

SOYBEAN APHID HOST RANGE AND VIRUS TRANSMISSION EFFICIENCY

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Introduction

The soybean aphid (*Aphis glycines* Matsumura) was discovered infesting soybean fields in southern Wisconsin in July of 2000. This was the first time aphids had been found colonizing soybeans in Wisconsin. A host range study was performed on this aphid the following winter to determine whether or not the aphid was utilizing plants other than soybean for reproductive purposes. Virus transmission experiments were also conducted with the soybean aphid.

Materials and Methods

Detached leaves of a number of commonly found legumes were placed in Petri dishes that contained water agar and a small amount of soluble fertilizer. Red clover, berseem clover, crimson clover, kura clover, white sweet clover, yellow sweet clover, and white clover were all tested in this study. Classic alfalfa variety Vernal and Pioneer varieties 5454 and 53v63, which is glandular haired, were also examined. Five varieties of snap bean were also tested in this study. Single aphids that had reached adulthood within 24 h of the start of the experiment were placed on each leaf or leaflet in the study. These aphids were allowed to reproduce for one day. If five or more nymphs had been produced, the adult was removed. If five nymphs had not been produced, the adult was left for another 24 h. At the end of this time the adult and any excess nymphs were removed from the dishes. The length of time that it took each nymph to mature was recorded. The number of aphids that reached maturity and the number of these aphids that were winged or wingless was also recorded. If any nymphs reached adulthood, the number of nymphs that they produced within the first four days of their lives was recorded. These factors were used to determine the host suitability of each plant for the soybean aphid.

Aphids were starved for two hours before initiation of transmission experiments. They were then allowed to feed on infected plant tissue for 2-3 minutes. They were placed on healthy plants for 24 h, at which time soap based insecticide was applied to kill the aphids. Enzyme linked immunosorbent assay was used to test plants for virus presence 2-4 weeks later.

Results and Discussion

Crimson clover, which is not commonly found in Wisconsin, red clover, and soybean were found to support high levels of soybean aphid reproduction and to be excellent hosts of the soybean aphid. To a lesser extent, berseem clover and kura clover

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were found to support reproduction of this aphid. These plants were less suitable hosts for the soybean aphid. These experiments also show that white clover, white sweet clover, and yellow sweet clover can support low levels of reproduction but are extremely poor hosts of the soybean aphid.

Vernal supported very low levels of aphid reproduction, but no nymphs reached adulthood on these plants. Aphids also reproduced at low levels on Pioneer varieties 5454 and 53v63. The aphids that survived to adulthood were winged. This evidence suggests that alfalfa, in general, is a poor host of the soybean aphid.

Soybean aphid adults produced nymphs on snap bean varieties Evergreen, Fury, Hystyle, Pueblo and Top Crop. All nymphs produced on all varieties of snap bean in these experiments died before reaching maturity except those produced on Evergreen. A small number of nymphs were able to reach maturity on this variety.

A series of greenhouse experiments were then conducted to determine whether soybean aphids could use whole plants as hosts as well as detached leaves. Aphids were placed on crimson clover, red clover, and snap bean variety Top Crop. The soybean aphid can persist at very low populations for long periods without causing obvious detrimental effects to red clover. Aphid populations peaked when plants began to flower. In general, red clover plants can be kept in a cage with soybean aphids for up to three weeks before the plants were unable to support aphid populations and needed to be removed. Aphids can also persist on crimson clover and, in general, cause more direct damage to these plants than to red clover. Eight crimson clover plants that have been placed in this colony have been susceptible to this damage and have died within ten days of infestation. One plant, however, has shown a tolerance to the aphid and sustained a population for almost three weeks before it was overwhelmed. As observed in Petri dishes, many soybean aphid nymphs were produced on snap bean variety Top Crop. None of these nymphs reached adulthood.

During the summer of 2001 the soybean aphid was observed infesting red clover in Arlington, Wisconsin and in southern Wisconsin in late July. Very high numbers of soybean aphids were observed in snap bean fields across Wisconsin in late July and early August. Many winged aphids were observed with large numbers of nymphs surrounding them. All of these aphids died before reaching maturity. There were no reports of soybean aphids beyond the F₁ generation in snap bean fields during the summer of 2001.

The ability of the soybean aphid to feed and reproduce on crops other than soybean led to the question of whether the aphid can transmit viruses between these crops or from these crops to soybean. Transmission experiments were performed in the laboratory to determine whether the soybean aphid is capable of transmitting alfalfa mosaic virus (AMV), cucumber mosaic virus (CMV), and soybean mosaic virus (SMV). AMV is commonly found in legumes across Wisconsin. CMV is a common virus of many crops and weed species that grow in Wisconsin. SMV is found in soybean across Wisconsin and all over the world where soybeans are grown.

The soybean aphid was able to transmit AMV from infected red clover to healthy soybean at low efficiencies. It was able to transmit AMV from infected soybean to healthy soybean at low efficiency levels. It was also able to transmit this virus from infected snap bean to healthy snap bean at low efficiency levels. The aphid was able to transmit CMV from infected snap bean to healthy snap bean at high efficiency levels. The aphid was shown in collaborative work with Iowa State to transmit SMV from infected soybean to healthy soybean at levels similar to the green peach aphid (*Myzus persicae*), which has been a common vector of this virus in Wisconsin.