Short communication

VARROACIDE EFFECTIVENESS OF POLYVAR YELLOW® (FLUMETHRIN 275 MG) PREPARATION

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Abstract

The aim of the experiment was to check the effectiveness of the varroacide veterinary product called PolyVar Yellow® (flumethrin 275 mg) in field conditions in the area of north-eastern Poland. The experiment was carried out on twenty bee colonies, of which in ten (group PY) were tested with the veterinary product and the remaining ten constituted a control group without anti- varroosis treatment (group C). Treatment began in mid-August and lasted until the end of October when bee flights ceased. A control treatment was then conducted with a 3.2% oxalic acid solution. The effectiveness of Varroacide of PolyVar Yellow® was estimated on the basis of the parasite falls on the *Varroa* sticky inserts and based on the infestation rate of bees with the parasite before and after the treatment. High varroacide effectiveness of the preparation was obtained at 97%. The tested veterinary product was shown to protect effectively bee colonies against reinvasion of *Varroa destructor* mites.

Keywords: honeybees, PolyVar Yellow®, *Varroa destructor*, varroacide effectiveness

INTRODUCTION

Many acaricides are highly effective fighting against *Varroa destructor* (Bąk et al., 2013; Semkiw et al., 2013) but may be unreliable due to the reinvasion of the parasite (Cornelissen et al., 2013). A new preparation called PolyVar Yellow® (275 mg flumethrin) has appeared on the market. This preparation, in the form of strips with round holes, is to be placed in the hive entrance for a recommended four months. The research aimed to check the effectiveness of the varroacide veterinary product (flumethrin 275 mg) in field conditions in the north-eastern area of Poland and whether bee colonies are protected against the reinvasion of the *V. destructor* parasite.

MATERIAL AND METHODS

Experimental apiary

Twenty bee colonies of the Carnica breed (*Apis mellifera carnica* L.), the Kortówka line, were allocated to the experiment. At the beginning, they were of equal strength (average of sixteen inter-combs way). The colonies were divided randomly into two groups. The first group (PY) of ten honey bee colonies was treated with the tested veterinary product according to the producer's instructions. The second group (C) of the remaining ten bee colonies was a control group in which varroosis was not treated.

Experiment

The experiment was carried out, according to the modified method by Blacquière et al. (2017), after the last honey harvest during the winter feeding of bees. Lasting 107 days, it consisted of the 1st stage - "before treatment" (3 days), the 2nd stage - "treatment" (from day 0 to day 90 - PolyVar Yellow in the PY group) and the 3rd stage – "after treatment" (from day 90 to day 104 - determination of the number of *V. destructor* fall after pouring with oxalic acid on day 90) (Fig. 1). The sticky bottom inserts with fallen mites were replaced starting from

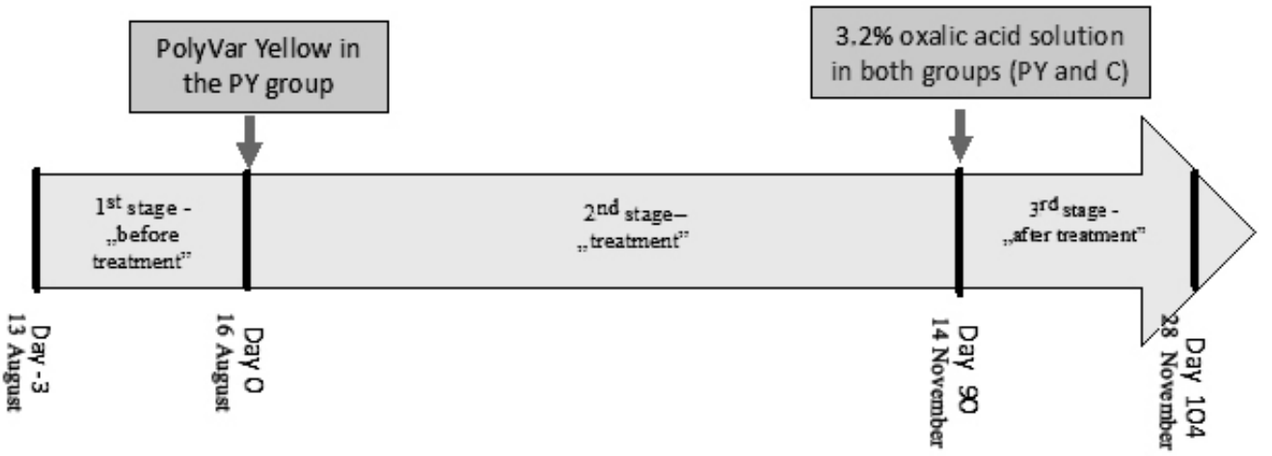

Fig. 1. Experimental design.

the 3rd day before the experiment's beginning (day 3) to the 104th day, one or three times a week depending on the needs and weather, and then the parasites were counted.

Examination of the varroacide effectiveness: The varroacide effectiveness was determined based on the number parasites falling on the *Varroa* sticky insert (Dietemann et al., 2013; EMA, 2011) and the parasite infestation rate of bees (the number of *V. destructor*/ 100 bees) before and after the treatment (Abbott, 1925; Fries et al., 1991).

Statistical analysis

All statistical analyses were carried out using the "Statistica" (№ license JPZ7017977704AR-A). The means were tested using the ANOVA test and the Duncan's test on a significance level of α=0.01.

RESULTS

Average daily fall of *V. destructor*

The average daily parasite fall at the "before treatment" stage in both groups did not differ statistically, 14.50 in group PY and 18.07 in group C. The average daily fall monitored at the "treatment" stage also did not differ statistically between the groups, 14.67 in group PY and 15.76 in group C. The average daily fall after pouring oxalic acid in the bee colony was 1.44 mites in group PY and 49.11 mites in group C. The differences were confirmed statistically ($F_{1,16}$=31.1003, p=0.0000) (Tab. 1).

The first month of the "treatment" stage was characterized as high and not statistically different; daily parasite fall was 41.59 in group PY and 28.36 in group C. Statistical differences in daily parasite fall were found in the second month of treatment ($F_{1,18}$=10.1818, p=0.0051) and third month ($F_{1,17}$=13.1015, p=0.0021) (Tab. 2). After the first month of PolyVar Yellow® use, 91% of the *V. destructor* population in group PY fell on the *Varroa*-sticky insert during the "treatment" stage (Fig. 2).

The infestation rate of bees

The average infestation rate with *V. destructor* at the "before treatment" stage was similar in both groups, 13.53% in group PY and 12.82% in group C, respectively. No statistical differences were found. A very low infestation rate with the parasite was found in the group PY colonies (0.52% on average) compared to those of group C (13.94%) after the withdrawal of the PolyVar Yellow® preparation ($F_{1,16}$=21.4343, p=0.0003) (Fig. 3).

Varroacide effectiveness of PolyVar Yellow®

The average varroacide effectiveness of the preparation calculated based on parasite fall "during treatment" and "after treatment" in group PY amounted to 97%. The average varroacide effectiveness of the preparation, calculated based on the infestation rate of bees with parasite "before treatment" and "after

Table 1.

The average daily fall of *V. destructor* on *Varroa*-sticky paper inserts and the average sum of fallen off parasites at various stages of the experiment in individual groups (with range and SD)

Group	Stage I „before treatment"			Stage II „treatment"			Stage III „after treatment"		
	n	Average daily fall of *V. destructor* (range, SD)	Average no. of the parasite in the colony from the whole stage (range)	n	Average daily fall of *V. destructor* (range, SD)	Average no. of the parasite in the colony from the whole stage (range)	n	Average daily fall of *V. destructor* (range, SD)	Average no. of the parasite in the colony from the whole stage (range)
PY	10	14.50 (0.30-57.33) (24.38)	43.50 (1-172)	10	14.67 (0.30-88.86) (31.23)	1320.90 (61-5098)	10	1.44^{A} (0.20-3.70) (1.00)	20.10^{A} (2-45)
C	10	18.07 (0.30-23.66) (28.98)	54.20 (1-177)	9	15.76 (8.00-36.90) (29.14)	1418.22 (260-3688)	8	49.11^{B} (14.20-157.30) (27.96)	687,00^{B} (426-1233)

Legend:
PY- a group of bee colonies treated for varroosis with PolyVar Yellow®
C- a group of bee colonies not-treated for varroosis
Capital letters indicate the significance of mean differences between the groups at $p<0.01$ in columns

Table 2.

Average daily fall of *V. destructor* per one bee colony on *Varroa*-sticky board in subsequent months of the "treatment" stage in individual groups

Group	Average daily fall per one bee colony of *V. destructor* at the "treatment" stage (range, SD)		
	1st month	2nd month	3rd month
PY n=10	41.59 (0.69-104.97) (56.08)	2.38^{A} (0.29-5.58) (1.95)	1.56^{A} (0.67-3.02) (0.92)
C n=10	28.36 (2.27-97.38) (35.77)	21.92^{B} (2.17-68.04) (19.27)	11.23^{B} (3.24-26.05) (8.42)

Legend:
PY- a group of bee colonies treated for varroosis with PolyVar Yellow®
C- a group of bee colonies not-treated for varroosis
Capital letters indicate the significance of mean differences between the groups at $p<0.01$ in columns

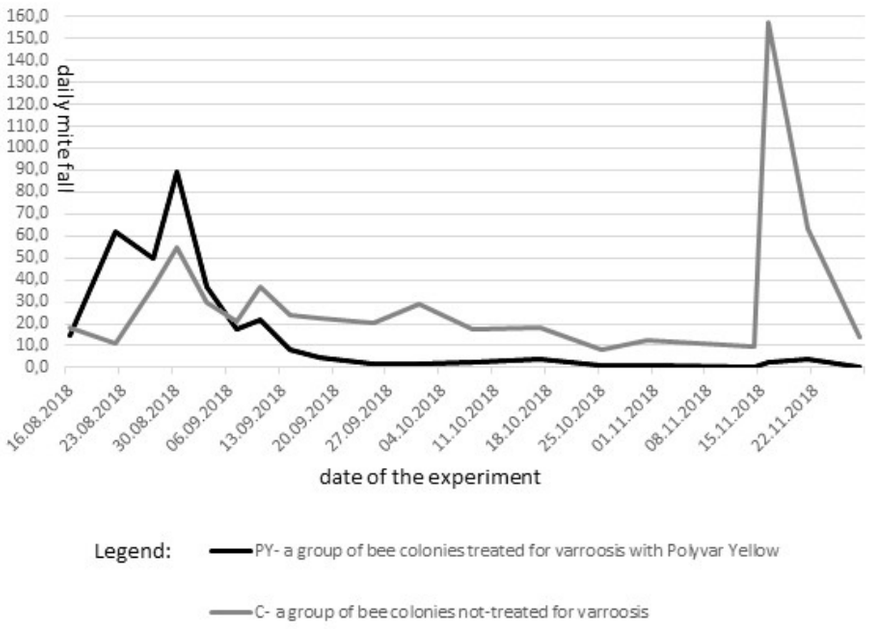

Fig. 2. Average daily mite fall of the bee colony in individual groups from subsequent collected *Varroa*-sticky inserts.

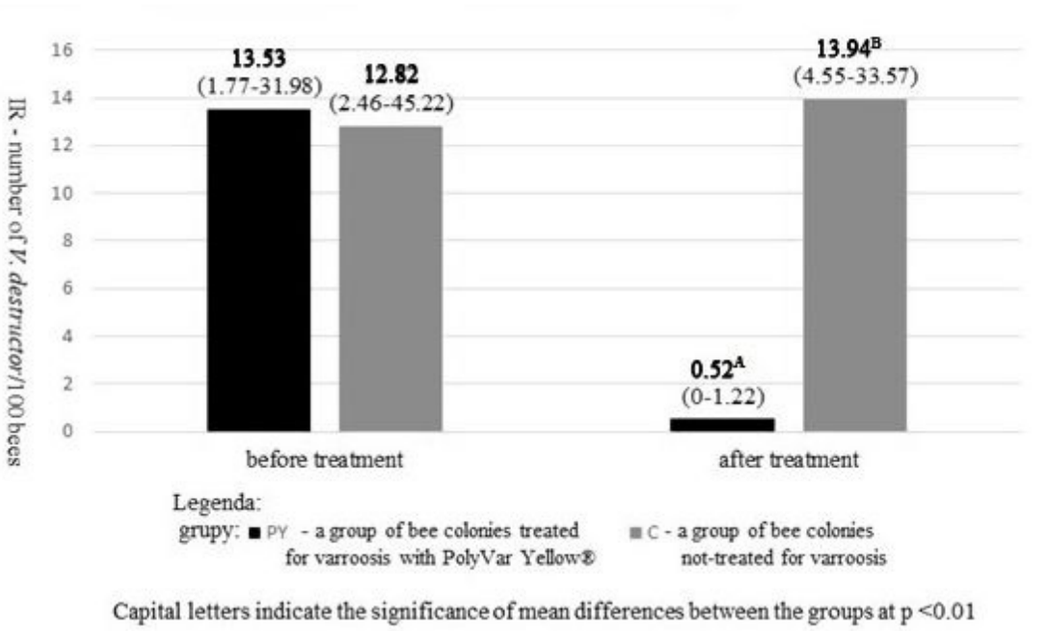

Fig. 3. Average infestation rate of bees with *Varroa destructor* (IR) [%] „before treatment" - IR0 and „after treatment" - IR1 with ranges

treatment" amounted to 95% (Tab. 3).

The group C colonies not-treated with PolyVar Yellow® in one apiary, were strongly infected by mites (some 45%). Thus, colonies from group PY were threatened with the possibility of reinvasion, but the use of the veterinary preparation tested in them protected them.

Conclusions

Summing up, we found that PolyVar Yellow® has a 97% varroacide effectiveness and can become a crucial tool in the treatment of varroosis. The majority of *V. destructor* mites living in the bee colony were exterminated in the first month of use. Therefore, PolyVar Yellow® significantly reduces parasites infestation to a safe level that does not threaten the survival of bee colonies.

Table 3.

Varroacide effectiveness of PolyVar Yellow® [%] in individual treated colonies

group	the ID of bee colony (PY group)	Varroacide effectiveness of PolyVar Yellow® [%]	
		based on the mite fall on the *Varroa*-sticky board during the treatment and after treatment	based on the infestation rate of bees with *V. destructor* before treatment and after treatment
PY	30	out*	89.80
	31	out*	95.62
	33	90.91	83.73
	36	99.42	90.69
	52	99.64	100.00
	53	98.85	100.00
	63	95.96	95.49
	66	89.96	97.43
	102	99.13	97.36
	111	99.50	98.14
mean		97	95

* results rejected due to less than 1/day parasite fall during "treatment" (Blacquičre et al., 2017)

With long-term use, PolyVar Yellow® effectively prevents *V. destructor* reinvasion of an apiary in autumn and late autumn, and colonies are protected until spring.

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