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SEASONAL OCCURRENCE OF THE SOD WEBWORM MOTHS (LEPIDOPTERA: CRAMBIDAE) OF OHIO

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ABSTRACT

While nearly 100 species of sod webworms are known to occur in North America, the species complex and seasonal occurrence of these moths has been documented in relatively few states. For Ohio, there is little published record of the sod webworm species complex, and the seasonal occurrence of only a few economically important species has been documented. Using black light traps, sod webworm adult flight activity was monitored over the course of three to five years at four different locations throughout Ohio. In this paper we report the seasonal occurrence of sod webworms species captured at these locations. These data provide a historical benchmark of sod webworm species diversity, local abundance, and seasonal occurrence in Ohio.

Although far from complete, recent gains have been made in documenting the lepidopteran fauna of Ohio. Major contributions include documentation of the superfamililies Papilionoidea and Hesperiioidea (butterflies and skippers) (Iftner et al. 1992), and the moth family Noctuidae (Rings et al. 1992). The two prior groups have likely received more attention because of their relatively large size and colorful ornamentation (Scott 1986), while many of the Noctuidae are serious pests of agricultural crops (Rings et al. 1992). Conversely, many moth families are often overlooked simply because they are smaller, less visually appealing, harder to identify, and tend to be nocturnal. One such group, the sod webworm moths (Lepidoptera: Crambidae), comprise a cosmopolitan family of moths formerly classified as a subfamily of the Pyralidae. Adult sod webworms are similar to pyralid moths in having abdominal tympanal organs, and elongate, scaled labial palpi extending in front of the head to form a proboscis. However, sod webworm moths can be distinguished by their habit of holding the wings close around the body when at rest (Borror et al. 1989). The larvae of these moths feed primarily on plants in the family Graminae and, as a result, several species are considered economically important pests of turfgrasses (Cobb 1995), cereal, and forage crops (Ainslee 1922). Some species of sod webworms are also known to feed on tobacco (Bohart 1947), cranberries (Franklin 1950), and coniferous nursery stock (Kamm et al. 1983).

Both univoltine and multivoltine species are known and, although there are exceptions (e.g., the cranberry girdler, *Chrysoteuchia topiaria*(Zeller)), the univoltine species are generally somewhat less important economically. Of the six most economically important temperate sod webworm species, four

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are multivoltine (Vittum et al. 1999). The multivoltine species are believed to be more important economically primarily because of their numbers and prolonged period of activity.

While nearly 100 species of sod webworms are known in North America (Bohart 1947), the species complex and occurrence of these moths has only been reported from Florida (Ainslee 1923, 1927; Kimball 1965), Iowa (Decker 1943), New York (Forbes 1923), North Carolina (Brimley 1938, 1942), Oregon (Prescott 1965), Tennessee (Matheny and Heinrichs 1975), and Virginia (Tolley and Robinson 1986). Like many of the Great Lakes States, there is little published record of the sod webworm species of Ohio. Therefore, the species complex and seasonal occurrence of this group is relatively unknown in this region.

The goal of this study was to document the species complex and seasonal flight activity of the common sod webworm moths of Ohio. In this paper, we consider the univoltine and multivoltine species separately because of the more evident economic significance of the latter. Using black light trap data collected from four different locations in Ohio, we identified the species complex and assembled seasonal flight activity profiles for all sod webworm species collected over the course of three to five years (16 total trap years). Supplemental data were gathered from the insect collection housed at The Ohio State University, Museum of Biological Diversity located in Columbus, OH. Together, these data provide a biological record of this common, but often overlooked group of insects, and clarify the seasonal occurrence of several species in this part of the Great Lakes region.

MATERIALS AND METHODS

Collection sites and dates. Collection sites represented the northern, central, and southern latitudes of the state (Figure 1). The northern Ohio collection site was established at the main campus of the Ohio Agricultural Research and Development Center (OARDC) in Wooster (Wayne Co.). Wooster lies within the Walhonding watershed and data were collected from the Wooster site from May, 1978 through October, 1982 (5 years) two central Ohio collection sites were used, both within the Upper Scioto watershed . The first site was located at Milford Center, in Union County. Data were collected from the Milford Center site from May through October of 1978, 1979, and 1982 (3 years). The second central Ohio site was located at the TruGreen Chemlawn research facility in Delaware (Delaware County). Data were collected from the Delaware site from May, 1986 through October, 1989 (4 years). The southern Ohio site was located at the Southern Branch of the OARDC in Ripley, OH (Brown Co.). Brown County lies within the Ohio Brush-Whiteoak watershed and data were collected from the Ripley site from May, 1978 through October, 1981 (4 years). No attempt was made to quantify the vegetation at any of the sites although all areas were predominantly surrounded by a matrix of agricultural fields and forest fragments. Additionally, the Delaware site was surrounded by 40 acres of managed turfgrass which was further surrounded by forest and agricultural land. Major agricultural crops include corn, soybeans, alfalfa, and wheat in the northern and central regions, and corn, alfalfa, and tobacco in the southern region.

Collecting methods and data management. Collection was performed using Ellisco® light traps with 15 W blacklight tubes. One light trap was placed at each of the collection sites and was on from dusk until dawn during all collecting seasons. At the Wooster, Millford Center, and Ripley locations, one insect strip (Vapona®) was used in each trap to kill captured

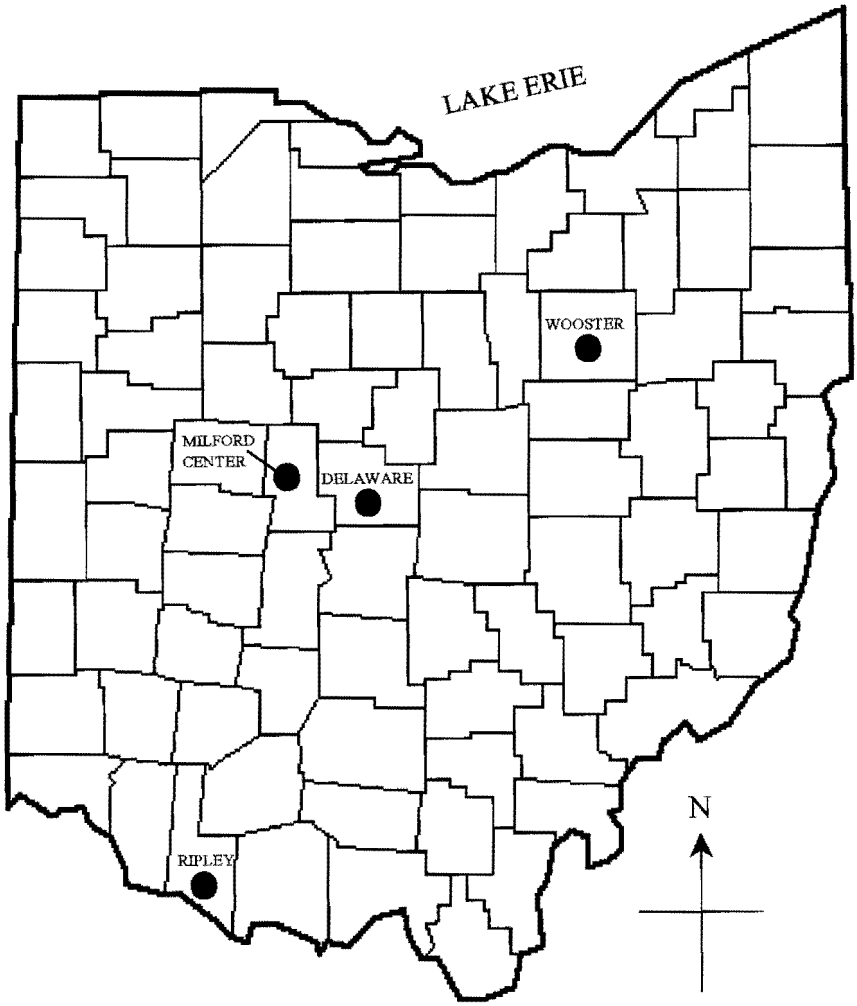

Figure 1. Map of Ohio showing location of collection sites used to assess sod webworm flight activity in Ohio (●). Collections were made at the Wooster site during 1978–82, at the Delaware site during 1986–89, at the Milford center site during 1978, 79, and 82, and at the Ripley site during 1978–81.

moths and strips were replaced regularly. At the Delaware location, an open container of ethyl acetate was placed in the trap head as the killing agent and was refilled daily. Captured moths were collected daily (except weekends) and kept frozen until identification, sorting and counting could be performed. Sod webworm adult species identifications were verified by D. C. Ferguson (Systematic Entomology Laboratory, USDA, Washington, D. C.).

Voucher specimens were deposited in the insect collection at the OARDC. Data were organized by year, calendar date, and location, and comparisons between locations were based on the average total number of each species collected per year.

RESULTS AND DISCUSSION

Univoltine species. Seven species and three genera of univoltine sod webworm moths were collected during the course of the study although there were considerable differences in local abundance. Only four of the seven univoltine sod webworm species collected were regularly found at all four sites. These species include *Crambus laqueatellus* Clemens, *Crambus agitatellus* Clemens, *Chrysoteuchia topiaria* (Zeller), and *Agriphila vulgivagella* (Clemens). Based on the average total number of moths collected per year, *C. laqueatellus* was generally more abundant at the Milford Center and Ripley sites than at either of the other two sites (Figure 2) *Crambus agitatellus* was roughly equally abundant at the Milford Center, Delaware, and Ripley sites but was much less common at the Wooster site (Figure 3). *Chrysoteuchia topiaria* was most abundant at Delaware followed in order by Milford Center, Ripley, and Wooster (Figure 4). *A. vulgivagella* was most abundant at the Delaware and Ripley sites followed by the Milford Center and Wooster sites. Wooster recorded the lowest abundance of all four of these common species.

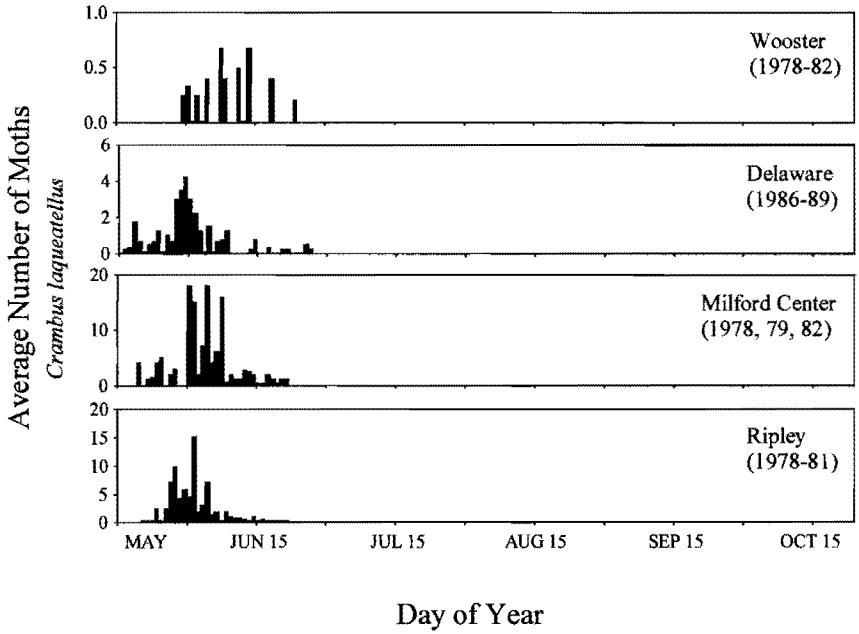

Figure 2. Seasonal flight activity of *Crambus laqueatellus* Clemens at four locations in Ohio as determined by the average number of moths caught in black light traps on each date.

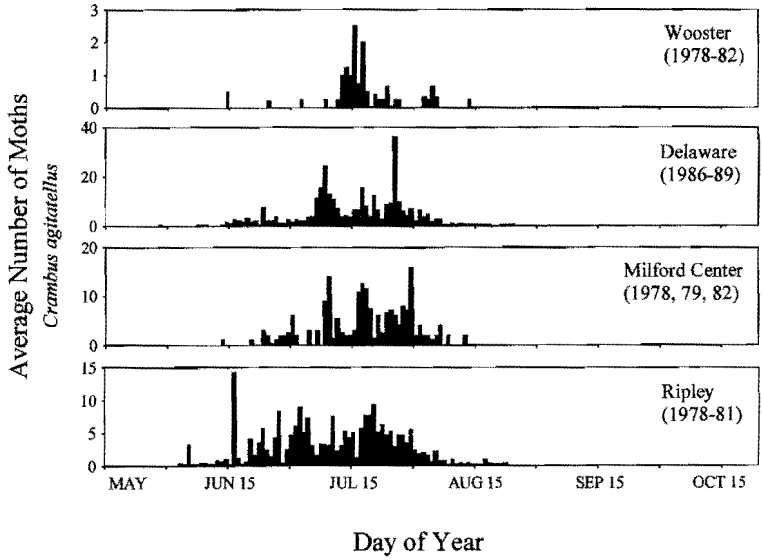

Figure 3. Seasonal flight activity of *Crambus agitatellus* Clemens at four locations in Ohio as determined by the average number of moths caught in black light traps on each date.

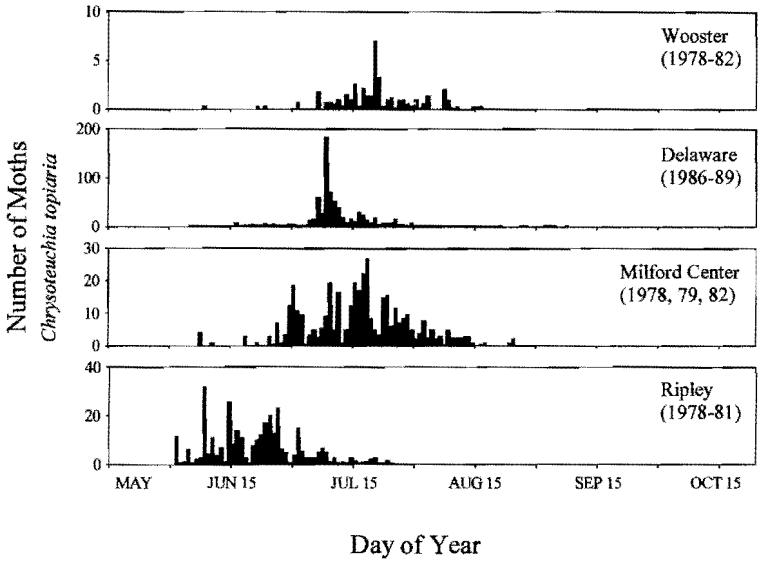

Figure 4. Seasonal flight activity of *Chrysoteuchia topiaria* (Zeller) at four locations in Ohio as determined by the average number of moths caught in black light traps on each date.

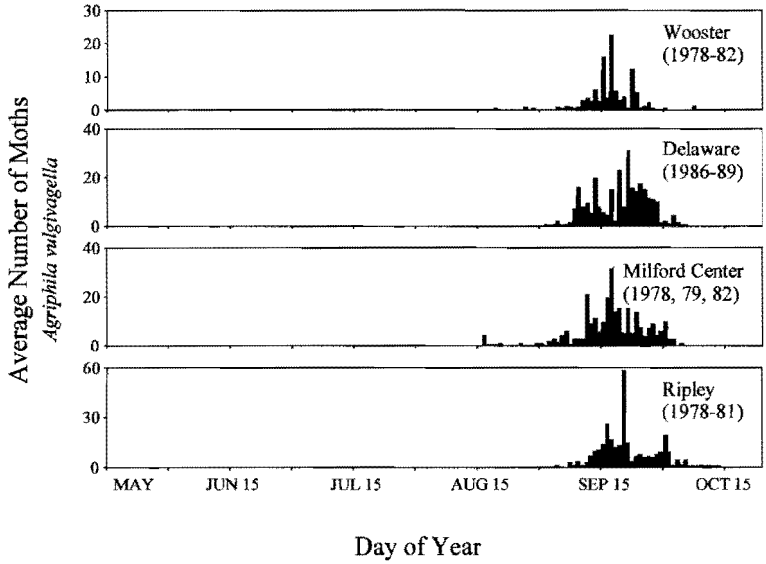

Figure 5. Seasonal flight activity of *Agriphila vulgivagella* (Clemens) at four locations in Ohio as determined by the average number of moths caught in black light traps on each date.

Three of the seven species collected were found regularly only at the Delaware site (Figure 5). These species included *Crambus caliginosellus* Clemens, *Crambus luteolellus* Clemens, and *Agriphila ruricolella* (Zeller). Based on the average total number of moths collected per year, *C. caliginosellus* was by far the most abundant of these species followed in order by *C. luteolellus*, and *A. ruricolella*. Although all three of these species may have been collected at the other sites, their numbers were extremely low. This problem could have been exacerbated by handling practices. Because sod webworm moths tend to be small and delicate, excessive handling, freezing, and shipping made many specimens impossible to identify. Future efforts directed at collecting this group of moths should also explore alternative methods since blacklight traps may not be the most effective way to collect all species.

There appeared to be a trend of earlier to later emergence corresponding to latitude for *C. laqueatellus*, *C. agitatellus*, and *C. topiaria* but not *A. vulgivagella*. This observation implies that while development and adult flight of the prior three species is mainly temperature dependent, the later species may rely more heavily on other environmental cues such as photoperiod. Indeed, Tolley and Robinson (1986) determined that calendar date was a better flight peak predictor than degree-days for many sod webworm species in Virginia. Further research will be necessary to determine the relative importance of various environmental factors in determining seasonal flight activity for each species.

Based on seasonal flight activity profiles, there appear to be three dis-

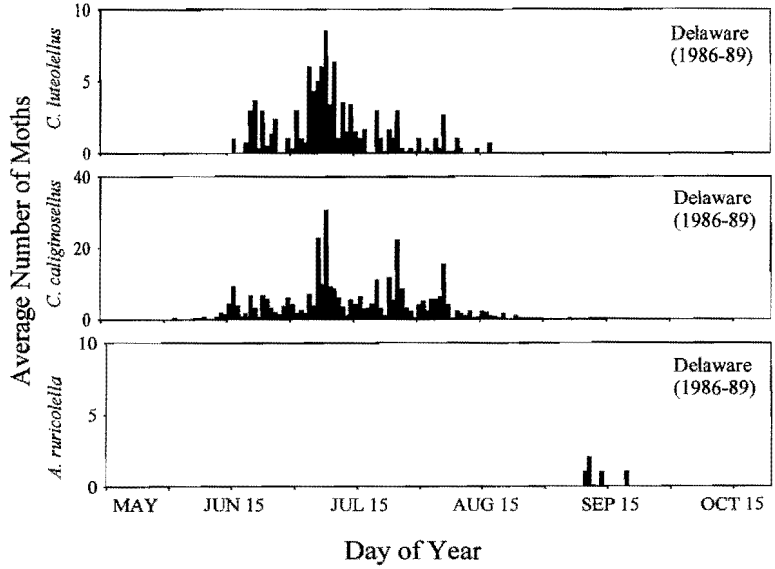

Figure 6. Seasonal flight activity of *Crambus luteolellus* Clemens, *Crambus caliginosellus* Clemens, and *Agriphila ruricolella* (Zeller) at Delaware, Ohio, as determined by the average number of moths caught in black light traps on each date.

tinct life-history strategies employed by these univoltine moths: early emergence, mid-season emergence, and late emergence. While the majority of species (four) can be considered mid-season emergers (*C. agitatellus*, *C. topiaria*, *C. caliginosellus*, and *C. luteolellus*), one species, *C. laqueatellus*, falls into the early emergence category, and two species can be considered late season emergers (*A. vulgivagella* and *A. ruricolella*). These different emergence periods may result in a temporal partitioning of available resources between similar species thereby limiting interspecific competition.

Multivoltine species. Five species representing five different genera of multivoltine sod webworms were collected during the course of the study (Figs.7–11). However, numbers varied between sites and only four species were collected at all of the collection sites: *Parapediasia teterrella* (Zincken), *Pediasia trisecta* (Walker), *Fissicrambus mutabilis* (Clemens) and *Microcrambus elegens* (Clemens) (Table 2). *Crambus praefectellus* (Zincken) was notably absent from the Ripley site and was the least abundant species at both Wooster and Milford Center although it was far more abundant at the Delaware site. *P. teterrella*, *P. trisecta*, and *F. mutabilis* were most abundant at the Delaware site followed in decreasing order by Milford Center, Ripley, and Wooster. Although *M. elegens* was most abundant at the Delaware site as well, its abundance at Wooster was a close second followed by Milford Center and Ripley. Based on the average total number of moths collected per location per year, the most abundant species overall was *P. teterrella*, followed in decreasing abundance by *P. trisecta*, *F. mutabilis*, *M. elegens*, and *C. praefectellus*.

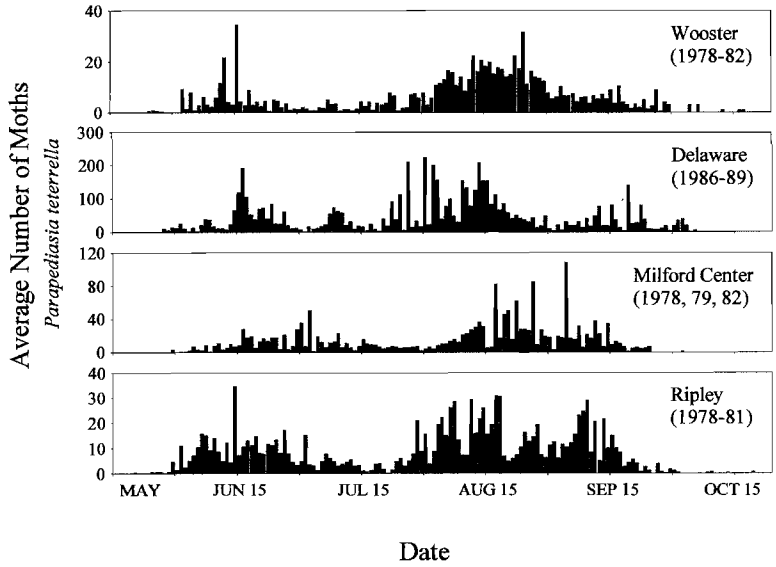

Figure 7. Seasonal flight activity of *Parapediasia teterrella* (Zincken) at four locations in Ohio as determined by the average number of moths caught in black light traps on each date.

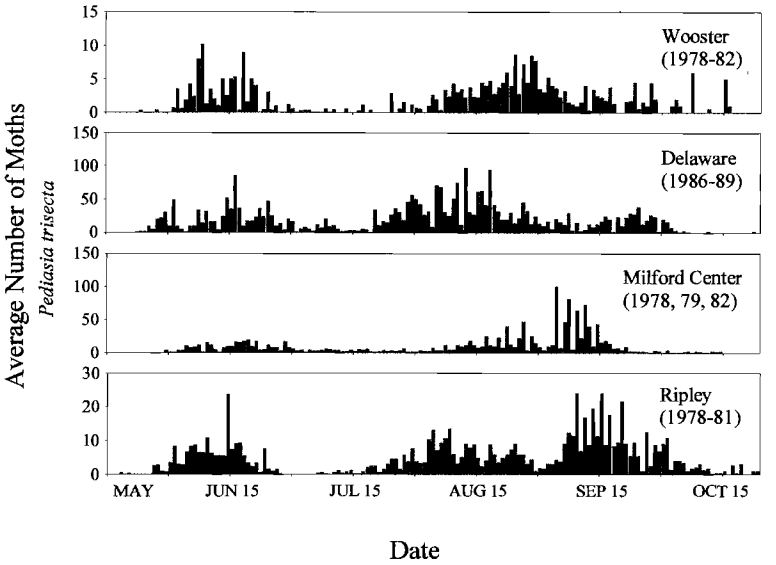

Figure 8. Seasonal flight activity of *Pediasia trisecta* (Walker) at four locations in Ohio as determined by the average number of moths caught in black light traps on each date.

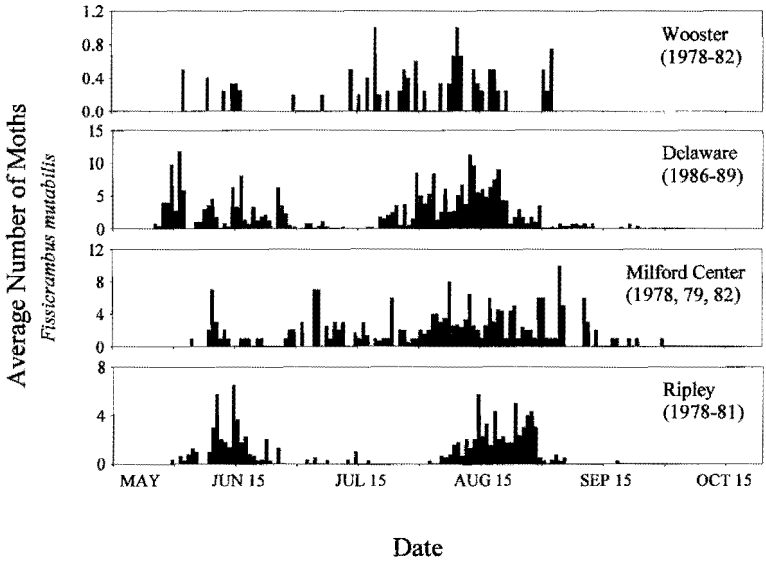

Figure 9. Seasonal flight activity of *Fissicrambus mutabilis* (Clemens) at four locations in Ohio as determined by the average number of moths caught in black light traps on each date.

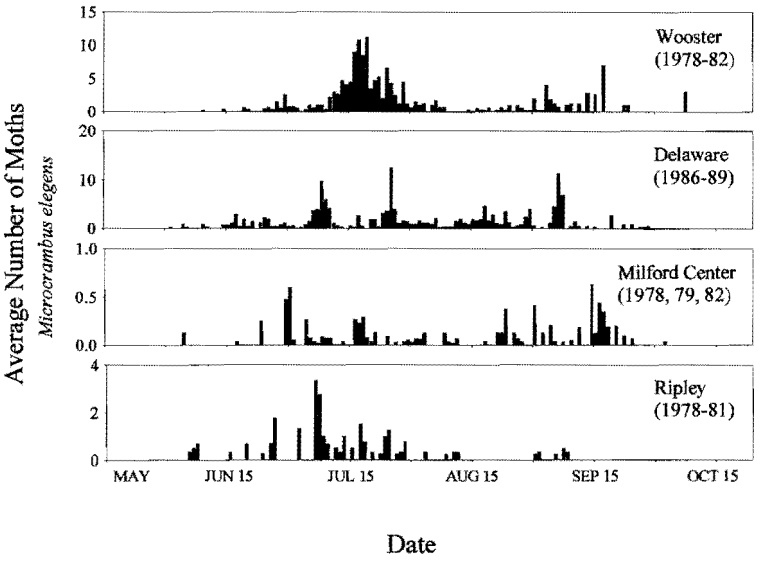

Figure 10. Seasonal flight activity of *Microcrambus elegens* (Clemens) at four locations in Ohio as determined by the average number of moths caught in black light traps on each date.

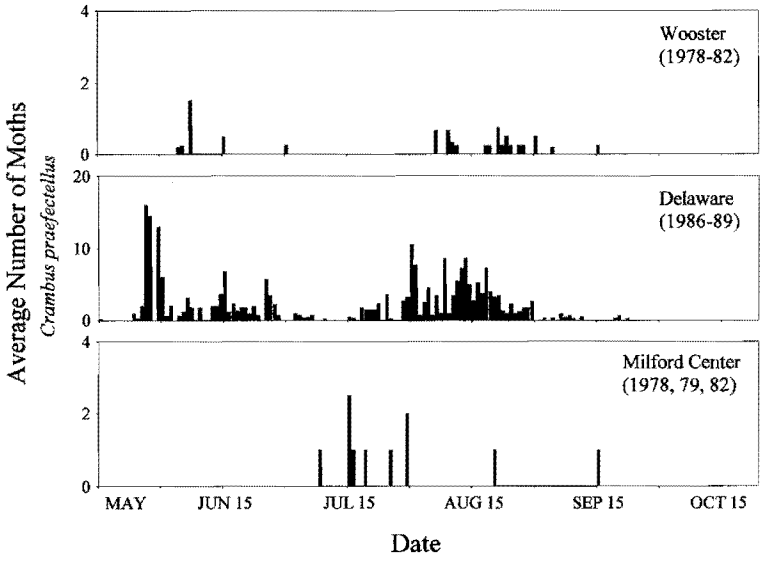

Figure 11. Seasonal flight activity of *Crambus praefectellus* (Zincken) at three locations in Ohio as determined by the average number of moths caught in black light traps on each date.

TABLE 1. Average number of seven different univoltine sod webworm species collected per year* at four locations in Ohio (total number collected/number of years collected).

Species	Wooster	Delaware	Milford Center	Ripley
Agriphila vulgivagella	371	937	533	921
Agriphila ruricolella	—	5	—	—
Chrysoteuchia topiaria	131	2,713	1,041	1,107
Crambus agitatellus	64	1,095	300	819
Crambus caliginosellus	—	1,186	—	—
Crambus laqueatellus	19	108	154	256
Crambus luteolellus	—	251	—	—

*Number of years varies with collection site; Wooster = 5 years, Delaware = 4 years, Milford Center = 3 years, and Ripley = 4 years.

Table 2. Average number of five different multivoltine sod webworm species collected per year* at four locations in Ohio (total number collected/number of years collected).

Species	Wooster	Delaware	Milford Center	Ripley
Parapediasia teterrella	625	5,210	1,564	1,016
Pediasia trisecta	203	2,603	1,283	618
Fissicrambus mutabilis	11	241	113	87
Microcrambus elegens	116	149	92	23
Crambus praefectellus	6	196	4	—

*Number of years varies with collection site; Wooster = 5 years, Delaware = 4 years, Milford Center = 3 years, and Ripley = 4 years.

Table 3. Date/Locality records for sod webworm specimens in The Ohio State University insect collection—Columbus, OH.

Species	Location	Date (month/year)
Agriphila ruricolella (Clemens)	Granville, OH	August 1929
Agriphila vulgivagella (Clemens)	Granville, OH	August 1929
	Columbus, OH	September 1942
Arequipa turbatella (Walker)	Granville, OH	July 1930, July 1989
Crambus alboclavellus Zeller	Granville, OH	June, July and August 1930
Crambus agitatellus Clemens	Columbus, OH	July 1898
Crambus albellus Clemens	Granville, OH	June 1930
Crambus caliginosellus (Clemens)	Granville, OH	June 1930
Crambus girardellus Clemens	Granville, OH	June 1930
Crambus hortellus Hubner	Granville, OH	June 1930
Crambus laqueatellus Clemens	Columbus, OH	—*
	Granville, OH	June 1930
Crambus luteolellus	Granville, OH	June 1930
Crambus pusionellus Zeller	Sugar Grove, OH	July 1920
Crambus zeellus Fernald	Black Hand, OH	July 1930
Fissicrambus mutabilis (Clemens)	Granville, OH	June 1930
Microcrambus elegens (Clemens)	Granville, OH	July 1929
Parapediasia teterrella (Zincken)	Granville, OH	August 1929
Parapediasia decorella (Zincken)	Granville, OH	June 1930
	Columbus, OH	July 1897
Pediasia trisecta (Walker)	Granville, OH	August 1929, June 1930
Urola nivalis (Drury)	Oak Harbor, OH	June 1925
	Granville, OH	June 1929
	Oak Openings, OH	July 1975

*— = no data available

Of the five species collected, four are considered important pest species: *P. teterrella*, *P. trisecta*, *F. mutabilis* and *C. praefectellus* (Vittum et al. 1999). Knowledge of the seasonal flight activity of pest species is particularly important for timing of monitoring and intervention. Flight activity profiles for some species illustrate differences in the number of generations occurring between sites. For instance, *P. teterrella* appeared to have at least a partial third generation at Wooster and Delaware while a third generation was obvious at Ripley. This same trend was true of *P. trisecta* with close to a full third generation appearing in some years at Ripley. These differences in voltinism are not overly surprising and may be due to local weather patterns or microclimate effects. Indeed, other authors have reported similar findings. For instance, *P. trisecta* is reported to have one generation per year in the Pacific Northwest, two generations in the Midwest, and three in Virginia (Ainslie 1927, Crawford and Harwood 1964, Robinson and Tolley 1982). Similarly, *P. teterrella* is reported to have two generations in Virginia and three generations in Tennessee (Robinson and Tolley 1982, Ainslie 1930). Our data indicate that both *P. teterrella* and *P. trisecta* may regularly have three generations in Ohio, a fact that was previously undetermined.

ACKNOWLEDGMENTS

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