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Zaprionus tuberculatus (Diptera Drosophilidae): first records from the European mainland

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Abstract

First records of the exotic species *Zaprionus tuberculatus* Malloch (Diptera Drosophilidae) for the European mainland are given. In September and October 2013, nineteen *Z. tuberculatus* specimens were found in Trentino (Italy). Information on the morphology, distribution and ecology of this species are provided. Field research to monitor *Z. tuberculatus* population dynamics in the European mainland is required. Agricultural damages deriving from its presence, with special emphasis to soft fruit cultivations, must be also assessed.

Key words: cryptic species, invasive pest, soft fruits, taxonomy, *Zaprionus indianus*.

Introduction

Invasive species are recognised as a threat to biodiversity. They can alter the environment and displace endemic species, thus imposing huge costs to agriculture, forestry and human health (Messing and Wright, 2006; Calabria *et al*., 2012). Catching a species in the beginning of possible spread offers a rare opportunity to study the dynamics of such an invasion in progress (van der Linde *et al*., 2006). In the course of field investigations carried out during a research project on the monitoring and control of the spotted wing drosophila *Drosophila suzukii* Matsumura (Diptera Drosophilidae) in Trentino (Italy) (Ometto *et al*., 2013), numerous species of Diptera were captured using traps filled with liquid bait (Cini *et al*., 2012). In September and October 2013, nineteen specimens of the exotic species *Zaprionus tuberculatus* Malloch (Diptera Drosophilidae) (figure 1) were captured by one of the authors (A.G.) in Trentino. We reported the detection of this drosophilid species as the first records for the European mainland.

Materials and methods

Individuals of *Z. tuberculatus* were caught in 2013 during a *D. suzukii* territorial monitoring in Trento province (Italy). Specimens were collected in two sites in close proximity to Trento. The first site was a deciduous wood located in Vattaro (Trento) at 700 m a.s.l. (45°59'24.71"N 11°13'50.31"E), while the second was a public garden in Trento, at 190 m a.s.l. (46°3'15.89"N 11°7'25.17"E).

Traps for *D. suzukii* were 1 litre red plastic flasks with six holes of 0.5 cm diameter, filled with liquid bait. The latter was a mixture of 75% apple cider vinegar, 25% red wine and a teaspoon of raw brown sugar. Traps were randomly hung on bushes at about 80 cm from the ground level. They were placed at the beginning of March 2013 and weekly renewed till 2014 February. Old baits were sieved in laboratory for counting *D. suzukii* adults. Specimens of *Z. tuberculatus* were

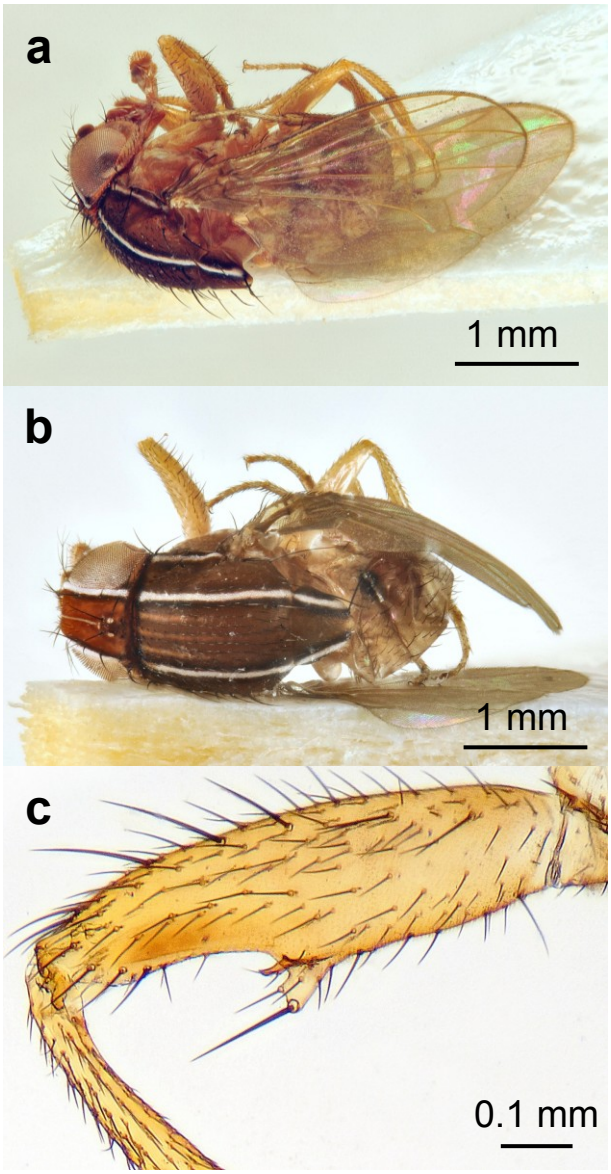

Figure 1. *Z. tuberculatus*: a) lateral and (b) dorsal view of a male, note the narrow central frontal band; (c) detail of the tuberculus on the forefemur in a female.

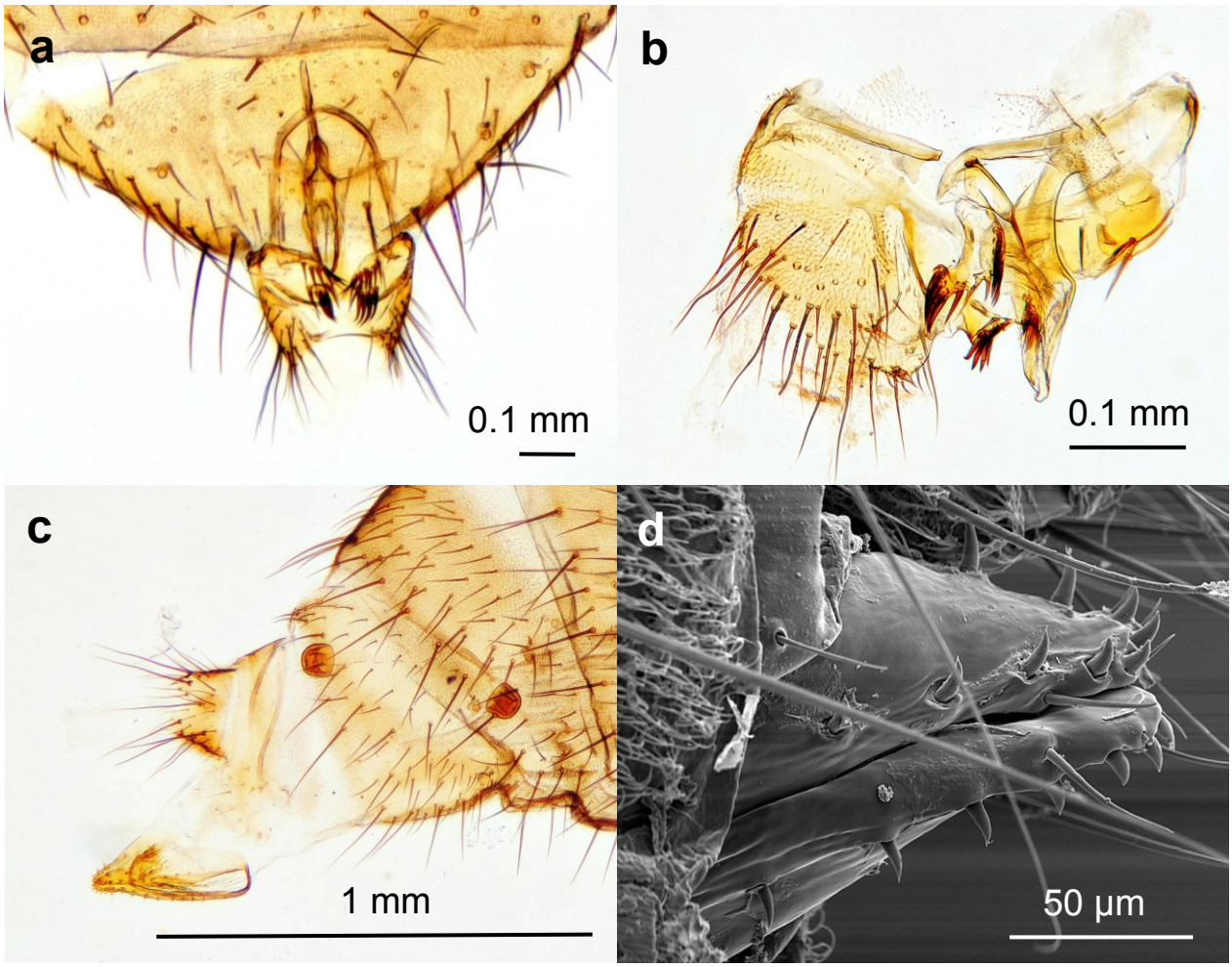

Figure 2. Taxonomic details of *Z. tuberculatus*: (a) ventral and (b) lateral view of the male genitalia. Detail of the female: (c) spermatechae and ovipositor; (d) scanning electron micrograph of the ovipositor.

collected, kept in 70% (v:v) alcohol and sent to one of the authors (A.R.) for specific identification. Voucher specimens are available at the Department of Agriculture, Food and Environment of the University of Pisa (Italy).

Results and discussion

All the individuals examined belonged to a unique species, *Z. tuberculatus* (figures 1 and 2) (Yassim, 2008; Yassim and David, 2010 and references therein). The captures of *Z. tuberculatus* were distributed over time as follows: September 2013, 6 males and 4 females; October 2013: 2 males and 7 females.

Z. tuberculatus is a species described by Malloch (1932) examining specimens from Rhodesia. The genus *Zaprionus* Coquillett is characterized by the presence of longitudinal white stripes on the frons and the mesonotum. It is a Paleotropical genus whose species are classified in two subgenera: *Zaprionus* sensu stricto (s.s.) in the Afrotropical region (48 species), and *Anaprionus* in the Oriental and Australasian regions (11 species) (Yassim and David, 2010).

The subgenus *Zaprionus* is a key element of the Afrotropical Drosophilidae, both in terms of number of species and relative abundance (Collart, 1937a; 1937b; 1937c; Lachaise, 1974; Tsacas, 1980; 1985; Chassagnard, 1988; Tsacas and Chassagnard, 1990; Yassin and David, 2010). Among the subgenus *Zaprionus* s.s., the *Z. tuberculatus* species subgroup is considered as a member of the *armatus* group (Chassagnard and Tsacas, 1993; Yassin, 2008). It was originally created as a complex of three species, mainly characterized by the presence of a spur borne on a salient tubercle on the medioventral margin of the forefemur (Tsacas *et al.,* 1977). The three species were *Z. tuberculatus* Malloch, *Zaprionus sepsoides* Duda and *Zaprionus mascariensis* Tsacas et David. The creation of the *Z. tuberculatus* species subgroup was due to the fact that the three mentioned species, despite that they were very similar from a morphological point of view, did not hybridize in laboratory conditions (Tsacas *et al.,* 1977). Concerning their geographical distribution, *Z. tuberculatus* and *Z. sepsoides* are sympatric species largely distributed in all the Afrotropical regions. *Z. tuberculatus* is present in Mauritius, Réunion, Madagascar, Saint-Helena, Cape Verde and Seychelles (Tsacas *et al*., 1977; Chassagnard and Kraaijeveld, 1991; Chassagnard and McEvey, 1992; Cariou *et al*., 2008). It is also present in the North Africa, Malta, Cyprus, Canary Islands and Near East (Ebejer, 2001; Patlar *et al*., 2012; Bächli, 2013), while

Z. mascariensis is endemic in Mauritius and Réunion (Yassin and David, 2010). Recently, the *Z. tuberculatus* species subgroup has been revised using both molecular and morphometrical techniques and two new cryptic species have been described (Yassim 2008; Yassim *et al*., 2008; Yassim and David, 2010).

The larvae of the *Zaprionus* s.s. genus usually develop on decaying fruits, even if some species feed on flowers (Buruga and Olembo, 1971). Concerning carpophagous ones, they are quite generalists. Indeed, *Z. tuberculatus* can be successfully reared on 49 different species of fruits, *Zaprionus indianus* Gupta on 79 species, *Zaprionus ghesquierei* Collart on 24 species (Lachaise and Tsacas, 1984; Chassagnard and Kraaijeveld, 1991). *Z. indianus*, *Z. tuberculatus* and *Z. ghesquierei* have been recognised as invasive species in the Palearctic region (Chassagnard and Kraaijeveld, 1991). Nowadays, *Z. tuberculatus* has been found in several locations of North Africa, Near East and Mediterranean islands (Bächli, 2013). Our data pointed out that it is now present in Italy. To the best of our knowledge, no data are available about the potential risk for agriculture deriving from the presence of this exotic drosophilid. However, the close-related species *Z. indianus*, currently widespread in four continents (i.e. Asia, Africa, Americas and Europe) (Carles-Tolrá, 2009; Commar *et al*., 2012; Bächli, 2013), has been recognised as a pest of fig orchards, with special reference to Central and South America (van der Linde *et al*., 2006). On this basis, we encourage further field research to monitor this species and assess possible agricultural damages deriving from its presence, with special emphasis to soft fruit cultivations.

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