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The occurrence and control of aphids and thrips in winter triticale

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Abstract. Studies were carried out at the Lithuanian Institute of Agriculture during the period 2002–2004. Contact and systemic insecticides were used for pest control in winter triticale. Pesticide application timing was determined according to the threshold of harmfulness of thrips and aphids. In our investigation we used as the threshold of thrips' harmfulness, 1–2 pests per stem, and for aphids, 5–10 pests per stem. Our results suggest that thrips and aphids were the main pests occurring in winter triticale crops during the experimental years. The occurrence of thrips was more intensive in 2002 and 2003 than in 2004. The occurrence of aphids was the most intensive in 2002, less intensive in 2004. Almost no aphids were found in 2003. The appearance of aphids in 2004 was later compared with that in 2002. Both insecticides reduced the occurrence of thrips and aphids. The winter triticale grain yield was higher in the plots applied with insecticides.

Key words: winter triticale, thrips, aphids, insecticides, grain yield

INTRODUCTION

Although thrips and aphids long have been known as serious pests in many cereals, there are very few reports quantifying their damage in winter triticale. In one study in Lithuania in 2001, the occurrence of thrips in winter triticale was 4.36 thrips per stem at maximum. It was 2.2 times less than in rye, but 2.4 times higher than in winter wheat (Smatas, 2002). Polish experimental evidence suggests that the abundance of thrips tends to increase annually (Kąkol & Kucharczyk, 2004). In spring barley, which was more comprehensively investigated in Lithuania, the occurrence of aphids can reach 25–30 aphids per stem (Surkus, 1997) when weather conditions are favourable. The research data on the occurrence and damage done by aphids in triticale in Lithuania are scarce. The aim of our study was to estimate the abundance of aphids and thrips in winter triticale and to compare the efficacy of contact and systemic insecticides against sucking pests, using the insecticides according to thrips' and aphids' thresholds of harmfulness.

MATERIALS AND METHODS

The field trial was conducted at the Lithuanian Institute of Agriculture in Dotnuva during 2002–2004 with the winter triticale variety 'Tornado'. Experimental design: **1.** Untreated; **2.** Contact insecticide (a. i. lamda–cyhalothrin 10 g ha^{-1}) at an average

infestation level of 1–2 thrips per stem (in tables referred to as CT); **3.** Systemic insecticide (a. i. thiamethoxam 15 g ha^{-1}) at an average infestation level of 1–2 thrips per stem (in tables referred to as ST); **4.** Contact insecticide (a. i. lamda–cyhalothrin 10 g ha^{-1}) at an average infestation level of 5–10 aphids per stem (in tables referred to as CA); **5.** Systemic insecticide (a. i. thiamethoxam 15 g ha^{-1}) at an average infestation level of 5–10 aphids per stem (in tables referred to as SA).

Contact insecticide Karate (active ingredient lamda–cyhalothrin 50 g l^{-1}) and systemic insecticide Actara (active ingredient thiamethoxam 250 g kg^{-1}) were used for the spray application. Insecticide application was timed according to thrips' (1–2 thrips per stem) and aphids' (5–10 aphids per stem) thresholds of harmfulness. The assessments of pests were made following the EPPO guidelines (EPPO Standards, 1997). Plant growth stages were recorded according to BBCH scale (Meier, 1997). The significance of data was determined by the Fisher's criterion with a significance level of $P \leq 0.01$ and 0.05. Prior to the statistical analysis the data of thrips and aphids counts per tiller were transformed to Log(X+*1)*. Significant differences from untreated in tables are marked as ***(*$P \leq 0.01$*)* and *(*$P \leq 0.05$).

RESULTS AND DISCUSSION

The occurrence of thrips was intensive each experimental year. The occurrence of aphids was more intensive in 2002, less intensive in 2004. In 2003 aphids did not reach their threshold of harmfulness and insecticides were used only according to thrips' threshold of harmfulness. We did not provide the data for the spread of aphids in 2003, as just a few were found in the winter triticale crop.

In 2002 the occurrence of thrips reached their threshold of harmfulness in the middle of heading, reached maximum level at early milk stage, and sharply decreased after a week at medium milk stage (Table 1). Spraying contact and systemic insecticides according to the thrips' threshold of harmfulness significantly reduced the number of thrips per stem in winter triticale for 43 days, and according to aphids' threshold of harmfulness, for 33 days, in many cases (Table 2). Aphids reached the threshold of harmfulness at the full flowering stage. The application of systemic insecticide according to the thrips' threshold of harmfulness significantly reduced the number of aphids per stem for a longer period than contact insecticide.

In 2003 the occurrence of thrips reached the threshold of harmfulness at the booting stage. The number of thrips per stem reached its maximum at the watery ripe stage and gradually decreased until the early dough stage. The application of systemic insecticide significantly reduced the number of thrips per stem for 42 days and contact, for 47 days (Table 3).

In 2004 the occurrence of thrips and aphids was less intensive compared with the previous years. The occurrence of thrips reached its maximum at the full flowering stage. The application of contact and systemic insecticides according to the thrips' threshold of harmfulness significantly reduced the number of thrips per stem for 26 days (Table 4).

Table 1. Reduction in the number of thrips per stem as affected by the use of contact and systemic insecticides in winter triticale in 2002.

Treatment[1]	Number of thrips per stem after insecticide application							
	4 d.[2]	11 d.	15 d.	22 d.	29 d.	36 d.	43 d.	50 d.
			4 d.[3]	11 d.	19 d.	26 d.	33 d.	40 d.
	59[4]	65	69	73	75	77	83	87
Untreated	1.35	9.93	10.48	11.08	3.05	1.18	0.60	0.08
CT	0.40**	0.33**	1.98**	1.08**	0.38**	0.23**	0.25**	0.15
ST	0.10**	0.15**	3.63**	1.13**	0.53**	0.38**	0.20**	0.03
CA	n.a.	n.a.	4.63**	4.15**	1.73	0.50**	0.23**	0
SA	n.a.	n.a.	3.83**	3.93**	2.15	0.73	0.18**	0

[1] – treatment details in materials and methods; [2] – number of days after insecticide application, when spray application was made according to thrips threshold of harmfulness; [3] – number of days after insecticide application, when spray application was made according to aphids threshold of harmfulness; [4] – growth stage by BBCH; n.a. – not assessed;
* and ** - significant differences from the control at 95 and 99% probability level

Table 2. Reduction in the number of aphids per stem as affected by the use of contact and systemic insecticides in winter triticale in 2002.

Treatment[1]	Number of aphids per stem after insecticide application							
	4 d.[2]	11 d.	15 d.	22 d.	29 d.	36 d.	43 d.	50 d.
			4 d.[3]	11 d.	19 d.	26 d.	33 d.	40 d.
	59[4]	65	69	73	75	77	83	87
Untreated	1.40	6.93	11.25	20.45	1.93	0.93	1.33	0.05
CT	0**	0.13**	0.15**	1.28**	0.58**	0.35	0.78	0.05
ST	0.05**	0.03**	0.58**	0.63**	0.68*	0.53	0.28**	0.03
CA	n.a.	n.a.	1.23**	1.73**	0.08**	0.03	0.03**	0
SA	n.a.	n.a.	0**	1.05**	0.70*	0.13	0.30*	0

[1–4] – explanation under table 1; n.a. – not assessed;
* and ** - significant differences from the control at 95 and 99% probability level

Table 3. Reduction in the number of thrips per stem as affected by the use of contact and systemic insecticides in winter triticale in 2003.

Treatment[1]	Number of thrips per stem after insecticide application							
	4 d.[2]	11 d.	18 d.	25 d.	34 d.	42 d.	47 d.	54 d.
	45–47[3]	55	65	71	75	75–77	77	83
Untreated	1.70	1.40	6.03	10.25	8.85	5.33	1.05	0
CT	0.08**	0.08**	0.10**	0**	0.03**	0.18**	0.48*	0.08
ST	0.03**	0**	0.10**	0.03**	0.23**	0.45**	1.00	0.05

[1] – treatment details in materials and methods; [2] – number of days after insecticide application;
[3] – growth stage by BBCH

The occurrence of aphids reached their threshold of harmfulness at the medium milk stage. The application of contact insecticide according to the thrips' threshold of harmfulness provided better protection to the winter triticale crop against both pests than systemic insecticide. Spraying according to the aphids' threshold of harmfulness winter triticale significantly reduced the number of aphids and thrips per stem for a much shorter period than spraying according to the thrips' threshold of harmfulness (Table 5).

Table 4. Reduction in the number of thrips per stem as affected by the use of contact and systemic insecticides in winter triticale in 2004.

Treatment[1]	Number of thrips per stem after insecticide application				
	3 d.[2]	10 d.	19 d.	26 d.	33 d.
			3 d.[3]	10 d.	17 d.
	65–69[4]	71	75	77	83
Untreated	2.63	4.73	4.03	2.18	0.15
CT	0.43**	0.03**	0.28**	0.08**	0.03
ST	0.53**	0.33**	0.70**	0.18**	0.28
CA	n.a.	n.a.	1.63**	1.98	0.10
SA	n.a.	n.a.	3.05	0.73**	0

[1–4] – explanation under table 1; n.a. – not assessed;
* and ** - significant differences from the control at 95 and 99% probability level

Table 5. Reduction in the number of aphids per stem as affected by the use of contact and systemic insecticides in winter triticale in 2004.

Treatment[1]	Number of aphids per stem after insecticide application				
	3 d.[2]	10 d.	19 d.	26 d.	33 d.
			3 d.[3]	10 d.	17 d.
	65–69[4]	71	75	77	83
Untreated	1.55	3.75	1.83	0.38	0.10
CT	0**	0.13**	0.15**	0.28	0.03*
ST	0.43**	0.80**	0.93*	0.40	0.10
CA	n.a.	n.a.	0.15**	0.03	0**
SA	n.a.	n.a.	1.25	0.28	0**

[1–4] – explanation under table 1; n.a. – not assessed;
* and ** - significant differences from the control at 95 and 99% probability level

Table 6. Effect of insecticides on winter triticale grain yield and 1000 grain weight during 2002–2004.

Treatment[1]	Yield and yield increase t ha^{-1}			1000 grain weight and grain weight increase g		
	2002	2003	2004	2002	2003	2004
Untreated	7.92	5.96	9.62	43.59	45.12	53.28
CT	+0.49	+0.37	+0.47	+1.22	+0.94	+1.23
ST	+0.59	+0.49	+0.37	+0.81	+1.03	+0.85
CA	+0.44	–	+0.12	+0.71	–	+0.95
SA	+0.54	–	+0.05	+0.64	–	+0.52
LSD_{05}	0.395	0.348	0.263	0.334	0.767	0.695

[1] – treatment details in materials and methods

In our investigations the application of contact and systemic insecticides according to the thrips' thresholds of harmfulness significantly increased the winter triticale grain yield and 1000 grain weight (Table 6). The application of contact and systemic insecticides according to the aphids' thresholds of harmfulness significantly increased the winter triticale yield in 2002. Significant yield increase was not obtained in plots sprayed according to the aphids' threshold of harmfulness in 2003 because the occurrence of pests in unsprayed plots decreased naturally at the same time as in plots,

after insecticide application. It is difficult to compare our results with the literature because the research of the thrips and aphids in triticale is not thorough enough. In our investigations the highest number was 11.08 thrips per stem. Larson (2005) investigated the occurrence of thrips and their damage in cereals, including triticale and found that the occurrence of and yield reduction by thrips was similar in all cereals. Maximum occurrence of thrips was 27 on the leaf sheath and yield loss was 21–26 kg ha^{-1} per thrips per leaf sheath. According to Terry (1997) thrips can reduce the yield by 0.15–0.43 t ha^{-1} in winter rye. Although aphids often reduce wheat yield, it is not an annual occurrence. (Entwistle & Dixon, 1987). According to Rabbinge et al. (1981) aphids can reduce wheat yield by 0.7 t ha^{-1}.

CONCLUSIONS

The occurrence of thrips was intensive each experimental year, while that of aphids was about 4 times more intensive in 2002 than in 2004. The application of contact and systemic insecticides according to the thrips' threshold of harmfulness significantly reduced number of thrips per stem for 26–43 days and the number of aphids per stem for 19–43 days during the 2002–2004 period. The application of the insecticides according to the aphids' threshold of harmfulness significantly reduced the number of thrips and aphids per stem for 3–33 days during 2002 and 2004. Significant yield increases were achieved when spraying contact and systemic insecticides according to the thrips' threshold of harmfulness each experimental year and spraying contact and systemic insecticides according to the aphids' threshold of harmfulness in 2002. These cases show that thrips are more harmful pests than aphids, and that it would be more expedient to spray winter triticale according to the thrips' threshold of harmfulness.

REFERENCES

EPPO Standards. Guidelines for efficacy evaluation of plant protection products. Insecticides & acaricides. 1997. Paris, **3**, 232 pp.

Entwistle, J.C. & Dixon, A.F.G. 1987. Short-term forecasting of wheat yield loss caused by the grain aphid *(Sitobion avenae)* in summer. *Annals of Applied Biology* **111**, 489–508.

Kąkol, E. & Kucharczyk, H. 2004. The occurrence of thrips (*Thysanoptera*) on winter and spring wheat in chosen regions of Poland. *Acta Phytopathologia et Entomologica Hungarica* **39**, 263–269.

Larsson, H. 2005. Economic damage by *Limothrips denticornis* in rye, triticale and winter barley. *Journal of Applied Entomology* **129**, 386–392.

Meier, U. 1997. Growth Stages of Mono- and Dicotyledonous Plans. BBCH – Monograph. Berlin – Wien, 611 pp.

Terry, L.I. 1997. *Thrips as Crop Pests*. University Press, Cambridge, 740 pp.

Rabbinge, R., Drees, E.M., Van der Graaf, M., Verberne, F.C.M. & Wesselo, A. 1981. Damage effects of cereal aphids in wheat. *Netherlands Journal of Plant Pathology* **87**, 217–232.

Smatas, R. 2002. Spread of thrips on winter cereals in Lithuania. In Klasens, V., Spogis, K., Lypsik, A., Waller, K.P., Hulgren, J., Tuherms, H., Valters, J. & Bernhard A. (eds): *Research for rural development 2002. International scientific conference proceedings.* Jelgava, LV, pp. 42–44.

Surkus, J. 1997. Insecticides against pests on spring barley. *Agriculture. Scientific articles* **60**, 142–152 (in Lithuanian).