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Zelus renardii Kolenati, 1857 (Hemiptera, Reduviidae), a new member of the entomosarcosaprophagous fauna

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Abstract: *Zelus renardii* Kolenati, 1857 (Hemiptera, Reduviidae) is reported for the first time from a forensic case which occurred in the Región de Murcia (SE Spain). The first reference of the species related to the cadaveric ecosystem is given, enlarging the list of species belonging to the entomosarcosaprophagous fauna.

Key words: Hemiptera, Reduviidae, *Zelus renardii*, entomosarcosaprophagous fauna, Spain.

Resumen: *Zelus renardii* (Kolenati, 1857) (Hemiptera, Reduviidae), un nuevo elemento de la fauna entomosarcosaprófaga. Se presenta, a través de las evidencias recogidas en un caso forense ocurrido en la Región de Murcia (SE España), la primera referencia conocida de la especie *Zelus renardii* Kolenati, 1857 (Hemiptera, Reduviidae) en relación con el ecosistema cadavérico, ampliando así el listado de especies de la fauna entomosarcosaprófaga.

Palabras clave: Hemiptera, Reduviidae, *Zelus renardii*, fauna entomosarcosaprófaga, España.

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Introduction

Entomosarcosaprophagous fauna is a highly valuable resource and a necessary tool in forensic studies. Studying its composition and dynamics allows getting different approaches, being perhaps the most well-known estimation of the postmortem interval (PMI). In addition to the potential forensic application of the corpses related fauna, some studies are providing interesting faunistic news, most of them concerning Diptera species (see i.e., Arnaldos et al., 2014; Carles-Tolrá et al., 2014; Disney & Manlove, 2009; Martínez-Sánchez et al., 2011; Prado e Castro et al., 2012), although data also exist on other insect groups, i.e. Hemiptera (e.g. Adler & Wheeler, 1984; Baz et al., 2010; Constant, 2007; Eger et al., 2015; Payne et al., 1968), since a corpse represents a hot spot of biological and chemical activity

(Barton et al., 2013) capable of sheltering species with very different needs thanks to the dynamics of the decomposition process. A wide variety of arthropod species is attracted to carrion playing different roles in the decomposition process; the community at a particular stage of decomposition may be named after the feeding habit of its characteristic members (Bornemisza, 1957). The usual classification of sarcosaprophagous fauna divides it into five distinct ecological groups: necrophages, necrophiles, omnivores, opportunists and accidentals, the necrophiles being those that feed on the necrophages in the corpse by predation or parasitism (Arnaldos et al., 2005). Most of the species belonging to the family Reduviidae are considered predaceous or blood-sucking, living mainly on the blood of insects or other animals (Miralles-Núñez et al., 2021; Payne et al., 1968) and some species have been collected on animal carrion (Arnaldos et al., 2004; Baz et al., 2010; Eger et al., 2015; Payne et al., 1968). According to the former classification of the ecological groups of the sarcosaprophagous fauna, Reduviidae family belongs to the necrophile group. Despite it, Baz et al. (2010) report the presence of a Reduviidae species (*Rhynocoris cuspidatus* Ribaut, 1921) on carrion, as well as two Nabidae species, under the "umbrella" of phytophagous insects, without commenting anything on them.

Materials and methods

In an actual forensic case, studied at the Laboratory of Forensic Entomology and the SECyTeF of the University of Murcia, concerning a dog (*Canis familiaris* L.) carcass hanging from a tree by a rope (Fig. 1), a high number of specimens of *Zelus renardii* Kolenati, 1857 were recorded inside it. The dog was found by SEPRONA's (Servicio de Protección de la Naturaleza) Civil Guard agents at the Sierra de la Pila Regional Park in the Región de Murcia, at the site known as "El Boquerón" (UTM WGS84 30S X651456; Y4239627), belonging to the municipality of Abarán. The area where the dog was found is very little travelled, although hunting and grazing activities are performed in proximity. The dog probably was a non-feral mongrel about a year and a half old.

Once at the laboratory, the corpse was inspected both on surface and inside. Apparently, the corpse was in the dry stage of decomposition process and different entomological fauna was detected of which abundant evidence was collected, many of them alive, from different parts of the body. The samples were preserved in 70% ethanol.

Results

The entomological evidence was composed of Diptera: Calliphoridae (*Chrysomya albiceps* (Wiedemann, 1819) and Polleniinae), Sarcophagidae (*Sarcophila latifrons* (Fallén, 1817)), Muscidae (*Musca domestica* L., *Hydrotaea* sp.); Coleoptera: Dermestidae (*Dermestes frischii* Kugelann, 1792, adults, larvae, exuviae, fragments and numbered peritrophic membranes), Nitidulidae (*Nitidula* sp.); Hemiptera: Coreidae, Reduviidae (*Z. renardii* adults); and Arachnida. All entomological evidence matches an advanced decomposition stage (dry stage). The



Fig. 1.- Condition of the corpse at the time of discovery. Source: SEPRONA.

estimation of the minimum PMI was made based on Dermestidae specimens, that have been revealed as potentially useful indicators in forensic investigations related to skeletonized and mummified human corpses, and according to data given by Martín-Vega *et al.* (2017). It was concluded that the animal's dead could have occurred about a minimum of 40 days before the discovery of the corpse.

Discussion

Among the entomological evidence, the presence of *Z. renardii* is especially noteworthy since is an exotic invasive species never-before collected related to the cadaveric ecosystem. The bugs were recovered almost from everywhere in the corpse, the head (Fig. 2), the neck and the body cavity (Fig. 3). The specimens were alive and very active and were found together with also abundant Dermestidae larvae, also alive, on which they were observed feeding.

Zelus renardii is the only species of the genus that has been reported from Europe; it is endemic to Central and North America, from where it has been introduced in other parts of the world, most likely dispersed by human activities (Pinzari *et al.*, 2018). The species is considered as one of the Reduviidae with the biggest geographical expansion in the last years (Miralles-Núñez *et al.*, 2021). In Europe, it was firstly reported from Greece (Davranoglou, 2011) and then from Spain (Baena & Torres, 2012; Vivas, 2012), where it has been reported from the provinces of Barcelona, Castellón, Valencia, Alicante, Murcia, Almería, Málaga, Sevilla, Cádiz and Madrid (Baena & Torres, 2012; Goula *et al.*, 2019; Miralles-Núñez *et al.*, 2021; Rodríguez Lozano *et al.*, 2018; Vivas, 2012), being probably settled in a large part of the Iberian Peninsula (Vivas, 2012) since it has been already reported from Southern Portugal (van der Heyden & Grosso-Silva, 2020). It acts as an exotic invasive species because of being adaptable, highly dispersive and able to colonize new areas readily (Davranoglou, 2011). Some bites on humans due to this species have been reported from Spain which may be because it is becoming more frequent, mainly in anthropic environments but also in agricultural ones (Miralles-Núñez *et al.*, 2021). The pioneering nature of this species (Weirauch *et al.*, 2012), its dispersal more than likely by human activities and its tolerance to adverse conditions, such as high temperature, could create direct competition with other indigenous reduviids of the Palaearctic region (Pinzari *et al.*, 2018) and it can go hand in hand, and even increase, with global warming.

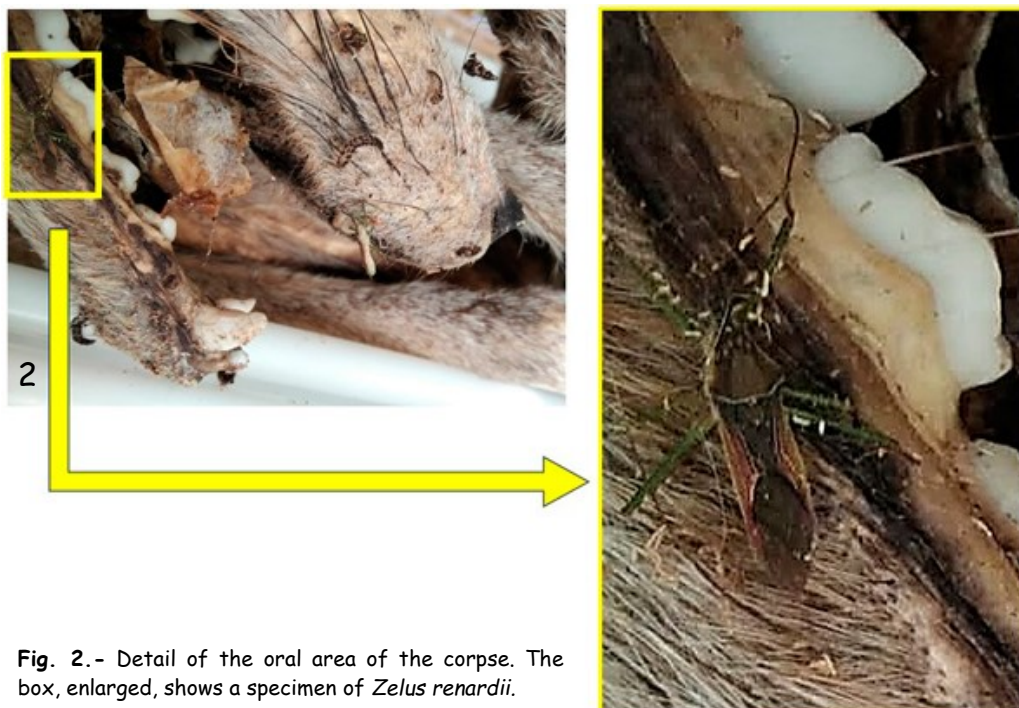


Fig. 2.- Detail of the oral area of the corpse. The box, enlarged, shows a specimen of *Zelus renardii*.

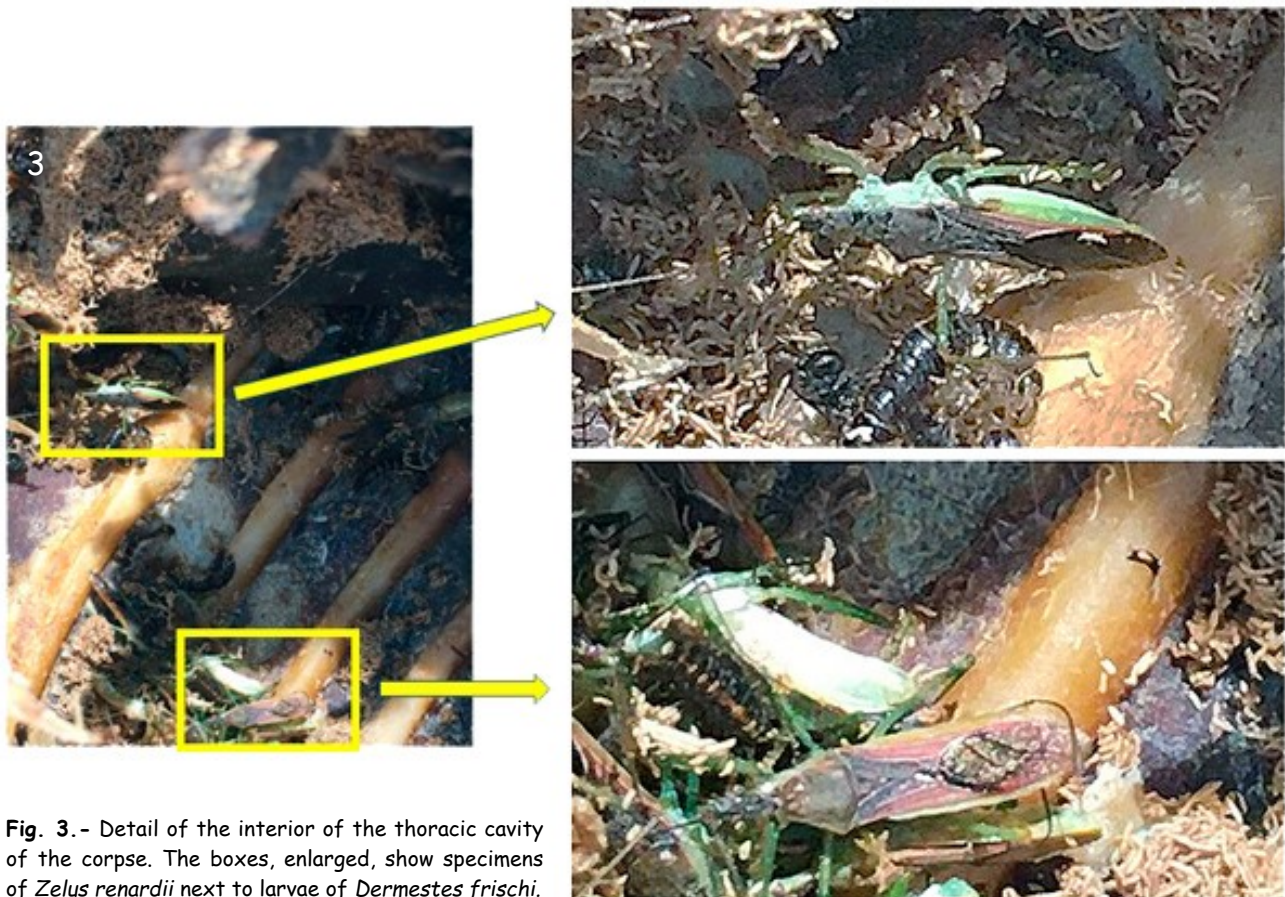


Fig. 3.- Detail of the interior of the thoracic cavity of the corpse. The boxes, enlarged, show specimens of *Zelus renardii* next to larvae of *Dermestes frischi*.

Due to the observed predaceous behaviour of this species on Dermestidae larvae, its role as necrophilous within the entomosarcosaprophagous fauna becomes obvious. *Zelus renardii* is considered a generalist predator, the adults can feed on almost any arthropod they can catch (Pinzari et al., 2018). Although it is not surprising due to its generalist nature as a predator, as far as we know Dermestidae have never been reported as prey for *Z. renardii*; thus, the list of species on which it can feed is enlarged. The interest of such predation, from a forensic perspective, deals with the potential capacity of removing a big amount of Dermestidae larvae from the corpse which can modify the faunal succession and the decomposition itself, even compromising the estimation of minimum PMI when considering the entomological evidence, as it occurs in the case of *Nasonia vitripennis* (Walker, 1836) (Hymenoptera: Pteromalidae) affecting Diptera larvae (Charabizde & Hedouin, 2014).

Zelus renardii had not previously been reported from a corpse; thus, this is the first forensic case on record it is involved in. Our finding extends the global list of insects of forensic importance, emphasizing the need to identify all entomological evidence in forensic practice since all species can provide information related to the case.

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