INCIDENCE OF SPIREA APHID (HOMOPTERA: APHIDIDAE) IN APPLE ORCHARDS IN VIRGINIA, WEST VIRGINIA, AND MARYLAND

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ABSTRACT

Spirea aphid, *Aphis spiraecola* Patch, greatly outnumbered [87% *A. spiraecola* (S.D. ± 3.4)] apple aphid, *Aphis pomi* DeGeer, in apple orchards sampled in spring of 1986 in Virginia, West Virginia and Maryland. Apple as a primary host of *A. spiraecola* was shown for the first time by the presence of oviparae in the fall and fundatrices in the spring. Based on this survey, we suggest future research with "apple aphids" include species determination and preservation of voucher specimens.

Key Words: Apple, *Aphis spiraecola, A. citricola, A. pomi*

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INTRODUCTION

In the United States, three species of Aphididae are commonly reported overwintering as eggs on apple (*Malus* X *domestica* Borkhausen): apple aphid, *Aphis pomi* DeGeer, rosy apple aphid, *Dysaphis plantaginea* (Passerini), and apple grain aphid, *Rhopalosiphum fitchii* (Sanderson) (Matheson 1919). In our collections of sexual forms (oviparae and males) of aphids from an apple orchard at Shenandoah Valley Research Station (SVRS) at Steeles Tavern, Virginia, in the fall of 1983 and 1984, no *A. pomi* were collected. The only *Aphis* species in our samples was spirea aphid, *Aphis spiraecola* Patch, a species morphologically similar to *A. pomi.* Aphids collected at SVRS in the spring of 1983 and 1984, and summer of 1984 in Berkeley Co., West Virginia, were also identified as *A. spiraecola.* Apple has previously been reported as a secondary host for *A. spiraecola* (Blackman and Eastop 1985), often under the name *Aphis citricola* van der Goot (cf. Eastop and Blackman 1988).

The importance of proper systematic determination of aphid species has been shown by the presence of *Acyrthosiphum kondoi* Shinji with *A. pisum* (Harris) on alfalfa. These congeneric species are also similar morphologically but differ in their relations with host plant (Sharma and Stern 1980), parasites (Bates and Miln 1982) and pathogens (Milner et al. 1983).

The purpose of this study was to compare the extent of *A. spiraecola* occurrence in apple orchards relative to *A. pomi* in the Appalachian apple-growing region.

MATERIALS AND METHODS

During the last week of May and the first week of June 1986, leaves bearing viviparae of *Aphis* spp. were collected in 15 orchards in Virginia (one leaf per tree

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from ten trees): Nine in the Piedmont (four each in Albemarle and Nelson Cos., one in Franklin Co.), two in the upper Shenandoah Valley (Rockbridge Co.), and four in the Roanoke Valley (Botetourt Co.). Eight orchards were sampled in West Virginia: Six in the lower Shenandoah Valley (three each in Jefferson and Berkeley Cos.) and two in the Potomac Highlands (Morgan Co.). The West Virginia counties contain most of the apple orchards in the state. Two orchards were sampled in the Cumberland Valley of Maryland (Washington Co.). The Piedmont orchards were on the east side of the Blue Ridge; the remainder were on the west side. A second sample of the West Virginia and Maryland orchards was taken in the last week of July.

The leaf containing an *Aphis* colony was placed in a vial of 70% ethanol in the field. One adult aphid per colony (either apterous or alate vivipara) was mounted using the procedure of Baer and Kosztarab (1985). In the event of a mixed colony, which occasionally occurred, it is assumed that the predominant species would be represented in the sample.

Three *Aphis* adult females that were known to have emerged from overwintered eggs in the spring of 1986 in Bardane, West Virginia, were collected and mounted.

Between 21 and 28 October 1986 (West Virginia and Maryland) and 13 and 25 November 1986 (Virginia), at least ten oviparae were taken from the limbs and twigs of each of five trees in each of 12 orchards sampled. Because of the difficulty in identifying oviparae in the field, it was not known how many of the oviparae belonged to *Aphis* until examination in the laboratory. The numbers of *Aphis* oviparae therefore varied with site: 109 at Carter Mt., 100 in Crown Orchard, 75 at Drumheller, 109 at Seaman, 20 at SVRS, 6 at Bardane, 2 at Kearneysville, 4 at Walnut Hill, 12 at Swan Pond, 2 at Lewis Bros., 1 at Paw Paw, and 9 at Smithburg. Oviparae were mounted as above.

Males were not included in the survey because males of *A. spiraecola* are alate while those of *A. pomi* are apterous. Hence, numbers found may not be comparable because of the differing vagility of the males.

Identifications of viviparae were made using characters presented by Blackman and Eastop (1985). Viviparae of *A. pomi* possess lateral tubercles on abdominal segments two through four and rarely have less than 14 setae on the cauda. Viviparae of *A. spiraecola* lack lateral tubercles on those segments and usually have less than 12 setae on the cauda. *A. pomi* and *A. spiraecola* are most easily differentiated in the sexual generation (Palmer 1952). The oviparae of *A. spiraecola* have greatly swollen metatibiae covered with flat pseudosensoria. The oviparae of *A. pomi* have only slightly swollen metatibiae and only a few pseudosensoria. *Aphis* oviparae are differentiated from those of *D. plantaginea* by the lack of a central tubercle on the frons (found in the latter species), and from *R. fitchii* by six antennal segments (five in *R. fitchii*). Voucher specimens from this study are located in the Department of Entomology, VPI&SU, Blacksburg VA 24061.

Each orchard was treated as a replication and individual aphids as subsamples. Regions were compared using a chi-squared test for equal probability on untransformed numbers of *A. spiraecola* and *A. pomi* colonies in the Piedmont, Roanoke Valley, Upper Shenandoah Valley, Lower Shenandoah Valley, Potomoc Highlands, and Cumberland Valley. The relative preponderance of *A. spiraecola* in spring versus mid-summer was determined by comparing the ten orchards that were sampled at both times (six in the Lower Shenandoah, two each in the Potomoc Highlands and Cumberland Valley). A paired t test was employed after data (percent *A. spiraecola* in sample) were transformed(arcsin x^{-2}). Because of the low

number of *Aphis* oviparae collected in some orchards, no regional comparison was made.

RESULTS

In the May and June, 1986, samples, *A. spiraecola* comprised 87% (S.D. ± 3.4) of the *Aphis* colonies sampled in Virginia, West Virginia and Maryland; *A. pomi* comprised the remainder. Data from individual orchards arranged by geographical region are presented in Table 1. The proportion of *A. spiraecola* colonies was not significantly different among regions (chi-square = 8.57, df = 5, alpha = 0.05). In those orchards sampled both in May-June and late July, there was a higher percentage of *A. pomi* in the later samples (t = 5.98, df = 9, alpha = 0.001).

Table 1. Percentage of *A. spiraecola* in *Aphis* colonies in apple orchards in Virginia, West Virginia and Maryland (ten colonies per orchard, one adult vivipara per colony.*

Region, Orchard	May-June	Region, Orchard	May-June	July
Piedmont		**Lower Shenandoah Valley**		
Carter Mountain	80	Bardane, USDA	20	20
Harvey	90	Kearneysville	90	10
Clarewin	80	Walnut Hill	100	40
Gray Rock	70	Swan Pond	100	80
Drumheller	100	Lewis Bros.	90	0
Seaman	70	Hedgesville	90	50
Bruguiere	100	Mean (S.D.)	82(12.5)	
Saunders	90	**Potomoc Highlands**		
Garst	70	Applejack	100	30
Mean (S.D.)	83(4.1)	Paw Paw	100	30
Roanoke Valley		Mean (S.D.)	100(0.0)	
Rieley	90	**Cumberland Valley**		
Ikenberry	100	Keedysville	90	40
Sprinkle	80	Smithsburg	90	50
Kinzie	100	Mean (S.D.)	90(0.0)	
Mean (S.D.)	92(4.8)			
Upper Shenandoah Valley		**OVERALL**		
SVRS	90	**MEAN** (S.D.)	87(3.4)	35(7.2)
Alexander	100			
Mean (S.D.)	95(5.0)			

* Piedmont, Roanoke Valley and Upper Shenandoah Valley orchards were sampled in May-June only. Lower Shenandoah Valley, Potomoc Highland and Cumberland Valley orchards were also sampled in July.

Aphis spiraecola was the predominant *Aphis* species in the samples of oviparae collected across the general area sampled, comprising 73% of the total *Aphis* oviparae (322 of 439). The numbers of *A. spiraecola* found among *Aphis* oviparae in individual orchards are as follows: Carter Mountain, 0 of 100; Crown Orchard, 100 of 100; Drumheller, 72 of 75; Seaman, 108 of 109; SVRS, 20 of 20; Bardane, 2 of 6; Kearneysville, 2 of 2; Walnut Hill, 2 of 4; Swan Pond, 6 of 12; Lewis Brothers, 2 of 2; Paw Paw, 1 of 1; Smithsburg, 7 of 9. Few *Aphis* oviparae were available from

Bardane, Kearneysville, Walnut Hill, Lewis Brothers and Paw Paw (West Virginia), and from Smithsburg (Maryland). Although aphid oviparae were collected from these sites, a greater proportion consisted of *D. plantaginea* in the West Virginia and Maryland samples (55% versus 0.4% in the four Virginia orchards). Two of the fundatrices collected in Bardane in spring 1986 were *A. spiraecola*; the third was of questionable identity.

DISCUSSION

These findings are important because *A. pomi* has been considered a pest species and has been the subject of research on integrated pest management and insect-plant relationships (Carroll and Hoyt 1986; Hamilton et al. 1986). Although *A. spiraecola* has been known to colonize apple as a secondary host (Patch 1923; Blackman and Eastop 1985), no research has been published on this species as a pest on apple trees. Any action threshold or economic injury level developed for *A. pomi* should be validated for *A. spiraecola* because of the preponderance of this species in apple orchards of the mid-Atlantic states. Population dynamics for *A. spiraecola* should also be determined on apple; several demographic and phenological parameters have been shown to vary with choice of host plant (Neubauer et al. 1981; Komazaki 1983). Steiner et al. (1985) found genetic differences between strains of *A. spiraecola* on different host plants.

The species are very similar morphologically. Patch (1923) considered *A. spiraecola* to be a race of *A. pomi* because of their morphological similarity and because both colonize spirea (*Spiraea* spp.) as well as apple. The validity of the species is now recognized (Palmer 1952; Blackman and Eastop 1985). Geographic origins are probably European for *A. pomi* (Matheson 1919) and Far Eastern for *A. spiraecola* (Blackman and Eastop 1985).

Leonard and Bissell (1970) listed only one record for *A. spiraecola* on apple in this region, while multiple records were given for *A. pomi*. Therefore the current predominance of *A. spiraecola* over *A. pomi* may reflect a real change in aphid species composition in apple orchards of the mid-Atlantic region, rather than historical misidentification. Zehavi and Rosen (1987) found that although *A. pomi* had been common in the past, only *A. citricola* could be found on apple in Israel (no quantitative data were given).

For years *A. spiraecola* was assumed to overwinter only on spirea, dispersing in the spring to other hosts. However, this species was reported to overwinter on citrus in 1979 (Komazaki 1983). Our discovery of oviparae of *A. spiraecola* in these orchards is the first indication that *A. spiraecola* may also use *Malus* as a primary host. The presence of many *A. spiraecola* oviparae indicate a liklihood that this species overwinters on apple, but not a certainty. The number of *Aphis* fundatrices collected was too low to permit conclusions on the relative abundance of the two species in this generation; the results are reported only to confirm the use of apple as a primary host in the region.

Because of the morphological similarity between the two species, much research presumed to be performed on *A. pomi* may have used *A. spiraecola* in reality (Blackman and Eastop 1985). The need to submit voucher specimens for systematic identification in the course of investigations is emphasized by this research.

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