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Outbreaks of March Fly *Bibio xanthopus* (Wiedemann) in Grass Seed Fields in Western Oregon

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ABSTRACT

The seasonal biology of the March fly, *Bibio xanthopus* (Wiedemann), is described for western Oregon. During outbreaks, large numbers of larvae destroyed seedling stands of commercial grass seed fields. Damage was most severe in minimum or no-tillage fields when winter rains saturated the soil and forced larvae to the surface where they aggregated in the seed furrow made by the coulter on the drill. Plowed fields sustained less damage because larvae were not as concentrated in the seed row. In laboratory tests, larvae fed only dead organic matter completed development and emerged as adults. During outbreaks, larvae inadvertently chew through small seedlings as they move through the soil. Because outbreaks cannot be predicted, early fall planting is recommended to obtain well-rooted plants that can withstand large larval populations.

Additional index words: **grass pests, fine fescue, ryegrass, pest management**

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INTRODUCTION

In 1977-78 and 1984-85, large numbers of *Bibio xanthopus* (Wiedemann) occurred in grass seed fields throughout the Willamette Valley of western Oregon. In Europe and Canada, March flies in the family Bibionidae occasionally damage cereals, grasses, and other crops. Most species feed on decaying plant material and play a valuable role in recycling nutrients (Hardy, 1945). A few species are omnivorous, first feeding as scavengers, but later feeding on living plant tissue. Swarms of adults that disperse from peat bogs in Florida are attracted to the hydrocarbon odors in automobile exhaust and become a nuisance near highways (Callahan and Denmark, 1973). Females prefer to oviposit in dead leaves, grass clippings, lawns, and pastures (Schremer, 1958). Little or no biological information is available for the Bibionidae because most are unmanaged beneficial decomposers of plant residues.

The present paper describes observations and tests with *Bibio xanthopus* (Wiedemann) in grass seed fields in the Willamette Valley of Oregon.

MATERIALS AND METHODS

The seasonal cycle of *B. xanthopus* was observed in or alongside commercial grass seed fields near Corvallis, Oregon. During the 1977-78 and 1984-85 outbreaks, observations were made in full- and minimum-tillage fields of ryegrass. The adult population was observed both in and alongside fields where wild cherry (*Prunus* spp.) and willow (*Salix* spp.) were in bloom. To obtain eggs, adult females were collected from these trees and confined (5 per dish) in stacking culture dishes (5 by 12 cm) provisioned with a layer of moist sandy soil 4 cm deep. After eggs were laid, dishes were divided into three equal lots and exposed to the outdoor environment in a protected area; to 10 h light - 14 h dark at 15 C in controlled environment chambers; and to 16 h light - 8 h dark at 21 C in controlled-environment chambers. Moisture was added as necessary to keep the soil moist. Also, a few egg masses were dug from the field and exposed to the outdoor environment. Samples of soil for larvae and pupae were collected from a field of fine fescue that had been windrowed and then abandoned for several years. The area below the windrow was sampled for larvae and pupae at two week intervals.

Laboratory tests were initiated with half-grown larvae collected from the field during November and December. In the feeding test, 25 larvae were placed in each of 10 stacking culture dishes with 2.5 cm of moist peat. Ryegrass was seeded on top of the peat in half of the dishes and the remaining dishes had peat only. The test was terminated when seedlings were 12-14 cm tall and well rooted in the peat. To obtain laboratory reared pupae and adults, 100 field-collected larvae were reared in groups of 10 in translucent freezer containers (20 x 27 x 7 cm) provisioned with only a layer of moist peat (4 cm deep) as food. Five containers were exposed to 16 h light - 8 h dark in a greenhouse maintained at 20 C and five containers were exposed to natural photoperiod and outdoor temperatures during winter. Moisture was added as required to keep the peat moist. Another test was conducted using the same environmental conditions, but fine fescue straw was used instead of peat.

In fields sampled for larvae, a cylinder coring device 10 cm diam was used to delineate the sample area to a depth of 2.5 cm. Sampling was continued until at least 25 individuals were found or until 10 samples had been evaluated.

RESULTS

Description of Life Stages. Adults are 1.2 cm long, black in color, and the ventral side of the thorax and abdomen are covered with grey pubescence. The legs are predominantly reddish-brown with black markings. Males have a large round head with large eyes that are covered with pubescent hairs. In contrast, females have a small elongated head with very small eyes. The tibia on the front legs are enlarged and have two large fossorial spurs for digging.

The eggs are cylindrical, oblong, and pale white when first laid. They gradually turn yellow, and embryonic development is discernible as development progresses. Females usually lay all of their eggs in a single mass.

Mature larvae are slightly flattened dorsoventrally and have 12 segments, the first of which appears partially divided. Larvae are about 1.5 cm long with characteristic rows of short spines on each segment. Larvae are brownish-gray with a dark-brown head capsule. Pupae are brownish-yellow and slightly shorter than larvae. The females are usually larger than males and readily distinguished from males by small compound eyes.

Seasonal History and Biology. Adult *B. xanthopus* begin emerging in late March and continue through April. Large numbers of adults were observed on blooming willow and cherry trees. Males die soon after mating, and often the ground beneath blooming trees is littered with dead males. Females dissected the same day of adult emergence contained between 150-200 mature eggs, all of which were about the same size. The abdominal cavity contained virtually no fat body and is probably why females live only long enough to dig a hole and deposit an egg mass. When mated females were provided a choice of moist peat or soil, they oviposited only in the soil. Females first dig a hole several cm deep with the large spurs on their front legs and then enlarge the bottom of the hole for the eggs. Typically, females lay all their eggs in a single mass and often die within the tunnel.

Eggs laid in the laboratory or in the field failed to hatch. In the laboratory test, each treatment contained at least 30 egg masses obtained during April, and most were still in good condition the following September. Many had developed red eye spots, indicating they were fertile. Field search for egg masses proved difficult because holes dug by females for oviposition are similar in appearance to the abundant holes made by night crawlers in most grass fields.

The seasonal occurrence of larvae (Fig. 1) was determined from egg masses found in the field in late May when small, nonfeeding larvae were found entwined around numerous unhatched eggs. Despite numerous attempts, no larvae were found during summer. The first feeding larvae were found in late October and were 7 mm long. Feeding larvae readily burrow through loose soil and feed on moist straw, chaff, dead roots, and other organic matter. In feeding tests, 52% of the larvae fed straw and 61% of larvae fed peat from December-April completed development and pupated without any live plant material as food.

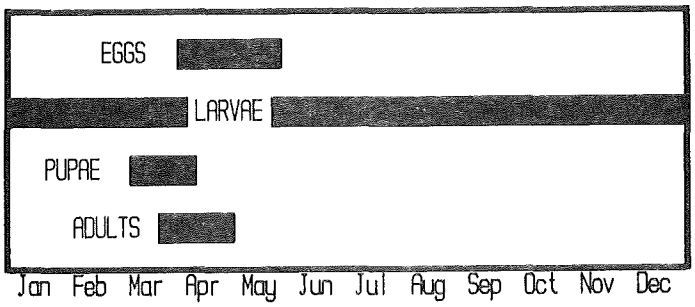

Figure 1. Seasonal occurrence of the different life stages of the March fly *B. xanthopus* in the Willamette Valley of Oregon.

When ryegrass was seeded into peat in containers with and without larvae, the subsequent seedlings germinated and readily rooted in the peat. Despite the constant burrowing of larvae through the peat, none of the seedling roots sustained feeding injury. No difference was found in the height of seedlings in dishes with or without larvae. Only those larvae exposed to the outdoor regime completed larval development. All others died within two weeks. When pupae were found in the field, they were always in contact with the soil in a vertical burrow, head up and just below the soil surface.

Outbreaks and Field Damage. In early December 1976, an estimated 20,000 hectares of seedling grasses were infested with larvae. Large numbers of larvae came to the soil surface when heavy rains saturated the soil to the point of runoff. The density of larvae in the seed rows ranged from 5-47 larvae per core sample (10 cm diam x 2.5 cm deep). In fields under full-tillage regimes, larvae aggregated under clumps of old roots, straw, or clods of soil. In minimum-tillage fields, larvae forced to the surface aggregated in the seed row where the coulter of the drill opened the soil to a depth of ca 2 cm but failed to close the furrow. In some fields, small seedlings often protruded through large aggregations of larvae with no apparent damage to the seedlings, but in other fields seedlings were damaged or completely severed at the soil surface. Larvae consumed little if any of the seedlings and appeared to chew through the shoots or roots at or just below the soil surface. Large aggregations of larvae on the soil surface attracted flocks of starlings, killdeer, and other birds that gorged themselves on the larvae. Both living and dead larvae were observed in pools of surface water after heavy rains. Despite these mortality factors, large numbers of adults were evident the following April, and subsequent fall seedings were again infested with larvae but to a lesser degree than the previous year. Between 1979 and 1983, only small localized concentrations of larvae were found in fall-seeded grasses where damage was confined to areas 5-10 m in diam. Seedlings that developed 4 or 5 tillers and had well-established root systems sustained little or no observable damage.

Another outbreak occurred in 1984-85 when large populations of *B. xanthopus* larvae infested commercial grass seed fields. One of the infested fields was fine fescue windrowed for harvest and then abandoned for two years. During this time, larvae converted the lower layer of the windrow to a finely ground layer of organic humus 1-2 cm deep. Typically larvae aggregated in a mass above the soil surface but under the top layer of straw. No feeding injury was evident on live fescue crowns.

In summary, the larvae of *B. xanthopus* feed on many types of dead organic matter both on the soil surface or incorporated into the soil. Eggs laid in the spring give rise to larvae that survive dry summers and seedbed preparation. Except for the damage inflicted by larvae to small seedlings in fall plantings, this insect is beneficial in accelerating the decomposition of plant residues. Damage to seedlings may be inadvertent because little or none of the seedlings are consumed. Most larvae present in minimum-tillage fields were close to the soil surface. When winter rains saturated the soil, larvae were forced to the soil surface where they aggregated in the seed furrow opened by the coulter on the drill. The incorporation of straw into the soil in full-tillage fields may increase the food supply for larvae. However, plowing results in a loose soil structure that facilitates movement and dispersal of larvae through the soil and away from the seed row. In general, full-tillage fields sustained less feeding damage than no-till or minimum-tillage ryegrass fields. Germinating seedlings in the seed furrow are most susceptible to larval damage. Sowing grasses in early fall to obtain well-rooted plants with several tillers before cold weather will minimize damage by unexpected infestations. No method is presently available to predict outbreaks.

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