Bulletin of
Insectology

Research Article
Bulletin of Insectology 78 2025, 113–119
DOI 10.3897/bull.insectology.168209

Edaphic ants in vineyards and cherry orchards, with first record of *Strumigenys silvestrii* (Hymenoptera, Formicidae, Attini) for Chile

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Academic editor: Serena Magagnoli ♦ **Received** 8 August 2025 ♦ **Accepted** 22 October 2025 ♦ **Published** 13 November 2025

Abstract

Ants (Hymenoptera: Formicidae) are a diverse and ecologically important group of social insects that play crucial roles in ecosystems worldwide. In this study, we aim to identify the community of ant species present in two important fruit crops of Central Chile. Ants were sampled from January to March in three cherry orchards and three vineyards, using standard pitfall traps to sample above-ground, and subterranean pitfall traps to sample below-ground. We found in total seven species of ants, three native and four introduced, with *Strumigenys silvestrii* Emery, 1906 being the first record of Attini species for central Chile. The introduced *Hypoponera eduardi* (Forel, 1894) was the most frequently sampled species, while the invasive *Linepithema humile* (Mayr, 1868) was found in only two sites. The ecological or functional roles of these species within the Chilean agroecosystems deserve further investigation.

Key Words

Biological invasion, Exotic species, Invasive ants, Native species, Trap-jaw ant

Introduction

Ants (Hymenoptera: Formicidae) are a diverse, abundant, and ecologically important group of social hymenopterans that play crucial roles in various ecosystems worldwide (Schultheiss et al. 2022). In natural environments, they serve as key seed dispersers (Anjos et al. 2020; Dai 2022), predators, and, through their scavenging and nest-building activities, they contribute to the decomposition of organic matter and soil aeration (Farji□Brener and Werenkraut 2017). In agroecosystems, some ant species are regarded as agricultural pests due to their herbivorous habits and their tendency to protect honeydew-producing insects. However, other species can be effective predators, acting as biological control agents (Anjos et al. 2022; Lutinski et al. 2024), and improve the chemical conditions of the soil by integrating organic matter (Benckiser 2010). Sustainable agricultural practices, as inter-row vegetation, can increase the predation of pests by ants in Mediterranean organic vineyards (Blaise et al. 2021). On the other hand, some ant species are also among the worst invasive species negatively impacting native biodiversity, agriculture and human health (Hernández□Teixidor et al. 2020; Lach 2021; Angulo et al. 2024).

The Chilean ant fauna comprises 82 species in 24 genera distributed in 8 subfamilies (Snelling and Hunt 1975; Cuezzo 2007; Pacheco and Mackay 2013; Johnson and Moreau 2016; Johnson 2021). However, knowledge of species assemblages and their interactions, both in natural and managed environments, is still very limited.

In Chile, fruit and wine grape production are important economic activities, encompassing an area of approximately 380,000 and 115,000 hectares, respectively, according to the most recent fruit and wine cadaster (CIREN 2025). Among fruit crops, cherries are the main species, with 70,686 ha. Both cherries and wine grapes are concentrated in the central part of Chile, mainly in the Metropolitan, O'Higgings and Maule Regions, between 32°55'S and 36°33'S (over 90% of cherries and 70% of winegrapes grown in the country), which is also where Chile's main hotspot of vascular flora is located (Mittermeier et al. 2011). The management intensity of these crops is very different, because cherry production is oriented to a fresh export market, with high cosmetic and sanitary standards, while wine grapes are processed, and lower yields are desirable to produce high quality wines. In this context, a project to study the effects of interrow vegetation on above and below ground orchard biodiversity, phytosanitary conditions and yield was developed, where we collected data on several arthropod taxa. In the present study, our aim was to identify the community of ant species present in these two important fruit crops of Central Chile. We hypothesized that a richer ant community would be found in vineyards than in cherry orchards, because of the lower pesticide use and less intensive soil management, and that common invasive ant species would be more prevalent than native species. We also present the first record of the tribe Attini in central Chile.

Methods

Study sites

Six conventionally managed farms were sampled, including three cherry orchards (*Prunus avium* L.) and three vineyards (*Vitis vinifera* L.). Five farms were located in the O'Higgins region (34°S, 71°W) and one in the Metropolitan region (33°S, 70°W), all of which corresponded to the Mediterranean climate of central Chile (Fig. 1).

Trap design and ant sampling

We used two types of pitfall traps, one for above-ground sampling and one for subterranean sampling. The pitfall traps for above-ground sampling consisted of white plastic containers (8 cm diameter by 9 cm height), buried at ground level with a roof above them. The pitfall remained in place for three to five days. The subterranean traps were adapted from Owen (1995). It consisted of PVC tubes (44 cm length by 7.5 cm diameter), with the section

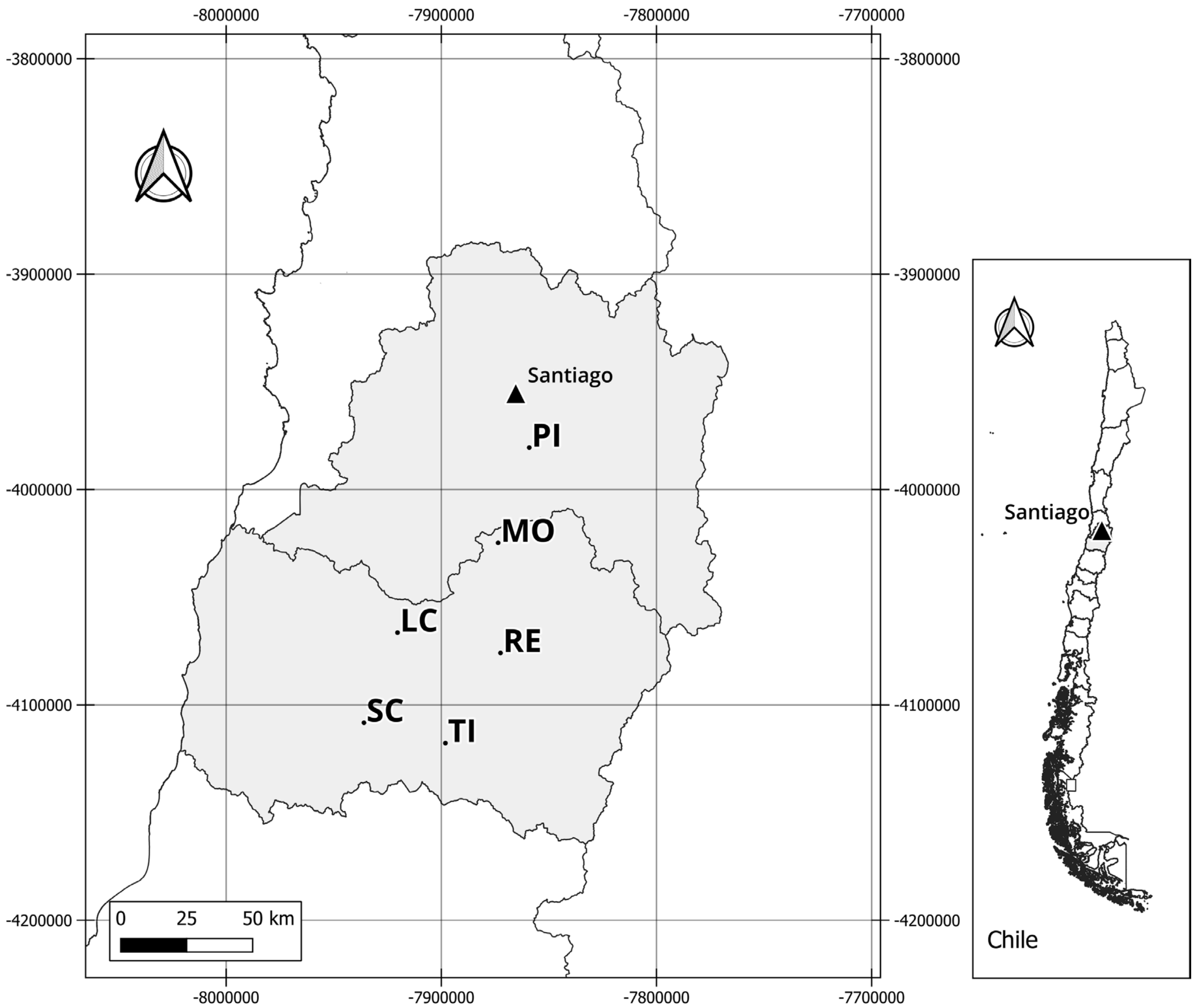

Figure 1. Location of the six farms sampled. Metropolitan Region: Pirque (PI, Vineyard); O'Higgins Region: San Francisco de Mostazal (MO, Cherry), Las Cabras (LC, Cherry), Requínoa (RE, Vineyard), Santa-Cruz (SC, Vineyard), Tinguiririca (TI, Cherry).

Figure 2. Subterranean trap installation. **A.** PVC tube with an opening section covered by plastic mesh. **B.** Trap in the process of installation (half-buried). **C.** Removable cover remaining the ground level once trap is fully installed.

between 14 cm and 33 cm with openings covered by plastic mesh (7 mm). The tubes were buried vertically and left permanently in the soil. The top of the PVC tubes at ground level was sealed with a removable cover (Fig. 2).

At the bottom of the tube, a plastic container (7.5 cm diameter by 7 cm height) was placed, and left for 12 to 16 days for collecting. The containers of subterranean and pitfall traps were filled with a solution of water with salt (20 g/l), and a few drops of uncolored detergent. In each farm, a total of 12 pitfalls and 12 subterranean traps were distributed in two areas approximately 90 m apart. In each area, the traps were equitably distributed in the inter-row and tree rows. In the first area, three to four inter-rows were sown every winter with a mixture of annual plant species belonging to the families Poaceae, Asteraceae, and Brassicaceae to enhance plant diversity within the inter-row area. Unsown rows, approximately 100 m from the sown rows, were selected within the same productive plot and consisted of either bare soil or sparse native and ruderal vegetation, typically dominated by weedy or introduced grassy species (Suppl. material 1: fig. S1).

Following the detection of the first individuals of *Strumigenys silvestrii* Emery, 1906 in January 2022 in the farm of Requínoa (RE), this field was newly sampled in February 2022 with subterranean traps to confirm the identification. In March 2022, the six farms were sampled with both types of pitfall traps.

Ant identification

The collected arthropods were revised under a stereoscopic binocular Wild M8 (magnification 6×–50×). Ants were preserved in 70% ethanol and later identified to the genus level using the keys of Palacio and Fernández (2003), which allow the identification of all the genera present in the Neotropical region. Then, the keys of Snelling and Hunt (1975), which allow the identification of most of the species present in Chile were used to confirm the identification. The identification at species level was done with the keys of Bolton and Fisher (2011) for *Hypoponera* species, and the keys of Brown (1962) and the updated diagnosis of MacGown et al. (2012) for *Strumigenys* species.

Three individuals of *S. silvestrii* were deposited in the following entomological collections: Museo Nacional de Historia Natural de Chile (**MNHNCL**), Instituto de Entomología de la Universidad Metropolitana de Ciencias de la Educación (**IEUMCE**), Facultad de Agronomía y Sistema Naturales de la Pontificia Universidad Católica de Chile (**PUCFASN**), Servicio Agrícola y Ganadero de Chile, Central, Lo Aguirre (**SAGC**), and personal collection of the second author (**PCERPA**).

Results

A total of seven species of ants were identified: the natives *Brachymyrmex patagonicus* Mayr, 1868, *Solenopsis gayi* (Spinola, 1851), *Solenopsis latastei* Emery, 1895, and the introduced *Hypoponera eduardi* (Forel 1894), *Linepithema humile* (Mayr, 1868), *Solenopsis helena* Emery, 1895, *Strumigenys silvestrii* Emery, 1906 (Table 1).

Table 1. Distribution of the seven ant species in the six localities in March 2022. P indicates the species is present in the locality. (n) after the species name indicates native species, following the categorization of AntWeb (2025). Detailed collection data is available on GBIF: https://doi.org/10.15468/hgqahy.

Species | Locality	Cherry orchards			Vineyards		
	TI	MO	LC	RE	SC	PI
Brachymyrmex patagonicus (n)		P		P	P	
Hypoponera eduardi	P	P	P	P		P
Linepithema humile	P		P			
Solenopsis gayi (n)				P	P	
Solenopsis helena				P		P
Solenopsis latastei (n)	P	P		P*		
Strumigenys silvestrii			P	P		P

*species only collected in February 2022.

Full information on the species collection and deposition of the vouchers are available on the Global Biodiversity Information Facility (GBIF) (https://doi.org/10.15468/hgqahy).

The farms exhibited different ant communities (Table 1). The vineyards in Requínoa (RE) supported five (six, including the sampling carried out in February) of the seven species, while only two or three species were detected on the other fields. In the cherry orchards, three species were detected in each field, with five species in total in this crop. The invasive ant *L. humile* was only detected in this crop. Two species *S. gayi* and *S. helena* were only observed in vineyards. The introduced *H. eduardi* was the most common species detected, being present in five of the six locations. The other ant species were observed in two or three locations.

Material examined

See GBIF database for download extended information in Darwin Core standard, including catalog numbers, depository collections for each species (Amouroux et al. 2025).

Strumigenys silvestrii. CHILE • 9 minor workers and 1 queen; Región O'Higgins, Requínoa; -70.72, -34.35; 27 Jan. 2022; col. PCERPA, PC2972. • 8 minor workers; Región O'Higgins, Requínoa; -70.72, -34.35; 17 Feb. 2022; col. PCERPA, PC1812; • 8 minor workers; Región O'Higgins, Requínoa; -70.72, -34.35; 17 Feb. 2022; col. PCERPA, PC2267; • 4 minor workers; Región O'Higgins, Requínoa; -70.72, -34.35; 17 Feb. 2022; col. PCERPA, PC2402; • 3 minor workers; Región O'Higgins, Requínoa; -70.72, -34.35; 17 Feb. 2022; col. PCERPA, PC2855; • 3 minor workers; Región O'Higgins, Requínoa; -70.72, -34.35; 17 Feb. 2022; col. MNHNCL, PC2992; • 3 minor workers; Región O'Higgins, Requínoa; -70.72, -34.35; 17 Feb. 2022; col. SAGC, PC3014; • 3 minor workers; Región O'Higgins, Las Cabras; -71.32, -34.28; 03 Mar. 2022; col. PCERPA, PC1504. • 23 minor workers; Región O'Higgins, Requínoa; -70.72, -34.35; 03 Mar. 2022; col. PCERPA, PC2702. • 3 minor workers; Región O'Higgins, Requínoa; -70.72, -34.35; 03 Mar. 2022; col. PUCFASIN, PC2702C. • 3 minor workers; Región O'Higgins, Requínoa; -70.72, -34.35; 03 Mar. 2022; col. IEUMCE, PC2702B. • 3 minor workers; Región Metropolitana, Pirque; -70.60, -33.64; 23 Mar. 2022; col. PCERPA, PC1979.

The trap-jaw ant, *S. silvestrii* (Fig. 3), not previously recorded for Chile, was only collected on subterranean traps in three localities: the vineyards of Pirque (Metropolitan Region) and Requínoa (O'Higgins Region), and in the cherry orchard of Las Cabras (O'Higgins Region), at least in one trap at each sampling date.

Discussion

Seven species were detected during our survey in vineyards and cherry orchards from central Chile. Three species are native, while four are introduced. This is the first

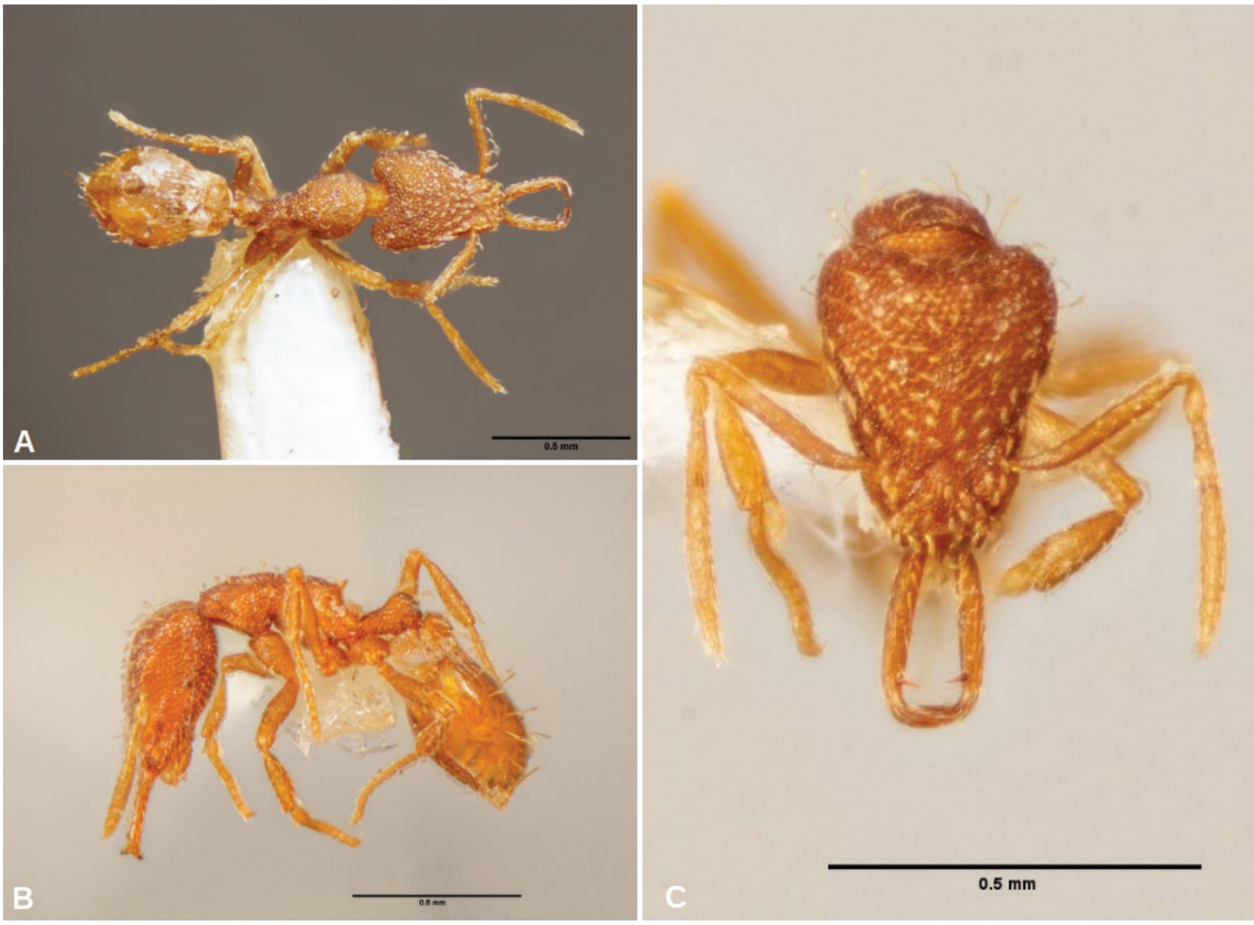

Figure 3. Habitus of the worker of *Strumigenys silvestrii* Emery, 1906. Individual found in Requínoa, O'Higgins Region, January 2022. **A.** Dorsal view; **B.** Lateral view; **C.** Frontal view.

report of the trap-jaw ant *Strumigenys silvestrii* for Chile, along with the tribe Attini.

The genus *Strumigenys* has a cosmopolitan distribution, with native species found in almost all the biogeographic realms, except the Palearctic, where only a few species, such as *S. rogeri* and *S. silvestrii*, have been introduced (Tang et al. 2019). Recent molecular work placed the genus within Attini tribe (Ward et al. 2015). In the Neotropics, the genus includes about 100 described species. Some of these species have become tramp ants, establishing populations outside their native ranges. Their small size, cryptic foraging behavior below the soil surface or litter, and tendency to remain immobile when disturbed often result in them going unnoticed, even during field surveys (MacGown et al. 2012). *Strumigenys silvestrii* is a tiny ant (1.6-2.0 mm in total length) that preys on collembolas and other small soft-bodied arthropods in the soil and leaf litter. Its native area spreads to the Eastern Regions of South America, from Argentina to Brazil. It has been introduced to the USA, Mexico, Cuba, Lesser Antilles, Madeira Islands, and Portugal (Wong et al. 2023). In Chile, the distribution of *S. silvestrii* according to our sampling spread at least through 100 km, suggesting an old introduction and/or an anthropogenic dispersion by plant materials. Contrary to Booher (2021), *S. silvestrii* was only collected by the subterranean traps and not by pitfall. This supports the value of hypodaeic pitfall traps for sampling hidden ant fauna (Schmidt and Solar 2010). Although *S. silvestrii* should not negatively affect the Chilean economy or biodiversity, its introduction shows the difficulty for the phytosanitary services to detect little soil species (Morales-Rodríguez et al. 2019). Two additional records of alate *Strumigenys* individuals were recently reported within the same regions we sampled on the iNaturalist platform in January 2024 (near Rancagua; iNaturalistCL 2024) and January 2025 (near Santiago; iNaturalistCL 2025). Although species-level identification from these reports could not be confirmed from the available photographs, these observations suggest that the beginning of January may correspond to one nuptial flight period of the species.

The invasive Argentine ant, *L. humile*, was only detected in two cherry orchards. Its competitive abilities and adaptability within agroecosystems, as vineyards, have been previously described (Hogg et al. 2018). Indeed, it is considered a pest of fruit crops in Chile and other countries (Angulo et al. 2024). On the other hand, the most frequently detected species in this study was the introduced *H. eduardi*, a circum-Mediterranean species also mentioned in Afrotropical, Australasian, and Malagasy Regions. In the Neotropical region, this species has only been recorded in Chile (Wong et al. 2023), where it was described by Forel in 1914 as *Ponera opaciceps* r. *chilensis* (Bolton and Fisher 2011). The mention of *H. eduardi* in the O'Higgins Region represents an extension to the south of its previously reported distribution in Chile.

A richer ant community was found in vineyards (6 out of the 7 species recorded) than in cherry orchards (4 out of the 7 species). The richness likely reflects the intensity of the agricultural practices, such as pesticide applications (Masoni et al. 2017) or soil disturbance (Rocher et al. 2022). The latter should particularly affect hypogaeic and litter-dwelling taxa, including native *Solenopsis* spp. and cryptic predators such as *Hypoponera* and *Strumigenys*. Despite all the farms being under conventional management, vineyards' agricultural practices are less intensive both in insecticide and herbicide applications.

The surrounding landscape can also influence farm biodiversity (Gibson et al. 2007). In this study, vineyards were surrounded by larger natural areas with native vegetation, whereas the cherry orchards were mostly included in an agricultural and urban matrix (Suppl. material 1: fig. S2). Notably, the Requínoa vineyard is located in the Andean foothills, with most of the area around the sampled site being natural or seminatural vegetation. This proximity to natural areas may explain the higher ant diversity (6 out 7 species), including all three native ant species detected. However, further sampling is required both temporally to confirm these ant communities, and spatially to determine the distribution of *S. silvestrii*.

In conclusion, both native and introduced ant species were detected in vineyards and cherry orchards in Central Chile. The hypogaeic traps were key for capturing cryptic soil-dwelling arthropods and should complement standard pitfalls for monitoring biodiversity in the agroecosystem. The community assembly reflects interacting filters that need to be explored, amongst others, ground-layer structure, disturbance intensity, and resource availability. The tramp ant, *S. silvestrii*, was reported for the first time in Chile and is considered introduced, while the invasive *L. humile* was not found to be as prevalent as expected, considering its pest status in orchards. The ecological or functional role of these species within the Chilean agroecosystems remains unclear.

Author Contribution

PA: Data curation; investigation; Visualization; Writing—original draft. PC: data curation; formal analysis; Writing—review & editing. TZ: conceptualization; funding acquisition; supervision; Writing—review & editing.

Data resources

Full information on the species collection and deposition of the vouchers are available on the Global Biodiversity Information Facility (GBIF) at Amouroux P, Cerpa P, Zaviezo T (2025). Edaphic ants in vineyards and Cherry orchards, with first record of *Strumigenys silvestrii* (Hymenoptera: Formicidae: Attini) for Chile. Version 1.3. Centro de Observación de la Tierra "Hémera". Occurrence dataset https://doi.org/10.15468/hgqahy accessed via GBIF.org.

Acknowledgements

We are grateful to the owners of the farms that allowed us to carry out collections in their fields. We also thank Patricio Candia for his support on field collection, and Gabriela Cordovez and Fernanda Suazo from the laboratory "Ecofisiología y Control de Malezas".

The present work was funded by the project LivinGro® (Syngenta).

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Supplementary material 1

Study sites and sampling methods

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Data type: pdf

Explanation note: **figure S1:** Unsown (.1) and sown rows (.2) within **A** vineyards of Pirque (Región Metropolitana); **B** cherry orchard of Las Cabras. (Región O'Higgins). **figure S2:** 1-km Buffer (red circle) around the sample sites with the Standard layer of OpenStreetMap (https://wiki.openstreetmap.org/wiki/OpenStreetMap_Carto/Areas#Areas).

Link: https://doi.org/10.3897/bull.insectology.168209.suppl1