Leafminers, *Liriomyza trifolii*, on Cotton in Arizona

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Abstract

Liriomyza leafminers have occurred in Arizona for several years. It has only been recently that a new species, Liriomyza trifolii, has been reported on vegetable crops such as melons and lettuce. During the 1991 growing season, L. trifolii was observed causing damage to cotton for the first time in Central Arizona. Infestations occurring in Coolidge, had reached damaging levels and required control, whereas populations occurring in Yuma were very low. The impact of management and environmental factors responsible for the outbreaks of L. trifolii on cotton are discussed.

Introduction

Agromyzid leafminer species in the genus *Liriomyza*, have become serious economic pests of several vegetables and ornamental crops in North America. The polyphagous species *Liriomyza trifolii* (Burgess) and *Liriomyza sativae* Blanchard are most prevalent and have overlapping host ranges (Spencer 1973). Although both species occur on a wide range of cultivated and uncultivated host plants, *L. trifolii* is considered the more serious threat to agricultural production. Presently, the number of known host plants of *L. trifolii* worldwide is estimated at about 120 species in 21 families (Spencer 1981).

In Arizona, *Liriomyza* leafminers have long been recognized as pests of vegetables. In 1950, leafminers were reported to cause substantial damage to melons and lettuce in the Salt River Valley (Hills and Taylor 1951). Although the above report failed to identify which *Liriomyza* species was present, Spencer (1973) speculated that it was probably *L. sativae*. Since that time, *L. sativae* has been reported on several host plants occurring in Arizona, including cotton, *Gossypium* spp.(Spencer 1981). In contrast, the first occurrence of *L. trifolii* in Arizona was reported in 1987 where heavy infestations were observed on lettuce and celery (Rethwisch 1989). It is unknown how the pest became established in the state, but *L. trifolii* has been present in the neighboring Imperial Valley of California since 1977 (Spencer 1981).

Cotton has not previously been listed as a host for *L. trifolii* (Spencer 1981, Spencer 1973). Yathom (1984) reported that *L. trifolii* adults fed and oviposited on seedling cotton in laboratory studies, but larvae failed to develop into pupae. However, many entomologists and growers in Arizona have assumed that *L. trifolii* occurs on cotton because of the large numbers which typically infest fall lettuce and melons in close proximity to cotton (Scott Tollefson, per. comm). In 1991, fruiting cotton in Central Arizona became heavily infested with leafminers in mid-season, requiring insecticide applications to prevent defoliation. Initially, it was unknown which species had occurred on the cotton, but upon close inspection it was determined that a large population of *L. trifolii* was present. The purpose of this note is to report two cotton species, *Gossypium hirsutum and G. barbadense*, as new hosts of *Liriomyza trifolii*.

Materials and Methods

Reported herein are observations of larval populations and damage to upland and pima cottons grown in Pinal Co. and Yuma Co., Arizona in the summer of 1991. Leaf samples were collected from cotton fields in Coolidge and Yuma in July, 1991. Leaves were collected from the upper 1/3 of the plants, placed in plastic containers, and immediately transported to the laboratory. Each individual leaf was examined for mines and larvae with a dissecting scope using substage lighting. Leaves were then placed in emergence cages to allow for collection of pupae and rearing of adults. Specimens of each species of *Liriomyza* reared were identified by Dr. Eric Fisher, Calif. Dept. of Food & Agric., Sacramento. Specimens of parasitoids were identified by Carl Olson, Univ. of Arizona, and Dr. Gordon Gordh, University of California, Riverside.

Results and Discussion

The first observation involves cotton infested on July 23, at Coolidge, Arizona. About 200 acres of sub-surface drip irrigated cotton (DPL 56-90) were heavily damaged by leafminer. The cotton contained a very large population of larvae and adults that primarily consisted of *L. trifolii*. Mined leaves were distributed regularly throughout the field, and most leaves in the upper and middle plant canopy were infested with larvae. From the number of exited mines observed on leaves on the lower canopy, it was apparent that several generations had previously developed. Infested leaves contained an average of 28.9 $\pm$ 8.9 mines and 11.2 $\pm$ 5.3 larvae per leaf. In the heaviest mined leaves, it was estimated that a large proportion of the leaf surface ($>$ 60%) was chlorotic as a result of leafminer feeding. On the field margins, about 10% of the leaves had been defoliated from the lower plant due to heavy mining. Large numbers of adult leafminer flies were readily observed flying within the upper plant canopy. Close examination of several of these flies indicated that they were *L. trifolii*. Adult flies reared from infested leaves in the laboratory confirmed these observations. A total of 319 pupae, of which 180 of them yielded adult *L. trifolii*, was collected (Table 1.). Only four pupae yielded *L. sativae* adults; the remaining 139 pupae were either parasitized with the hymenopterous parasitoids *Chrysocharis parksi* and *Dacnusa* spp. or did not yield viable insects. In addition, 189 *Diglyphus* spp. adults emerged from parasitized mines. Pima cotton (S-6) sampled at Coolidge were not heavily infested with leafminers, but two *L. trifolii* adults were collected from the leaf samples.

The second observation of *L. trifolii* on cotton was at Yuma, Arizona. Cotton (DPL 90) leaves were collected from a 45-acre field on July 10, 1991. Leaves were taken primarily from the lower plant canopy because very few mines were observed on the middle and upper canopy. Numbers of total mines (1.72 $\pm$ 0.6) and larvae (1.06 $\pm$ 0.7) per leaf were much lower than those examined from Coolidge. Very little mining of leaves was observed, and adult flies were not detected on the plants. A total of 74 pupae were collected from the infested leaves, of which 20 yielded *L. trifolii*; 32 yielded adults of *L. sativae*, and the remainder consisted of adult parasitoids. The number of larvae and mines in pima (S-6) leaves was very low, resulting in only a single *L. trifolii* adult.

Although *L. trifolii* has probably occurred on cotton for several years, this is the first report of *L. trifolii* infesting and damaging upland cottons in any growing region. The incidence of defoliated leaves at Coolidge demonstrates the capability this insect has for inflicting heavy leaf damage to fruiting cotton. Populations of leafminers (*L. sativae*) in cotton normally occur at low levels during the season. This is usually a direct result of larval and pupal parasitism (Werner et al. 1979). However, cotton infested at Coolidge was grown using a combination of very unique management and cultural practices. First, it was irrigated using sub-surface, drip technology that utilizes minimum-tillage of the soil. In addition, the cotton was planted in fields that are annually rotated with watermelons and lettuce, or in near proximity to these crops. Both of these vegetable crops have a history of *L. trifolii* outbreaks in that area. Mild spring and summer temperatures occurring in 1991 were also favorable for leafminer development. Finally, the cotton received multiple applications of broad-spectrum insecticides (methyl parathion, thiodicarb & acephate) for early season insect control. The use of insecticides has previously caused outbreaks of *L. trifolii* in other cropping systems by reducing natural enemy populations (Trumble 1990). It is probable that the combination of these management practices predisposed the cotton for such an outbreak of *L. trifolii*. In conclusion, infestations of *L. trifolii* noted in this report should serve as a warning that large numbers of leafminers are capable of causing damage and defoliating fruiting cotton under special circumstances.

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Table 1. Species composition of populations of *Liriomyza* infesting cotton at Coolidge and Yuma, Arizona in 1991.

Cotton variety	Location	No. leaves sampled	Mean larvae per leaf	% *Liriomyza* adults / sample	
				trifolii	*sativae*
DPL 56-90	Coolidge	45	11.2 ± 5.3	97.8	2.2
Pima S-6	Coolidge	34	0.2 ± 0.1	40.0	60.0
DPL 90	Yuma	80	1.1 ± 0.7	38.5	61.5
Pima S-6	Yuma	80	0.1 ± 0.1	25.0	75.0