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THE BIONOMICS AND CONTROL OF PECAN LEAFMINERS IN GEORGIA (LEPIDOPTERA, NEPTICULIDAE, GRACILLARIDAE, HELIOZELIDAE)

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A b s t r a c t : *Stigmella juglandifoliella* (CLEMENS) (Lepidoptera: Nepticulidae), *Cameraria caryaefoliella* (CLEMENS) (Lepidoptera: Gracillariidae) *Phyllonorycter caryaealbella* (CHAMBERS) (Lepidoptera: Gracillariidae) and *Coptodisca lucifluella* (CLEMENS) (Lepdioptera: Heliozelidae) infest pecans in Georgia. *C. caryaefoliella* and *P. caryaeabella* emerge in mid-March from litter on the orchard floor. Each species has from four to five generations per year. Numerous hymenopterous parasitoids attack pecan leafminers. Control tactics can be made more efficient by utilizing leafminer biology.

K e y w o r d s : *Stigmella juglandifoliella* (CLEMENS), *Cameraria caryaefoliella* (CLEMENS), *Phyllonorycter caryaealbella* (CHAMBERS), *Coptodisca lucifluella* CLEMENS, Pecan, *Carya illioensis* KOCH, seasonal dynamics, hymenopterous parasitoids, timed sprays.

Introduction

Four species of lepidopterous leafminers are commonly found infesting pecan, *Carya illioensis* KOCH, in the southeastern United States: *Stigmella juglandifoliella* (CLEMENS), *Phyllonorycter caryaealbella* (CHAMBERS), *Cameraria caryaefoliella* (CLEMENS) and *Coptodisca lucifluella* CLEMENS. These

insects have tradtitonally been considered secondary pests. In recent years, however, economically significant infestations of pecan leafminers have become more common. This increase in the frequency of damaging pecan leafminer infestations, coupled with the fact that lepidopterous leafminers have attained primary pest status in other orchard crops such as apples (DUTCHER & HOWITT 1978, MAIER 1981) leads one to conclude that pecan leafminers possess the potential to become primary pests. Sound control strategies for leafminers as well as other pecan pests must be formulated and implemented if the realization of this potential is to be avoided. These strategies must necessarily take into account the biology of the pest insect as well as the biologies of natural enemies.

Leafminer biology

Studies conducted at Tifton, Georgia during the winter of 1981-82 revealed that *C. caryaefoliella* and *P. caryaealbella* overwinter in orchard litter as last instar larvae and pupae respectively. Pupation in overwintering *C. caryaefoliella* larvae occurs immediately before adult emergence.

Abiotically induced mortality in the overwintering generation was also measured during the 1980-81 and 1981-82 winter. Mortality was measured at two locations in the same orchard and in the case of *C. caryaefoliella* was found to be as low as 31 percent (1981-82) and as high as 95 percent (1981-82). Mortality among *P. caryaealbella* pupae during the two winters ranged from 27 percent (1981-82) to 75 percent (1980-81). Large differences in overwintering mortality the same year demonstrates in part the environmental variability of an orchard floor during a winter.

First spring emergence of *P. caryaealbella* adults occurred on 22 March 1981 and 11 March 1982. First spring emergence of *C. caryaefoliella* adults occurred on 22 March 1981 and 17 March 1982. Spring emergence of *P. caryaealbella* adults occurred over a period of five weeks in 1981 and four weeks in 1982. Spring emergence of *C. caryaefoliella* occurred over a period of five weeks in 1981 and seven weeks in 1982. Year long foliar sampling

revealed *S. juglandifoliella* to have five generations per year while *C. caryaefoliella*, *P. caryaealbella* and *C. lucifluella* had four generations per year.

Natural enemies

The biologies of thirty-seven hymenopterous parasitoids are included in a study by HEYERDAHL & DUTCHER (1985). Many of these pecan leafminers parasitoids are also listed as parasitoids of other leafminer species (POTTINGER & LeROUX 1971, MAIER 1982, CHENG & LeROUX 1969). POTTINGER & LeROUX (1971) suggest that these similarities in parasitoid complexes are a result of niche specific and not species specific parasitoids.

The impact of parasitoids on pecan leafminers populations has yet to be determined. However, VAN DRIESCHE & TAUB (1983) cite parasitoids as a significant natural control factor of lepidopterous leafminers in apples. In addition, they suggest that a pesticide driven, selective process which favours insecticide resistant moths over parasitoids can result in a leafminer species becoming a primary pest. Studies conducted at an unsprayed orchard located at Tifton, during 1981 and 1982 revealed parasitism levels from fourteen percent (*C. caryaefoliella* pupae 1982) to sixty one percent (*C. lucifluella* pupae 1982). In most cases percent parasitism of any leafminer species was found to be approximately twenty percent. If they occur during initial leafminer generations low parasitism levels, such as those found in this study, may serve to reduce later generations.

Chemical control

GEIER (1966) stated that an insect control strategy should be selective against a specific population. Timing a control tactic is one

way to obtain this specificity. The existence of discrete, non-overlapping generations in sprayed *C. juglandifoliella* populations makes it possible to the time foliar sprays to coincide with adult emergence and thereby increase its effectiveness. The timing of "adult" sprays is determined through samling larval populations.

Timed leafminer sprays, in addition to increased efficiency, also provide for more flexibility in choosing a particular class of insecticide. HEYER-DAHL & DUTCHER (1985) achieved control of an economically significant *S. juglandifoliella* population using a single application of an insect growth regulator and insecticides in the classes, carbamate, synthetic pyrethroid and organophosphate.

Summary

Increased incidences of insecticide resistance such as that now being found in pecan aphid species makes sound control practices for all pecan insects a necessity. The repeated use of broad-spectrum insecticides to control major pests can serve to reduce or remove the natural controls of a second insect species. This second species may often be transformed, through the indiscriminate use of insecticides, from a secondary pest into a primary pest. To avoid the transformation of pecan leafminers into primary pests will require a holistic approach. The biology of both leafminers and their natural enemies must be thoroughly examined. Whenever possible the effect of these natural enemies must be enhanced. Finally, chemical control practices must be used as a last resort and must be made more efficient.

I am no longer directly involved with leafminer research in pecans. However, I do hope to publish a final manuscript sometime this year. This manuscript will deal primarily with the seasonal dynamics of pecan leafminers. Present research is being conducted by Dr. James D. Dutcher, Department of Entomology, University of Georgia, Tifton, Georgia. Further research is needed to determine the effect of control strategies on pecan leafminers parasitoids, the impact of parasitoids on leafminers and the effect of leafminers on the yielding capability of pecans.

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