

## ***Nagusta goedelii* (Kolenati, 1857) (Hemiptera Heteroptera Reduviidae) in Sardinia: human-mediated dispersal aids this species to spread west**

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### **ABSTRACT**

This note reports the first finding of the reduviid bug *Nagusta goedelii* (Kolenati, 1857) in Sardinia and is first ascertained case of the human-mediated introduction of this species. In fact, *Nagusta goedelii* is showing an expansion of its geographical range from the east to the west, however the causes are still unknown and further studies are needed. A brief review of the European distribution of this species is given. An update of its regional occurrence in Italy, based on verified records available online, is also provided. The species was observed in co-occurrence with the invasive bug *Halyomorpha halys* (Stål, 1855), which would appear to be one of its possible predators.

### **KEY WORDS**

Alien species; brown marmorated stink bug; *Halyomorpha halys*; introduced species; reduviid.

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On 23 October 2020 - as part of a volunteer monitoring of the brown marmorated stink bug, *Halyomorpha halys* (Stål, 1855) (Hemiptera Heteroptera Pentatomidae) in Sardinia (Italy) - one of the authors (MR) observed an adult *Nagusta goedelii* (Kolenati, 1857) (Hemiptera Heteroptera Reduviidae) on a window of the Court of Appeal in Sassari, NW-Sardinia (40°42'38"N 08°33'03"E) (Fig. 1). One month later, on 19 November, a female specimen was observed in the same site (Fig. 2) and collected (preserved in the entomological collection of the Department of Agricultural Sciences, University of Sassari), thus confirming the presence of the species.

*Nagusta goedelii* has been expanding its geographical range from the east to the west (see Dorow et al., 2018). It is a generalist predator potentially capable of attacking the eggs and first instar nymphs of *Halyomorpha halys* (Bulgarini et al., 2020) which recently colonized Sardinia (Loru et al., 2018; see Cianferoni et al., 2018, 2019 for distribution review). However, the use of alien reduviids in the biocontrol of invasive preys always needs to be carefully evaluated. In fact, the proposal to enhance the predatory role of another alien reduviid has garnered a lot of criticism (Pinzari et al., 2018; Bella, 2020). This is the case of *Zelus renardii* (Kolenati, 1856), which is native to North America and has been in-

roduced into several countries across the world including Italy. It has been recently proposed as potential biocontrol agent of the native *Philaenus spumarius* (Linnaeus, 1758) (Hemiptera Auchenorrhyncha Aphrophoridae), a vector of the bacterium *Xylella fastidiosa* subsp. *pauca* ST53 (Cornara et al., 2016; Liccardo et al., 2020).

Species of the genus *Nagusta* Stål, 1859 are widespread mainly in Africa and Asia (Maldonado Capriles, 1990), but only *Nagusta goedelii* has reached eastern Europe (Putshkov & Putshkov, 1996). In fact, this species was originally known in Central Asia, the Caucasus, the southern European part of Russia, Ukraine, northern parts of the Middle East, Cyprus, and south eastern Europe (e.g., Kolenati, 1857; Stål, 1859; Jakovlev, 1876; see also Putshkov & Putshkov, 1996 and Dorow et al., 2018). In the last 125 years at least, *Nagusta goedelii* has been spreading slowly westwards. Just before the begin of the 20<sup>th</sup> century, it was found in Hungary (Horváth, 1900), from 1930 in Slovenia (Gogala, 2004), from 1952 in Slovakia (Stehlík & Vavřínová,

1998), and from 1999 in Austria, however it was probably already present from the first half of the century (Rabitsch, 2001; see Dorow et al., 2018).

More recently the speed of its diffusion has increased and it was first recorded in Italy in 2007 (Olivieri, 2011), in the Czech Republic since 2010 (Kment & Dolejšová, 2010), in France, first in the Maritime Alps (2014), then increasingly further west to the Gironde (2020) (Fadda & Dusoulier, 2016; Haxaire & Ducamp, 2016; Baghi & Maurel, 2017; Labatut & Charles, 2020), and in Germany since 2017 (Dorow et al., 2018).

In Italy, the species was found in 2007 in Abruzzo (Olivieri, 2011) and Emilia-Romagna (Dioli, 2014), in 2010 in Tuscany (Dioli, 2014). It then spread to many other regions of northern and central Italy (Luthi & Dioli, 2020). Further records of this species (also reconfirmed by the authors of this note) in southern Italy are available from the platform iNaturalist and other web resources, i.e., [www.entomologiitaliani.net](http://www.entomologiitaliani.net), [www.naturamediteraneo.com](http://www.naturamediteraneo.com) (unpublished data). Observations are



Figures 1, 2. *Nagusta goedelii* (Kolenati, 1857), Court of Appeal, Sassari, Sardinia (Italy). Fig. 1: first observed adult specimen, 23 October, 2020 (photo by Chiara Martinez). Fig. 2: second observed adult specimen (female), 19 November, 2020; preserved in the entomological collection of the Department of Agriculture, University of Sassari (photo by Giorgia Bruzzi).

also available from Friuli-Venezia Giulia (from 2016), Piedmont (from 2017), Lombardy, Veneto, Latium, and Basilicata (from 2018), Liguria (from 2019), Trentino-Alto Adige (Trentino), Marche and Molise (from 2020). The distribution in Italy seems limited by the Alps and the Apennines, and the diffusion southwards is still ongoing.

The causes of the western dispersal of *Nagusta goedelii* are still unknown. However, dispersal is always a complex process, often with the stratification of a natural short-distance dispersal (SDD) and an anthropogenic long-distance dispersal (LDD) (see for example Butikofer et al., 2018). This pattern has been highlighted in relation to many important pests on which there are detailed data, for example the screw-worm (*Cochliomyia hominivorax* (Coquerel, 1858), Diptera Calliphoridae) in Australia (Mayer et al., 1993), Argentine ants (*Linepithema humile* (Mayr, 1868), Hymenoptera Formicidae) worldwide and in the USA (Suarez et al., 2001), and the gypsy moth (*Lymantria dispar* (Linnaeus, 1758), Lepidoptera Erebidae) in the USA (Biggs et al., 2011).

We believe that our new finding of *Nagusta goedelii* in Sardinia will help us to better understand its dispersal mechanisms. This is clearly a case of human-mediated introduction (the first one ascertained, on the basis of available data). In fact, the distance between the island and the continental coast is so wide that it is definitely beyond the autonomous dispersal capacities of this species.

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