

Ladybeetle (*Coleoptera: Coccinellidae*) Complex in Urban Green Landscapes in Spain

ISSN: 2770-6745



Belén Lumbierres, Roberto Meseguer, Alexandre Levi-Mourao and Xavier Pons*

Department of Agricultural and Forest Sciences and Engineering, University of Lleida, Spain

Abstract

The ladybeetle species occurrence in Spanish urban green landscapes after a continue and extensive surveillance has been updated. The species relative abundance, prey association and type of vegetation habitat are given. More than 30 species were identified on trees, shrubs and herbs. The most common species prey on aphids or on scales and mealybugs. Among the aphidophagous species, *Adalia bipunctata*, *Oenopia conglobata*, *Harmonya axyridis* and the genus *Scymnus* sp. were the most common. Interactions between some of these species are reported.

Key words: Ladybirds; Prey; Habitat preferences; Species interactions

***Corresponding author:** Xavier Pons,
University of Lleida, Alc. Rovira Roure 191,
Lleida, Spain

Submission:  March 06, 2024

Published:  March 25, 2024

Volume 4 - Issue 4

How to cite this article:

Belén Lumbierres, Roberto Meseguer,
Alexandre Levi-Mourao and Xavier Pons*.
Ladybeetle (*Coleoptera: Coccinellidae*)
Complex in Urban Green Landscapes in
Spain. Biodiversity Online J. 4(4). BOJ.
000594. 2024.
DOI: [10.31031/BOJ.2024.04.000594](https://doi.org/10.31031/BOJ.2024.04.000594)

Copyright@ Xavier Pons. This article is
distributed under the terms of the Creative
Commons Attribution 4.0 International
License, which permits unrestricted use
and redistribution provided that the
original author and source are credited.

Introduction

Parks, gardens and roadside trees and other ornamental vegetation conforming green urban landscapes are essential to maintain the urban quality of life of citizens [1]. They provide various benefits, including health, social, economic, and ecological advantages [2,3]. The vegetation of these green areas is affected by arthropod pests that cause injuries to the plants and aesthetic damages, but also disturbances to the citizens, especially by the products derived from its feeding. Recently, the most relevant tendency to avoid that pests achieve the injury levels is to prevent pest outbreaks by conservation biological control. This methodology aims to enhance ecosystem services, such as predation and parasitism, provided by already existing natural enemies in urban landscapes [4]. Achieving this goal requires precise knowledge of the natural enemy complex in a given region, including the most relevant species and the primary pest-natural enemy assemblages. In the European Mediterranean region, the most frequent groups of pests in urban green landscapes belong to the hemipteran-homopterans (aphids, psyllids, whiteflies, scales, and mealybugs). Coccinellids or ladybeetles (*Coleoptera: Coccinellidae*) are crucial predators of these pests, recognized for their significant role as biological control agents. This article provides an overview of the ladybeetle species complex observed in urban green landscapes in Spain, their associations with pests, and the primary habitats where they are predominantly found.

Material and Methods

The provided information was gathered over 25 years of sampling pests in public and private parks, gardens, street trees and urban green sites of Catalonia and other regions of Spain. Ladybeetles were identified visually "in situ" or using identification keys [5-8] in the laboratory. The pest associated with the ladybeetle and the plants were also recorded.

Results

More than 30 species have been recorded in green urban landscapes in Spain. Table 1 shows the ladybeetle species complex, their relative occurrence, association with groups of

prey, and the type of vegetation habitat where they were recorded. Most of the ladybeetle species were associated with aphids in trees or shrubs, followed by those associated to scales or mealybugs. Some aphidophagous species (i.e. *Oenopia conglobata* L., *Oenopia lyncea* (Olivier) or *Harmonia axyridis* Pallas) were also associated with psyllids. A few species were associated with whiteflies (*Clitostethus arcuatus* (Rossi) and *Delphastus catalinae* (Horn)) and only one was associated with spider mites (*Stethorus pussilus* (Herbst) = *S. punctillum*). Four of the species recorded feed on mildews (Table 1). Species like *Adalia bipunctata* (L.), *O. conglobata*, *H. axyridis*, and, globally, the genus *Scymnus* sp., all preying on aphids and mainly

living on arboreal habitats, were the most common species (Table 1). Other aphidophagous species like *Adalia decempunctata* (L.), *Hippodamia variegata* Goeze and *Coccinella septempunctata* L. were mainly common only in some habitats. Whereas *A. decempunctata* was found on trees, *H. variegata* was common on herbaceous plants and on shrubs (especially on oleanders, *Nerium oleander*) and *C. septempunctata* on herbaceous plants. Coccidophagous species like *Cryptolaemus montrouzieri* Mulsant and *Chilocorus bipustulatus* (L.) were recorded on trees and shrubs, preying mainly on mealybugs and scales respectively. *Clitostethus arcuatus* was easily found preying whiteflies on ornamental orange trees.

Table 1: Ladybeetle species identified in urban green landscapes of Spain, its relative occurrence (1: very common; 2: common; 3: infrequent; 4: very infrequent; 5: rare), main prey and vegetation habitat by order of occurrence (T: trees, S: shrubs, H: herbs).

Ladybeetle Species	Relative Occurrence	Prey	Habitat
<i>Adalia bipunctata</i> (L.)	1	aphids	T, S
<i>Adalia decempunctata</i> (L.)	2	aphids	T, S
<i>Anatis ocellata</i> L.	5	aphids	T
<i>Calvia quatuordecimguttata</i> (L.)	4	aphids, psyllids	T
<i>Chilocorus bipustulatus</i> (L.)	2	scales	T, S
<i>Chilocorus renipustulatus</i> (Scriba)	5	scales	T, S
<i>Clitostethus arcuatus</i> (Rossi)	2	whiteflies	T
<i>Coccinella septempunctata</i> L.	2	aphids	H, S, T
<i>Coccinula quatuordecimpustulata</i> (L.)	4	aphids	H
<i>Cryptolaemus montrouzieri</i> Mulsant	2	scales	T, S
<i>Delphastus catalinae</i> (Horn)	4	whiteflies	T
<i>Exochomus quadripustulatus</i> (L.)	3	scales, aphids	T, S
<i>Halyzia sedecimguttata</i> (L.)	4	mildew	T
<i>Harmonia axyridis</i> Pallas	1	aphids, psyllids, scales	T, S
<i>Harmonia quadripunctata</i> Pontoppidan	3	aphids	T
<i>Hippodamia variegata</i> Goeze	2	aphids	H, S, T
<i>Hyperaspis</i> sp.	4	aphids, mealybugs	T
<i>Myzia oblongoguttata</i> L.	5	aphids	T
<i>Myrrha octodecimguttata</i> (L.)	3	aphids	T
<i>Nephus includens</i>	4	mealybugs	S, T
<i>Oenopia conglobata</i> L.	1	aphids, psyllids	T, S
<i>Oenopia doublieri</i> Mulsant	4	aphids	T
<i>Oenopia lyncea</i> (Olivier)	4	aphids, psyllids	T, S
<i>Platynaspis luteorubra</i> (Goeze)	4	aphids	S, T, H
<i>Propylea quatuordecimpunctata</i> (L.)	3	aphids	H, S, T
<i>Psyllobora vigintiduopunctata</i> (L.)	2	mildew	T, S
<i>Rhyzobius lophantae</i> (Blaisdell)	3	scales	T
<i>Rodolia cardinalis</i> (Mulsant)	3	Mealybugs	T
<i>Scymus apetzi</i> Mulsant	2	aphids, scales	T, S
<i>Scymnus interruptus</i> Goeze	2	aphids, scales	T, S
<i>Scymnus</i> sp.	1	aphids, scales	T, S
<i>Sospita vigintiguttata</i> L.	5	aphids, psyllids	T
<i>Stethorus punctillum</i> (S. <i>pussilus</i> Herbst)	2	spider mites	T, S, H
<i>Thythaspis sedecimpunctata</i> (L.)	3	mildew	H
<i>Vibidia duodecimguttata</i> (Poda)	5	mildew, aphids	T

Discussion

Extensive and continuous surveillance effort done in urban green landscapes has allowed updating the previous information [9] on the occurrence and relative occurrence of the ladybeetle species complex in Spain. The ladybeetle species complex in Spanish urban landscapes is diverse and includes some of the most common species recorded in Europe [7]. There is dominance of aphidophagous species followed by coccidophagous species, which may be explained because aphids, scales and mealybugs are the most common pest in Spanish urban landscapes [10]. Some remarkable features related to several of the most common aphidophagous species can be underlined. *Adalia bipunctata* is naturally found in different habitats and localities but it is also the main aphidophagous species produced commercially. Its extensive and regular release in augmentative biological control programs in cities has fostered its relative abundance over other common native species [11]. In localities where *O. conglobata* was previously prevalent, repeated releases of *A. bipunctata* over the years have led to the latter becoming the dominant species. Although *H. axyridis*, an invasive species native to Asia, was recorded in Europe at the beginning of this century, its establishment in Spain has been recently reported [12]. Its rapid expansion in urban green landscapes has resulted in the displacement of *A. bipunctata* and other native ladybeetles, as observed in other European regions [11,13]. Not only species interactions, habitat requirements and prey preferences, but also plant-prey-specialization may affect the efficacy of biological control programs. Oleanders could be taken as an example. They are commonly planted in Mediterranean urban green areas and heavily infested by *Aphis nerii* Boyer de Fonscolombe (*Hemiptera: Aphididae*). It is known that this plant-aphid assemblage is toxic for most of the ladybeetles. In Spain, the only species associated with *A. nerii* and capable of reproducing by feeding on it is *H. variegata* [14].

Conclusion

These extensive and continuous surveillance efforts conducted in urban green landscapes across Spain provides valuable knowledge into the diversity, relative occurrence, and ecological interactions of the ladybeetle species. Our findings contribute to the understanding of the relationships between ladybeetles, pests, and vegetation in urban environments. As these landscapes continue to evolve, ongoing monitoring and research efforts are essential to adapt conservation biological control strategies.

Acknowledgement

The authors would like to thank the councils of Barcelona, Vic and Lleida, the Arboretum "Pius Font i Quer" of Lleida, the

IPM group of the Associació de Professionals dels Espais Verds de Catalunya and to Almudena Bigatà.

Conflict of Interest

Authors declare no potential conflicts of interest.

References

- Kabisch N, Haase D (2013) Green spaces of European cities revisited for 1990-2006. *Landscape and Urban Planning* 110(1): 113-122.
- Barrico L, Castro H, Coutinho AP, Gonçalves MT, Freitas H, et al. (2018) Plant and microbial biodiversity in urban forests and public gardens: Insights for cities' sustainable development. *Urban Forestry & Urban Greening* 29: 19-27.
- van den Berg M, Wendel-Vos W, van Poppel M, Kemper H, van Mechelen W, et al. (2015) Health benefits of green spaces in the living environment: A systematic review of epidemiological studies. *Urban Forestry & Urban Greening* 14(4): 806-816.
- Shrewsbury PM, Leather SR (2012) Using biodiversity for pest suppression in urban landscapes. In: Gurr GM, Wratten SD, Snyder WE (eds.), *Biodiversity and insect pests: Key issues for sustainable management*. (1st Edn), John Wiley and Sons, Ltd, Chichester, UK, pp. 293-308.
- Cardoso Raimundo AA, Gomes Alves MLL (1986) Revisão dos Coccinélidos de Portugal. Serviço de reprografia e Publicações da Universidade de Evora, p. 104.
- Eizaguirre S (2015) Fauna ibérica. Vol. 40, *Coleoptera: Coccinellidae*. Museo Nacional de Ciencias Naturales. Consejo Superior de Investigaciones Científicas. Madrid, Spain, p. 514.
- Nedved O (2015) Ladybird beetles (*Coccinellidae*) of Central Europe. Academia, Prague (Czech Republic), p. 304.
- Nedved O, Djuric M (2022) Ladybirds of Europe. Field guide. Novi Sad, Serbia, p. 304.
- Lumbierres B, Pons X, Stary P (2005) Parasitoids and predators of aphids associated with public green areas of Lleida (NE Iberian Peninsula). *Advances in Horticultural Science* 19(2): 69-75.
- Pons X, Lumbierres B, Eizaguirre M, Albajes R (2006) Plagas de los espacios verdes urbanos: bases para su control integrado. *Boletín de Sanidad Vegetal, Plagas* 32: 373-384.
- Meseguer R, Lumbierres B, Pons X (2022) Establishment and expansion of *Harmonia axyridis* Pallas (*Coleoptera: Coccinellidae*) in urban green areas in the Iberian Peninsula: From 2015 to 2021. *Insects* 13(8): 741.
- Pons X, Roca M, Lumbierres B, Lucas E (2015) Characterization of a newly established aggregation of the invasive ladybeetle *Harmonia axyridis* and current status of the invader in Spain. *Spanish Journal of the Agricultural Research* 13(2): e1006.
- Sloggett JJ (2017) *Harmonia axyridis* (*Coleoptera: Coccinellidae*): Smelling the rat in native ladybird declines. *European Journal of Entomology* 114: 455-461.
- Madeira F, Lumbierres B, Pons X (2022) Contribution of surrounding flowering plants to reduce abundance of *Aphis nerii* (*Hemiptera: Aphididae*) on oleanders (*Nerium oleander* L.). *Horticulturae* 8(11): 1038.