Trogoderma variabile Ballion, 1878: a possible new pest of Italian entomological collections (Coleoptera: Dermestidae)

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Abstract
The first infestation of an entomological collection in Italy by Trogoderma variabile Ballion, 1878 is recorded; it was detected in Rome in 2014. This record and another one from the Molise Region, are herein discussed. Distributional, biological and nomenclatural data on this polyphagous alien pest are summarized, and its possible local establishment is discussed.

Key words: Dermestidae, new record, peninsular Italy, stored product pests, museum pests.

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Introduction
Trogoderma variabile Ballion, 1878 (Figs 1–2) is a cosmopolitan (Háva 2015) polyphagous species of high economic relevance, since it represents a pest of stored products and of zoological and botanic collections (Hagstrum & Subramanyam 2009; Hagstrum et al. 2013; see also http://www.MuseumPest.net).

Hereunder, captures of this alien species in Italy are discussed in order to alert museum curators handling botanical and zoological collections.

Material and Methods

The specimens were identified following various works (Bousquet 1990; Kingsolver 1991; Peacock 1993; Banks 1994; Háva 2011) and finally, identification was confirmed by Jiří Háva (Praha-západ, Czech Republic).

Acronyms of specimen depositories:

- CGN: G. Nardi collection, Cisterna di Latina (Latina), Italy
- CJH: J. Háva collection, Praha-západ, Czech Republic (J. Háva, pers. comm., 2017)
- CVV: V. Vomero collection, Rome (Italy)

Results

Trogoderma variabile Ballion, 1878

- Trogoderma variabilis [sic!] Ballion, 1878: 277.
- Trogoderma (Phradonoma) variabilis [sic!] Ball.: Sumakov 1907: 17.
- Globicornis 4-guttata [(Reitter, 1878)] ssp. unifasciata Pic, 1908: 41.
- Globicornis quadriguttata ssp. subfasciata [sic!] Pic, 1908: Dalla Torre 1911: 64.
- Phradonoma variabile Ballion, 1878: Dalla Torre 1911: 66.
- Trogoderma persica [sic!] Pic, 1914: 10.

Material examined. Italy: Lazio, Roma, Nuovo Salario, 41.57.18.59N, 12.31.6.94E (WGS84), Jun 2014, V. Vomero leg., on dry beetles, many adults and larvae (CGN; CVV); Molise, Campomarino (Campobasso), 25 May 1993, J. Háva sen. & Y. Elznicoova leg., at light, 2 adults (CJH).

Chorotype and distribution. Cosmopolitan (Háva 2015). This species, indigenous to Central Asia (cf. Ballion 1878; Mroczkowski 1968; Hagstrum et al. 2013), is currently known from all zoogeographical regions, but is mainly...
Nardi & Vomero

distributed in the Holarctic Region (cf. Hagstrum & Subramanyam 2009; Háva 2015). In Europe, it was firstly recorded from Caucasus (Mroczkowski 1968) and since 1975 in other regions (cf. Šefrová & Laštůvka 2005; Denux & Zagatti 2010). In Europe it is known from: Armenia, Belarus, Czech Republic, Finland, Great Britain, Greece, Italy, Latvia, Lithuania, South European Russia, Sweden and The Netherlands (Barševskis 2001; Hagstrum et al. 2013; Zhantiev 2013; Háva 2015).

This species was also recorded from Belarus (Barševskis 2001), Kyrgyzstan (Ovchinnikov 1996), “Syrie” (Pic 1908, as Globicornis 4-guttata unifasciata; Háva 2007), and The Netherlands (cf. Hagstrum et al. 2013; Zhantiev 2013) and these countries were not included in the distributional data provided by Háva (2015).

Ecology. In synanthropic environments, the larvae of *T. variabile* feed on grain, seeds, cereals, legumes, cocoa, nuts, milk powder and a wide range of other dried high-protein materials, including specimens of zoological collections and of herbaria (cf. Bousquet 1990; Peacock 1993; Beal 2003; Hagstrum et al. 2013). The adults do not feed (Peacock 1993). The synanthropic association of *T. variabile* is very old; Chu and Wang (1975, as *T. persicum* Pic) recorded this species from a Chinese tomb of ca. 100 B.C. In natural habitats, this dermestid develops in bees’ and birds’ nests and these can act as a source of infestation (Peacock 1993; Ikin et al. 1999).

Females of *Trogoderma variabile*, exhibit a diel pattern of calling behavior, and they produce a potent sexual pheromone to attract males (cf. Tobin & Bell 1986; Wright & Delves 1994); both males and females have four categories of antennal sensilla (Wei et al. 2015), that probably are involved also in the sexual communication.

The females of this species, as those of other congeners, are known to develop through a higher number of larval instars than males: on average, female larvae pupate after six larval instars, whereas males pupate after five. Under optimal conditions the life cycle of *Trogoderma variabile* from egg to adult is completed in 30 to 37 days. Nevertheless, if conditions are unfavorable larvae can enter diapause during which period they can survive more than a year without food (cf. Esperk et al. 2007; Hagstrum & Subramanyam 2009; see also http://www.MuseumPest.net). The larvae (Fig. 3), have numerous hastisetae on the dorsal surfaces of all segments (Peacock 1993). Hastisetae are easily pulled from the larva when setae of another arthropod become wedged in the slots, so their function is defensive, incapacitating possible arthropod predators by entangling their appendages (cf. Hagstrum & Subramanyam 2006). Anyway, the larvae and pupae of this species are the host of some ectoparasitic wasps of the genus *Laelius* Ashmead, 1893 (Hymenoptera, Bethylidae) (cf. Hagstrum & Subramanyam 2009), moreover, some nematode species are endoparasites of this dermestid (Rumbos & Athanassiou 2017), and a coccidian Protist can infect larvae, pupae, and adults of this species (Loschiavo 1969, as *T. parabile* Beal).

Unlike many *Trogoderma* species, the adult of *T. variabile* can fly and, at least, the males have a high degree

Figs 1-2 – *Trogoderma variabile*, adults from Italy, Rome. 1, dorsal view of a ♂ (body length: 3.15 mm); 2, dorsal view of a ♀ (body length: 3.1 mm) (photos by M. Gigli).
collected from Laos and Italy. This Italian material was housed in the entomological collection of V. Vomero, on several adults and larvae (Figs 1–3) infesting dry bee hereinafter. The above-mentioned record from Rome is based region is two years older than the previous records from other
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