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Taxonomic notes on the genus *Zabrus* (Coleoptera, Carabidae, Zabrini)

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SUMMARY

It is discussed the validity of *Zabrus* Clairville, 1806 as a separate genus from *Amara* Bonelli, 1810 on the basis of apomorphies such as the presence of a single periorbital seta, the lack of a single seta in the posterior angle of the pronotum, larval features and the high chromosome number.

The names of the new subgenera of *Zabrus* described by GANGLBAUER (1915) are considered as valid since the author distributed reprints in advance to the publication of the fourth volume of Münch. Kol. Z. (this was never distributed), thus making the same names published subsequently by FREUDE (1986) to be synonyms.

The subgenus *Pelor* Bonelli, 1810 is considered polyphyletic and must be revised on phylogenetic grounds. It includes two lineages with morphological and geographical characteristics deserving their description as new subgenera, *Italozabrus* subg. nov. (type species *Zabrus orsinii* Dejean, 1831), and *Himalayozabrus* subg. nov. (type species *Zabrus malloryi* Andrewes, 1930).

Zabrus kraatzi nom. nov. is proposed as a replacement name for *Z. rugulosus* Kraatz, 1884, a homonym of *Z. tenebrioides* var. *rugulosus* Letzner, 1852.

Key words: *Zabrus*, Zabrini, Carabidae, Coleoptera, *Italozabrus* subg. nov., *Himalayozabrus* subg. nov., taxonomy, keys.

RESUMEN

Notas taxonómicas sobre el género *Zabrus* (Coleóptera, Carabidae, Zabrini)

El género *Zabrus* Clairville, 1806 se diferencia bien del género afín *Amara* Bonelli, 1810 por apomorfías como la presencia de una sola seda periorbital, la carencia de una seda en el ángulo posterior del pronoto, diversos caracteres larvarios y el elevado número de cromosomas.

Se consideran válidamente publicados los nombres subgenéricos que describió GANGLBAUER (1915), ya que este autor distribuyó separatas con anterioridad a la publicación del cuarto volumen del Münch. Kol. Z. (que no llegó a publicarse), por lo cual los mismos nombres usados luego por FREUDE (1986) son considerados sinónimos.

El subgénero *Pelor* Bonelli, 1810 es considerado como polifilético y debe ser revisado en términos filogenéticos. Incluye dos linajes que por sus características morfológicas y geográficas son descritos en este trabajo como nuevos subgéneros: *Italozabrus*

subg. nov. (especie tipo *Zabrus orsinii* Dejean, 1831) e *Himalayozabrus* subg. nov. (especie tipo *Zabrus malloryi* Andrewes, 1930).

Se propone a *Zabrus kraatzi* nom. nov. como nombre de reemplazo para *Z. rugulosus* Kraatz, 1884, que es un homónimo de *Z. tenebrioides* var. *rugulosus* Letzner, 1852.

Palabras clave: *Zabrus*, Zabrini, Carabidae, Coleoptera, *Italozabrus* subg. nov., *Himalayozabrus* subg. nov., taxonomía, claves.

INTRODUCTION

The genus *Zabrus* Clairville, 1806 is included in the tribe Zabrini and the supertribe Pterostichitae. It shows a circummediterranean distribution reaching to the east the Himalayas and Western China. The relationships of Zabrini with related tribes are partially solved since ROIG-JUÑENT (1993) and ROIG-JUÑENT and FLORES (1995) have postulated that Cnemalobini is the sister taxa of Zabrini. ARNDT (1993, 1998) has found larval apomorphies for postulating a lineage made up by Zabrini, Cnemalobini (= Cnemacanthini), Harpalini and a subset of the current Platynini, separated from Pterostichini, Morionini, etc. LIEBHERR AND WILL (1998) have corroborated the affinity of Zabrini and Cnemalobini based on characters from the female reproductive tract.

The genus *Zabrus* is closely related to the genus *Amara* Bonelli, 1810, and in particular to some lineages represented by the subgenera *Percosia* Zimmermann, 1832, *Harpalodema* Reitter, 1888, *Polysitamara* Kryzhanovskij, 1968, and others (some of these are regarded as distinct genera: KRYZHANOVSKIJ *et al.*, 1995). The difficulties of finding exclusive apomorphies for defining the genus *Zabrus* have led FREUDE (1986) to question its taxonomic value as a separate genus from *Amara*.

The genus *Zabrus* is currently divided into subgenera following the criteria of GANGLBAUER (1915). Lately, the subgenus *Platyzabrus* Jeanne, 1968 was erected for two Iberian species and JEANNE (1968) included the Iberian species of the subgenus *Pelor* group 1 of Ganglbauer in the subgenus *Iberozabrus*, but he did not state the characteristics and new limits of the subgenus *Iberozabrus* Ganglbauer, 1915 for justifying such decision. FREUDE (1986) made a subgeneric division of *Zabrus* repeating that of Ganglbauer and omitted the suggestions of JEANNE (1968). FREUDE (1986) also discussed the validity of the subgenera erected by GANGLBAUER (1915) because of the problems that happened with the distribution of his paper. Lately, FREUDE (1989) divided the complex subgenus *Pelor* Bonelli, 1810 into species groups in a way similar to that of Ganglbauer, but reinforcing the importance of the geographic distribution for making such groups.

Most of the subgenera of *Zabrus* currently admitted are probably monophyletic lineages characterised by one or more apomorphies (ANDÚJAR, 1993). The most important taxonomic problems concern the large subgenera *Pelor* and *Iberozabrus*, which apparently lack any apomorphy for recognising them on phylogenetic grounds. However, *Iberozabrus* may be well a monophyletic lineage according to karyotypic and molecular data (SERRANO *et al.* in preparation). On the other hand, the subgenus *Pelor* in the classification of GANGLBAUER (1915) and FREUDE (1986, 1989) is clearly polyphyletic on morphological and geographical grounds and needs a careful revision. An initial study of ANDÚJAR (1993) has shown that some species groups of *Pelor* may represent monophyletic lineages and should be eventually ranked as distinct subgenera,

whereas other species groups require the analysis of further data before arriving to founded conclusions.

RESULTS AND CONCLUSIONS

The distinctness of the genus *Zabrus*

The presence of a single periorbital seta should be considered as a valid apomorphy of the genus. The fact that isolated species of *Amara* show also a single seta due to recessive or dominant simple mutations (HIEKE, 1978), giving rise to a polymorphism, constitutes a parallelism of minor phylogenetic importance. This also applies to the existence of a few polymorphic species of *Zabrus*, which occasionally show two periorbital setae or lose the typical seta.

The lack of a seta in the posterior angle of the pronotum is also a good apomorphy for the genus. In the taxa related to *Zabrus* this state is only found in *Amara (Polysitamara) luppovae* (Kryzhanovskij, 1962). A third apomorphy for the genus is the occurrence of high chromosome numbers (2n= 46-63), among the highest of the family (SERRANO and GALIÁN, 1998), whereas in *Amara* the chromosome number is 2n= 37 or lower. ARNDT (1993) indicates four larval features that might be also apomorphies of *Zabrus*, namely, nasal with a median notch and two teeth in the anterior margin (4-6 in *Amara*), head without coronal and cervical sutures and stipes wholly divided by a membranous strip.

Other possible apomorphies of *Zabrus* to be corroborated are the presence in the adult of a protruding-like spine under the typical internal spine of the protibia, and the backward displacement of the toilette organ with regard to *Amara*. In conclusion, *Zabrus* seems to be a genus well differentiated from the typical *Amara* species, although a detailed comparative analysis of the *Amara* subgenera *Percosia, Harpalodema, Polysitamara* and others is needed for corroborating the taxonomic and phylogenetic value of the above mentioned characters.

The validity of the subgenera erected by Ganglbauer in 1915

FREUDE (1986) has questioned the validity of these subgenera, because the fourth volume of the Münchener Koleopterologische Zeitschrift including Ganglbauer's paper was never distributed. However, authors contributing to that volume received in advance reprints of their work and distributed them. According to the ICZN the articles of that volume must be considered as valid publications, although not in a recommended way (rec. 21A). In fact, a photocopy of Ganglbauer's paper can be obtained without special difficulty. For this reason, the redescription of Ganglbauer's subgenera made by FREUDE (1986) is unnecessary and has lead to names that are at the same time homonyms and synonyms.

The splitting of *Pelor*

As stated in the introduction the large subgenus *Pelor* is probably polyphyletic, since no synapomorphy is shared by the many morphological and geographical lineages included in it. It seems better to split this taxon into monophyletic lineages and rank them as new subgenera. Two of these lineages are here treated.

***Italozabrus* subg. nov**

The subgenus is characterised by micropterous wings, metepisternae almost as long as wide, smooth or scarcely punctate, long elytra, scutellar stria longer than the width of scutellum, a continuous row of umbilical setae, median lobe of aedeagus bent in square angle with a protruding ventral edge forming a keel, and lateral sides showing a notch, its apical ostium closed by a well sclerotized ligula. The subgenus is endemic to the Italian Peninsula. The type species of the subgenus here designated is *Zabrus orsinii* Dejean, 1831.

Description

Body dark black, slender and moderately cylindrical, length around 15 mm. Head moderate, not strong, smooth eyes convex with one periorbital seta. Pronotum transverse narrowed forwards, almost straight backwards with square posterior angles. Anterior and posterior margin incompletely beaded, disk convex and poorly (*Z. orsinii*) or clearly (*Z. costae*) punctate anteriorly. Anterior margin regularly arcuate, the anterior angles not protruding forwards. Basis as wider as that of the elytra, slightly sinuate and completely punctate, the dense and fine punctures also invading the lateral margin. One clear depression at each side close to the middle. Lateral margin narrow forewords and becoming wider in the posterior half. Lateral bead thickened in the posterior half. Elytra long, moderately widened backwards to the posterior quarter. Striae well-impressed, moderately or clearly punctate, intervals slightly convex, scutellar stria long. Basal margin progressively narrowed towards shoulder (Fig. 1), forming there a small tooth. Lateral margin narrow, particularly nearly the shoulder, ninth interval with a continuous umbilical row of setae. Pro- meso- and metepisternae smooth or with few punctures. Metepisternae as long as wide (Fig. 2). Three penultimate abdominal segments with one median seta at each side, the last segment with two or three setae at each side in the posterior margin. Antennae and legs dark brown, palps reddish brown. Protarsi of male clearly dilated. Median lobe of aedeagus with basal bulb well-developed and apical half bent in a square angle. Dorsal ostium closed by a slerotized ligula, right lateral wall of ostium proximally with a dorsal clear notch, apically clearly (*Z. orsinii*) or moderately (*Z. costae*) protruding outwards, left side with a larger and deeper notch (Figs. 3, 4). Apex of penis asymmetrical, turn to right. Right paramere also forming a square angle and ending in a well-developed hook (Fig. 5). Female gonostyli with a basal piece longitudinally grooved and with a triangular field of setae close to the boundary with the distal piece. Ratio of proximal to distal pieces 1.4.

The subgenus includes two species, *Zabrus orsinii* Dejean, 1831 and *Z. costae* Heyden, 1891, that are sometimes treated as subspecies (FREUDE, 1989). *Z. orsinii* is found in the Central Apennines whereas *Z. costae* is found between these mountains and the Calabrian mountains. A key for these two species is included.

Key to the species of the genus *Zabrus*, subgenus *Italozabrus* nov.

1. Elytral striae shallow and finely punctate, basal margin of elytron only narrowed close to shoulder, metepisternae smooth. Apex of aedeagus sharp, left lateral wall markedly protruding outward (Fig. 3) *Z. orsinii*

- Elytral striae deep and punctate, basal margin of elytron progressively narrowed towards shoulder, metepisternae moderately punctate. Apex of aedeagus rounded, left lateral wall only moderately convex (Fig. 4) *Z. costae*

The subgenus *Italozabrus* is related to the subgenera of *Zabrus* that show characters associated to flight (actual or vestigial), as are the presence of wings with different degrees of development, long metepisternae, long elytra, and long scutellar stria. The subgenera showing these characteristics are *Zabrus*, *Macarozabrus* Ganglbauer, 1915, and *Himalayozabrus* subg. nov. The two species of *Italozabrus* show an overall resemblance with the species of the subgenus *Zabrus*, and particularly with *Z. tenebrioides* (Goeze, 1777). The new subgenus may well represent a recent lineage originated from a winged ancestor of the subgenus *Zabrus* with a large distributional area that was isolated in the Italian Peninsula during the last glaciation events. The sclerotized ligula of the male aedeagus resembles that of the species of the subgenus *Pelobatus* (=*Eutroctes*) Fischer, 1817, but other characters from the genitalia, the external morphology, and the geographic distribution suggest that the ligula evolved independently in both lineages.

***Himalayozabrus* subg. nov.**

The subgenus is characterised by micropterous wings, scutellar stria longer than the width of scutellum, metepisternae almost as long as wide, lateral margin of pronotum wide and lateral bead of pronotum only slightly thickened backwards, and right paramere of aedeagus without apical hook. The genus is found in the Himalayan Mountains and Western China. The type species here designated is *Zabrus malloryi* Andrewes, 1930.

Description

Body dark brown or black, moderately flattened, average length around 14-16 mm. Head robust, smooth or superficially punctate, slightly narrowed after the eyes forming a neck, eyes clearly convex with one periorbital seta. Pronotum transverse, briefly narrowed forwards, clearly narrowed backwards, sides arcuate or straight. Anterior and posterior margins incompletely beaded. Maximum width of pronotum before middle, where there is a single lateral seta. Anterior angles slightly protruding, posterior angles obtuse and well marked. Disk moderately convex with superficial punctures anteriorly. Lateral margin wide, even in the anterior middle, widened backwards. Lateral bead poorly thickened backwards. Posterior basis moderately convex in middle, slightly narrower than the anterior basis of elytra, with vestigial foveae, complete and finely punctate, the punctures extending to the lateral margin. Elytra long and slender, moderately widened backwards to the last third or quarter, flattened, striae fine, superficially to moderately punctate, intervals almost flat, scutellar stria long. Basal margin narrow laterally (fig. 6), humeral tooth absent or small. Lateral margin narrow near the shoulder, moderately widened backwards and flat, setae of the ninth interval forming two groups (humeral and apical). Pro-, meso-, metepisternae, and sides of the three last abdominal segments from almost smooth to finely and densely punctate. Metepisternae almost as long as wide, ratio 0.95, (fig. 7). Intermediate abdominal segments with two (one) median setae at each side, last segment with two setae close to the posterior margin. Antennae and legs dark brown, palps yellowish brown. Male protarsi clearly dilated. Median lobe of aedeagus with basal bulb moderately developed (fig. 9), apical half moderately arcuate and narrow, apex forming an almost symmetrical triangle and a small hook at tip, ligula poorly developed (fig. 8), right paramere slender, without apical hook (fig. 10). Female gonostyli with the proximal piece grooved and a triangular field of setae close to the boundary with the distal piece. Ratio of proximal to distal pieces 1.4

The subgenus includes four species distributed through the Himalayan Mountains

(Tibet, Nepal) and Western China, *Zabrus malloryi* Andrewes, 1930, *Z. martensi* Freude, 1986, *Z. potanini* Semenow, 1889, and *Z. przewalskii* Semenow, 1889. A key for these species is included.

Key to the species of *Zabrus*, subgenus *Himalayozabrus* nov.

1. Metepisternae regularly punctate 2
• Metepisternae smooth or scarcely punctate 3
2. Eyes convex. Maximum width of pronotum in the first anterior third, pronotal fovea almost faint. Basal margin of elytron narrowed only close to shoulder, humeral tooth absent, elytral striae fine and almost impunctate, the ninth not interrupted *Z. martensi*
• Eyes moderately convex. Maximum width of pronotum in the middle, pronotal fovea evident. Basal margin of elytron progressively narrowed towards shoulder, humeral tooth present, elytral striae deep with crenulate punctures, the ninth sometimes interrupted *Z. malloryi*
3. Head with small and abundant punctures. Maximum width of pronotum in the first third, posterior angles obtuse, anterior basis regularly arcuate. Elytral striae deep and almost impunctate, humeral tooth absent *Z. przewalskii*
• Head smooth or with scarce punctures. Maximum width of pronotum in the middle, posterior angles well marked and slightly protruding outwards, anterior angles slightly protruding forwards. Elytral striae deep and punctate, humeral tooth present *Z. potanini*

As stated above, the subgenus *Himalayozabrus* seems to be phylogenetically close to other subgenera showing characters related with flight, and particularly with *Z. morio* Ménétriès, 1832, the species of the winged subgenus *Zabrus* with the easternmost distribution. It might be that *Himalayozabrus* represents a lineage recently derived from a winged ancestor of the subgenus *Zabrus*.

Zabrus kraatzi nom. nov. for *Zabrus rugulosus* Kraatz, 1884

The name *rugulosus* was first used for a *Zabrus* taxon by LETZNER in 1852 for nominating a variety of *Z. tenebrioides* (GOEZE, 1777). Thus *Z. rugulosus* Kraatz, 1884 becomes a homonym, and the replacement name *Zabrus kraatzi* nom. nov. is here proposed for this species.

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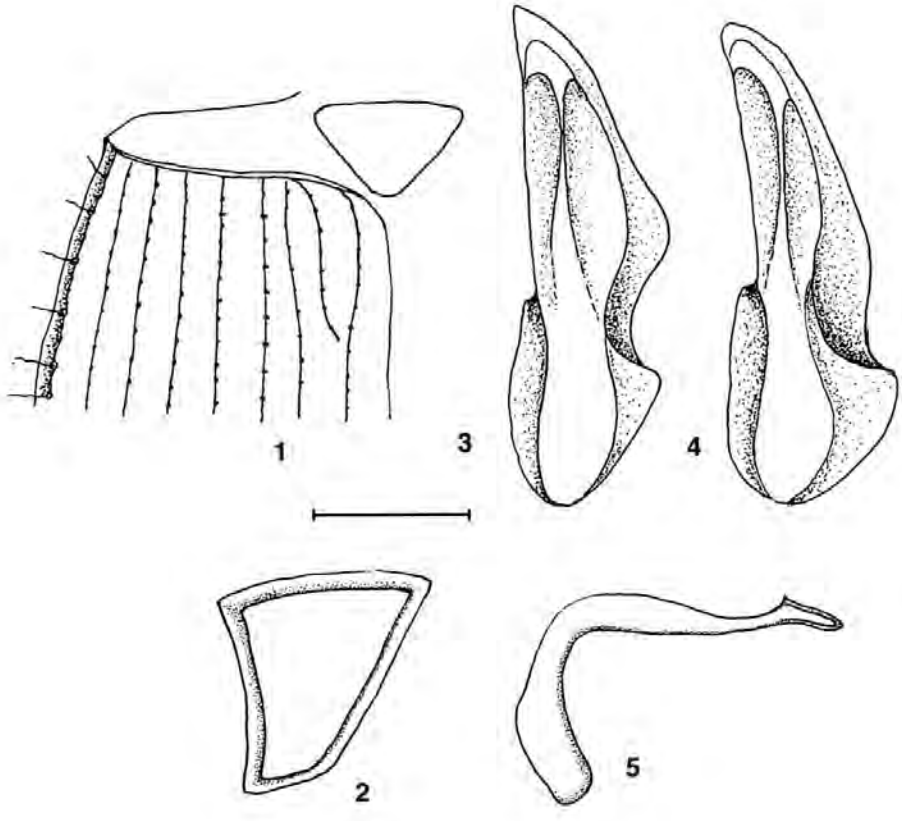
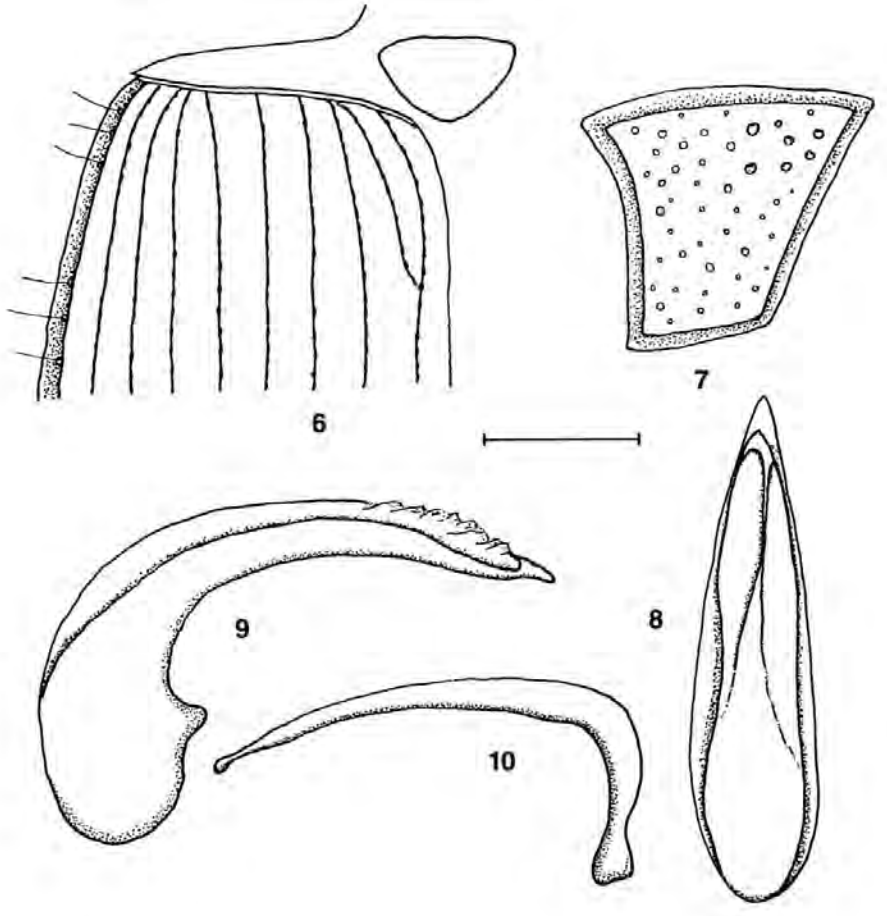


Figures 1-3: *Zabrus (Italozabrus) orsinii* Dejean from Gran Sasso, Abruzzi (Italy). 1) Details of the elytron. 2). Metepisternum. 3) Median lobe of aedeagus.
Figures 4-5: *Zabrus (Italozabrus) costae* Heyden from Majella, Abruzzi (Italy). 4) Dorsal view of median lobe of aedeagus. 5) Right lobe (paramere) of aedeagus. Bar equals 1 mm in Figs. 1 and 3-5, and 0.66 mm in Fig. 2.

Figuras 1-3: *Zabrus (Italozabrus) orsinii* Dejean del Gran Sasso, Abruzos (Italia). 1) Detalles del élitro. 2). Metaepisterna. 3) Lóbulo medio del edeago.
Figuras 4-5: *Zabrus (Italozabrus) costae* Heyden de Majella, Abruzos (Italia). 4) Vista dorsal del lóbulo medio del edeago. 5) Lóbulo derecho (parámero) del edeago. La barra equivale a 1 mm en las Figs. 1 y 3-5, y a 0,66 mm en la Fig. 2.



Figures 6-7: *Zabrus (Himalayozabrus) malloryi* Andrewes, syntype from Dinka La (Tibet). 6) Details of the elytron. 7) Metepisternum.
Figures 8-10: *Zabrus (Himalayozabrus) przewalskii* Semenow from Amdo Mountains (China). 8) Dorsal view of median lobe of aedeagus. 9) Lateral view of median lobe of aedeagus. 10) Right lobe (paramere) of aedeagus. Bar equals 1 mm in Figs. 6 and 8-10, and 0.66 mm in Fig. 7.

Figuras 6-7: *Zabrus (Himalayozabrus) malloryi* Andrewes, sintipo de Dinka La (Tibet). 6) Detalles del élitro. 7) Metaepisterna.
Figuras 8-10: *Zabrus (Himalayozabrus) przewalskii* Semenow de las Montañas de Amdo (China). 8) Vista dorsal del lóbulo medio del edeago. 9) Vista lateral del lóbulo medio del edeago. 10) Lóbulo derecho (paámero) del edeago. La barra equivale a 1 mm en las Figs. 6 y 8-10, y a 0,66 mm en la Fig. 7.

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