ORANGE WHEAT BLOSSOM MIDGE

Ed Tanner

History in North East Saskatchewan

In 1982, there appeared to be a bumper crop on the horizon. A hard frost in the last week of August caused serious damage to the developing crop. Though there was a hard frost, many farmers harvested fairly good yields of frozen wheat. However, farmers in the Aylsham, Carrot River Area reported very poor yields on their fields and wondered why. Farmers felt there had to be another reason for such low yields.

Agricultural Representatives and Crop Specialists with the Saskatchewan Department of Agriculture and Research Scientists with the Canada Department of Agriculture examined these fields after harvest. Wheat plants from corners, swather misses and field borders were examined to find clues to the low yield. No signs of insect damage was found but the majority of the samples showed signs of the disease called Glume Blotch, which is part of the septoria complex. Plant Pathologists felt that it was unlikely that Glume Blotch could cause the type of yield reduction that farmers were claiming. However, plans were made to carry out a research program to monitor the effects of Glume Blotch in wheat in 1983.

In the spring of 1983, all the common varieties of wheat and four varieties of barley were grown in three disease variety demonstration plots and fields in the Aylsham Area. Disease symptoms and other factors affecting crop yields were observed. In late July, the Wheat Midge was discovered while surveying a field of wheat in the New Osgoode Area for the septoria complex. Within days it was found in all fields in the area and identified as a serious economic threat to wheat production. This was the first time that the Orange Wheat Blossom Midge had been found in economic numbers in the Prairie Provinces.

History in North America

The Orange Wheat Blossom Midge, Sitodiplosis mosellana, has world-wide distribution. It occurs in the British Isles, Ireland, Netherlands, France, Italy, Denmark, Sweden, Germany, Poland, Czechoslovakia, Hungary, Russia, China, Japan, Canada, U.S.A.

The Orange Wheat Blossom Midge was introduced into Quebec in 1828 or possibly a few years earlier. It spread southward into New York State, Vermont and eventually into Ohio. In 1854, estimated losses to the Midge were $15 million in New York State alone. Damage by the Midge continued sporadically in the U.S.A. and Ontario until 1900. After that, no serious problems occurred in Ontario and only occasional references to the Midge appear in publication.

In Western Canada, the Midge was reported in British Columbia in 1904. It spread southward into the U.S.A. and inland, causing serious damage in 1905 at Agassiz. Outbreaks occurred in the Okanagan Valley in 1937

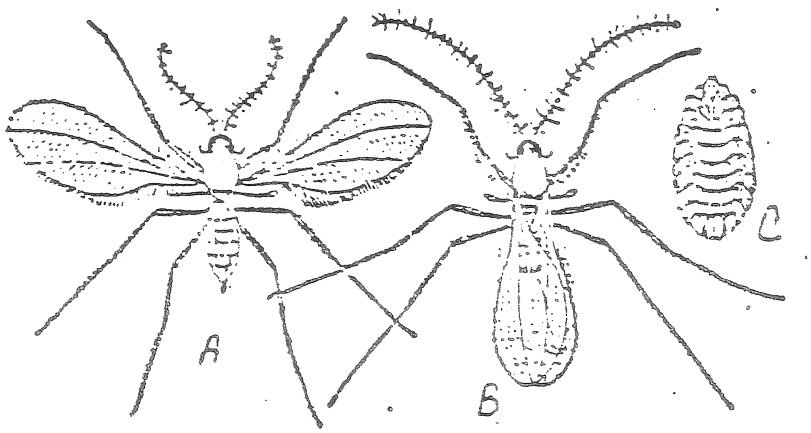
and to some extent in 1954. In the period of 1957-62 it was a continuous problem around Kersley, B.C. The only control recommended was to grow Winter Wheat, which matured early enough to escape attack.

In Manitoba, a moderate outbreak occurred in 1956-57. It ceased to be a problem until 1983 when it appeared again in the Swan River Area.

Description & Life History

The Midge adult is a delicate orange fly about three millimeters long. The adults begin to emerge from the soil about the last week of June. The males, which have a long feathery antennae, mate with the females at emergence and then die. Individual females live only about four days and lay forty to eighty eggs in a lifetime. Even though individual females live only a few days, female emergence from the soil takes place over a period of about three weeks. The most egg laying will occur shortly after the peak emergence of the flies.

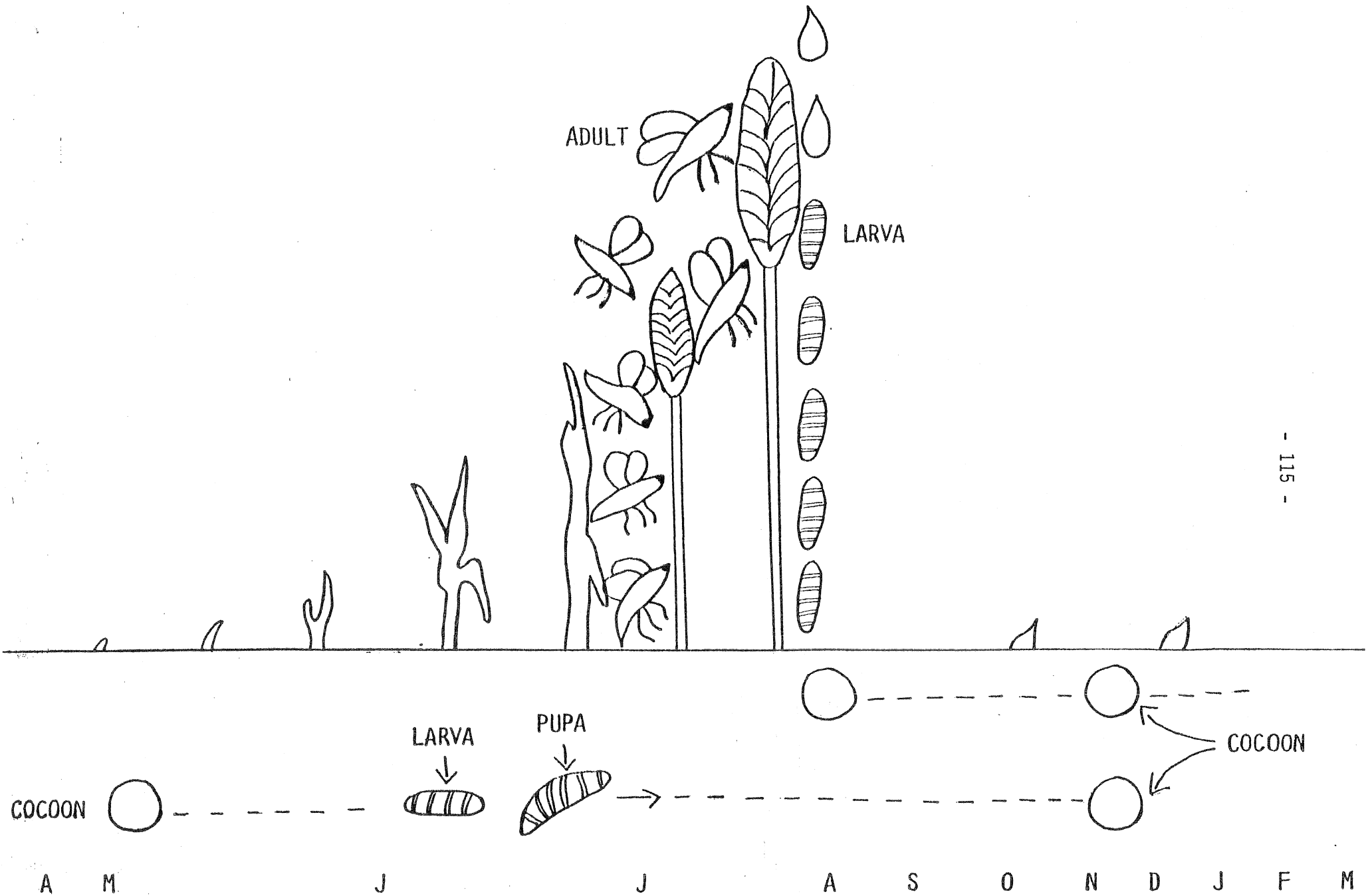
The females fly at dusk, seeking crops at the right growth stage on which to lay their eggs. They fly within or just above the crop and can travel about one kilometer. They do not fly at wind speeds over ten kilometers per hour or at temperatures below fifteen degrees Celsius.



A. Female Fly B. Male Fly C. Larva

Eggs are laid in florets that are clear of the 'boot' but have not flowered. Midges start laying on the lower ears in a crop at about six o'clock in the evening and work higher as the light fails. Egg laying continues until dark. The eggs are cylindrical and are laid within the floret. The Orange Midge also lays on the outside of the floret and on the glumes. Each female lays many batches of about four eggs (range 1-8) and under ideal conditions in the laboratory can lay 100 eggs or more.

CHART OF LIFE CYCLE



The time taken for the eggs to hatch depends on the mean daily temperature. It is more than 10 days at 15° C and less than four days at 20° C. The number of larvae in each floret varies from one to about twenty in the heaviest attacks. Normally, only one or two Orange Midge larvae survive from each egg batch. They feed for 2-4 weeks and grow to a length of about 3 mm. The mature larva retains its skin after the last moult and is paler than the other stages.

When fully fed, the larva leaves the ear, often after rain, and drops or crawls to the ground. It burrows a few centimeters down in the soil and spins a cocoon which is later buried more deeply by cultivation.

Not all larvae become adult in the next season. Most do so within three years but Orange Midges have been recorded emerging after 13 years in the soil. The reactivated larva leaves its cocoon and moves up near the soil surface to pupate. Emergence of adults is controlled by fluctuations in temperature and varies according to local climatic differences. It can occur within a week of pupation.

Natural Enemies

During the emergence of the adults and the return to the soil by the slow-moving larvae, a large proportion may be destroyed by predatory beetles or spiders. Several parasites lay their eggs within the egg of the Wheat Blossom Midges. About a week after the main Midge emergence, large numbers of these parasites may be found searching for Midge eggs. The most common is the wasp Leptacis tipulae (Kirby), which can exert useful control of Orange Wheat Blossom Midge populations. The egg of L. tipulae is laid within the Midge egg but remains dormant while the Midge larva feeds and overwinters. It hatches when the Midge larva becomes active in the spring. The parasite larva then rapidly consume the Midge larval tissue, pupating within the Midge larval skin. L. tipulae is most active during the late flowering stage of the crop. When there is a severe Midge infestation, the application of aphicides or late Midge sprays at this time should be avoided to protect the parasites.

Area of Infestation

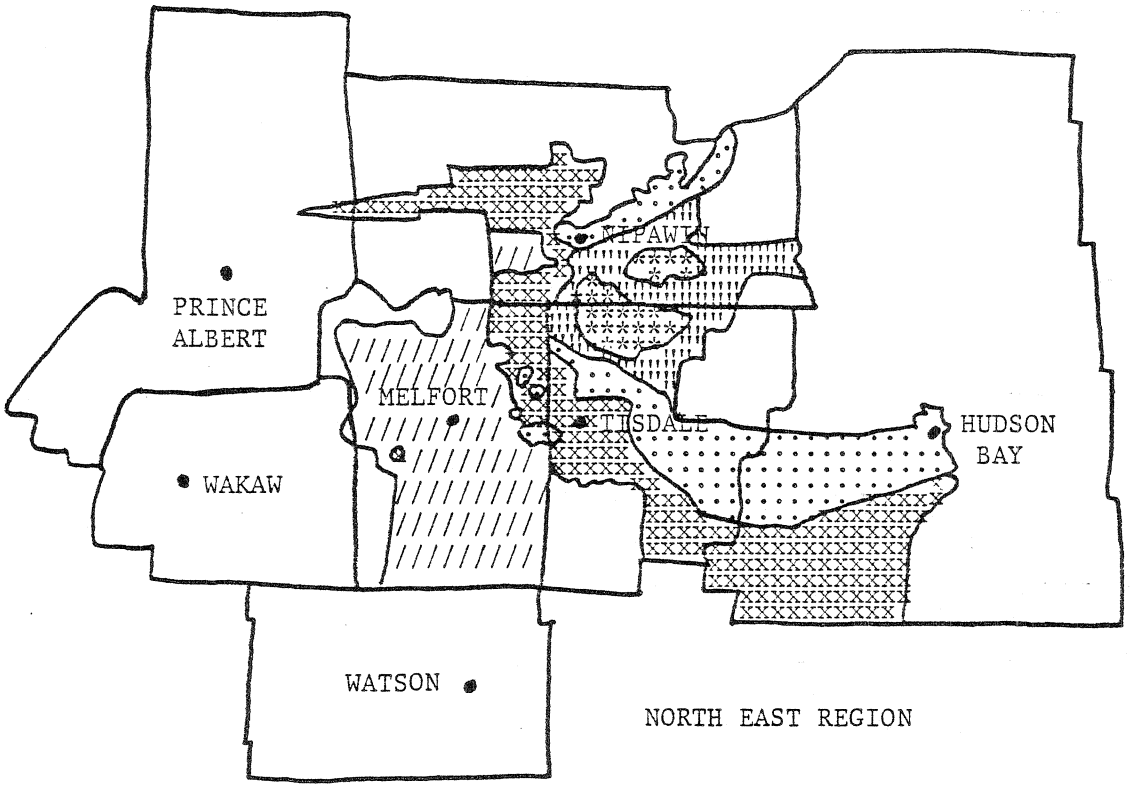
During August of 1983, staff of the Saskatchewan Department of Agriculture performed a survey of the infested area. An area of infestation was found from Canora to Meath Park, with the worst hit area being centered by the Town of Aylsham.

Refer to chart on following page.

It is apparent from the infestation map that there is a large area of relatively low numbers of Midge. This is probably the area that the Midge moved into in 1983. The very heavily infested area around Aylsham has probably been infested for at least two years. It is very hard to predict populations of these insects. If weather conditions are favourable for the Midge, their level and area of infestation will probably increase in 1984.

WHEAT MIDGE INFESTATION - 1983

% Kernels Infected



0 - 1	/ /// /
2 - 20	/ xxx /
21 - 50	/ ... /
51 - 70	/ ''''' /
71 - 100	/ *** /
Unsurveyed	/ /

Yield Losses at Aylsham

In 1983, there were plots at three farms in the Aylsham District. These plots were set up to demonstrate varietal difference to the septoria complex. These plots were heavily infested with the Wheat Midge. Lloyd Harris, Pest Control Specialist SDA, and Dr. John Doane, CDA, Saskatoon, sampled these plots to see if the Wheat Midge made any varietal selections.

WHEAT MIDGE SURVEY

Variety	Mean Kernels Per Head	Mean Larvae Per Head	Mean Larvae Per Kernel	% Kernels Infested
Neepawa	21	101.8	4.85	91.0
Manitou	25	125.0	5.00	92.5
Park	22	98.6	4.56	86.0
Selkirk	24	125.0	5.19	85.0
Sinton	34	145.9	4.28	83.3
Selkirk (d)	25	164.0	4.59	82.0
Pembina (d)	33	140.7	4.32	81.0
Katepwa	19	73.5	3.83	83.0
Glenlea	44	167.0	3.83	81.4
Pembina	23	110.0	4.72	82.0
Columbus	24	109.0	4.52	92.5
Benito	20	91.1	4.47	93.0
HY 320	29	103.1	3.54	81.0
HY 407	25	64.5	2.64	69.4
Neepawa (d)	23	94.3	4.14	85.0

* 100% of heads of all varieties were infested.

Rank of Wheat Yields

Variety	% Kernels Infested	Yield Bu/Acre
HY 407	69.4	28
HY 320	81.0	22
Glenlea	81.4	21
Pembina (d)	81.0	14
Selkirk (d)	82.0	14
Pembina	81.0	13
Selkirk	85.0	13
Columbus	92.5	12
Manitou	92.5	11
Katepwa	83.0	11
Neepawa	91.0	11
Neepawa (d)	85.0	9.5
Park	86.0	9.5
Sinton	83.3	9
Benito	93.0	7

Note: (d) denotes diseased seed

Tim Wright, CDA Melfort, harvested the plots and reported the preceding yields.

These yields compare very well with farmers' yields in the district or may be even higher than some have reported. It appears that the late maturing varieties (HY 320, Glenlea, Columbus) or early maturing varieities (Pembina, Selkirk) were able to miss the worst effects of the Wheat Midge. However, these varieties more than likely had a yield loss of over 50%. The late maturing varieties also have a severe frost potential in the North East.

According to the literature on the Wheat Midge, barley can be used as a host. Normally little damage is done to this crop. The following table supports these statements.

BARLEY

Variety	Yield	Infestation	
	(kg/ha)	(% Heads)	(% Kernels)
Johnson	3940	80	6.1
Norbert	3730	50	2.4
Bonanza	3500	20	2.6
Klages	3480	30	1.4
Elrose	3020	10	0.44

Johnston is a late maturing variety of barley. It appears to have been most susceptible to the Midge but that did not prevent it from being the highest yielding variety in the test. Based on this limited test, it appears as if barley won't be severely affected by the Wheat Midge.

Lesley McCallum, a registered seed grower at Aylsham, paid very close attention to their crop this year. They are experienced Winter Wheat growers and wanted to see if there was a difference in yields between Spring and Winter Wheat. The following table is provided by Lesley McCallum.

WINTER WHEAT

	1982 Seeding Date	Heading Date	Harvest Date	Yield bu/acre
Field 1	Aug. 22	June 26 to July 2	Aug. 18	48
Field 2	Sept. 4	June 28 to July 4	Aug. 23	51
Field 3	Sept. 12	July 2 to July 8	Aug. 30	30

	BENITO	NORSTAR
Seeding Date	May 8	Aug. 22, 1982
Heading Date	July 12	July 2
Harvest Date	Aug. 16	August 18
Yield (bu/acre)	20	40

Lesley McCallum had several comments on the fields, which I would like to quote from a report she gave at a Midge Meeting in Nipawin.

"The later developing crop was more susceptible to Midge damage, because the kernels are in the milk stage when the larvae are most active. Note that Field #3 headed out a full week later than the other fields. It would appear that Fields 1 and 2 were already in the soft dough stage when the Midge "hit" the crops with full force.

Field 3, however, was badly infested with Midge to be found on nearly every head. There was more seed damage here, which was evident when the seed was cleaned. Clean out was 25%, as opposed to 10% on the earlier fields. It yielded 22 bushels of clean seed and 8 bushels of screenings. The germination of the clean seed was 86%; probably indicating some damage to the germ end of the seed."

Lesley McCallum had the following comments on the field of Benito. *"It was harvested the same week as our Norstar; August 16 versus August 18. The final result was a 20 bushel crop of No. 3 CW Wheat. The certified Norstar yielded 48 bushels per acre of No. 1 HRW."*

Her conclusion from her 1983 experiences are: *"It is evident this year that the poorest field of Winter Wheat is considerably better than the average wheat crop in our district."*

Winter Wheat appears to have a place in an area that is infested with the Wheat Midge. Precautions must be taken so that maturity is not lengthened or severe yield reductions may take place.

Control Methods

Probably the easiest method to control the Wheat Midge is to avoid the pest until its numbers are low enough that it won't cause a problem.

There are many crops that can be planted as an alternative to wheat. Oilseed crops such as canola and flax are not affected. The legume crops such as peas and lentils are also not affected by the Midge. Forage crops for seed production have not been affected. Barley, while it can be attacked, showed no significant losses in 1983. Winter Wheat that was managed, to encourage early maturity appeared to escape the worst of the damage. But Winter Wheat is a perfectly acceptable host for Wheat Midge and under the right conditions, can have significant yield losses.

At present, there are no registered chemical products for control of the Wheat Midge in Canada. In Europe, which has more history of problems with the Wheat Midge, various compounds have been tried and some products

registered. These products are currently being researched to see if they may have an application in Canada. At present, it is expected that at least one chemical will be registered for emergency use in 1984.