Ant communities of cornfields in the Roanoke Valley of Virginia

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Introduction

We characterized ant communities of two corn fields from monoculture and polyculture farms in the Roanoke Valley of Virginia. Ants play key ecological roles in terrestrial systems, including agricultural ones. On farms, ants may serve as bioturbators—moving soil, promoting aeration of soil and facilitating movement of water through soil-- although their important work in these areas has long been overlooked in favor of often-celebrated earthworms. Ants are potential bioindicators of soil health and of the impacts of different agricultural methodologies (Benckhiser 2010; Lobry de Bruyn, 1999). Corn is a crucial agricultural commodity in the United States, grown on nearly 94 million acres of farmland in 2013. The monoculture corn farm we studied employed Bt-corn which has been genetically modified to express *Bacillus thuringiensis* (Bt). This gram-positive aerobic soil bacterium expresses Cry proteins, which provide the bacteria with its insecticidal characteristics (Sanchis and Bourguet, 2008). Previous studies have suggested that Bt-corn has negative effects on non-target insects (Losey et al 1999) but other studies suggest little impact on non-target insects (Marvier et al. 2007).

In this initial survey of ants on two farms, the farms we studied were differentiated by the use of conventional methods (monoculture of Bt- corn, synthetic chemical fertilizer) versus organic methods (polyculture of non-Bt corn in three-sisters planting, no synthetic chemicals used).

Methods

1. We used pitfall traps (50-ml centfifuge tubes, half-filled with a brine solution, in the first two weeks of September, 2014 to collect insects from an organic, polyculture farm's three-sisters corn patch (Lick Run Farm) in Roanoke, Virginia and a conventional monoculture farm's Bt-cornfields (Beahm Farm) in nearby Hollins, VA.
2. Ant specimens were identified using keys (Antweb.org, and *Ants of North America* by Fisher and Cover 2007) and by comparison to voucher specimens from Banschbach and Ogilvy (2014).
3. Species richness, frequency (ants per trap), relative abundance, and species diversity were calculated. A rarefaction analysis was performed to examine difference in species richness present in the overall data set for the farms.

Photo of conventional, Bt corn at Beahm Farm, September, 2014.

Results

•In total, we collected 2214 ants on the two farms (Table 1). There were a total number of 357 individuals for conventional farm, and 1,299 individuals for organic (Table 1). Average number of ants per trap was higher for Michael Beahm Farm (Table 1).

Table 1	# ants	# traps	Mean # ants per trap
Conventional, Bt corn	357	20	17.9
Organic corn	1299	17	76.4

- We found 20 ant species from 14 genera (Table 2).

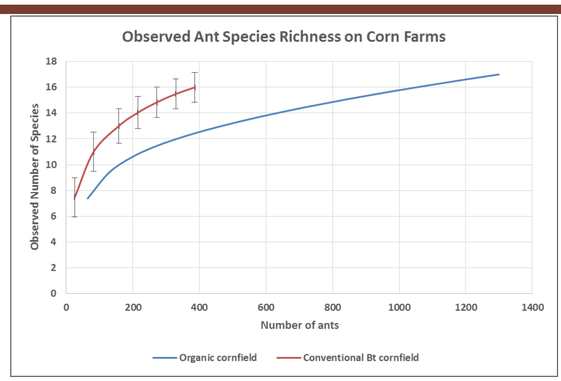
Table 2. Relative abundance (# ants per total number of ants) in the organic versus conventional farm cornfields. Dark blue cells contain the five most abundant species for each site.

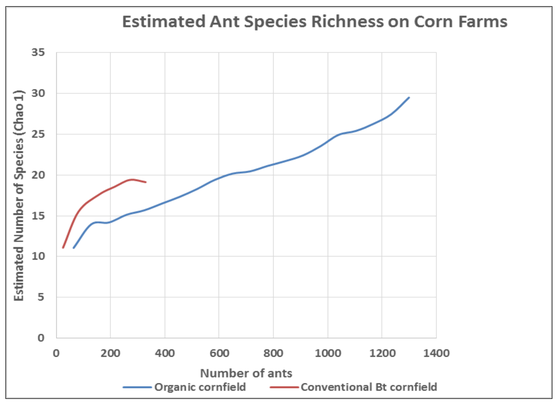
Ant species	Organic corn	Conventional, Bt-Corn
	Relative Abundance	
Aphaenogaster rudis	0.001	0.015
Camponotus castaneaus	0.001	0.000
Formica difficilis	0.004	0.006
Lasius alienus	0.000	0.122
Lasius umbratus	0.014	0.099
Monomorium emarginatum	0.055	0.012
Monomorium minimum	0.021	0.009
Myrmecina americana	0.781	0.000
Myrmica punctiventris	0.000	0.003
Pachycondyla (=Brachyponera) chinensis	0.008	0.163
Pheidole dentata	0.001	0.000
Pheidole sp. A.	0.001	0.006
Pheidole bicarinata	0.002	0.038
Pheidole sp. B	0.002	0.012
Prenolepis imparis	0.047	0.353
Solenopsis molesta	0.001	0.003
Stenamma brevicorne	0.013	0.085
Stenamma impar	0.010	0.038
Tapinoma sessile	0.000	0.003
Temnothorax curvispinosus	0.038	0.000

Table 3.Shannon diversity index (H') in the corn plots for organic versus conventional Bt-corn fields.

	Organic Farm	Conventional Farm
Shannon Index	2.07	1.87

Photo of organic Lick Run Farm , September, 2014.





Conclusions

•The mean number of ants captured per trap, estimated species richness (Chao 1), and Shannon index of diversity in the organic cornfield was higher than in the conventional Bt cornfield (Table 1, 2 and 3; Figures).

•Bt-corn on the Beahm Farm was grown in monoculture, which reduces ecological niches for ant species thus lowering species richness, compared to the organic polyculture cornfield with the accompanying squash and bean plants, increasing number of ecological niches.

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