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Nesaeoduvalius (gen. n.) *vailatii* sp. n., from Euboia island (Eastern Greece) (Coleoptera: Carabidae, Trechinae) (**)

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Abstract
Nesaeoduvalius (new genus) *vailatii* Casale & Giachino, new species (Coleoptera: Carabidae: Trechini) is described and illustrated from the Euboia (Evvia) island (eastern Greece). The new taxon belongs to the *Duvalius* "isotopic" trechine lineage, but is markedly characterized by the peculiar combination of several morphological features in the general shape, chaetotaxy of head, serrate lateral margins of elytra, and features of male genitalia (both in median lobe of aedeagus and endophallus). Its putative position amongst the trechines of the *Duvalius* phyletic lineage is discussed. Data on the distribution and habitat of this new, insular and unexpected taxon are also provided.

Key words: *Nesaeoduvalius vailatii*, new genus, new species, Coleoptera, Carabidae, Trechini, Greece.

Introduction

The discoveries of new subterranean taxa in the Euro-Mediterranean area are frequent, and their descriptions are a current, every-day taxonomical practice. Nevertheless, some of these taxa are particularly interesting, because their morphological features and geographical patterns of distribution permit postulating the history and evolution of some lineages and better understanding the taxonomic position of previously described relatives (Casale et al. 2011 b, 2012).

The diversity of subterranean genera of Trechini in Greece is low, when compared to the Dinaric chain and the Balkan peninsula as a whole, which are an impressive hotspot of subterranean biodiversity. Amongst Carabidae Trechini, as recently showed by Lohaj & Lakota (2010), Lohaj & Mlejnek (2012) and Casale et al. (2012), ten genera of so-called "anisotopic" aphaenopsoid Trechini beetles of the former « série phylétique d'*Aphaenops* » *sensu* Jeannel (1922, 1928, 1930) and Casale & Laneyrie (1982) are currently known from the territory of the Dinaric range, from northern Croatia up to the north and central Albania in the south: *Scotoplanetes* Absolon, 1913, *Adriaphaenops* Noesske,1928, *Dalmataphaenops* Monguzzi, 1993, *Albanotrechus* Casale & Guéorguiev, 1994, *Croatotrechus* Casale & Jalzic, 1999, *Minosaphaenops* Quéinnec 2008, *Derossiella* Quéinnec, 2008, *Jalzicaphaenops* Lohaj & Lakota, 2010, *Acheroniotes* Lohaj & Lakota, 2010, and *Velebitaphaenops* Casale & Jalzic, 2012. Besides these, several genera of different lineages are represented in the area: the "anisotopic" genus *Neotrechus* G. Müller, 1913 and the "isotopic" genera *Anophthalmus* Sturm, 1844 and *Aphaenopsis* G. Müller, 1913 in Dinarides, the isolated genus *Pheggomisetes* Knirsch, 1923 in the Balkan, while the genus *Duvalius* Delarouzée, 1859 (in the widest sense of authors) is widely spread everywhere.

On the contrary, in Greece, the genus *Duvalius* only is represented, which shows however an impressive specific diversity in all areas of the country and a wide adaptive radiation both in caves and in upper hypogean zone (Casale 2011a; Casale et al. 1996, 2013).

Therefore, it is particularly interesting the discovery in the Euboia island (south-eastern Greece) of a blind, specialized trechine species, which is here attributed to a new genus for the peculiar combination of its morphological features.

Material and methods

The morphological features of the holotype of the new taxon were examined using Wild M5, Wild M3 and Olympus

SZ 60 stereo-microscopes. Male genitalia were dissected, cleaned and mounted in Canada balsam on transparent slide under the examined specimen.

Drawings of aedeagus were obtained using Leitz Dialux transmitted-light microscopes with attached drawing tube.

Measurements:

TL: total body length (measured from the anterior margin of clypeus to the apex of elytra)

L: overall length, from apex of mandibles to apex of elytra, measured along the suture

PL/PW: ratio length of pronotum, as linear distance from the anterior to the basal margin, measured along the midline/maximum width of pronotum.

EL/EW: ratio length of elytra/maximum width of elytra.

Acronyms:

CGi: Pier Mauro Giachino collection, Torino, Italy.

Results

Nesaeoduvalius Casale & Giachino, **gen. n.** (Figs 1–9)

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Type species: *Nesaeoduvalius vailatii* sp. n., by monotypy.

Diagnosis. A genus of medium-sized trechine beetles with the character states of the "isotopic" lineage of *Duvalius* Delarouzée, 1859 in the widest sense of Jeannel (1928) and Casale & Laneyrie (1982), recently confirmed as monophyletic unit in the molecular phylogeny of Alpine trechines by Faille et al. (2013), but markedly characterized by the peculiar combination of the following apomorphic features: genae pubescent, tempora each with a long seta in the posterior half; elytra with lateral margins serrate from the humeral angles to the median group of the umbilicate series; apical stria almost vanished and apical carina very reduced; median lobe of aedeagus hooked on the dorsal and ventral sides, endophallus without copulatory piece but armed with small, dense spines in dorsal position.

Description. Body apterous, depigmented, anophthalmous.

Head glabrous with tempora pubescent, each with some short lateral erected setae and one additional long seta in the posterior half, shorter than the supraorbital setae (Figs 1, 3). Eyes absent. Frontal furrows very deep, complete.

Two supraorbital setae present on each side. Clypeus (Fig. 1) with two pairs of setae. Labrum with a prominent median tooth on the anterior margin and three pairs of setae (Fig. 2).

Mandibles elongate, regularly curved; left mandible with one, acute tooth at base; right mandible with a large sized, elongate retinaculum, with traces of two teeth. Submentum (Fig. 4) not transversally furrowed, with eight setae along the anterior margin.

Mentum free, not fused with the submentum along the suture, with a pair of long labial setae, without a pair of sensory foveae; mentum tooth wide, very prominent, widely emarginated at apex, largely bifid, with acute teeth; ligula elongate, not bifid at apex, with two long apical and several lateral setae; paraglossae very long and slender, pubescent on the inner margin. Penultimate palpomere of the labial palpi with three setae, two on the inner margin and one, sub-apical, on the outer one.

Pronotum transverse, markedly cordiform, with deep, wide marginal furrows and with lateral margins deeply sinuate anteriorly to the basal angles. Median furrow impressed, reaching the basal margin. Anterior angles obtusely rounded, basal angles acutely prominent outside. One pair of antero-lateral and one pair of baso-lateral setae present, the anterior pair at the anterior sixth of pronotum, the basal one moved anteriorly to the basal angles.

Elytra elongate, widened in the middle; humeral angles rounded but evident. Lateral margins deeply sinuate posteriorly to the humeral angles and finely but distinctly serrate in the basal two/thirds, from the humeral angles to the level of pores 5-6 of the lateral umbilicate series. Apical lobe, pre-apical sinuation and apical recurrent stria very reduced. Juxta-scutellar striola and inner striae 1-4 evident, the outer striae 5-8 vanished. Chaetotaxy: one pair of basal setiferous pores near scutellum; two discal setiferous pores and one preapical pore on interval 3 in each elytron; marginal umbilicate series of 8 punctures aggregated, i.e. punctures 1–8 (4 of the humeral group, 4 of the apical group) situated along the putative stria 8; latero-apical pore close to the apical stria; inner apical pore present, so that the so-called apical triangle (in the sense of Jeannel, 1928) is complete.

Abdominal sterna IV–VII with a pair of setae (male), longer on VII.

Legs long but robust; protibiae thickened, pubescent, without external furrow; two basal tarsomeres of male protarsi dilated and denticulate inwards.

Male genitalia (Figs 3, 4): median lobe of aedeagus very elongate and slender, with apical lamina axe-shaped, hooked on both the dorsal and ventral sides. Endophallus without copulatory piece, but armed with a series of small, sclerotized spines. Parameres long and slender, each with 4 apical long setae.

Female genitalia: unknown.

Etymology. Named after the combination of the Latinized adjective *Nesaeus* (insular) (from the ancient Greek *Nísaios*), and *Duvalius*, to stress the relationships of this new taxon with the genus *Duvalius* in the widest sense, and the insular, isolated distribution of its type species. Gender is masculine.

Nesaeoduvalius vailatii Casale & Giachino, **sp. n**.
(Figs 1–9)

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Type locality: Greece, Euboia (Evvia) island, Dirfis Mountain, road S. Dirfios-A. Iríni, m 1080.

Type material: Holotype ♂, labelled: "Grecia, nom. Évia, O. Dírfis, str. S. Dirfios-A. Iríni, nevaio a m 1080, vers. W" [**Greece**: Euboia prov., Mt. Dírfis, road S. Dirfios-A. Iríni, snowfield, 1080 m a.s.l., W slope], 29 May 1998, Giachino & Vailati leg. (CGi).

Description (male holotype). General features as in Fig. 1. Medium sized: TL: 4.94 mm; L: 5.44 mm. Colour uniformly paler yellow reddish.

Dorsal surface shiny; transversal cuticular microlines evident on frons and pronotum, scarcely visible as polygonal meshes on elytral intervals.

Head robust, smooth, with frontal furrows very deep, complete, angulate in the anterior third; frons convex; supraorbital setiferous punctures inserted on ranges slightly convergent backwards. Eyes absent.

Genae swollen, convergent and markedly narrowed to the neck. Labrum (Fig. 2) slightly emarginate at the anterior side, with obtuse, prominent tooth in the middle; mentum tooth (Fig. 4) wide, prominent, widely emarginate at apex. Antennae elongate but robust, exceeding backwards the level of the fourth humeral setiferous puncture.

Pronotum markedly cordiform, transverse (ratio PL/PW: 0.83), wider than head, widest at the anterior fifth; disc moderately convex; lateral sides curved in front, shortly and deeply sinuate towards hind angles, which are acute and prominent outside; marginal furrows wide and deep; anterior margin gently arcuate, front angles effaced; base curved in the centre; basal foveae very deep.

Elytra elongate (ratio EL/EW: 1.89), widened in the middle, much wider than prothorax; disc depressed; humeri rounded but evident, with pre-humeral margins oblique; lateral furrows wide and deep. Apical lobe almost indistinct. Striae 1–4 deeper, visible, finely punctuate, 5–8 effaced. Intervals 2-4 slightly convex, interval 6 slightly convex at apex. Apical striola slightly distinguishable, apical carina effaced. Chaetotaxy as in Fig. 1: three setiferous discal punctures (two discal, one pre-apical) on stria 3; umbilicate pores 5 and 6 moved at the apical third of elytron, very close to each other; apical and angulo-apical punctures present, forming with the pre-apical puncture an apical triangle.

Legs long but robust; protibiae dilated, pubescent on the anterior side, not grooved on the external side; protarsi in male each with two basal tarsomeres dilated and denticulate inwards. Tarsal claws long and curved.

Male genitalia as in Figs 7–9. Median lobe of aedeagus long (1.26 mm), slender, in lateral aspect straight, sinuate on the dorsal side, hooked on both the dorsal and ventral sides at apex. Basal bulb and basal sagittal carina not distinguishable in the holotype (immature, damaged male genitalia). Parameres long and slender, each with 4 apical long setae. Endophallus without copulatory piece, but armed with a series of small, dense, sclerotized spines in dorsal-apical position.

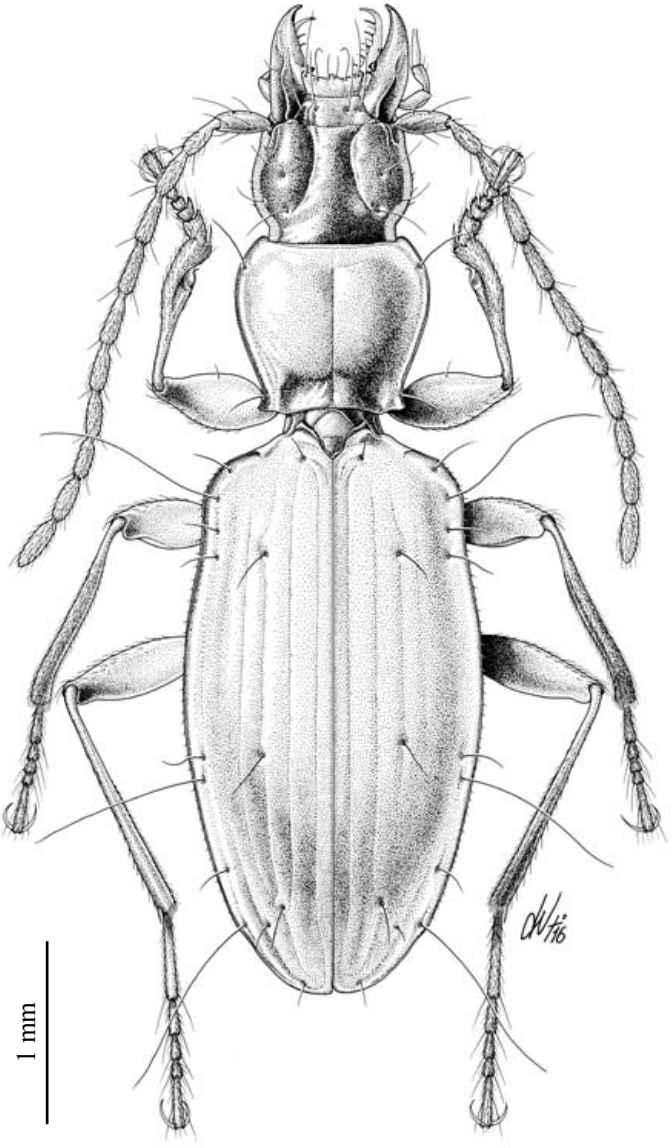
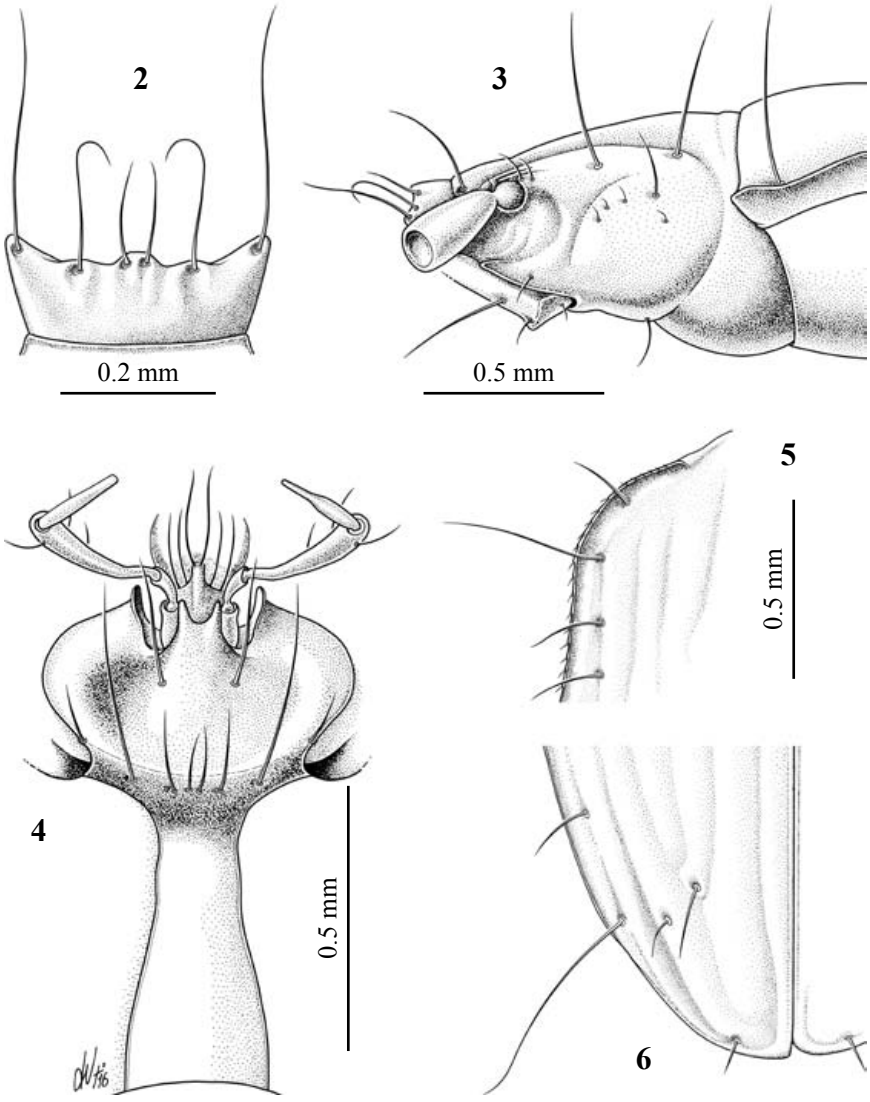


Fig. 1 – *Nesaeoduvalius* (gen. n.) *vailatii* sp. n., HT ♂, Habitus.

Specific epithet. We wish to dedicate this species to our good friend Dante Vailati (Brescia, Italy), excellent speleologist and explorer of subterranean environments in Greece and everywhere, who sampled the only specimen known so far of this interesting new taxon.

Geographical distribution and habitat. The only male specimen of the new species here described was sampled on the Eastern slope of Mt. Dirfis, near the place named Lirí, along the road from S. Dirfios to A. Iríni (Euboia Island, Central-Eastern Greece) at 1080 m of altitude, un-



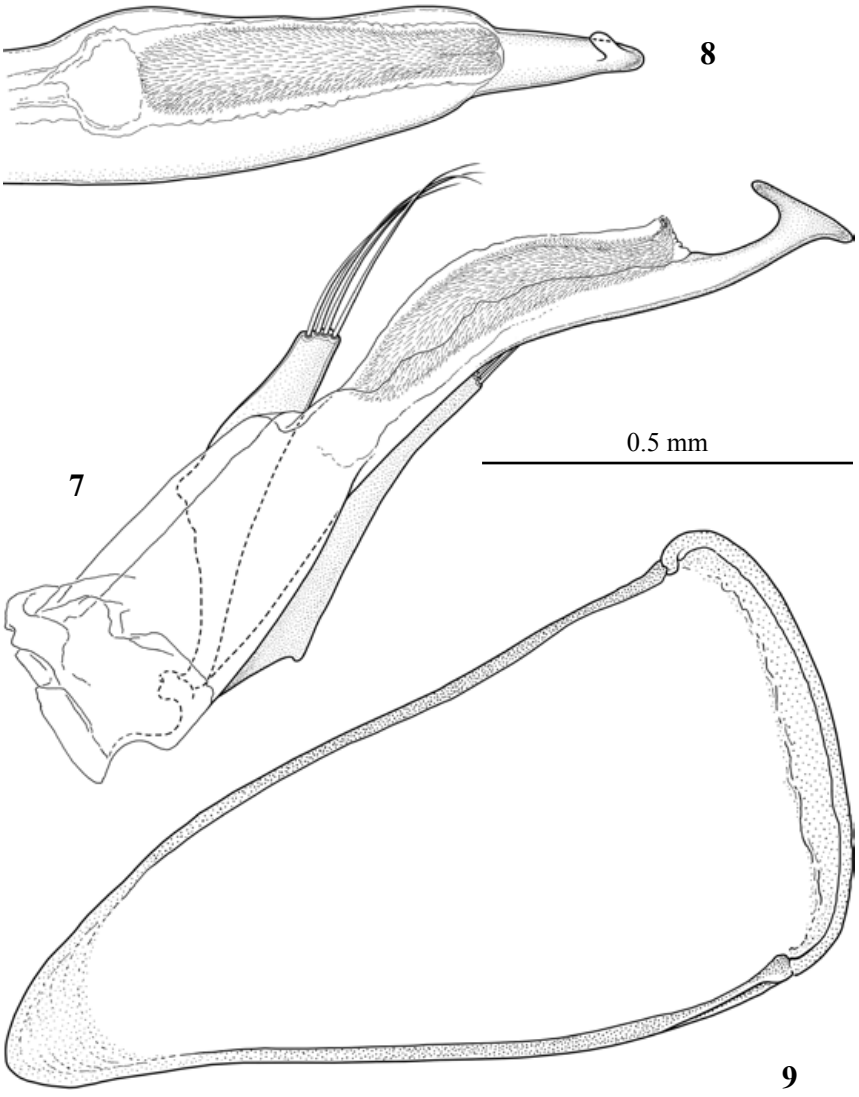
Figs 2-6 – *Nesaeoduvalius* (gen. n.) *vailatii* sp. n., HT ♂: **2**, labrum; **3**, head in lateral view; 4, mentum; **5**, elytron shoulder; **6**, elytron apex.

der stones near the snow (Figs 10–11). Like many Trechini species of the Euro-Mediterranean area, it is an upper hypogean species in the alpine zone. This specimen was sampled during the first survey to the island by P.M. Giachino and D. Vailati in 1998. Later, in the following years (1999, 2000, 2002, 2003, 2004, 2005, 2006, 2010, 2011, 2012, 2014), they investigated with care the same biotope, and caves and subterranean superficial habitat (M.S.S.) of the same and close mountains, and in different environmental conditions (presence or absence of snow, more or less dried substrate), but were not able to collect any further specimen of this species.

Morphological features (body flattened, eyes fully absent, serrate lateral margins of elytra, legs robust, protibiae without external furrows), its extreme rarity in investigated environments, and its absence in caves of the island, indicate a high grade of specialization of this species to life in fissures of superficial subterranean compartments (Giachino & Vailati 2010), where only in particular environmental (climatic) conditions it is likely possible to meet it.

Relationships

Nesaeduvalius (new genus) *vailatii* sp. nov. is particularly interesting for both taxonomical and biogeographical aspects. Its peculiar, apomorphic features, and its isolation on an island merit the institution of a new genus. We have to stress that the Euboia (Evvia) island, despite its position relatively close to the eastern coast of continental Greece, hosts some peculiar, very isolated subterranean genera and species which don't show apparent relationships with any continental taxon. As examples, amongst carabids, we should cite the exceptional, big-sized spho-



Figs 7-9 – *Nesaeoduvalius* (gen. n.) *vailatii* sp. n., HT ♂: **7**, aedeagus in lateral view; **8**, eadeagus in dorsal view; **9**, IX genital segment.

drine *Hystrichosphodrus vailatii* Casale & Giachino, 2004 and, amongst cholevids Leptodirini, *Henrotiella eubeensis* Perreau, 1999, from the cave of Agia Triada near Káristos (South Euboia).

The genus *Duvalius* as a whole in the Balkan peninsula includes, in the current taxonomic treatment, a high number of species (Moravec et al. 2003; Lorenz 2005). The validity of some so-called "genera" recently described has been widely debated by Lohaj & Mleinek (2013) and Ćurčić et al. (2013). Personally, we are inclined to preserve this genus as a monophyletic unit (Casale et al. 2013), as perfectly established by Jeannel (1928) and confirmed by molecular data (Faille et al. 2013), despite the heterogeneity of morphological features of species ascribed to the genus (epigean or hypogean, pigmented or depigmented, winged or micropterous, oculate, microphthalmous or blind). As for aphaenopsoid Dinaric and Balkan genera of the "anisotopic" lineages, in which the diagnostic features are mostly based on plesiomorphic characters, or derived by different grades of specialization, relationships amongst the different species of *Duvalius* in this area remain unclear, and hidden by features corresponding to different grades of evolution, radiation, and adaptation to the subterranean way of life (Quéinnec 2008).

We proposed however a generic rank for this new taxon of the Euboia island because the combination of the unique, peculiar characters described above, and for its geographical isolation by the closest continental relatives of the genus *Duvalius* (in the widest sense), which are very numerous: 47 species described so far in Greece (Crete island included), and many others not yet described (Casale, Giachino & Vailati, in progress).

As illustrated by Jeannel (1928), Casale (2011a), Casale & Vigna Taglianti (1999), Casale et al. (2013), in

Fig. 10 – Type locality of *Nesaeoduvalius* (gen. n.) *vailatii* sp. n. on May 29th, 1998, as the type specimen was found.

Fig. 11 – Outlook of type locality of *Nesaeoduvalius* (gen. n.) *vailatii* sp. n. in Dirfis Mountain, along the road S. Dirfios - A. Iríni at 1080 m.

Greece the genus *Duvalius* includes so far representatives of many different groups (or subgenera of authors), belonging to the southern Balkan *krueperi*, *georgi*, *oertzeni*, *olympiadicus*, *fuchsi*, *wichmanni*, *taygetanus*, *ionicus* and *sbordonii* species group, to the Balkan, Carpathian, Dinaric *Biharotrechus* Bokor, 1922 (= *Duvaliotes* Jeannel, 1928), *Hungarotrechus* Bokor, 1922 (= *Duvalidius* Jeannel, 1928) and Dinaric *Euduvalius* subgenera, and to the "Southern Aegean" (Anatolian) lineage of *Duvalius huetheri* Jeannel, 1934, with two isolated species both endemic to Mt. Taygetos (Greece, Peloponnesus): *D. diaphanus* Rottenberg, 1874, and *D. mirei* Deuve, 2001 (Casale & Lebenbauer, 2011). The subgenus *Paraduvalius* Knirsch, 1924 is localized with a few species in the north-eastern Rhodopes area of the country.

Nesaeoduvalius vailatii shares some characters with different subgenera or species groups of *Duvalius* in the widest sense: owing to its glabrous body with pubescent genae, the complete frontal furrows, elytra with setae of the lateral umbilicate series all "aggregate" and vanished external striae, and fore tibiae without external furrows, it shows any relationships with the Carpathian and Balkan *Hungarotrechus* species. The median lobe of aedeagus with axe-shaped, hooked apical lamina is similar to that of *D*. (*Hungarotrechus*) *merkli* (Frivaldsky, 1877) from Transylvania (see Jeannel, 1928: fig. 1791), whereas the endophallus without a copulatory piece, substituted by sclerotized spines in dorsal position, is shared with the oculate and isolated *D*. (*Platyduvalius*) *macedonicus* (G. Müller, 1917). The labrum with a median tooth on the anterior margin is shared with some Greek species of the *krueperi* group of authors, as *D*. (*Duvalius*) *milenae* Casale, 1983.

Concerning some lineages of *Duvalius* in the Balkan and Anatolian peninsula, the validity and limits of the Subgenus *Duvaliotes* Jeannel, 1928, and its distinction from the Subgenus *Duvalidius* Jeannel, 1928, currently treated as synonyms of *Biharotrechus* Bokor, 1922 and *Hungarotrechus* Bokor, 1922, respectively (see Moravec et al. 2003 and Lorenz 2005) have been widely debated by Casale & Vigna Taglianti (1984) and Casale (2011 b).

Conversely, in *Nesaeoduvalius* some other informative apomorphic features are absolutely unique, i.e. the general shape of body, the occurrence of an additional temporal seta, elytra with serrate humeral and lateral margins and vanished both apical lobe and apical stria. In particular, serrate humeral angles and lateral margins of elytra are a character present in endogean taxa of Trechini of the *Cimmerites* lineage and, amongst other tribes of carabid beetles, in Clivinini Reicheiina and Bembidiini Anillina, but absent in all genera of the *Duvalius* phyletic lineage. These characters, associated with its insular, isolate geographical distribution (no *Duvalius* species is known from Euboia island), support the institution of *Nesaeduvalius* as a new genus distinct from all described taxa currently attributed to *Duvalius* and related "isotopic" genera.

In this case, we could hypothesize an ancient origin of *Nesaeoduvalius vailatii* as an extant taxon derived by a common ancestor (with *Biharotrechus*, *Hungarotrechus* and *Platyduvalius*), now extinct, of a phyletic lineage of continental (Carpathian and Balkan) *Duvalius* lineage in isolated massifs of the eastern Aegean coast.

Molecular phylogenies, like those recently performed in different areas (see Faille et al. 2010, 2013) and further discoveries of new taxa should provide in the future new and interesting information on these lineages of Dinaric and Balkan subterranean carabids, speciated and radiated in mountains and islands of a very complex geographical area.

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