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Tests of Suitability of Overwintering Hosts of Aphis glycines: Identification of a New Host Association with Rhamnus alnifolia L'Héritier

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Abstract

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Tests of Suitability of Overwintering Hosts of *Aphis glycines*: Identification of a New Host Association with *Rhamnus alnifolia* L'Héritier

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ABSTRACT Eleven species from the family Rhamnaceae, including both species exotic and native to North America, were tested for their acceptability to the fall migrants of the soybean aphid, *Aphis glycines* Matsumura. Two species, *Rhamnus cathartica* L. and *Rhamnus alnifolia* L'Héritier were accepted and had overwintering eggs deposited on them. Eggs survived the winter, and colonies developed on both hosts in the spring. *R. alnifolia* is a new overwintering host for the soybean aphid.

THE SOYBEAN APHID, *Aphis glycines* Matsumura, has a complex life cycle and survives winters as eggs on woody hosts in the genus *Rhamnus* and the summer on hosts primarily in the genus *Glycines* (Wang et al. 1962, Takahashi et al. 1993). The species of *Rhamnus* used as winter hosts in China and Japan are *Rhamnus davurica* Pallas and *R. japonica* Maximowicz. Both species are rare in North America. After its discovery in North America in summer 2000, the soybean aphid survived the winter 2000–2001. Given the widespread occurrence of aphids in North American soybean in 2001, winter survival was thought to have occurred on more common *Rhamnus* than these rare Asian species. In the midwestern U.S., there are two widespread, invasive, exotic species of European, Asian, and/or African origin: *R. cathartica* L. and *R. frangula* L. Laboratory tests in fall 2000 demonstrated that the fall migrants of the soybean aphid accepted *R. cathartica*, and their oviparous offspring deposited eggs on it. Gynoparae and oviparous nymphs have been seen in the wild on *R. frangula* (D.J.V., unpublished data); however, no mature oviparae or eggs have been seen on this host. Intensive surveys made in early spring 2001 on *R. cathartica* in Michigan, Indiana, Wisconsin, Minnesota, and Illinois found aphids at only two sites in Illinois and one in Wisconsin. The fact that no eggs were observed on *R. cathartica* in fall 2001 and no colonies were observed on it in spring 2002 generated some concern that *R. cathartica* may not be the only winter host used by the soybean aphid. Furthermore, the lack of confirmation of soybean aphids on field populations of *R. frangula* called into doubt its role as an overwintering host of the aphid.

An experiment was designed for fall 2002 to test the possibility that the soybean aphid could use other plants as an overwintering host. The basic design was to provide aphids the opportunity to develop and deposit eggs on putative host plants in a choice-test protocol. We used the deposition of eggs as confirmation of host plant selection for overwintering capability. Eleven species of *Rhamnus* and representatives of other genera in the same plant family (the Rhamnaceae, Table 1) were reared at Iowa State University, Ames, IA. The plants were brought to Champaign, IL, in August and placed in field cages (2 by 2 by 2 m) in mid-September along with four soybean plants heavily infested with the soybean aphid. Eight replicate cages were set up with the one plant of each of the 11 test species randomly located around the inside perimeter of each cage, and soybean plants infested with aphids were placed in the center of the cage. Observations were made twice a week. Gynoparae, oviparous nymphs, and oviparae were counted, and presence of eggs was noted until the middle of October.

Fall migrants displayed different levels of acceptance of the different plant species, ranging from none (no gynoparae on the plant) to heavy (many gynoparae on plant and abundant nymphs produced). Oviparae matured and deposited eggs only on *R. cathartica* and *R. alnifolia*.

Test plants of *R. cathartica* and *R. alnifolia* with eggs on them were left in the cages for exposure to conditions of winter 2002–2003. After several days of above-normal temperatures in mid-March 2003, these test plants in the experimental cages were examined. On 26 March, both *R. cathartica* and *R. alnifolia* had partially opened buds, and varying numbers of first instar fundatrices were observed feeding on these partially unfolded leaves. It thus seems that the eggs survived winter 2002–2003 and that the fundatrices accepted the host on which they emerged. We plan to repeat the experiment in fall 2003, and a detailed

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Table 1. The 11 taxa in Rhamnaceae included in overwintering study

Plant species	Origin
<i>Rhamnus cathartica</i> L.	Europe, Asia
<i>Rhamnus frangula</i> L.	Europe, Asia, Africa
<i>R. frangula</i> cv. <i>Asplenifolia</i>	
<i>R. frangula</i> cv. <i>Columnaris</i>	
<i>Rhamnus caroliniana</i> Walt.	Southeastern United States
<i>Rhamnus alnifolia</i> L' Hér.	Northern United States
<i>Rhamnus lanceolata</i> Pursh.	East central United States
<i>Rhamnella franguloides</i> (Maxim.) Weber.	Asia
<i>Hovenia dulcis</i> Thunb.	Asia
<i>Ceanothus americanus</i> L.	Eastern United States
<i>Berchemia scandens</i> (J. Hill) C.Koch	Southeastern United States

account of this and similar laboratory experiments will be published at a later date.

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