Varietal Resistance to Onion Thrips (Thysanoptera: Thripidae)[1] in Processing Cabbage

A. M. SHELTON,[2] R. F. BECKER,[3] AND J. T. ANDALORO[4]

New York State Agricultural Experiment Station, Cornell University, Geneva, New York 14456

ABSTRACT

J. Econ. Entomol. 76: 85–86 (1983)

Resistance to *Thrips tabaci* Lindeman injury in processing cabbage was observed among the 16 varieties tested. Although all varieties had some injury, 'Titanic 90' and 'Blue Boy' were the least susceptible, with only a few, slight feeding patches on 2 to 3 of the outer 10 leaves of the head. 'Hinova' and 'NKX 9035' were the most severly damaged varieties and had >90% of their outer leaves severely injured by thrips. Differences in susceptibility could not be attributed to high dry-matter quality or date of maturity.

In the last 2 years, the onion thrips, *Thrips tabaci* Lindeman, has become a serious insect pest of processing cabbage in upstate New York. Thrips feed on the leaves causing a bronze color and rough texture. Damage occurs in patches and has been observed on the leaves of the outer third of the head.

Processed (sauerkraut) cabbage must conform to USDA standards which require it to be "practically free from defects and blemishes" (Anonymous 1967). Furthermore, since the Food and Drug Administration (FDA) has not established a defect action level, processors have invoked a tolerance of zero insect contaminants to avoid any discretionary seizure by the FDA. Studies conducted at Geneva to determine onion thrips damage and contamination in sauerkraut revealed that both occur at detectable levels, although such levels are much less than would be predicted from examination of fresh cabbage (Shelton et al. 1982).

The current practice of frequent applications of foliar insecticides has not been effective in preventing thrips infestations within the head. In light of this, as well of as economic, social, and environmental concerns, other control tactics must be investigated for processing cabbage to meet USDA and FDA standards. Varietal resistance in onions to onion thrips has been documented by Jones et al. (1935), Lall and Verma (1959), and Coudriet et al. (1979). This study examined susceptibility to onion thrips of 16 commercial and trial varieties of processing cabbage.

Materials and Methods

Experiments were conducted during 1981 at Vegetable Research Farm near Geneva, N.Y. Greenhouse-grown plants of 16 varieties were transplanted on 2 June. Plots were composed of a single row of 30 plants, and rows were spaced 0.9 m apart with plant spacing of 41 cm. A fallow alleyway of 2 m separated replicates. Plots were replicated three times in a randomized complete block design. Standard herbicide and fertilization practices were employed. One application of chlorpyrifos at 1.12 kg of AL/ha was used as an over-the-row spray for the control of cabbage maggot. Two applications (24 July, 10 August) of a combination of *Bacillus thuringiensis* Berliner (0.56 kg of AI/ha) and methomyl (0.50 kg of AI/ha) and one application (19 August) of *B. thuringiensis* (1.12 kg of AI/ha) were applied for control of Lepidoptera.

Varieties matured at different times and each was harvested and scored during its period of optimum maturity (one to three sampling dates). Harvest data were taken on 27 August, 16 and 25 September, and 9 and 29 October. At each harvest, three sound heads per replicate of a maturing variety were cut in half along the core axis. One-half of each head was examined for thrips injury by peeling back each of the outer 10 leaves. Leaves were scored for the presence or abscence of thrips injury. Additionally, each half was qualitatively scored for thrips injury on a scale of 0 (no injury) to 4 (severe injury). This scale was based on the extent to each leaf as well as the number of leaves which had injury. A rating of 4 typically had all 10 leaves damaged, with each leaf having ca. 40% of its surface injured.

For analyses, only data from the one peak maturation date were used. Mean separation tests were performed on numbers of leaves injured and qualitative damage scores. Regression analysis relating damage scores to number of leaves injured was also performed.

Results and Discussion

Although no variety was immune from thrips injury, there were marked differences in the degree of susceptibility (Table 1). 'Titanic 90' and 'Blue Boy' received the lowest damage ratings and incurred only few and slight feeding patches on 2 to 3 of the outer 10 leaves. In these cases, it was only by careful examination that injury could be detected. 'Roundup' and 'King Cole,' both major processing varieties in New York, received slightly higher damage ratings, although differences between 'King Cole' and the previous varieties were not significant. Varieties with damage ratings ≥3 typically had nearly 70% of their inspected leaves damaged by thrips and damage to each leaf was very apparent. Varieties which had damage ratings >3.5 ('Hitoma,' 'Hybrid N,' 'NKX 9035,' and 'Hinova') had >80% of the inspected leaves severly injured by thrips.

The qualitative damage rating compared favorably to the quantitative assessment of number of leaves injured

[1]Approved by the Director, N.Y. State Agric. Exp. Stn., for publication as Journal Paper No. 34261. Received for publication 30 March 1982.

[2]Dept. of Entomology.
[3]Dept. of Seed and Vegetable Sciences.
[4]Vegetable IPM Program.

0022-0493/83/0100-8502$02.00/0

Table 1.—Relative susceptibility to onion thrips in processing cabbage varieties, Geneva, N.Y., 1981

Variety	Date of maturity	Damage rating[a,b]	No. of injured leaves[b,c]
'Hinova'	29 Oct.	3.90a	10.00a
'NKX 9035'	27 Aug.	3.67ab	9.33ab
'Hybrid N'	16 Sept.	3.63abc	8.23bcd
'Hitoma'	29 Oct.	3.57abc	10.00a
'Hancock'	27 Aug.	3.43abc	7.03de
'Bejo 1002'	16 Sept.	3.43abc	9.33ab
'Krautpacker'	25 Sept.	3.07bcd	8.67abc
'FM 142'	16 Sept.	3.00cd	6.67e
'Superette'	16 Sept.	2.53d	6.63e
'ACX 502'	25 Sept.	2.53d	7.67cde
'Roundup'	25 Sept.	1.67e	4.67f
'King Cole'	27 Aug.	1.57ef	3.87fg
'Falcon'	29 Oct.	1.20ef	2.43gh
'NKX 929'	27 Aug.	1.10ef	3.47fgh
'Blueboy'	9 Oct.	1.00f	2.00h
'Titanic 90'	25 Sept.	1.00f	3.13fgh

[a]Scale: 0 = none, 4 = severe (see text).
[b]Column means with similar letters are not significantly different at 5% level, by Duncan's multiple range test.
[c]Based on outer 10 head leaves from head cut in half along core axis.

($r^2 = 0.84$, 46 df). This suggests that the former method can be used to accurately assess overall susceptibility. Date of maturity appeared to have little influence on the degree of susceptibility, since, for example, 'NKX 9035' was very susceptibile but had the same maturation date as the less susceptible 'NKX 929.' Also, differences in susceptibility could also not be strictly attributed to the high dry-matter quality of the variety. This characteristic is considered important in processing varieties because it promotes minimum waste during processing. Varieties which are noted for the high dry-matter characteristic, especially 'Hinova,' 'Hitoma,' and 'Falcon,' had marked differences in susceptibility. No observed plant growth factors could solely account for differences in susceptibility.

These data on varietal susceptibility agree with observation in unreplicated commercial fields of different varieties grown under similar conditions and insecticidal control strategies. Processors have encouraged increased acreage in 'Hinova' and 'Hitoma' by offering a bonus because of their high dry-matter quality and minimum loss of leaves during harvesting. However, growers near Geneva who have used these varieties have incurred more injury by thrips, even with a 7- to 10-day schedule of insecticide applications.

These data suggest that plant resistance is a feasible component in the solution to the problem of thrips on processing cabbage. This, combined with the establishment of a reasonable defect action level by FDA (Shelton et al. 1982), should eliminate much of the ineffective spraying for control of thrips which we have witnessed in the past 2 years.

REFERENCES CITED

Anonymous. 1967. United States Standards for Grades of Bulk Sauerkraut. Source: Fed. Reg. 7568.

Coudriet, D. L., A. N. Kishaba, J. D. McCreight, and G. W. Bohn. 1979. Varietal resistance in onions to thrips. J. Econ. Entomol. 72: 614–615.

Jones, H. A., S. F. Bailey, and S. L. Emsweller. 1935. Field studies of *Thrips tabaci* (Lind.), with special reference to resistance in onions. Ibid. 28: 678–6180.

Lall, B. S., and S. K. Verma. 1959. Variability of resistance in onion varieties against the onion thrips, *Thrips tabaci* (Lind.). Sci. Cult. 24: 575–576.

Shelton, A.M., J. R. Stamer, W. T. Wilsey, B. O. Stoyla, and J. T. Andaloro. 1982. Onion thrips damage and contamination in sauerkraut. J. Econ. Entomol. 75: 492–494.