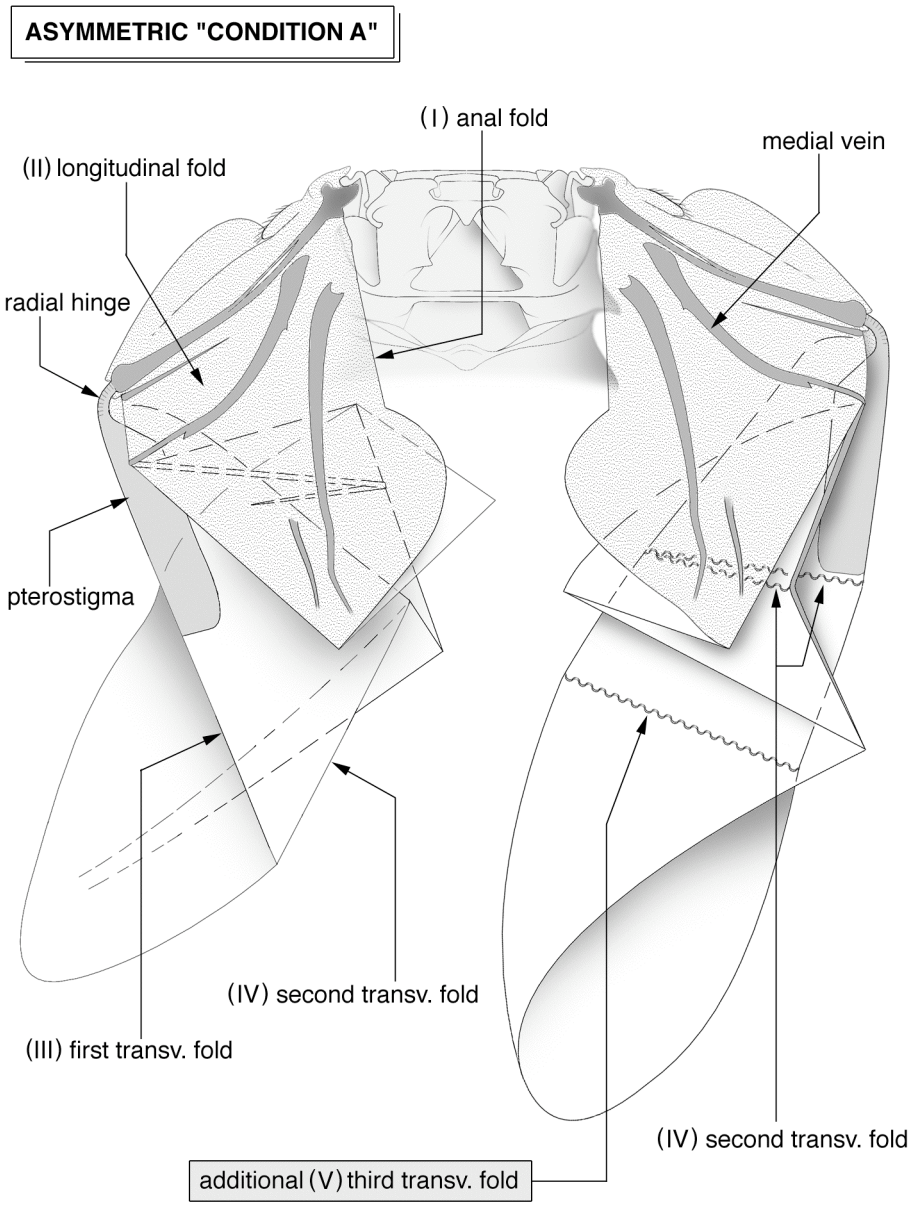

Fig. 3 - *Creophilus maxillosus* (Linnaeus): double hind-wind folding mechanism in a specimen showing the asymmetric “condition A”.

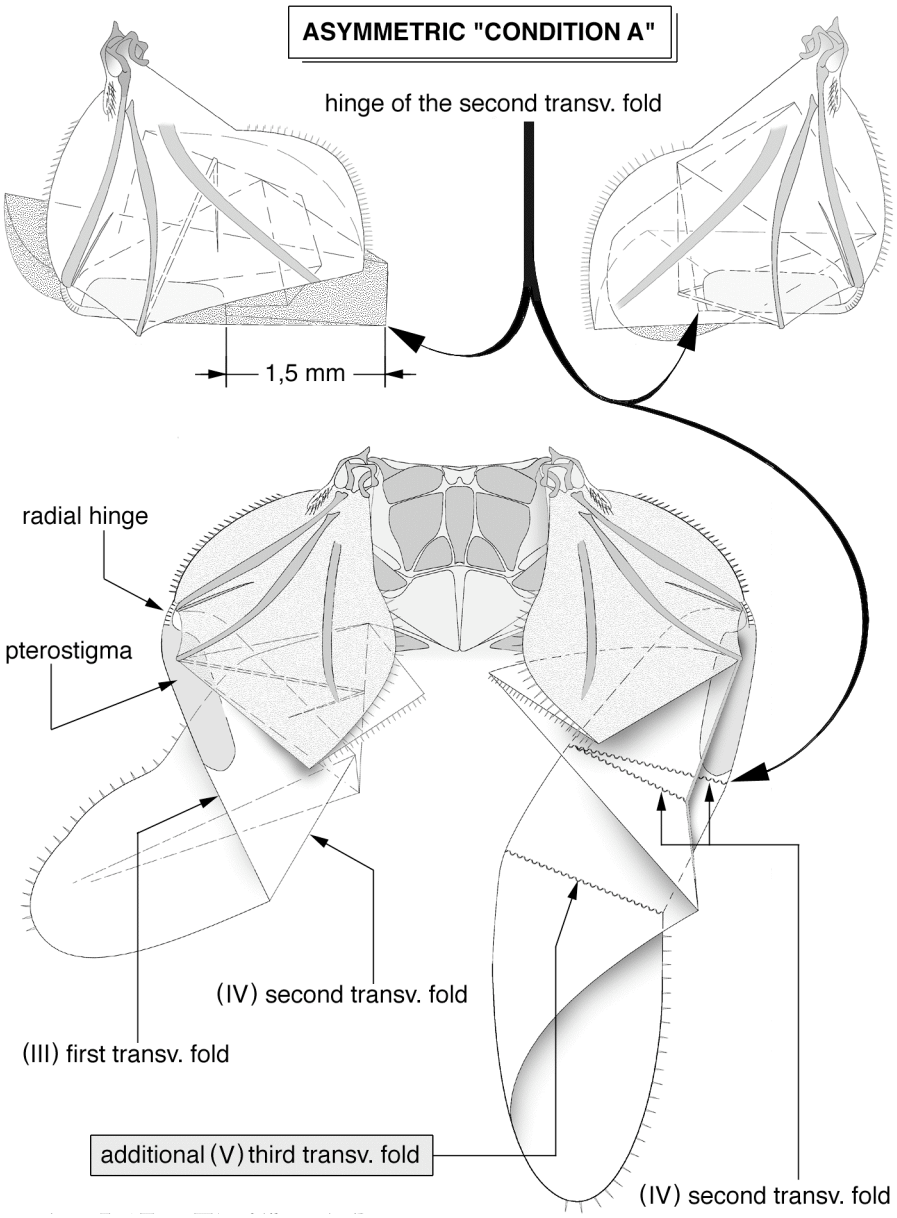

Fig. 4 - *Megalinus glabratus* (Gravenhorst) (tribe Xantholinini): folded hind wings in a specimen showing the asymmetric “condition A” and the corresponding double folding mechanism.