PARASITOIDS AND PATHOGENS OF THE SOYBEAN LOOPER, *PSEUDOPLUSIA INCLUDENS* (WALKER), IN SOUTH GEORGIA SOYBEAN

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ABSTRACT

Larvae of the soybean looper (SBL), *Pseudoplusia includens* (Walker), were collected from soybean fields in south Georgia during the 1982, 1983, and 1984 growing seasons. Larvae were reared in the laboratory to determine levels of parasitism and disease incidence. Twelve parasitoid species including one hyperparasitoid were reared from SBL larvae. The three most common parasitoid species were *Copidosoma truncatellum* (Dalman), *Meteorus autographae* Muesebeck, and *Cotesia marginiventris* (Cresson). The most abundant pathogen was the fungus *Entomophthora gammae* Weiser, but the fungus *Nomuraea rileyi* (Farlow) Samson and a nuclear polyhedrosis virus also were present. Peak SBL densities were 73.5 larvae per row-meter in 1982, 30.9 in 1983, and 19.8 in 1984. Total mortality of larvae collected from different locales due to parasitism and disease ranged from 36.5 to 77.6% during 1982, from 4.8 to 73.2% during 1983, and from 0 to 93.9% during 1984.

Key Words: Soybean looper, survey, parasitoids, pathogens.

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INTRODUCTION

The soybean looper (SBL), *Pseudoplusia includens* (Walker), is a common lepidopterous defoliator of soybean [*Glycine max* (L.) Merrill] in the southeastern United States, frequently developing economically injurious populations. Management of this pest is accomplished generally through the use of chemical insecticides. However, alternate SBL control strategies which conserve and utilize naturally occurring mortality factors such as predators, parasitoids, and entomopathogens are being investigated. Knowledge of these natural agents' distribution and abundance is important to the success of applied control systems.

Parasitoids of the SBL have been surveyed in Louisiana (Burleigh 1971, 1972), North Carolina (Dietz et al. 1976), Texas (Harding 1976), South Carolina (McCutcheon and Turnipseed 1981), and Florida (Martin et al. 1981). The most widespread SBL parasitoids are members of two braconid genera, *Cotesia (= Apanteles)* and *Meteorus,* and the encyrtid *Copidosoma (= Litomastix) truncatellum* (Dalman). The most commonly reported pathogens of SBL larvae are two fungi, *Entomophthora gammae* (Weiser) and *Nomuraea rileyi* (Farlow) Samson (Harper and Carner 1973; Carner et al. 1975; Dietz et al. 1976).

The objective of this survey was to identify the SBL larval parasitoids and pathogens which were present in south Georgia soybean fields and to determine their relative abundance.

MATERIALS AND METHODS

SBL larvae were collected from six to eight grower soybean fields on each of nine to ten dates in 1982 and 1983 from Brooks, Crisp, Colquitt, Dooly, Thomas, and Tift counties and in 1984 from Brooks and Colquitt counties, Georgia. Larvae collected from various locations on the same date were combined. Sampling dates and numbers of larvae collected at each date are shown in Table 1.

Larvae were collected from soybean by shaking foliage over a 0.91×0.76 m ground cloth. Specimens were placed individually into 30 ml plastic cups containing an artificial pinto bean/wheat germ diet, similar to that of Greene et al. (1976), as they were collected in the field. Cups containing larvae were placed into styrofoam coolers for transport to the laboratory. Larvae were grouped into size categories based on instar: small (1st - 2nd instar), medium (3rd - 4th instar), and large (5th - 6th instar). Larvae were incubated at 26.7°C and checked at 24 hour intervals for disease symptoms or parasitoid emergence. Larvae successfully pupating were held until adult emergence to detect parasitoids emerging from host pupae. Larvae which died due to injury during collection, or from unknown causes, were excluded from the survey. Parasitoids emerging from SBL larvae were held for adult emergence before being pinned and prepared for identification. Parasitoid species were either determined by comparison with reference specimens, or were sent to the Insect Identification and Beneficial Insect Introduction Institute, ARS, USDA, Beltsville, MD, for identification.

Densities of SBL larvae were estimated in fields from which larvae were collected utilizing the plant shake method (Turnipseed 1974) and groundcloth described above with eight to twelve 0.91 m (3 ft) samples taken per field. Samples from all fields on a given date were combined and averaged for mean number of larvae per meter.

RESULTS AND DISCUSSION

Eleven parasitoid and one hyperparasitoid species emerged from 4,917 SBL larvae collected in 1982, 1983, and 1984 (Table 1). The most abundant parasitoid during the three year study was the polyembryonic *C. truncatellum* (Hymenoptera: Encyrtidae) which parasitizes SBL in the egg stage and subsequently develops within SBL larvae. *Meteorus autographae* Muesebeck and *Cotesia marginiventris* (Cresson) (Hymenoptera: Braconidae) also were commonly collected. *Chaetophlepsis plathypenae* Sabrosky, *C. townsendi* (Smith), *Lespesia aletiae* (Riley), *L. archippivora* (Riley), and *Voria* sp. near *aurifrons* (Townsend) (Diptera: Tachinidae) were not abundantly collected. Only one specimen each of *Euplectrus* sp. (Hymenoptera: Eulophidae) and *Campoletis* sp. (Hymenoptera: Ichneumonidae) were collected during the study. *Euplectrus* sp. failed to survive to adulthood and was not positively identified. McCutcheon and Turnipseed (1981) and Harding (1976) previously identified *Euplectrus comstockii* Howard as a parasitoid of SBL larvae. *Mesochorus discitergus* (Say) (Hymenoptera: Ichneumonidae) was abundant only in 1984. This species has been reported as a hyperparasitoid of *Cotesia* sp. (Nickle 1976; McCutcheon and Turnipseed 1981). All parasitoids collected in this study had been previously noted as SBL parasitoids except *Voria* sp. near *aurifrons.*

Over the three year period, 15.8, 12.0, and 16.7% of large, medium, and small larvae were parasitized by *C. truncatellum,* respectively. No large, 1.9% of medium,

Table 1. Larval density and numbers of parasitized and diseased *P. includens* larvae collected from soybean in south Georgia, 1982, 1983, and 1984.

					Number parasitized						Number diseased				
			Mean no. larvae/meter	Total collected	*C. truncatellum*	*M. autographae*	*C. marginiventris*	*M. discitergus**	other†	Tot. % parasitism	*E. gammae*	*N. rileyi*	*NPV*	Tot. % disease	Tot. % mortality‡
1982	July	26	4.9	53	14	4	0	0	0	34.0	19	0	0	35.8	69.8
	Aug.	4	29.6	123	26	14	1	1	4	37.4	6	0	0	4.9	42.3
		14	53.9	241	32	8	0	0	1	17.0	42	1	4	19.5	36.5
		18	73.5	88	9	2	1	0	1	14.8	16	4	0	22.7	37.5
		29	55.5	140	4	2	0	0	0	4.3	87	1	4	65.7	70.0
	Sept.	15	64.0	151	27	6	3	0	1	24.5	30	1	32	41.7	66.2
		24	35.4	196	5	11	0	0	0	8.2	44	56	7	54.6	62.8
	Oct.	1	–	300	6	1	0	0	3	3.3	83	105	35	74.3	77.6
1983	July	19	4.3	22	5	2	2	0	0	40.9	0	0	0	0.0	40.9
		28	4.4	39	3	0	1	0	0	12.1	0	0	0	0.0	12.1
	Aug.	9	1.6	105	2	1	0	0	2	4.8	0	0	0	0.0	4.8
		17	7.2	168	55	18	7	0	4	50.0	8	0	0	4.8	54.8
		24	29.2	509	102	12	8	0	1	24.2	8	4	81	18.3	42.5
		31	30.9	301	54	5	9	0	1	22.9	11	0	44	18.3	41.2
	Sept.	7	–	702	86	37	8	1	4	19.4	164	6	80	35.6	55.0
		16	25.9	315	8	2	4	0	2	5.1	103	30	54	59.4	64.5
		26	–	287	43	4	7	0	0	18.8	125	10	21	54.4	73.2
	Oct.	4	1.4	78	9	5	9	0	0	29.5	23	5	6	43.6	73.1

1984	July	8	0.1	7	0	0	0	0	0	0.0	0	0	0	0.0	0.0
		26	0.7	4	2	0	0	0	0	50.0	0	0	0	0.0	50.0
	Aug.	7	0.2	25	2	4	0	0	1	28.0	0	0	0	0.0	28.0
		16	9.8	130	19	34	21	4	1	60.8	3	4	0	5.4	66.2
		22	19.8	299	87	47	36	9	1	60.2	5	15	0	21.7	81.2
		29	9.4	328	57	81	23	23	0	56.1	95	16	13	37.8	93.9
	Sept.	6	9.9	198	30	26	0	0	0	28.3	83	14	2	50.0	78.3
		13	5.4	108	22	3	2	0	1	25.9	3	24	0	25.0	50.9

* A hyperparasite of *C. marginiventris*.

† *C. plathypenae, C. townsendi, L. aletiae, L. archippivora, Voria* sp. near *aurifrons, Campoletis* sp., and *Euplectrus* sp.

‡ Parasitism and disease mortality combined.

and 11.4% of small larvae were parasitized by *C. marginiventris*. *Meteorus autographae* parasitized 3.2, 5.7, and 10.1% of all large, medium, and small larvae collected, respectively. *Copidosoma truncatellum* parasitizes SBL eggs but does not cause host mortality until the final larval instar; therefore, parasitism was expected to be similar for all three larval size classes in the absence of any increased susceptibility of parasitized larvae to other mortality factors. The low % parasitism of large and medium larvae by *C. marginiventris* and *M. autographae* suggests that they emerge generally from SBL larvae prior to the attainment of the two final larval instars, but *M. autographae* was occasionally observed to emerge from late instar SBL larvae.

The tachinid parasitoids normally emerged from large larvae. *Lespesia aletiae* emerged only after parasitized SBL hosts had pupated. Two specimens of *L. aletiae* successfully emerged from the same SBL pupa on three occasions.

Of the three pathogens observed the most important was the fungus *E. gammae*, which infected 20.4% of all larvae collected over the three year period. The fungus *N. rileyi* was also a contributing factor to SBL larval mortality in all three seasons. The third disease was confirmed by electron microscopy to be a singly-embedded nuclear polyhedrosis virus (NPV) (G. R. Carner, personal communication) and commonly was observed in some late-season SBL larval collections. Published reports of the natural occurrence of this virus from the Southeastern United States apparently are lacking. An NPV of the SBL from Central America has been described previously (Livingston and Yearian 1972).

Percent mortality due to disease was distributed approximately evenly among all larval size classes collected except *E. gammae*-infected larvae which exhibited the resting spore form. No small larvae collected were observed to have the resting spore form of *E. gammae*. The resting spore form was more common in late season collections, as previously reported by Newman and Carner (1975). Only 20.2% of all *E. gammae*-infected larvae collected during the months of July and Aug. exhibited the resting spore form; however, this figure rose to 63.5% for larvae collected in Sept. and Oct.

Biases involved with sampling parasitoids and pathogens of soybean pests enumerated by Marston (1980) and Carner (1980) certainly apply to the present study. The presence of alternate hosts for these parasitoids and pathogens (not sampled during this study) also may effect their incidence in SBL larval collections. With the exception of *C. truncatellum* and *Voria* sp. near *aurifrons*, all SBL parasitoids noted in Table 1 have been reported as parasitoids of other soybean lepidoptera (McCutcheon and Turnipseed 1981).

However, the estimates of total % mortality of collected larvae due to parasitism and disease do suggest the importance of these natural factors in suppressing SBL larval populations in south Georgia. Total mortality of collected larvae was 36.5% or greater from mid-Aug. through the remainder of the season in all three years. During the three-year survey, economically injurious levels of SBL larvae often developed in grower fields in spite of the presence of these natural biological control agents, especially during 1982. However, in the absence of the beneficial effects of such control factors, potentially damaging populations would be expected to occur more frequently as well as earlier in the growing season. For this reason, applied control strategies for the SBL and other pests of soybean should be coordinated to augment, not interfere with, the population suppression provided by these organisms.

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