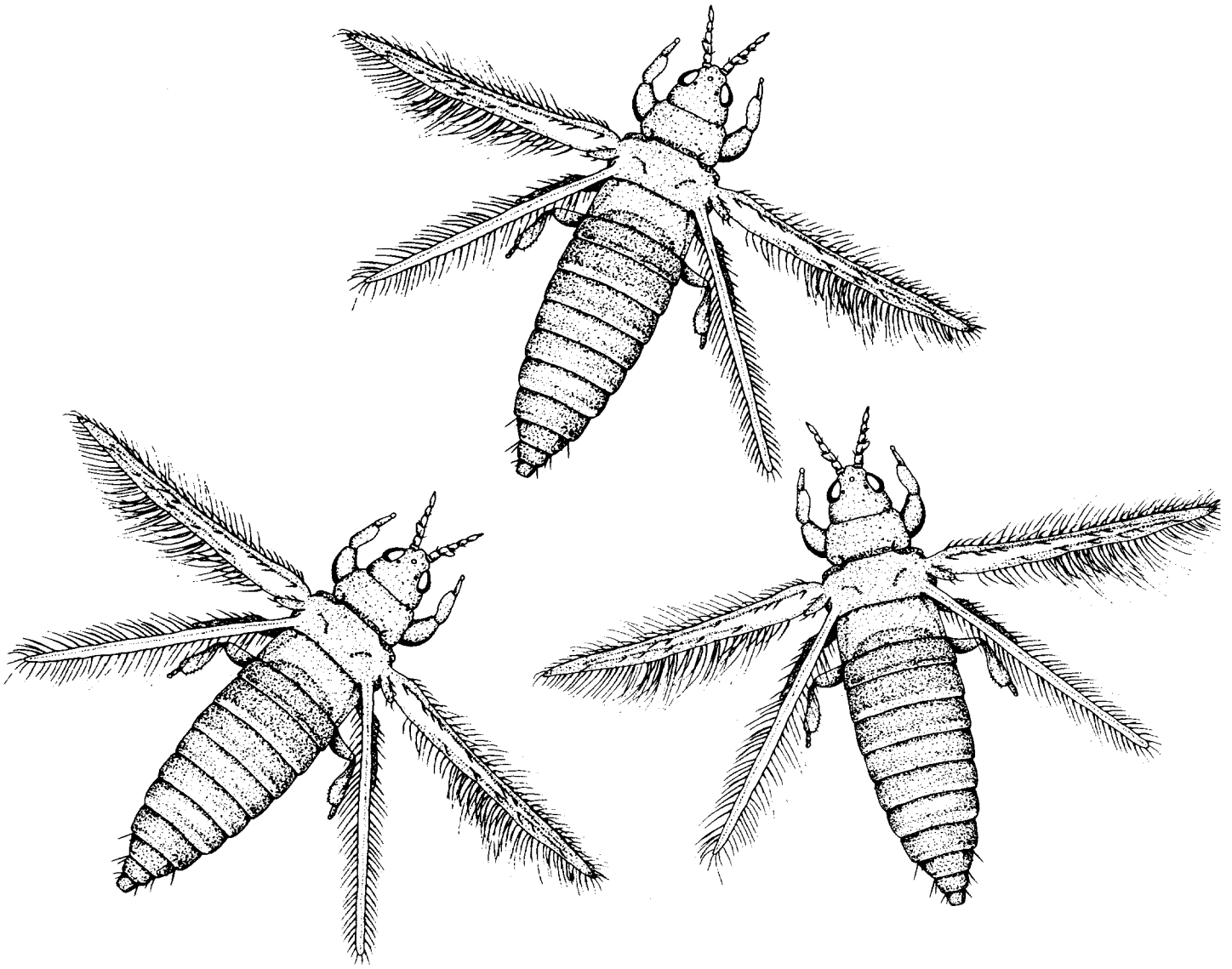
E-1007

Biology and Management of Barley Thrips

Barbara A. Bates
Graduate Research Fellow

Michael J. Weiss
Associate Professor

Dean K. McBride
Extension Entomologist



NDSU EXTENSION SERVICE
North Dakota State University, Fargo, ND 58105

MAY 1991

The barley thrips was first found in the United States in 1923 in New York. By 1946 barley thrips had reached North Dakota, and in 1951 large numbers were found in spring barley fields. Currently, barley thrips can be found from Canada to the central United States.

The barley thrips is native to Europe, parts of Asia, and Siberia. In Europe, it is frequently found on many cereal grains and wild grasses, but is considered to be of importance only on rye. In the United States, although it is found on rye and many other cereal grains, the barley thrips has only been reported damaging barley.

Descriptions

The adult barley thrips is very small, between 1.1 to 1.8 mm (0.04 to 0.07 in.) long and dark brown or black. A diagnostic characteristic is a toothlike projection on the third antennal segment **(see Figure 1).** This projection can be seen with the aid of a microscope or a magnifying lens. ▼

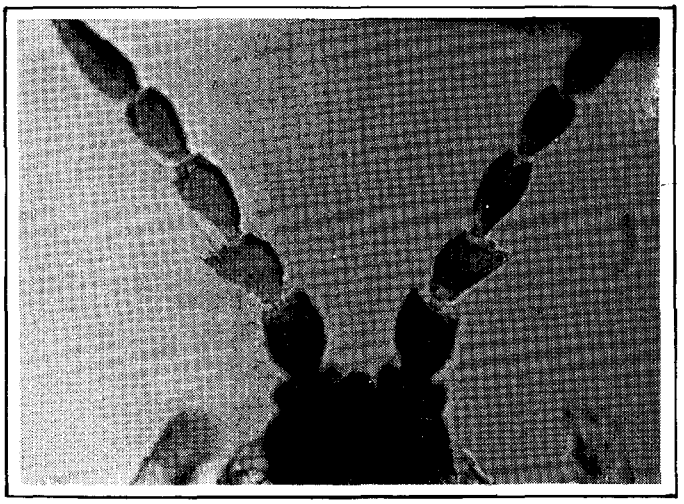


Figure 1. The antennae of an adult barley thrips. Note the tooth-like projection on the third antennal segment.

Adult Female. (Figure 2). Only the adult female is winged. The margins of the wings are fringed with long hairs. Fringed wings are characteristic of all thrips. Females range in size from 1.5 to 1.8 mm (0.06 to 0.07 in.) long. The shape of the abdomen is slightly pointed. ▼

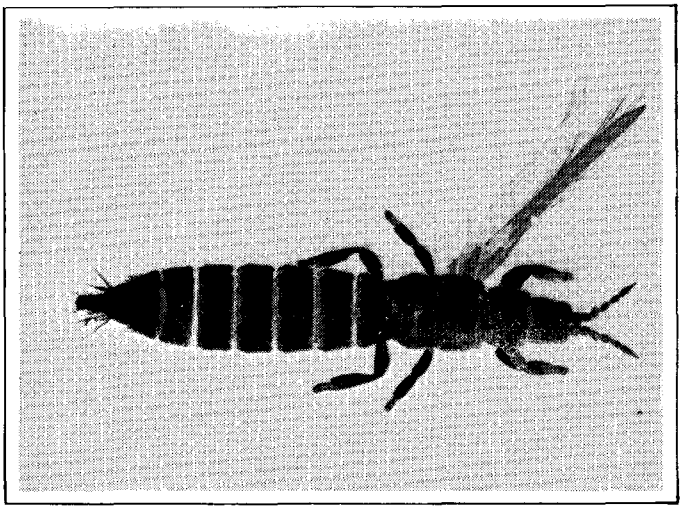


Figure 2. Adult female barley thrips.

Adult Male. (Figure 3). The average male is smaller than the female, ranging in size from 1.1 to 1.5 mm (0.04 to 0.06 in.) long. The male's abdomen is rounded compared to the female's. ▼

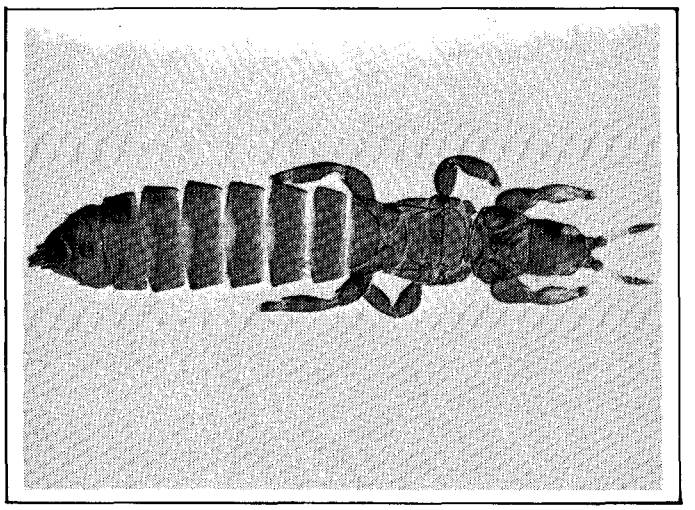


Figure 3. Adult male barley thrips.

Immatures. (Figure 4). Immature barley thrips superficially resemble the adults, but are smaller and white or green. Immatures are very hard to see on the plant due to their size and coloration. ▶

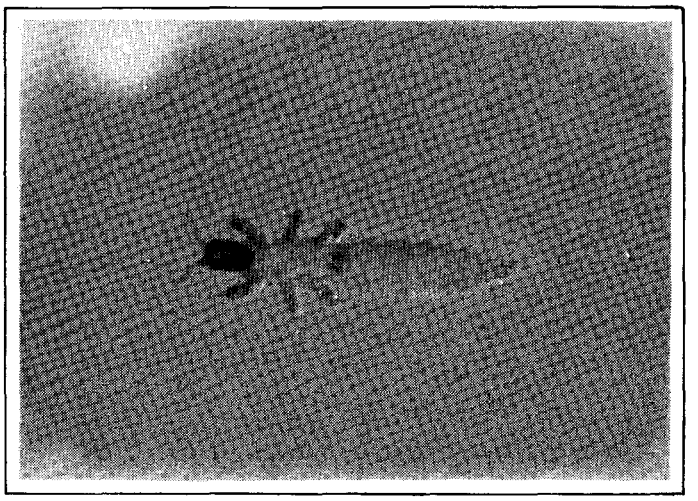


Figure 4. An immature barley thrips.

Life Cycle (Figure 5)

In mid to late May, female barley thrips move from overwintering sites to winter grasses (e.g., winter rye) or early spring grasses (e.g., spring barley), where they insert eggs into the inner tissue of upper leaf sheaths. On the average, one female barley thrips will deposit 20 eggs in a leaf sheath before moving to a new one. A female barley thrips deposits approximately 100 eggs during her lifetime. The eggs are very small and cannot be seen without the aid of a microscope. Eggs hatch in about three to 10 days. ▼

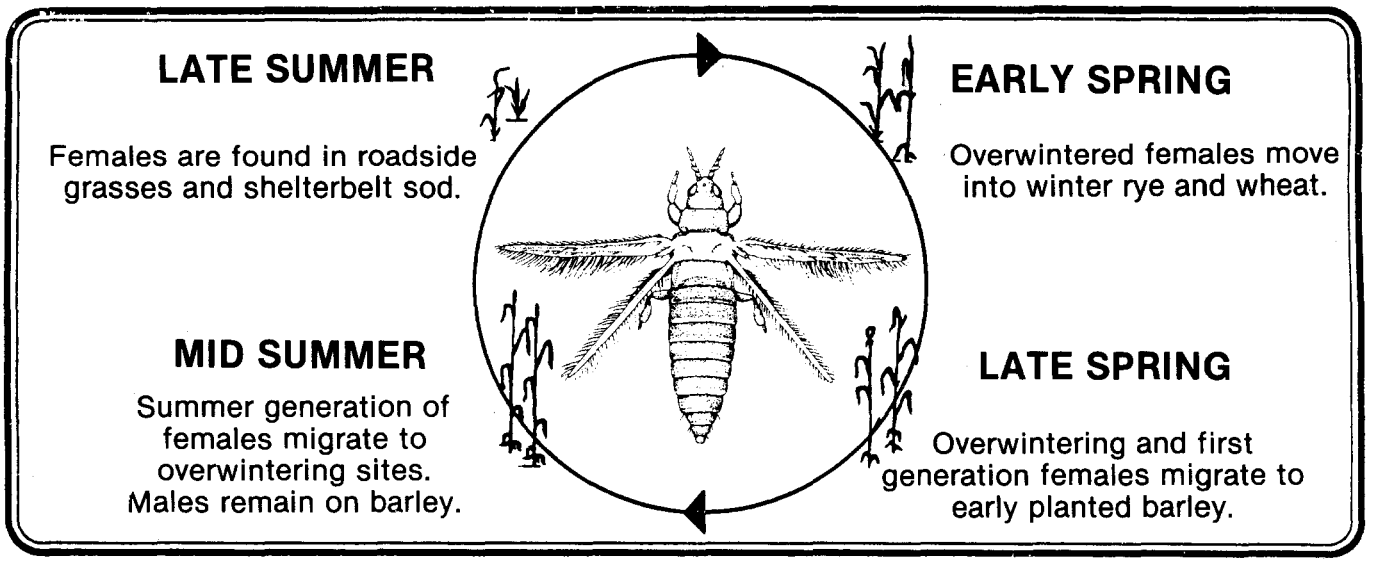


Figure 5. Life cycle of the barley thrips.

Once the eggs hatch, the barley thrips progress through four developmental stages. There are two larval stages lasting between 17 and 30 days followed by the prepupal and pupal stage. During these last two stages, the larvae are not active. The prepupal stage is very short lasting only a few hours to one day. The pupal stage lasts between two and six days.

By mid-June all developmental stages of the barley thrips can be found on barley. Males mature faster than females and mate only with immature (prepupal) females. Generally, females that mature in one summer will not deposit eggs until the following year. This is usually the case in North Dakota, resulting in only one generation per year. However, under ideal conditions, the newly matured females may deposit eggs the same year, leading to more than one generation developing in a single growing season.

Newly emerged adult females cannot immediately fly but must wait several hours. Once they are able to fly, females move to overwintering sites, completing this activity by the end of July. In North Dakota, barley thrips overwinter in shelterbelts and roadside sod near barley fields. Males, which cannot fly, remain on the barley and do not overwinter.

Damage and Economic Importance

Damage. In barley fields, a severe infestation of barley thrips may be detected by the appearance of whitened plants surrounded by healthy green plants **(Figure 6).** The bleaching or whitening of the upper leaves and stem is a direct result of the thrips feeding. Both immature and adult barley thrips feed by rasping the plant and sucking up the plant juices. This causes the plant to lose color and eventually senesce (dry up), giving the plant a bleached appearance **(Figure 7).** Severely infested plants may take on a characteristic goose neck shape. ▶

Figure 6. An infested barley field.

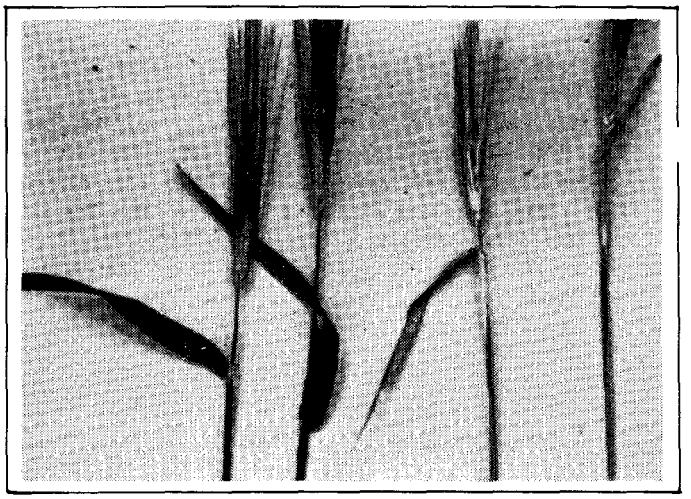


Figure 7. Typical appearance of infested plants. Healthy plants are on the left, infested ones on the right.

Economic Importance. Throughout the late 1950s and 1960s, the North Dakota Agricultural Experiment Station conducted studies to determine the economic importance of barley thrips on barley. Results from these studies indicated that an infestation of one adult thrips per stem resulted in the loss of 0.4 bushel per acre. Studies also showed that an infestation of barley thrips can reduce test weight and kernel plumpness. A study conducted in England has shown that barley thrips will feed on pollen, which may result in reduced seed germination.

Management

Sampling. Sampling for barley thrips should be initiated when the flag leaf is first visible and continue until the head is completely emerged from the boot. Barley thrips, like many insects, exhibit an "edge effect." That is, there are usually more thrips near protected field margins than other areas of the field. Therefore, samples should be taken from all areas of the field, and at least 50 feet from any edge.

Past sampling plans for treatment recommendations are unproven and not reliable for accurate treatment decisions. A new sampling plan has been developed using sequential sampling. Sequential sampling plans generally require fewer samples and take less time than sampling plans using a fixed number of samples.

To make the sequential sampling plan more responsive to fluctuations in the cost of control and market value of barley, sampling plans should be formulated for a grower's specific needs. An explanation of how to formulate your own sampling plan is contained on the following pages. If you do not have access to a computer or would like help formulating your sampling plan, contact your county agent. A video tape titled "Sampling Procedures for Barley Thrips" can be obtained by contacting your county extension agent or the NDSU Extension Service.

Sampling Barley for Thrips. Most barley thrips can be found under the top two leaf sheaths, although a few may be crawling on the outside of the sheath. To count the number of thrips on a stem, first break off the plant at the second node from the top. Run your thumbnail between the two edges of the sheath at the collar and slowly unroll the sheath away from the stem **(Figure 8).** It is best if you examine stems with your back to the wind to prevent the thrips from being blown off the plant. The adult thrips should be easy to see running up and down the underside of the sheath. Make sure you examine the area around the joint and collar. Also, examine the head, if it is present, especially around the developing kernels. ▶

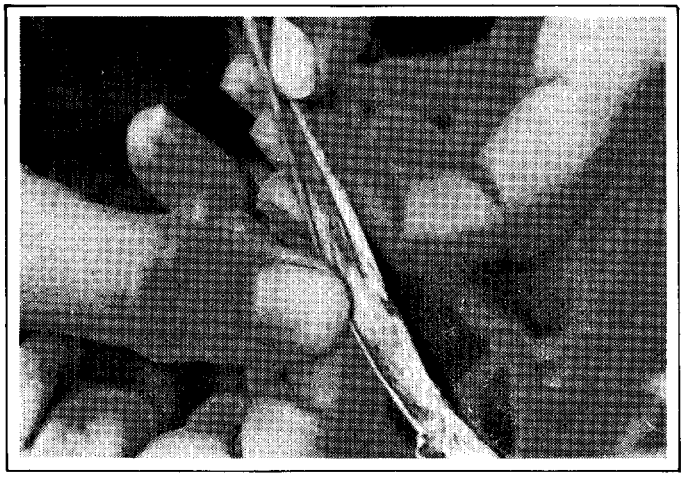


Figure 8. How to sample an individual barley stem.

Formulating Your Own Sequential Sampling Plan

1. **Determine the field's threshold.** To calculate the threshold, you must know the cost of control (cost of the insecticide and application cost), the expected per bushel dollar value of the barley, and the bushels lost due to one thrips/stem (estimated at a constant 0.4). The threshold is the cost of control divided by the expected bushel dollar value which is then divided by 0.4.

$$\text{THRESHOLD} = \frac{\text{Cost of control/expected dollar value per bushel}}{0.4}$$

2. **Determine the stop lines.** The sequential sampling plan relies on two stop lines. When the population of thrips is at or below the lower stop line, treatment is not recommended. When the population is at or above the upper stop line, treatment is recommended. When the population is between the two lines, more samples must be taken in order to make a decision. To use the sequential sampling plan, you must calculate five stopping points (9, 18, 27, 36, and 45) on both the upper and lower line. The calculations to determine the five stopping points are easily accomplished with a hand-held calculator.

To calculate the UPPER STOP POINTS

1. Multiply the number of stems (9, 18, 27, 36, and 45) by your field's threshold (see part 1).
2. Multiply 1.69 by the threshold.
3. Multiply 0.42 by the threshold squared.
4. Add the values from steps 2 and 3 together.
5. Multiply the number of stems sampled by the value from step 4.
6. Take the square root of the value in 5 and multiply it by 1.645.
7. Add the values from step 6 to the value from step 1.
8. The number of thrips for the upper stop limit is equal to the value obtained in step 7.

To calculate the LOWER STOP POINTS

1. Repeat steps 1 through 6.
2. Subtract the value obtained in step 6 from the value obtained in step 1.
3. The number of thrips for the lower stop limit is equal to the value obtained in step 2.

EXAMPLE: The cost of control is $4.50/acre and the expected return is $3.50/bushel.

$$\text{Threshold} = \frac{4.50/3.50}{0.4} = 3.21$$

Upper Limit

1. Number of stems = 9, 9 x 3.21 =	28.89
2. 1.69 x 3.21 =	5.42
3. 0.42 x 10.30 = (10.30 = 3.21 x 3.21)	4.32
4. 5.42 + 4.32 =	9.74
5. 9 x 9.74 =	87.66
6. 1.645 x 9.36 =	15.39
7. 28.89 + 15.39 =	44.28

8. Number of thrips for the upper limit = 44 when the number of stems to be sampled equals 9. **REPEAT** the process using the number of stems to be sampled equal to 18, 27, 36, and 45.

Lower Limit

1. Number of stems = 9, 9 x 3.21 =	28.89
2. 1.69 x 3.21 =	5.42
3. 0.42 x 10.30 = (10.30 = 3.21 x 3.21)	4.32
4. 5.42 + 4.32 =	9.74
5. 9 x 9.74 =	87.66
6. 1.645 x 9.36 =	15.39
7. 28.89 - 15.39 =	13.50

8. Number of thrips for the lower limit = 14 when the number of stems to be sampled equals 9. **REPEAT** the process using the number of stems to be sampled equal to 18, 27, 36, and 45.

3. Divide the field into nine equal sections and count the number of adult thrips on one stem in each section. Maintain a running total of the number of adult thrips found on each stem. After sampling one stem from each section of the field, compare your total with the values you calculated in part 2 of this section. If the total number of adults is greater than or equal to the number on the upper stop line, treatment is suggested. If the total adult count is less than or equal to the number on the lower stop line, treatment is not suggested. If the total falls between the upper and lower limit, another nine stems should be examined. Add the total number of thrips found on your second set of nine stems to the number from your first set. Compare this value to the value you calculated for 18 stems in part 2 of this section. This process may be repeated until a total of 45 stems have been examined. If after you have sampled 45 stems you have not reached a treatment decision, wait 24 hours and sample your field again. Also, if no treatment is suggested, the field should be sampled every few days until heading because thrips populations can increase rapidly over a short period of time.

Control. Studies conducted in North Dakota have shown that treatment of barley for barley thrips is only effective if applied before heading is complete. Treatment after heading has not demonstrated a yield increase. Currently, the only insecticides labeled for barley thrips control on barley are ethyl and methyl parathion at 4-6 oz active ingredient per acre. These chemicals are extremely toxic and can only be applied by an aerial applicator. Furthermore, fields treated with ethyl parathion must not be entered for three days following application, and not for 48 hours after methyl parathion is applied. Fields must be posted with warning signs when either chemical is used.

References

Boivin, G. & C. Vincent. 1983. Sequential sampling for pest control programs. Project no. 923, Saint-Jean-sur-Richelieu. Research Branch Ag. Canada.

Bournier, A. 1956. Contribution a l'etude de la parthenogenese des Thysanopteres et de sa cytologie. Arch. Zool. Exp. Gen. 93:280-292.

Herrick, G.W. 1924. The genus *Limothrips* in America. Ann. Entomol. Soc. Am. 17:231-232.

Holtmann, H. 1963. Utersuchungen zur biologie der getreide-Thysanopteren. Z. Agnew. Entomol. 51:1-41.

Koppa, P. 1967. The composition of the thrips species in cereals in Finland. Ann. Agric. Fenn. 6:30-45.

1970. Studies on the thrips (Thysanoptera) species most commonly occurring on cereals in Finland. Ann. Agric. Fenn. 9:191-265.

Oakley, J.N. 1980. Damage to barley germination by *Limothrips* spp. (Thysanoptera: Thripidae). Pl. Pathol. 29:99 (abstr.).

Post, R.L. 1955. The barley thrips in North Dakota. ND Seed J. 24:2-3.

1958. A new pest on the northern plains: barley thrips. Dakota Farmer 78:30-31.

Post, R.L., W.J. Colberg. 1958. Barley thrips in North Dakota. ND State Ext. Cir. A-292.

Post, R.L., R.G. Helgeson. 1966. Barley thrips. ND Seed J. 35:3.

Post, R.L., D.K. McBride. 1966. Barley thrips biology and control. ND State Ext. Cir. A-292 (Rev.).

Helping You Put Knowledge To Work

NDSU Extension Service, North Dakota State University of Agriculture and Applied Science, and U.S. Department of Agriculture cooperating. William H. Pietsch, Director, Fargo, North Dakota. Distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. We offer our programs and facilities to all persons regardless of race, color, sex, religion, age, national origin, or handicap; and are an equal opportunity employer. 3M-5-91