

## **Influence of vegetable specimen KAS-81 and its components upon development of nosematosis in bee colony with natural invasion background**

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**The purpose.** To study influence of feeding with specimen KAS-81 and its components (extracts from *Artemisia absinthium* and gemmas of *Pinus sylvestris*) on bee colony with natural invasion background.

**Methods.** Experiments in nature environment were spent on nucleus colonies with natural invasion environment, equal on force which occupied on the average 3–4 frames in the early spring. **Results.** Effect of optimum densities of BAS of vegetable origin on force of colonies and extent of their infestation by spores of *Nosema sp.* is determined. **Conclusions.** Improving effect of specimen KAS-81 and its components is determined. It manifested itself in faster (for 12 – 15 days) clearing of experimental colonies from spores of *Nosema sp.* in comparison with control ones (bees without treatment). Specimen KAS-81 has appeared more effective than extract from its components.

**Key words:** *nosematosis, colonies with natural invasion background, Nosema sp., KAS-81, Artemisia absinthium, gemmas of Pinus sylvestris, force of family, manifestation of nosematosis.*

Today, the most common disease of honeybee *Apis mellifera L.* is Nosema disease (nosemosis). This invasive disease is the cause of the periodic mass death of bees not only in Ukraine but all over the world [1– 4]. The causative agents of Nosema disease are *Nosema apis* [5] and *Nosema ceranae* [6, 7] – obligated intracellular parasites.

The most used drugs in the world against Nosema disease until recently were drugs based on antibiotics. Recently antibiotics and sulfanilamide preparations prohibited for use both in European countries (EU/3/01/081) and in Ukraine (DSTU 4497:2005 «Natural honey. Technical specifications»). Despite this, against Nosema disease in Ukraine and CIS countries still widely used drugs, the active substances of which are oxytetracycline, metronidazole, fumagillin bicyclohexylamine (Nozemat, Nozematsyd, Nozetom, Fumahillin-B) etc. Nowadays this is a huge problem for countries, which export honey to Europe. It is known that honey from Ukraine is often banned due to the presence of antibiotics, sulfanilamide, nitrofurans in it [8].

In connection with the latter, the expansion and approbation of new, environmentally safe methods for treatment and acceleration of the development of bee colonies at Nosema disease are relevant today as never before.

The evidence in the scientific literature indicates that biologically active substances, which are included in plant extracts in optimally selected concentrations, even essentially not inhibiting the development of microsporidia, significantly increase the life expectancy of bees with Nosema disease, and this is confirmed by both Ukrainian and foreign researchers [9].

The earliest researches aimed at searching ecologically safe methods of bees' treatment at Nosema disease are studies of V. I. Poltev (1957), who studied in laboratory conditions on bees with Nosema disease, the effect against Nosemosis of eucalyptus and anise oil. He observed their high therapeutic effect [10].

In South Korea was investigated the effect against Nosemosis of the *Doellingeria scabra* Thunb. and *Artemisia dubia* Wall. extracts. They slowed down the development of *N. ceranae* spores in infected bee cells [11].

Scientists from Argentina investigated the effect against Nosema disease of plant extracts from the wormwood (*Artemisia absinthium* L.), garlic (*Allium sativum* L.), laurel noble (*Laurus nobilis* L.), yerba mate (*Ilex paraguariensis* A.St.-Hil.) [12]. Other researchers from Argentina have also confirmed the effect against Nosemosis of the extract from the leaves of the laurel noble [13].

In Ukrainian literature from the beekeeping, there are many folk methods of bees' treatment from invasive diseases, including Nosemosis and Varroosis. Therefore, against Nosemosis and Varroosis it is widely recommended the plant preparation KAS-81, which is easy to prepare at home [2].

Taking into account, that the wormwood and pine buds, which are the components of the KAS-81 preparation, according to the literature, have antiparasitic, mycocidal and bactericidal effects [14], it was of great interest for us to confirm experimentally the ability of its use for the bees' treatment at Nosema disease.

The study **aim** – to investigate the influence of the complex plant preparation KAS-81 on bee colonies at Nosema disease.

The **objective** of the study: to investigate the effect from feeding of the KAS-81 preparation in comparison with its components – an extracts from the wormwood *Artemisia absinthium* L. and pine buds *Pinus sylvestris* L. on the development of bee colonies (by the number of bee brood) and the manifestation in the experimental bee colonies of Nosema disease (by the dynamic of decreasing of the degree of bees, infected by the spores of *Nosema* sp.).

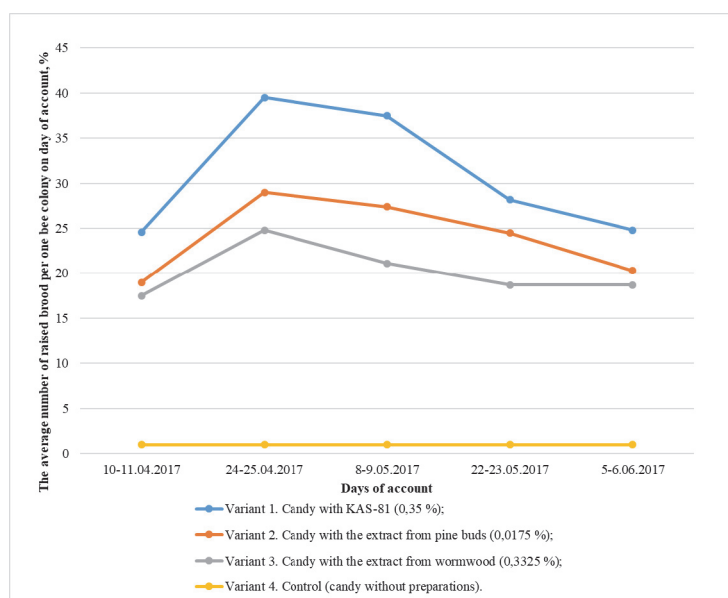
**Material and methods.** The experiments in natural conditions were carried out on nucleus bee colonies with a natural invasive background, with queen bee sisters of the first year of use, equal in strength, which occupied an average of 3 – 4 frames in the early spring [15].

Determined: the influence of optimal concentrations of BAR of the plant origin (the KAS-81 preparation (0,35%) and its components – extracts from the wormwood (0,3325%) and pine buds (0,0175%)) on the strength of bee colonies [16] and the degree of their invasion with the spores of *Nosema* sp. [2]. For each variant, there were 7 nucleus bee colonies: 2 with an average degree of invasion with the spores of *Nosema* sp., 5 – with weak.

**Results.** The results of the influence of two-time feeding in the early spring with candy of KAS-81 preparation and its components – aqueous plant extracts from the pine buds and wormwood, on the development of bee colonies and the manifestation of Nosema disease presented in table 1 and figure 1.

**Table 1. Influence of the preparation KAS-81 and its components (extracts from pine buds and wormwood) on the development of bee colonies (M±m, n=7, p>0,001)**

Variant of the experiment	The average number of raised brood per one bee colony on a day of account									
	10-11.04.2017		24-25.04.2017		8-9.05.2017		22-23.05.2017		5-6.06.2017	
	number	%	number	%	number	%	number	%	number	%
<b>Variant 1.</b> Candy with KAS-81 (0,35 %)	614,3	124,6 ±0,54	4691,4	139,5 ±0,70	12860,4	137,5 ±0,20	23454,2	128,2 ±0,11	34691,9	124,8 ±0,24
<b>Variant 2.</b> Candy with the extract from pine buds (0,0175 %)	586,7	119 ±1,50	4338,3	129 ±0,74	11915,7	127,4 ±0,16	22777,3	124,5 ±0,34	33441	120,3 ±0,10
<b>Variant 3.</b> Candy with the extract from wormwood (0,3325 %)	579,3	117,5 ±1,31	4197	124,8 ±0,22	11326,5	121,1 ±0,74	21716,2	118,7 ±0,13	32996,2	118,7 ±0,23
<b>Variant 4.</b> Control (candy without preparations)	493	100 ±0,40	3363	100 ±0,57	9353	100 ±0,12	18295	100 ±0,81	27798	100 ±0,44



**Fig. 1.** Influence of the preparation KAS-81 and its components on the development of bee colonies

In natural conditions in bee colonies, for the low and medium degree of bees invasion with *Nosemosis*, it was confirmed the treatment effect of the plant KAS-81 preparation (0,35% concentration) and its components, namely extracts from the pine buds and wormwood in concentrations 0,0175 and 0,33325 %, respectively, in condition of two-time feeding with candy at interval of 20 days in a dose of 0,5 kg per bee colony. This was manifested in more rapid (12 –15 days) release of experimental bee colonies from the spores of *Nosema sp.* compared with such in control (where bees were not treated).

The studied samples of plant preparations in the investigated concentrations significantly accelerated the development of bee colonies; in particular, it manifested in the rapid build-up of their strength. Thus, with the use of the KAS-81 preparation and the extract from the pine buds, the number of raised bee brood increased in average, depending on the variant of the experiment, on 19 (119±1,5 %) – 39,5 % (139,5±0,7 %), n=7, p>0,001, compared to the control. When using an extract of wormwood – on 17,5 (117,5±1,31 %) – 24,8 % (124,8±0,22 %), n=7, p>0,001.

At the same time, the KAS-81 preparation was more effective than an extract from its components. After the use of KAS-81 preparation the number of raised bee brood was higher on 24,6 (124,6±0,54 %) – 39,5 % (139,5±0,7 %), n=7, p>0,001, in comparison with the control. While in the variant with the extract of pine buds and wormwood, the number of bee brood increased compared with the control on 19 (119±1,5 %) – 29 % (129±0,74 %), n=7, p>0,001 and at 17,5 (117,5±1,31 %) – 24,8 % (124,8±0,22 %), n=7, p>0,001, respectively.

At the same time, in the variant with an extract of pine buds and wormwood the number of bee brood increased compared with the control at 19 (119±1,5 %) – 29 % (129±0,74 %), n=7, p>0,001 and at 17,5 (117,5±1,31 %) – 24,8 % (124,8±0,22 %), n=7, p>0,001, respectively.

Thus, we have noted the improving and stimulating properties of all three of our plant samples when fed to bee colonies at low and medium degree of invasion by the spores of *Nosema sp.* At the same time, the most effective was the KAS-81 preparation, which combines our investigated plant extracts.

## Conclusions

Under the natural conditions, it confirmed the treatment effect of the plant preparation KAS-81 and its components on bee colonies affected at the low and medium degree by *Nosemosis*. It manifested in more rapid (12 – 15 days) release of experimental bee colonies from the spores of *Nosema sp.* in comparison with such in control (where bees were not treated).

All of the experimental samples of plant preparations in the investigated concentrations significantly accelerated the development of bee colonies, which manifested in the rapid build-up of their strength. In addition, the preparation KAS-81 proved to be more effective than individually each of its extract. With the

use of the KAS-81 preparation the number of grown bee brood increased by 24,6 – 39,5 % compared with the control.

That is, we observed the treatment and stimulating properties of all three of our samples of preparations on bee colonies affected by low and medium degree by the spores of *Nosema sp.* However, the best of our investigated variants can be considered the KAS-81 preparation, which combines the studied samples. The obtained results allow us to recommend KAS-81 as a highly effective, environmentally safe preparation for the treatment and increasing the strength of bee colonies at *Nosema* disease, as an alternative to antibiotics.

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