

Harmonia axyridis recordings in northern Italy

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Abstract

In summer 2008, larvae, pupae and adults of *Harmonia axyridis* (Pallas) (Coleoptera Coccinellidae) were found in several localities in northern Italy. Since the first record in Turin (Piedmont) in 2006, this ladybird, just two years later, was collected up to the northeast of Italy. The colour forms found consisted for 97.52% of *H. axyridis succinea* and 2.48% of *H. axyridis spectabilis* (n = 1049). These records may represent a case study in modelling intra-guild predation and the spread of an exotic species.

Key words: exotic species, establishment, Italy, *Harmonia axyridis*, form *succinea*, form *spectabilis*, Coleoptera, Coccinellidae.

Introduction

The multicoloured Asian or harlequin ladybird beetle *Harmonia axyridis* (Pallas) (Coleoptera Coccinellidae) is considered as invasive exotic species in Europe and North America (Brown *et al.*, 2008). Recently, some reviews on *H. axyridis* focused on the ecology, biology, spread, distribution, biological application and potential impacts of this coccinellid (Koch, 2003; Majerus *et al.*, 2006; Pervez and Omkar, 2006). A synthesis of research on *H. axyridis*, providing current perspective and future directions, was published (Roy and Wajnberg, 2008). Besides questions related to the ecological risks of this exotic ladybird species, as synthesized in the cited book, there is also an interest in following its spread and the dynamics of its potential geographic distribution by keeping records up to date (P. M. J. Brown, *in litteris*). For its biological features, *H. axyridis* is considered a case study in modelling the spread of an exotic species. Simulation models were used to predict the establishment potential of this coccinellid (Poutsma *et al.*, 2008). Concern about asymmetric intra-guild predation (IGP) is also an important topic to evaluate in new colonized areas. Up to now, bioassays in Italy were only performed in the laboratory (Burgio *et al.*, 2002; 2005) and experiments on predation under semi-field conditions (Burgio *et al.*, 2008). Moreover, the capability to overwinter was demonstrated for artificially reared individuals (Bazzocchi *et al.*, 2004).

From 1995 to 1999 adults of *H. axyridis* were released in Italian protected crops as beneficial biological control agents of pest aphids (Orlandini and Martellucci, 1997). The commercialization was eventually discontinued due to the suspected invasiveness.

In October 2006, the first feral *H. axyridis* adults and pupae (approximately 30 specimens) were detected in an urban area of Turin (Piedmont, northwest Italy). In 2007 a few adults were observed again in the same region (Brown *et al.*, 2008) and first anecdotal record from Lombardy occurred on the internet. In the present note we report the detection of this species in several new locations in northern Italy.

Materials and methods

Visual samplings were carried out, in a scattered way, since 2000 focusing particularly on the garden of Faculty of Agriculture, Bologna University. After the first finding in Emilia-Romagna region on June 29, 2008, near Verucchio, the sampling effort was increased. *H. axyridis* was monitored directly by visual observations made by the authors and also asked our colleagues in Italy. The samplings were conducted in the rural environments potentially subject to the colonization by *H. axyridis*, such as orchards, arable crops, hedgerows, isolated trees and field margins. *H. axyridis* was also monitored in some urban environments such as houses, buildings, gardens and boulevards.

The monitoring programme was employed in a qualitative way, by recording the presence of larvae, pupae or adults in case of localities with high populations of the coccinellids, and eventually counting the larval and adult specimens that were collected for the identification in the laboratory. The colour forms of specimens collected were counted in three localities (Crevalcore, Modena and Nonantola).

The sites in which *H. axyridis* was recorded were mapped using Google Earth (©2007 Google™), providing the coordinates of each site and including also the characteristics of the investigated habitats (figure 1).

Results and discussion

The sites where *H. axyridis* has been recorded are reported in table 1 and represented in figure 1. In addition internet records have occurred in 2008 as well. As only some of these could be confirmed, these are not included in the map. Most of the specimens belonged to the *succinea* form (Seo *et al.*, 2008). Between the melanic forms (*spectabilis* and *conspicua*) only the *spectabilis* was found in a very low percentage (no *conspicua* colour pattern was detected). The data on the last generation (migrant adults) were as follows: 97.68% *succinea* (n = 992,

Table 1. Localities in northern Italy in which *H. axyridis* was recorded. Data updated till the end of October 2008. Localities were ordered from North to South.

Code	Locality	Region	Coordinates	Plant/habitat
1	Tarcento (Udine)	Friuli-Venezia Giulia	46°12'48.99"N 13°12'50.10"E	Garden (adults) sample collected by I. Bernardinelli
2	San Fedele (Sondrio)	Lombardy	46°11'42.77"N 9°27'4.59"E	<i>Hibiscus</i> sp. (2 larvae)
3	Sueglio (Lecco)	Lombardy	46°5'12.20"N 9°20'5.47"E	Garden (2 pupae, 2 adults)
4	Martignacco (Udine)	Friuli-Venezia Giulia	46°5'32.31"N 13°7'49.85"E	House (1 adult) sample collected by P. Zandigiacomo
5	Vestreno (Lecco)	Lombardy	46°5'3.19"N 9°19'33.55"E	<i>Hibiscus</i> sp. (2 adults), garden hedge (20 larvae)
6	Corenno (Lecco)	Lombardy	46°4'55.26"N 9°18'38.95"E	<i>Buddleja davidii</i> (larvae and adults)
7	Dervio (Lecco)	Lombardy	46°4'21.85"N 9°18'13.64"E	Umbelliferae grass strips (2 mating adults), <i>Prunus spinosa</i> (1 adult)
8	Bellano (Lecco)	Lombardy	46°2'25.60"N 9°18'12.56"E	<i>Hibiscus</i> sp. (1 adult)
9	Menaggio (Como)	Lombardy	46°1'12.06"N 9°14'22.65"E	<i>Nerium oleander</i> (1 adult)
10	Lecco	Lombardy	45°51'10.74"N 9°23'24.25"E	<i>Tilia platyphyllos</i> (2 adults)
11	Cascina Barera (Milano)	Lombardy	45°24'8.66"N 9°0'42.60"E	Maize (adults) samples collected by G. Camerini
12	Legnaro (Padua)	Veneto	45°21'11.95"N 11°57'4.28"E	Garden (adults) samples collected by V. Girolami
13	Maleo (Lodi)	Lombardy	45°10'12.00"N 9°46'29.99"E	Maize (adults) samples collected by L. Garioni
14	Codogno (Lodi)	Lombardy	45°9'44.00"N 9°43'15.00"E	Maize (adults) samples collected by L. Garioni
15	Somaglia (Lodi)	Lombardy	45°8'48.02"N 9°38'14.37"E	<i>Laurus nobilis</i> (adults preying <i>Ceroplastes</i> sp.) samples collected by L. Garioni
16	Chierichezze (Lodi)	Lombardy	45°6'58.00"N 9°39'39.00"E	Maize (adults) samples collected by L. Garioni
17	Bastida Pancarana (Pavia)	Lombardy	45°5'10.27"N 9°4'56.54"E	Maize (adults) samples collected by G. Camerini
18	Bressana Bottarone (Pavia)	Lombardy	45°4'44.03"N 9°7'58.79"E	Maize (adults) samples collected by G. Camerini
19	Castelletto di Branduzzo (Pavia)	Lombardy	45°4'13.36"N 9°5'56.03"E	Maize (adults) samples collected by G. Camerini
20	Polesine Parmense (Parma)	Emilia-Romagna	45°1'16.18"N 10°5'33.08"E	Garden (adults)
21	Occhiobello (Rovigo)	Veneto	44°53'55.83"N 11°36'23.04"E	<i>Ficus carica</i> (adults) samples collected by R. Ferrari and M. Pozzati
22	Parma	Emilia-Romagna	44°49'50.71"N 10°20'14.60"E	Hedgerows (adults)
23	Novi Ligure (Alessandria)	Piedmont	44°44'19.53"N 8°46'49.64"E	House (adults) samples collected by F. Panella
24	Ravarino (Modena)	Emilia-Romagna	44°43'25.42"N 11°5'59.88"E	Vineyard (adults)
25	Crevalcore (Bologna)	Emilia-Romagna	44°43'17.67"N 11°9'3.47"E	Maize and houses (adults)
26	Castello d'Argile Bologna	Emilia Romagna	44°41'0.08"N 11°18'6.15"E	House (adults) samples collected by A. Puggioli
27	Nonantola (Modena)	Emilia-Romagna	44°40'35.76"N 11°2'7.38"E	<i>Acer campestre</i> and house (adults)
28	Modena	Emilia-Romagna	44°39'14.26"N 10°53'31.28"E	House (adults)
29	Bologna	Emilia-Romagna	44°30'52.14"N 11°24'19.38"E	Garden (mixed population of larvae, pupae and adults)
30	Crespellano (Bologna)	Emilia-Romagna	44°30'41.07"N 11°7'53.67"E	House (4 adults)
31	Monteveglia (Bologna)	Emilia-Romagna	44°28'18.00"N 11°6'6.75"E	Vineyard (adults)
32	Castello di Serravalle (Bologna)	Emilia-Romagna	44°26'09.89"N 11°07'09.74"E	Vineyard (1 adult)

(Continued)

(Table 1 Continued)

Code	Locality	Region	Coordinates	Plant/habitat
33	Sasso Marconi (Bologna)	Emilia-Romagna	44°24'1.73"N 11°15'2.33"E	Hedgerow (1 adult)
34	San Bartolo (Ravenna)	Emilia-Romagna	44°21'4.58"N 12°12'54.99"E	Peach orchard (adults)
35	Imola (Bologna)	Emilia-Romagna	44°21'21.29"N 11°42'58.03"E	House (1 adult)
36	Monterenzio (Bologna)	Emilia-Romagna	44°19'39.93"N 11°24'21.29"E	<i>Arbutus unedo</i> (mixed population of larvae and adults)
37	Pinarella (Ravenna)	Emilia-Romagna	44°14'31.59"N 12°22'12.08"E	Pine forest (adults)
38	Verucchio (Rimini)	Emilia-Romagna	43°58'59.97"N 12°25'22.67"E	<i>Rosa</i> sp. (2 adults, 1 larva)
39	Imperia	Liguria	43°53'27.71"N 8°1'46.24"E	Garden (adults)
40	Arma di Taggia (Imperia)	Liguria	43°50'2.87"N 7°51'14.29"E	<i>Citrus</i> sp. (adults)

Crevalcore), 90% *succinea* (n = 20, Modena), 97.29% *succinea* (n = 37, Nonantola). The *succinea* form was not further subdivided into form 1 or 2 like described by Seo *et al.* (2008). Overall, (n = 1049) 97.52% belonged to the *succinea* form and 2.48% to the *spectabilis* form.

Since the first record of a wild population in Turin in 2006, the harlequin ladybird, was recorded within 2 years up to the eastern Emilia-Romagna region, near to Adriatic Sea (about 400 km distance) and up to the eastern Friuli-Venezia Giulia region (about 440 km dis-

tance). Therefore, we can confirm that during the fall of 2008, this exotic ladybird is well established in most areas of northern Italy. Up to now we assume that the distribution of *H. axyridis* in northern Italy is corroborated by the collections of larval instars and by the presence of the ladybird in urban environments, indicating that the coccinellid successfully reproduced and migrated in all potentially suitable environments. We also observed larvae and adults of *H. axyridis* feeding on peach aphids together with *Coccinella septempunctata* L.,



Figure 1. *H. axyridis* recordings in northern Italy (see the table for information on each site). Sites that overlap at the map resolution were pooled in a single point. Diamonds represent sites where *H. axyridis* forms were counted. (In colour at www.bulletinofinsectology.org)

Adalia bipunctata (L.) and *Hippodamia (Adonia) variegata* (Goeze). Except for the Turin province (A. Alma, personal communication), no other noxious presences in houses have been observed in other locations. Incursions of *H. axyridis* adults into houses were detected for the first time this fall in Emilia-Romagna (Modena and Crevalcore). The samplings in Modena (October 9, 2008) and Crevalcore (October 11 and 13, 2008) were remarkable because *H. axyridis* adults were mixed with those of *Hippodamia (Semiadalia) undecimnotata* (Schneider) at a ratio *H. axyridis* : *H. undecimnotata* = 20:11, 131:13 and 75:21, respectively at each sampling date. The presence of *H. undecimnotata* in these overwintering clusters was surprising because this species has not frequently been observed in field or indoor environments (Modena and Crevalcore) during previous years of samplings. *H. undecimnotata*, is known to aggregate in large clusters under stones and grass tussocks during winter (Honek *et al.*, 2007), but is found much less indoors.

Up to now, our monitoring programme aimed to check the presence of *H. axyridis* wild populations in northern Italy. Although this species is already widespread in northern Italy, it should be interesting, however, to carry out a quantitative sampling in order to follow the population dynamics across the years and to study the relative abundance of *H. axyridis* within certain habitats (i.e. orchards). The development of populations as well as in comparison to native ladybird species, would allow us to investigate the competitive capacity (IGP) of this exotic species in the field.

What the exact origin of the populations found in northern Italy (immigrants from France or Switzerland or offspring of previous releases made in Italy) yet remains unclear and could be subject to molecular investigation.

Until now, in Italy no heavy damages to grapes and nuisance in houses have been registered. However, this does not mean that there is no concern about *H. axyridis* spreading and increasing its populations. Management techniques should be developed. The possibility to repel or attract adults and developing a push-pull technique - away from houses and into traps - should be considered (Riddick *et al.*, 2008). Insecticide use against this exotic predator should be avoided at all times.

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