

# STATUS OF LEPIDOPTERANS ASSOCIATED WITH PRAIRIES IN OHIO

Eric H. Metzler

Ohio Biological Survey  
1315 Kinnear Road  
Columbus OH 43212-1192  
(614) 888-3642

**ABSTRACT:** The Ohio Survey of Lepidoptera, conducted by The Ohio Lepidopterists, provides excellent baseline data pertinent to distribution of butterflies and moths in Ohio. Many of this survey's data from Ohio's prairie remnants hinted that lepidopterans, in addition to plants, share affinities with prairie habitats to the west of Ohio, thus supporting the concept of Transeau's prairie peninsula. Forty-one species of moths that are specialists of prairies in Ohio, including 19 species newly recorded from the state, were recorded from 199 samples, taken from 1992 through October 1996, at several prairie sites in Ohio: Huffman Prairie, Greene County; Killdeer Plains Wildlife Area, Wyandot County; Resthaven Wildlife Area, Erie County; Irwin Prairie State Nature Preserve, Lucas County; Kitty Todd Preserve, Lucas County; and Oak Openings MetroPark, Lucas County. Resource managers at the Ohio Chapter of The Nature Conservancy and the Ohio Department of Natural Resources, Division of Wildlife, responded to the new information about insects by adapting management practices to promote fully functioning prairies of animals and plants.

**Key words:** prairie, Ohio, Lepidoptera, Huffman Prairie, Resthaven Wildlife Area, Killdeer Plains Wildlife Area, Irwin Prairie State Nature Preserve, Kitty Todd Preserve, Oak Openings MetroPark

## INTRODUCTION

Insects comprise the largest number of species on Earth (May 1992), yet they are rarely considered in conservation decisions. They are the most numerous, as individuals, and they comprise the greatest biomass of all living animals on the planet. They comprise more than one-half the species of all living organisms, inhabiting nearly every niche, and exhibiting nearly every life style on Earth (Borror et al. 1989), and insects probably represent the bulk of the world's imperiled species.

Lepidoptera is the second largest order of insects. Because most lepidopterans are herbivores, their presence or absence in a habitat is directly related to phytogeography (Dana 1983, Panzer 1995). There is growing evidence that the evaluation of the health of a community of local Lepidoptera can be a meaningful indicator of the general health of a particular ecosystem (Kremen 1992). In spite of their importance, a dearth of papers has been published about the distribution and abundance of Lepidoptera that are associated with or restricted to prairies. Most species of moths associated with prairies, including those reported here, do not have common names.

A great impetus to the study of Lepidoptera in Ohio was the formation of The Ohio Lepidopterists in 1979. With 360 members, the goals of this organization are to promote interest in, provide information on, and increase the knowledge of Lepidoptera in Ohio and neighboring states. The Ohio Lepidopterists contracted with the Ohio Department of Natural Resources (ODNR), Division of Wildlife, to conduct an Ohio Lepidopteran Survey (Case and Fritz 1985,

Rings et al. 1992), after which an understanding of Ohio's lepidopteran fauna increased at a dramatic rate (Iftner et al. 1992). The six-year effort, from 1986 through 1992, produced a database with over 96,000 records of butterflies and moths from Ohio, representing specimen records from 3800 localities in the state. One hundred and fifty-one collections were examined for records.

The lepidopteran fauna of Ohio is as well known as any state in the U.S. The microlepidoptera, as classified by McDunnough (1939), are usually overlooked in faunal surveys because of their small size and difficulties with obtaining identifications. The Ohio Survey of Lepidoptera greatly benefited by data from the extensive collection of Lepidoptera assembled by Annette Francis Braun, a prominent microlepidopterist from Cincinnati, Ohio (Stein 1988, Solis 1990).

The concept of Transeau's prairie peninsula (1935) presents an excellent opportunity to examine the distribution of Lepidoptera relative to a mosaic of unique vegetational communities in Ohio. Not only should Ohio's relict prairies share suites of plants with states to the west of Ohio, but Ohio's prairies should also have disjunct populations of insects that are normally found in environs far to the west of the state. For example, *Tarachidia binocula* (Noctuidae) is recorded from three prairies in Ohio. It has not been recorded from Indiana nor Illinois and is known only from prairies in Wisconsin. It can be common in prairie habitats in states west of the Mississippi River.

Correlations of distributions of Lepidoptera, geology, soils, and plants were shown and discussed by Iftner et al. (1992) and Rings et al. (1992). Preliminary results of an intensive inventory at Huffman Prairie, near Dayton, Ohio, reported several examples of prairie specialist species (Metzler and Zebold 1995). The inventory of Huffman Prairie continued through 1996. Inventories at other prairies in Ohio were begun in 1994 and 1995 (Tables 1 and 2).

Lepidoptera respond directly to habitat size, past history of degradation, and management practices, such as burning (Dana 1986, Dana 1991, Miller 1979, Panzer 1988, Van

Amburg et al. 1981, Swengel 1996). With these factors in mind, optimum strategies and disciplines for the management of wildlife resources need to be developed on a continuous basis to obtain the best possible balance of healthy flora and fauna (Hafernik 1992). The goals of the research at Huffman Prairie, Killdeer Plains Wildlife Area, and Resthaven Wildlife Area included making recommendations for managing the habitats to maximize protection for the lepidopteran species, especially species listed as endangered in Ohio by the ODNR, Division of Wildlife, in 1991 (Ohio Administrative Code 1501:31-12-01).

**Table 1.** Name and location of Ohio prairies that were sampled for moths.

Ohio County	Name of Prairie	No. of sample sites/prairie	Years that samples were taken
Erie	Resthaven Wildlife Area	2	1995-1996
Greene	Huffman Prairie	3	1992-1996
Lucas	Irwin Prairie State Nature Preserve	1	1995-1996
Lucas	Kitty Todd Preserve	1	1995-1996
Lucas	Oak Openings Metro Park	1	1995-1996
Wyandot	Killdeer Plains Wildlife Area	4	1994-1996

**Table 2.** Number of samples for each Ohio prairie that was sampled for moths, listed by sampling method. bl = blacklight trap, mt = malaise trap, bt = bait, pt = pheromone trap, bn = butterfly net.

Name of Prairie	No. of sample days in 1992	No. of sample days in 1993	No. of sample days in 1994	No. of sample days in 1995	No. of sample days in 1996
Resthaven Wildlife Area	0	0	0	bl = 6	bl = 8
Huffman Prairie	bl = 10 bn = 21	bl = 18 bn = 18	bl = 24 mt = 6 bt = 4 pt = 3	bl = 11 mt = 1 pt = 5	bl = 2 6mt = 2
Irwin Prairie State Nature Preserve	0	0	0	bl = 2	bl = 5
Kitty Todd Preserve	0	0	0	bl = 2	bl = 5
Oak Openings Metro Park	0	0	0	0	bl = 5
Killdeer Plains Wildlife Area	0	0	bl = 9	bl = 11	bl = 6

## METHODS AND MATERIALS

Inventory protocols include blacklight traps, malaise traps, pheromone traps, baits, and insect nets. The various methods were selected to best sample all lepidopterans, including moths that fly during daylight hours.

A substantial number of moth species are active at night when they cannot be seen due to the darkness. These are best sampled by catching them in battery powered light traps. The traps were operated from dusk until dawn. The blacklight traps are modifications of the USDA design manufactured by the Elisco Company. The traps use 15-watt fluorescent blacklight bulbs. Malaise traps are designed to passively collect insects that fly past the trap (Townes 1972). Nothing is used to attract the insects to the malaise trap. The baits are mimics of substances that naturally attract lepidopterans to fermenting fruit. Some of the species of moths that come to baits are rarely, if ever, attracted to light. A bait mixture of decaying and fermenting fruit was applied to small synthetic sponges (3 inches x 6 inches x 1 inch). The sponges were hung from branches of nearby trees and bushes. Other species are attracted to pheromone traps, devices that contain a bait impregnated with commercially prepared synthetic chemicals which mimic sex attractant pheromones emitted by female moths.

The sites for the traps and baits were selected using a combination of criteria including consultation with land managers, ease of access by foot, flora near the sites, and geostalt. The sampling with a butterfly net at Huffman Prairie followed a transect that was designed to intersect with most of the plant communities in the prairie. Data pertinent to butterflies at the other sites are gleaned from the Ohio Survey of Lepidoptera's database.

The light traps were placed just before dark, and the samples were retrieved at dawn the following morning. The malaise traps were placed in the late afternoon. They were left in place for 24 hours, and samples were taken at dawn and in the late afternoon. The baits were placed just before dark. Samples were taken during the crepuscular hours until about mid-night, after which the baits were retrieved. Pheromone traps and butterfly nets were used during daylight hours.

All specimens of Lepidoptera were sorted to species and counted. The data were keyed into an IBM compatible computer using dBase® software. Each record, consisting of one or more specimens, includes the exact date and location of each species from each sample. The method of capture is included in the record. Many specimens, especially the smaller lepidopteran species, were pinned, mounted, dissected, and photographed for subsequent consultations with experts at the U.S. National Museum of Natural History, Washington, DC and Agriculture Canada's Centre for Biological and Land Resources, Ottawa, Ontario. All nonlepidopteran in the samples were stored in alcohol for

subsequent study. Lists of species from Ohio's prairies were compared with data from the Ohio Survey of Lepidoptera, distributions of the species, larval hosts, and habitats of the species.

## RESULTS

Forty-one species of Lepidoptera that are restricted to prairies in Ohio were recorded, in 199 samples, from 1992 through October 1996 (Tables 2 and 3). Nineteen of these species were recorded from Ohio for the first time. Eight hundred and fifty-five species of moths and 33 species of butterflies have been identified from the samples—the prairie specialists represent 5% of the species in the samples. None of the butterflies are restricted to prairies in Ohio.

Voucher specimens are deposited in the Dayton Museum of Natural History, the collection of The Ohio Lepidopterists at The Ohio State University Museum of Biological Diversity, The U.S. National Museum of Natural History, The Canadian National Collection, the Cleveland Museum of Natural History, The American Museum of Natural History, and the private collections of Eric H. Metzler and Roger A. Zebold. George Balogh, P.T. Dang, Donald R. Davis, Loran D. Gibson, Jean-François Landry, Ronald W. Hodges, Reed A. Watkins, and Donald J. Wright retained some specimens in exchange for expert identifications.

## DISCUSSION

A prairie specialist Lepidoptera in Ohio is a species that occurs in Ohio's prairies because of the processes of Transeau's prairie peninsula. When Ohio was more xeric and the prairie habitats of the Great Plains extended east into central Ohio, species of plants and animals expanded their range eastward into the state. As climatic conditions changed and the prairie peninsula retreated, relict populations of plants and animals survived in the state. In Ohio, prairie plants and animals share affinities with states west of Ohio, where the plants and animals are not necessarily restricted to prairies. Except for anomalous habitats in Pennsylvania, New York, and other eastern states, the prairie peninsula did not extend northeast of Ohio. Neither did the prairie-associated plants and animals. I consider lepidopterans to be prairie specialists in Ohio if they meet the following criteria: 1) they have been recorded only in prairies in Ohio; 2) they have been recorded only in prairie habitats in states east of Ohio; 3) they have been recorded in prairie or prairielike habitats in states east of the Mississippi River and west of Ohio, or 4) larval hosts and nectar sources are restricted to prairies in Ohio. The lepidopteran species may not be restricted to prairies in states west of the Mississippi River. The definition of prairie includes all sites reported as such. None of the species reported here have common names.

The affinity of Ohio's relict prairies with habitats in states to the west of Ohio is supported, and the number of prairie

**Table 3.** List of prairie remnant dependent moths recorded in the samples. rwa = Resthaven Wildlife Area, hp = Huffman Prairie, ip = Irwin Prairie, ktp = Kitty Todd Preserve, oo = Oak Openings Metro Park, and kpwa = Killdeer Plains Wildlife Area.

Name of Species	Occurs in these Prairies	Newly recorded from Ohio?
<i>Bucculatrix simulans</i>	hp	yes
<i>Bucculatrix staintonella</i>	kpwa	yes
<i>Caloptilia belfrageella</i>	rwa	no
<i>Agonopterix pteleae</i>	hp	yes
<i>Marmara leptodesma</i>	kpwa	yes
<i>Batrachedra praeangusta</i>	kpwa	yes
<i>Chedra inquisitor</i>	kpwa	yes
<i>Stereomita andropogonis</i>	rwa, hp, ip, ktp, oo, kpwa	no
<i>Aristotelia corallina</i>	kpwa	yes
<i>Aristotelia elegantella</i>	kpwa	no
<i>Aristotelia psoraleae</i>	hp	no
<i>Aristotelia salicifungiella</i>	hp	yes
<i>Gelechia lynceella</i>	kpwa	no
<i>Scrobipalpula artemisiella</i>	hp	yes
<i>Helcystogramma hystricella</i>	hp, kpwa	no
<i>Dichomeris costarufuella</i>	rwa	yes
<i>Acrolepiopsis leucoscia</i>	hp	yes
<i>Eucosma heathiana</i>	rwa, hp	yes
<i>Eucosma vagana</i>	hp, kpwa	no
<i>Eucosma matutina</i>	hp	no
<i>Eucosma giganteana</i>	rwa, hp, kpwa	no
<i>Eucosma bipunctella</i>	rwa, kpwa	no
<i>Eucosma bilineana</i>	kpwa	no
<i>Eucosma nandana</i>	rwa, hp, kpwa	no
<i>Eucosma fulminana</i>	rwa, kpwa	no
<i>Epiblema tripartitana</i>	hp	no
<i>Suleima helianthana</i>	kpwa	no
<i>Sonia canadana</i>	hp	no
<i>Dichrorampha sedatana</i>	hp	yes
<i>Platynota stultana</i>	rwa, hp	yes
<i>Aethes bomonana</i>	rwa, kt, kpwa	yes
<i>Aethes spartinana</i>	rwa, kpwa	yes
<i>Hysterosia villana</i>	hp, kpwa	yes
<i>Lychnosea intermicata</i>	hp	no
<i>Haploa reversa</i>	hp, kpwa	no
<i>Tarachidia binocula</i>	rla, hp, kpwa	no
<i>Tarachidia tortricina</i>	hp, kpwa	no
<i>Luperina stipata</i>	rla, hp, kpwa	no
<i>Papaipema beeriana</i>	rla, kpwa	no
<i>Papaipema silphii</i>	rla	no
<i>Tricholita signata</i>	rla	no



specialist species of Lepidoptera recorded in Ohio was more than doubled. *Tarachidia binocula*, previously known from a single specimen from Resthaven Wildlife Area, was found in Huffman Prairie and is abundant in Killdeer Plains Wildlife Area. *Eucosma heathiana* (Tortricidae) was first recorded from Ohio in Huffman Prairie in 1992, and it was found at Resthaven Wildlife Area in 1996. *Aethes spartinana* (Tortricidae) was described from South Dakota where the larvae feed on *Spartina pectinata* (Gramineae). *Aethes spartinana* is common at Killdeer Plains Wildlife Area, and one specimen was taken at Resthaven Wildlife Area. *Spartina pectinata* is common in both of these prairies. Prior to its discovery at Killdeer Plains Wildlife Area, *Marmara leptodesma* (Gracillariidae) was only known from the type locality in Texas, and *Aristotelia corallina* (Gelechiidae), described from Mexico, was only known from the southwest U.S.

Hafernik (1992) correctly states that invertebrates, as the predominant organisms on earth, should have greater attention in conservation strategies. Hafernik's recommendations coincide with the revised paradigm in conservation biology proposed by Pickett et al. (1992) in which it is argued that the system and process, rather than species-level preservation should be examined. The prairie animals, as well as the prairie plants, should be studied, inventoried, and protected. Fry (1991), New (1991), Pollard and Yates (1993), Samways (1994), New (1995), and Pullin (1995) provide examples of strategies to conserve invertebrates. For purposes of studying biological diversity with animals, lepidopterans are a good choice because they are numerous, they are excellent indicators of specific habitats, and they are a valuable food source for birds and mammals. Compared to most other insects, lepidopterans have positive public appeal making it easier to gain support for their study.

Ohio's remnant prairies are small and fragmented. Assuming that prairie specialist species in the state are restricted to prairies in the eastern U.S., or that they are disjunct populations of western species, their occurrence in Ohio's remnant prairies supports Transeau's concept of a prairie peninsula. Their isolation from other naturally occurring prairies makes it highly improbable that insects from other locations could colonize these areas.

Three concerns pertinent to prairie management are noted. The first concern is the protocol for using fire as a management tool, the second is invasion of woody plants, and the third is manipulation of wildlife areas for sporting activities. Managers of Ohio's remnant prairies are diversifying their strategies to protect the complete suite of plants and animals that comprise the prairie ecosystem.

Resource managers regularly use fire for prairie management and restoration. The practice is predicated on the idea that fire, whether naturally occurring or set by humans, is an important factor in the maintenance of prairie habitat. In

Ohio, fires for management purposes are used either in the early spring or late autumn following a hard frost, sometimes on an annual basis. Such use of fire does not mimic natural phenomena, thereby putting insects, which are vulnerable to fires, at risk.

The issue with fire is that in the original landscape disturbances were patchy. Even though the largest prairie remnants in Ohio are less than 100 acres, the discontinuity of burns must be maintained. A protocol for fire as a management tool should mimic naturally occurring fires. Natural fires burn in mosaics and leave unburned refugia for vulnerable animals. Resource managers should accommodate all plants and animals that are prairie specialists. Their survival in the remnants is as fragile as the prairies they inhabit.

The frequency of naturally occurring fires in Ohio's prairies is speculative, but the literature suggests that natural burns probably did not occur more often than one in five years at a given site. Costello (1969) vividly describes grassland fires, but their frequency may be from 5 to 30 years (Wright and Bailey 1982) depending on a variety of conditions. It is known that Native Americans burned grasslands to maintain openings, as frequently as every two years in Wood County, Ohio (Maryfield 1988), but there is little proof that Native Americans and early settlers routinely set fires (Russell 1983). At the most frequent, Ohio's prairies might have burned naturally every five years (Wright and Bailey 1982, Clark 1989).

The Ohio Chapter of The Nature Conservancy responded to the new information about insects. One of the study sites, Huffman Prairie, is located on Wright-Patterson Air Force Base near Dayton. Through a cooperative agreement with the Department of Defense, The Nature Conservancy provides recommendations to the base for restoration and management of Huffman Prairie. The Nature Conservancy used information provided by Metzler and Zebold (1995) to recommend a revised protocol for conducting prescribed burns. Previously, the prairie was either burned or mowed in its entirety on a nearly annual basis, beginning in 1984. The revised protocol recommends that only one quarter of the prairie is burned in any one year. Under the revised management strategy, each quarter of the prairie will be burned once every four years. Unburned areas will be left as refugia.

## CONCLUSIONS

Without management, the isolated prairie remnants in Ohio would succeed to forested communities. This would not only change the composition of the vegetation, but could also change the composition of the lepidopterans from prairie specialists to woodland species. The Ohio Chapter of The Nature Conservancy and Wright-Patterson Air Force Base used data from the inventory to intensify removal of

woody plants at Huffman Prairie. Fire would normally reduce the amount of woody vegetation. However, in years when a prescribed burn cannot be conducted, the designate unit will be mowed to temporarily suppress woody vegetation. In addition, the resource managers responded by removing woody plants through the selective use of herbicides.

The ODNR Division of Wildlife modified its manipulation of some plots in ways that accommodate the occurrence of prairie specialist species, and the Division of Wildlife routinely queries lepidopteran data when making management decisions. Management of Ohio's wildlife areas includes manipulation of the landscape for propagation of game animals. Food crops are planted and acreage is mowed to accommodate sporting activities. Prior to data from the Ohio Survey of Lepidoptera, Ohio's wildlife managers did not consider terrestrial insects in their management plans. The discovery of *Papaipema silphii* and *P. beeriana* at Resthaven Wildlife Area prompted the Division of Wildlife to remove additional prairie acreage from its crop rotation schedule. The discovery of *Tarachidia binocula*, *Luperina stipata*, and *P. beeriana* at Killdeer Plains Wildlife Area prompted the Division of Wildlife to look at activities pertinent to prairie acreage. Lepidopteran data were recently consulted before making a decision about drainage ditches and to modify plans for a major wetland improvement project.

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