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## DROSOPHILIDAE (DIPTERA) COLLECTED IN SPRING IN MICHIGAN

Henretta Trent Band<sup>1</sup>

## ABSTRACT

Drosophilids in mid-Michigan overwinter in a preadult stage. One hundred twenty-two individuals (84 ♂, 38 ♀) representing 14 species were collected over bait in April and May 1992. All appeared recently emerged and had entire wings. This agrees with earlier reports in Michigan and Massachusetts that *Drosophila affinis* group species overwinter as preadults. Among the species overwintering as preadults in Michigan, *Drosophila affinis*, *D. algonquin*, *D. athabasca*, *D. robusta*, *D. falleni* and *D. recens* have been found to overwinter as adults in New York. Latitude and climate may play a role in drosophilid overwintering stage.

How Drosophilidae survive the winter remains controversial. Lumme and Lakovaara (1983) summarized investigations to date. In the North Temperate Zone, species in the genus *Chymomyza* (Diptera: Drosophilidae) overwinter as larvae; species in the genus *Drosophila* primarily overwinter as adults. Later work by Band and Band (1987) on *Chymomyza amoena* (Loew) and Shimada and Riihimaa (1988) on *C. costata* Zetterstedt agreed with the evidence for larval overwintering by *Chymomyza*. However, Band (1991) bred *Drosophila affinis* Sturtevant and *D. algonquin* Sturtevant and Dobzhansky from overwintered apples in mid-Michigan. Carver (1968) reported preadult overwintering for these two species in apple orchards in Massachusetts but presented no data. Collier (1978, cited by Lumme and Lakovaara 1983), found that *D. affinis*, *D. algonquin*, and *D. athabasca* Sturtevant and Dobzhansky in the *D. affinis* species group all overwintered as adults in New York.

To obtain further information on drosophilid overwintering in mid-Michigan, collections were made during April and May 1992. Findings support preadult overwintering. This contrasts with additional recently obtained evidence for *Drosophila* adult overwintering in New York State (Jaenike 1992).

## MATERIALS AND METHODS

**Site:** Collections have been made in a garden having a variety of deciduous and evergreen trees, shrubs, ground cover and fruit trees (apple [*Malus pumilla* var. Jonathan], pears [*Pyrus communis*]) including a variety of fruit- and non-fruit producing ornamental crabapples. Other nearby fruit trees include plum (*Prunus*), sweet cherry (*Prunus avium*), apple and crabapple. Several black walnut trees (*Juglans nigra*) are also nearby.

**Collections:** Following a warm spell in mid-April 1991, rotting potato and

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onion were separately placed in small jars on the ground. Flies coming to bait were tapped into small plastic bags, sealed with a twist and identified in the laboratory. The necessity to carry out a vigorous spraying program against the bacterial disease fireblight, *Erwinia amylovora*, terminated collections in Spring 1991.

In Spring 1992, separate small jars were again set out. Commercial strawberries and mushrooms were used as bait. Collecting was as before. Flies were tapped into small plastic bags, one for each jar if it had attracted drosophilids. Individuals were etherized and identified in the laboratory. Additionally, females were dissected to determine their reproductive stage. If more than one female of the same species was collected on a given day, only one was dissected; the other was placed in a jar with food. The reproductive stage was scored according to Lumme and Lakovaara (1983). Females and males accumulated made it possible to determine when the breeding season started.

**Species identification:** Strickberger (1962) was used to identify the *Drosophila* collected. Sulerud and Miller (1966) was employed to differentiate *D. affinis* group males: *D. affinis*, *D. algonquin*, *D. athabasca*.

## RESULTS

In both years, all collected adults had entire wings and did not appear to be aged. Ragged wings and an aged appearance signify fall emergence and adult overwintering (see Lumme and Lakovaara 1983).

In 1991 all flies were collected on rotting potato. Species attracted were one *D. affinis* group ♀, one *D. robusta* Sturtevant ♀, 3 *D. algonquin* ♂, and 5 *D. affinis* ♀. Collecting extended over 3 days before being terminated. However species collected verified Band (1991) that the *D. affinis* group flies overwinter as preadults in Michigan rather than as adults in New York (Collier 1978).

In 1992, 14 species were collected; 11 on strawberries, 10 on mushrooms; some came to both baits. Females initially captured in Spring 1992 and dissected were in stage I, with undeveloped ovaries. Again, species collected in late April and early May included members of the *D. affinis* group, two species in the *D. robusta* group (*D. robusta*, *D. colorata* Walker), *Chymomyza amoena* and *D. immigrans* also began to be attracted to bait in late April and early May. All were collected on strawberries. By mid-May it was possible to obtain F<sub>1</sub> larvae of *D. affinis* and *D. immigrans* in the laboratory.

Species appearing in mid-to late May included *D. falleni* Wheeler, *D. tripunctata* Loew, *D. quinaria* Loew, *D. recens* Walker, *D. chagrinesis* Stalker and Spencer, *D. palustris* Spencer and *D. paramelanica* Patterson. These were principally attracted to mushrooms. *Drosophila tripunctata* and *D. falleni* collected were darker than F<sub>1</sub>'s emerging in the laboratory.

In the last week of May, given the choice of strawberries and mushrooms, most flies were attracted to mushrooms, including those not typically thought to be mushroom breeders: *D. affinis*, *D. immigrans*, *D. paramelanica*. However *D. affinis* and *D. paramelanica* appear to be more opportunistic than earlier suspected. Steyskal (1949) captured *D. algonquin* in the *D. affinis* group, *D. paramelanica* and *C. amoena* feeding on various Michigan trees feeding at frass.

Females captured and dissected in late May contained eggs (stage III). On 31 May baits were brought into the laboratory and the *Drosophila* that emerged were identified. Mushroom emergees included *D. tripunctata* and *D. falleni*. Strawberry emergees were *D. falleni* and *D. affinis*. Table 1 summarizes the species collected, numbers of males and females, substrates on which they were collected and first day of collection. It is not possible to distinguish

Table 1. Drosophilidae species collected in East Lansing, Michigan in spring, 1992. Date of first collection and substrate collected from [strawberries (S), mushrooms (M)] is also given.

Species	First Collecting Date	Sex		Substrate	
		r		S	M
<i>D. affinis</i>	30 April	22		S	M
<i>D. algonquin</i>	1 May	5		S	
<i>D. athabasca</i>	30 April	3		S	
<i>D. affinis</i> group			12	S	M
<i>D. colorata</i>	30 April	1	2	S	
<i>D. robusta</i>	30 April	1	5	S	
<i>C. amoena</i>	30 April	3		S	
<i>D. immigrans</i>	2 May	4	7	S	M
<i>D. falleni</i>	14 May	21	5	S	M
<i>D. recens</i>	27 May	4			M
<i>D. quinaria</i>	14 May	3	1		M
<i>D. tripunctata</i>	13 May	9	4	S	M
<i>D. chagrinesis</i>	28 May	2			M
<i>D. palustris</i>	29 May	1	1	S	M
<i>D. paramelanica</i>	30 May	5	1		M

females among the *D. affinis* group sibling species, hence the total number for the group is given.

#### DISCUSSION

*Drosophila* continue to be found to overwinter as adults in Hokkaido, Japan, lat. 44° N (Toda et al. 1984, 1986, 1990, Watabe et al. 1985). The reports cover endemic species not found in the United States. Walter (1990) has found evidence that both larvae and adults overwinter in the Swiss midlands. Seven species were netted over a compost heap during January 1983: *D. immigrans*, *D. busckii* Coquillett, *D. hydei* Sturtevant, *D. subobscura* Collin, *D. melanogaster* Meigen, *D. simulans* Sturtevant and *D. ambigua* Pomini. Also in January 1983 four species were bred from a compost heap: *D. immigrans*, *D. subobscura*, *D. busckii*, and *D. obscura* Fallen. Earlier Lumme and Lakovaara (1983) reported adult and preadult overwintering in England. Risch (1971) was the first to obtain evidence for preadult overwintering in Switzerland. He buried all stages of *D. subobscura* in forest soil and found the young immature larvae had the best survival.

In the United States, evidence for *Drosophila* preadult overwintering has been restricted (Carver 1968, Band 1991). Jaenike (1992) has also obtained new evidence for *Drosophila* adult overwintering in New York, complimenting the earlier work by Collier (1978). Thus the current finding of preadult overwintering in mid-Michigan indicates that *Drosophila* species in the United States can also survive as adults and preadults as in Switzerland. Evidence that the breeding season begins in mid-to late May in mid-Michigan agrees with McCoy (1962) for *Drosophila* in north-central Indiana.

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