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Beeswax replacement in organic bee keeping
Is there a risk of contamination by residues in hive walls?

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Summary

Numerous bee keepers are forced to replace heavily acaricide-contaminated beeswax by new residue-free wax, when changing over to organic honey production. The hive walls which are also highly contaminated might re-contaminate the new beeswax.

In this trial hives which were highly contaminated by coumaphos (Perizin) and fluvalinate (Apistan) were cleaned: scratched out only or scratched out, washed out with soda and flamed. The hives were re-colonised with artificial swarms in June 2000. These swarms originating from conventional bee keeping were placed onto residue-free foundations.

The beeswax samples of brood and honey combs gathered in October 2000 and 2001 contained no significant residues. When replacing beeswax it is sufficient to scratch out and flame the hives in order to avoid renewed, measurable contamination of the new wax. The replacement of hive material is not needed.

Introduction

Active ingredients of acaricides such as Apistan, Folbex VA and Perizin which have mostly been used for the control of *Varroa destructor* during the last years are fat-soluble and accumulate in beeswax (1,2,3,4,5,8,9). Old comb beeswax is recycled continuously into foundations. Compared to the original acaricide concentration in old combs the active ingredients in beeswax almost double during this process, depending on the substance used. Thus, honey combs are highly contaminated, too, (2). Under certain conditions these residues may cause minor acaricide residues in honey which lie far below the tolerance limits and, hence, present no toxicological risk for consumers (2,6,8). In organic bee keeping, however, such residues must be avoided. Consequently, bee keepers who purchase foundations in specialised trade or who use regularly acaricides for varroa control shall have to replace the entire beeswax used in the apiary by residue-free wax, when changing over to organic bee keeping. The bees spread the persistent acaricides used over the entire inner hive surface. In beeswax analysed by Wallner (7) residues were measured after beeswax replacement in cases of extreme wax contamination of over 100 mg /kg wax. Hence our question: do residues which are generally present on hive walls cause measurable contamination in the newly used, residue-free beeswax?

Materials and Methods

Trial set up

The trial was carried out at the experimental apiary of the Swiss Bee Research Centre in Liebefeld. Eight artificial swarms (two per trial) originating from conventional bee keeping were used and placed into contaminated Dadant hives on July 1st , 2000.

Four Dadant hives were contaminated mainly by coumaphos (Perizin), four other hives by fluvalinate (Apistan). Three fluvalinate-contaminated hives originated from a trial with an 8 year permanent Apistan treatment. The fourth hive was contaminated by fluvalinate solution after scratching out. The hives were cleaned in various ways before placing the swarms. They were either scratched out only or scratched out, washed with soda and flamed. (table 1). The artificial swarms were placed onto 7 foundations consisting of residue-free beeswax. In the course of summer the number of combs was increased by adding new, residue-free foundations, according to the colony development. In July the supers with new, residue-free foundations were added. The honey combs were constructed only inadequately or not at all, because of the missing honeydew flow. In 2001 the colonies were kept as normal economical units. The honey harvest was on average 15 kg per colony. In autumn 2000 and 2001 one sample of beeswax per colony was collected. The trial was completed in autumn 2001.

Table 1: Trial variants

Cleaning procedure	Residues of active ingredient	Colony
A. Scratching out only	coumaphos	1 + 2
	fluvalinate	3 + 4
B. Scratching out, washing with soda and, flaming	coumaphos	5 + 6
	fluvalinate	7 + 8

Measuring of residues

Samples

Each hive was scratched out before placing the artificial swarms. The material scratched out of each hive was collected and analysed, in order to determine the contamination degree of the hive walls.

Early in October 2000 and 2001 a piece of comb measuring 5 x 5 cm was cut out from each brood comb and melted into one sample of pure beeswax per colony. One sample of honey comb per colony was gathered in autumn 2001.

Analysis

The concentration of bromopropylate, coumaphos, fluvalinate and flumethrin was analysed in each sample by gas chromatography, according to the method of Bogdanov et al. (2) at the QA laboratory of the Swiss Bee Research Centre. The detection limit of the determination method was 0.25 mg/kg.

Results and Discussion

Residues

Material scratched out of hives

Analyses of the scratched out material showed that all hives were highly contaminated by either coumaphos or fluvalinate (table 2; fig. 1). No flumethrin was detected. Bromopropylate was found in small amounts in one hive only. Due to permanent treatment the fluvalinate contamination on the hive walls exceeds the value normally found in practice.

Brood and honey combs

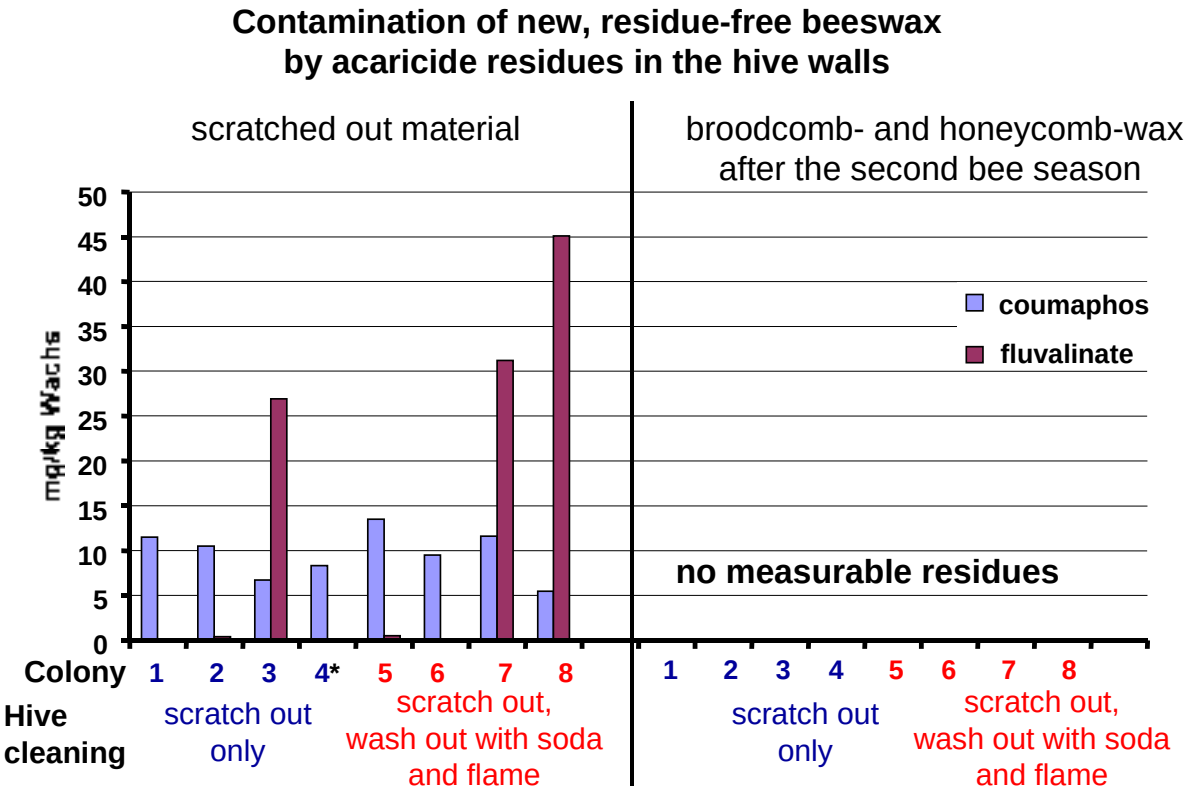
The concentrations of all active ingredients analysed in beeswax samples of brood and honey combs during the season 2000 and 2001 are below the detection limit (fig. 1) with one exception: 0.25 mg per kg wax were measured in the brood comb sample of colony 3 with the cleaning procedure A. This value is very low and corresponds to the detection limit of fluvalinate in beeswax. No residues were found in this colony in the following year.

Table 2: Residues in material scratched out of hive walls

Variant	Residues Active ingredient	Cleaning method	Co-lony	Residues mg/kg of scratched out material scratched out			
				Bromo propylate	Coumaphos	Fluvalinate	Flumethrin
1	Coumaphos	A	1	0.33	11.50	<0.25	<0.25
			2	<0.10	10.50	0.39	<0.25
2	Fluvalinate	A	3	<0.10	6.71	26.90	<0.25
			4	<0.10	8.33	<0.25*	<0.25
3	Coumaphos	B	5	<0.10	13.50	0.52	<0.25
			6	<0.10	9.50	<0.25	<0.25
4	Fluvalinate	B	7	<0.10	11.60	31.2	<0.25
			8	<0.10	5.46	45.1	<0.25

* This hive was contaminated artificially by fluvalinate solution after scratching out.

Figure 1: Acaricide residues in scratched out material and in beeswax samples in the end of trial.



* This hive was contaminated artificially by fluvalinate solution after scratching out.

Conclusions

These results show clearly that new beeswax is not significantly contaminated by residues remaining on the hive walls, when contaminated beeswax is replaced in the frame of organic bee keeping. It is sufficient to scratch out and flame the hives. The flaming of each hive is necessary for reasons of animal hygiene.

It is probable that even cleaned hive walls are slightly contaminated. However, there is a considerable diluting effect, when residue-free beeswax is used. Hence, the residues in new beeswax are below the detection limit. Studies by Bogdanov et al (2) showed that the residue values in honey from contaminated honey combs lie about 1000 to 2000 times below the residue values in beeswax. Presumably, the residues occurring in honey lie below 0.00025 mg per kg. The Swiss tolerance limits in honey for bromopropylate, coumaphos and fluvalinate are 0.1, 0.05 resp. 0.01 mg per kg. With a total exchange of beeswax and with correct hive cleaning bee keepers are absolutely on the safe side. The replacement of hive material is therefore not needed.

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