

Sensitization and cross-reaction patterns in Danish Compositae-allergic patients

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Results of aimed patch testing with constituents of sesquiterpene lactone (SL) mix, Compositae mix (CM) and other Compositae extracts and allergens in 190 Compositae-allergic patients detected in an 8-year period are presented. Feverfew of CM elicited positive reactions most frequently, followed by tansy, wild chamomile, yarrow and arnica, whereas dehydrocostus lactone of SL was the most frequent elicitor of positive reactions, followed by alantolactone and costunolide. Chrysanthemum (*Dendranthema*) and marguerite (*Argyranthemum frutescens*) were the most important suspected sensitizers in both occupationally and nonoccupationally exposed, and cross-reactions between chrysanthemum and feverfew/tansy/chamomile may partly explain the high prevalence of positive reactions to the 3 last mentioned. In the nonoccupationally sensitized group, garden plants such as feverfew, blanket flower (*Gaillardia*), elecampane (*Inula helenium*), large yellow ox-eye (*Telekia speciosa*) and cosmea (*Cosmos*) were additional important allergenic plants. The 3 last mentioned were picked up by SL mix. Most of the lettuce-sensitized persons were CM-positive. 19% of the occupationally sensitized group were negative to both SL and CM, making very aimed patch testing necessary, notably when suspecting rare sensitizers such as *Gerbera* and star of the veldt (*Osteospermum*). The significance of the weeds dandelion, dog fennel and ox-eye daisy as sensitizers is not clarified, but they are probably less important than cultivated plants.

Key words: allergic contact dermatitis; plants; sesquiterpene lactones; Compositae; Asteraceae; patch testing; occupational; feverfew; tansy; yarrow; chamomile; arnica; *Dendranthema*; *Argyranthemum*; lettuce; *Osteospermum*. © Munksgaard, 2001.

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Routine screening with sesquiterpene lactone (SL) mix supplemented with Compositae mix (CM) and other Compositae extracts and allergens detected 190 Compositae-sensitive individuals among 4386 patients patch tested in an 8-year period from 1990 to 1998 (1). Data on SL and CM testing have been reported elsewhere (1). This paper presents the results of patch testing with the above-mentioned other Compositae extracts and allergens in the 190 Compositae-allergic patients.

Materials and Methods

The constituents of SL mix (0.033% pet. preparations of alantolactone, costunolide and dehydrocostus lactone) and the constituents of CM except feverfew (arnica 0.5%, wild (German) chamomile 2.5%, yarrow 1%, tansy 1% pet.) were supplied by Trolab® (Hermal, Hamburg, Germany) for members of the European Environmental Contact Der-

matitis Research Group in the late 1980s (2, 3). Short ether extracts (4) of the following Compositae species were prepared at the hospital pharmacy in Odense: feverfew 1% pet., marguerite (sometimes called marguerite daisy) 3% pet. (*Argyranthemum frutescens*), chrysanthemum of florists 3% pet. (*Dendranthema* cultivar) and iceberg lettuce 10% pet. (*Lactuca sativa* var. *capitata*). The 2 first mentioned produced no reactions in 26 and 15 consecutive controls, respectively, while chrysanthemum elicited 1 positive reaction, probably representing a genuine Compositae allergy, in 30 consecutive eczema patients. In addition, costunolide (isolated from *Piper wallichii*) 0.1% pet. was made in Odense, but due to shortage of test material neither this nor the iceberg lettuce extract were tested in controls.

Compositae oleoresins from Hollister-Stier® (Spokane, Washington, USA) were tested under occlusion. The *Chrysanthemum* (*Tanacetum*) *ciner-*

ariifolium extract 1% pet. was supplied by Chemo-technique® (Malmö, Sweden).

Preparations of German feverfew 1% and chrysanthemum 3% pet., parthenolide 0.1% pet., alantolactone 0.1% pet., extra supplies of the Compositae mix and its constituents and all additional Compositae extracts and allergens were supplied by B. M. Hausen.

From January 1995, parthenolide 0.1% pet. (first prepared in Odense, later commercially available from Chemotechnique®) was included in the standard series. Extracts and allergens were applied in Finn Chambers® (Epitest Ltd., Helsinki, Finland) on Scanpor® (Norgesplaster A/S, Oslo, Norway) for 2 days. Readings were made on days 2–4 and, whenever possible, on days 5–8 according to the ICDRG recommendations.

The 190 Compositae-sensitive patients were tested between February 1990 and February 1998. However, results of additional Compositae patch testing performed later in 1998 and 1999 in 6 patients are included. Compositae extracts and allergens were selected according to the individual patient's history.

Results

Compositae mix

129 of 157 CM-positive (1) were tested with the constituents of the mix. Feverfew elicited positive reactions most frequently (81%), followed by tansy (77%), chamomile (64%), yarrow (41%) and arnica (23%) (Table 1). In addition, 41 persons were tested with a dilution series of feverfew (Table 2).

Cultivated plants

During the 8-year period, the Compositae-allergic patients were tested with a variety of cultivated plants and selected results are shown in Table 3.

Table 1. Distribution of reactions to constituents of the Compositae mix in 129 patients positive to the Compositae mix

	No. patients	
	tested	positive
feverfew 1.0% pet. (<i>Tanacetum parthenium</i>)	129	104 (81%)
tansy 1.0% pet. (<i>Tanacetum vulgare</i>)	129	99 (77%)
wild (German) chamomile 2.5% pet. (<i>Chamomilla recutita</i>)	129	83 (64%)
milfoil 1.0% pet. (<i>Achillea millefolium</i>)	129	53 (41%)
arnica 0.5% pet. (<i>Arnica montana</i>)	129	30 (23%)

Table 2. Results of testing with a dilution series of feverfew in 41 persons with positive reactions to feverfew 1% pet.

	No. patients	
	tested	positive
feverfew 0.3% pet.	41	35 (85%)
feverfew 0.1% pet.	41	33 (80%)
feverfew 0.01% pet.	41	22 (54%)

Relevance of feverfew allergy: 21 current/old, 19 unknown, 1 NR.

Table 3. Results of patch tests with ether extracts and allergens of selected cultivated Compositae species in 190 Compositae-sensitive persons

Extract/allergen	No. patients	
	tested	positive
chrysanthemum of florists 3% pet. (<i>Dendranthema cultivar</i>)	115	83 (72%)
marguerite 3% pet. (<i>Argyranthemum frutescens</i>)	89	66 (74%)
marigold 10% pet. (<i>Calendula officinalis</i>)	16	0
pyrethrum 1% pet. (<i>Tanacetum cinerariifolium</i>)	12	4
blanket flower oleoresin in pet. (<i>Gaillardia</i>)	6	3
lettuce oleoresin 1:10 w:v alc. (<i>Lactuca sativa</i>)	54	26 (48%) ^{a)}
lactucopicrin 1% pet.	36	5 (14%)
chicory oleoresin 1:10 w:v alc.	22	14 (64%)
iceberg lettuce 10% pet. (<i>Lactuca sativa</i> var. <i>capitata</i>)	19	6 (32%)
lactucin 1% pet.	10	4 (40%)
lettuce as is	7	4 ^{b)}
parthenolide 0.1% pet.	119	80 (67%)
telekin 0.1% pet.	35	23 (66%)
pyrethrosin 0.1% pet.	28	9 (32%)

a) Including 1 testing positive before 1990.

b) Including 3 testing positive before 1990.

As expected, most patients tested positive to the chrysanthemum pot plant, but the prevalence of positive reactions to the extremely popular marguerite used in pots indoors and out was similar to that of chrysanthemum.

Lettuce

Based on patch tests with various extracts and allergens (lactucin, lactucopicrin) of lettuce and chicory, 40 of 72 persons were sensitive to lettuce. In addition, 2 persons with occupational lettuce exposure and positive Compositae reactions, but doubtful positive lactucin and positive lettuce scratch patch test, respectively, should be included, making the overall prevalence of lettuce sensitiza-

Table 4. Results of patch tests with constituents of Compositae mix and parthenolide in 74 chrysanthemum-positive persons

Extract/allergen	No. patients	
	tested	positive
feverfew 1.0% pet.	74	70 (95%)
tansy 1.0% pet.	74	66 (89%)
wild chamomile 2.5% pet.	74	58 (78%)
yarrow 1.0% pet.	74	45 (61%)
arnica 0.5% pet.	74	22 (30%)
parthenolide 0.1% pet.	68	58 (85%)

Table 5. Distribution of reactions to constituents of the SL mix in 76 patients positive to the SL mix

	No. patients	
	tested	positive
dehydrocostus lactone 0.033%	76	62 (82%)
alantolactone 0.033/0.1%	76	40 (53%)
costunolide 0.033/0.1%	76	33 (43%)

tion 42/72 (58%). 12 of the 42 persons were occupationally sensitized or had occupational lettuce dermatitis. In the remaining 30 patients the lettuce allergy was considered of current/old relevance in 15, of unknown relevance in 13 and not recorded in 2. The diagnosis of lettuce allergy was based on positive reactions to lettuce oleoresin alone in 6 persons (of unknown relevance in 5 of these) and on positive reactions to lettuce or chicory oleoresin and doubtful positive reactions to other lettuce test substances in another 6 persons.

Parthenolide

Parthenolide, an important allergen in several Compositae species such as feverfew and tansy and also present in some members of the Magnoliaceae (2, 5), was positive in 69% of feverfew-sensitive, negative in 12% with positive feverfew reactions and negative in the remaining 19% who were also negative to feverfew ($n=114$).

Parthenolide and chrysanthemum

The reactions to constituents of CM and parthenolide were recorded in chrysanthemum-positive (Table 4) and -negative individuals. For comparison, the figures in the 29 chrysanthemum-negative individuals were 48% positive to tansy, 41% to feverfew, 17% to chamomile, 14% to arnica and 3% to yarrow. Likewise, only 32% of the chrysanthemum-negative individuals were positive to parthenolide compared to 85% of chrysanthemum-positive ($p<0.00005$).

Telekin

Telekin is found in the herbaceous perennial large yellow ox-eye (*Telekia speciosa*) along with isoalantolactone and other sesquiterpene lactones (5). Alantolactone and isoalantolactone also occurs in the closely related perennial elecampane (*Inula helenium*). In accordance with this, 20 of the 23 (87%) telekin-sensitive tested positive to alantolactone, while 13 (57%) were positive to costunolide which is also present in elecampane.

SL mix

76 of 122 SL mix-positive (1) were tested with all 3 allergens of the mix in different concentrations

Table 6. Distribution of reactions to SL mix, Compositae mix and their constituents in 42 occupationally Compositae-sensitized

Extract/allergen	No. patients	
	tested	positive
SL mix 0.1% pet.	41	19 (46%)
Compositae mix 6% pet.	40	29 (72.5%)
SL and Compositae mixes	40	15 (37.5%)
tested with both mixes and positive to SL and/or CM	40	32 (80%)
dehydrocostus lactone 0.033% pet.	11 ^{a)}	10 (91%)
costunolide 0.033/0.1% pet.	11	4 (36%)
alantolactone 0.033/0.1% pet.	11	3 (27%)
tansy 1.0% pet.	24 ^{b)}	19 (79%)
feverfew 1.0% pet.	24	18 (75%)
wild chamomile 2.5% pet.	24	11 (46%)
yarrow 1.0% pet.	24	7 (29%)
arnica 0.5% pet.	24	4 (17%)

a) Only SL mix-positive tested with all 3 allergens are included.

b) Only CM-positive tested with all 5 constituents are included.

Table 7. Results of patch tests with selected ether extracts and allergens of cultivated Compositae species in 42 occupationally Compositae-sensitized

Extract/allergen	No. patients	
	tested	positive
chrysanthemum of florists 3% pet.	28	20 (71%)
marguerite 3% pet.	22	16 (73%)
lettuce	18	12 (67%)
detected by the following		
lettuce oleoresin 1:10 w:v alc.	10	3 ^{a)}
chicory oleoresin 1:10 w:v alc.	5	3
iceberg lettuce 10% pet.	7	2
lettuce as is	5	4 ^{b)}
lactucopicrin 1% pet.	10	2
lactucin 1% pet.	4	2
<i>Gerbera</i> cultivars as is	1	1
star of the veldt as is	1	1
(<i>Osteospermum ecklonis</i>)		

a) Including 1 testing positive before 1990.

b) Including 3 testing positive before 1990.

Table 8. Results of patch tests with constituents of Compositae mix and parthenolide in 18 chrysanthemum-positive persons with occupational Compositae allergy

Extract/allergen	No. patients	
	tested	positive
feverfew 1.0% pet.	18	16 (89%)
tansy 1.0% pet.	18	15 (83%)
wild chamomile 2.5% pet.	18	9 (50%)
yarrow 1.0% pet.	18	6 (33%)
arnica 0.5% pet.	18	3 (17%)
parthenolide 0.1% pet.	14	11 (79%)

(Table 5). The number of positive reactions to alantolactone and costunolide were independent of the test concentration and they are therefore presented jointly.

Occupational Compositae allergy

Among the 190 Compositae-sensitive patients, 42 were suspected of occupational dermatitis and/or sensitization (1). Tables 6–8 present results of testing with SL mix and CM, the constituents of both and selected cultivated Compositae plants in these persons. Both SL mix and CM detected fewer cases in this group of patients and consequently the overall detection rate with the 2 mixes was only 80% compared to 93% in all 190 Compositae-allergic persons (1). Positive feverfew reactions of unknown relevance were found in 72% of occupationally sensitized compared to 49% of nonoccupationally sensitized individuals. 8 of the 12 individuals with negative reactions to both mixes (1) were occupationally sensitized. Table 9 shows patch test results in these persons.

Chrysanthemum, marguerite and lettuce were, not unexpectedly, the most frequent primary sensi-

tizers. Altogether, 12 of 18 tested with lettuce allergens/extracts were positive. 11 of these 12 persons were tested with SL mix and CM, but 2 were not evaluable because testing was performed with an interval of years. Only 2 of the 9 persons were SL mix-positive compared to 22 of 30 nonoccupationally sensitized and the 2 first mentioned actually had a concomitant work-related chrysanthemum allergy. 7 of the 9 were CM-positive compared to all of the nonoccupationally lettuce sensitized.

Most of the occupationally sensitized were gardeners and greenhouse workers, but sensitization also occurred in, e.g., a zone therapist/flower arranger from arnica in a massage oil, in a former canteen staff member (lettuce) and in a home help and a domestic help taking care of pot plants as part of their work.

Other weeds

Table 10 shows results of patch testing with a few selected Compositae weeds. Altogether 22/57 (39%) tested positive to dandelion (as is and/or oleoresin and/or ether extract). 20 of the 22 were positive to both SL mix and CM, 1 was negative to SL mix and positive to CM and 1 tested negative to both mixes.

Discussion

The distribution and relative frequency of positive reactions to CM-constituents is similar to that recorded in studies from Germany (3, 6). The variation in the prevalences of positive reactions in the larger of the German studies, however, was less marked with a range from 70% feverfew-positive

Table 9. Results of patch tests in 8 occupationally Compositae-sensitized persons with negative SL and Compositae mix reactions

Patient no.	Sex/age (years)	Occupation	Positive to
1	F/29	fruit grower	wild chamomile 2.5% pet.
2	F/42	former greenhouse worker	lettuce oleoresin 1:10 w:v alc.
3	M/39	former gardener	iceberg lettuce 10% pet.
4	F/30	greenhouse worker	marguerite 3% pet.
			marguerite 3% pet.
			ox-eye daisy 1% pet.
			feverfew 1% pet.
5	F/41	florist	<i>Dahlia</i> oleoresin 1:10 w:v alc.
			chrysanthemum of florists 3% pet.
6	F/55	greenhouse worker	6 <i>Gerbera</i> cultivars as is
7	M/30	gardener	yarrow 1% pet.
			tansy 1% pet.
8	F/24	apprentice gardener	2 <i>Osteospermum</i> cultivars as is

Table 10. Results of patch tests with ether extracts and allergen of selected Compositae weeds in 190 Compositae-sensitive persons

Extract/allergen	No. patients	
	tested	positive
ox-eye daisy 1.0% pet. (<i>Leucanthemum vulgare</i>)	60	4 (7%)
dandelion 2.5% pet. (<i>Taraxacum officinale</i>)	55	14 (25.5%)
dandelion oleoresin 1:10 w:v alc.	21	9 (43%)
dandelion as is	2	1
dog fennel 1.0% pet. (<i>Anthemis cotula</i>)	25	13 (52%)
anthecotulide 0.1% pet.	31	2 (6.5%)

to 52% arnica-positive (3). *Arnica montana* is a strongly sensitizing weed, not very common in Denmark or Germany, but along with other arnica species widely used in herbal medicine (e.g. arnica tincture) and cosmetics (7, 8). The comparatively fewer patients with arnica sensitization in Denmark may reflect partly a lower detection rate of the dried plant extract from Trolab® compared to the fresh plant extract (from Hausen) which was sometimes slightly irritant and not used on a routine basis, and partly a different exposure pattern through herbal remedies as 10 of 85 German patients were sensitized to arnica only versus 1 of 152 arnica-tested Danish patients (3).

The other 4 extracts of CM belong to the allergenically important Anthemideae tribe (chamomile tribe) (9). Yarrow and tansy are weak to moderate sensitizers and are common weeds in Denmark. Feverfew is a fairly common, strongly sensitizing, partly naturalized garden plant, while wild chamomile is a casually found weed with a low sensitizing potential (8).

Direct contact with Compositae plants is probably the primary mode of sensitization, and in general contact with cultivated plants must be assumed to occur more often than with weeds. The high prevalence of positive weed reactions – similar to or higher than that of some cultivated plants – could be at least partially attributable to cross-reactions. This is supported by the high prevalence of positive reactions to the very weak and very rare sensitizer wild chamomile (Table 1), and the frequency of feverfew reactions of unknown relevance even among highly sensitive persons (Table 2). In Hausen's patients all species present in CM did cross-react with chrysanthemum (8, 10). Several clinical observations on chrysanthemum-sensitive patients reacting to feverfew have been reported as summarized by Schmidt and Kingston who suggested feverfew as a suitable and more reliable screen for chrysanthemum allergy than testing with chrysanthemum as is (11). Our results show a

strong association between chrysanthemum sensitivity and positive reactions to feverfew, tansy, parthenolide and to a lesser degree wild chamomile (Tables 4, 8). The stronger association with feverfew and tansy in the mixed group of occupationally and non-occupationally sensitized (Table 4) reflects a higher rate of concomitant sensitization to feverfew and chrysanthemum as evidenced by the higher frequency of relevant feverfew reactions in the mixed group compared to the occupationally sensitized. Experimental support for these clinical observations was provided by Schulz et al. in 1975 where they proved true cross-sensitivity between chrysanthemum and parthenolide, present in both feverfew and tansy (12). This also explains the highly significant association between chrysanthemum and parthenolide sensitivity in our study. Furthermore, the genera *Dendranthema* (including chrysanthemum) and *Tanacetum* (including tansy) are morphologically and chemically closely related (13).

Similar experimental evidence for cross-reactivity between chrysanthemum and chamomile, yarrow and tansy was provided by Hausen in 1979 (10). Based on this, it is likely that a large proportion of the positive reactions to especially feverfew, tansy and chamomile are due to chrysanthemum sensitivity.

Aimed patch testing with marguerite shows a high prevalence of positive reactions in both occupationally and nonoccupationally exposed individuals (Tables 3, 7). The genus *Argyranthemum* is closely related to the genus *Chrysanthemum* which comprises annuals such as *Chrysanthemum carinatum* and *Chrysanthemum coronarium* (but not *Dendranthema*). Even if cross-reactions cannot be ruled out, marguerite is more likely to be an important primary sensitizer based on the clinical course and test results in occupationally exposed individuals (13, 14). Cross-reactions between marguerite and chrysanthemum of florists (*Dendranthema* cultivars) are difficult to assess since most patients have been exposed to both. In a few persons occupationally sensitized to marguerite, positive chrysanthemum reactions of unknown relevance indicate cross-sensitivity. Furthermore, the 2 genera belong to the same evolutionary group, the Chrysanthemum complex, making cross-reactions likely (13).

Gaillardia – blanket flower – is rarely reported as a sensitizer, but cross-reactions are seen occasionally (8). By aimed patch testing, however, we saw strongly positive relevant reactions in 3 and relevant doubtful positive reactions in 2 individuals. Severe exposed-site dermatitis has been described previously (15). Many Compositae species, including the 5 present in CM, are used in herbal

remedies and sensitization by topical plant-based preparations is suspected now and then (16, 17). The lack of positive reactions to the widely used marigold (*Calendula*) may seem reassuring, but it is actually weakly and rarely sensitizing (8). Likewise, lettuce is a weak sensitizer, but prolonged and intense, especially work-related, exposure may cause sensitivity which partly explains the fairly high prevalence of lettuce allergy in our study. Testing with oleoresins under occlusion elicits irritant reactions now and then, but as positive reactions to oleoresins solely were relatively rare, false-positive reactions are not a likely explanation of the high prevalence. Almost $\frac{1}{2}$ of the nonoccupationally lettuce-sensitized had unknown relevance of the allergy, indicating cross-reactions between lettuce and other Compositae species as described by Hausen & Vieluf (8). The number of patients with unknown relevance may well be higher since it is difficult to establish a causal relationship between the occasional household handling of lettuce and sensitivity, taking into account the possible rôle of gardening and pot-plant care. The nonoccupationally lettuce-allergic were also more broadly sensitized as indicated by a higher prevalence of positive SL mix reactions compared to the occupationally sensitized.

Screening with parthenolide only detected 1 further patient (18). Aimed patch testing with pyrethrosin, the allergen of the herbaceous perennial *Tanacetum coccineum* (*Pyrethrum roseum*), the florist's pyrethrum, revealed 1/3 to be positive, but the relevance was mostly unknown. Likewise, 3 of 4 positive reactions to the pyrethrosin-containing *Tanacetum cinerariifolium* (pyrethrum), introduced in our Compositae test materials in 1996, were of unknown relevance. The contact dermatitis elicited through harvesting flower heads to obtain the insecticide pyrethrum is of historical interest only (8). The active insecticidal component of pyrethrum, the pyrethrins, are chemically unrelated to pyrethrosin and are not allergenic; the contact dermatitis in the pyrethrum industry and in users of household pyrethrum-based sprays was thus due to contamination with sesquiterpene lactones (8). The pyrethrum-based insecticides sold today are highly purified, but sensitization from SL-containing insecticides on a previous occasion cannot be ruled out (8). Conversely, most of the positive reactions to telekin were relevant and caused by contact with, e.g., the perennial large yellow ox-eye, which is moderate to strongly sensitizing (8). Telekin is not commercially available, but as it occurs along with alantolactone derivatives, testing with SL mix will pick up sensitization to this substance. The closely related elecampane also contains costunolide and, in agreement with this, telekin-posi-

tive persons had a higher prevalence of positive costunolide reactions compared to the overall prevalence (Table 5). Costunolide has been isolated from the annual garden cosmeas (*Cosmos sulphureus* and an unidentified *Cosmos* cultivar), laurel (*Laurus nobilis*) and the hepatic frullania (*Frullania tamarisci*), the 2 last-mentioned from other plant families (5). Dehydrocostus lactone, on the other hand, is found in 2 rare garden plants, *Stokesia laevis* and *Vernonia hirsuta*, and therefore the majority of positive reactions are probably cross-reactions to other SLs of the same structural group (guaianolides), perhaps to arteglinin A in chrysanthemum (5, 8, 19).

Based on these results, positive SL mix reactions are more likely to occur in broadly sensitized hobby gardeners and this is in accordance with patch test results in occupationally sensitized (Table 6): the % of SL mix-positive reactions is lower than the 65% seen in all 190 Compositae-sensitive patients (1), and likewise, the percentage of alantolactone- and costunolide-positive reactions is considerably lower while dehydrocostus lactone is higher than that of nonoccupationally sensitized individuals. The lower detection rate of the SL mix and CM is made up for by the usually obvious relation to the work in the occupationally sensitized, but sometimes very aimed patch testing is necessary. The most frequent sensitizers are the pot plants chrysanthemum and marguerite, followed by lettuce. The last-mentioned allergy is not picked up by SL mix in accordance with the obser-



Fig. 1. *Osteospermum ecklonis* (star of the veldt). Reproduced with permission from GAU (Gartneribrugets Afsætningsudvalg).

variations of Shum et al. (20). Sometimes lettuce-allergic persons show negative reactions to CM too, and only specific testing with lettuce allergens and extracts will reveal the allergy (patient no. 2, Table 9). Testing with lettuce as is may result in false-negative reactions due to rapid degradation of the allergens by water and UV irradiation, making it necessary to test with freshly harvested lettuce (21). Type IV allergy to *Gerbera* is extremely rare and details of patient no. 6, Table 9, have been published previously as the 3rd case reported (22–24). Contact allergy to *Osteospermum ecklonis*, star of the veldt (Fig. 1), native to southern Africa and an increasingly popular pot plant in Denmark, has never been reported before. The patient was a 24-year-old female gardener apprentice who developed eczema of the dorsal aspect of hands and fingers, forearms and cheeks when handling *Osteospermum* cuttings. She had ++ reactions to ethanol-wetted leaves of the cultivars 'Caroline' and 'Girl' which were negative in 21 and doubtfully positive in 4 controls. There were no cross-reactions to feverfew, chrysanthemum or marguerite. As shown in Table 9 it may be worthwhile to test with ingredients of CM in CM-negative gardeners in addition to selected extracts and plants as is.

Testing with selected weeds showed a low sensitization rate to ox-eye daisy even if it is a strongly allergenic, common weed and cultivated plant in Denmark (Table 10). The reason for this is unknown, but the same extract was used throughout the 8-year period and if it is not representative, it may distort the picture. Sensitization to dandelion was more common, but contrary to a recent British study where dandelion was an important allergen on its own in SL mix-negative patients (25), almost all our dandelion-sensitive individuals were positive to both CM and SL mix. The plant is a rare and weak sensitizer (8), so probably some of the reactions are cross-reactions, even though $1/2$ of them were considered relevant. In a study of weed sensitivity in the USA, dandelion failed to elicit positive reactions (26), while 16 of 66 photosensitivity dermatitis/actinic reticuloid patients in another British study were dandelion-sensitive, mostly clinically relevant (27). Therefore, we agree with Goulden and Wilkinson that dandelion may be an important weed allergen in Europe, especially in patients keeping rabbits, birds, guinea pigs or tortoises. Dog fennel is a strongly allergenic and irritant weed, but as it is rather rare in Denmark, most of the reactions are probably cross-reactions. In accordance with this, only 2 persons were positive to the strong allergen of the plant, anthecotulide, and the sensitization rate is low compared to the 92% reported from an area in the USA where the plant was widespread (26).

In conclusion, patch testing with SL mix, CM, their constituents and parthenolide seems to detect most of our Compositae-allergic patients. To give more specific advice and to trace sensitizers, aimed patch testing based on the individual patient's story is necessary, notably in the occupationally sensitized who may be allergic to 1 or 2 species only. Important sensitizers in Denmark are pot plants such as chrysanthemum and marguerite and garden plants such as feverfew, elecampane, large yellow ox-eye, lettuce and possibly cosmea and pyrethrum. The significance of weeds as sensitizers is difficult to assess, but they probably play a lesser part compared to cultivated plants.

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