APPLICATION OF COUPLED ELECTRICAL AND SOUND STIMULATION FOR HONEYBEE VENOM COLLECTION

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Received 28 September 2007; accepted 24 October 2007

Summary

In the years 1998-2001, in apiaries of the Apiculture Division, Research Institute of Pomology and Floriculture, a study was undertaken to evaluate the efficiency of honeybee venom collection by means of coupled electrical and sound stimulation as compared to standard electrical stimulation as elaborated earlier. Venom was recovered simultaneously from five colonies with a similar strength. In three of them, both standard stimulation with electrical impulses and sound stimuli emitted through loudspeakers mounted on venom storeys were used; whereas in the two others use was only made of the standard stimulation with electrical impulses. In each experimental year, venom collection was carried out in three terms, in 14-day intervals.

The results obtained in the experiment enabled concluding that the application of coupled electrical and sound stimulation for venom collection yielded a significantly higher mass of venom as compared to that recovered with the use of electrical stimulation only.

When expressed in percent, the mean mass of venom collected at single treatment from one honeybee colony was higher by 86% with the application of the coupled electrical and sound stimulation.

Keywords: honeybee venom, electrical stimulation, sound stimulation.

INTRODUCTION

In the years 1989-1994, in the Apiculture Division, Research Institute of Pomology and Floriculture, a technology was elaborated for honeybee venom collection by means of electrical impulses as stimuli of honeybees stinging (Rybak et al. 1995). Investigations have also been carried out into the effect of that process on the strength and output of honeybee colonies (Skubida et al 1995), as well as into the impact of biological factors on results of honeybee venom collection (Muszyńska et al. 1998). The idea of using sound stimuli to increase the efficiency of treatments of honeybee venom collection has emerged in the course of another research task, carried out by the author and a research group, addressing the effect of sound stimuli on individual bees and whole bee colonies (Rybak and Muszyńska 1996). The cited research demonstrated that in specified frequency ranges with appropriate intensity, sounds are likely to affect behavior of both single bees and whole bee colonies. This may consist in either a decrease or increase of their motion activity. Research on the effect of sound signals on bees has also been carried out by Es'kov (1973), who claimed that it was possible to inhibit the flight activity of bees with the use of sounds with a frequency of ca. 800 Hz. That author also investigated sounds emitted by bee colonies (Es'kov 1970, 1971, 1972). In Poland, this subject has been investigated by Chuda-Mickiewicz et al. (1992).

In the reported study, in order to aid the standard process of honeybee venom collection consisting in the stimulation of bees for stinging by means of electrical impulses, the so-called electrical stimulation,

Journal of Apicultural Science

use was made of sounds that affect enhancement in the motion activity of bees, i.e. sounds with a frequency range of 130-250 Hz and intensity of ca. 80 dB (Rybak and Muszyńska 1998, Muszyńska and Rybak 2002).

MATERIAL AND METHODS

Experiments were carried out in the Apiculture Division in the years 1998-2001. In 1998, only preliminary investigations were carried out on a few honeybee colonies. In the years 1999-2001, an experiment was conducted that consisted in the collection of honeybee venom with the use of standard electrical stimulation and additional stimulation in the form of sound signals. Venom was recovered in productive colonies at various apiaries. Standard treatments of venom collection by means of electrical stimuli were carried out using an impulse generator and venom bodies made at the Apiculture Division. Sound stimuli were generated with the use of a set composed of a sound generator and loudspeakers. That set of equipment was also constructed at the Apiculture Division, Research Institute of Pomology and Floriculture (Photo 1).

Honeybee venom was collected simultaneously in five colonies with a similar strength. In three of them, both standard stimulation with electrical impulses and sound stimuli emitted through loudspeakers mounted on venom storeys were used; whereas in the other two use was only made of the standard stimulation with electrical impulses. In each experimental year, venom collection was carried out in three terms, in 14-day intervals. In all cases, the process of venom collection lasted for 1 hour. Venom recovered from each colony was weighed in order to determine the treatment's efficiency.

The obtained results were elaborated statistically with the use of an analysis of variance without transformation, and the evaluation of significance of differences was carried out with the use of Duncan's test. Calculations were performed at a significance level of $p = 0.05$.

Photo 1. A set of equipment used for venom collection using combined electrical and sound

Table 1

Mean mass of venom collected at single treatment from one honeybee colony using coupled electrical and sound stimulation and with the use of solely standard electrical stimulation in the years 1999-2001 (g).

MASS OF VENOM (g)				
VARIANTS	SAMPLE NO.	RANGE	MEAN	%
Coupled electrical and sound stimulation	27	0.02-0.41	0.138 b	186
Standard electrical stimulation	18	0.02-0.23	0.074 a	100

RESULTS AND DISCUSSION

Over the three years of investigations, a total of 18 venom samples were collected by means of solely electrical stimulation, and 27 venom samples with the use of coupled electrical and sound stimulation. Results were subjected to a statistical analysis and collated in table 1.

The results obtained in the experiment demonstrated that the application of coupled electrical and sound stimulation for venom collection enabled obtaining a significantly higher mass of venom as compared to that yielded with the use of electrical stimulation only.

When expressed in percent, the mean mass of venom collected at single treatment from one honeybee colony was higher by 86% with the application of the coupled electrical and sound stimulation.

World-wide literature lacks data on venom collection with the use of coupled electrical and sound stimulation. Comparisons can only be made for mean mass of venom obtained as a result of standard electrical stimulation. Hence, for instance: Fakhimzadeh (1998) reports on the efficiency of 26 mg of dry venom from one honeybee colony during a 1-hour treatment, whereas a device described by Nobre (1990) under similar conditions reached 60 mg of venom. In respect of those findings, the efficiency of 74 mg (Table 1) may be claimed satisfactory. In turn, the mean mass of venom obtained upon the use of coupled electrical and sound stimulation, i.e. 138 mg (Table 1), is significantly higher.

CONCLUSIONS

The application of coupled electrical and sound stimulation for honeybee venom collection enabled a significant increase in the mass of recovered venom material as compared to earlier elaborated technology with the use of electrical stimulation only. The accomplished effect, apart from a cognitive value, is of great practical significance for the commercial collection of venom. The effect of coupled electrical and sound stimulation on honeybee colonies and their output requires further, more extensive, research.

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ZASTOSOWANIE ZESPOLONEJ STYMULACJI ELEKTRYCZNEJ I DŹWIĘKOWEJ DO POZYSKIWANIA JADU PSZCZELEGO

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Streszczenie

W latach 1998-2001 w pasiekach Oddziału Pszczelnictwa ISK oceniano skuteczność pozyskiwania jadu pszczelego przy zastosowaniu zespolonej stymulacji elektrycznej i dźwiękowej w porównaniu do opracowanej wcześniej standardowej stymulacji elektrycznej. Jad pszczeli pozyskiwano równocześnie w pięciu rodzinach o zbliżonej sile. W trzech z nich stosowano zarówno standardową stymulację impulsami elektrycznymi jak również bodźce dźwiękowe, które emitowane były przez głośniki umieszczane na korpusach jadowych. Natomiast w dwóch pozostałych stosowano tylko standardową stymulację impulsami elektrycznymi. W każdym roku badań pozyskiwanie jadu odbywało się w trzech terminach, co 14 dni.

Na podstawie uzyskanych wyników stwierdzono, że zastosowanie do pozyskiwania jadu zespolonej stymulacji elektrycznej i dźwiękowej pozwala na uzyskanie istotnie większej masy jadu w stosunku do tej jaką uzyskano przy zastosowaniu tylko stymulacji elektrycznej.

W ujęciu procentowym średnia masa jadu, jaką uzyskano podczas jednego seansu z jednej rodziny pszczelej była o 86% większa gdy stosowano zespoloną stymulację elektryczną i dźwiękową.

Słowa kluczowe: jad pszczeli, elektrostymulacja, stymulacja dźwiękowa.