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SEASONAL ABUNDANCE OF THE GREENBUG AND ITS NATURAL ENEMIES IN GRAIN SORGHUM IN THE TEXAS HIGH PLAINS

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SUMMARY

Based on population studies during 1971, 1972, and 1973, biotype C greenbug, *Schizaphis graminum* (Rondani), tended toward highest seasonal abundance in grain sorghum during mid- to late July. Predators showed a similar trend, but peak populations occurred shortly after greenbug populations began to decline. The proportion of the greenbug population parasitized increased to a peak in early August as the total greenbug population was declining rapidly. *Lysiphlebus testaceipes* (Cresson) was the most abundant primary parasite of the greenbug. Other primary parasites reared from mummies were *Diaeretiella rapae* (M' Intosh) and *Aphelinum nigritus* (Howard). Hyperparasites (parasites of parasites) reared from mummies were *Charips* sp., *Pachyneuron siphonophorae* (Ashmead), *Asaphes lucens* (Provancher), and *Aphidencyrtus aphidivorus* (Mayr). *Charips* sp., and *P. siphonophorae* were the most abundant hyperparasites affecting the primary parasite *L. testaceipes*. *Hippodamia* spp. were the most abundant predators.

INTRODUCTION

Better qualitative and quantitative characterization of pest populations – the damage they cause, their genetic variability, their relative numbers and mobility, and the many interactions between these parameters and various other environmental factors–is necessary. Assessment of seasonal distribution for pests such as greenbug, a key pest of grain sorghum in the Texas High Plains since 1968, is essential in the development of pest management strategies. Likewise, an assessment of important parasites and predators is required. Research results provide quantitative information on relative numbers of greenbugs and beneficial arthropods for defining seasonal trends in abundance as an aid in developing sound pest management strategies.

Seasonal abundance data for biotype C greenbug in grain sorghum were recorded in 1969 (Bottrell 1971). He reported that greenbug reproduction begins immediately after invasion of grain sorghum, with the greenbug population sometimes increasing at a rate of twentyfold per week. If not controlled, such populations continue to increase until mid-July to early August. Thereafter, they usually decline rapidly. Parasitization is an important factor in population decline (Bottrell 1971). Several major predators of the greenbug also contribute to this decline, although their role has not been quantified.

Predators and parasites of the greenbug, both indigenous and exotic, have been studied but often in relation to aphids and host plants other than the greenbug and grain sorghum. Daniels and Chedester (1972) reported on developmental studies of the indigenous predator species *Hippodamia convergens* (Guer) fed biotype C greenbug. In similar studies, Rogers et al. (1972a, b) reported on the biology, voracity, and survival of an exotic coccinellid, *Propylea 14-punctata* L.

The native parasite *Lysiphlebus testaceipes* (Cresson) has long been associated with the greenbug in small grains (Webster and Phillips 1912). Since 1968, when biotype C first appeared in damaging numbers in grain sorghum (Anonymous 1969), research interest in this parasite has been renewed (Hight et al. 1972, Jackson et al. 1970, Starks et al. 1972, Walker et al. 1973). Exotic parasites suitable for possible introduction as biological control agents have been studied by several researchers (Jackson and Eikenbary 1971, Jackson et al. 1971, Esmaili and Wilde 1972, Archer and Eikenbary 1973). Secondary parasites collected from biotype C greenbug mummies are *Aphidencyrtus aphidivorus* (Mayr), *Pachyneuron siphonophorae* (Ashmead), *Charips* sp., *Asaphes lucens, Tetrastichus minutus* (Howard), (Archer et al. 1974, Walker et al. 1973, Jackson et al. 1970). Primary parasites besides *L. testaceipes* are *Aphelinus nigritus* (Howard), *A. varipes* (Foerster), (Archer et al. 1974, Jackson et al. 1970), and *Diaeretiella rapae* (M' Intosh), (Walker et al. 1973).

METHODS AND MATERIALS

During the 1971-1973 growing seasons, abundance of the greenbug and associated predators and parasites was determined weekly in grain sorghum at the Texas Agricultural Experiment Station, Lubbock County, Texas. The commercial heteroyellow endosperm hybrid was planted in early May and fertilized, irrigated, etc. according to agronomic practices customarily employed in the area. Rainfall records were taken during the growing season of each year. Population densities of insects were determined from seedling emergence until September. On each sample date, at least 100 whole plants were selected at random and examined thoroughly. Parasitism determination was based on

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mummy counts. Mummies were inspected to exclude those from which adults had emerged. Adult parasites were identified after emerging from samples of field-collected mummies, which were confined in 2-ounce blood sample cups in the laboratory.

Major predators recorded weekly were: *Hippodamia* spp., *Chrysopa* spp., *Scymnus* spp., *Syriphid* spp. (larvae), spiders, and three hemipteran species, *Orius* spp., *Nabis* spp., and *Geocoris* spp.

RESULTS AND DISCUSSION

Greenbugs infested grain sorghum soon after emergence of the plants, generally during the last week in May (Figures 1, 2, 3). Rainfall reduced population density early in the season when plants were small. Levels of infestation differed each year, but peak greenbug infestation occurred during the third week in July and declined rapidly thereafter. Mean weekly observed rates of increase for greenbug were 6.6X, 3.5X, and 4.6X for 1971, 1972, and 1973, respectively, or approximately fivefold per week.

Although abundance of parasites cannot accurately be determined by mummy counts because they are an "after the fact" measure, the presence of mummies provided a means of expressing the number of greenbugs eliminated by parasitism. Greenbug populations each year reached a high density before parasites reduced the population significantly. However, parasitism suppressed the greenbug populations and prevented continuing abundance increases in August. The period of peak greenbug abundance was short, and if the economic threshold was reached, chemical control was required only for a brief period. Teetes and Johnson (1973) attempted to define the economic injury level of greenbugs and showed that greenbugs in excess of 1,300 to 1,500 per plant were required to cause economic yield loss. The population data presented here indicate that the greenbug does not often attain damaging levels. When it does, the damaging period lasts only for 1 to 2 weeks.

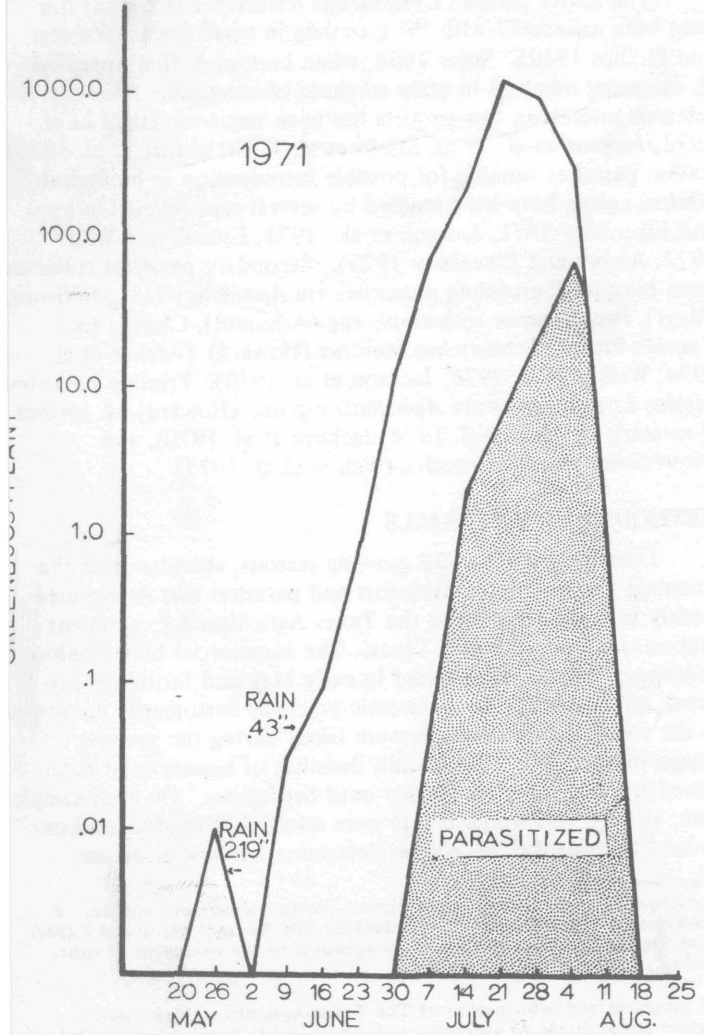


Fig. 1. Seasonal abundance and parasitism of the greenbug in grain sorghum 1971.

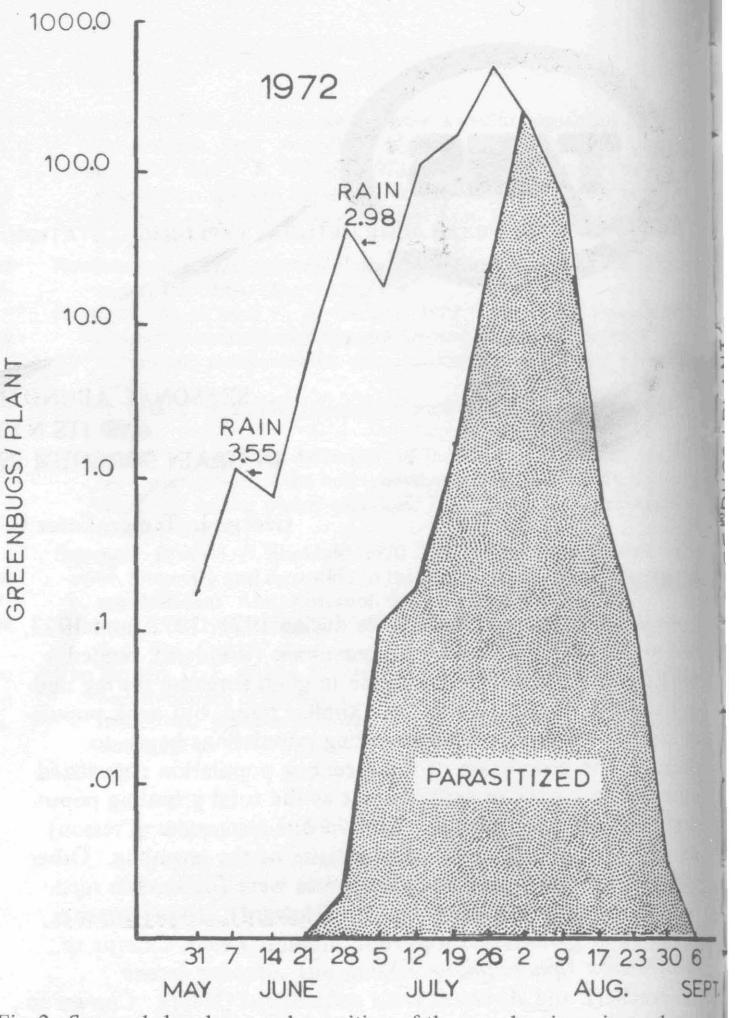
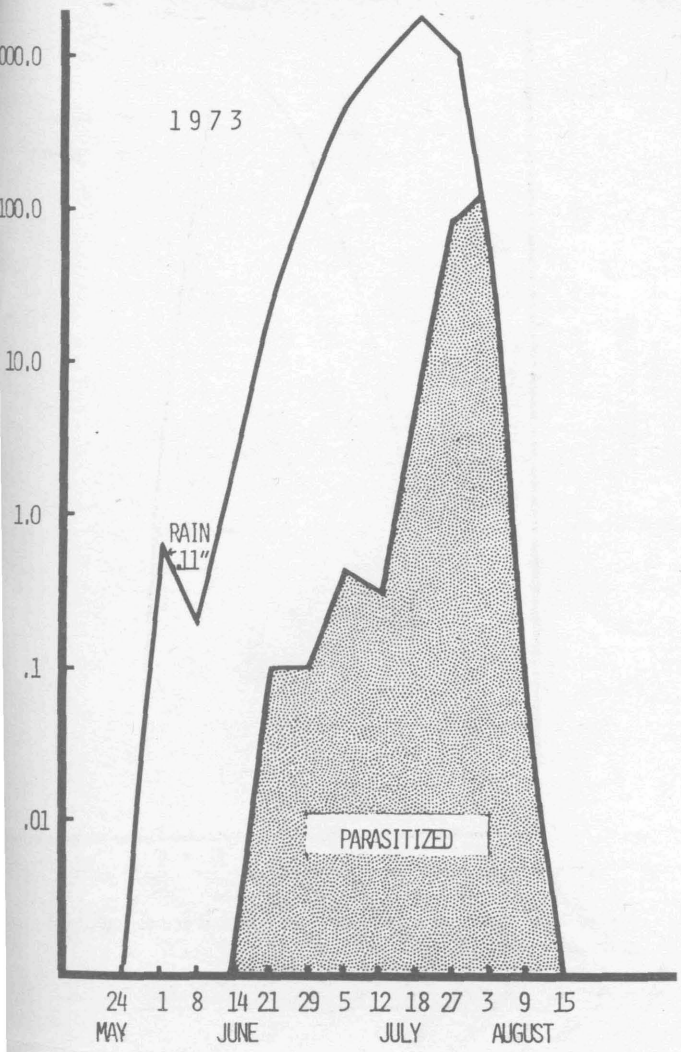


Fig. 2. Seasonal abundance and parasitism of the greenbug in grain sorghum in 1972.

The braconid wasp, *Lysiphlebus testaceipes* (Cresson), was the major primary parasite attacking the greenbug (Table 1). Two other primary parasites, *Diaeretiella rapae* (M' Intosh) and *Aphelinus nigritus* (Howard), were collected, but they represented a small percentage of the total parasites reared from greenbug mummies. Hyperparasites (parasites of parasites) collected were *Charips* sp., *Pachyneuron siphonophorae* (Ashmead) *Asaphes lucens* (Provancher), and *Aphidencyrtus aphidivorus* (Mayr). *Charips* sp. and *P. siphonophorae* were the dominant secondary parasites, with *Charips* sp. more abundant in early season collections and *P. siphonophorae* more abundant in August collections.

Abundance of secondary parasites apparently was sufficient to adversely affect primary parasitism by *L. testaceipes*. The hyperparasites destroyed a high percentage of the primary parasites in the mummified greenbugs collected June 28, July 2, and during August, when only one-fourth or fewer of the adults emerging from mummies were primary parasites. Parasitism by *L. testaceipes* apparently could be greatly enhanced if secondary parasites could be suppressed.



g. 3. Seasonal abundance and parasitism of the greenbug in grain sorghum 1973.

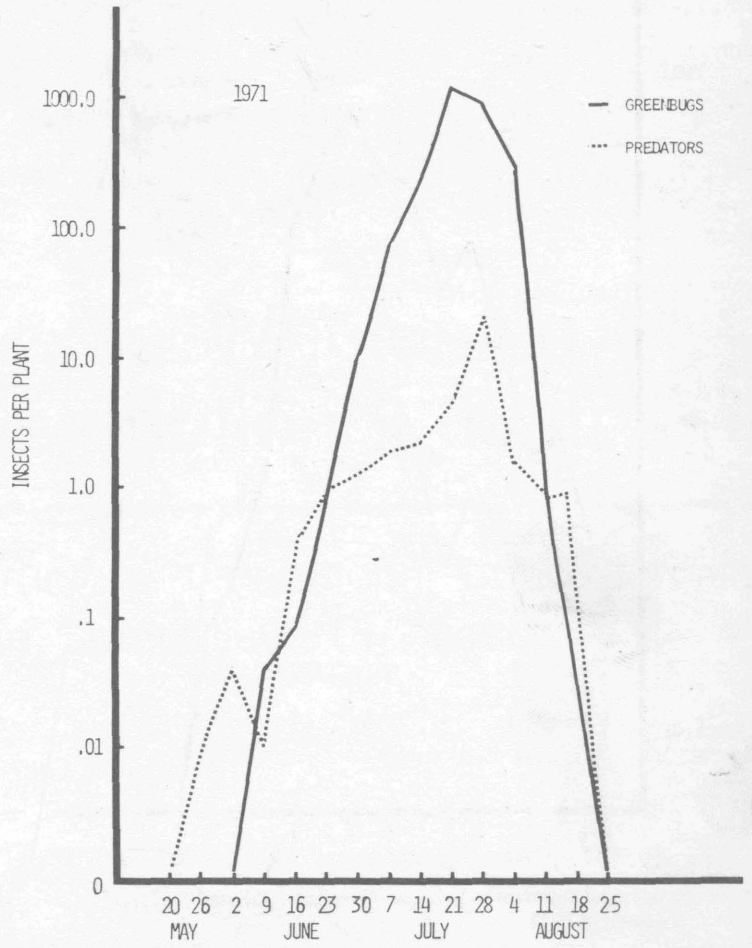


Fig. 4. Seasonal abundance of the greenbug and associated predators in grain sorghum in 1971.

Predators in grain sorghum feed extensively on greenbugs d corn leaf aphids, *Rhopalosiphum maidis* (Fitch). Abundance aphid predators peaked during the last week of July and the st week of August and then declined as the greenbug popula- n decreased (Figures 4, 5, 6). Early in the season, predators re sometimes more abundant than greenbug (Figure 4) as rn leaf aphid apparently served as a food source. *Hippodamia* p. was the most abundant predator (Table 2) and in most ses constituted more than one-half of the total predator pulation.

Greenbug was affected by natural mortality factors throughout the growing season. Aphid predators did not prevent the greenbug from reaching high populations, and parasitism occurred too late to prevent greenbug damage to sorghum.

CONCLUSIONS

These data and those reported by Bottrell (1971) show a definite trend of increase in abundance of greenbugs and major predators and parasites in grain sorghum on the Texas High Plains. Knowledge of these trends further support the reliability of the integrated control approach by Cate et al. (1974) where extremely low dosage rates are used to suppress greenbug and

BLE 1. PARASITES EMERGING FROM MUMMIES COLLECTED FROM GRAIN SORGHUM, LUBBOCK, TEXAS, 1973

ate of llection	Mean number per plant		Mummies collected		Percent of parasites consisting of			
	Greenbugs	Mummies	Number	Percent emerged	*L. testaceipes*	*Charips* sp.	*P. siphono-phorae*	Other species[1]
ne 28	117	< 1[2]	35	77	25	42	25	8
ly 2	484	< 1	100	93	14	71	8	7
ly 10	984	< 1	200	90	55	33	10	2
ly 19	1,864	6	300	88	48	33	12	7
ly 26	1,102	79	300	91	71	21	8	< 1
gust 2	45	142	300	83	23	41	35	1
gust 9	1	14	300	44	1	8	90	1
gust 16	-----	-----	300	13	2	3	95	0

Included *D. rapae, A. aphidivorus, A. lucens, and A. nigritus.*

No mummies were detected prior to June 28.

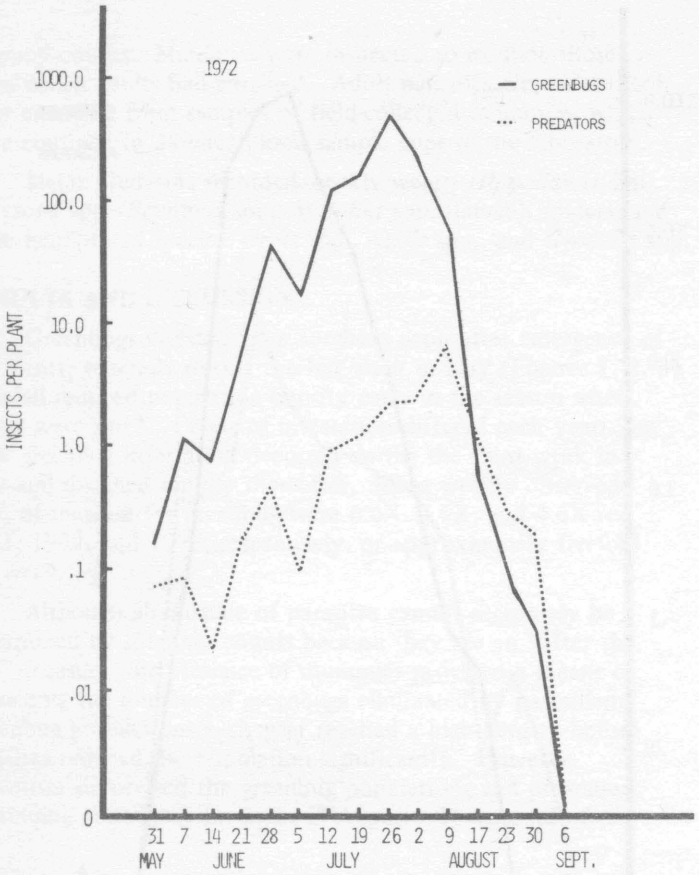


Fig. 5. Seasonal abundance of the greenbug and associated predators in grain sorghum in 1972.

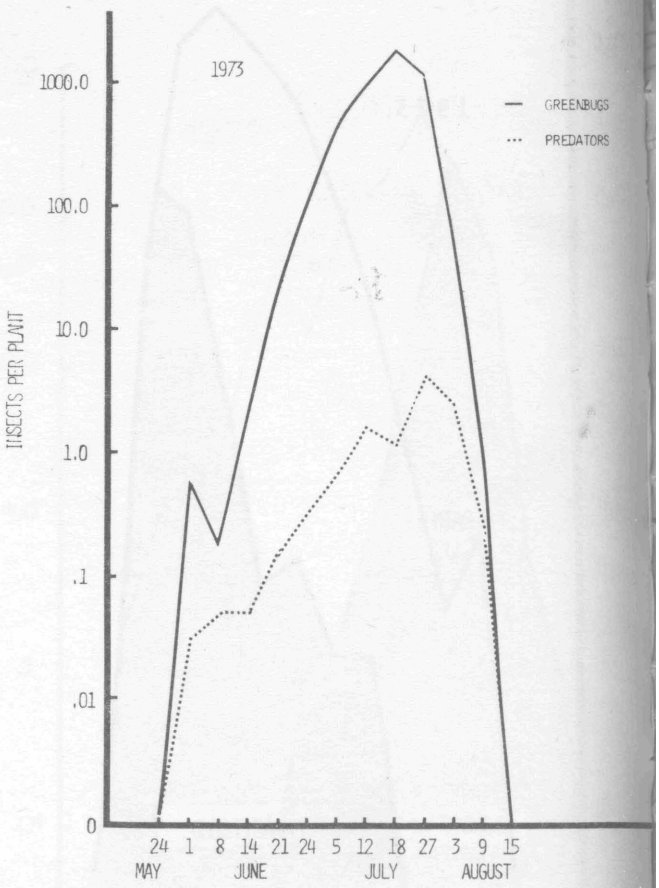


Fig. 6. Seasonal abundance of the greenbug and associated predators in grain sorghum in 1973.

TABLE 2. MAJOR PREDATORS ASSOCIATED WITH THE GREENBUG IN GRAIN SORGHUM

	Seasonal mean percentage of aphid predators					
Year	*Hippodamia* spp.	Predaceous bugs[1]	*Chrysopa* spp.	*Scymnus* spp.	*Syriphid* spp.[2]	Spiders
1971	66	2	13	1	0	16
1972	52	7	7	9	1	24
1973	47	20	3	2	1	27
Mean	56	10	8	4	1	22

[1] Included *Orius* spp., *Nabius*, spp., *Geocoris* spp.

[2] Larvae only.

spare beneficial arthropods. The data also illustrate that greenbugs do not always reach economically damaging levels, and when they do reach this level, the damaging time period is short.

ACKNOWLEDGMENT

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