Proceedings of the Indiana Academy of Science
(1988) Volume 98 p. 201-206.

# POPULATION AND BEHAVIOR MODIFICATIONS OF SELECTED ARTHROPOD PESTS IN INDIANA DURING THE 1988 DROUGHT

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## INTRODUCTION

The severity of the 1988 drought throughout the Midwest may never be fully appreciated. Effects of the drought were felt throughout the State of Indiana. Agriculture was dealt a severe economic blow. Field crops died for lack of water, stock ponds dried up, cattle were sold for lack of feed to hold them over the winter, and arthropod pests infested field crops at an unprecedented rate. Incidence, behavior, and injury from many pests, including insects, was altered.

Populations of some agronomic pests were unusually high, and damage was severe. Other annual pests were conspicuously absent. Some health related pests were less of a nuisance during drought conditions. Others, though fewer in numbers, were more active and thus more commonly encountered. Injury from ornamental plant pests was compounded by the already drought weakened condition of the plants. Development of some insects of economic importance appeared to be more rapid than usual but was delayed in others.

Information about the incidence and behavior of pest arthropods in drought conditions for the most part is lacking in Indiana. This study seeks to fill some voids in those records.

## METHODS

Trends presented in this study represent a summary of reports from the Insect Diagnostic Laboratory, survey results, National Weather Service data, a special inquiry telephone line, and other observations reported by the Department of Entomology at Purdue University. The Insect Diagnostic Laboratory serves Indiana clientele by identifying and recommending controls for anthropods or anthropod-related problems affecting plants or animals in the home, yard, or agronomic environments. The laboratory receives more than 1000 samples each year, usually through County Extension Agents. Many additional direct contacts are made through organized meetings and by telephone. Plant pest surveys, conducted through the Purdue University Extension Service, also provide much needed information concerning the development of many pests. A network of black light as well as pheromone traps maintained at critical locations throughout the State contribute to this effort. Field inspections at specific locations and times also aid as needed. Records of specific weather data from within the State is maintained and managed at the Midwest Agricultural Weather Service Center, West Lafayette.

A "drought hot-line" with a toll-free number was installed on 21 June at Purdue University. This service was designed to address questions from Indiana

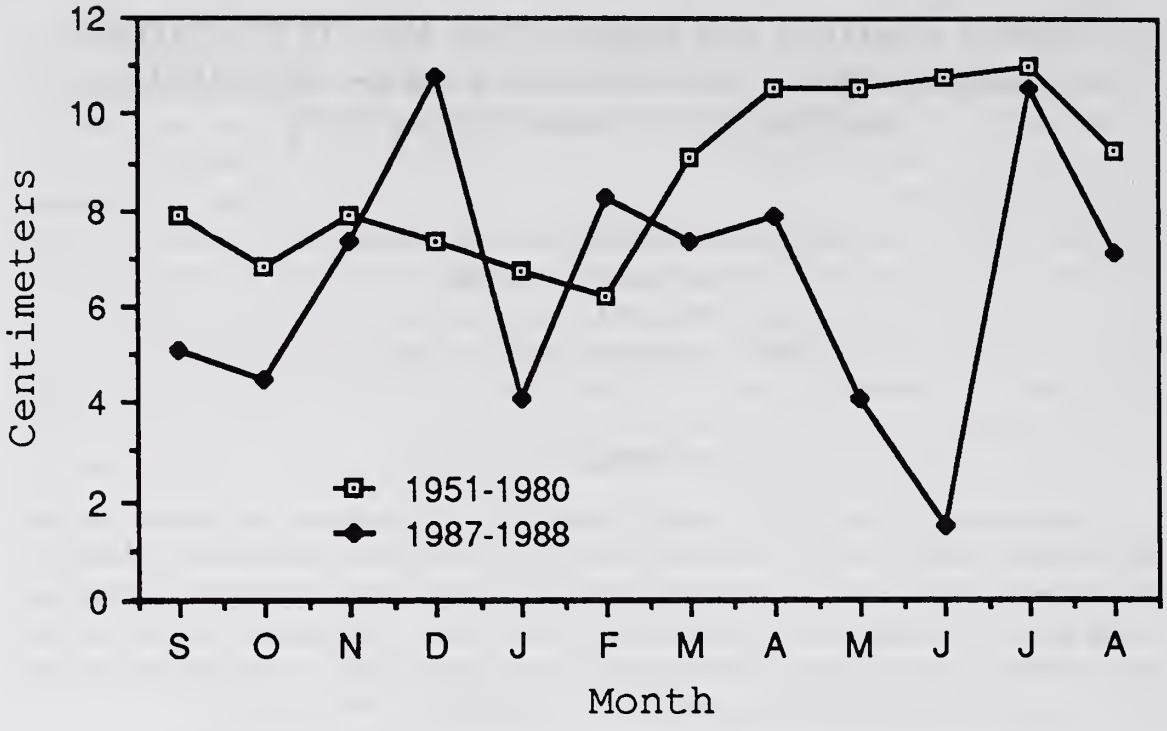


FIGURE 1. Indiana monthly precipitation averages.

residents about agriculture as well as how to deal with associated stress and financial problems caused by the drought in 1988. From 21 June to 21 October, the operators received approximately 4800 calls. Initially, 6-8% of the daily calls concerned entomologically related questions. However, as the drought continued and associated problems intensified in July and August, the Entomology Department received up to 50% of the calls (sometimes as many as 100 calls per day).

## RESULTS

A comparison of 1988 precipitation records (State-wide monthly averages) with the average for the years from 1951 to 1980 indicates that until April, precipitation did not differ greatly from the 30 year average (Figure 1). April, May, June, and July, however, all had precipitation levels that were far below normal. Between 31 April and the 9 July, Indiana received less than 4 cm of precipitation (15% of normal). Lack of rainfall in the spring proved to be critical for agriculture. Many crops were planted into soil barely moist enough to germinate seed, much less support further plant growth.

Daily high temperatures, reported as monthly averages, also were substantially higher than the 30 year averages (Figure 2). During June, July, and August, temperatures averaged more than 3° C above normal.

## PESTS OF AGRONOMIC CROPS

An estimated $50 million was spent for insect and mite control on agronomic crops alone in Indiana during 1988. Approximately $25 million more was lost due to crop damage resulting from those pests (personal comm., C. R. Edwards, Purdue University).

Spider mites (*Tetranychus* spp.) were Indiana's primary arthropod problem in 1988. Earlier than normal movement into fields from drying grasses and field

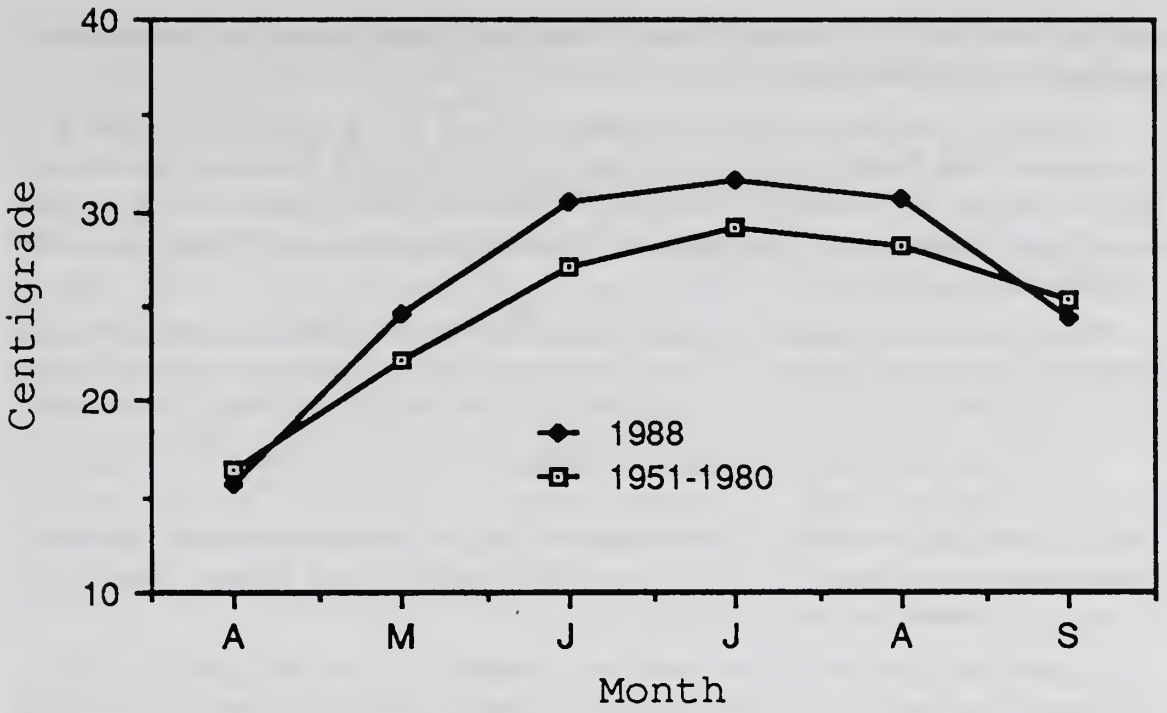


FIGURE 2. Indiana maximum temperature averages.

margins was reported by early July, when the already drought stressed plants were young. Soybeans were hit the hardest. Spider mite damage was so severe throughout most of the State that supplies of registered miticides became depleted. Miticides were shipped in from across the country to meet the demand. Twelve new 24-C (special local needs) registrations for miticides also were approved by the EPA to meet this emergency. An estimated 1 million acres of soybeans in Indiana were treated with miticides in 1988, many of which received multiple applications.

Bean leaf beetle (*Cerotoma trifurcata*), an important pest of soybeans, was also very prevalent this year. More concern was created than normal, because of the high numbers of beetles feeding on small plants already stressed by the drought.

Mexican bean beetle (*Epilachna varivestis*), a pest which has been steadily increasing in numbers and importance in Indiana over the past few years (Meyer, 1987), was not a major concern in 1988. Very few accounts of Mexican bean beetle either in field crops or home gardens were received, probably due to decreased survivorship of the larvae during the drought.

Corn rootworm (*Diabrotica virgifera virgifera*) was a pest on corn throughout the State this year. Higher temperatures early in the season increased their rate of development, causing first emergence of adult beetles slightly earlier than normal. Increasing soil temperatures apparently became too warm for optimum larval development by late June. As a result, even though first adults emerged somewhat earlier than normal, peak adult emergence was later than normal.

The drought may also have had an indirect effect on corn rootworms. Many rootworm insecticides that are applied at planting are dependent upon moisture to move them down into the root zone, where they protect roots from rootworm feeding. Lack of precipitation after insecticide application left insecticides sus-

pended near the soil surface. Drought was implicated in several instances of rootworm insecticide failure.

European corn borer (*Ostrinia nubilalis*) was not a significant concern to growers in 1988. Moths began to fly when expected in 1988. However, the intense heat accompanying the drought may have interfered with normal mating and egg deposition. Fewer egg masses were deposited than normal, and those that were oviposited often desiccated.

Black cutworm (*Agrotis ipsilon*) moths arrived in Indiana about the same calendar date as in other years. However, reproduction and larval development were greatly hindered, because of the intense heat and drought of the early season.

Survival of grasshopper egg pods are known to be increased in dry conditions (Grace and Johnson, 1985). As expected, reports of increased grasshopper activity were received early in the season. However, significant grasshopper outbreaks and subsequent damage did not materialize. Survival and damage was low to moderate in most areas of the State.

In addition to mites, insects which suck plant juices, including thrips, aphids, and scales, tended to be greater pests this year than normal. Not only do those insects have direct access to water (through the plant), but they may benefit in two other ways as well. Plants under stress are known to limit production of natural chemical insect defenses and channel those nutrients to more basic life sustaining functions. This offers sucking insect pests an unrestricted avenue of attack. During stressful conditions (such as drought), new plant growth also has more concentrated proteins. This may directly benefit herbivorous insects, which are dependent on protein for growth and reproduction.

Alfalfa surveys indicated that potato leafhopper (*Empoasca fabae*) arrived on schedule as compared with 1986 (Meyer, 1987), but unlike other sucking insects, they never developed to economic populations, while the weather remained dry. Incidences of severe localized damage were reported, after significant precipitation was received in August, however.

The grape colaspis (*Colaspis brunnea*) beetle in soybeans caused isolated damage in 1988, whereas in other years, it was either insignificant or a very minor pest.

Significant outbreaks of chinch bugs (*Blissus leucopterus leucopterus*) were anticipated but did not occur. False chinch bugs (*Nysius raphanus*) were very common in many parts of the State and often were reported moving in very large numbers. Some growers did apply insecticides for this insect, even though little damage to cultivated plants was documented.

Complaints of Indian hempworm (*Pyrausta futilalis*) were common this season. This increase can be indirectly attributed to the drought. Lack of precipitation hampered the performance of many herbicides this year. More weeds (especially dogbane, the insect's primary host plant) occurred in cultivated fields. When these weeds dried down, the higher populations of hempworm began to migrate in large numbers, which led to more encounters and thus complaints from people. Again, little damage due to the feeding of this insect was documented.

The drought may have an indirect effect on future insect management in stored grain. Much of the grain harvested this fall was highly variable in condition, size, and moisture content. Unless artificially dried to a uniform moisture, Indiana

growers may expect localized damp spots to develop in the grain mass, which may mold, heat, and create hot spots favorable to insect development and continued moisture buildup.

## PESTS OF MAN AND ANIMALS

Generally, biting/stinging pests populations were reduced due to the drought. Social wasps and bees depend upon water to survive and to cool their colonies. Fewer naturally occurring water sources forced wasps and bees to search further and to expend more energy in search of this vital resource. Increased complaints of wasps and bees encountered at swimming pools, bird baths, etc. resulted even though actual numbers of these insects probably were reduced this year.

Mosquitos, which must have standing water to reproduce had very limited populations, especially in the early spring of 1988. If these were any positive effects found in the drought, this was probably it for most Hoosiers.

Flea larvae did not survive well out of doors in 1988. Flea complaints to the diagnostic laboratory were minimal. Tick reports were more prevalent than usual this spring. The heat and drought stresses may have caused ticks to be more active than usual. Recent news accounts of Lyme disease and Rocky Mountain Spotted Fever also may have increased public consciousness of ticks producing more reports than normal. Long term implications of the drought may be that the tick will have increased it's range in 1988, because primary host animals (deer and rabbits) increased their ranges in search of food and water (personal comm., R. Williams, Purdue University).

Other livestock pests, in particular face flies (*Musca autumnalis*) and horn flies (*Haematobia irritans*), decreased in number by mid summer. Horn fly populations recovered in numbers by the end of the summer, whereas face fly populations did not. Incidence of confinement flies was lower than most years, likely a direct result of the decreased availability of breeding sites and lower humidity.

## PESTS OF ORNAMENTAL PLANTS

Drought-stressed trees and shrubs are less able to tolerate defoliating insects, such as caterpillars, sawfly larvae, and beetles. Continued stress will weaken even large trees, making them more attractive and vulnerable to bark beetles and wood borers (Schultz, 1983).

Eastern tent caterpillar (*Malacosoma americanum*) was a very common pest in the early spring of this year. Whether or not their increased occurrence was drought related is debatable. What is significant is that the trees' complete recovery from early season defoliation was clearly hindered by later drought stresses.

Annual white grubs' (Japanese beetles (*Popilia japonica*) and northern masked chafter (*Cyclocephala borealis*)) adult emergence was later than normal in 1988. High soil temperatures during late larval development were credited for this delay. Shortly before peak emergence (early August), enough precipitation fell in most areas of the State to bring most lawns out of drought induced dormancy. This fortuitous rain may have diluted the potential severity of concentrated attack by white grubs on green irrigated lawns. Some insecticide failures this year were

linked to the facts that many grubs remained deep in the soil to avoid heat and water stress, chemicals were not moved down into the root zone (Niemczyk and Krueger, 1987), and chemicals broke down more quickly in the intense heat and sunlight. Fewer problems with adult Japanese beetles were reported this year either in the home yard and garden or agronomic crops.

Complaints of outdoor ants invading homes (probably in search of water) were more common in 1988 than in other years. Few complaints of carpenter ants (*Camponotus* spp.)) were reported.

Boxelder bugs (*Leptocoris trivittatus*) were an unusually common pest in 1988. Nymphs and adults of the first generation began entering homes in July. In most years, the first generation remains out of sight in the trees, and only the second generation becomes a problem from late August through October.

## BENEFICIAL INSECTS

Survival of most beneficial insects, parasites, and predators was negatively affected by the drought. Honey bee (*Apis mellifera*) survival and honey production was variable and dependent upon specific geographical location. Some flowers are known to produce more nectar in drought conditions, while others produce less (personal comm., W. Fischang, Purdue University). Actual production of honey seemed to be closely correlated with proximity to certain flower species. In general, however, even bee colonies supplemented with water and food reserves through the drought were probably stressed, because of higher than normal temperatures.

## SUMMARY

Drought in 1988 elicited species specific effects from arthropod populations in Indiana. Lack of water and breeding sites limited the survival and reproduction of many annual pests. Pests which have piercing-sucking mouthparts tended to do very well in the drought and were by far the most serious group of pests of 1988. High temperatures accompanying the drought both increased and retarded the development of insects depending on their stage of development and the temperatures attained. Overall, high temperatures increased stress and decreased survival of most insect populations.

It is difficult to predict how the drought of 1988 will affect future pest populations. Generally, grain harvested in 1988, unless artificially dried, is expected to be in a condition conducive to attack by stored grain pests. Drought stressed and weakened shade trees and shrubs were stressed sufficiently to increase their susceptibility to wood borer and bark beetle damage in the coming seasons.

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