

SHORT COMMUNICATION

How are arthropod communities organized on an introduced plant *Solidago altissima*?

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We have tried to understand mechanisms of organizing herbivore communities on introduced tall goldenrod, *Solidago altissima*. At first, to assess pattern on herbivore communities on *S. altissima*, we compared community composition, density, and species richness of herbivorous insects on *S. altissima* and on a related native species *Solidago virgaurea* at a same habitat in Japan. We found a large difference in community composition on the two plant species. In particular, exotic aphid greatly contributed to the difference in community composition. Next, to examine the aphid impacts on other herbivores, we conducted several experiments in Japan. We found strong impacts of the aphid on co-occurring herbivorous insects through the removal behavior of tending ants and on temporally separated herbivorous insects through changes in foliar quality and production of *S. altissima*. These two studies suggest that the exotic aphid plays an important role in organizing herbivore communities on *S. altissima*.

Keywords: arthropod community; introduced plant; ant-mediated indirect effect; plant-mediated indirect effect; invasion; exotic insect

Introduced plants have insect communities that often differ species richness, species composition, and abundance from those on native plants (Tallamy 2004). Understanding the impacts of plant introduction on plant-based communities is to know how herbivore communities are newly organized on introduced plants.

We have tried to understand mechanisms organizing herbivore communities on introduced tall goldenrod, *Solidago altissima* Linn (Compositae), which was introduced to Japan from North America approximately 100 years ago. To assess pattern on herbivore communities on *S. altissima*, we compared community composition, density, and species richness of herbivorous insects on *S. altissima* and on a related native species *Solidago virgaurea* at a same habitat in Japan (Ando et al. 2010). We found a large difference in community composition on the two *Solidago* species. In particular, the most dominant and exotic aphid *Uroleucon nigrotuberculatum* Olive (Hemiptera: Aphididae), which came from North America, greatly contributed to the difference in community composition on the two plant species.

To examine the aphid impacts on other herbivorous insects, we conducted several experiments in Japan. We found strong impacts of the aphid on abundance and performance of herbivorous insects through increasing ants attracted to aphid honeydew and modification of plant traits on *S. altissima* (Ando and Ohgushi 2008). In spring when the aphid was present, the aphid decreased the densities of leafhop-

pers and geometrid moth caterpillars through ant-mediated indirect effects, because aphid honeydew scattered adjacent leaves attracted native ants which subsequently removed these herbivores. In autumn when the aphid was absent, aphid-induced plant modification had impacts on the scale insect and grasshopper in a different way. The aphid indirectly decreased the density and survivorship of the scale insect. On the other hand, the number of grasshoppers increased as a result of the increased number of leaves and leaf nitrogen content induced by prior aphid feeding. However, aphid infestation did not affect the survivorship of the grasshopper. The aphid removal experiment demonstrated that the aphid had a strong indirect effects on co-occurring herbivorous insects through the removal behavior of tending ants and on temporally separated herbivorous insects through changes in foliar quality and production of *S. altissima* (Figure 1).

These two studies suggest that the exotic aphid plays an important role in organizing herbivore communities on *S. altissima*. Our ongoing research is focusing on underlying the mechanisms responsible for organization of herbivore communities on the introduced plants, to answer following questions: (1) How does community structure of insect herbivores on *S. altissima* in the introduced habitat differ from that in original habitat? (2) How does the role of the aphid in structuring herbivore communities on *S. altissima* differ between the introduced and original habitats? To study these issues, we are conducting

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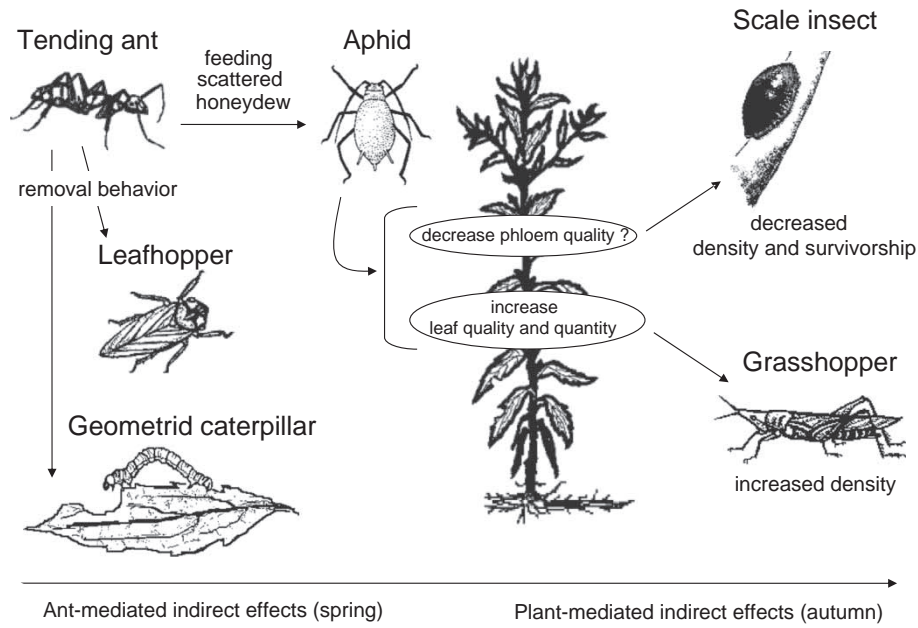


Figure 1. Ant- and plant-mediated indirect effects induced by aphid colonization on co-occurring and temporally separated herbivorous insects on the introduced plant, *Solidago altissima*.

reciprocal transplant common garden experiments in North America and Japan.

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