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Propolis and Beeswax in Cosmetics: A Market Survey and Literature Review on Their Relationship and Role in Allergic Contact Dermatitis

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ABSTRACT

Background: Cosmetics have been suggested as sources of exposure in patients with positive patch tests to propolis. It has also been proposed that beeswax in cosmetic products may cause allergic contact dermatitis due to contamination with propolis.

Objectives: To assess how often propolis is listed in cosmetics and to review evidence on the propolis–beeswax relationship, including whether residual propolis in beeswax can elicit dermatitis in propolis-sensitised individuals.

Materials and Methods: Market survey of ingredient lists for 500 cosmetics and a literature review on allergy to beeswax and its association with propolis allergy.

Results: None of the 500 cosmetics contained propolis. Evidence on the propolis–beeswax relationship is inconsistent, but occasional co-reactivity is reported.

Conclusions: Based on the available evidence, propolis is not or only rarely used in conventional cosmetics on the European market and is therefore unlikely to be a relevant exposure source for patients with positive patch tests to propolis. Reactions to beeswax in propolis-sensitised individuals from residual propolis cannot be fully excluded but appear uncommon and mainly involve allergic contact cheilitis from lip balms. Within the scope of the present data, patients with positive patch tests to propolis do not need to avoid all cosmetics containing beeswax.

1 | Introduction

In our patient population at the Department of Dermato-Allergology and Occupational Dermatology of Amsterdam UMC, allergic reactions to propolis are rarely found to be clinically relevant, relevant meaning that patients have used products containing propolis at the site of current or previous dermatitis [1, 2]. However, several studies have reported that many observed propolis reactions were deemed clinically relevant, with cosmetics most frequently mentioned as the (suspected) source of exposure [3–6]. For this to be the case, propolis would need to be a common

ingredient in cosmetic products. Previously, we examined the labels of 50 randomly selected cosmetics and found that none contained propolis (unpublished data). We have now expanded this investigation into a formal study assessing the presence of propolis in cosmetic products. The research questions were:

1. Is propolis a common ingredient in cosmetics?
2. Can cosmetics be a frequent source of contact with propolis in patients with positive patch test reactions to this substance?

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In addition to propolis, we also investigated beeswax, which is a major constituent of crude propolis—the raw material from which commercial propolis is derived [7]. Purified beeswax, listed as both beeswax and cera alba in the European INCI nomenclature and as beeswax in the American system, is used in cosmetics for its skin-conditioning, emollient, surfactant, emulsifying and film-forming properties [8].

It has repeatedly been stated that beeswax is often contaminated, adulterated, or polluted with propolis [9–12]; that propolis commonly occurs as an impurity in beeswax [9, 11, 13]; that many cases of allergic reactions to beeswax appear to result from propolis contamination [9, 13] and that patients sensitised to propolis should be advised to avoid products containing beeswax [10]. To evaluate whether beeswax in cosmetics may indeed cause allergic contact dermatitis in patients with positive patch tests to propolis—due to residual propolis in the beeswax—and, if so, how often this occurs, we critically reviewed the available literature on this topic.

The research questions were:

1. How frequently does contact allergy to beeswax occur?
2. How often do co-reactions between propolis and beeswax occur?
3. Is there evidence that beeswax used in cosmetics contains sufficient propolis to elicit hypersensitivity reactions in propolis-sensitised individuals?
4. What other explanations exist for concomitant reactions to beeswax and propolis?
5. Should patients with positive patch test reactions to propolis be advised to avoid cosmetics containing beeswax?

2 | Materials and Methods

2.1 | Cosmetics Ingredient Lists Search

Ingredient lists of conventional stay-on cosmetics (selected because these have the highest risk of sensitization and allergic contact dermatitis) were collected from www.bol.com, the largest online retailer in the Netherlands, between September 23 and October 2, 2025. The following categories and sample sizes of stay-on cosmetics were selected for this study: day creams ($n=100$), night creams ($n=100$), sunscreens ($n=50$), eye creams ($n=50$) and lip salves ($n=50$). Consecutive cosmetic products identified through the search strategy were included in the analysis. However, products with missing or seemingly incomplete ingredient lists, cosmetics shown in the list that belonged to other categories, products with nearly identical names to those already included, and items that reappeared in the list due to sponsorship were excluded. The same exclusion criterion applied to products of brands that had already been represented five times (in the groups of 100) or four times (in the groups of 50).

The following data was collected for each individual product: brand, full product name, country of manufacture, complete ingredient labeling and the presence or absence of propolis cera,

propolis wax, propolis extract and beeswax/cera alba. Beeswax was nearly always listed as ‘cera alba/beeswax’ or ‘cera alba (beeswax)’. We also checked for cera flava, although this name is not present in the European INCI system. The ingredient ‘synthetic beeswax’ was not included. We also checked the labels of 60 shampoos, 50 hair wax products and 45 depilatory waxes and pre-waxed depilatory strips, collected in the same manner, for the presence of these ingredients but without collecting further data as described above.

2.2 | Literature Search Relationship Beeswax—Propolis

A PubMed search was performed using the search terms ‘beeswax’, ‘cera alba’ and ‘cera flava’ in combination with ‘allergy’ and ‘dermatitis’ with no time limit. Literature lists of identified articles were screened for additional relevant studies. For literature related to propolis, we consulted our 2013 full review article on propolis allergy [7] and its recent update 2013–2025 [14].

3 | Results

The Results section presents the findings of the market survey, followed by a structured presentation of published data from the literature and our own unpublished observations, all addressing the same predefined research questions.

3.1 | Cosmetics Ingredient List Search

The brands of the 350 cosmetic products, their countries of manufacture and the number of products from each brand—both by product type (day creams, night creams, sunscreens, eye creams and lip salves) and for the total sample—are presented in the Supporting files, Table S1. A total of 108 individual brands were identified. The largest number of brands originated from France ($n=24$), followed by the United States ($n=20$), the Netherlands ($n=18$), South Korea ($n=15$), Germany ($n=9$) and the United Kingdom ($n=6$). Three brands were from Spain, two each from Canada, Italy, Sweden and Switzerland, and one each from Belgium, China, Denmark, India and Japan (Table S2).

Of the 350 products, 93 (27%) were French brands, 75 (21%) originated from the USA, 52 (15%) each from the Netherlands and Germany, 30 (9%) from South Korea, 11 (3%) from the United Kingdom and 7 (2%) from Japan. The remaining 10 countries each contributed 1–6 products (0.3%–1.7%) (Table S3).

None of the 350 products contained propolis cera, propolis wax, or propolis extract, according to the INCI labels. Cera alba was identified in 8 of 100 day creams (8%), 11 of 100 night creams (11%), none of the 50 sunscreens (0%), 2 of 50 eye creams (4%) and 21 of 50 lip salves (42%). Among the 300 non-lip salve products, cera alba was present in 21 cosmetics (7%). Cera flava was not identified in any cosmetic. In the ingredient lists of the 60 shampoos, 50 hair wax products and 45 depilatory waxes and pre-waxed depilatory strips, screening for ‘propolis’ resulted in zero hits.

3.2 | Literature Review Relationship Beeswax—Propolis

We found 21 relevant articles on the relationship between allergy to propolis and to beeswax, presenting patch test studies in unselected patients suspected of contact dermatitis (routine testing) [15–17], patch testing in groups of selected patients [13, 18, 19], case series [20, 21] and single case reports [9, 22–33].

3.2.1 | Patch Testing in Unselected Patients Suspected of Contact Dermatitis (Routine Testing)

In a hospital in the United Kingdom, before 2007, 684 consecutive patients were patch tested with propolis 10% pet. and beeswax (not specified). There were 24 (3.5%) positive reactions to propolis, of whom 1 patient (4.2%) co-reacted to beeswax [16]. These data are probably also included in the results of the next study.

Also in the United Kingdom, in a multicenter study in 10 hospitals, a patch test study was performed to assess the prevalence of propolis allergy and investigate cross-sensitivity with beeswax [15]. A total of 2828 successive subjects suspected of contact dermatitis were patch tested with propolis 10% in petrolatum (Chemotechnique) and pharmaceutical grade yellow beeswax (cera flava) and white beeswax (cera alba), tested pure (100%). Of 2828 subjects, 55 (1.9%) had a positive patch test to propolis and 13 (0.46%) had positive reactions to beeswax, 10 to yellow (0.35%) and 3 (0.11%) to white beeswax. Of the 10 patients who had a positive patch test to yellow beeswax, 4 (40%) co-reacted to propolis; none of the white beeswax-allergic individuals co-reacted to propolis. Conversely, of the 55 patients reacting to propolis, 4 (7.3%) co-reacted to yellow propolis, but none to cera alba [15].

In the early 1960s, Hjorth and Trolle-Lassen performed patch tests with 30% cera alba in oil on 2634 consecutive patients with dermatitis and not a single reaction was encountered [17].

3.2.2 | Patch Testing in Selected Patient Groups

In Italy, in the period 2001–2006, 129 patients suffering from chronic cheilitis were patch tested with beeswax 30% (probably white beeswax) and there were 2 (1.6%) positive reactions, both of which were relevant; the culprit products were not mentioned. There were also 2 positive patch tests to propolis (tested undiluted). It was not mentioned whether there were co-reactions between propolis and beeswax [18]. In India, in 2022–2024, of 40 beekeepers with suspected occupational allergic contact dermatitis, 6 (15%) reacted to propolis 10% pet. None of these six reacted to 100% beeswax. Both preparations for patch testing had been prepared from materials obtained from local Indian apiaries [19]. In a retrospective study in Sweden, performed between 2009 and 2016 in a university hospital and a private practice, 95 adult patients (83 women) with contact cheilitis, facial eczema or a suspicion of contact allergy to beeswax were patch tested with yellow and white

beeswax (cera flava and cera alba) and with propolis 10% pet. (Chemotechnique), in addition to the Swedish baseline series [13]. Yellow beeswax was pharmaceutical grade and white beeswax was obtained from a cosmetics manufacturer; both were tested undiluted ('as is'). Sixteen of the 95 patients (17%) showed positive reactions to yellow beeswax; 9/49 (18%) were positive to cera alba. In the patients tested with both products, eight reacted to both, five only to yellow and one only to white beeswax. In the beeswax-positive patients, 16 of 17 positive reactions were rated as being currently clinically relevant. The main product used was a brand of Swedish lip balm and emollient declared to contain beeswax. Nine of 17 patients (53%) with positive reactions had used this type of product [13]. Concomitant positive reactions to propolis were found in 14 of the 17 patients who reacted positively to beeswax, and 14 of the 16 patients who reacted positively to propolis also reacted positively to beeswax. Significantly more concomitant reactions to colophonium, *Myroxylon pereirae* resin and Fragrance mix I were found than in the general test population. Ten beeswax-positive patients were tested with caffeic acid and two ester derivatives, previously identified as haptens in propolis. Among these patients, three reacted to caffeic acid, phenethyl ester and/or caffeic acid 1,1-dimethylallyl ester. These three patients had previously shown strong ($++$, $n = 1$) or very strong ($+++$, $n = 2$) patch test reactions to both yellow beeswax and to propolis. Using time-of-flight secondary ion mass spectrometry (ToF-SIMS), the authors demonstrated the presence of caffeic acid, caffeic acid phenethyl ester and caffeic acid 1,1-dimethylallyl ester on the surface of both yellow and white beeswax. The relative surface signals of these compounds were consistently and significantly lower in the white wax, amounting to roughly 25% for caffeic acid, 10% for the phenethyl ester and only 4%–5% for the dimethylallyl ester compared with the yellow wax [13].

3.2.3 | Case Series

In Germany, in the late 1980s, six patients with contact dermatitis to propolis (three women, three men) were reported. The men had eczema on their hands and had acquired their sensitization in the course of bee keeping. The women had been sensitised by propolis contained in therapeutic ointments ($n = 2$) and a cosmetic product ($n = 1$). Upon patch testing, all six patients reacted to 'raw propolis', undiluted. Four patients were later tested with cera flava and cera alba (undiluted), and there were two reactions to both; details were not provided and the co-reactivity was not further discussed [21].

In Italy, in 1984, 5 women, ranging in age from 19 to 66 years, had developed allergic contact dermatitis from propolis-containing products. Four had used topical compounds for treatment of skin disorders, the fifth used a cosmetic propolis-based face cream. All five had positive patch tests to propolis 20% and four of them also reacted to beeswax 20%. The source of the beeswax was not specified [20]. *Comment:* Propolis at that time was not yet available as a commercial test allergen and the authors concluded that 'the frequent reactions to beeswax suggest that pollution by propolis necessitates the avoidance of beeswax by beekeepers sensitized to propolis'. This data suggests that both the propolis and

the beeswax had been obtained from apiaries. As a consequence, beeswax highly likely was not purified (and therefore would indeed contain propolis).

3.2.4 | Case Reports

Details of case reports of patients with allergic contact dermatitis from beeswax (with or without data on propolis patch testing) are shown in Table 1.

3.2.5 | Our Unpublished Observations

In the period November 2019 to June 2024, 414 patients have been tested in our 'topical medication series' to cera alba 5% pet. (Sigma-Aldrich, in-house preparation) and 5 (1.2%) had a positive reaction. Propolis 10% pet. (Allergeaze) was tested in this cohort in the European baseline series and there were 46 positive reactions (11.1%). None of the 5 cera alba-positive patients co-reacted to propolis and none of the 46 propolis-positive patients co-reacted to cera alba.

4 | Discussion

Apis mellifera honeybees produce beeswax, which they use as a construction material for their combs, in specialised wax glands located on the ventral side of the abdomen. The liquid wax secreted by these glands cools immediately to form fine, white wax scales, which are collected by the hind legs and processed with the mouthparts. Freshly produced beeswax is white but turns yellow over time due to the incorporation of propolis and pollen pigments. Beehive combs are melted down to obtain pure wax. After melting and cleaning, the wax has a yellow colour.

Beeswax is further purified by melting it in a water bath at 70°C–80°C for at least 8 h, after which only the pure upper layer of wax floating on the water is collected. Yellow beeswax can then be bleached with acids or hydrogen peroxide to produce white beeswax (cera alba). Under industrial conditions, the liquid wax undergoes additional purification through filtration or hot filtration—often more than once—resulting in minimal levels of impurities such as pollen, oils or propolis [34].

In the EU, cosmetics manufacturers use white beeswax (cera alba) in their products. The same applies to the USA, although yellow beeswax may occasionally be used in cosmetics (approximately 1 in 2300 products; see Section 4.1). Therefore, the following discussion primarily focuses on cera alba (white beeswax).

4.1 | Presence of Propolis in Cosmetics

Within the scope of the present market survey, propolis is hardly ever (or not) used as an ingredient in conventional cosmetics available in Europe: none of the 350 leave-on cosmetics, 60 shampoos, 50 hair waxes and 45 depilatory waxes and pre-waxed strips contained propolis in any form. We have found the

following data that shows that, also in the United States, propolis is very little used in cosmetics. In October 2025, propolis (as propolis extract [$n = 192$], propolis wax [$n = 18$], propolis [$n = 17$], propolis cera [$n = 13$], bee propolis [$n = 3$] or bee propolis extract [$n = 1$]) was present in 244 of 134 400 (0.18%) cosmetic products of which the composition is known in EWG's Skin Deep Cosmetics Database, USA (<https://www.ewg.org/skindeep/>). Of the 244, 80 (33%) had propolis ($n = 46$), honey, royal jelly, bee or beeswax ($n = 34$) in their name, suggesting that these cosmetics may be classified as 'biocosmetics' rather than as conventional cosmetic products.

De Groot and Rustemeyer recently reviewed investigations in which labels of cosmetic products had been screened for the presence of propolis [14]. In 14 American studies, in which adequate data were available, a total of 3677 product labels of various types of stay-on and rinse-off cosmetic products were examined. In 12 studies, not a single product was found to contain propolis. In the 13th study, 1 of 100 products contained propolis, but beeswax was given as a synonym. In the 14th study, it was found that, of 59 beard moisturisers, 17 (29%) apparently contained propolis [35]. As we considered this to be unbelievable, we checked the labels of 25 beard care products ourselves at the same sites as where the authors had checked cosmetic labels (Walgreen, Target). Of 25 products, none contained any form of propolis, but 8 (32%) contained beeswax (in 2 cases also cera alba was mentioned). Therefore, we believe that in this particular study [35] beeswax was very likely scored as 'propolis'.

The review [14] also discussed a series of investigations performed by the American Contact Alternatives Group. 'Propolis' was identified in 11% of 90 concealers, 5% of 304 eyeshadows, 3% of 279 shampoos, in 61% of 256 mascaras, in 21% of 429 lipsticks and in 61% of 92 lip moisturisers. However, the authors claimed (without providing any evidence) that 'cosmetic grade beeswax often contains propolis as an impurity' and therefore, beeswax was scored as propolis (which explains the high percentage of 'propolis' in lip moisturisers) [14].

Answering our research questions on this topic, we conclude that, within the scope of the available data: 1. propolis is a rare ingredient in conventional cosmetics in Europe and the USA and 2. these products therefore cannot be considered a frequent source of contact with propolis in patients with positive reactions to propolis.

4.2 | Presence of Beeswax in Cosmetics

In this study, cera alba/beeswax was shown to be present frequently in lip salves (42%) but less often (mean 7%) in the other categories of cosmetics investigated and not at all in sunscreens and shampoos. In the USA, in October 2025, beeswax (USA INCI name) was present in 9523 of 134 400 (7.1%) cosmetic products of which the composition is known in EWG's Skin Deep Cosmetics Database (<https://www.ewg.org/skindeep/>). 4076 of these 9523 products (43%) were lip cosmetics. In lip balms, beeswax was found in 1864/4775 (39%) products. Apparently, these data refer to white beeswax. Yellow beeswax was a separate ingredient in EWG's database and was present in 58/134982 (0.043%) products.

TABLE 1 | Case reports of patients with contact allergy to beeswax.

Year	Country	Sex and age	Positive patch tests			Clinical details and comments	References
			Propolis	Beeswax			
				White	Yellow		
<i>Propolis and beeswax positive</i>							
2024 ^a	France	F 45				<p>Beekeeper and Positive patch test reactions to <i>Myroxylon pereirae</i> resin, fragrance mix I, vanillin, white sage incense, isoeugenol, eugenol, and both propolis and beeswax brought in by the patient. There were no reactions to Chinese propolis 10% pet. (Chemotechnique) and white beeswax supplied by a cosmetics manufacturer.</p> <p><i>Comment:</i> Negative patch tests to commercial propolis and white beeswax.</p>	[9]
2023	Belgium	F 32	+	30%		<p>Allergic contact cheilitis from 6 lip balms caused by cera alba, candelilla cera, shea butter and sunflower oil. Also positive PTs to <i>Myroxylon pereirae</i> resin, FM1, limonene and linalool hydroperoxides and colophonium.</p> <p><i>Comment:</i> Co-reactions of propolis and cera alba. The reaction to propolis may well have been a (pseudo)cross-reaction to MPR and FM1. In 4/6 lipsticks other allergens were present to which the patient also reacted and which could have caused allergic contact cheilitis.</p>	[23]
2016	Sweden	M 81	+	–	100%	<p>Cheilitis from a lip product containing propolis and probably also from eating (non-propolis-enriched) honey (pos. PT). Also pos. PT to <i>Myroxylon pereirae</i> resin. Beeswax was pharmaceutical grade.</p> <p><i>Comment:</i> Negative PT to white beeswax but positive reaction to yellow beeswax suggests that the yellow variety contained residual propolis constituents not removed by purification, which white beeswax did not have.</p>	[24]
2006	Denmark	F 44	+	20%	30%	<p>Cheilitis and face dermatitis from beeswax in lip balm. Worsening by eating wine gums coated with cera alba. Positive patch test to cera alba provided by the manufacturer of the lip balm.</p>	[22]

(Continues)

TABLE 1 | (Continued)

Year	Country	Sex and age	Positive patch tests			Clinical details and comments	References
			Propolis	Beeswax			
				White	Yellow		
2002 ^a	Germany	M 60	+		30%	<p><i>Comment:</i> Co-reactivity of yellow beeswax, white beeswax and propolis may be explained by (1) allergen in yellow and white beeswax not present in propolis with independent sensitization to propolis; (2) beeswax-related allergen also present in propolis; (3) residual propolis in yellow beeswax and also in white beeswax despite purification.</p> <p>ACD from a pharmaceutical ointment containing 7% beeswax (cera flava). The authors suggested that the beeswax was contaminated with propolis. Three similar cases of contact allergy to the pharmaceutical ointment (unguentum leniens), yellow beeswax and propolis had been reported previously (27 [2 cases], 28).</p> <p><i>Comment:</i> White beeswax was not tested.</p>	[26]
1995 ^a	Spain	F 32	+ (100%)		100%	<p>Allergic contact dermatitis from a nipple protective made of beeswax (unspecified). Also positive reactions to honey and multiple haptens in a series of propolis ingredients.</p> <p><i>Comment:</i> White beeswax was probably not tested.</p>	[25]
<i>Beeswax positive, propolis negative</i>							
2023	UK	F 29	–		30%	<p>Allergic contact cheilitis from cera alba in a lip balm.</p> <p><i>Comment:</i> reaction to white beeswax not from any propolis content.</p>	[32]
1996	Italy	F 11	–		30%	<p>Allergic contact cheilitis from an emollient lip formulation. The beeswax was the same as used in the cosmetic and was said to be purified. No reactions to propolis, fragrance mix and <i>Myroxylon pereirae</i> resin.</p> <p><i>Comment:</i> Reaction to unspecified but purified beeswax not from any propolis content.</p>	[29]

(Continues)

TABLE 1 | (Continued)

Year	Country	Sex and age	Positive patch tests			Clinical details and comments	References
			Propolis	Beeswax			
				White	Yellow	Unspecified	
<i>Beeswax positive, propolis not tested or unknown whether propolis had been tested</i>							
2017 ^a	Belgium	F 25	Not recorded	30%		Allergic contact cheilitis from cera alba in 2 lip balms; unknown whether propolis had been tested.	[30]
1975 ^a	Spain	F 40	Not tested		100%	Occupational allergic contact dermatitis in a woman moulding figures from beeswax. As the beeswax was collected from the beehive by the farmer, it almost inevitably contained propolis.	[31]
1967	USA	M 65	Not tested		Raw beeswax	Farmer, beekeeper with eczema of the hands, forearms and face. Also positive PT to extract of poplar buds, poplar leaves and poplar buds. Negative patch test to purified beeswax. <i>Comment:</i> Negative reaction to purified beeswax. Raw beeswax very likely contained propolis. Propolis itself was not tested but would almost certainly have been positive, as there were also reactions to poplar buds and their extract.	[33]

Abbreviations: ACD, allergic contact dermatitis; FM1, fragrance-mix 1; MPR, *Myroxylon pereirae* resin; PT(s), patch test(s).

^aThe data in this publication cannot contribute to the answers to the research questions.

4.3 | Contact Allergy to Beeswax and Relationship to Propolis

4.3.1 | How Often Does Contact Allergy to White Beeswax Occur?

Contact allergy to white beeswax appears to be very infrequent in routine testing with 3/2828 (0.11%) reactions in one study from the United Kingdom [15] and 0% in an early study from Denmark [17] (Section 3.2.1). We have found 11 case reports of allergic contact dermatitis from beeswax (Table 1). In only five were patch tests to white beeswax positive [22, 23, 29, 30, 32]. All culprit products causing allergic contact dermatitis were lip balms/emollients.

In two case series (Section 3.2.3) [20, 21] there were two patients reacting to cera alba, but details were not provided [21]. Finally, there are two publications in which white beeswax had been tested in selected patient groups (Section 3.2.2) [13, 18]. In a group of 129 patients with chronic cheilitis, there were 2 (1.6%) positive reactions to beeswax 30% (probably white beeswax), both of which were relevant; the culprit products were not mentioned [18]. By far the largest group of patients with positive patch tests to cera alba were reported in a study from Sweden [13]. Nine out of 49 patients tested with pure white beeswax (18%) had positive reactions. This was a highly selected group

with inclusion criteria contact cheilitis, facial eczema or a suspicion of contact allergy to beeswax. Over half of the reactions were caused by one particular lip balm of a Swedish brand. The nine patents were seen in a period of 3.5 years in a private practice and a university hospital (average 1.3 patient per practice per year) [13].

Conclusion: Based on the available evidence, contact allergy and allergic contact dermatitis to white beeswax appear to be infrequent to very rare. The majority of cases are caused by lip balms/moisturisers.

4.3.2 | How Frequent Are Co-Reactions Between Propolis and White Beeswax?

In the UK, 2828 successive patients were patch tested with propolis 10% and pure white beeswax. Fifty-five individuals (1.9%) had a positive patch test to propolis and 3 (0.11%) to white beeswax. None of the 55 propolis-positive patients co-reacted to white beeswax [15]. Four patients reacting to 'raw propolis' were later tested with cera alba (undiluted) and there were two reactions to cera alba. Details were not provided and the co-reactivity was not further discussed [21]. In only two single case reports, patients had positive reactions to both propolis and white beeswax (Table 1) [22, 23].

Of the nine patients reported in the retrospective Swedish study, eight (89%) co-reacted to white beeswax. Conversely, of 15 patients reacting to propolis who were also tested with white beeswax, 8 (53%) co-reacted to it [13].

Conclusion: Data on co-reactivity are conflicting. In the UK study, 0 of the 55 propolis-positives co-reacted to white beeswax [15] and there are only 2 single case reports with co-reactivity [22, 23]. However, high co-reactivity percentages (89% and 53%) have been reported from Sweden in a highly selected group with >50% reactions from one particular lip cosmetic [13]. The relationship between positive reactions to beeswax and propolis should be clarified further.

4.3.3 | Is There Evidence That White Beeswax Used in Cosmetics Contains Enough Propolis to Elicit Hypersensitivity Reactions in Propolis-Sensitised Individuals?

We have found no evidence for this within the scope of the available literature. The presence of caffeic acid, caffeic acid phenethyl ester and caffeic acid 1,1-dimethylallyl ester has been shown with mass spectrometry analysis of the surface of four yellow and four white beeswax samples (unspecified). The contents of all three substances were significantly (4–20 times) lower in white beeswax than in yellow beeswax. The method used did not allow for quantification of its presence in the material. Patch testing with caffeic acid and 2 caffeates, known to be allergens in Chinese propolis, did not show that they were important haptens in beeswax [13].

4.3.4 | What Other Explanations Are There for Concomitant Reactions Between White Beeswax and Propolis?

There are several possible explanations for co-reactions between propolis and beeswax other than beeswax being ‘contaminated/adulterated/polluted’ with propolis. A better description would be ‘beeswax still containing ingredients of propolis after purification’.

In all the following scenarios that might explain co-reactivities, there is either no remaining propolis in the beeswax or an amount too low to elicit allergic contact dermatitis.

1. An allergen in beeswax is also present in propolis;
2. An allergen in beeswax cross-reacts to or from an allergen in propolis;
3. The patient has been sensitised to propolis and to beeswax in the same product (e.g., raw propolis in beekeepers) (concomitant sensitization) or in different products (independent sensitization);
4. The reaction to propolis is a (pseudo)cross-reaction in patients reacting to *Myroxylon pereirae* resin, one or both fragrance mixes, colophonium, or other fragrances which often co-react with propolis [14, 36];

5. A weak (irritant) reaction to either has been scored as positive (allergic).

4.3.5 | Should Patients With a Positive Patch Test to Propolis Be Advised to Avoid Contact With Cosmetics Containing White Beeswax?

Based on the available evidence, we consider this unnecessary. There is insufficient evidence that patients with a positive patch test to propolis will have a great risk of also reacting to white beeswax present in cosmetics. All cases of allergic contact dermatitis from white beeswax in patients with positive reactions to propolis have thus far been from using lip salves/moisturisers. Instructing patients that the use of lip salves which contain beeswax has led to an allergic reaction in a few users is advisable and should be sufficient.

5 | Conclusions

Based on the available evidence, propolis is hardly ever (or not) used as an ingredient in conventional cosmetics available on the European market, and such products are therefore not a source of exposure in patients with positive patch tests to propolis. Allergic reactions to beeswax in propolis-sensitised individuals from residual propolis cannot be entirely excluded but are uncommon and mostly limited to allergic contact cheilitis from lip balms. Patients with positive patch tests to propolis do not need to avoid all cosmetics containing beeswax.

6 | Suggestions for Further Research

Long-term or multicenter routine testing of yellow and white beeswax could provide deeper insight into their relationship with contact allergy to propolis. Chemical analyses of white beeswax samples from different suppliers of cosmetic-grade cera alba may help identify and quantify compounds known to be present in propolis. In addition, serial dilution testing of propolis could be employed to determine the threshold concentration for eliciting allergic reactions. These data could then be compared with the levels of propolis detected in cera alba and the corresponding quantities used in cosmetic formulations.

7 | Limitations

This review was conducted as a narrative review. Given the heterogeneity of study designs and the rarity of reported cases, a systematic review approach was considered unlikely to substantially improve methodological robustness.

Author Contributions

Anton C. de Groot: conceptualization, investigation, writing – original draft, writing – review and editing. **Norbertus A. Ipenburg:** investigation; writing – review and editing. **Thomas Rustemeyer:** supervision, writing – review and editing.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Research data are not shared.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Table S1:** Brands (alphabetical), countries of origin, number of products by brand per product type and in all products. **Table S2:** Number of brands by country. **Table S3:** Number of products by country.