

# Allergy to propolis in Polish beekeepers

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## Abstract

**Introduction:** According to the literature propolis is a non-toxic and safe substance. However, propolis can induce allergy. Beekeepers may be the group most affected by contact allergy and propolis is an occupational contact allergen for them.

**Aim:** To determine the prevalence of propolis contact allergy in beekeepers and their families and its possible association with other coexistent conditions.

**Material and methods:** The questionnaire '*Allergy to propolis among beekeepers*' was distributed to beekeepers by hand through the Beekeepers Associations, especially the Provincial Association of Apiarists in Krakow. The study was conducted on adults of both genders who had given informed consent to participate in the study. The program Statistica was used for data management and statistical analysis.

**Results:** A total of 2540 questionnaires were distributed, including 1360 questionnaires from Malopolska region. Five hundred and fifty-eight questionnaires were returned, including 345 from Malopolska region. The response rate was 21.97% (25.4% Malopolska region). Among 558 beekeepers propolis contact allergy occurred in 17 cases (3.05%). Four hundred and four of 558 beekeepers used propolis as a therapeutic agent. Eleven of 404 (2.72%) beekeepers reported propolis allergy. Only 5 beekeepers reported concomitant propolis allergy after contact with this substance during beekeeping and using propolis as a therapeutic agent. Among 2205 members of families who were using propolis only 14 patients (0.63%) reported propolis allergy.

**Conclusions:** Allergy to propolis in Polish beekeepers does not seem to be a common phenomenon.

**Key words:** propolis allergy, propolis, beekeepers, contact allergy, occupational allergy.

## Introduction

Propolis is a substance collected by worker bees from the resin of trees, mainly from poplar buds and conifer. It is used by them as a multifunctional material in constructing and maintaining hives and also as protection from microbiological contamination. Propolis has a long history of use. Propolis is known to have been used by Ancient Greeks and Romans, even 300 years BC.

The most important properties of propolis are antibacterial, antiviral and antifungal activity, but also it has anti-inflammatory and regenerative properties. Nowadays, propolis is used as an active substance in some drugs administered externally for healing wounds, burns and chilblains, as well as dietary supplements and cosmetics [1-6].

The first reports on the subject of propolis allergy came from beekeepers, who have more contact with propolis than others, but also from musicians and sculptors of wax figures. Later, other reports were described relating to larg-

er populations [7-9]. The first case of propolis contact allergy was published in 1915 and described a beekeeper with allergy contact dermatitis on his hands. From that time propolis was recognized as an occupational contact allergen in beekeepers, because they are the group most affected by exposure to allergens from propolis [10-12].

## Material and methods

In the Pharmacodynamic Department in the Faculty of Pharmacy at Jagiellonian University a questionnaire study of allergy to bee products in the group of high risk as beekeepers and their families was conducted.

### Study questionnaire

The questionnaire '*Allergy to propolis among beekeepers*' was developed on the basis of earlier investigations on the subject of allergy in beekeepers and on the basis of aller-

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gy to bee products in the general population. The questionnaire was tested on 20 volunteers for intelligibility. Questions asked in the questionnaire are presented in Table 1.

### Subjects

Questionnaires were sent to beekeepers by hand through the Beekeepers Association, especially the Provin-

cial Association of Apiarists in Krakow. This study was directed at beekeepers, the occupational group most affected by propolis contact allergy and allergy to bee products. The study was conducted on adults of both genders who had given informed consent to participate in the study. Every beekeeper who gave informed consent was included in the study.

**Table 1.** Fragment of the questionnaire sent to beekeepers

<b>Propolis allergy – beekeepers</b>	
1. Have you suffered from allergy in the past?	
1.1 <i>If yes, which allergens were responsible (e.g. substances, drugs, house dust mites, animals, pollen, food)?</i>	
2. Do you suffer from: a) atopic dermatitis, b) asthma, c) allergic rhinitis (hay fever), d) eczema, e) other allergic diseases, f) none of the above?	
2.1 <i>Do you receive any treatment because of your disease?</i>	
2.2 <i>Which remedies were prescribed or which medicines are administered currently?</i>	
3. Do you use any drugs systematically (e.g. during hypertension, diabetes, arteriosclerosis or other disease)?	
3.1 <i>If yes, please give the name</i>	
3.2 <i>Did you notice any change of intensity of reaction to propolis when taking drugs?</i>	
4. Do you have any side-effects after contact with propolis (during beekeeping)?	
4.1 <i>If yes, are they: a) very strong, b) strong, c) moderate, d) slight?</i>	
5. Do you use propolis preparations in pro-health aims?	
5.1 <i>If yes, do you have any side-effects?</i>	
5.2 <i>If side-effects occurred, were they: a) very strong, b) strong, c) moderate, d) slight?</i>	
5.3 <i>Do any side-effects occur? a) itching, b) eczema, c) swelling, d) redness, e) others (please specify)</i>	
5.4 <i>Side-effects required: a) hospitalization, b) general practitioner consultation, c) dermatological consultation, d) stop taking/administering propolis</i>	
5.5 <i>Symptoms of propolis allergy over time: a) stay the same, b) worsen, c) diminish</i>	
6. Are you allergic to bee products other than propolis? What are the symptoms?	
<b>Allergy to propolis in family members, friends, clients, etc.</b>	
1a. What is your experience of pro-health properties of propolis? a) none, b) very bad experience, c) bad experience, d) not good or bad, e) good experience, f) very good experience	
2a. Do you recommend propolis to your clients for its pro-health properties?	
3a. Do you possess any information about propolis allergy in clients who had bought propolis from you? If yes, how many persons and which way of administration (e.g. orally, cutaneous, etc.)	
4a. Have any side-effects occurred in persons from your family working with propolis during beekeeping?	
4.1a <i>If yes, are they: a) very strong, b) strong, c) moderate, d) slight?</i>	
5a. How many people used propolis because of pro-health properties?	
6a. Did they complain about adverse reactions after using propolis (e.g. itching, rash, swelling, different allergic symptoms)?	
6.1a <i>If side-effects occurred, were they: a) very strong, b) strong, c) moderate, d) slight?</i>	
6.2a <i>Side-effects required: a) hospitalization, b) general practitioner consultation, c) dermatological consultation, d) stop taking/administering propolis</i>	
6.3a <i>Did any of these side-effects occur in members of your family: a) itching, b) eczema, c) swelling, d) redness, e) others (please specify)?</i>	
6.4a <i>Is the person in whom side-effects occurred after using propolis an allergy sufferer?</i>	

**Table 2.** Demographic characteristics of the study group

Characteristic		Result
Age [years]	Up to 20	0.40%
	21-40	12.58%
	41-60	45.84%
	Over 60	41.18%
Gender	Female	6.29%
	Male	93.71%
Time spent as beekeeper [years]	Up to 5	6.90%
	6-10	15.01%
	11-15	15.01%
	Over 15	63.08%
Number of bee hives on farm	Median	42.69

### Statistical analysis

The program Statistica was used for data management and statistical analysis.

### Ethical approval

The study was submitted to the Bioethics Committee of Jagiellonian University in Krakow, Poland. The agreement was approved on the 25<sup>th</sup> of November, 2010 (number of agreement KBET/211/B/2010).

### Results

A total of 2540 questionnaires were sent, including 1360 questionnaires from Malopolska region. Five hundred and fifty-eight questionnaires were returned, including 345 from Malopolska region. The response rate was 21.97% (25.4% Malopolska region), which indicates the limited interest of beekeepers in occupational allergies and little compliance between beekeepers and researchers. The characteristics of the responding beekeepers are given in Table 2.

Seventeen cases of allergic reactions after working in an apiary were reported; the rate of propolis allergy was

3.05% (17/558). Taking into consideration the frequency of allergy in different regions of Poland, the highest number of cases of allergy was noted in Lubelskie region. Table 3 presents all cases of propolis allergy in different regions in subjects who participated in this study (were willing to participate and returned filled questionnaires).

Two of 17 (11.76%) beekeepers allergic to propolis had a very strong reaction, 6 of them (35.29%) a moderate reaction, 9 of 17 (52.94%) a slight reaction. Additionally, 404 of 558 (72.40%) used propolis as a therapeutic agent. In 11 of them (2.72%) propolis allergy occurred. Four (36.36%) had a slight reaction, 5 (45.45%) a moderate reaction, but 2 (18.18%) reported a strong reaction. In the overwhelming majority (8 beekeepers = 72.72%) it was sufficient to stop taking/administering propolis, while in 2 cases (18.18%) adverse reactions required dermatological consultation, and consultation with a general practitioner was required in 1 case (9.09%). Eleven of 17 beekeepers allergic to propolis after contact with it while working in an apiary used propolis for therapeutic purposes. Only 5 of them had concomitant adverse reactions after contact with propolis and use of propolis as a therapeutic agent. There was no report of concomitant allergy to propolis and other bee products. Only 14 of 2205 (0.63%) family members, using propolis as a therapeutic agent, reported propolis allergy.

Only 12 of 558 (2.15%) beekeepers reported allergy to bee products other than propolis: 3 beekeepers are allergic to bee pollen, 2 are allergic to honey and 7 beekeepers are allergic to bee venom. The results of the study of allergy to bee products excluding propolis are shown in Table 4.

There were 45 allergic beekeepers (8.06%) in the whole group. Only 14 were allergic to propolis; it means that from 17 beekeepers allergic to propolis as many as 14 of them (82.35%) suffered from other allergic reactions. Sixty-two beekeepers suffered from different allergic diseases. From that group in 14 beekeepers (20.29%) allergy to propolis occurred after contact with this substance. Among 4 beekeepers with atopic dermatitis 3 beekeepers were allergic to propolis. Among 9 beekeepers with concomitant allergic diseases (e.g. allergic rhinitis and eczema) 4 beekeepers were allergic to propolis. Obtained data from beekeepers about the relation between the occurrence of allergic diseases and allergy to propolis are presented in Table 5.

**Table 3.** Cases of propolis contact allergy in regions participating in the study

Region	Number of questionnaires returned	Cases of allergy	% of allergy
Malopolskie	345	12	3.48
Podlaskie	28	0	0
Wielkopolskie	65	0	0
Lubelskie	66	5	7.57
Dolnoslaskie	14	0	0
Lubuskie	40	0	0

Most of the beekeepers (405 = 72.58%) had good or very good experience with pro-health properties of propolis. No experience with propolis was reported by 114 beekeepers (20.43%), while only 10 persons (1.79%) reported that they had had a bad experience and 1 beekeeper (0.18%) a very bad experience with propolis. Twenty-eight patients (5.02%) reported no good or bad experience with this substance. Results of the experience with propolis in beekeepers are presented in Table 6. Despite different experience with propolis pro-health activities as many as 492 beekeepers (88.88%) recommended propolis to their clients. This means that some beekeepers must recommended propolis to their clients even without experience. Maybe the question was not understandable enough or really beekeepers sell propolis without conviction of its properties.

## Discussion

Based on the results it can be assumed that propolis is a known allergen for beekeepers, but it does not seem to be a common phenomenon for this occupational group. Many beekeepers (almost 3/4 of the population) use propolis because of its pro-health properties. With such high exposure to propolis allergens and taking into account the average time spent as beekeepers (over 15 years for 60% of beekeepers), allergy in this occupational group is not a great risk. However, beekeepers should be aware of the possibility of allergy occurrence and should take precautions against direct contact with propolis, because allergy to propolis can even appear after many years. According to German researchers the average time of allergy

**Table 4.** Allergy to bee products excluding propolis in Polish beekeepers

Bee products	Number of allergic beekeepers	% allergic beekeepers (n = 558)
Bee pollen	3	0.54
Honey	2	0.36
Royal jelly	0	0
Bee venom	7	1.42

occurrence is 9.5 years [13]. In this study in one beekeeper propolis allergy occurred after 20 years of being beekeeper, not counting the time of exposure in childhood (the father was a beekeeper also).

Taking into account the occurrence of propolis allergy in different regions it can be assumed that ecological clean regions may not be conducive to the occurrence of propolis allergy. Cases of propolis allergy were reported from Malopolskie and Lubelskie regions. According to the ecological map of Poland the lead content is the highest in Slaskie region and then in Malopolskie region. Regions with the lowest content of lead in the soil are Podlaskie, Pomorskie, Kujawsko-Pomorskie, Wielkopolskie and Lubuskie. In those regions no propolis allergy case was reported according to data obtained in this study. Obviously, the question of contamination of regions in correlation with propolis allergy should be a subject of further studies.

Factors which can have an influence on the occurrence of allergy can also be allergic diseases, for example atopic allergic dermatitis or other allergies to different allergens which induce eczemas. Based on the estimates from

**Table 5.** Relation between occurrence of allergic diseases and allergy to propolis

Allergic diseases	Number of beekeepers affected	Number of beekeepers allergic to propolis	Percentage [%]
Atopic dermatitis	4	3	75.00
Asthma	9	0	0
Allergic rhinitis (hay fever)	34	5	14.71
Eczema	16	5	31.25
Other allergic diseases	6	1	16.67

**Table 6.** Experience of pro-health properties with propolis in Polish beekeepers

Experience of pro-health properties of propolis	Number of beekeepers	Percentage [%]
No experience	114	20.43
Very bad experience	1	0.18
Bad experience	10	1.79
Neither good nor bad	28	5.02
Good experience	195	34.95
Very good experience	210	37.63

**Table 7.** Comparison of data from literature on the subject of propolis allergy in beekeepers

Population	Number of beekeepers	% allergy	Literature
Beekeepers (Malopolska region)	297	4.04	Illg J, <i>et al.</i> Przegl Dermatol 1976; 6 (Suppl): 135-7
Farmers with a suspected skin occupational disease (Poland)	132	0.76	Kieć-Świerczyńska M, <i>et al.</i> Medycyna Pracy 2003; 54: 237-43
Farmers with a suspected skin occupational disease (Poland)	101	2	Śpiewak R. Am J Ind Med 2003; 43: 647-55.
Beekeepers (Germany)	1051	3.6	Münstedt K, <i>et al.</i> Allergol Immunopathol (Madr) 2007; 35: 95-100
Beekeepers (Poland)	558	3.05	Basista K
<b>Average % of beekeepers allergic to propolis</b>			<b>2.86% (0.76-4.04%)</b>

this study, 3 of 4 beekeepers with atopic dermatitis were allergic to propolis. According to data in the literature hypersensitivity to propolis in the form of allergic dermatitis more often appears in dermatological patients treated earlier for allergic dermatoses (1.2-6.7%; average 3.82%) [14-21].

Comparing the results of the propolis allergy in this study with others conducted in Poland and in the world we can state that allergy to propolis in beekeepers is not a common phenomenon. Additionally, there is not a greater risk in beekeepers taking into account time and the scale of exposure to the allergens from propolis [22-24]. In Table 7 the results of studies of the allergy in beekeepers from the literature are presented.

Furthermore, we compared the results of this study in Malopolska region with another study conducted in the same region in 1976 by Illg *et al.* It can be stated that the percentage of beekeepers allergic to propolis in this region is diminishing. According to Illg *et al.* it was 4.04%, while currently it is 3.48%. This fact may be related to the mass cutting down of poplars, which have strong allergenic properties and substances from their resin constitute components of propolis.

## Conclusions

The study demonstrated that an occupational allergy in beekeepers exists, but is not a common phenomenon. Beekeepers are more affected by propolis allergy than the healthy population (0.64-1.3%) [14, 25, 26], but are not more affected by propolis allergy than dermatological patients cured earlier because of allergic dermatoses (1.2-6.7%) [14-21].

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