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First records of *Ameles spallanzania* in the Western Alps and habitat preferences

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Abstract

The European dwarf mantis *Ameles spallanzania* (Rossi) (Mantodea Mantidae) is a European-Mediterranean species that has shown rapid expansion in Italy over the past few decades. Its rapid diffusion in the northern peninsula seems to be linked to artificial communication routes, such as railways. This article reports the first records of this species in the Western Alps (Susa Valley), in the Natura 2000 site IT1110030. Some surveys were carried out on the area of presence and a generalized linear model (GLM) was implemented to investigate the relationship between the habitat and its presence-absence. The results indicate a preference for sparsely and vegetated environments with presence of flowering plants typical of xeric areas. The proximity of some observations to the railways suggests that the new presence data may be related to a new colonization rather than a relict population.

Key words: European dwarf mantis, expansion, Susa Valley, xeric, railways, Foresto.

Introduction

The European dwarf mantis *Ameles spallanzania* (Rossi) (Mantodea Mantidae) is a European-Mediterranean species (Fontana *et al*., 2005), mainly distributed in southern Europe and northern Africa (Agabiti *et al*., 2010; Battiston *et al*., 2010). This species mainly occupies Mediterranean habitats such as maquis and garrigue and is more common in coastal areas (Cogo and Battiston, 2007; Battiston, 2020).

In Italy, the distribution of *A. spallanzania* was historically concentrated in the central-southern coastline (Fontana *et al*., 2005; Cogo and Battiston, 2007). However, it has recently shown a rapid increase in observations especially in the central-northern and north-eastern Italy (Battiston and Buzzetti, 2012; Uliana and Battiston, 2012; Leandri *et al*., 2013; Ballini and Wilhalm, 2014; Buzzetti *et al*., 2018; Battiston *et al*., 2020a; Tabarelli de Fatis and Debiasi, 2020), which at least in part could be attributable to an expansion of the species northwards (Battiston *et al*., 2020a). In north-western Italy the historical distribution of *A. spallanzania* mainly concerned the Ligurian coast, while for Piedmont there were only few occurrences dating back to 1930 and 1936 in the province of Alessandria, not far from Liguria (Fontana *et al*., 2005; Sindaco *et al*., 2012). Recently, a small new population of this species has been documented in central-eastern Piedmont among the Vercelli rice plain (Ciraci, 2016) and two more observations were recorded on the citizen science platform iNaturalist.org in 2019, a few kilometres from this. Overall in northern Italy, the proximity of the new occurrences of *A. spallanzania* to communication routes or urban centres suggests the spread of the species through human activity (Battiston and Buzzetti, 2012; Battiston *et al*., 2020a). Furthermore, the increase of population in the continental area is supposed to be related to the climate warming underway (Battiston *et al*., 2020a). This species is classified as LC (least concern) according to the classification provided by IUCN (Battiston, 2020).

In this paper we present a new record of *A. spallanzania* for north-western Italy and a simple analysis on the relative habitat selection.

Materials and methods

The study area was inside the site of Natura 2000 network IT1110030 "Oasi xerotermiche della Valle di Susa - Orrido di Chianocco e Foresto", located in the Western Italian Alps. This protected area is characterized by the presence of distinctly xeric habitats, which host numerous floristic and faunistic elements typical of the Mediterranean biogeographical region (Sindaco *et al*., 2009).

The new station of *A. spallanzania* was identified after the accidental finding of a male specimen. Given the capacity of the males to disperse by flying, it was deemed necessary to find females to verify the presence of other specimens colonizing the surroundings. For this purpose, the research has been extended to a radius of about 150 m from this first occurrence.

In order to collect ecological information, an area of 7500 m^2 including all observations was sampled. A regular network of points spaced 10 m apart was superimposed on the area, randomly selecting 60 of them with QGIS (ver. 2.18.25). Each selected point was used as the centre of a plot, represented by a square of 5 × 5 m. For each plot, the species was carefully researched, using both the entomological sweep net and probing the tufts of grass, forbs and bushes with a stick. At the same time, abundances of some land cover variables were visually estimated according to the scale of Braun-Blanquet (1932): bare soil, grass, forbs, bushes and trees. In addition, the presence-absence of visible flowers was noted.

To model the presence-absence of *A. spallanzania* within the surveyed plots, a series of Bernoulli generalized linear models (GLM) were performed. In the response variable, only the presence of females was considered, while males were considered less informative. In fact, only the males are winged and can disperse away to

search for females (Battiston and Galliani, 2011), therefore they could be found not only in suitable microhabitats but also in areas that they can reach randomly during their flights. Land cover data collected were used as predictors, after checking the absence of strong correlations between them (< 0.7). The best model was selected based on the Akaike Information Criterion, widely used evaluation method to compare models (Zuur *et al*., 2009). Goodness-of-fit of the model was assessed with the proportion of explained deviance, also known as McFadden's pseudo-R2, which can be interpreted similarly to the coefficient of determination in ordinary regression (McFadden, 1974). All statistical analysis were performed with R (ver. 3.6.3).

Results

On 9 September 2021, one adult male of *A. spallanzania* was accidentally observed by the author on a tuft of grass. On 11 September subsequent research allowed to find several specimens of both sexes, at a minimum distance of about 70 m from the first observation. On 13 and 14 September the 60 randomly selected plots were surveyed. Overall, 19 adult specimens were observed standing on forbs: 5 on *Echinops sphaerocephalus* L., 5 on *Artemisia campestris* L., 4 on *Centaurea paniculata* L., 3 on *Eryngium campestre* L. and 2 on *Odontites luteus* (L.) Clairv. (figures 1-2). The species was found in 14 plots and the presence of females was found in 12 of these. The presence area was located at an altitude of about 520 m a.s.l., inside the LR50 10 × 10 km UTM grid cell, according with the data mapping method provided in Ruffo and Stoch (2005).

No strong correlation was detected between independent variables used in the modelling. The best GLM shows a good fit, attained a pseudo-R^2 of 0.43. Only bare soil abundance and the presence-absence of flowers were significant predictors of the presence-absence of *A. spallanzania* in the study area (table 1, figure 3-4).

Further investigations made it possible to observe two other female specimens on 12 and 22 October 2021, at a minimum linear distance of 1100 m from the first observations and about 50 m from the railway line.

Discussion

The data collected constitute the first presence records of *A. spallanzania* in the Western Alps. The specimens were found in a xerothermic oasis inside the Susa Valley, known for hosting numerous elements typical of the Mediterranean bioregion. According to the model, here the species seems to be predominantly present in slightly vegetated microhabitats, with presence of flowering plants. Various environments with minimal vegetation are also considered the most suitable according to Cassar (2020) in the Maltese Islands, where according Battiston *et al*. (2020b) this species was found mainly in areas with sclerophilous vegetation. The individuals were observed mainly on herbaceous flowering plants typical of arid and warm environments, which well characterize the climate of the site. The use of flowering plants for rest and hunting was observed by Pezzi and Bendazzi (2007). All the specimens observed were adults, as expected for the populations of colder latitudes who overwinter as oothecae (Battiston and Galliani, 2011).

Figure 1. Specimens of *A. spallanzania* standing on forbs observed during the surveys: **a)** female on *Echinops sphaerocephalus*, **b)** female on *Odontites luteus*, **c)** male on *Eryngium campestre* and **d)** male on *Artemisia campestris*.

Figure 2. A typical slightly vegetated habitat in which *A. spallanzania* were found.

Table 1. Summary of the GLM implemented to model the probability of presence of *A. spallanzania* in the study area.

Model parameter	Estimate	SE	z value	p
Intercept	12.80	3599.36	0.00	1.00
Bare soil	0.13	0.05	0.66	0.01
Forbs	−1.49	239.36	−0.01	1.00
Flowers	3.31	1.55	2.13	0.03

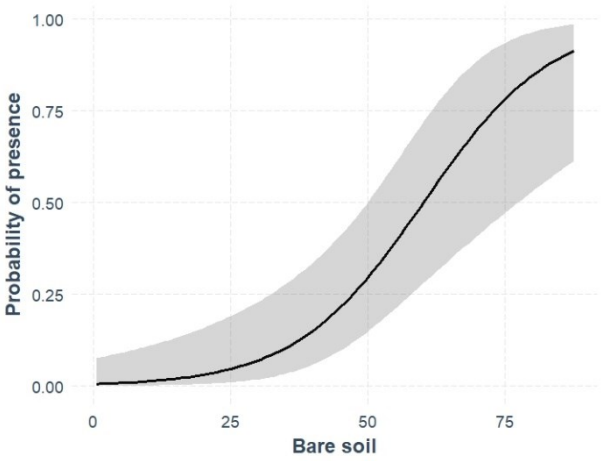

Figure 3. Effect of the abundance of bare soil on the probability of the presence of *A. spallanzania.*

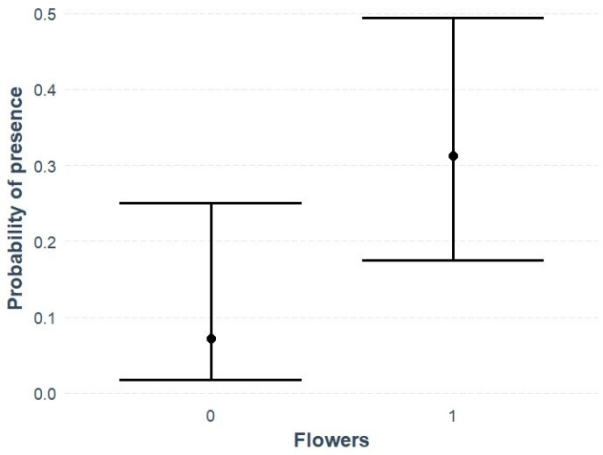

Figure 4. Effect of the presence-absence of flowers on the probability of the presence of *A. spallanzania.*

Currently, it is not possible to establish with certainty the origin of the presence of *A. spallanzania* in this area. However, the supposed rapid and recent expansion of this species in the northern Italy (Battiston *et al*., 2020a), suggests that it could be a new colonization. In this regard, the proximity of some observations on the railway line seems to support this hypothesis. The great dispersive potential shown by this species along the human communication routes (Battiston and Buzzetti, 2012; Battiston *et al*., 2020a) could therefore have brought it this far, where it has found climatic and environmental conditions suitable for its survival. However, the existence of xerotermic suitable habitat for this species could indicate the possibility of a relict population, similarly to

other Mediterranean species present in the area, such as *Saga pedo* (Pallas) present less than 100 m away (Anselmo 2019). The existence of isolated and relict populations has also been hypothesized in the north-eastern Italy to the Euganean hills (Cogo and Battiston, 2007). Not being sure of the conservative value of the new data and in accordance with the policies of the site of Natura 2000 network, no precise coordinates are given on the location of the records. Future and in-depth genetic analyses could clarify the situation. In the meantime it will be necessary to monitor the site and the adjacent areas, to check if it is a stable population and to observe any expansions of the species.

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