

PROGRAMM OF THE FIGHT AGAINST RESISTANT *VARROA* MITES IN CZECH REPUBLIC

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S u m m a r y

Prevention and control of resistant populations of *Varroa* mites is based on the monitoring of the occurrence and on the measures in foci and their protection zones. Monitoring is carried out on the basis of field experiments, where natural fall and efficacy of acrinathrin, fluvalinate and amitraz are compared. Control measures are legalized. They include limitation of movement of bee colonies, rotation of preparations and increased care in winter time, especially using aerosol form of application. The objective of the measures is interruption of the generation sequence of resistant mites.

Keywords: resistance, *Varroa* mite, cross field experiments, pyrethroids, acrinathrin, fluvalinate, amitraz, aerosol administration, generation sequence.

The territory of Czech Republic is like other European countries threatened with resistant populations of *Varroa* mites (Milani 2001). But hitherto only individual foci of resistance to pyrethroids were recorded and this phenomenon was found in southern and southeastern border regions. Regardless of this fact we have introduced certain organization measures (Veselý 2002).

The Czech programm of prevention and control of resistant populations consists of two parts: First, monitoring of the occurrence and second, measures in occurrence foci and their protection zones. Monitoring is carried out on the basis of field cross experiments where the efficacy of acrinathrin and fluvalinate at late summer treatment (tab.1) and the efficacy of fluvalinate and amitraz at autumnal treatment (tab. 2) of bee colonies are compared. Besides that, there is compared the efficacy of carriers with long time effectiveness in the first days of exposition with the previous natural fall of mites. The monitoring action is completed by the declaration of the foci and 5 km protection zones.

Cross experiments are established on following principles: The experimental group is to include at least 8 bee colonies and hives are to be equipped by double nett pads to prevent the bringing out of mites by bees. This equipment enables daily monitoring of the fall of mites. Bee colonies of this experimental group are divided into odd and even colonies. Into odd colonies at late summer experiments we put long time acting strips with the content of acrinathrin (Gabon PA 92). At autumnal experiments odd bee colonies are treated by fumigation by amitraz (Varidol FUM). Into even bee colonies at late summer experiments we put long time acting strips with the content of fluvalinate (Gabon PF 90). At autumnal experiments we treat these colonies by fluvalinate fumigation (MP-10 FUM). At late summer experiments after 15 days we change the strips mutually between odd and even colonies. At autumnal experiments we carry out the second treatment by fumigation after 4 - 7 days. This treatment is reciprocal, that means odd bee colonies are treated by fluvalinate and even bee colonies by amitraz. After the finish of late summer

Table 1

Scheme of late summer cross experiments (acrinathrin - fluvalinate)

Odd bee colonies										
Hive No.	Natural Fall date/number of females	Gabon PA 92 input Date	Fall of Mites			Gabon PA 90 input Date	Fall of Mites 16 th -30 th day	Check fumigation		SUM of Fall of Mites (whole experiment)
			1 st day	2 nd day	3 rd -15 th day			Date	Fall of Mites	
Even bee colonies										
Hive No.	Natural Fall date/number of females	Gabon PA 90 input Date	Fall of Mites			Gabon PA 92 input Date	Fall of Mites 16 th -30 th day	Check fumigation		SUM of Fall of Mites (whole experiment)
			1 st day	2 nd day	3 rd -15 th day			Date	Fall of Mites	

Table 2

Scheme of autumnal cross experiments (amitraz - fluvalinate)

Odd bee colonies									
Hive No.	1. fumigation Varidol FUM Date	Fall of Mites			2. fumigation MP-10 FUM Date	Fall of Mites			SUM of Fall of Mites (whole experiment)
		1. day	2. day	In total		1. day	2. day	In total	
Even bee colonies									
Hive No.	1. fumigation MP-10 FUM Date	Fall of Mites			2. fumigation Varidol FUM Date	Fall of Mites			SUM of Fall of Mites (whole experiment)
		1. day	2. day	In total		1. day	2. day	In total	

experiments, after 30 days, we treat bee colonies by amitraz fumigation and find the fall of mites after 12 hours. The efficacy is stated as percentage of fall of mites during 30 days after application of both types of carriers and of the total fall inclusive checks fumigation. Detailed estimation evaluates the difference of the effect of acrinathrin and fluvalinate and the share of mites on adult bees, that is fall after the first two days of experiment and the share of mites on brood, that is fall after the third to thirties days of experiment. At autumnal experiments we determine the efficacy of percentage expression of mites fall after the first fumigation to the total fall after both fumigations.

The resistance of mites to pyrethroids is proved if in late summer experiments both types of carriers show no effect or lower effect below the value of 80% and when at autumnal experiments the fumigation by

fluvalinate shows significantly lower efficacy than amitraz

The monitoring network is made by volunteers from beekeepers rank. The number of the monitoring sites is in individual years about two hundred and sites are distributed on the whole territory of the Czech republic. We do our best to influence the location of monitoring sites so that the network may cover regions with higher risk of the occurrence of resistance to pyrethroids. There are Czech - Austrian border regions and localities where beekeepers express suspicion that preparations based on pyrethroids show lower efficacy. All deliveries of medications for areal treatments are provided with leaflets as to pay the attention to possible resistance and with challenge for monitoring of the efficacy by comparison of the natural fall with the fall of mites of the first

two days with the exposition to medications.

Measures in resistance foci and in protection zones are as follows: ban on transport of bee colonies into not resistant regions, ban on use of pyrethroids in all application forms, substitution of pyrethroids by formic acid in season time, increased number of winter treatments by amitraz in the aerosol form, winter debris investigation and early spring treatment of sites where mites in winter debris were found and this in quantity more than one mite per bee colony. Such colonies are treated repeatedly by amitraz in the interval of 10 days and as soon as possible that means if daily temperature achieves without larger deviations 20°C, by evaporating sheets with formic acid. Methodical Instruction of the State Veterinary Administration legalized all these measures. The target is to reach an interruption of the generation sequence of

resistant mites by full destruction or by the decisive reduction of their population.

All efforts connected with the implementation of the program are justified. Combination of acrinathrin in late summer and amitraz in autumnal and winter treatment proved to be highly effective and hygienically flawless without negative side effects.

REFERENCES

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PROGRAM WALKI Z ODPORNymi POPULACJAMI ROZTOCZY *Varroa* W CZECHACH

V e s e l ý V .

S t r e s z c z e n i e

Zapobieganie i zwalczanie odpornych populacji roztoczy *Varroa* oparte jest o monitoring występowania i o pomiary ognisk i ich stref ochronnych. Monitoring prowadzony jest w oparciu o doświadczenia terenowe, gdzie porównuje się osyp naturalny i skuteczność akrynatryny, fluwalinatu i amitrazu. Zabiegi zwalczania są zalegalizowane. Obejmują one przemieszczanie rodzin pszczelich, rotację (przemienne stosowanie) preparatów i zwiększoną opiekę w sezonie zimowym, w szczególności stosowanie preparatów w formie aerosolu. Celem zabiegów jest przerwanie następstwa pokoleń odpornych roztoczy.

Słowa kluczowe: odporność, roztocze *Varroa*, doświadczenia terenowe, pyretroidy, akrynatryna, fluwalinat, amitraz, forma aerozolowa aplikacji, następstwo pokoleń, Czechy.