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EPURAEA IMPERIALIS (REITTER, 1877)

NEW INVASIVE SPECIES OF NITIDULIDAE (COLEOPTERA) IN EUROPE, WITH A CHECKLIST OF SAP BEETLES INTRODUCED TO EUROPE AND MEDITERRANEAN AREAS

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(communicated by Salvatore Fasulo)

ABSTRACT. Australian species *Epuraea imperialis* (Reitter, 1877), previously introduced to New Zealand, is recorded as a new invasive species from the Canary Islands, Continental Spain, Portugal, France, Belgium, and Italy. It is redescribed and figured, and its taxonomic position in the genus *Epuraea* Erichson, 1843 is discussed. A tentative checklist of sap beetles introduced to Europe and the Mediterranean areas is finally included.

1. Introduction

Beetle family Nitidulidae displays a comparatively broad spectrum of feeding habits and life strategies (Audisio 1993; Jelínek *et al.* 2010). Especially, some mycophagous and saprophagous species seem to be preadapted for life in the anthropogenic habitats like orchards and plantations feeding on ripening fruits and/or in stored products. Such species may acclimatize and then rapidly extend their new ranges. The number of invasive species in Europe has increased considerably in the last decades as a consequence of trade globalization (see, e.g., Gardner and Classey 1962; Spornraft 1972; Nüssler 1973; Lompe 1976; Kirejtshuk and Gillerfors 1987; Audisio 1988; Audisio and Scaramozzino 1990; Audisio, Ciampolini, and Trematerra 1990; Delobel and Tran 1993; Audisio 1993; Burle and Lechanteur 2000; Wenzel 2004; Jelínek 2007; Lasoń and Przewoźny 2009; Roques *et al.* 2010; Denux and Zagatti 2010; Brown 2010; Marini *et al.* 2013; Audisio *et al.* 2014; Baviera and Audisio 2014; Avgin *et al.* 2015; Genovesi *et al.* 2015). Among the most recent introductions, remarkable was the arrival of the dangerous small hive beetle (SHB), *Aethina tumida* Murray, 1867 into southern Italy (Calabria) (Baviera and Audisio 2014; Mutinelli *et al.* 2014; Palmeri *et al.* 2015); as well as the recent introduction to Sicily of *Colopterus abdominalis* Erichson, 1843 (Baviera and Audisio 2014), which reached Calabria in most recent times (Mutinelli *et al.* 2015, see Table 1).

Most invasive species, especially those originating from subtropical areas, repeatedly display the same distributional pattern: they settle and acclimatize first in the Mediterranean and/or Macaronesian region and subsequently advance northwards, as illustrated by *Stelidota geminata* (Say, 1825) that arrived recently from North America (Israelson 1985; Audisio 1993, 2002; Coulon 1994; Schuh, Plonski, and Brojer 2006; Callot 2007; Bensusan, Torres, and Perez 2008; Köhler 2009; Merkl, Lokkos, and Szaloki 2009; Vávra, Mantič, and Sitek 2012; Tsinkevich and Solodovnikov 2014; Baviera and Audisio 2014; Avgin *et al.* 2015). The same pattern of arrival and dispersal in its initial stage is reported here for the Australian species *Epuraea imperialis* (Reitter, 1877).

Epuraea imperialis, described by Reitter (1877) as *Haptoncura imperialis*, remained unknown to Blackburn (1891, 1903), was omitted by Kirejtshuk and Kvamme (2002), and was briefly mentioned by Grouvelle (1905, 1913). It is found throughout eastern Australia (*Atlas of Living Australia* 2015) and was presumably introduced to Lord Howe Island. *Epuraea imperialis* is also known from New Zealand (Carlton and Leschen 2007; Maddison 2010), including offshore islands (Chatham and Kermadec Islands) (Kuschel 1990; Emberson 2002). Kuschel (1990) reported *E. imperialis* from an Auckland suburb (Lynfield) where it was very common in open habitats and collected from compost and fermenting fruits and vegetables. The earliest New Zealand record is from Whangarei, Northland in 1929 (Kuschel 1990) and there are specimens in the New Zealand Arthropod Collection (NZAC) spanning the entire country, as far south as Dunedin, Otago. The exact identity of this species was unknown in Europe until now, and was reported previously from southern Italy (Campania, Mount Vesuvio area; NE Sicily) under the name *Epuraea (Haptoncus)* sp. (Audisio and Nardi 2007; Baviera and Audisio 2014).

In southern Europe, *E. imperialis* does not appear to represent an economically important pest. Like several other introduced Carpophilinae and Epuraeainae, *E. imperialis* frequently co-occurs with *Stelidota geminata, Epuraea (Haptoncus) ocularis* Fairmaire, 1849, and *E. (H.) luteola* Erichson, 1843 in cultivated areas and orchards and disturbed forest habitats where they mostly attack ripening and fallen fruits. In certain areas of NE Sicily monitored in 2010 and 2015, it has become the most common and locally abundant sap beetle species in anthropogenic environments, chiefly in orange orchards feeding in fallen fruits (Baviera and Audisio, unpublished data). Here we provide additional European records and redescribe the species to facilitate its identification. We also provide a checklist of the sap beetle species introduced to Europe in historical times, with particular attention to those introduced during the last 50 years (Table 1), to meet the goals of the DAISIE (2009) initiative to report on invasive species.

2. Materials and methods

Dry mounted specimens were studied with Wild stereomicroscope, and measurements were taken with ocular micrometer attached to it, under 50x magnification. The habitus photographs were taken using a Canon MP-E 65mm f/2.8 macro lens with 5:1 optical magnification on bellows attached to a Canon EOS 550D camera. Partially focused images of specimen were combined using Helicon Focus 5.1.19 software. Drawings of genitalia were prepared using a drawing tube mounted on Olympus BX50 biological microscope (400x).

The following acronyms refer to measured body parts:

ANCL – length of antennal club.
ANCW – width of antennal club.
ANLE – length of antenna.
FE1L, FE2L, FE3L – length of pro-, meso-, and metafemur, respectively.
FE1W, FE2W, FE3W – width of pro-, meso-, and metafemur, respectively.
HWAE – width of head across eyes.
LELY – length of elytra.
LEPR – length of pronotum along its median axis.
TI1L, TI2L, TI3L – length of pro-, meso-, and metatibia, respectively.
TI1W, TI2W, TI3W – width of pro-, meso-, and metatibia, respectively.
WELY – maximum width of elytra combined.
WPR1 – width of pronotum at posterior angles.
WPR2 – maximum width of pronotum.
WPR3 – width of pronotum between vertices of its anterior angles.

Depository of the material examined express the following acronyms:

BMNH – coll. The Natural History Museum, London (U.K.)
CAR – coll. Paolo Audisio, Zoological Museum of the Sapienza Rome University, Rome (Italy)
CBM – coll. Cosimo Baviera, Messina University, Messina (Italy)
CBT – coll. Hervé Brustel, Toulouse (France)
CGC – coll. Hanife Genç, Çanakkale (Turkey)
CLB – coll. Andrzej Lasoń, Białystok (Poland)
CMT – coll. Bernard Moncoutier, Velizy (France)
CMO – coll. Marion Mantič, Ostrava (Czech Republic)
CNBF – coll. CNBF, National Centre for Forestry Biodiversity "Bosco Fontana", Marmirolo (Mantova, Italy)
CPD – coll. Jacques Poussereau, Dax (France)
CRB – coll. Klaus Renner, Bielefeld (Germany)
CRPA – coll. Rossano Papi, Castelfranco di Sopra, Arezzo (Italy)
LNEF-ONF – coll. Laboratoire National d'Entomologie Forestière de l'Office National des Forêts, Quillan (France)
MUSB – coll. Museum of Upper Silesia, Bytom (Poland)
NMPC – coll. National Museum, Prague (Czech Republic)
NZAC – New Zealand Arthropod Collection, Auckland (New Zealand)

3. Results

Epuraea (Haptoncus) imperialis (Reitter, 1877)

Haptoncura imperialis Reitter, 1877: 128
Haptoncura imperialis; Blackburn, 1891: 103, 105
Epuraea imperialis; Grouvelle 1905: 242

3.1. Material examined.

Australia: 5 spec., Lord Howe Island, A.M. Lea lgt.,(BMNH); 2 spec., N.Q.[ueensland], Ravenshoe Rd., Hot Springs, 11.I.1962, A.B. Britton lgt., (BMNH); 1 spec., New South Wales, Nowra, 30.III.1934, F.A.Rodway lgt. (BMNH); 4 spec., New South Wales, Launceston, L. Erben lgt. (NMPC); 2 spec., Victoria, Red Hill, ex coll. O. Marek (NMPC).

New Zealand: 1 spec., AK, Lynfield, 14.VIII.1976, litter at bush margin, G. Kuschel;1 spec., dtto, 11.IX.1976, compost bin, G. Kuschel lgt. (BMNH); 2 spec., Marlborough, Dead Horse Creek S of Canvas-town, 41°19.59´S, 173°39.57´E, 30.XI.2010, wet stones with algae & moss along exposed stream, Fikáček & Leschen lgt. (NMPC); approximately 300 specimens held in the NZAC from the following areas (Crosby, Dugdale, and Watt 1998): North Island - ND, AK, CL, BP, HB, WN; South Island - NN, SD, MB, MC, SD.

Italy: 1 spec., Opi, Abruzzo National Park (L´Aquila), 1.VII.1998, lgt R. Papi (CRPA); 1 spec., Lazio (Rome), near Rocca di Papa, Bosco del Cerquone, 550 m, pitfall trap, 16.-23.VI.2007, V. Viglioglia leg. (NMPC); 1 spec., Lazio, Pomezia (Rome), 21.IV.2015, 56 m, on rotten orange, P Audisio & E. Mancini lgt, (CAR); 2 spec., Campania, Mount Vesuvio National Park (Naples), Ercolano municipality, Mount Vesuvio, N slope, trail to the Crater, 960 m a.s.l., 14.VI-8.VIII.2000, G. Nardi lgt, pitfall trap (CNBF, CAR); 2 spec., Campania, Mount Vesuvio National Park(Naples), Ottaviano municipality, Mount Somma, E slope, Cognoli trail, 600 m a.s.l., 31.V-8.VIII.2000, G. Nardi lgt, pitfall trap; 2 spec., ibidem, 8.VIII- 28.IX.2000, G. Nardi lgt (CNBF, CAR); 15 spec., Campania, Mount Vesuvio National Park (Naples), Ottaviano municipality, Mount Somma, E slope, Vallone Mazzamei, 450 m a.s.l., 31.V-8.VIII.2000, G. Nardi lgt (CNBF, CAR); 1 spec., ibidem, 8.VIII-28.IX.2000, G. Nardi lgt (CNBF); 35 spec., Campania, Mount Vesuvio National Park (Naples), Somma Vesuviana municipality, Mount Somma, N slope, Santa Maria di Castello, 500 m a.s.l., 31.V- 14.VI.2000, G. Nardi & V. Viglioglia lgt, pitfall trap (CNBF, CAR); 48 spec., ibidem, 14.VI-8.VIII.2000, G. Nardi lgt, pitfall trap (CNBF, CAR); 7 spec., ibidem, 8.VIII-28.IX.2000, G. Nardi lgt (CNBF, CAR) (data from Campania from Audisio & Nardi 2007); 8 spec., Calabria, Piana di Gioia Tauro, San Ferdinando (Reggio Calabria), 5 m a.s.l., 38.50232N, 15.92300E, 22.IV.2015, on rotten oranges, P. Audisio & F. Artese lgt (CAR); Sicily, Messina, Monti Peloritani, Musolino, 400 m a.s.l., 22.III-07.IV.2004, C. Baviera leg. (CAR, CBM); Sicily, Messina, Monti Peloritani, Salice Urni, 400 m, 21.V-02.VI.2004, C. Baviera leg. (CAR, CBM); Sicily, Messina, Monti Peloritani, Castroreale, Cavallaro, 400 m a.s.l., in pitfall trap, 18.VII-11.VIII.2013, V. Valenti leg. (CAR, CBM); Sicily, Catania, Mount Etna, Piano Provenzana, 1800 m a.s.l., 10.VII-04.VIII.2002, in pitfall trap, C. Baviera leg. (CAR, CBM); Bosco Cerrita, 10.VII-04.VIII.2002, in pitfall trap, C. Baviera leg. (CBM) [data from Sicily in Baviera and Audisio (2014)].

Portugal: 36 spec., Faro, Vilamoura, 37°04´00´´ N / 08°05´53´´ W, 4.III.2007, meadow, in oranges, M. Mantič lgt. (CMO, NMPC); 35 spec., Faro, Caldas de Mochique, orchard, in oranges, 21.III. 2009, M. Mantič lgt., (CMO).

Spain: 1 spec., Galicia, Lugo province, Folgoso do Courel, 26.vii.2012, by grassnetting, T. Struyve lgt (CRB); 1 spec., Canary Islands, Tenerife, Anaga, Las Mercedes env., 28°31,76928´N, 16°17,26776´W, 880 m, 27.i.2014, leaf litter sifting, M. Kocian

lgt. (NMPC); 2 spec., Canary Islands, Tenerife, Las Mercedes, 820 m, 3.V.2014, R. Dobosz lgt. (CLB, MUSB).

France: 9 spec., Landes, Dax, Le Sarat, 6.VI.2014, piège vin rouge [red wine bait] (CPD); 1 spec., dtto, 7.V.2014 ; 1 spec., dtto, 2.VI.2014, battage [beating] (CPD, NMPC); 5 spec., Dax, 20.VII.2014, jardin, Prunes mûres [garden, matured prunes], lgt. J. Poussereau (CPD); 12 spec., Toulouse, Escalquens-31, pommes pourries [rotting apples], 26.X.2015, B. Moncoutier lgt. (CMT).

Belgium: 2 spec., East Flanders, Brussels Region, Oudenaarde municipality, near Ename, 24.VI.2012, by grassnetting, T. Struyve lgt. (CRB); 3 spec., ibidem, 30.III.2014, T. Struyve lgt. (CRB).

3.2. Redescription.

Body ovate, moderately convex (Figs. 1-2). Yellow-brown, pronotal disc as a rule black, each elytron sometimes with oblong oval dark spot embracing yellow-brown center, sometimes more or less interrupted at outer side, antennae beginning from distal end of antennomere iii gradually infuscate, antennal club or antennomere viii-xi black-brown. Pubescence golden, sparse and recumbent, particular setae fairly reaching base of following ones. Body length 2.4-2.8 mm, width 1.0-1.2 mm.

Head narrower than anterior margin of pronotum (WPR3/HWEA = 1.12); eyes moderately convex, not projecting from outline of head; temples flatly convex, converging posteriorly, not angulate behind eyes. Frons almost flat with pair of shallow impressions at antennal insertions; punctures of frons nearly equal in size to eye facets, separated by one diameter, becoming gradually smaller on clypeus; interspaces more or less dull, without distinct microsculture; anterior margin of clypeus truncate, not bordered. Antennae somewhat shorter than width of head (ANLE/HW = 0.91), antennal club oblong oval (ANCL/ANCW = 1.43), occupying one third of antenna length (ANCL/ANLE = 0.33); antennomere x. wider than neighbouring ones; antennomere iii. 2x longer than iv, v. 1.33x longer than iv., viii. 1.33x wider than vii.; ratio length/width of antennomeres i-xi as follows: 1.6, 1.3, 2.5, 1.5, 2.0, 2.0, 0.5, 0.4, 0.4, 0.4, 0.7. Antennal furrows broad, rectilinear, converging posteriad, widely separated; inner margins S-shaped, raised, sharp, outer ones straight, fine, indistinct. Labrum nearly twice as wide as long, deeply bilobed, with median V-shaped excision reaching its midlength, its lobes narrowly rounded. Mandibles arcuate, acutely pointed, inner margin with additional tooth near apex. Terminal maxillary palpomere ca. twice as long as wide, tapering towards narrowly truncate apex. Terminal labial palpomere subcylindrical, almost as wide as long, broadly truncate apically.

Pronotum widest behind its midlength, distinctly narrowed both anteriorly and posteriorly, twice as wide as long (LEPR/WPR2 = 0.50); anterior margin with trapezoidal emargination nearly as deep as eye width, nor bordered; anterior angles obtuse, almost rounded; lateral margins arcuate, narrowly explanate, explanate sides anteriorly nearly as wide as length of pedicellus, becoming gradually wider posteriad; posterior margin not bordered, broadly truncate in middle, shallowly flatly concave besides posterior angles; posterior angles obtuse, not projecting posteriad; pronotal disc broadly moderately convex, slightly depressed along longitudinal axis. Punctures of pronotum slightly larger than eye facets, flat, shallow, separated by one diameter or (mostly) less, interspaces dull, without distinct microsculpture. Setae inconspicuous, recumbent, reaching base of the following ones, becoming somewhat

FIGURE 1. *Epuraea imperialis* from Portugal, Vilamoura, male (length: 2.6 mm).

FIGURE 2. *Epuraea imperialis* from Portugal, Vilamoura, female (length: 2.5 mm).

longer in front of scutellum. Scutellum large, triangular, punctate like elytra, punctures separated by less than one diameter.

Elytra nearly as long as their combined width (ratio LELY/WELY= 1.01), widest at basal fifth, twice as long as pronotum (ratio LELY/LEPR = 2.13) and slightly wider than pronotum (ratio WPR2/WELY = 0.93), gradually narrowed posteriad, reaching their maximum length at suture. Humeral angles obtusely rounded, lateral margins arcuate, distinctly explanate sides nearly as wide as length of antennomere ii in basal portion, gradually narrowed posteriad. Sutural lines distinct in posterior half of elytra, fine and running close to suture. Dorsal surface of elytra broadly moderately convex, with broad shallow impression at inner side of humeral bulge. Punctures somewhat smaller and shallower than those on pronotum, separated by 1.0-1.5 diameters, becoming closer along suture and at the apex of each elytron; interspaces smooth, moderately shining. Vestiture as on pronotum, rather sparse, yellow, recumbent.

Pygidium densely finely punctate, subtruncate apically, tergite viii exposed, rounded. Distances between pro-, meso- and metacoxae as 1:1.6:2.3. Femora slender, widest behind their midlength (FE1L/FE1W = 2.5, FE2L/FE2W = 2.5, FE3L/FE3W = 2.8), somewhat longer than corresponding tibiae (FE1L/ TI1L = 1.19, FE2L/TI2L = 1.31, FE3L/TI3L = 1.12). Protibia gently arcuate and gradually dilated distad, TI1L/TI1W = 3.66; outer margin apparently smooth, only microscopically denticulate in distal portion, outer subapical angle obtusely rounded. Mesotibia strongly arcuate all along its length, with inner subapical angle extended inwards, obtusely rounded, TI2L/TI2W = 5.0; outer margin with fine, short and dense spines. Metatibia slender, straight, becoming gradually wider distad, TI3L/TI3W = 5.0; outer margin finely and densely spinulose like on mesotibia. Protarsomeres i-iii bilobed and strongly dilated, reaching ca 2/3 of tibia width, strongly densely setose ventrally; tarsomere v as long as the preceding ones combined; tarsal claws simple. Mesotarsomeres i-iii shallowly bilobed, as wide as half of mesotibia width. Posterior tarsi narrow, simple. Prosterum bluntly roof-shaped, finely rugosely punctate. Hypomera isodiamerically reticulate with widely spaced, shallow and indistinct punctures. Prosternal process longitudinally arcuate and finelly bordered between procoxae, behind them depressed and broadly rounded apically. Mesoventrum broadly convex, bluntly mediolongitudinally carinulate, microscopically isodiametrically reticulate, at anterior margins of mesocoxae broadly arcuately canaliculate; posterior intercoxal process between mesocoxae broadly shallowly concave. Metaventrum in middle flattened with faint mediolongitudinal line, punctures smaller than eye-facets, shallow, but well defined, separated by l-2 diameters; interspaces in middle smooth, at sides reticulate. Abdominal sterna finely punctate, punctures finer than those of metaventrum, becoming finer laterally; interspaces smooth in middle, reticulate at sides.

Male genitalia as depicted in Fig. 3(a-c), small-sized and with barely sclerotized median lobe of aedeagus.

Female: Habitus as in male, with elytra slightly narrower distad (Fig. 2). Pro- and mesotibiae somewhat curved at base, otherwise simple. Tarsi narrower than in male. Pygidium simple, narrowly rounded apically. Ovipositor as depicted in Fig. 3(d).

Taxonomic notes. *Epuraea imperialis* is a native Australian species and can be easily separated from other Australian *Epuraea* by the deeply emarginate anterior margin and explanate sides of pronotum, elytra strongly narrowed posteriad and rounded apically, and

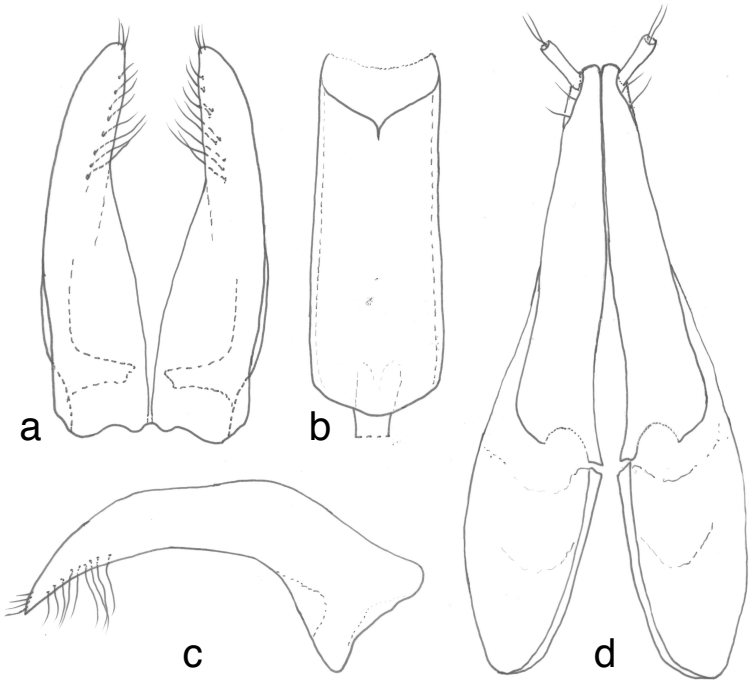

FIGURE 3. Genitalia of *Epuraea imperialis* from Mount Vesuvio, Ottaviano near Naples, Italy; a: tegmen, dorsal view; b: median lobe of the aedeagus, dorsal view; c: tegmen, lateral view); d: ovipositor (ventral view).

antennae shorter than the width of head across eyes. Most Australian species of *Epuraea* belong to the recently described subgenus *Blackburnaea* Kirejtshuk & Kvamme, 2001 leaving two species (*E. victoriensis* (Blackburn, 1891) and *E. simsoni* Grouvelle, 1897) in *Epuraea* s. str. (both species of which are considered synonymous by Arrow (1927). The four or five endemic New Zealand *Epuraea* species have not been thoroughly studied and are not placed into subgenera, while remaining species in the genus from nearby New Caledonia have been listed by Kirejtshuk and Kvamme (2001). Grouvelle (1905), who discussed the classification of the species of *Haptoncura* Reitter, 1875, attributed *E. imperialis*, along with other Australian taxa he studied, to *Epuraea* and considered *Haptoncus* Murray, 1864 as a distinct genus. *Haptoncus* was "tentatively" classified as a subgenus of *Epuraea* by Kirejtshuk (1989) to contain small (sub)tropical *Epuraea* with a short, truncate terminal labial palpomere. *Haptoncus* sensu Gillogly (1982) was clearly paraphyletic and despite the attempt by Kirejtshuk (1998) to clarify problems in the classification of *Haptoncus* by the removal of potentially unrelated taxa, the monophyly of *Haptoncus* remains questionable. Nevertheless, *E. imperialis* which has the distinctive shortened labial palpi should be classified as member of *Haptoncus*. *Epuraea imperialis* differs from all known species of *Haptoncus* by its elytra strongly narrowed posteriad with rounded apices and the modification of its male mesotibiae. Specimens of *E. imperialis* with a distinct black pattern

may resemble *E. ocularis*, which occur in syntopy (e.g., France, Landes, Dax, CPD; Italy, Sicily, Messina province; Italy, Calabria, Reggio Calabria province, San Ferdinando) but differs from *E. imperialis* by the temples acutely projecting behind eyes, elytra much less narrowed posteriad and subtruncate apically, lack of black pigmentation on the pronotum, and markedly different shape of male mesotibiae.

TABLE 1. Tentative checklist of the sap beetle species introduced in historical times to Europe and circum-Mediterranean areas. Only the most frequently used synonyms are listed; for a complete list of synonyms, refer to Jelínek and Audisio (2007). Occasional introductions of other intercepted species not followed by at least a first documented phase of acclimatization were not recorded. Only major contributions to the distribution of alien sap beetles in Europe have been recorded. All species considered to be autochtonous at least in part of the Mediterranean and European areas (Audisio 1993; Jelínek and Audisio 2007), including a few ones belonging to the genus *Carpophilus*, have not been treated.

SPECIES	AREA OF ORIGIN	COUNTRIES OF OCCURRENCE AND YEAR (PERIOD) OF PRESUMED INTRODUCTION [MAIN REFERENCES]	DAMAGES
CARPOPHILINAE			
***Carpophilus bifenestratus* Murray, 1864** = *tersus* Wollaston, 1865	Palaeotropical	**Mediterranean areas; probably 1700'** [(Audisio 1993); the inclusion of some southern Mediterranean countries in the species' original range cannot be excluded]	ripening and rotten fruits, under bark
***Carpophilus dimidiatus* (Fabricius, 1792)** = *auropilosus* Wollaston, 1854	Palaeotropical	**Mediterranean areas; probably 1700'** (Hinton 1945; Audisio 1993)	mostly dried fruit
***Carpophilus extensus* Grouvelle, 1908** = *trapezicollis* Kirejtshuk, 1995	W Africa	**N Germany, 2004** (Kirejtshuk and Herrmann 2007)	unknown

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Table 1 – *Continued from previous page*

SPECIES	AREA OF ORIGIN	COUNTRIES OF OCCURRENCE AND YEAR (PERIOD) OF PRESUMED INTRODUCTION [MAIN REFERENCES]	DAMAGES
***Carpophilus fumatus* (Boheman, 1851)** = *ochropterus* Klug, 1862	Afrotropical	**Portugal (Azores, 1985; Madeira, 1996); Cape Verde Islands, 1988; Italy, 1990; Madeira 1996; Near East, Morocco 2000'** (Ratti and Rampini 1977; Israelson 1984; Gillerfors 1986; Geisthardt 1988; Audisio 1993; Erber and Franquinho Aguiar 2001; Jelínek and Audisio 2007)	ripening and rotten fruits
***Carpophilus hemipterus* (Linnaeus, 1758)** = *pictus* (Heer, 1841)	Paleotropical	**Mediterranean areas; probably Roman Age** (Hinton 1945; Audisio 1993)	ripening and rotten fruits, dried fruits
***Carpophilus indicus* S. Hisamatsu, 1963**	India Arabian Peninsula	**Southern Jordan, Aqaba, 2010** [Audisio unpublished data; Aqaba may be the northern limit of its original range]	mostly dried and rotten fruits
***Carpophilus jelineki* Audisio and Kirejtshuk, 1989** = *pictus* Jelínek, 1986, nec (Heer, 1841)	India Arabian Peninsula	**Southern Jordan, Aqaba, 2010** [Audisio unpublished data; Aqaba may be the northern limit of its original range]	mostly dried and rotten fruits
***Carpophilus ligneus* Murray, 1864** = *decipiens* (Horn, 1879)	Central America	**England 1940; Greece; Northern Africa; Canary Islands; Germany** (Hinton 1945; Audisio 1993; Machado and Oromi 2000; Leschen and Marris 2005; Jelínek and Audisio 2007; Reibnitz 2007)	mostly dried and rotten fruits
***Carpophilus lugubris* Murray, 1864**	Southern USA	**NE Italy** (Marini *et al.* 2013; Audisio *et al.* 2014)	cornfields, inside beehives, on mature strawberries

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Table 1 – *Continued from previous page*

SPECIES	AREA OF ORIGIN	COUNTRIES OF OCCURRENCE AND YEAR (PERIOD) OF PRESUMED INTRODUCTION [MAIN REFERENCES]	DAMAGES
***Carpophilus marginellus* Motschulsky, 1858** = *nitens* Fall, 1910	Paleotropical	**Mediterranean areas; Europe, including Fennoscandia and Ireland; probably 1800/1900'** (Moore and Anderson 2006; Jelínek and Audisio 2007)	ripening and rotten fruits
***Carpophilus mutilatus* Erichson, 1843** = *lucidus* Murray, 1864 = *pilosellus* Motschulsky, 1858, nec auct.	Paleotropical	**Mediterranean areas; probably 1800/1900'** (Dobson 1954; Nuzzaci 1968; Audisio 1993)	ripening and rotten fruits
***Carpophilus nepos* Murray, 1864** = *freemani* Dobson, 1956	Paleotropical	**Mediterranean areas; probably 1800/1900'** (Dobson 1956; Audisio 1993; Jelínek and Audisio 2007)	ripening and rotten fruits
***Carpophilus obsoletus* Erichson, 1843** = *cribrellatus* Motschulsky, 1858	Paleotropical	**Mediterranean areas and Belgium, probably 1700'** (Verbeelen 2008)	ripening and rotten fruits
***Carpophilus succisus* Erichson, 1843**	Neotropical	**Portugal (Azores, 2000')** (Jelínek and Audisio 2007; Borges *et al.* 2010; Borges 2015; DAISIE 2015)	ripening and rotten fruits
***Carpophilus truncatus* Murray, 1864** = *pilosellus* auct., nec Motschulsky, 1858 = *floridanus* Fall, 1910 = *halli* Dobson, 1954	Paleotropical	**Mediterranean areas; probably 1800'** (Hinton 1945; Audisio 1993)	mostly dried fruit

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Table 1 – *Continued from previous page*

SPECIES	AREA OF ORIGIN	COUNTRIES OF OCCURRENCE AND YEAR (PERIOD) OF PRESUMED INTRODUCTION [MAIN REFERENCES]	DAMAGES
***Carpophilus zeaphilus* Dobson, 1969**	East Africa	**Portugal, 1985; Spain; Monaco; Italy (Sicily, peninsular Italy); Albania; Near East, 1991/2015** (Jelínek and Audisio 2007; Jelínek 1988; Audisio 1993; Angelini *et al.* 1995; Audisio and De Biase 2005; DAISIE 2009, 2015; Ponel *et al.* 2011; Avgin *et al.* 2015; Audisio *et al.* 2015)	ripening and rotten fruits, dried fruits, flowers of Rosaceae
***Urophorus humeralis* (Fabricius, 1798)** = *ricksekeri* (Fall, 1910)	Paleotropical	**Europe, probably 1900'** (Hinton 1945; Audisio 1993)	ripening and rotten fruits
EPURAEINAE			
***Epuraea (Haptoncus) imperialis* (Reitter, 1877)** = *ricksekeri* (Fall, 1910)	Australia	**Canary Islands; Continental Spain; Portugal; France; Belgium, 2007/2015**; **Italy (Abruzzo and Naples areas, 1998/2000; NE Sicily, 2002)** (Audisio and Nardi 2007; Baviera and Audisio 2014);	ripening and rotten fruits
***Epuraea (Haptoncus) luteola* Erichson, 1843** = *texana* Crotch, 1874 = *subquadrata* (Reitter, 1877) = *albertisi* (Reitter, 1880)	Oriental	**Israel and Near East, 1970'; Mediterranean and southern European areas, 1980'** (Kehat, Blumberg, and Greenberg 1976; Kehat, Blumberg, and Williams 1983; El-Haidari 1969; Trematerra 1988; Audisio and Scaramozzino 1990; Audisio 1993; Busato 2002; Jelínek and Audisio 2007; Aberlenc and Brustel 2014)	ripening and rotten fruits

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Table 1 – *Continued from previous page*

SPECIES	AREA OF ORIGIN	COUNTRIES OF OCCURRENCE AND YEAR (PERIOD) OF PRESUMED INTRODUCTION [MAIN REFERENCES]	DAMAGES
***Epuraea (Haptoncus) ocularis* Fairmaire, 1849** = *decorata* Reitter, 1873 = *subquadrata* (Reitter, 1877) = *albertisi* (Reitter, 1880)	Oriental	**Spain (Canary Islands, 1992); Portugal (Madeira, 1996); south and central Europe; Moldova; Turkey; Caucasus** (Jelínek 1997; Audisio *et al.* 2000; Rogé 2000; Machado and Oromi 2000; Ponel and Rogé 2000; Renner 2000; Konzelmann 2001; Audisio 2002; Wenzel 2004; Jelínek and Audisio 2007; Callot 2007; DAISIE 2009, 2015; Cline and Audisio 2011; Rittner and Nir 2013; Tsinkevich and Solodovnikov 2014; Aberlenc and Brustel 2014; Avgin *et al.* 2015)	ripening and rotten fruits
NITIDULINAE			
***Aethina tumida* Murray, 1867**	Afrotropical	**Portugal, 2004**; **Italy (Calabria, Sicily, 2014)** (Murilhas 2005; Neumann and Ellis 2008; Baviera and Audisio 2014; Palmeri *et al.* 2015; Mutinelli *et al.* 2014)	beehives and bees colonies
***Ithyra hirsutula* Reitter, 1873**	Tropical Africa	**Italy (Sicily, 1936)** (Audisio 1978, 1993; Baviera and Audisio 2014); [not fully acclimated]	ornamental plants (Acanthaceae)
***Omosita funesta* Reitter, 1873**	Mexico	**Spain (Teruel, 1931)** (Audisio 1991, 1993; Jelínek and Audisio 2007); [not fully acclimated]	probably on imported sausages
***Lobiopa insularis* (Laporte, 1840)**	Tropical South & Central America	**Spain (Canary Islands; Tenerife, 2008)** (Lasoń and Przewoźny 2009)	ripening and rotten fruits (dates)

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Table 1 – *Continued from previous page*

SPECIES	AREA OF ORIGIN	COUNTRIES OF OCCURRENCE AND YEAR (PERIOD) OF PRESUMED INTRODUCTION [MAIN REFERENCES]	DAMAGES
***Phenolia tibialis* (Boheman, 1851)** = *curvitibia* (Kraatz, 1895)	west tropical Africa	**Azores and Madeira, 1985**; **continental Portugal, 2008**; **Spain (Valencia and Murcia, 2015)** (Serrano and Borges 1987; Borges *et al.* 2010; Kirejtshuk and Kvamme 2002; DAISIE 2009, 2015; Santos *et al.* 2010; Baena and Zuzarte 2012; Montagud and Orrico 2015)	ripening and rotten fruits
***Phenolia picta* (W. S. Macleay, 1825)** = *testudinaria* Reitter, 1873	Oriental and Palaeotropical	**southern Spain (Almeria Province, 2014)**; **(Valencia and Murcia, 2015)**; **eastern Spain, 2015**; **southern France, 2014-15; Turkey, 2014** (Viñolas, Muñoz-Batet, and Soler 2014, as *Phenolia limbata tibialis*; Montagud and Orrico 2015) [(Brustel and Micò, unpublished data); Spain (Castellon), Window trap on *Quercus suber*, Sierra de Espadan, Chovar, 20.VII.2015, 1 spec., D. Perez leg. (CBT)] [(Audisio, Barnouin, and Genç, unpublished data); France, Cagnes-sur-Mer, 25.XII.2014, 1 spec., Pierre Gros lgt; France, Nice, Mont Boron, 10 m a.s.l., window trap on Carob tree (bait: ethanol 20%), 2/17.VII.2015, 1 spec. (LNEF-ONF); Turkey, Çanakkale, Lapseki, 22.IX.2014, 3 spec. (CGC, CAR)]	ripening and rotten fruits

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Table 1 – *Continued from previous page*

SPECIES	AREA OF ORIGIN	COUNTRIES OF OCCURRENCE AND YEAR (PERIOD) OF PRESUMED INTRODUCTION [MAIN REFERENCES]	DAMAGES
***Stelidota geminata* (Say, 1825)**	Southern USA	**Portugal (Azores Islands, Flores, 1984)**; **northern Italy (Lombardy, Sicily, 1996/1998)**; **Belgium; Spain (including Canary Islands); France; Switzerland; Slovenia; Austria; Germany; Hungary; Turkey; Russian Caucasus, 1993/2015** (Israelson 1985; Audisio 1993, 2002; Baviera and Audisio 2014; Coulon 1994; Schuh, Plonski, and Brojer 2006; Callot 2007, 2008; Bensusan, Torres, and Perez 2008; DAISIE 2009, 2015; Köhler 2009; Merkl, Lokkos, and Szaloki 2009; Vávra, Mantič, and Sitek 2012; Tsinkevich and Solodovnikov 2014; Avgin *et al.* 2015)	ripening and rotten fruits, vegetables
CILLAEINAE			
***Brachypeplus deyrollei* Murray, 1864**	W tropical Africa	**SW France (Aquitaine, 1998)** (Burle and Lechanteur 2000; Aberlenc and Brustel 2014)	ripening and rotten fruits, vegetables
***Brachypeplus mauli* Gardner and Classey, 1962** = *pudicus* Kirejtshuk and Gillerfors, 1987	Australia	**Portugal (Azores and Madeira, 1957)** (Gardner and Classey 1962; Kirejtshuk and Gillerfors 1987; Audisio 1993)	under bark of introduced trees; ripening and rotten fruits
***Colopterus abdominalis* (Erichson, 1843)**	tropical South America	**Italy (east Sicily and Calabria, 2004/2014)** (Baviera and Audisio 2014; Mutinelli *et al.* 2015)	ripening and rotten fruits

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Table 1 – *Continued from previous page*

SPECIES	AREA OF ORIGIN	COUNTRIES OF OCCURRENCE AND YEAR (PERIOD) OF PRESUMED INTRODUCTION [MAIN REFERENCES]	DAMAGES
CRYPTARCHINAE			
***Glischrochilus fasciatus* (A. G. Olivier, 1790)** = *geminatus* Melsheimer, 1844 = *quadrimaculosus* Melsheimer, 1844	USA	**Switzerland, 1992; Germany; Austria; Slovenia; Finland** (Jelínek 1997, 2007; Jelínek and Audisio 2007)	ripening and rotten vegetables
***Glischrochilus quadrisignatus* (Say, 1835)** = *canadensis* Brown, 1832	USA	**Germany, 1945; Italy, 1985, central and SE Europe** (Spornraft 1972; Nüssler 1973; Lompe 1976; Balarin 1984; Jelínek 1984, 2007; Audisio 1985, 1990, 1993; Jelínek and Audisio 2007; Callot 2008; Aberlenc and Brustel 2014)	ripening and rotten vegetables

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