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Notes and Comments

First report of Coccinellid (Coleoptera: Coccinellidae) species found on Citrus orchards from the Central-West region of Santa Catarina, Brazil

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Coccinellids (Coleoptera: Coccinellidae), commonly known as lady beetles, ladybirds or labybugs, include more than six thousand identified species around the world, placed in 360 different genera and 42 tribes (Nedved and Kovar, 2012; Zazycki et al., 2015). For Brazil, according to Almeida et al. (2018) this family is represented by 667 species allocated in 96 genera. Coccinellids are round- to oval-bodied insects with a size ranging from 0.8 to 18mm. Their feeding habit varies according to the tribe they are placed. These insects are considered, by some authors (Hodek and Evans, 2012; Ducatti et al., 2017), as voracious predators and perhaps one of the more important families within the Order Coleoptera due to their predatory and economic importance. Coccinellids have been found feeding on insects of the Order Hemiptera (aphids, scales and whiteflies), eggs of the Order Lepidoptera (Lima et al., 2018), plants (Szawaryn et al., 2015), pollen, nectar, fungi, thrips (Hodek and Evans, 2012; Alvim et al., 2016), members of the family Chrysomelidae (Roberts, 2016), of the Order Hymenoptera (Majerus et al., 2007) and on members of the family Coccinellidae through cannibalism and intraguild predation (Ducatti et al., 2017).

Within this perspective, this study aimed at investigating the species of coccinellids present in organic and conventional citrus orchards located in the Central-west region of Santa Catarina, Brazil, and report differences on the diversity, evenness, abundance and richness between the studied areas.

The selected orchards had a similar size (4.0 hectares), altitude (580m), were separated by a linear distance of 25 km and farmed with *Citrus sinensis* (L.) Osbeck cv. Valência. Samplings were carried out every 14 days, between March 13th and June 19th, 2016 following the methodologies described by Colunga-Garcia et al. (1997) and Udayagiri et al. (1997). A total of seven cards were used by each area in each sampling date, totaling 49 cards per area. Coccinellids were removed from the cards using paint thinner solvent, placed in Eppendorf®, added with citronella oil (10%) and sent to the Universidade Federal do Paraná to be identified. Statistical analyses were performed using the statistical program RStudio© version 1.0.136.

A total of 291 coccinellids placed in nine different tribes were sampled and identified. An amount of 48.80% were identified to the taxon of species, 14.43% to the taxon of genus and 36.77% were identified up to their tribe. Individuals identified only by the tribe, were divided according to their morphological characteristics and placed in groups dominated sp.1, sp.2 and sp.3 (Table 1).

The organic orchard presented 54.29% of all the specimens sampled and had a richness and evenness 16.67% and 11.36% greater than the conventional orchard, respectively. Nevertheless, both orchards were statistically similar as for their diversity ($P = 0.5694$).

Pentilia egena Mulsant, *Cycloneda sanguinea* Linnaeus, both native to Brazil, and individuals allocated in the tribe Diomini were the most abundant species in both farming systems in this study (Table 1). It has been reported that the main aphid-fed coccinellids for citrus in the region of Taiúva-SP, Brazil, were individuals belonging to the genus *Diomus* sp. (70.95%), and the species *C. sanguinea* (18.83%) (Guerreiro et al., 2005), which can prey a daily average of 233.8 and 209 aphids (*Aphis craccivora*) by female and male adults, respectively (Solano et al., 2016).

For the state of Rio de Janeiro, the most common species of coccinellids sampled, in citrus, was *P. egena,* which was present in 10 of the 11 studied cities. *Pentilia egena* is characterized by being one of the more important predator species of coccinellids found in citrus orchards, mainly due to its high level of predation on scale insects. The daily average consumption of *Chrysomphalus ficus* Ashmed (Hemiptera: Diaspididae) by *P. egena* is of 69.21, 54.40 and 15.61 individuals in their 1st, 2nd nymph and adult development stages, respectively (Guerreiro et al., 2003).

About 98% of all sampled specimens identified in this study are allocated in aphid-, scale-fed tribes, which may be beneficial as for the biological control coccinellids play in the studied areas (Table 2).

Another species found in this study, and reported worldwide was *Harmonia axyridis*, a species native from Asia and highly voracious (Milléo et al., 2008; Ducatti et al., 2017). This species was first recorded in Brazil in 2002, in the state of Paraná, probably following its introduction in the province of Mendonza, Argentina in the end of the 90's (Milléo et al., 2008). This is the first time *H. axyridis* is recorded for the city of Chapecó-SC.

Table 1. Tribe, species and abundance (%) of coccinellids sampled in both, organic and conventional, citrus orchards located in the Central-west region of Santa Catarina.

Tribe	Species	Conventional system		Organic system	
		Quantity	(%)	Quantity	(%)
Azyini	*Azya luteipes* (Mulsant, 1850)	1	0.75	0	0.00
Chilocorini	*Exochomus orbiculus* (Weise, 1893)	2	1.50	3	1.90
Coccinellini	*Cycloneda pulchella* (Klug, 1829)	0	0.00	1	0.63
Coccinellini	*Cycloneda sanguinea* (Linnaeus, 1763)	23	17.29	15	9.49
Coccinellini	*Harmonia axyridis* (Pallas, 1773)	1	0.75	0	0.00
Coccinellini	*Cycloneda* sp	0	0.00	1	0.63
Cryptognathini	*Calloeneis signata* (Korschefsky, 1935)	1	0.75	15	9.49
Diomini	sp. 1	0	0.00	27	17.09
Diomini	sp. 2	40	30.08	4	2.53
Diomini	sp. 3	1	0.75	5	3.16
Diomini	*Diomus* sp.	0	0.00	24	15.19
Chnoodini	*Exoplectra* sp.	2	1.50	0	0.00
Coccinellini	*Psyllobora distinguenda* (Crotch, 1874)	2	1.50	0	0.00
Coccinellini	*Psyllobora gratiosa* (Mader, 1958)	1	0.75	5	3.16
Hyperaspidini	*Hyperaspis matronata* (Mulsant, 1853)	0	0.00	1	0.63
Hyperaspidini	*Tenuisvalvae rosariensis* Gonzáles 2010	6	4.51	1	0.63
Ortaliini	*Zenoria serva* (Gordon, 1971)	0	0.00	3	1.90
Ortaliini	*Zenoria* sp.	0	0.00	1	0.63
Cryptognathini	*Pentilia egena* (Mulsant, 1850)	25	18.80	36	22.78
Cryptognathini	*Pentilia* sp.	3	2.26	11	6.96
Scymnini	sp. 1	2	1.50	2	1.27
Scymnini	sp. 2	23	17.29	3	1.90
Total		133	100.00	158	100.00

Table 2. Feeding habits and abundance of Coccinellidae tribes identified in citrus orchards from the Central-west region of Santa Catarina.

Tribe	Abundance (%)	Feeding habit[(1)]
Azyini	0.34	Scale insects, aphids
Chilocorini	1.72	Scale insects, aphids
Chnoodini	0.69	*Inga adulis* nectar, white-fly, scale insects, aphids
Coccinellini[(2)]	16.84	Chrysomelidae, scale insects, Psyllidae, aphids, fungi, ants
Cryptognathini	31.27	Scale insects, aphids, mites
Diomini	34.71	Scale insects
Hyperaspidini	2.75	Scale insects
Ortaliini	1.37	Psyllidae
Scymnini	10.31	Scale insects, white-fly, aphids

[(1)]Compiled from Guerreiro et al. (2003), Hodek and Evans (2012), Alvim et al. (2016), Ducatti et al. (2017), Majerus et al. (2007) and Lima et al. (2018). [(2)]Species placed in the genera *Psyllobora* sp. are mycophagous (Hodek and Evans, 2012).

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