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Bee assemblage in habitats associated with *Brassica napus* L.

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ABSTRACT

Assessments in agricultural crops indicate that alterations in the landscape adjacent to the crops can result in reduced productivity due to loss or low abundance of pollinating agents. In the canola crop, production is partially dependent on insect pollination. Therefore, knowledge of the faunal diversity within and near crop fields is key for the management of these insects and consequently for the increase in productivity. This study aimed to determine and compare the diversity of bees in habitats associated with canola fields in southern Brazil. Bees were captured in four agricultural areas using pan traps in three habitat classes: (1) flowering canola crop, (2) forest remnant, and (3) grassland vegetation. The highest abundance of bees was observed in the grassland vegetation (50%) and in the flowering canola field (47%). Eight species common to the three habitat classes were recorded, four of which are represented by native social bees. In addition, a single or a few individuals represented species that were exclusive to a specific habitat class; eight species were collected exclusively in the interior of the canola field, 51 in the grassland vegetation, and six in the forest remnant. The majority of the rare species recorded exhibits subsocial or solitary behaviour and inhabit open places. The composition of bee groups differed between the habitats showing the importance of maintaining habitat mosaics with friendly areas for pollinators, which promote the pollination service for canola flowers.

Introduction

Assessments in agricultural crops indicate that alterations in the landscape of habitats adjacent to plantation fields and the consequent loss of pollinating agents result in reduced productivity (Vaissiere et al., 1996; Vicens and Bosch, 2000). Thus, the presence of pollinators of certain crops is dependent on the quality of the areas surrounding the plantation fields (Klein et al., 2003). The production of coffee plantations near forest remnants increases by approximately 15%, a result related to pollination services (De Marco and Coelho, 2004). Currently, 33% of the plants cultivated for human consumption depend on pollination, which is usually performed by bees (Klein et al., 2007). On a global scale, the pollinators contributed with 9.5% of the total production crops used for human food in 2005 (i.e., EUR 153 billion) (Gallai et al., 2009).

Brassica napus L. oleifera variety, known as canola, is the third most cultivated oleaginous plant in the world, and its seed production is partially dependent on insect pollination (Tomm et al., 2010). In 2012, the cultivated area of canola was 43,800 ha, with 41,500 ha of this area residing in southern Brazil (Conab, 2013). The production of this crop is targeted at obtaining oil for human consumption and for biodiesel production (Marjanović-Jeromela et al., 2008).

Although canola is self-fertile, its productivity is increased by insect visitation to its flowers, with *Apis mellifera* considered the main pollinator (McGregor, 1976; Abrol, 2007; Rosa et al., 2010). This bee species has been studied extensively, but studies with native bees are scarce, despite their important role in the pollination of canola plants (Morandin and Winston, 2005). Studies have identified a number of limiting factors for producing canola seeds, including environmental conditions, compensatory ability of the crop, and the frequency of floral visitors (Mesquida et al., 1988; Free, 1993). In Canada, the introduction of three *A. mellifera* colonies per hectare promoted an increase of 46% seeds yield of canola (Sabbahi et al., 2005). In Brazil, pollination of *B. napus* (Hyola 432 cultivar) performed by free visit of insects resulted in a 22% increase in seed production compared with autogamy (Rosa et al., 2010).

Knowledge of the regional fauna of potential pollinators in agricultural areas is necessary for the establishment of strategies aimed at increasing the productivity of canola seeds. Therefore, this study aimed to determine the diversity of bees in the habitats associated with canola production in southern Brazil and to compare the bee species composition between these different habitats.

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Table 1
List of bee species collected from August 2010 to October 2011 in Esmeralda, Rio Grande do Sul, Brazil.

Taxa	Flowering canola field				Forest remnant				Grassland vegetation			
	NI	M	Do	Colour	NI	M	Do	Colour	NI	M	Do	Colour
Andreninae												
Anthrenoides ornatus (Urban, 2005)	0				0				1	11	r	Y
***Anthrenoides* sp. 1**	**1**	**8**	**r**	**W**	0				0			
Anthrenoides sp. 2	0				0				1	12	r	Y
Oxaea austera (Gerstaecker, 1867)	0				0				1	3	r	W
Psaenythia sp. 1	0				0				1	3	r	Y
Psaenythia sp. 2	0				0				1	11	r	W
Psaenythia sp. 3	0				0				1	3	r	B
Rhophitulus sp. 1	0				0				4	8, 11	r	Y, B, W
***Rhophitulus* sp. 2**	**1**	**8**	**r**	**W**	0				0			
Rhophitulus sp. 3	0				0				1	11	r	Y
Apinae												
Apis mellifera (Linnaeus, 1758)	223	8–10	E	Y, B, W	0				31	1, 4, 5, 7–11	S	Y, B, W
Bombus pauloensis (Friese, 1913)	6	8, 9	R	Y, B	2	2	r	Y, W	15	2–4, 7, 8, 12	S	Y, B, W
Ceratina rupestres (Holmberg, 1884)	0				0				9	9, 11, 12	R	Y, B
Exomalopsis trifasciata (Brèthes, 1910)	0				0				1	3	r	Y
Exomalopsis sp. 1	0				0				4	1, 3, 7, 11	r	B
Exomalopsis sp. 2	0				0				1	11	r	B
Exomalopsis sp. 3	0				1	9	r	W	0			
Melissodes nigroaenea (Smith, 1854)	0				0				2	5, 12	r	Y, B
Mourella caerulea (Friese, 1900)	20	8–10	S	Y, B, W	3	11	r	Y	5	3, 9–12	R	Y, B
Peponapis fervens (Smith, 1879)	0				0				1	2	r	B
Ptilothrix cf. *plumata* (Smith, 1853)	0				0				16	1, 3, 4, 10–12	S	Y, B, W
Scaptotrigona bipunctata (Lepeletier, 1836)	24	8–10	S	Y, B, W	1	6	r	W	31	4–9, 11	S	Y, B, W
Tapinotaspoides sp.	0				1	11	r	B	1	3	r	B
Thygater analis (Lepeletier, 1841)	0				0				1	1	r	B
Thygater mourei (Urban, 1961)	23	8–10	S	B	0				1	9	r	B
***Thygater* sp.**	**2**	**8, 9**	**r**	**B**	0				0			
Trigona spinipes (Fabricius, 1793)	7	9, 10	R	Y, B, W	1	6	r	B	8	2, 5, 6, 8, 12	R	Y, B, W
Colletinae												
Colletes sp.	0				0				1	8	r	W
Tetraglossula anthracina (Michener, 1989)	0				0				5	3	R	Y, B
Halictinae												
Augochlora amphitrite (Schrottky, 1909)	6	9, 10	R	Y, B, W	1	9	r	B	28	1, 2, 4, 6–12	S	Y, B, W
Augochlora sp. 1	0				1	2	r	W	2	8, 11	r	B, W
Augochlora sp. 2	0				0				1	1	r	Y
Augochlora sp. 3	0				0				1	6	r	W
Augochlora sp. 4	0				0				1	5	r	B
Augochlora sp. 5	0				1	12	r	B	1	2	r	B
Augochlora sp. 6	0				0				1	3	r	Y
Augochlora sp. 7	0				1	10	r	B	0			
Augochlora sp. 8	0				0				2	3, 10	r	Y, W
Augochlora sp. 9	0				0				1	7	r	B
Augochlora sp. 10	0				1	2	r	W	1	3	r	B
Augochlora sp. 11	1	10	r	W	0				3	6, 7	r	Y, W
Augochlora sp. 12	1	9	r	Y	1	9	r	W	3	1, 6, 11	r	Y, B, W
Augochlora sp. 13	0				0				2	3–4	r	W
Augochlora sp. 14	0				0				1	6	r	W
Augochlora sp. 15	0				0				1	7	r	B
Augochlora sp. 16	0				0				1	5	r	W
Augochlora sp. 17	0				0				1	8	r	Y
Augochlora sp. 18	0				0				1	1	r	B
Augochlora sp. 19	0				0				1	3	r	W
Augochlora sp. 20	0				0				1	5	r	B
Augochlora sp. 21	0				0				1	8	r	B
Augochlora sp. 22	0				0				3	1, 6, 7	r	Y, W