ences (χ^2 = 79.42***, with 3 df) among seasons in the probability of a trap having a catch, but the year x season interaction also was significant (χ^2 = 57.15***, with 3 df). There were no such significant differences (χ^2 = 0.95, n.s. for 3 df) among quadrants, in agreement with DeBarr et al. (1975) who found no significant differences in the numbers of *G. fuscus*-attacked female slash pine conelets among quadrants. Further research is needed to determine seasonal changes in the density of this thrips in managed slash pine seed orchards.

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A MITE, *OGMOTARSONEMUS EREPSIS* (TARSONEMIDAE), IN OVIPOSITION INCISIONS OF THE PLANTHOPPER *PROKELISIA MARGINATA* (HOMOPTERA, DELPHACIDAE) ON THE SALTMARSH CORDGRASS, *SPARTINA ALTERNIFLORA*

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The upper surfaces of leaves of saltmarsh cordgrass (*Spartina alterniflora* Loisel) on the shores of the northern Gulf of Mexico frequently bear distinctive brown wounds. The largest of these wounds are deep and visible through the leaf, from the lower, abaxial, surface. These wounds are more frequent and larger on older, basal, leaves of

cordgrass. Large wounds are made up of anastomosed patches of small linear wounds. Although many sorts of damage can cause cordgrass leaves to turn brown, most natural browning is caused by the mite *Ogmotarsonemus erepsis* Lindquist (Lindquist 1986). This mite is concentrated within healthy cordgrass leaves, and the only access to the interior is through a break in the leaf cuticle. Most access to the interior of green leaves in nature is via linear oviposition incisions made by the planthopper *Prokelisia marginata*. Incisions are made between the longitudinal ridges on the leaf. Leaves bearing no hopper incisions have no mites inside and no linear brown wounds. Mites lay eggs within a few days of colonizing an incision, but do not spread their activities more than a few millimeters from the incision. Isolated incisions have only small isolated brown areas, which do not grow larger in the absence of additional oviposition incisions by the planthopper.

Basal cordgrass leaves can remain green and healthy for several months in nature and accumulate a large number of hopper ovipositions. At the base of an old leaf, dense aggregations of spots will anastomose into a large blotch of brown, which grades into a narrower scattering of spots 2 or 3 cm up the leaf (Fig. 1). In heavy aggregrations of hopper eggs, the cuticle becomes so tattered that the leaf laminae sag apart, allowing the mites freer access to leaf tissue and spreading the browning more broadly than around isolated incisions.

Mite-free cordgrass can be produced from corms that have had dead leaves removed before potting in the greenhouse. As well, mites can become extinct from greenhouse cordgrass that has had old leaves removed promptly upon the first signs of senescence.

Mites have no apparent effect upon planthopper eggs, which have very high hatching rates in both the presence and the absence of mites. Similarly, neither obvious benefit nor risk to the egg parasitoid of the planthopper, *Anagrus delicatus* Dozier (Mymaridae) (Stiling & Strong 1982, 1983), is caused by the mite. Any difference in attractiveness to wasps between browned and mite-free oviposition sites must be slight, because eggs are usually parasitized before mites have much effect on incisions.

Oviposition incisions of the planthopper turn brown only after being invaded by the mite. Even very high egg densities of the planthopper cause no leaf discoloration or

Fig. 1. Section of cordgrass leaf with moderate level of infestation by *Ogmotarsonemus erepsis*. The larger dark patches toward the left end of the leaf are anastomosed individual wounds. The smallest linear flecks are isolated individual wounds. Virtually all of the wounds on this leaf were made by the mite in oviposition scars of the planthopper *Prokelisia marginata*. Leaf is 1.4 cm wide at right edge of the photo.

apparent damage when the mite is absent. Almost invisible to the naked eye without the mite, oviposition scars with the mite stand out as obvious brown flecks.

The age of an incision can be known by the developmental stage of its planthopper eggs. Hopper eggs with no discernible eyespots are less than three days old at summertime temperatures; well-developed eyespots appear within six days. The outlines of the head, thorax, and abdomen appear at approximately one week. The hopper egg hatches about 10 days after being laid, during the warm months of April through October.

At our study sites at St. Marks National Wildlife Refuge and Oyster Bay, Wakulla Co., Florida, most incisions in naturally growing corgrass contain mites by the time the eye has appeared in the host egg. Therefore, dispersing mites are abundant throughout the marsh. The distinctive brown spotting appears in all oviposition incisions of the planthopper within two weeks after mite-free cordgrass has been transplanted from the greenhouse to our study sites.

The mite lives and reproduces in places other than oviposition incisions of the planthopper, as is obvious from the rapid colonization of incisions at sites with few planthoppers and of mite-free cordgrass set in the marsh in habitats where cordgrass does not grow naturally. Nonetheless, mite colonization and the resulting brown spots are so reliable an indication of hopper oviposition incisions that planthopper eggs can be found at extremely low densities. For example, on offshore oyster bars where vigorous waves wash most nymphs off cordgrass before maturity, planthopper densities are extremely low. Even so, on the bars, oviposition scars invariably contain mites and are brown.

Examination of a large number of planthoppers has revealed no phoretic mites; mites disperse independently of the planthopper. The brown spots made by mites in oviposition incisions are readily distinguished from other sorts of injury to cordgrass leaves. On the offshore oyster bars, our standard sampling protocol is to examine a large number of leaves and to collect those with any brown flecks or spots for microscopic examination in the laboratory. With the naked eye in the field, we separate spotted leaves into two groups, those with longitudinal spots characteristic of mite-browned oviposition incisions and those with other sorts of spots (which are usually round or transverse). Later, in the laboratory, microscopical examination of all spotted leaves invariably confirms the field distinction. Very young eggs of the planthopper can be missed by this technique because oviposition incisions take a few days to be colonized by the mites and turn brown. The next week's sampling detects these eggs, after they and their incisions have aged but before the hopper eggs hatch. The mite's browning of the leaf allows study of parasitism rates by the wasp *Anagrus delicatus* at extremely low host egg densities (Stiling & Strong 1983, Antolin & Strong 1987).

The mite was identified by H. A. Denmark, Chief of Entomology, Florida Department of Agriculture and Consumer Services. It is preserved as Lot 85-04712 of the Systematic Entomology Laboratory, IIBIII, of the Insect Identification and Beneficial Insect Introduction Institute, Agricultural Research Service, United States Department of Agriculture, Beltsville, MD 20705. The research was supported by grant BSR 8206856 from the National Science Foundation.

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