The 9th Symposium on Analytical and Environmental Problems, Szeged, 30 September 2002

MEANS OF ENVIRONMENT-FRIENDLY PROTECTION OF WHITE CABBAGE AGAINST THE ONION THRIPS

József Fail, Béla Pénzes and **Krisztina Hudák**

Szent István University, Faculty of Horticultural Sciences, Department of Entomology, Ménesi út. 44., H-1118 Budapest, e-mail: FAIL@OMEGA.KEE.HU

ÖSSZEFOGLALÁS

Mivel fejes káposzta állományokban a fejesedés kezdetétől mind a kémiai, mind a biológiai védekezés szabadföldön hatástalannak bizonyult a dohánytripsz (*Thrips tabaci* Lind.) ellen, ezért a lehetséges védekezési módok köre ellenálló fajtákra és az időzített termesztésre szűkült. Az utóbbi két módszer létjogosultságát támasztják alá megfigyeléseink. 2001-ben 43 fejes káposzta-fajta ellenállóságának felmérésére került sor szabadföldi körülmények között, a dohánytripsz spontán betelepedése mellett kialakuló kártétel mértéke alapján. Minden fajta károsodott kisebb-nagyobb mértékben. Az Autumn Queen F_1, Balashi F_1, Riana F_1, Ammon F_1 és Quattro F_1 fajták károsodtak a legkevésbé, így rezisztens minősítést kaptak. Az időzített termesztés kártételt mérséklő hatását több augusztusban és az ősz folyamán is értékelt fajta a későbbi időszakban megfigyelt kisebb károsodása szemlélteti. A rendkívül ellenálló Autumn Queen F_1 fajta esetében az időzítésnek nem volt kimutatható hatása a kialakult csekély kártételre.

INTRODUCTION

In Hungary the onion thrips (*Thrips tabaci* Lind.) was first observed damaging white cabbage (*Brassica oleracea* L. convar. *capitata* [L.] Alef. var. alba [DC.]) outdoors in the early 1980s [5]. Since then, it has become one of the main obstacles in the development of quality cabbage growing in Hungary and in several regions of the world. Thrips injury appears as bronze discoloration and rough texture on the head leaves and results in cabbage that does not meet fresh market standards [6]. According to North and Shelton, all stages of thrips can be found in the mature head [7]. This coincides with our own observations [2]. After head formation has started, onion thrips colonise the cabbage plant in mass from other hosts, including alfalfa, red clover [14] and amongst many others all kinds of onion [3].

The use of insecticides results in poor control of onion thrips on cabbage [1], and the release of predatory mites on cabbage fields does not give adequate control either [4]. Based on extensive research, Shelton stated that the primary control for thrips damaging cabbage should be the selection of tolerant varieties [17] although the timing of planting is also a possible mean of protection, as it can reduce the damage [18]. Field trials have been carried out in order to asses the resistance of several cabbage varieties against onion thrips. The screening method has been based on either the extent of the injury observed on leaves [8,9,10,11,12,13], or on both the extent of the injury and the number of thrips collected [15,16,19]. The effect of timed growing under our climatic conditions has not been illustrated by thorough observations.

In this presentation, we aimed to emphasize the significance of varietal resistance as well as to draw attention to the possible effect of timed growing on the rate of damage.

MATERIALS and METHODS

Field screening tests were carried out at three stations (Tordas, Fertőd and Szarvas) of the National Institute for Agricultural Quality Control (NIAQC) in 2001. Greenhouse-grown plants of 43 varieties were transplanted outdoors from May until July. Plots were composed of 5 rows of 14 plants, spaced 0,5 by 0,5 or 0,6 by 0,6 or 0,7 by 0,6 m apart. Plots were replicated twice in a randomised complete block design with an alleyway of 2 m separating replicates. Standard herbicide and fertilization practices were employed. Plants were treated by pesticides against pests and diseases. Varieties matured at different times and each was screened during the period of its optimum maturity. One variety was sampled only once by evaluating the thrips injury observed only on the head leaves of 5 randomly chosen plants per replicates. For this purpose, a six-degree damage rating scale was elaborated based on the extent of the symptoms appearing on the leaves:

0 - No damage
1 - Few rough brown blisters, less than 10 % of the leaf is covered
2 - Blisters covering not more than 1/3 of the leaf
3 - Blisters covering not more than half of the leaf
4 - Blisters covering not more than 3/4 of the leaf
5 - Blisters covering more than 3/4 of the leaf.

Leaves were evaluated and pealed off the head one after the other until three consecutive leaves showed no damage. The extent of damage (ratings of the scale) and the number of the leaf (the first one being the outer, the second being the one below it and so on) on which it was observed were noted. In order to exclude subjectivity the vast majority of the evaluation procedure was done by the same person. Varieties were code-named therefore unknown at the time of observation. For analyses, the ratings for each leaf were multiplied by the square root of the leaf-number. One head was represented by the sum of these values. Analysis of variance was performed on cumulated damage ratings for separate groups of varieties screened roughly at the same time. Varieties of the same group were compared in pairs by Games-Howell tests.

RESULTS

Sampling data were divided into 6 groups based on the date of the observation. Varieties assessed at the same time (with deviation no longer than two weeks during the summer months) were mounted into one group. The susceptibility of varieties was compared only within groups. The greatest differences between the varieties were found during July and August in the 2nd, 3rd and 4th group (Table 1). The values in the column "Cumulated damage" - expressing the susceptibility of varieties - were counted as the statistical average of the cumulated damage ratings counted for each observed head with 10 replicates for every variety. The higher values indicate susceptibility, whereas the lower ones mean resistance.

Three varieties assessed in two locations (Fertőd and Szarvas) at the same time showed no difference in the rate of damage (Table 2). Although the variety 'Autumn Queen' was damaged to the same extent in October as in August, in case of 'Ama-Daneza' the observed damage in November was significantly smaller than that in August.

Varieties moderately or severely damaged in August, when growing later - although at another venue - suffered significantly smaller damage (Table 3).

CONCLUSIONS

Although no varieties were found absolutely resistant to thrips injury, there were significant differences in the degree of susceptibility. The injury occurred as a result of natural infestation. Since there were adjacent onion fields to our cabbage plots (some of them were overwintering), we could expect a great number of thrips invading to the cabbage field. Assuming that the onion thrips pressure was uniform in each section at the venues, we must conclude that this phenomenon was due to varietal resistance. The varieties 'Autumn Queen', 'Balashi', 'Riana', 'Ammon' and 'Quattro' were appointed as resistant ones. These varieties suffered far less damage than the most susceptible ones. Our observations confirm the justification for the growing of resistant varieties as a possible mean of successful protection against the onion thrips.

Table 1. Comparison of the damaged varieties assessed in Tordas.

Varieties	Time of assessment	Cumulated damage♦	St. d. ˣ	Varieties	Time of assessment	Cumulated damage♦	St. d. ˣ
3rd group				**2nd group**			
Hurricane	17 August	72,4 **a**	17,0	Green Gem	27 July	110,4 **a**	14,8
Geronimo	17 August	82,1 **ab**	32,3	Consul	27 July	73,3 **a**	31,5
Quisto	3 August	39,8 **bc**	9,0	Farao	20 July	31,5 **b**	10,1
Sutri	10 August	38,5 **bc**	12,4	Marcello	27 July	31,8 **bc**	13,0
Quisto	17 August	35,8 **bc**	13,6	Pandion	20 July	24,2 **bcd**	10,3
Bronco	10 August	31,3 **cd**	15,1	Júniusi óriás	13 July	20,7 **bcd**	10,4
Fieldforce	3 August	13,8 **de**	7,0	Surprise	13 July	16,6 **cd**	6,8
Ducati	3 August	9,6 **de**	4,9	Histona	27 July	13,3 **d**	6,3
Ama-Daneza	17 August	10,1 **defg**	6,3	**4th group**			
Agressor	17 August	7,3 **e**	2,4	Vestri	29 August	48,6 **a**	19,8
Leopard	10 August	6,6 **ef**	3,0	Sutri	29 August	47,0 **a**	11,0
Quattro	17 August	3,8 **efg**	1,6	Azan	10 September	23,4 **b**	9,2
Matsumo	3 August	6,4 **efgh**	4,0	Triptor	29 August	19,3 **b**	7,0
Riana	10 August	2,4 **fgh**	1,9	Galaxy	29 August	5,9 **c**	7,2
Balashi	10 August	1,3 **gh**	1,6	Pict	29 August	3,7 **c**	3,8
Autumn Queen	3 August	0,6 **h**	1,0	Ammon	10 September	2,4 **c**	2,8

♦ Significance: values denoted by similar letters are not significantly different from each other at p=0,05 (ANOVA, Games-Howell test pair wise comparison).

ˣ St. d. = Standard deviation.

The rise in the size of the onion thrips population differs year by year. Our observations were not planned to describe the exact connection between the onion thrips pressure and the dates in the calendar since not only the time of an observation but mostly the location as well varied for the same variety. They were aimed to draw attention to the possible effect of timed growing. Based on our previous experience the location in Hungary has usually negligible effect on the size of the onion thrips population assuming, that suitable host plants could be find at each venue. The role of the climatic conditions is fare more significant. Although they might vary from place to place at a given time, regarding the small size of Hungary this variation has usually minor significance. All the more vary the climatic conditions at the same location in time. This is one of the reasons why the difference in the rate of damage observed on the same variety between two locations at various dates was attributed mainly to the effect of time. The other reason is that there were onion fields adjacent to the cabbage plots. In our opinion, the presence of this favoured host plant could have compensated the possibly minor difference in the size of the onion thrips population between the venues. Therefore the significantly smaller damage observed in case of the varieties in Table 2. and 3. in our judgement was primarily the effect of timed growing, a possible protection method. For estimating the exact effect of timing further experiments are needed. It appears to us that timed growing is an important way of protection in case of susceptible or moderately resistant varieties. When growing a highly resistant variety, 'Autumn Queen' it does not seem to have the influence of further reducing the rate of damage. At least, it was not detectable by our screening method.

Table 2. The effect of the location and timing on the rate of damage.

Varieties	Location Cumulated damage	Date St. d.[x]	Location Cumulated damage	Date St. d.[x]	Significant difference♦
Autumn Queen	Tordas 0,62	3 August 1,01	Fertőd 1,38	9 October 3,03	**No**, p=0,05
	Tordas 0,62	3 August 1,01	Szarvas 0,88	11 October 1,30	**No**, p=0,05
	Fertőd 1,38	9 October 3,03	Szarvas 0,88	11 October 1,30	**No**, p=0,05
Hinova	Fertőd 19,4	13 November 13,99	Szarvas 10,63	14 November 10,38	**No**, p=0,05
Ama-Daneza	Tordas 10,11	17 August 6,28	Fertőd 2,17	13 November 2,98	**Yes**, p<0,01
	Tordas 10,11	17 August 6,28	Szarvas 2,40	14 November 4,68	**Yes**, p<0,01
	Fertőd 2,17	13 November 2,98	Szarvas 2,40	14 November 4,68	**No**, p=0,05

♦: Games-Howell test pair wise comparison
[x] St. d. = Standard deviation.

Table 3. The effect of timing on the rate of damage.

Varieties	Location Cumulated damage	Date St. d.[x]	Location Cumulated damage	Date St. d.[x]	Significant difference♦
Quisto	Tordas 39,75	3 August 8,97	Szarvas 7,09	25 September 5,09	**Yes**, p<0,01
Ducati	Tordas 9,60	3 August 4,87	Szarvas 0,14	25 September 0,45	**Yes**, p<0,01
Geronimo	Tordas 82,10	17 August 32,31	Szarvas 8,63	25 September 8,62	**Yes**, p<0,01
Hurricane	Tordas 72,41	17 August 16,97	Szarvas 29,01	25 September 13,52	**Yes**, p<0,01
Agressor	Tordas 7,34	17 August 2,40	Szarvas 1,53	14 November 4,26	**Yes**, p<0,05
Quattro	Tordas 3,80	17 August 1,60	Szarvas 1,53	11 October 1,57	**Yes**, p<0,05
Triptor	Tordas 19,33	29 August 6,99	Szarvas 2,38	25 September 3,26	**Yes**, p<0,01

♦: Games-Howell test pair wise comparison, [x] St. d. = Standard deviation.

REFERENCES

1. Andaloro, J.T., Hoy, C.W., Rose, K.B. and Shelton, A.M., 1983. Evaluation of insecticide usage in the New York Processing-Cabbage Pest Management Program. Journal of Economic Entomology 76: 1121-1124.
2. Fail, J. and Pénzes, B. (2002a): Dohánytripsz fejes káposztán. Kertészet és Szőlészet, 51, 2.: 7-8.
3. Fail, J. and Pénzes, B. (2002b): A dohánytripsz *(Thrips tabaci)* kártétele szántóföldi zöldségféléken. Agrofórum, 13, 4.: 70-72.
4. Hoy, C.W. and Glenister, C.S., 1991. Releasing *Amblyseius* spp. [Acarina: Phytoseiidae] to control *Thrips tabaci* [Thysanoptera: Thripidae] on cabbage. Entomophaga 36(4): 561-573.
5. Kristóf, L.né and Pénzes, B., 1984. Parás szemölcsök fejeskáposztán (Suberized verrucae on cabbage). Kertészet és Szőlészet. 33(49): 9.
6. North, R.C. and Shelton, A.M., 1986a. Ecology of Thysanoptera within cabbage fields. Environmental Entomology 15: 520-526.
7. North, R.C. and Shelton, A.M., 1986b. Colonization and intraplant distribution of *Thrips tabaci* (Thysanoptera: Thripidae) on cabbage. Journal of Economic Entomology 79: 219-223.
8. Pénzes, B. and Szani, Sz., 1990. Fejeskáposzta fajták tripszérzékenysége. „Lippay János“ Tudományos Ülésszak előadásainak és posztereinek összefoglalói, 1990. november 10. Növényvédelmi szekció. In: Geday (Szerk.) Kertészeti és Élelmiszeripari Egyetem Kiadványai, Budapest, 203.
9. Pénzes, B. and Szani, Sz., 1992a. A fajta szerepe a dohánytripsz (*Thrips tabaci* Lind.) kártételének kialakulásában. „Lippay János“ Tudomanyos Tudományos Ülésszak előadásai és poszterei. Kertészeti Egyetem Kiadványai, Budapest. Kertészet, Növényvédelmi szekció. 529-531.
10. Pénzes, B. and Szani, Sz., 1992b. A dohánytripsz (*Thrips tabaci*) kártétele fejeskáposzta fajtákon. Növényvédelmi Tudományos Napok. Budapest, 56.
11. Pénzes, B., Szani, Sz. and Ferenczy, A., 1996. Damage of Thrips tabaci on cabbage varieties in Hungary. Supplement of Folia Entomologica Hungarica, 52: 127-137.
12. Pénzes, B., Szani, Sz. and Ferenczy, A., 1998. A dohánytripsz kártétele fejes káposztán. Növényvédelem 34(2): 67-73.
13. Pénzes, B., Szani, Sz., Fail, J., Papp, J. and Ferenczy, A., 2000. A fajtahasználat szerepe a dohánytripsz (*Thrips tabaci* Lind.) elleni védelemben. „Lippay János-Vas Károly” Tudományos Ülésszak, Budapest 2000. November 6-7., Növényvédelmi Szekció 436-437.
14. Shelton, A.M. and North, R.C., 1986. Species composition and phenology of Thysanoptera within field crops adjacent to cabbage fields. Environmental Entomology 15: 513-519.
15. Shelton, A.M., Becker, R.F. and Andaloro, J.T., 1983. Varietal resistance to onion thrips (Thysanoptera: Thripidae) in processing cabbage. Journal of Economic Entomology 76: 85-86.
16. Shelton, A.M., Hoy, C.W., North, R.C., Dickson, M.H. and Barnard, J., 1988. Analysis of resistance in cabbage varieties to damage by Lepidoptera and Thysanoptera. Journal of Economic Entomology 81(2): 634-640.
17. Shelton, A.M., Wilsey, W.T. and Schmaedick, M.A., 1998. Management of onion thrips (Thysanoptera: Thripidae) on cabbage by using plant resistance and insecticides. Journal of Economic Entomology 91(1): 329-333.
18. Stoner, K.A. and Shelton, A.M., 1988a. Effect of planting date and timing of growth stages on damage to cabbage by onion thrips (Thysanoptera: Thripidae). Journal of Economic Entomology 81(4): 1186-1189.
19. Stoner, K.A. and Shelton, A.M., 1988b. Influence of variety on abundance and within-plant distribution of onion thrips (Thysanoptera: Thripidae) on cabbage. Journal of Economic Entomology 81(4): 1190-1195.