STATUS OF ORANGE WHEAT BLOSSOM MIDGE IN IDAHO

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INTRODUCTION

The orange wheat blossom midge, *Sitodiplosis mosellana* [Diptera:Cecidomyidae], is an introduced pest of European origin first recorded in North America during 1828 at Quebec, Canada. Sporadic outbreaks thereafter were reported from both Canada and the U.S., including the first PNW detection during 1904 in British Columbia and a subsequent 1912 outbreak in adjacent Whatcom County, WA. (Reeher 1945. USDA Circ. 732). But economic infestations were infrequent until the mid-1980's when epidemic populations occurred across the western Canadian provinces of Saskatchewan and Manitoba. By 1995, populations expanded southward into Minnesota and North Dakota; densities in some areas exceeded 110 overwintering pupae / 1-ft^2 and wheat yield losses were estimated at $27 million.

In Idaho, OWBM first was reported during 1991 from Boundary County (our northernmost county which immediately adjoins Alberta, Canada); yield losses in untreated fields exceed 40%. Infestations have not been reported from any other Idaho counties, though a sample of suspect [but unidentifiable] puparia were recovered in southeast Idaho.

Midge control currently depends on Lorsban 4E insecticide applied as foliar sprays to kill adult flies before they oviposit on flowering wheat heads. Application timing is critical. Once eggs hatch and larvae begin to feed on the developing kernels, insecticides become less effective because the glume protects larvae from direct insecticidal contact. Recommended IPM scouting methods are difficult at best. Adult midges are tiny (1/8-inch) and fragile; they only fly at twilight when winds are calm and temperatures are warm. Current IPM recommendations call for wheat growers to visually inspect flowering wheat heads with flashlights after sunset when evening temperatures are warmer than 59°F and wind speed is less than 7.5 mph. Easier-to-use alternatives clearly would help wheat growers make better IPM decisions

We report here our work during 1999 to determine current distribution of OWBM in northern Idaho and to develop simpler-to-use alternatives to visual counts of adult midges;

Objective 1 — delimit midge distribution

METHODS

We conducted sweepnet surveys of 25 commercial winter and spring wheat fields between 20 June and 5 July at 5 to 10-mile intervals along a 150-mile transect from the known infestations in Boundary County southward to Nez Perce County [Figure 1].

RESULTS & DISCUSSION

We never detected OWBM except in Boundary County where substantial populations were recorded. While failure to detect a pest does not absolutely indicate pest absence, we deliberately timed our surveys to maximize probability of detection by sampling during the period of wheat plant flowering when adult midges most likely are present on heads.

We believe it unlikely that infestations naturally will expand southward beyond Boundary County. Adult midges are weak fliers, and though they seemingly can be displaced several miles on the wind, the virtual absence of commercial wheat production in adjoining Bonner County effectively creates a 50-mile wide barrier of forested land to natural dispersal. The greater potential is for human-directed expansion of midge infestations by transport of infested plant materials.

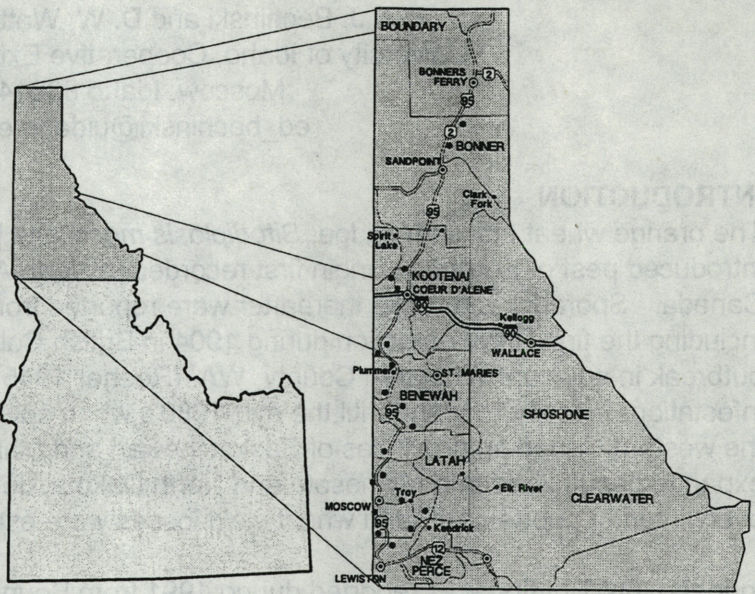

Figure 1. Idaho OWBM Survey Sites, 1999

Objective 2 — alternatives to visually inspecting plants for adult midges

METHODS

We compared absolute counts of midges with easier-to-collect relative density estimates from sticky trap and sweepnet sampling at a single OWBM-infested commercial spring wheat field in Boundary County. Samples were collected on 8 dates between 30 June and 20 July 1999 from the late vegetative stages of wheat plant growth through post-heading. Absolute counts of midges per head were made at twilight [after 8 p.m.] by examining 10 randomly selected wheat heads for OWBM adults. Sweepnet sampling consisted of five 180° sweeps across the canopy at 10 randomly selected sites approximately 50-feet from visual samples; we sampled at two times each day: mid-afternoon [approximately 2 p.m.] and twilight.

Figure 2. Trap array, Boundary County 1999

Traps were made from either white or yellow colored 8-inch diameter disposable styrofoam dinner plates coated with a thin film of canola oil and placed vertically on stakes at plant canopy level [Figure 2]. We reasoned that oil would effectively ensnare the light-bodied adult midges while allowing heavier-bodied insects to escape and so simplify trap examination and insect identification by commercial wheat producers.

In addition to trap color, we also examined the effect of directional aspect (cardinal direction) on midge captures. There were two yellow-trap treatments(east vs west) and four white-trap treatments (north, south, east and west) arranged as a randomized complete block with 10 replications. Traps were scraped clean at each examination date.

RESULTS & DISCUSSION

Sweepnet sampling at twilight was the most accurate [most highly correlated] alternative to counting midges on wheat heads. The relationship between true midge density per head and sweepnet samples was described by the linear model [Figure 3]:

no. adult midges per head = 0.39 + (1.62)(no. adult midges per sweep)
[n = 8, $p > F = 0.03$, $r^2 = 0.56$]

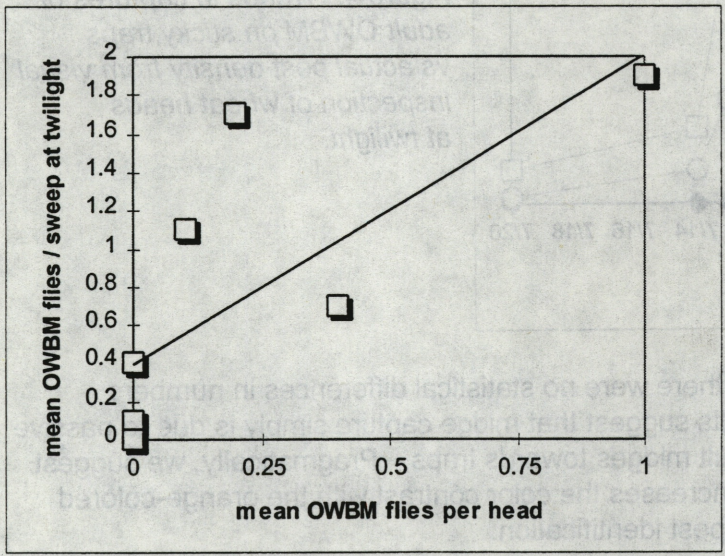

Figure 3. Relationship between adult midge density per sweep during twilight hours and midge density per wheat head; each data point is the mean of 50 sweeps and 10 plant inspections

The statistical model is useful because it can greatly simplify midge IPM decisions. Rather than visually inspecting wheat heads with a flashlight during twilight for the flighty, smaller-than-mosquito adult midges, growers instead more easily can make control decisions by sweepnet sampling. In particular, the linear model predicts that if <u>any</u> adult midges are collected in sweepnets, the infestation exceeds the economic threshold and insecticide application is justified for larval control. However, the degree of confidence that can be placed in a spray:don't spray decision is moderate at best; the r^2-value indicates that the statistical model only accounts for approximately half of the variability observed in midge densities per head. An additional season of field study is needed to refine the model before sweeping confidently can be recommended for OWBM control decisions.

In contrast to twilight samples, sweepnet sampling during daylight hours prior to dusk had no value for assessing OWBM fly densities. Mid-afternoon sweepnet sampling on 8 dates between 30 June and 20 July only detected a single adult fly. In contrast, twilight sweeping at the same field detected midges on 6 of 8 sampling dates. It seems that adult OWBM remain close to the soil surface during daylight hours where they escape collection by sweepnet, but then move to wheat heads at dusk where they easily can be collected.

Sticky traps proved to be simple-to-make, easy-to-use, and most importantly, highly sensitive detectors of adult midges. Traps captured midges when none could be detected by visually examining plants in the field [Figure 4]. In particular, captures continued approximately 10-days post-flowering when heads were no longer attractive to egg-laying females. Consequently, season-long correlations were poor between traps and actual midge density per head. Correlations between traps and true midge density were better when analyses were restricted to the period of wheat flowering. We recommend traps be used whenever the purpose of sampling is to assess midge presence:absence or to determine midge flight activity.

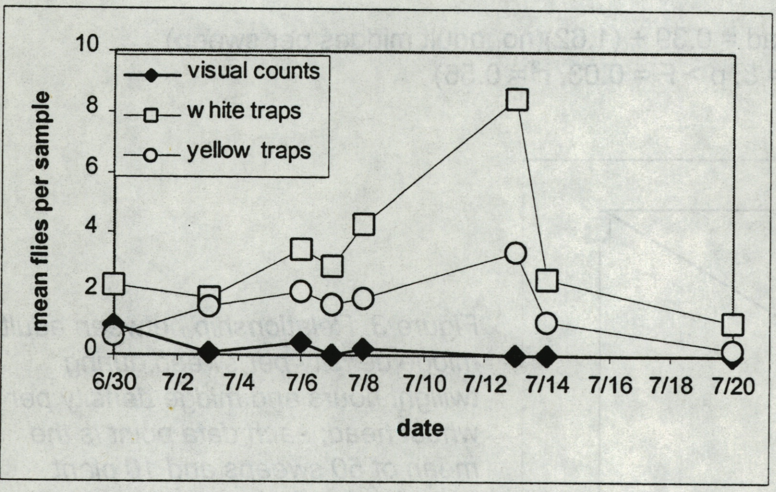

Figure 4. Trends in captures of adult OWBM on sticky traps vs actual pest density from visual inspection of wheat heads at twilight.

Trap color had no effect on fly captures; there were no statistical differences in numbers trapped on yellow vs white plates. Results suggest that midge capture simply is due to passive interception and not directed flight by adult midges towards traps. Pragmatically, we suggest wheat growers adopt white traps; white increases the color contrast with the orange-colored bodies of adult midges and so improves pest identification.

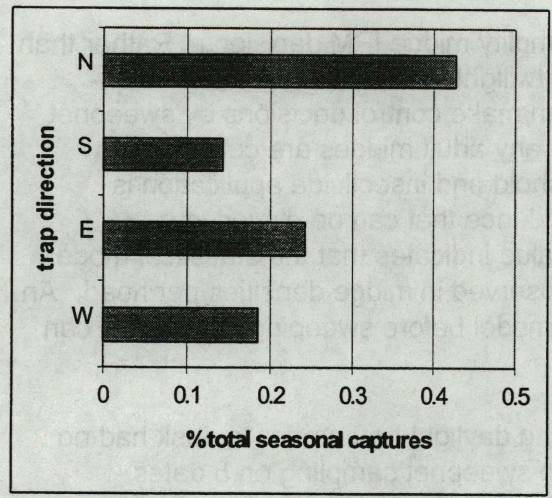

Figure 5. Midge captures on white traps as a function of cardinal direction.

Cardinal direction did influence numbers of flies trapped; traps that faced north captured the most midges while traps that faced south captured the fewest [Figure 5]. Hence, if the purpose of sampling is to determine if any midges are present (such as regional delimiting surveys), north-facing traps maximize the likelihood of pest detection. The most precise (least variable) density estimates were from west-facing traps while the least precise (most variable) were from east facing traps; pest densities were measured with ± 20% vs ± 34% precision, respectively. Hence, when sampling to monitor flight activity, west-facing traps are preferred.