Toxicity of lime sulphur on predatory mite Typhlodromus pyri in apple

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Abstract

In 2009 the effect of lime sulphur (2 %) on predatory mite (Typhlodromus pyri Scheuten*, 1857) was evaluated. The trial was carried out on apple trees of the variety Idared in a commercial orchard from July to September. The orchard is located in South Moravia (Czech Republic). Lime sulphur treatments were performed eleven times. The T. pyri population was evaluated six times. Toxicity of lime sulphur was found to be in range from 15 % up to 54 % during the trail period. The average toxicity was 33 %.*

Keywords: apple, *Malus domestica*, *Typhlodromus pyri*, lime sulphur, toxicity, apple scab, *Venturia inaequalis*

Introduction

Lime sulphur is commonly used against apple scab (*Venturia inaequalis* (Cooce) G**.** Winter**,** 1875.) in organic orchards (Holb *et al*., 2003). Together with copper and sulphur it is a part of complex preventive scab strategy. It could also be used as a curative treatment even during wet conditions (Kunz *et al*., 2008).

Predatory mite *Typhlodormus pyri* Scheuten (1857) is commonly present in European orchards (Sölva *et al*., 1997; Prasličkа & Barteková, 2008). This species is an effective predator of harmful mites from the family Tetranychidae (Collyer, 1964). It is frequently used as a commercial bioagens in orchards (Zacharda, 1991; Sekrecka & Niemczyk, 2006).

Native or introduced T. pyri population survives during the whole orchard production period in case of a reasonable pesticide strategy. *T. pyri* population can be significantly decreased or even eliminated in case of inadequate, i.e. harmful, pesticide treatment (Zacharda & Hluchý, 1991; Raudonis *et al*., 2004).

The aim of this study was to evaluate side effects of lime sulphur (2%) on *T. pyri* population.

Material and Methods

The trail was conducted in a commercial apple orchard located in South Moravia (Czech Republic). The variety Idaret was grown on 14 ha in the selected orchard.

The trail had two variants. The lime sulphur product (sulphide content 22.5/23.5%) was made by an Italian company Polisenio. Two variants included the lime sulphur (2%) treated variant and the untreated control. Each variant had three repetitions. Repetition included three trees. Water volume was 400 l ha^{-1}.

Variants were treated eleven-times (tab. 1). *T. pyri* population was counted on 50 randomly selected leaves per repetition. Leaf samples were assessed according to the method after Zacharda *et al*., 1988. Samples were collected six times during the trial (tab. 1).

Obtained data were statistically evaluated by software Statistica 8. Lime sulphur toxicity was assessed using Abbott's formula (Abbott, 1925).

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Table 1. Variant treatment and sampling dates.

Date	treatment	sampling
May 13	x	
May 20	x	
May 27	x	
June 3	x	
June 10		x
June 12	x	
June 17	x	
July 1	x	x
July 16	x	x
July 30	x	x
August 14	x	
August 31	x	
September 14		x
September 25		x

Results

T. pyri population development had a similar trend in both variants (fig. 1). Population in the untreated plot was always higher than population in the treated one. Lime sulphur (2%) toxicity was found to be from 15% up to 54%. Average toxicity was 33% (tab. 2). The difference between the untreated and treated variant was statistically significant (tab. 3).

Obtained average 33% toxicity belongs to "harmless or slightly harmful" category according to IOBC Working Document of Selectivity of Pesticides (Boller *et al.*, 2005). Toxicity above 50% (moderately harmful) was found only in one case.

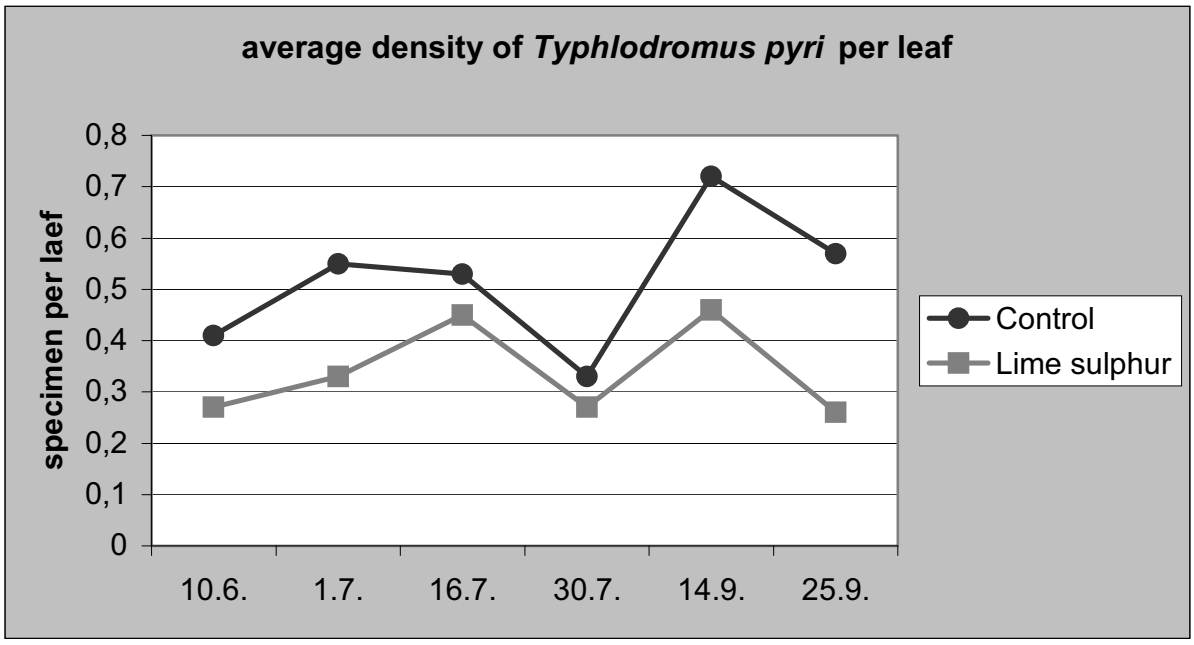

Figure 1: Average *T. pyri* population density

Table 2: Lime sulphur (2%) toxicity on *T. pyri* population

	10.6.	1.7.	16.7.	30.7.	14.9.	25.9.	Average toxicity
Control	0,41	0,55	0,53	0,33	0,72	0,57	
Lime sulphur (2%)	0,27	0,33	0,45	0,27	0,46	0,26	
Toxicity	34,15%	40%	15,09%	18,18%	36,11%	54,39%	**33%**

Table 3: ANOVA

	SS	DF	MS	F	p
Variant	**711,11**	**1**	**711,11**	**6,5742**	**0,017031***
Date	797,56	5	159,51	1,4747	0,234888
Variant*Date	196,22	5	39,24	0,3628	0,868834
Error	2596,00	24	108,17		

Discussion

The effect of lime sulphur on reduction of the *T. pyri* population has been confirmed by several authors (Haas, 1987; Hiebler, 1991; Häseli & Graf, 1992; Mohr et al., 1994; Kreiter et al., 1998). The same effect was confirmed by this study.

Lime sulphur side effect on *T. pyri* could also be phytotoxic (Holb et al., 2003).

It is necessary to find balance between the negative effects and effective fungicidal effect when lime sulphur is used.

The toxicity of higher lime sulphur concentrations on *T. pyri* population should be studied in future research.

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References

Abbott, W. S., 1925: A method of computing the effectiveness of an insecticide. *J. econ. Entomol.* **18**: 265-267.

Boller, E. F., Vogt, H., Ternes, P. & Malavolta, C., 2005: Working document on selectivity of pesticides. International Organisation for Biological and Integrated Control of Noxious Animals and Plants. Available on-line at: < http://www.iobc.ch/2005/Working%20Document%20Pesticides_Explanations.pdf>

Collyer E., 1964: A summary of experiments to demonstrate the role of *Typhlodromus pyri* Scheut. in the control of *Panonychus ulmi* Koch. in England. *Acarologia* **2**: 363-371.

Haas, E., 1987: Nebenwirkungen von Pflanzenschutzmitteln auf Raubmilben und Zikaden. *Obstbau Weinbau* **24**: 70-73.

Häseli, A. & Graf, B., 1992: Nebenwirkungen einiger Apfelschorffungizide im Obstbau. In 5. Internationaler Erfahrungsaustausch über Forschungsergebnisse zum ökologischen Obstbau. 19./20.11. 1992, Weinsberg.

Hiebler, A., 1991: Nebenwirkungen von Schwefelspritzungen auf Raub- und Spinnmilben. *Besseres Obst*. **36**:10-11.

Holb, I.J., de Jong, P.F. & Heijne, B., 2003: Efficacy and phytotoxicity of lime sulphur in organic apple production. *Annals of Applied Biology* **142**: 225-233.

Kreiter, S., Sentenac, G., Weber, M., Rinville,C., Barthes, D. & Auger, P., 1996: Effets non intentionnels de quelques produits phytopharmaceutiques sur Typhlodromus pyri, Kampimodromus aberrans et Phytoseius plumifer. *Phytoma* **480**:1-6.

Kunz, S., Mögel, G., Hinze, M. & Volk. F., 2008: Control of apple scab by curative applications of biocontrol agents. In 13th International Conference on cultivation technique and phytopathological problems in organic fruit-growing (FÖKO e.V., ed, Weinsberg:

Fördergemeinschaft Ökologischer Obstbau e. V., 62-67.

Mohr, H.D., Loosen, R. & Englert, W.D., 1994: Auswirkungen „ökologischer“ und „konventioneller“ Spritzfolgen auf Raubmilben (T. pyri) und Spinnmilben (P. ulmi) im Weinbau. *Nachrichtenblatt deutscher Pflanzenschutzdienst* **46**: 52-60

Prasličkа, J. & Barteková, A., 2008: Occurrence of predatory mites of the *Phytoseiidae* family on apple-trees in integrated and ecological orchards. *Plant Protect. Sci*. **44**: 57–60.

Raudonis, L., Survilienė, E & Valiuškaitė, A., 2004: Toxicity of pesticides to predatory mites and insects in apple-tree site under field conditions. *Environmental Toxicology* **19**: 291-295.

Sekrecka, M. & Niemczyk, E., 2006: Introducing Typhlodromus pyri (Phytoseiidae) into apple orchards in Poland. *Journal of Fruit and Ornamental Plant Research* **14**: 203-207.

Sölva, J., Zöschg, M., Hluchý, M. & Zacharda, M., 1997: Predatory phytoseiid mites (Acari: Mesostigmata) in vineyards and fruit orchards in Southern Tyrol. *Anz. Schädlingskde., Pflanzenschutz, Umweltschutz* **70**: 17-29.

Zacharda M., 1991: *Typhlodromus pyri* Scheut. (Acari: Phytoseiidae) a unique predator for biological control of phytophagous mites in Czechoslovakia In: *Modern Acarology* (ed. Dusbábek F. & Bukva V.). pp. 205-210. Academia Prague and SPB Academic Publishing bv The Hague, The Netherlands.

Zacharda, M. & Hluchý, M., 1991: Long-term residual efficacy of commercial formulations of 16 pesticides to *Typhlodromus pyri* Scheuten (Acari: Phytoseiidae) inhabiting commercial vineyards. *Experimental and Applied Acarology* **13**: 27-40.

Zacharda, M., Pultar, O. & Muška, J., 1988: Washing technique for monitoring mites in apple orchards. *Experimental and Applied Acarology* **5**: 181-183.