



Research article

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A review of the powderpost beetle genus, *Xylopertha* Guérin-Ménéville, 1845, with a new species and new synonymy (Coleoptera: Bostrichidae: Bostrichinae: Xyloperthini)

Lan-Yu LIU^{1,*} & Roger A. BEAVER²

¹Department of Science Communication, National Pingtung University, No.4-18, Minsheng Rd, Pingtung City, Pingtung County 90049, Taiwan.

²161/2 Mu 5, Soi Wat Pranon, T. Donkaew, A. Maerim, Chiangmai 50180, Thailand.

*Corresponding author: liulysky@gmail.com

²Email: rogerbeaver6@gmail.com

¹[urn:lsid:zoobank.org:author:8A4ECE7C-2607-440D-B1BC-6E3B05EF02BB](https://zoobank.org/author:8A4ECE7C-2607-440D-B1BC-6E3B05EF02BB)

²[urn:lsid:zoobank.org:author:EEF5C471-ECFB-4786-8E2F-13C5B5EC4F0D](https://zoobank.org/author:EEF5C471-ECFB-4786-8E2F-13C5B5EC4F0D)

Abstract. We review the three species currently placed in the genus *Xylopertha* Guérin-Ménéville, 1845, and describe a new species, *Xylopertha elegans* sp. nov., from Turkey. We propose the following new synonymy: *Xylopertha* Guérin-Ménéville, 1845 (= *Paraxylogenes* Damoiseau, 1968); *Xylopertha reflexicauda* (Lesne, 1937) (= *Paraxylogenes pistaciae* Damoiseau, 1968). We give details of the sexual dimorphism, and summarise information on the distribution and biology of all species. A key to the species of *Xylopertha* is provided.

Keywords. Biogeography, key, new species, new synonymy, *Paraxylogenes*.

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Introduction

The tribe Xyloperthini Lesne, 1921 is the most species-rich in the Bostrichidae Latreille, 1802, and currently includes 34 genera (Borowski & Węgrzynowicz 2007; Park *et al.* 2015; Liu *et al.* 2016a). The tribe has a worldwide distribution, but the individual genera are mostly confined to a single zoogeographical region or subregion (Borowski & Węgrzynowicz 2007).

The genus *Xylopertha* Guérin-Ménéville, 1845 was erected in a key to bostrichid genera, for several species previously included in the genus *Apate* Fabricius, 1775. In a footnote, Guérin-Ménéville (1845) listed the ‘types’ of the genus as “*Apate minuta* Fabricius, *truncata* Dejean, *longicornis* Fabricius, *sinuata* Fabricius, etc.”. *Apate sinuata* Fabricius, 1792 was selected as type species of the genus by Gorham (1883). Of the remaining species, *truncata* is a *nomen nudum*, *minuta* is now placed in *Dinoderus* Stephens, 1830, and *longicornis* in *Tetrapriocera* Horn, 1878 (Fisher 1950). Lesne (1901) erected a new genus, *Xylonites* Lesne, 1901, for two species, *X. retusus* (Olivier, 1790), originally described in the genus

Bostrichus Geoffroy, 1762 (Olivier 1790), and *X. praeustus* (Germar, 1817), originally described in the genus *Apate* Fabricius, 1775 (Germar 1817). However, Schilsky (1899) synonymised *Apate sinuata*, the type species of *Xylopertha*, with *Xylonites retusus*. Fisher (1950) synonymised *Xylonites* Lesne, 1901 with *Xylopertha* Guérin-Méneville, 1854. The species included by Lesne (1901) in the genus *Xylopertha* sensu Lesne 1901, were transferred to a new genus, *Xyloperthella* Fisher, 1950 (Fisher 1950). Two more species have been added to *Xylopertha* since the publication of the monograph of Lesne (1901), *X. reflexicauda* (Lesne, 1937), and *X. dunensis* (Rai & Chatterjee, 1964). *Xylopertha dunensis* has been synonymised with *X. praeusta* (Germar, 1817) by Borowski & Singh (2017). Thus, *Xylopertha* currently includes three species (Borowski & Węgrzynowicz 2007; Borowski & Singh 2017).

In this paper we review the three species currently included in *Xylopertha*, and describe one further species, *X. elegans* sp. nov. We synonymise *Paraxylogenes* Damoiseau, 1968 with *Xylopertha*, and *Paraxylogenes pistaciae* Damoiseau, 1968 with *X. reflexicauda*. We also provide a key to the four species now included in *Xylopertha*.

Material and methods

In the course of this study, the senior author has examined all available types, and other specimens of Xyloperthini in the Paris Museum, other European museums, and certain private collections. We have examined type materials or reliably identified specimens of 31 out of 34 genera included in the tribe, and have checked the descriptions of the remaining three genera.

The following abbreviations are used for Museums and other collections:

IFRI	=	Indian Forest Research Institute, Uttar Pradesh, Dehra Dun, India
IRSNB	=	Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium
LYL	=	Private collection of Liu Lan-Yu, Yilan, Taiwan
MAIC	=	Private collection of Michael Ivie, Bozeman, USA
MIZPAN	=	Entomological department, Muzeum i Instytut Zoologii Polskiej Akademii Nauk, Warsaw, Poland
MNB	=	Entomological department, Museum für Naturkunde Berlin, Berlin, Germany
MNHN	=	Muséum national d'Histoire naturelle, Paris, France
MTM	=	Zoological Department, Magyar Természettudományi Múzeum, Budapest, Hungary
NHMUK	=	The Natural History Museum, London, United Kingdom
NMBS	=	Entomological department, Naturhistorisches Museum Basel, Basel, Switzerland
NME	=	Entomological department, Naturkunde Museum Erfurt, Erfurt, Germany
NMNH	=	National Museum of Natural History, Washington, USA
NMPC	=	Narodni Muzeum, Entomologické odd., Praha, Czech Republic
NMS	=	Entomological Department, Naturkunde Museum, Museum am Löwentor, Stuttgart, Germany
NMW	=	Entomological department, Naturhistorisches Museum Wien, Vienna, Austria
SDEI	=	Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany
SNSD	=	Senckenberg Naturhistorische Sammlungen, Dresden, Germany
ZMHB	=	Museum für Naturkunde der Humboldt-Universität, Berlin, Germany
ZSM	=	Zoologische Staatssammlung München, Munich, Germany

Photographs were taken with a Panasonic Lumix GX8 digital camera, combined using the program CombineZP, and optimized with Adobe Photoshop CS2.

The descriptions of the species are mainly based on Lesne (1901, 1937), with additional characters obtained from the examination of specimens from the museums and collections listed above, and dissection of specimens in LYL.

Actual quotations from data labels are enclosed in square brackets.

Results

Taxonomic account

Superfamily Bostrichidae Latreille, 1802

Family Bostrichidae Latreille, 1802

Subfamily Bostrichinae Latreille, 1802

Tribe Xyloperthini Lesne, 1921

Genus *Xylopertha* Guérin-Méneville, 1845

Figs 1–4

Xylopertha Guérin-Méneville, 1845: XVII.

Xylonites Lesne, 1901: 575. Synonymy: Fisher 1950: 143.

Paraxylogenes Damoiseau, 1968: 1, **syn. nov.**

Type species

Type species of *Xylopertha*: *Apate sinuata* Fabricius, 1792 (Fabricius 1792: 362). Subsequent designation by Gorham (1883: 215).

Type species of *Xylonites*: *Bostrichus retusus* Olivier, 1790 (Olivier 1790: 110). Subsequent designation by Fisher (1950: 143). Synonymy of *Apate sinuata* with *Xylopertha retusa*: Schilsky (1899: 291).

Type species of *Paraxylogenes*: *Paraxylogenes pistaciae* Damoiseau, 1968 (Damoiseau 1968: 4). Original designation.

Diagnosis

Xylopertha is the type genus of Xyloperthini Lesne (1921). The tribe is characterised by the lamelliform intercoxal process of the first abdominal ventrite, and the mandibles crossed at the tips (Lesne 1921; Fisher 1950; Liu & Schönitzer 2011). The genus is distinguished from all other genera of Xyloperthini by the following combination of characters: frons with upwardly directed hairs (Fig. 2); antenna with nine antennomeres, the funicle with four and the club with three antennomeres, antennomeres of club lacking stiff, erect hairs, with indistinct sensory impressions near the apex of antennomeres 7 and 8, but absent on the last antennomere; pronotum without a lateral carina; elytral suture raised on declivity, but not strongly swollen; last ventrite of male with pleural pieces at sides; last ventrite of female emarginate.

Compared with the other five genera of Xyloperthini with nine antennomeres which occur in the same geographical area as *Xylopertha*, *Scobicia* Lesne, 1901 can be distinguished by the strong swelling of the suture on the elytral declivity in both sexes, and the last ventrite of the female is entire not emarginate; *Psicula* Lesne, 1941 is distinguished by the presence of an uncus on the anterior angles of the pronotum in both sexes, and the absence of pleural pieces in the male; *Enneadesmus* Mulsant, 1851 and *Xylogenes* Lesne, 1901 have distinctly delimited sensory areas on the first two segments of the antennal club, and the females of *Enneadesmus* have the last ventrite entire. The synonymy of *Paraxylogenes* with *Xylopertha* is discussed later in the paper.

Description

BODY. Elongate, cylindrical, 4–8 mm long.

HEAD. Deeply inserted in prothorax, not visible from above. Frons simple, finely punctured, with fine, upwardly directed hairs, denser and much longer in female, fronto-clypeal suture distinct at sides,

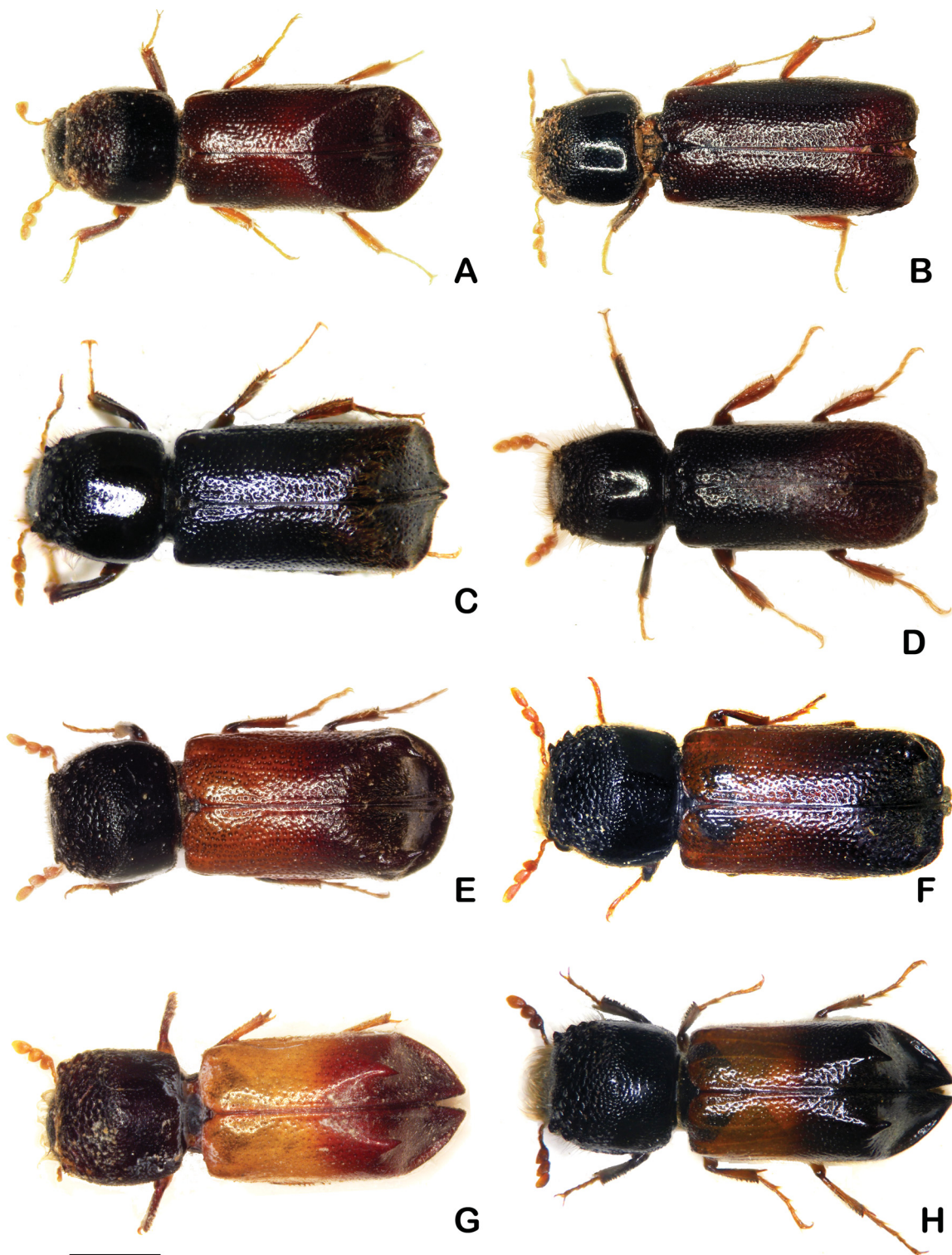


Fig. 1. Dorsal view of species of *Xylopertha* Guérin-Ménéville, 1845. **A.** *Xylopertha elegans* sp. nov., ♂. **B.** *X. elegans* sp. nov., ♀. **C.** *X. retusa* (Olivier, 1790), ♂. **D.** *X. retusa* (Olivier, 1790), ♀. **E.** *X. praeusta* (Germar, 1817), ♂. **F.** *X. praeusta* (Germar, 1817), ♀. **G.** *X. reflexicauda* (Lesne, 1937), ♂. **H.** *X. reflexicauda* (Lesne, 1937), ♀. Scale bar = 1 mm.

strongly impressed in middle; clypeus transverse, finely and densely punctured; labrum transverse with a fringe of long hairs along anterior margin. Mandibles subequal, sharply pointed. Eyes small, oval, strongly projecting. Antenna with 9 antennomeres, first antennomere elongate, about twice as long as oval second, antennomeres 3–6 forming a loose funicle, each antennomere transverse, the fifth widest, together about as long as first antennomere of club, antennomeres 7–9 forming the elongate, compressed club, each antennomere of club with a dense covering of short, recumbent hairs, lacking distinct, clearly defined sensory impressions on all segments, antennomeres 7 and 8 subquadrate, subequal in length, last antennomere more elongate, oval.

PRONOTUM. Slightly wider than long, anterior angles with a small upcurved tooth without an uncus inserted a little behind margin, anterior margin between teeth slightly concave, not depressed behind the margin; area above anterior margin flat or weakly impressed, strongly, densely punctured, without teeth;

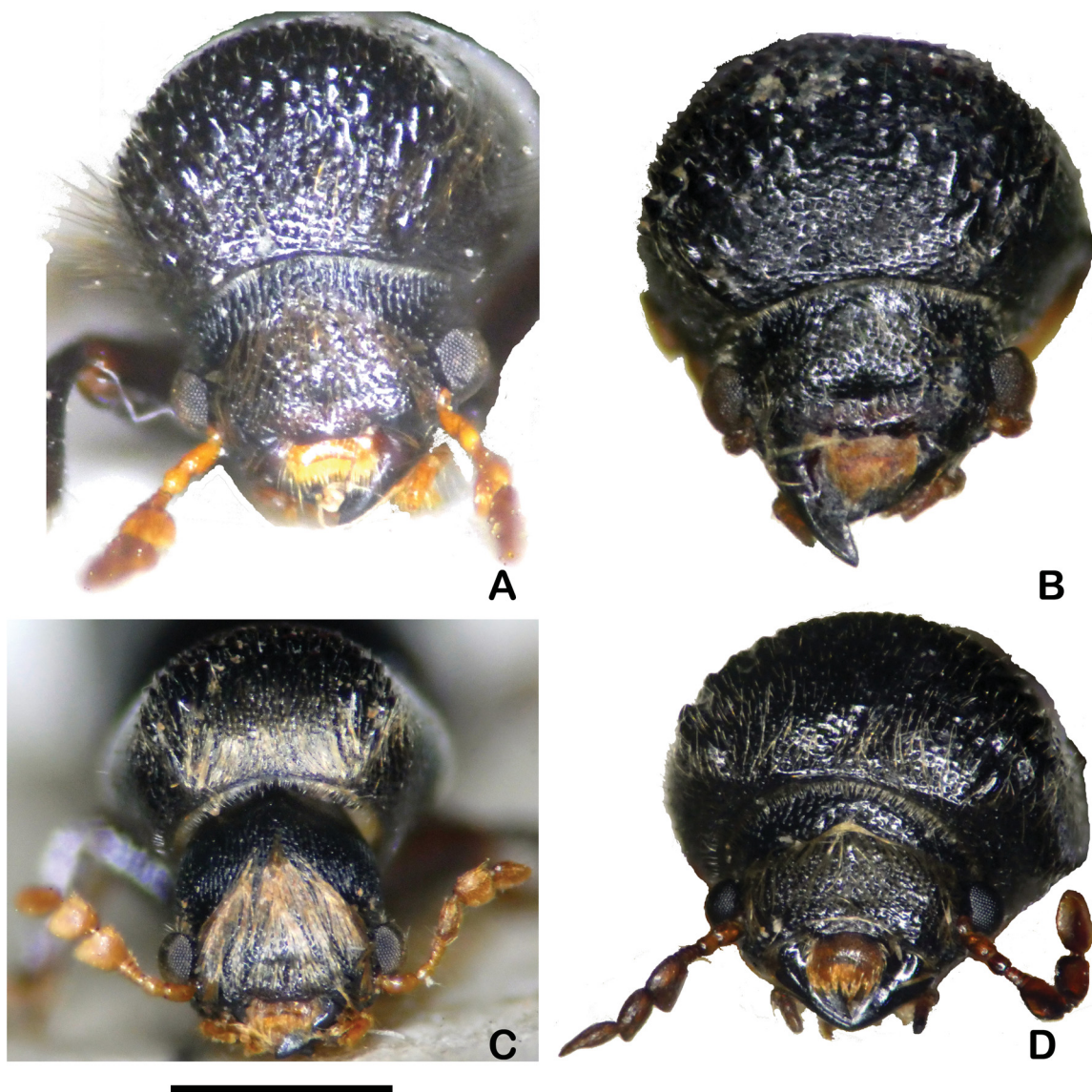


Fig. 2. Frontal view of the females of species of *Xylopertha* Guérin-Ménéville, 1845. **A.** *Xylopertha retusa* (Olivier, 1790). **B.** *X. praeusta* (Germar, 1817). **C.** *X. elegans* sp. nov. **D.** *X. reflexicauda* (Lesne, 1937). Scale bar = 1 mm.

sides moderately to broadly rounded, converging more strongly anteriorly, posterior angles broadly rounded, without a lateral carina, postero-lateral area with fine rugulosities; disc smooth, shining, indistinctly punctured, glabrous; anterior slope with 3 or 4 large, upcurved teeth antero-laterally on each side behind the marginal tooth, with smaller teeth between them.

SCUTELLUM. Small, tongue-shaped, shining, finely punctured.

ELYTRA. Subequal to pronotum in width, strongly convex, shining, strongly, rather evenly punctured on disc, glabrous anteriorly, the declivity usually strongly sexually dimorphic (Fig. 1A–F).

LEGS. Subequal in length, procoxae contiguous, mesocoxae narrowly separated, protibiae grooved on external face, widened to apex, posterior tibiae with long hairs on outer side. Second and third segments of tarsi usually distinctly wider than the following segments.

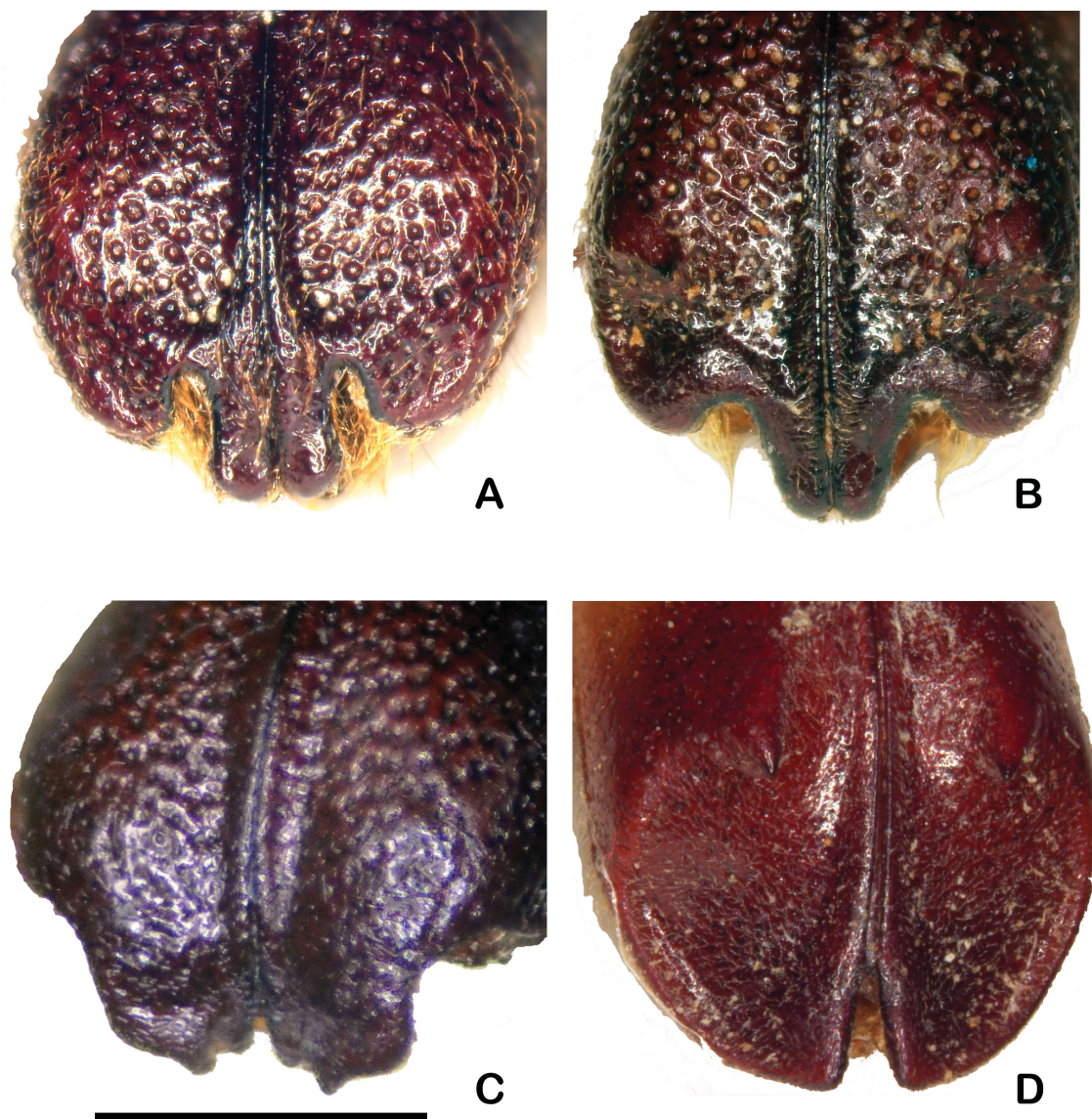


Fig. 3. Declivity of the females of species of *Xylopertha* Guérin-Méneville, 1845. **A.** *Xylopertha retusa* (Olivier, 1790). **B.** *X. praeusta* (Germar, 1817). **C.** *X. elegans* sp. nov. **D.** *X. reflexicauda* (Lesne, 1937). Scale bar = 1 mm.

ABDOMEN. Intercostal process of first abdominal ventrite lamelliform, the ventral face a little widened in one species (*X. praeusta* (Germar, 1817)).

Sexual dimorphism

The genus shows strong sexual dimorphism in both the vestiture of the frons, and in the form and sculpture of the elytral declivity (except in *X. reflexicauda*), as well as in the genitalia. In the female the frons is more densely and finely punctured, and the upwardly directed hairs are much longer and denser than in the male. In the male, the elytral declivity is more angularly separated from the disc, and the elytral apices are either conjointly rounded or separated by a small V-shaped emargination. In the female, the disc curves more evenly into the declivity, and the elytral apices are strongly emarginate, the emargination partly filled by a pair of ventrally-directed processes (Fig. 3A–C) (except in *X. reflexicauda*; Fig. 3D). The last abdominal ventrite of the male has pleural pieces which converge posteriorly towards the midline; these are absent, and the last ventrite is emarginate in the female.

Distribution

Southern and central Europe, North Africa and Middle East.

Biology

The adults of *Xylopertha* are polyphagous, usually attacking a taxonomically wide variety of host trees, although they may appear to show some host preferences. They bore into twigs and branches, where they construct a short gallery, usually consisting of a circumferential and one or more longitudinal branches in which the eggs are laid (Liu *et al.* 2008). The larvae bore through the wood making extensive galleries filled with fine wood particles and excreta. The new generation of adults emerges through the bark, but may reattack the same stem, so that the whole of the sapwood is eventually converted into fine powder

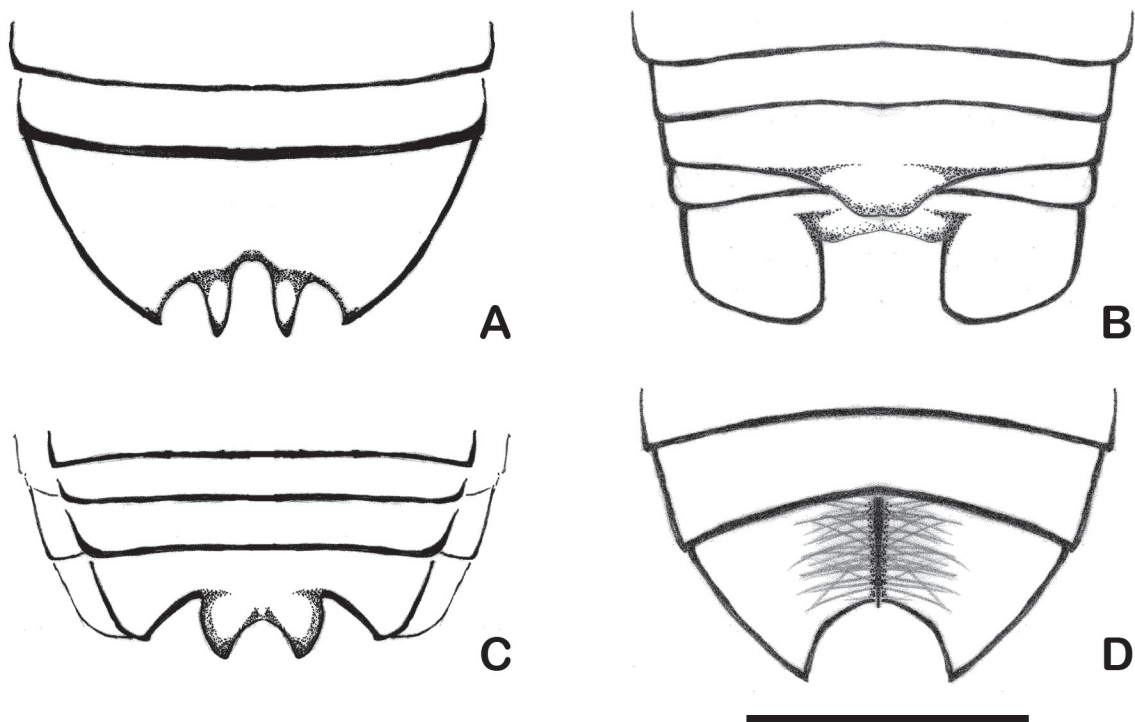


Fig. 4. Last 3 or 4 visible abdominal ventrites of females of species of *Xylopertha* Guérin-Ménéville, 1845. **A.** *Xylopertha retusa* (Olivier, 1790). **B.** *X. elegans* sp. nov. **C.** *X. praeusta* (Germar, 1817). **D.** *X. reflexicauda* (Lesne, 1937). Scale bar = 1 mm.

(Liu *et al.* 2008). The development time is variable depending on local conditions, and may vary from a few weeks to over a year (Beeson & Bhatia 1937).

Xylopertha elegans sp. nov.

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Figs 1A–B, 2C, 3C, 4B, 5E–F

Amongst the bostrichid collection in the Staatliche Naturhistorische Sammlungen, Dresden (now Senckenberg Naturhistorische Sammlungen, Dresden), the senior author found a series of specimens identified as a new species of *Xylopertha* by J.M. Vrydagh, but not described. Further specimens were found in the Museum für Naturkunde, Berlin. This species is described here using the specific name suggested by Vrydagh.

Etymology

The specific epithet '*elegans*' used by Vrydagh, is from the Latin word for 'elegant' or 'handsome'.

Material examined

Vrydagh selected a holotype, allotype and four paratypes from SNSD, and one paratype from ZMHB. However, the holotype and allotype he selected are in poor condition, and we have accordingly selected a new holotype and allotype in better condition from the same series.

Holotype

TURKEY: ♂, [Anatolia, Toros, Karaman, Habiller], (no date), [Muche leg.] (ZMHB).

Allotype

TURKEY: ♂, same data as for holotype (SNSD).

Paratypes

TURKEY: 6 ♂♂, 6 ♀♀, same data as for holotype (4 ♂♂, 3 ♀♀ in SNSD; 1 ♂, 2 ♀♀ in ZMHB; 1 ♂, 1 ♀ in LYL).

Description

Male

BODY. 4–5 mm long, about 3.5 times as long as wide. Head, pronotum and ventral side black, elytra dark reddish brown, antennae, mid- and hind-legs paler.

HEAD. Clypeus finely punctured, with a pair of small rounded projections on either side of mid-line, slightly emarginate laterally. Fronto-clypeal suture distinct, with a median fovea. Frons simple with sparse, fine punctures, each puncture with an upwardly-directed short hair, a pair of very long hairs on each side near the eyes directed towards the midline. Antennae 9-segmented, segments 3–6 together slightly shorter than last segment of club, first and second segments of club slightly wider than long, with small, indistinct areas of dense sensillae, third segment more elongate, and longer than previous segments, without areas of dense sensillae.

PRONOTUM. About 1.1 times wider than long, anterior margin slightly concave, sides quite strongly rounded, widest in basal third, anterior slope quite strongly granulate-punctate in middle above head, without long hairs antero-laterally, disc shining, with very sparse, fine punctures bearing very short hairs.

SCUTELLUM. Tongue-shaped.

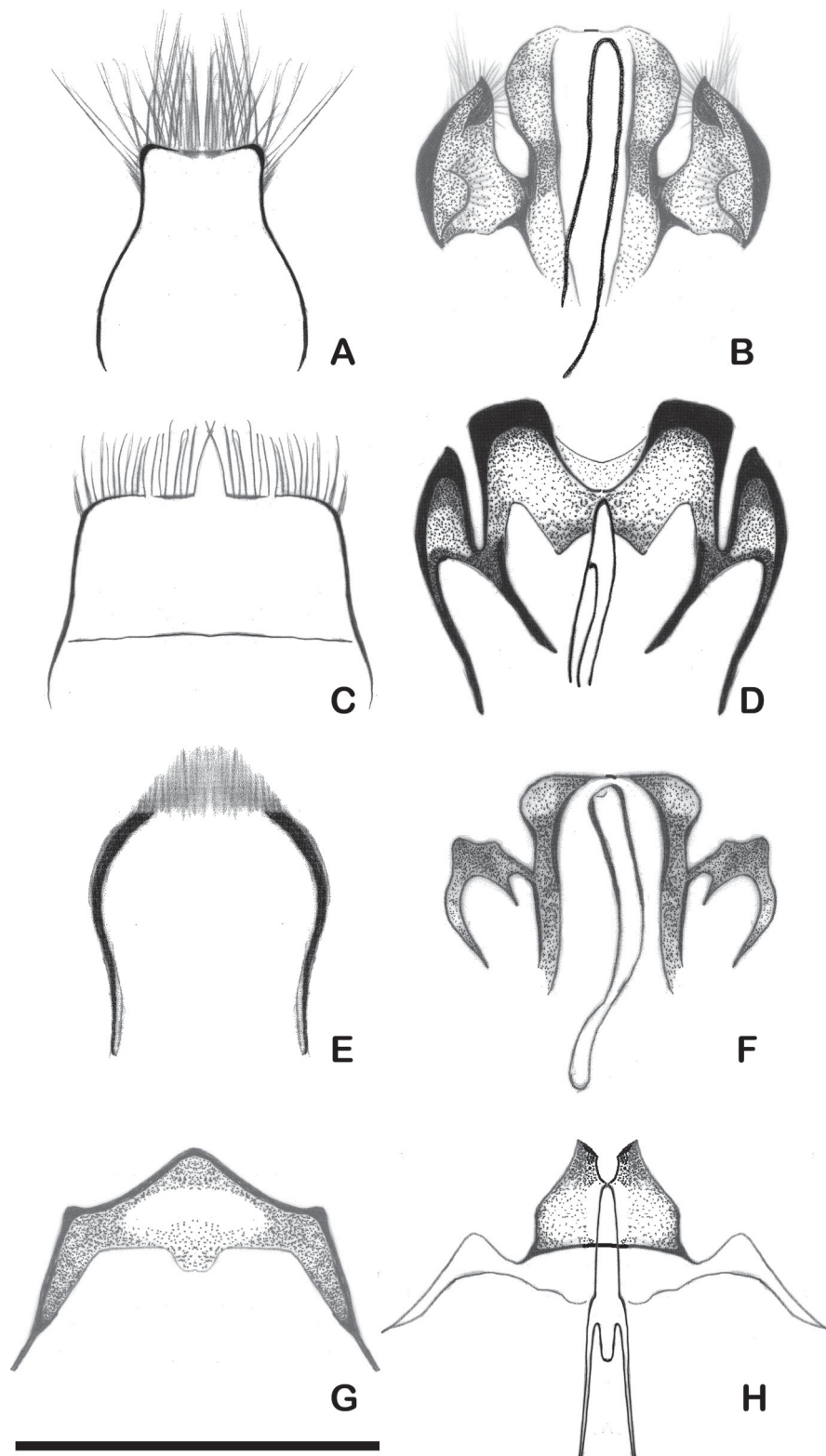


Fig. 5. Male 8th tergite, 5th ventrite and aedeagus of species of *Xylopertha* Guérin-Méneville, 1845. **A.** *Xylopertha retusa* (Olivier, 1790), 8th tergite. **B.** *X. retusa* (Olivier, 1790), 5th ventrite and aedeagus. **C.** *X. praeusta* (Germar, 1817), 8th tergite. **D.** *X. praeusta* (Germar, 1817), 5th ventrite and aedeagus. **E.** *X. elegans* sp. nov., 8th tergite. **Figure F.** *X. elegans* sp. nov., 5th ventrite and aedeagus. **G.** *X. reflexicauda* (Lesne, 1937), 8th tergite. **H.** *X. reflexicauda* (Lesne, 1937), 5th ventrite and aedeagus. Scale bar = 1 mm.

ELYTRA. 2.5–2.8 times longer than wide, parallel-sided, shining, disc and sides with confused, dense, moderately strong punctures, bearing minute hairs; declivity commencing a little behind middle, angularly separated from disc, its upper margin without long, erect hairs, the upper part almost flat, a weak transverse convexity just below middle, apical part weakly concave, the apex strongly extended, a short V-shaped emargination separating the pointed elytral apices, declivital margins forming a distinct rim at the sides and apex, puncturation and vestiture similar to disc, the suture raised in middle part of declivity (Fig. 1A).

LEG. Anterior tibiae broadly grooved on external face. Second and third segments of tarsi distinctly wider than the following segments.

ABDOMEN. Abdominal ventrites finely, moderately densely punctured, the punctures with moderately long, whitish hairs; fifth ventrite with large pleural pieces, converging strongly towards apex of ventrite. Aedeagus simple, without long apophyses (Fig. 5E–F).

Female

BODY. Generally similar to male, but differentiated as follows.

HEAD. Clypeus and frons more densely punctured, the punctures with very long yellowish hairs directed towards vertex and partly concealing surface.

PRONOTUM. Anterior face of pronotum wider, very densely, finely punctured, above the head the punctures with very fine, very long, upwardly directed hairs, discal punctures slightly larger and denser.

ELYTRA. 2.6–2.9 times as long as wide, elytral puncturation coarser and denser, disc gradually curving into declivity in apical quarter, declivity very steep, deeply grooved on either side of the raised suture (Fig. 1B), the sides gibbous without a spine or tubercle, the apex of each elytron projecting as a broad approximately rectangular process, its apex with a small pointed tooth next to the suture, the processes separated by a shallow U-shaped emargination, a broad emargination lateral to each process, the edge of the emargination with a fringe of short hairs (Fig. 3C).

ABDOMEN. Abdominal 3rd ventrite projecting medially over 4th ventrite, which is only visible at sides, 5th ventrite very deeply, broadly emarginate, the base of the emargination projecting ventrally as a thin lamina behind the process on the 3rd ventrite and concealing the middle part of the 4th ventrite (Fig. 4B).

Distribution

Central Turkey (Anatolia).

***Xylopertha reflexicauda* (Lesne, 1937)**

Figs 1G–H, 2D, 3D, 4D, 5G–H

Xylonites reflexicauda Lesne, 1937: 199.

Paraxylogenes pistaciae Damoiseau, 1968: 4, **syn. nov.**

Xylopertha reflexicauda – Borowski & Węgrzynowicz 2007: 145.

Paraxylogenes reflexicauda – Buse *et al.* 2013: 690, 692.

Damoiseau (1968) erected the genus *Paraxylogenes* for five specimens collected in Iraq and Pakistan in the wood of pistachio trees (*Pistachia vera*). The genus is monobasic with *P. pistaciae* Damoiseau, 1968

being the only species. Damoiseau (1968) separated the genus from four other genera of Xyloperthini with species having nine antennomeres, but failed to compare it with *Xylopertha*.

We have examined male and female syntypes of *Xylopertha reflexicauda* from Pakistan (MNHN), the holotype male, allotype female, and three female paratypes of *Paraxylogenes pistaciae* from Iraq and Pakistan (NHMUK, IRSNB), and further specimens from South Europe and Middle Asia in LYL, NMPC and IRSNB. It is clear that only a single species is represented, and *P. pistaciae* is here synonymised with *X. reflexicauda*. Buse *et al.* (2013) listed *P. pistaciae* as a synonym of *Paraxylogenes reflexicauda* [sic] in a paper on the ecology of oak wood-inhabiting beetles in Israel, but made no further comments, and gave no indication that they had examined type material. The synonymy of the only species of *Paraxylogenes* with *X. reflexicauda* automatically makes *Paraxylogenes* a synonym of *Xylopertha*.

We note below that the male and female genitalia of *X. reflexicauda* differ in several respects from those of the other species of *Xylopertha*. However, we do not consider these and other morphological differences sufficient to retain *Paraxylogenes* as a distinct genus from *Xylopertha*.

Diagnosis

Distinguished from *Xylopertha elegans* sp. nov. and *X. retusa* (Olivier, 1790) by the presence of a spine on each elytron in both sexes, the spines smaller in the female. *Xylopertha reflexicauda* differs from *X. praeusta* in the position of the spines, which are located on the middle of the upper margin of the declivity in *X. reflexicauda*, whereas in *X. praeusta* they are located on the dorso-lateral margin of the declivity (Fig. 1E–H). *Xylopertha reflexicauda* is also distinguished from the other three species of *Xylopertha* by the absence of any sexual modification of the apical margin of the elytra. The male and female genitalia differ in certain respects from those of the other three species. The posterior margin of the 8th tergite of the male is sclerotised in *X. reflexicauda* (Fig. 5G), but membranous in the other three species (Fig. 5A, C, E). The posterior margin of the last ventrite of the male is bidentate without a median lobe in *X. reflexicauda* (Fig. 5H), but has a median lobe and a process on either side in *X. elegans* sp. nov. (Fig. 5F) and *X. retusa* (Fig. 5B). In *X. praeusta* (Fig. 5D), the posterior margin is bilobed and lateral processes are present. The aedeagus of *X. reflexicauda* has a pair of long apophyses (Fig. 5H), but the apophyses are absent in the other three species (Fig. 5B, D, F). The last ventrite of the female of *X. reflexicauda* has a strong median ridge (Fig. 4D), which is absent in the other three species (Fig. 4A–C).

Material examined

For *Xylopertha reflexicauda* (Lesne, 1934):

Syntypes

IRAN: 1 ♂, 1 ♀, [Sud Iran, Prov. de Kirman, Krausseri, Env. de Rafssindjan, Kausseri 1937.] (MNHN).

For *Paraxylogenes pistaciae* Damoiseau, 1968:

Holotype

IRAQ: ♂, [Mosul, B 5.2, 10 May 1965, H. Knopf leg.] (NHMUK).

Allotype

PAKISTAN: ♀, [Shingarh, ex *Pistacia* wood, 29 Aug. 1957, F. Entomologist leg.] (NHMUK).

Paratypes

IRAQ: 1 ♀, [Mosul, 22.v.1965, *Pistacia*, 52, F. Shalaly leg.] (NHMUK); 1 ♀, [Nenava, 9 May 1965, breeding, *Pistacia*, 52, F. Shalaly leg.] (IRSNB).

PAKISTAN: 1 ♀, [Shingarh, ex *Pistacia* wood, 29 Aug. 1957, F. Entomologist leg.] (IRSNB).

Additional material

GREECE: 1 ♀, [Crete, Amudarion, 1983, M. Siáma leg.] (LYL) (New record for Greece).

IRAN: 2 ♂♂, 1 ♀, [Prov. Tehran, Karaj, University of Agriculture, 35°47'97" N, 51°00'25" E, 1360 m, 30 Apr. 2010, A. Skale leg.]; 2 ♀♀, same data as previous, [#10, A. Weigel leg., ex *Salix*]; 1 ♂, 1 ♀, [Kaschan, May 1960, A. Davatchi leg.] (all LYL).

The specific identity of more than 70 further specimens was checked in the following museums: IRSNB and MAIC under *X. reflexicauda*; NHMUK and NMPC under *Paraxylogenes pistaciae*, but detailed locality data were not recorded. All specimens came from the distributional area given below.

Description

BODY. 5–7 mm long, about 2.8–3.0 times as long as wide, subelongate, parallel-sided. Head, prothorax, scutellum, metasternum and abdomen black, elytra reddish anteriorly, black posteriorly, antennae and legs reddish, anterior tibiae brown.

HEAD. Above finely punctured, with erect, grey or reddish setae (denser and longer in female), eyes moderate, similar in both sexes; antennae 9-segmented, segments 3–6 very small, 7–9 forming the club, biconvex, subglabrous, sensory impressions scarcely visible, penultimate segment slightly transverse.

PRONOTUM. Subquadrate, about 1.1 times wider than long, the sides weakly curved, widest at middle, with long hairs antero-laterally, anterior angles armed with small, sharp-edged and pointed teeth, the apex not uncinat; posterior part of disc very finely, sparsely punctured.

ELYTRA. Cylindrical part glabrous, fairly strongly punctured (in male sometimes weaker); apical declivity minutely punctured, with dense, recumbent, very short hairs; elytral declivity with a inflated, sharply pointed spine located on the middle of upper margin of the declivity of each elytron (Figs 1G–H, 3D); elytral suture cariniform on declivity; apical margin entire, sutural angles prominent, reflexed, forming a v-shaped emargination, blunt at apex; postepipleura absent.

Male

ELYTRA. Apical declivity of elytra without large punctures, lateral margin subcarinate.

ABDOMEN. Last ventrite whole, pleural parts very distinct. The posterior margin of the 8th tergite of the male is sclerotized, margin of the last ventrite of the male is bidentate without a median lobe (Fig. 5H). The aedeagus has a pair of long apophyses (Fig. 5H).

Female

ELYTRA. Apical declivity of elytra with larger punctures in upper part, laterally not marginate, spines on upper margin smaller than in male, apical margin entire.

ABDOMEN. The last ventrite with a deep incision apically, anterior to the incision a very short, high, longitudinal carina, its summit knife-like, its sides with very long, stiff, red setae standing perpendicular to the carina (Fig. 4D), the surface of the sternite with similar hairs.

Distribution

Israel, Iraq, Iran, Pakistan, Greece (Crete). Intercepted in Australia (PaDIL 2014) and Charleston, SC, USA (NMNH).

Biology

Recorded from pistachio tree wood (*Pistacia vera* L. (Anacardiaceae R. Br.)) in Iraq, Iran and Pakistan (Lesne 1937; Damoiseau 1968; Halperin 1986; Modarres Awal 1997), and this species appears to be its usual host. It is a secondary pest of pistachio in Israel (Halperin 1986). The species is also recorded in Iran from *Quercus* sp. (Fagaceae Dumort), *Ficus carica* L., *Morus alba* L. (Moraceae Link) (Modarres Awal 1997), and *Salix* sp. (Salicaceae Mirb.), and in Pakistan from *Prosopis cineraria* (L.) Druce (= *spicigera*) (Fabaceae Lindl.) (Lesne 1937). Gerstmaier *et al.* (1999) record *Denops albofasciatus* (Charpentier, 1825) (Coleoptera, Cleridae) as a predator in Israel.

Xylopertha retusa (Olivier, 1790)

Figs 1C–D, 2A, 3A, 4A, 5A–B

Bostrichus retusus Olivier, 1790: 110.

Apate sinuata Fabricius, 1792: 362. Synonymy: Schilsky 1899: 291.

Apate aterrimus Faldermann, 1837: 250. Synonymy: Lesne 1901: 578.

Xylonites retusus – Lesne 1901: 577.

Xylopertha retusa – Fisher 1950: 143.

Type material of *X. retusa* was not located, but the species is well-known in the Mediterranean area, and the senior author has examined numerous specimens determined by Lesne, Vrydagh and others in IRSNB, LYL, MAIC, MIZPAN, MNB, MTM, NHMUK, NMBS, NMPC, NMS, NMW, SDEI, SNSD, ZMHB and ZSM, mainly from North Africa, South and Central Europe, Turkey, and Iran.

Diagnosis

The species is easily separable from *X. praeusta* and *X. reflexicauda* by the absence of spines on the elytra in both sexes. The male can be separated from *X. elegans* sp. nov. by the presence of long, erect hairs on the upper margin of the elytral declivity (absent in *X. elegans* sp. nov.), and by the form of the 8th tergite and genitalia (Fig. 5A–B: *X. retusa*; Fig. 5E–F: *X. elegans* sp. nov.). In the female of *X. retusa*, the apex of each elytron is strongly emarginate, the emargination filled by a pair of ventrally-directed processes with rounded tips next to the suture (Fig. 3A); in *X. elegans* sp. nov., the apex of each elytron projects as a broad, approximately rectangular process, its apex with a small pointed tooth next to the suture, the processes separated by a shallow U-shaped emargination, a broad emargination lateral to each process (Fig. 3C). In the female of *X. retusa*, the fourth ventrite is visible across its entire width, and the base of the emargination of the 5th ventrite does not project ventrally (Fig. 4A); in *X. elegans* sp. nov., the 3rd abdominal ventrite projects medially over the 4th, which is visible only at the sides, and the 5th ventrite is very deeply, broadly emarginate, the base of the emargination projecting as a thin lamina behind the process on the 3rd ventrite (Fig. 4B).

Material examined

AUSTRIA: 1 ♂, 1 ♀, [Mistelbach, 16 May 1992, Schillhammer leg.]; 1 ♂, [A.B. Leche, Seewinkel, Apr. 1967, Holzschuh leg.] (LYL).

BELGIUM: 1 ♀, [Yvoir, 7 Jul. 1946, A. Collart leg.] (LYL, more than 50 in IRSNB from South Europe).

CZECH REPUBLIC: 1 ♀, [Bohemia, Dievic Dřevíč, 8 Jun. 1995, P. Zahradník leg.] (LYL, 80 more in NMPC).

FRANCE: 1 ♂, 1 ♀, (no locality); 1 ♀, (no locality), [deciduous forest, #51, I.G. 19.501].

MACEDONIA: 1 ♂, [10 km N of Struga, 4 Jun. 1992, Zbaždi, P. Zahradnik leg.] (LYL).

IRAN: 2 ♀♀, [Prov. Mazandaran, vic. Kolijak, mountain slope, 36°28'18" N, 51°40'14" E, 1840 m, 5 May 2010, A. Weigel leg. #22a.] (1 ♀ in LYL, 1 ♀ in NME).

The specific identity of more than 800 further specimens was checked in the following museums: IRSNB, MAIC, MIZPAN, MNB, MTM, NHMUK, NMBS, NMPC, NMS, NMW, SDEI, SNSD, ZNHB and ZSM, but detailed locality data were not recorded. All specimens came from the distributional area given below.

Description

BODY. 3–6 mm long, about 2.8–3.0 times as long as wide, elongate. Black or dark brown, moderately shiny, antennae and tarsi reddish, the posterior part of the elytra often paler.

HEAD. Clypeus finely and densely punctured, not convex in front. Frons with puncturation less fine and less dense than the clypeus, slightly rough, and covered by fairly long, fine pubescence directed upwards. First and second segments of antennal club as wide as long.

PRONOTUM. Slightly wider than long, fairly strongly narrowed in the anterior third, bearing golden, long, erect pubescence on the anterior angles; area above head finely and more or less roughly punctured; median and posterior areas shiny with fine, sparse puncturation; sides evenly rounded; posterior angles rounded; widest in basal part.

ELYTRA. 1.8–2.2 times longer than wide, parallel-sided at disc and widest at middle of declivity. Elytral disc moderately dense puncturation, not coarser posteriorly. Upper margin of the elytral declivity bearing reddish, quite long erect pubescence, denser in the male. Elytral suture projecting on declivity, more strongly towards the apex. Elytral declivity without spines on each elytron in both sexes.

LEGS. External face of the anterior tibiae broadly grooved, not narrowed towards the apex. Segments 2 and 3 of anterior tarsi distinctly wider than the others.

Male

ELYTRA. Widened posteriorly. Upper margin of elytral declivity bearing long, erect pubescence. Elytral suture not raised on disc, strongly raised on declivity. Declivity rather finely punctured in the upper half, almost impunctate below, sometimes transversely ridged on much of its surface. Apical declivity larger than in female, more sharply truncate, a little concave, bordered on the lower-lateral side by a carina not extending to the sutural angle, the carina expanded at the sides of the declivity to form a marginal callus. Sutural angles pointed, conjointly projecting or weakly separated at the apex (Fig. 1C–D).

ABDOMEN. Anterior margin of 8th tergite fringed by long erect outwardly directed hairs. Genitalia strongly sclerotised, with extended lobes laterally, fringed with long hairs at apex and on a small inwardly projecting lobe towards base on each side. Aedeagus simple, without long apophyses (Fig. 5A–B).

Female

HEAD. Frons covered by longer, denser upwardly directed hairs than in male.

ELYTRA. Parallel, suture strongly raised on declivity. Declivity strongly and densely punctured with a truncate raised area at apical third. Lateral margin of declivity sinuate. Apex of each elytron strongly emarginate, the emargination filled by a pair of ventrally-directed processes with rounded tips next to suture (Fig. 3A).

ABDOMEN. Third abdominal ventrite not projecting medially over 4th, which is visible across its entire width; 5th segment longer than 2 to 4 together, strongly, longitudinally grooved in the middle, and provided on its posterior margin with two large teeth, contiguous at the base, strongly pointed, and slightly recurved dorsally near the apex; on the outer side of the teeth the posterior margin of the segment is semicircularly emarginate (Fig. 4A).

Distribution

Central and southern Europe, North Africa (except Egypt), Cyprus, Israel, Turkey, Iran, part of Caucasia and Siberia (Liu *et al.* 2016b).

Biology

The species has been recorded from the wood of trees in the families Fabaceae, Fagaceae, Moraceae, Ulmaceae Mirb. and Vitaceae Juss. (Lesne 1901; Bahillo de la Puebla *et al.* 2007; Marković & Stojanović 2012; Buse *et al.* 2013). The species is active from May to July in Southern Europe (Cymorek 1961 as *Xylonites retusus*; Bahillo de la Puebla *et al.* 2007), but from October to December in Israel (Buse *et al.* 2013). In Central Europe, the beetles prefer boring into dry oak branches; the larvae tunnel particularly in the sapwood; they overwinter in diapause and pupate in spring (Cymorek 1961 as *Xylonites retusus*). Several clerid and a melyrid predators (Coleoptera: Cleridae, Melyridae) are listed by Bahillo de la Puebla *et al.* (2007). Yu *et al.* (2012) list three species of braconid Hymenoptera as parasitoids.

Xylopertha praeusta (Germar, 1817)

Figs 1E–F, 2B, 3B, 4C, 5C–D

Apate praeusta Germar, 1817: 226.

Xylopertha appendiculata Lucas, 1849: 466. Synonymy: Jacquelin du Val 1860: 164.

Xylopertha dunensis Rai & Chatterjee, 1964: 122. Synonymy: Borowski & Singh 2017: 198.

Xylonites praeustus – Lesne 1901: 581.

Xylopertha praeusta – Rai & Chatterjee 1964: 124.

The type material of *X. praeusta* was not located, but the species is well known in the Mediterranean area. The senior author has examined numerous specimens determined by Lesne and Vrydagh, and numerous other specimens in IRSNB, LYL, MAIC, MNB, NHMUK, SDEI, SNSD and ZMHB, from various countries in southern Europe and North Africa. Borowski & Singh (2017) examined the type series of *Xylopertha dunensis* deposited in IFRI, and synonymised *X. dunensis* with *X. praeusta*. They state that the specimens in the type series came in fact from Tulon [*sic*] (correctly Toulon), S-France. It has become apparent that K. Rai falsified the type location of several species that he described (Borowski & Singh 2017). India should, therefore, be excluded from the distribution of *X. praeusta*. If the species does occur in India, it is almost certainly introduced.

Diagnosis

The species is distinguished from *X. elegans* sp. nov. and *X. retusa* by the presence of a spine on each elytron in both sexes (Fig. 1). It is distinguished from *X. reflexicauda* by the position of the spine, which is on the dorso-lateral margin of the declivity in *X. praeusta*, but on the middle of the upper margin of the declivity in *X. reflexicauda*. Differences in the abdomen and genitalia are illustrated in Figs 4 and 5.

Material examined

ITALY: 1 ♂, [Corsicac. Ug., Corte, 28 May 20, 11, F/o Bmann, Tavignano-Tal] (NME).

FRANCE: 1 ♂, 1 ♀, [Larale Valley, Pyrenees, J. Kettere leg.]; 1 ♀, [A. Melie L/B, LE/5-6-1960, ex coll. A. Jacobs (IG: 28.548)].

MOROCCO: 1 ♂, [Col du Zad, 13 Jul. 1959, M. Vazquez leg.]; 1 ♂, [Bab-Bou-Idir env., 34°4' N, 4°7' W, 28 May–3 Jun. 1999, Tazzeke N.P., I. Smatana leg.] (LYL).

The specific identity of more than 260 further specimens was checked in the following museums: IRSNB, MAIC, MIZPAN, MNB, MTM, NHMUK, NMBS, NMPC, NMS, NMW, SDEI, SNSD, ZNHB and ZSM, but detailed locality data were not recorded. All specimens came from the distributional area given below.

Description

BODY. 4–8 mm long, about 2.5–2.8 times as long as wide, stout, parallel-sided. Body shiny, head, pronotum, ventral side and femora black; elytral disc dark brown, darker toward the declivity; tibiae dark brown, antennae and tarsi paler.

HEAD. Clypeus finely and densely punctured, convex along its anterior margin, its median truncation as wide as base of labrum. Frons with puncturation less dense than clypeus, covered by fairly long, upwardly directed hairs. First and second segments of antennal club slightly elongate. Fifth antennal segment often nicked on external side, but this is not constant, nor particular to one sex. Pronotum about 1.1 times wider than long, narrowed in anterior third, without long hairs antero-laterally, area above the head finely punctured.

ELYTRA. Puncturation dense and strong on whole of disc; elytral declivity with a tubercle-like spine with a pointed apex located on dorso-lateral margin of declivity of each elytron (Figs 1E–F, 3B); pubescence of apical declivity short, erect, reddish, especially noticeable near upper margin where formed of longer hairs.

LEGS. External face of anterior tibiae narrowly grooved, widened to apex. Second and third segments of anterior tarsi scarcely wider than the following ones.

Male

ELYTRA. Apical declivity larger than in female, covered by an exceedingly fine and dense puncturation, and often wrinkled in its upper part; elytral spine robust, directed inwardly, strongly bulbous on outer side at base, narrow and very pointed at apex, below it a broad flange beginning at sutural angle and extending at sides to about level of lateral spine; sutural angles not projecting, rounded at apex (Fig. 1E).

ABDOMEN. Anterior margin of 8th tergite wider and fringed by shorter erect hairs than in *X. retusa*. Genitalia more strongly sclerotised than in *X. retusa*, with pair of ventrally-directed processes with pointed tips next to inner lobes which are separated by a U-shaped emargination in middle. Aedeagus simple, without long apophyses (Fig. 5C–D).

Female

ELYTRA. Declivity less distinctly truncate than in the male, strongly punctured, the lateral spines smaller, or replaced by tubercles; suture inflated on the declivity (Fig. 1F). Apical emargination of elytra broad, the emargination largely filled by a pair of ventrally-directed, extended processes with rounded tips next to suture (Fig. 3B).

ABDOMEN. Last visible segment of abdomen densely pubescent on sides, not grooved in middle; posterior margin of segment armed by two dorsally recurved large median teeth (Fig. 4C).

Distribution

Southern Europe, North Africa, Israel, Turkey.

Biology

The species has been recorded from the following genera and families of trees: *Viburnum* L. (Adoxaceae E.Mey.), *Mangifera* L., *Pistacia* (Anacardiaceae), *Acacia* Mill. (Fabaceae), *Castanea* Mill., *Quercus* L. (Fagaceae), *Ficus* L. (Moraceae), *Eucalyptus* L'Hér. (Myrtaceae Juss.), *Populus* L. (Salicaceae), *Vitex* L. (Vitaceae Juss.) (Lesne 1901; Rai & Chatterjee 1964; Akşit *et al.* 2005; Buse *et al.* 2013). However, it develops primarily in oaks (*Quercus*) (Bahillo de la Puebla *et al.* 2007; Nardi & Mifsud 2015). In Europe, adults emerge in May–July (Lesne 1901), but are active until November in Israel (Buse *et al.* 2013). The species has diurnal habits. The gallery system is typical of the genus. Larvae overwinter and complete their development in the spring of the following year (Lesne 1901).

Key to species of *Xylopertha*

1. Elytral declivity with a spine on each elytron in both sexes (Fig. 1E–H)2
 - Elytral declivity without spines in both sexes (Fig. 1A–D)3
2. Tubercle-like spine with a pointed apex located on the dorso-lateral margin of the declivity of each elytron (Figs 1E–F; 3B). Male: 8th tergite and genitalia as in Fig. 5C–D. Female: last four abdominal ventrites as in Fig. 4C*X. praeusta* (Germar, 1817)
 - Spine located on the middle of upper margin of the declivity of each elytron (Figs 1G–H; 3D). Male: eighth tergite and genitalia as in Fig. 5G–H. Female: last three abdominal ventrites as in Fig. 4D*X. reflexicauda* (Lesne, 1937)
3. Male: upper margin of elytral declivity without long, erect hairs. The 8th tergite and genitalia as in Fig. 5E–F. Female: apex of each elytron projecting as a broad approximately rectangular process, its apex with a small pointed tooth next to the suture, the processes separated by a shallow U-shaped emargination, a broad emargination lateral to each process (Fig. 3C); 3rd abdominal ventrite projecting medially over 4th, which is visible only at sides; 5th ventrite very deeply, broadly emarginate, base of emargination projecting ventrally as a thin lamina behind process on the 3rd ventrite, concealing middle part of 4th ventrite (Fig. 4B)*X. elegans* sp. nov.
 - Male: upper margin of elytral declivity bearing long, erect hairs. The 8th tergite and genitalia as in Fig. 5A–B. Female: apex of each elytron strongly emarginate, the emargination filled by a pair of ventrally-directed processes with rounded tips next to suture (Fig. 3A); 3rd abdominal ventrite not projecting medially over 4th, which is visible across its entire width, base of emargination of 5th ventrite not projecting ventrally as a thin lamina (Fig. 4A)*X. retusa* (Olivier, 1790)

Discussion

The tribe Xyloperthini has the highest number of genera (33, after the synonymy of *Paraxylogenes* with *Xylopertha*) in the whole family Bostrichidae, and often shows characters which are continuously variable amongst genera (Liu & Schönitzer 2011). The morphological distinctions between some of the genera are slight, and certain genera and species should possibly be synonymised (Liu, personal observations). The tribe includes five genera with nine-segmented antennae: *Xylopertha*, *Enneadesmus* Mulsant, 1851, *Scobicia*, *Xylogenes* Lesne, 1901, *Psicula*. However, of these genera, only *Psicula* appears to be closely related to *Xylopertha* (see Table 1). *Enneadesmus*, *Scobicia* and *Xylogenes* have clearly delimited circular sensory depressions on the first two segments of the antennal club, the frontal setae are arranged in a crown or in two lateral rows, and the posterior margin of the female elytra is entire. The posterior margin of the fifth ventrite of the female is also entire in *Enneadesmus* and *Scobicia*, although emarginate in *Xylogenes*. In *Xylopertha* and *Psicula*, the antennal segments have two indistinct zones of sensory pores, the frontal

Table 1. Comparison of characters of *Xylopertha* Guérin-Ménéville, 1845 with selected genera of Xyloperthini Lesne, 1921.

Character	Genus	<i>Xylopertha</i>	<i>Psicula</i>	<i>Xylionulus</i>	<i>Xylobosca</i>
No. of antennal segments		9	9	10	10
Funicle length relative to 1 st antennomere of club		¼ to ½ times shorter	Equal in length	Equal in length	More than half the length
Stiff, erect hairs on antennal club		Absent	Absent	Absent	Absent
Sensory impressions on antennal club		1 st and 2 nd antennomeres of club with two indistinct zones of denser pores; 3 rd without.	1 st and 2 nd antennomeres of club with two zones of denser pores; 3 rd without.	1 st and 2 nd antennomeres of club with two large, distinct impressions on each face; 3 rd without.	1 st and 2 nd antennomeres of club with two zones of denser pores; 3 rd without.
Long hairs on frons		Directed upwardly (forwardly in <i>X. reflexicauda</i>)	Directed upwardly	Absent	Directed upwardly, long to very long in female, short or absent in male.
Hairs on the anterior margin of pronotum		Long, except in <i>X. reflexicauda</i>	Long on anterior angles	Absent	Short or absent
Posterior angles of pronotum		Without lateral carina	Without lateral carina	Without lateral carina	Without lateral carina
Form of elytral suture on declivity		Suture moderately raised	Male: suture slightly raised. Female: Suture strongly raised	Suture raised, more strongly in middle	Suture not raised
Sculpture of upper part of declivity		One pair of pointed spines (stronger in males) present on or near upper margin (absent in <i>X. elegans</i> , <i>X. retusa</i>)	Male: upper margin with a pair of small teeth. Female: two longitudinal ridges on upper margin on each side, each ending in a minute spine.	Two pairs of spines present on upper margin (very small and rounded in <i>X. epigrus</i>).	Male: upper margin unarmed, with or without a pair of strong spines on disc of declivity. Female: without distinct upper margin
Shape of disc of elytral declivity		Male: weakly to strongly concave (except <i>X. retusa</i>). Female: convex	Male: concave Female: convex	Strongly concave	Male: concave Female: convex
Sculpture of apical margin of declivity		Male: with a small V-shaped emargination at apex. Female: apex of each elytron strongly emarginate, emargination filled by a pair of ventrally-directed processes next to suture (except <i>X. reflexicauda</i>).	Male: without an apical emargination. Female: apex of each elytron strongly emarginate, emargination filled by a pair of ventrally-directed processes next to suture	Both sexes with a tiny V-shaped emargination at apex, a pair of small teeth ventrally (indistinct in male <i>X. epigrus</i>)	Male: not emarginate at apex Female: emarginate
Modified ventrites of female abdomen		5 th ventrite variously modified, 3 rd ventrite also modified in <i>X. elegans</i> .	5 th ventrite emarginate in middle posteriorly.	4 th and 5 th ventrites emarginate in middle posteriorly.	1 st ventrite enlarged; 4 th and 5 th ventrites emarginate in middle posteriorly; 4 th ventrite with a pair of spines in some species
Pleural pieces of male abdomen		Present	Absent	Present	Present
Profibia		Widest at apex, grooved on external face	Widest close to apex, external face flattened	Widest at apex, external face more or less flattened	Widest towards middle, without a flat external face
Sexual dimorphism		Strong	Strong	Slight	Strong
Geographical distribution		Mediterranean	India	Afrotropical	Australian

setae cover the whole frons, and are upwardly directed, the posterior margin of the female elytra is strongly emarginate, and the female fifth ventrite is variously modified. It seems likely that *Enneadesmus*, *Scobicia* and *Xylogenes* evolved a nine-segmented antenna independently from *Xylopertha* and *Psicula*. Here, we compared the characters of *Xylopertha*, *Psicula* and two other genera, *Xylobosca* Lesne, 1901 and *Xylionulus* Lesne, 1901, that appear to be related to *Xylopertha*, in Table 1.

Xylobosca is distinguished from the other genera considered here by the form of the protibia, which is atypical for Xyloperthini, widest towards the middle rather than at the apex, and lacking a flat external face. *Xylionulus* differs from *Xylopertha* especially in characters of the antennae, the vestiture of the frons and pronotum, and the lack of strong sexual dimorphism. *Psicula* is the genus most similar to *Xylopertha* morphologically (Table 1), with very similar characters of the antennae, frons, pronotum and elytra, but the male lacks the pleural pieces on the fifth abdominal ventrite that are present in *Xylopertha*. The two genera also have nearly adjacent geographical distributions, *Xylopertha* extending through the Mediterranean region as far East as Pakistan, and *Psicula* recorded in North-East India (Sikkim, West Bengal).

The tribe Xyloperthini is greatly in need of revision and further phylogenetic analysis. There are at present no molecular studies of any tribe of Bostrichidae, and much progress may be made in the future using molecular methods. Liu & Schönlitzer (2011) suggest that the tribe Xyloperthini is polyphyletic, but their study included only nine genera. A study including as many genera as possible is needed. The geographical distribution of the tribe covers all zoogeographic regions except the Arctic-Siberian, although most species occur in the Palaearctic and Afrotropical regions. A preliminary analysis of the phylogeography of the family suggests that it originated in Gondwana rather than Laurasia (Liu 2016). The genera currently included in the tribe Xyloperthini appear to have multiple geographical origins (Liu, unpublished), again suggesting polyphyly. The present paper is the second in a larger project which will try to resolve some of these problems.

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