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Field Studies of Delphacid Planthopper Populations (Homoptera: Delphacidae), With Notes on Their Dryinid Parasites (Hymenoptera: Dryinidae)[1]

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ABSTRACT: Delphacid populations were sampled weekly in a weedy, mixed-grass habitat in central Kentucky during 1980 and 1981. *Delphacodes lutulenta* (Van Duzee) was the most abundant of the eleven delphacid species collected. The other most abundant species during the 2-yr period (in descending order) were *Liburniella ornata* (Stal), *Delphacodes puella* (Van Duzee), *Delphacodes campestris* (Van Duzee), and *Euides weedi* (Van Duzee). The 6 remaining species constituted only ca. 2% of the total specimens collected. The dryinid, *Dicondylus americanus* (Perkins), parasitized *D. lutulenta* and 3 other delphacid species, but the incidence of parasitism was consistently low. Percentage macroptery was much higher in *D. puella* and *L. ornata* than in *D. lutulenta, D. campestris,* and *E. weedi.*

Until recently, few studies of delphacid planthoppers in North America have been reported. Denno et al. (1981, and references therein) and McCoy and Key (1981) have studied delphacid populations associated with salt marsh grasses (*Spartina* spp.) along the eastern and southern coasts of the United States. Stoner and Gustin (1980) studied the biology of *Delphacodes campestris* (Van Duzee) in the laboratory, and Whitmore et al. (1981) determined the relative abundances of this planthopper on several species of cool-season grasses. Giri and Freytag (1983a) studied the biology of *Delphacodes lutulenta* (Van Duzee), and Giri and Freytag (1983b) published a partial list (14 species) of delphacid planthoppers known to occur in Kentucky.

This paper reports the seasonal abundance of delphacid planthoppers in a mixed-grass habitat, with particular emphasis on *D. lutulenta.* Incidence of parasitism by the dryinid *Dicondylus americanus* (Perkins) is also reported.

Materials and Methods

The study site consisted of four 0.4 ha plots of mixed grasses within an old field (ca. 5 ha) on a University of Kentucky farm near Lexington. A 1.2 ha corn field was located in the center of the old field, and our four plots were located (one each) on the north, south, east, and west sides of the corn field. The predominant grasses in the plots were *Festuca arundinacea* Schreb, *Dactylis glomerata* L., *Poa pratensis* L., *Setaria faberi* Herrm., *Sorghum halepense* L., *Digitaria sanguinalis* (L.), and *Muhlenbergia schreberi* Gmel. Broadleaf weeds occurred in all plots, but were more prevalent in the plots located on the east and west sides of the corn field. Those weeds included *Viola tricolor* L., *Lamium amplexicaule* L., *Chenopodium album* L., *Polygonum pensylvanicum* L., *Capsella bursa-pastoris* (L.), and *Plantago lanceolata* L. All four plots were periodically mowed to a height of 20 to 25 cm (specific dates are indicated in Figs. 1–4).

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Populations of delphacid planthoppers were sampled weekly from the first week of May until the first week of October in 1980 and from the first week of May until the first week of November in 1981. On each sampling date, 12 samples (3 per plot) were taken using a D-Vac® suction sampler. Each sample unit consisted of the material collected from an area of 0.25 m^2. In 1980, this area was delineated with a 1 m high plastic cylinder with a metal rim on the bottom edge. The height of that cylinder was reduced to 33 cm in 1981 so that plants within the 0.25 m^2 area could be pulled or cut.

Specimens in the samples were anesthetized with ethyl acetate in the field, then placed in ethyl alcohol (70%), and taken to the laboratory for sorting and identification. Delphacids were identified and categorized as either unparasitized or parasitized. Parasitism was indicated by an external sac on the abdomen of the host; it should be noted that our estimates of per cent parasitism are conservative, because some of the delphacids which were categorized as unparasitized may have harbored young parasites without showing external signs of parasitism. Presence of adult dryinids in the samples was also noted.

Data on the seasonal abundance of delphacids were analyzed using Duncan's multiple range test to determine if significantly different densities occurred in the four plots. Prior to analysis, those data were transformed with the square root transformation. To examine the spatial distribution pattern of *D. lutulenta,* the data were compared to a negative binomial distribution using a Chi-square test.

Results

1980: Delphacids were recovered from the samples from May to October. No significant differences were detected ($P > 0.05$) in the numbers of delphacids collected in the four plots. *Delphacodes lutulenta* was more abundant than other delphacid species, and it was active over a longer period (Fig. 1). Comparison of the data with the predicted distribution of the negative binomial model suggests that *D. lutulenta* populations have a clumped spatial distribution (K = 0.155, $\chi^2 = 1.484$, d.f. = 3, $P > 0.05$).

Among the delphacid species other than *D. lutulenta,* the most abundant in 1980 were *Delphacodes puella* (Van Duzee), *D. campestris,* and *Liburniella ornata* (Stal). Other species accounted for less than 5% of the total delphacid individuals collected, and some were represented in the samples only as nymphs. Percentage macroptery was higher in *D. puella* and *L. ornata* than in *D. campestris* and *D. lutulenta* (Table 1).

Parasitized delphacids were recovered from June until October, with the overall average parasitism of *D. lutulenta* by the dryinid *Dicondylus americanus* being 4.1%. Only 7 adults of *Dicondylus americanus* (2 males, 5 females) were found in the 1980 samples, those being collected in June and July. *Dicondylus americanus* also parasitized *D. campestris* (5.1%), *D. puella* (2.2%), and *L. ornata* (10.9%).

1981: Delphacid densities were higher at the study site than in 1980. Also, significantly ($P < 0.05$) more delphacids were collected from the plots located north and south of the corn field than from the plots located east and west of that field. The latter plots had more broadleaf weeds than the former did, which may have accounted for those differences in delphacid densities. Such differences among

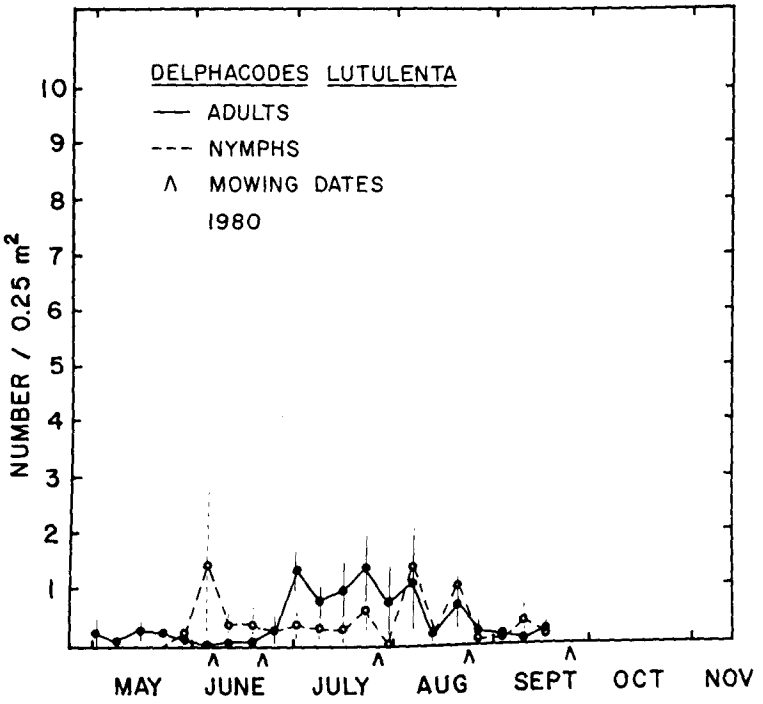

Fig. 1. Seasonal occurrence of *Delphacodes lutulenta* adults and nymphs during 1980 in a mixed-grass habitat near Lexington, Kentucky. Bars represent ±1 SE.

Table 1. Number of nymphs, number of adults, and percentage macroptery of delphacids collected during 1980 and 1981 near Lexington, KY.

Species	1980			1981		
	No. of nymphs	No. of adults	Percent macroptery	No. of nymphs	No. of adults	Percent macroptery
Delphacodes lutulenta (Van Duzee)	82	112	3.6	841	317	10.1
Delphacodes campestris (Van Duzee)	49	48	31.3	82	86	42.5
Delphacodes puella (Van Duzee)	37	56	93.0	140	99	85.5
Delphacodes lateralis (Van Duzee)	0	0	—	0	5	0.0
Delphacodes montezumae (Muir and Giffard)	0	0	—	0	1	100.0
Liburniella ornata (Stal)	0	49	67.3	354	125	84.0
Euides weedi (Van Duzee)	1	0	—	160	91	7.7
Pissonotus flabellatus (Ball)	3	0	—	15	4	25.0
Pissonotus marginatus (Van Duzee)	0	0	—	1	2	100.0
Sogatella kolophon (Kirkaldy)	0	0	—	3	0	—
Stenocranus sp.	22	0	—	4	0	—

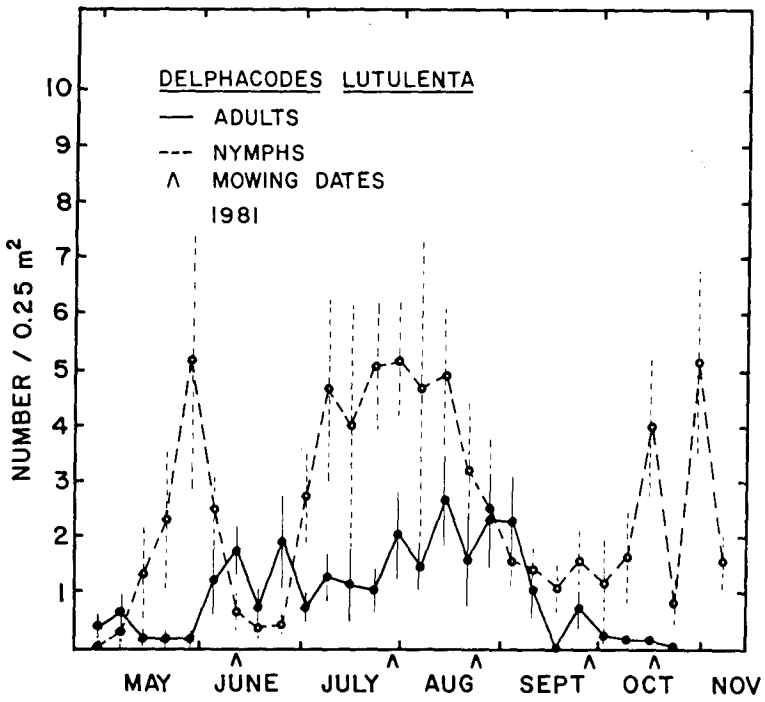

Fig. 2. Seasonal occurrence of *Delphacodes lutulenta* adults and nymphs during 1981 in a mixed-grass habitat near Lexington, Kentucky. Bars represent ±1 SE.

plots were not detected the previous year, perhaps due to the lower delphacid densities collected.

Delphacodes lutulenta was again the most abundant delphacid species collected (Table 1). Seasonal occurrence and spatial distribution of *D. lutulenta* were similar to those observed during the previous year (Fig. 2); comparison with the negative binomial distribution indicated a clumped spatial distribution ($K = 0.549$, $\chi^2 = 15.534$, d.f. = 10, $P > 0.05$).

In addition to *D. lutulenta,* as in the previous year, *D. puella, D. campestris* and *L. ornata* were relatively abundant. Another species, *Euides weedi* (Van Duzee), was much more abundant in 1981 than in 1980. The seasonal occurrence of those species is shown in Figs. 3 and 4. Population densities of *L. ornata* and (especially) *E. weedi* increased rapidly during August and declined sharply in September. Percentage macroptery was much higher in *D. puella* and *L. ornata* than in *D. campestris, D. lutulenta,* and *E. weedi* (Table 1).

The overall average parasitism of *D. lutulenta* by *Dicondylus americanus* (2.5%) was less than that observed during 1980. During 1981, parasitized delphacids were collected from the last week of May through mid-October. Only 2 adults (both female) of *Dicondylus americanus* were recovered from the 1981 field samples, those occurring in samples taken on July 17 and August 7. Parasitism by

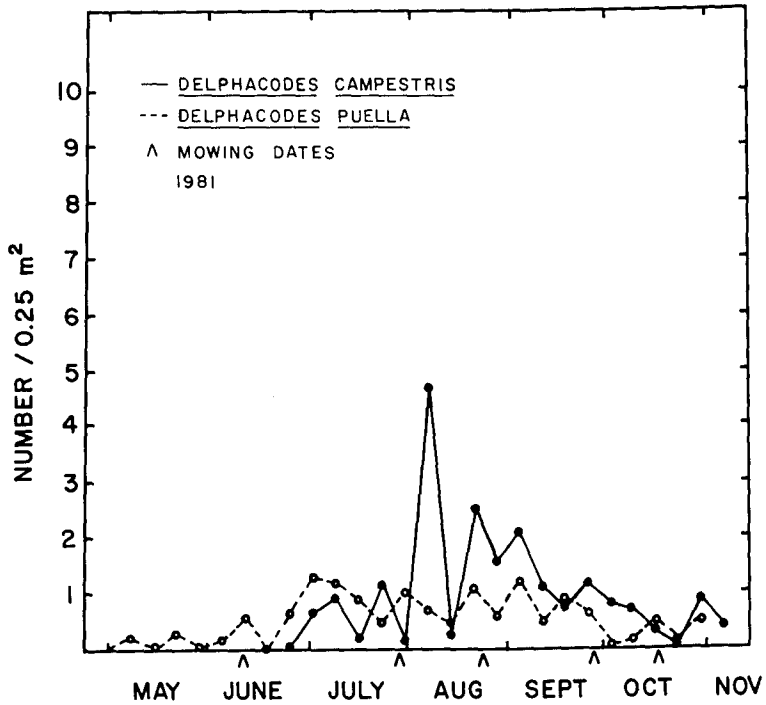

Fig. 3. Seasonal occurrence of *Delphacodes campestris* and *Delphacodes puella* (adults and nymphs combined) during 1981 in a mixed-grass habitat near Lexington, Kentucky.

Dicondylus americanus was also observed in the field-collected specimens of *D. campestris* (1.7%) and *L. ornata* (1.4%); this parasite was not observed on specimens of *D. puella* collected in 1981.

Discussion

Eleven species of delphacids were recovered during our 2-yr study. Of these, *D. lutulenta* was the most abundant species both years. The 1981 data on seasonal abundance of nymphs indicate that *D. lutulenta* had 3 generations/yr in the field (Fig. 2). Giri and Freytag (1983a) found that this species required ca. 5 weeks to develop from egg to adult in the greenhouse at 26 ± 3°C. The average monthly temperatures at a weather station near the study site during 1981 were as follows: May, 16.1°C; June, 23.3°C; July, 24.4°C; August, 23.3°C; September, 19.4°C; and October, 13.9°C. Inasmuch as *D. lutulenta* would require longer to develop at those field temperatures than at a continuous temperature of 26°C, our estimate of 3 generations/yr in the field seems reasonable.

Of the remaining delphacid species inhabiting the study site, *D. puella, D. campestris, L. ornata,* and *E. weedi* were most abundant. The dryinid *Dicondylus americanus* parasitized *D. lutulenta, D. puella, D. campestris,* and *L. ornata.* Because *Dicondylus americanus* females are wingless, their macropterous hosts likely play an important role in the dispersal of this parasite. The percentage

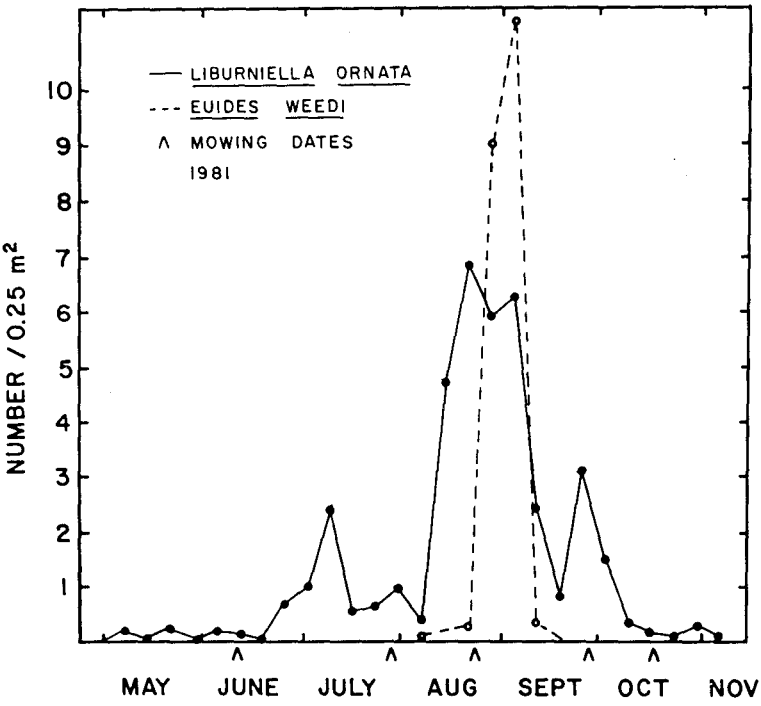

Fig. 4. Seasonal occurrence of *Liburniella ornata* and *Euides weedi* (adults and nymphs combined) during 1981 in a mixed-grass habitat near Lexington, Kentucky.

macroptery was much higher in *D. puella* and *L. ornata* than in *D. lutulenta* and *D. campestris*.

This study characterized the seasonal occurrence and relative abundance of the delphacid species associated with a mixed-grass habitat in central Kentucky. Our results also indicate that the percentage parasitism of those delphacids by dryinids is quite low throughout the season.

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