Abstract*

Effectiveness of aphid (Homoptera: Aphididae) protection from entomophagous species (Insecta varia) by different ant species (Hymenoptera: Formicidae)

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A comparative analysis was made of the efficiency of protection of aphids (Homoptera: Aphididae) from aphidophagous species by different species of ants (Hymenoptera: Formicidae). The investigations were carried out in the Novosibirsk region in 2006. Colonies of myrmecophile aphids (521) were explored alongside 44 km of a road and at model sites located in different plant associations. The degree of protection of aphids from aphidophagous species by 12 ant species with different territorial organizations was investigated. Based on types of territorial organization, data on ant species were subsumed under genera / subgenera: *Formica* s.str. (*F. rufa* LINNAEUS, 1761, *F. lugubris* ZETTERSTEDT, 1838, *F. polyctena* FÖRSTER, 1850, *F. pratensis* RETZIUS, 1783) with large protected territories; *Camponotus* (*C. saxatilis* RUZSKY, 1895, *C. herculeanus* (LINNAEUS, 1758)) and *Lasius* (*L. niger* (LINNAEUS, 1758)) with partially protected feeding sites; and *Formica* (*Serviformica*) (*F. fusca* LINNAEUS, 1758, *F. cunicularia* LATREILLE, 1798) and *Myrmica* (*M. rubra* (LINNAEUS, 1758), *M. ruginodis* NYLANDER, 1846, *M. schencki* VIERECK, 1903) with unprotected feeding sites. Aphidophagous species of eight families were noted in the aphid colonies: Aphidiidae, Aphelinidae (Hymenoptera), Coccinellidae (Coleoptera), Chrysopidae (Neuroptera), Syrphidae, Cecidomyiidae (Diptera), Nabidae, and Anthocoridae (Heteroptera). The numbers of aphid colonies with aphidophagous species that were tended by various ants differed significantly (one-way ANOVA: $F = 29.08$, $p < 0.0001$). The share of aphid colonies with aphidophagous species (from the whole number explored that were tended by the mentioned ants) was 5.2 % for *Formica* s.str. (n = 249), 56.3 % for *Serviformica* (n = 16), 29.2 % for *Camponotus* (n = 48), 26.4 % for *Lasius* (n = 140), and 52.9 % for *Myrmica* (n = 68). Comparative analyses demonstrated that the efficiency of the protection of the aphid colonies from aphidophagous species depended on the territorial organization of the ants (Tab. 1). Ants with different types of feeding territories differed significantly in their sharing of aphid colonies with aphidophagous species, whereas ants with the same type of territorial organization, i.e., partially protected (*Camponotus* vs. *Lasius*) or unprotected (*Myrmica* vs. *Serviformica*) territories did not differ. Dominant species (*Formica* s.str.) were shown to provide aphids with the highest degree of protection in multi-species associations. Predators were rare in the aphid colonies tended by *Formica* s.str.: the share of aphid colonies with aphidophagous species for these ants was 5 - 6 times lower than for the species with partially protected territories and 10 - 11 times lower than for the ants with unprotected feeding sites. Recent observations and preliminary experiments exploring the behavioral reactions of various ants to different types of aphidophagous species have shown that ants of *Formica* s.str. are the most aggressive (NOVGORODOVA 2005). They attack both mobile (mostly adult) and slowly-moving (larvae) aphidophagous individuals. Ants with partially protected territories guard aphids mostly from the mobile ones. Additionally, these ants display less aggressive reactions to aphidophagous species. The ants with non-protected feeding territories do not react to either mobile or slowly moving aphidophagous species and do not protect their aphid symbionts.

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References

NOVGORODOVA, T.A. 2005: Ant-aphid interactions in multispecies ant communities: Some ecological and ethological aspects. – European Journal of Entomology 102: 495-502.

Tab. 1: The means of t-tests with separate variance estimates ($t_{real}/t_{critical}$); * $0.05 > p > 0.01$; ** $p \leq 0.01$; n.s., not significant, $p > 0.05$.

Ants	Aphid colonies: explored / with aphidophagous species	*Formica* s. str.	*Camponotus*	*Lasius*	*Myrmica*
Formica s.str.	249 / 13	–	–	–	–
Camponotus	48 / 14	3.53 / 2.40**	–	–	–
Lasius	140 / 37	5.30 / 2.34**	0.35 / 2.37, n.s.	–	–
Myrmica	68 / 36	7.62 / 2.37**	2.63 / 2.36**	3.70 / 2.61**	–
Serviformica	16 / 9	3.95 / 2.60**	1.87 / 1.71*	2.23 / 1.73*	0.23 / 2.5, n.s.

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