

Contact allergy to propolis in beekeepers

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SUMMARY

Background: Some toothpastes, cosmetics and ointments contain propolis, a bee product, and it is increasingly popular as a dietary supplement. Although propolis is known to cause contact allergy, there have been no studies of the prevalence of this.

Objectives: This study aimed to determine the prevalence of contact allergy to propolis in beekeepers and any relationship between propolis allergy and environmental and physical and mental health characteristics in this group.

Subjects and methods: A specially developed instrument which included a validated questionnaire on emotional stability was included in the issues of three German beekeeping journals sent to subscribers in a number of regions (potential readership 35,000). A reference group also completed questionnaire.

Results: 1051 questionnaires were returned and 37 cases of allergic reactions to propolis were reported (3.6 %). Only 10 of the 37 (27 %) beekeepers had recognised the allergy before participating in this study. Propolis contact allergy was significantly associated with lung diseases and other allergic reac-

tions. Only some affected beekeepers protected their hands more while working with bees and showed significantly greater emotional instability than those not sensitised to propolis.

Conclusions: Contact allergy to propolis is common among beekeepers, but they do not seem to recognise the problem or protect themselves properly.

Key words: Contact allergy. Propolis. Beekeeper. Beekeeping.

INTRODUCTION

Propolis is a substance collected by worker bees from the resin of trees and flowers and used by them as a multifunctional material in constructing and maintaining their hives. Man has used propolis for centuries. In ancient Egypt, it was used for embalming the dead. Aristotle (around 330 BC) reported the first use in medicine, but it took more than 350 more years until the Roman scholar, Caius Plinius Secundus (23-79 AD), and the Greek, Pedanios Dioscorides (around 50 AD) continued with the medical uses of the substance¹. In the 17th century, Stradivarius used varnish containing propolis on his violins, and more recently a preparation called Propolisin, made from petroleum jelly and propolis, was used to treat wounds during the Boer War in South Africa (1899-1902)². Although scientific evaluation has provided substantial information on the biological activity and toxicity of propolis and indicates that the substance has antibiotic, antifungal, antiviral and anti-tumour properties, no

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propolis-containing preparation has yet found a place as accepted treatment in mainstream, western medicine. Nevertheless, many 'over the counter' products containing propolis are currently available, including cosmetics, toothpastes and ointments, and propolis is used increasingly as a dietary supplement.

The increase in the use of propolis has been paralleled by the publication of numerous case reports on contact allergy to the substance. Studies on patients with contact allergy from unknown causes found that 1.2 to 6.6 % of those who were patch-tested for dermatitis were sensitive to propolis³. In addition, many contact allergens have been found in propolis⁴. Beekeepers probably have more contact with propolis than others and may be the group most affected by propolis contact allergy, since the first case was described in a beekeeper in 1915. Because of this we undertook a study on beekeepers' health in order to determine the prevalence of propolis contact allergy in this group and its possible association with other health conditions.

METHODS

Study questionnaires

Because there have been no previous studies on this subject we had to develop a suitable instrument for gathering information – this was the Questionnaire for the Assessment of Beekeepers' Health (QABH). The questionnaire was based on previous research in other fields of medicine and on reports of various disorders in beekeepers⁵⁻¹⁴. The questionnaire was tested in 10 volunteers for intelligibility. The QABH was combined with the Inventory for the Measurement of Bodily Negative Affectivity – trait version (INKA-h) questionnaire. The INKA-h provides validated and robust evidence of emotional instability such as neuroticism, negative affectivity or stress-reactivity¹⁵. This is important since published reports show that emotional instability is associated with psychological and somatic disorders as well as subjective bodily discomfort¹⁶⁻²⁵.

Subjects

In Germany, some 81,818 beekeepers are members of the national Deutscher Imkerbund (DIB; German Beekeepers Association), an organization which is structured into regional groups. According to the association, only 5 to 10 % of German beekeepers are not members. Most members subscribe to journals informing them of regional news. The Deutscher Landwirtschaftsverlag GmbH (www.dlv.de) publishes three of these journals – *Die Biene*, *Der*

Imkerfreund, and *ADIZ*. Journal readership is particularly high in the following geographic areas: Baden, Bavaria, Hesse, Mecklenburg-Western Pomerania, Nassau, Rhineland-Palatinate, Rhineland, Saxony, Saxony-Anhalt, Saarland, and Thuringia. The QABH and INKA-h were incorporated into one questionnaire and included in the May 2006 issues of the three Deutscher Landwirtschaftsverlag beekeeping journals sent to subscribers in the areas mentioned above. The survey therefore reached approximately 35,000 beekeepers (Deutscher Landwirtschaftsverlag GmbH, personal communication). Readers were asked to complete the printed questionnaire and to return it by mail or fax or to complete the electronic questionnaire on the Internet. A copy of the questionnaire is available from KM.

Reference group

Members of the beekeeping association in the Giessen region were asked to serve as a reference group in order to detect or rule out any potential biases between beekeepers who responded to our journal survey and non-respondents. The Giessen association has 181 members – 178 individual members and 3 institutional members. Concurrently with the distribution of the questionnaire in journals, individual members of the Giessen association were asked to complete the questionnaire and return it using a postage paid envelope.

Statistical analysis

SPSS version 10.0 (SPSS, Chicago) was used for data management and statistical analysis. Various statistical methods were used in the study, including simple descriptive methods, bivariate correlations, cross-tabulation, and one-way ANOVA. A p-value of less than 0.05 was considered significant.

Ethical approval

The study was submitted to and approved by the ethics committee of the Justus-Liebig-University.

RESULTS

Questionnaires returned

In all, 1051 questionnaires were returned, mainly by mail or fax, but a few via email. Altogether 58 bee-

keepers completed the survey on the internet. The demographic characteristics of respondents are shown in table 1. Neither one-way-ANOVA or χ^2 -test showed any differences between the beekeepers who participated in the survey through the beekeeping journals and members of the Giessen Beekeeper Association who formed the reference group. Comparison of our data with statistics of beekeepers provided by the Deutscher Imkerbund also showed no relevant differences.

QABH – Prevalence of allergic reactions to propolis

Overall, 37 cases of allergic reactions to propolis on hand were reported; thus the rate of propolis allergy was 3.6 % (37/1051). However, when asked to name their allergy, only 10 of 37 (27.0 %) stated a known propolis contact allergy.

QABH – Allergy in relation to other factors

Neither cross tabulation nor one-way ANOVA was able to find any significant relationships between propolis allergy and age, gender, years spent as a beekeeper, number of bee hives kept, and body mass index. Reaction to bee stings (classified according to Müller²⁶) did not generally correlate with a reaction to propolis. However, those beekeepers who reported a stronger reaction to bee stings in the springtime, after not having been stung for months, were more frequently found to suffer from propolis allergy (2.7 % versus 5.9 %; $\chi^2 = 5.854$; $df = 1$; $p = 0.016$).

QABH – Significant associations

Propolis allergy was also significantly associated with benign lung diseases (3.3 % versus 7.3 %;

Table 1
Demographic characteristics of the study and reference groups

Characteristic	Entire group (n = 1051)	Journal survey (n = 899)	Giessen Beekeeper Association (n = 152)
Response rate [%]	–	~2.6	84.8
Age [years]			
Mean (SD)	61.8 (13.9)	61.0 (14.0)	63.7 (13.3)
Median	65	65	66
Range	4-94	4-94	12-90
Gender [%]			
Female	7.6	7.8	5.9
Male	92.4	92.2	94.1
Marital status			
Single	6.7	6.9	5.3
Married	86.2	86.1	86.8
Widowed	4.2	3.9	6.0
Divorced	2.9	3.0	2.0
Place of residence			
Town	25.7	25.4	27.3
Country	74.3	74.6	72.7
Body mass index [kg/m ²]			
Mean (SD)	26.6 (3.8)	26.3 (3.7)	27.1 (4.1)
Median	25.9	25.8	26.0
Range	15.1-59.2	15.1-59.2	19.5-57.4
Time spent as a beekeeper [years]			
Mean (SD)	25.9 (17.3)	26.2 (17.5)	24.4 (16.1)
Median	23	24	21
Range	0-91	0-91	1-65
Number of bee hives			
Mean (SD)	13.9 (15.5)	14.9 (16.4)	8.0 (5.0)
Median	10	10	7
Range	0-240	0-240	1-30

$\chi^2 = 3.91$; $df = 1$; $p = 0.048$). Unfortunately, the exact diagnoses were not given. In addition, propolis allergy was more frequently found in beekeepers suffering from other allergic reactions (2.7 % versus 8.0 %; $\chi^2 = 12.17.47$; $df = 1$; $p < 0.001$). Interestingly, beekeepers who were sensitive to propolis did not protect their hands during their work more frequently than those who did not have this sensitivity ($14/37 = 37.8$ % versus $401/986 = 40.7$ %; ns). This finding remained the same when the subgroup of beekeepers who reported a diagnosed allergy to propolis was analysed. Here, only 30 % (3/10) protected their hands. Beekeepers who were sensitive to propolis reported that they spent significantly more hours practising sport (3.53 h versus 5.20 h; $F = 7.17$; $p = 0.008$).

QABH – Therapeutic use of propolis

We asked beekeepers with propolis allergy whether they used propolis as a medication. Only 15 ($15/37 = 40.5$ %) reported did not use propolis. Six (16.2 %) sometimes used propolis, 8 (21.6 %) reported moderate use and 8 (21.6 %) reported frequent use of propolis. Interestingly, there are no differences between the use of propolis as a therapeutic treatment between beekeepers with and without skin reactions to propolis. Propolis-allergic beekeepers reported good or very good experiences with therapeutic effects of propolis in 13.5 % and 29.7 % respectively.

Association with the INKA-h scale

We also investigated whether propolis allergy was associated with higher values in the INKA-h scale. The 35 beekeepers with skin reactions to propolis

were compared with 315 who reported that they did not have any disorders. This subanalysis showed that beekeepers with propolis contact allergy had significantly higher mean values, indicating a higher rate of emotional instability in this group (table 2; $p = 0.019$).

DISCUSSION

Based on the estimates from this study, there are approximately 2900 propolis sensitive beekeepers in Germany. The study showed that contact allergy to propolis is common among beekeepers. However, they do not seem to recognise the problem and continue their hobby without protecting themselves from contact with the substance. On the contrary, many use propolis as medication for other disorders. We also identified factors influencing the likelihood of suffering from propolis allergy – the presence of benign lung diseases and of allergies other than propolis. These and the association with sport need further investigation.

This study had shortcomings. The first was the low response to the questionnaire published in the beekeeping journals. However, the response rate to another questionnaire included in the same journals was similar so we do not believe this effect was peculiar to our study²⁷. An additional problem was the fact that we did not have any evidence from patch testing that the reported skin reactions were from propolis. However, beekeepers do not seem to have been aware of the problems of contact allergy and we therefore assumed that most cases had been undiagnosed. We do not believe that bias was an issue in this study. The design included a reference group – the Giessen Beekeepers Association – and comparison of the results showed that there were no significant intergroup differences

Table 2

Inventory for the Measurement of Bodily Negative Affectivity-trait version (INKA-h) scores of beekeepers in perfect health and those with propolis allergy (one-way ANOVA)

Group	No	Mean (SD)				
Beekeepers reporting perfect health	315	1.7172 (0.78021)				
Beekeepers with propolis contact allergy	35	2.0482 (0.85383)				
			Sum of squares	df	Mean of squares	F-value
Between groups			3.5	1	3.450	5.56
Within groups			215.9	348	0.620	
Total			349			
						Significance
						0.019

in the characteristics assessed. In addition, the characteristics of the beekeepers in a study on beekeeping traditions from Rhineland-Palatinate and the data provided by the Deutsche Imkerbund survey in relation to age and number of beehives looked after did not indicate that there was appreciable bias in our study group²⁸.

More than 250 cases of allergy to propolis have been described in published reports. Some have been in beekeepers but musicians and people who come in contact with propolis as an additive to foods or in toiletries have also been affected^{10,29}. In studies of patients with suspected contact dermatitis, 0.5 % to 6.6 % were found to be sensitive to propolis^{30,31}. These differences can be explained by variations in the use of propolis in the general population; use is more frequent in countries where propolis is a popular folk medicine³⁰. Thus far, there have been no studies on the likelihood of contact allergy to propolis in the general population or in subgroups at risk, such as beekeepers.

The present study provides insight into the prevalence of contact allergy in beekeepers. The rate is surprisingly high, and it seems that the association is not realised by most beekeepers affected. Perhaps beekeepers deliberately ignore the problem as their work with bees is so important to them. We were able to show that even those who know about their allergy do little to reduce their exposure to propolis. This suggestion is supported by the fact that beekeepers continue with their hobby even when they have an allergic reaction to bee stings⁶.

In this study, we also assessed emotional instability (neuroticism, negative affectivity, and stress reactivity) using the INKA-h questionnaire and we found that propolis allergic beekeepers were more emotionally unstable than beekeepers without this allergy. Thus, we were able to show that personality variables may influence the development of contact allergies. This has also been demonstrated for patients suffering from other conditions which are considered to be allergy-related such as asthma²¹. However, there may also be an other explanation. Less emotionally stable beekeepers could be more likely to continue beekeeping in spite of allergic reactions. This issue needs to be addressed in future studies.

We conclude that the problem of contact allergy to propolis should be paid more attention in this group. Beekeepers should be better informed about propolis and about protecting themselves from contact with this substance and allergic beekeepers should receive instructions on coping with the problem. In particular, they should be advised not use propolis as a medication.

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