

Occupational dermatitis in Danish gardeners and greenhouse workers

(I). Prevalence and possible risk factors

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Floristry is considered a hazardous occupation from a dermatological point of view, but there are relatively few epidemiological studies to support this notion. The present investigation set out to assess the prevalence of and association between occupational dermatitis and possible risk factors in Danish gardeners and greenhouse workers. A cross-sectional study, based on a postal questionnaire and subsequent examination and patch testing of those who had occupational eczema from their present work or occupational problems with Compositae, was carried out in 1958 gardeners and greenhouse workers. The response rate was 84.6% and among 301 persons invited for further examination, 253 (84.1%) attended. The lifetime prevalence of occupational eczema in floristry, defined as dermatitis lasting more than 24 h, was 19.6% (95% confidence intervals 17.8–21.3%) among all potential respondents. Occupational mucosal symptoms, working with Compositae plants and a history of previous occupational eczema in floristry were significantly associated with an increased risk of occupational eczema. Sex, age and atopy did not seem to be important risk factors. The results confirm that floristry is a dermatologically hazardous occupation and emphasize the importance of eliciting agents in the working environment rather than personal inherent factors.

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Employment in floristry often implies exposure to a number of dermatitis-inducing plants and chemicals (1). However, the prevalence of occupational dermatitis is difficult to estimate. National statistics on occupational dermatoses may not reflect the true occurrence, but nevertheless both studies based on these (2–4) and different epidemiological, often questionnaire-based, studies (5–7) indicate that the risk of developing occupational dermatitis in floristry, agriculture and related occupations is not negligible.

In Denmark, the island of Funen with its approximately 463,000 inhabitants, is a centre of Danish floristry. Half of the total greenhouse area is situated here, especially around the main town Odense, and this makes the area suitable for epidemiological investigations in gardeners. The aims of the present study were to get an estimate of the prevalence of occupational dermatitis in Danish gardeners and greenhouse workers, to assess as-

sociations between occupational dermatitis and possible risk factors, and to gain knowledge of environmental etiological factors. Since Compositae allergy is fairly common among consecutive eczema patients in our area, the study was designed with special reference to this contact allergy.

Materials and Methods

Study design

A cross-sectional study, based on a postal questionnaire and subsequent examination of selected individuals, was carried out among 3 groups of gardeners from 1992 to 1994 (Fig. 1). The 1st group comprised 1635 members of the Gardeners' Trade Union in Odense who were working in Odense municipality, the 2nd 275 self-employed gardeners in Odense municipality and the 3rd 61 self-employed gardeners in Funen county who had grown different species of Compositae plants.

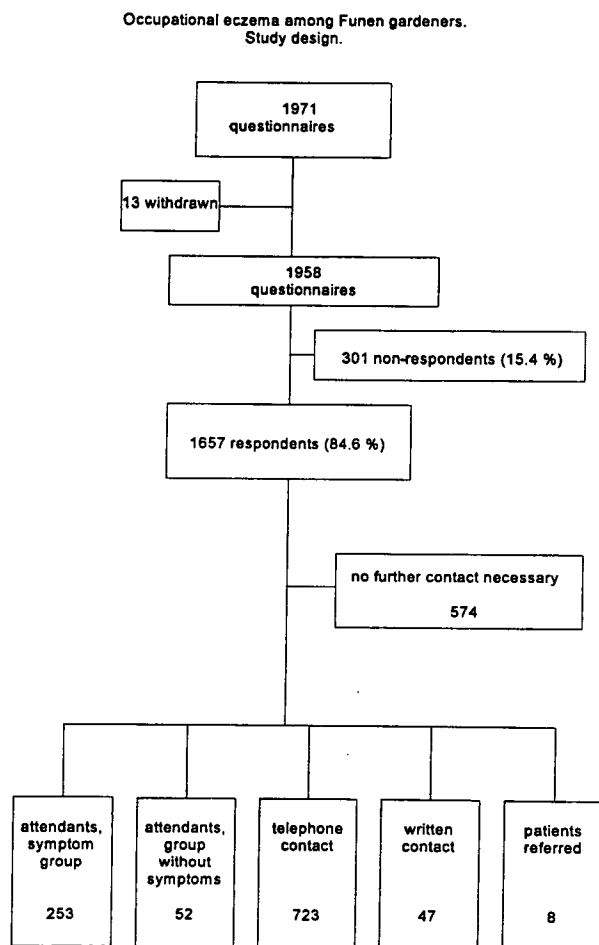


Fig. 1.

Most of the 1971 persons were registered as working in greenhouses and/or outdoors and relatively few in nurseries or orchards.

The questionnaire was designed to address a history of occupational eczema and/or mucosal symptoms as its main purpose, but also included information on family and/or personal history of atopy, allergy, problems related to occupational contact with Compositae plants, training and seniority in floristry or related occupations. In case of insufficient filling in of the questionnaire, the persons concerned were contacted by telephone or letter to clarify the problems.

Mainly persons reporting occupational dermatitis at their present work and/or symptoms (especially dermatitis) related to occupational contact with Compositae were invited for clinical examination, patch testing and skin prick tests/scratch patch tests if necessary. Non-attendants were contacted by telephone or letter to assess whether information on occupational eczema was correct and/or to get information on the nature of any occupational problems with Compositae plants. Be-

sides, randomly selected persons, who according to their questionnaires never had had eczema as grown-ups, were invited for clinical examination and patch tests in order to estimate the validity of negative information on eczema.

Description and results of test procedures will be presented in a subsequent paper.

The study was approved by the local ethics committee.

The questionnaire

The questions concerning health and occupation were non-validated, being designed for this study, and most of them had a yes/no/don't know type of response. Information on eczema and family/personal atopy was based on a "self-diagnosis" rather than symptoms, e.g., "Have you had eczema as a child/ at your work?". The duration of skin symptoms was not included in the questionnaire. Childhood eczema included all kinds of dermatitis, including summer rashes.

Questions concerning occupational mucosal problems of eyes and nose were symptom-based, e.g., "Have you had occupational problems with the eyes at your present work (e.g., itching, watery eyes, periorbital swelling)?"

Data analyses

The following modifications were applied to the questionnaire responses after contact by telephone, letter or personal interview: If the "eczema" always disappeared within 24 h, the diagnosis was changed to no eczema. Apprentice gardeners were registered as gardeners and unemployed of unknown training as greenhouse workers. If possible, the duration of employment in floristry only included jobs in greenhouses.

Differences in age and sex distribution between respondents/attendants and non-respondents/non-attendants were tested with the χ^2 statistic with Yates' correction. Backward stepwise logistic regression was used to assess the association between occupational dermatitis and selected risk factors. Generally, males and females were analysed together, but by inclusion of interaction terms allowed to behave differently for all other included factors. Doubtful reports on occupational eczema were included in the group with no eczema in the analyses. The significance level was taken at 0.05.

Results

Participation in the questionnaire study

The response rate after 2 reminders was 84.6% (Fig. 1), with significantly more respondents

Table 1. Sex and age distribution among the different groups of gardeners in the survey

	The Gardeners' Trade Union, Odense		Self-employed gardeners*	
	No.	Mean age (years)	No.	Mean age (years)
females	1141	34.0	24	40.3
males	491	31.4	241	48.5
total	1632		265	

* Sex and age of non-respondents are known in 4 and unknown in 61 cases.

among members of the Gardeners' Trade Union (85.5%) compared to self-employed gardeners (80.1%). The 2 groups of self-employed gardeners also differed considerably from the Trade Union group with regard to sex and age distribution (Table 1). The response rate among female members of the Gardeners' Trade Union was significantly higher than among males, but this was due to a significant difference in the age group over 35 years only. Since information on self-employed gardeners was obtained from Denmark's National Bureau of Statistics, personal data as sex and age were missing among most of non-responding self-employed gardeners.

13 persons were withdrawn from the study prior to analysis, either because they had never worked as gardeners or because they appeared twice in the registers (Fig. 1). 1464 of the 1657 respondents were either employed or unemployed gardeners or greenhouse workers, whereas 193 had another occupation. However, 36 of the 193 had plant-related work such as farmer, fruit grower, landscape gardener, employee in a florist's shop, etc. The majority of respondents had been or were working in greenhouses, at least part of the time. The median duration of employment in floristry and related jobs was 7 years (range 1 month to 64 years). 26 of the 1657 questionnaires were not completely filled in, but they were considered usable for calculation of prevalence rates. 16 of the 26 questionnaires were filled in by immigrant workers.

Non-respondents and non-attendants

221 of the 301 non-respondents did not return the questionnaire or were not found by the address given, 47 returned blank questionnaires (including 6 who did not have any problems), 19 cancelled their participation (including 11 who did not have any problems) and 14 were withdrawn because of insufficiently completed questionnaires. 8 of the 14 questionnaires were filled in by immigrant workers.

253 of 301 (84.1%) potential attendants with symptoms were examined. The attendance rate was

significantly lower in men than in women. 46 of 48 non-attendants were contacted by telephone or letter to assess the validity of information on eczema. The prevalence was not lower than among attendants. Among potential attendants without symptoms 52 of 74 (70.3%) were examined, and there was no difference in the attendance rates between the 2 sexes.

Assessment of data obtained by different methods of information

Changes in the prevalence of occupational eczema after contact by telephone, letter or personal interview (referred and examined patients) are shown in Table 2. Only 52 of the 253 persons with symptoms had eczema at the time of examination. Generally, members of the Gardeners' Trade Union contacted by telephone ($n=568$) tended to overestimate the prevalence of occupational eczema in their present work and underestimate it in their previous work, while self-employed gardeners contacted by telephone ($n=155$) underestimated the prevalence of occupational eczema in both present and previous work. In the examined group both members of the Gardeners' Trade Union and self-employed gardeners overestimated the prevalence of occupational eczema in present and previous work, the former to a higher degree than the latter.

The lifetime prevalence of occupational eczema was not significantly different in the questionnaire group (the 574 not contacted) compared to those of the groups contacted by telephone or letter, on condition that non-attendants with formally correct questionnaires were excluded from the telephone group.

Prevalence of occupational eczema

709 persons reported eczema after the above-mentioned changes in the questionnaires. Only 190, however, reported occupational eczema in present and 240 in previous work, while 47 reported both. Thus a total of 383 persons, 262 females and 121 males, had had occupational eczema at least once in their lives. This corresponds to a minimum lifetime prevalence of occupational eczema of 19.6%

Table 2. Corrected lifetime prevalence of occupational eczema after personal, telephonic or written contact

Occupational eczema	Telephonic contact ($n=723$)	Written contact ($n=47$)	Referred patients ($n=8$)	Examined patients	
				symptom group ($n=253$)	random group ($n=52$)
before	15.6%	19.1%	25%	84.9%	0%
after	16.6%	14.9%	37.5%	72.7%	1.9%

Table 3. Distribution of lifetime prevalence of occupational eczema in 1897 female and male gardeners of different age groups

Age group (years)	Females		Males		Total	
	no.	occup. eczema % of no.	no.	occup. eczema % of no.	no.	occup. eczema % of no.
≤25	344	27.3%	203	13.3%	547	22.1%
26–35	383	19.6%	193	16.1%	576	18.4%
>35	438	21.2%	336	18.8%	774	20.2%

The above figures include non-respondents in each age group except in 61 cases where the age was unknown.

(95% confidence interval: 17.8–21.3%) among the 1958 potential respondents. In comparison, the prevalence of self-reported eczema before the above-mentioned changes was 20.8%.

Among examined persons with symptoms, the overall duration of occupational eczema was >1

month in 69.6%, <1 month in 17.9% and unknown in 12.5%. In addition to the 383, 110 persons had an eczema of possible occupational origin and 42 persons had a possible eczema of occupational origin. The sex and age distribution among persons with occupational eczema is shown in Table 3. The prevalence of occupational eczema in present work was 14.4%, since only 1323 persons were employed as gardeners or greenhouse workers at the time of the study.

Based on questionnaires and case records 64 (25.3%) of the 253, who were clinically examined, had personal atopy.

Associations between occupational eczema and possible risk factors

The parameters selected as predictor variables in a stepwise logistic regression model with lifetime occupational eczema as response variable appear

Table 4. Associations between lifetime occupational eczema and selected risk factors in 1647* persons

Risk factor	Final model		
	OR	CI	p-value
occup.contact Compositae	1.989	(1.531–2.584)	0.0000
skilled gardener	1.798	(1.295–2.496)	0.0003
S*skilled gardener	0.511	(0.290–0.902)	0.0180
occupational symptoms of eyes	2.234	(1.661–3.007)	0.0000
occupational symptoms of nose	1.523	(1.143–2.030)	0.0034
sex	0.775	(0.498–1.204)	0.2465
Rejected risk factors			
pers.atopy-hayfever			0.9567
S*fam.atopy-childhood eczema			0.9275
S*occup.symptoms of eyes			0.7905
S*occup.symptoms of nose			0.6553
fam.atopy-hayfever			0.6479
fam.atopy-asthma			0.6265
S*childhood eczema			0.6007
S*fam.atopy-asthma			0.5396
S*fam.atopy-hayfever			0.4694
S*occup.contact Compositae			0.4567
pers.atopy-asthma			0.4473
pers.atopy-childhood eczema			0.3004
seniority			0.2552
S*seniority			0.4575
age group >35 years			0.3200
S*age group >35 years			0.3339
S*age group 26–35 years			0.3582
age group 26–35 years			0.2063
fam.atopy-childhood eczema			0.1592
S*hayfever			0.1430
S*asthma			0.0910

OR="odds ratio"=exp.logistic coefficient.

CI=95% confidence interval.

S*=interaction between sex and the variable in question.

pers.atopy=personal history of atopy.

fam.atopy=family history of atopy.

occup.contact Compositae=occupational contact with Compositae plants.

The p-values for the rejected risk factors are the values at the point of rejection, listed in order of rejection.

*10 of the 1657 respondents were withdrawn because of insufficient filling in of single questions.

Table 5. Associations between occupational eczema at present work and selected risk factors in 1437* persons

Risk factor	Final model		
	OR	CI	p-value
sex	0.396	(0.270–0.582)	0.0000
skilled gardener	2.118	(1.482–3.026)	0.0000
occupational symptoms of eyes	1.773	(1.209–2.601)	0.0028
occupational symptoms of nose	2.112	(1.456–3.065)	0.0001
history occup.eczema	2.126	(1.422–3.178)	0.0002
Rejected risk factors			
pers.atopy-childhood eczema			0.7642
S*history occup.eczema			0.7264
fam.atopy-asthma			0.7158
S*fam.atopy-hayfever			0.6821
pers.atopy-hayfever			0.6510
fam.atopy-hayfever			0.6814
S*fam.atopy-childhood eczema			0.5965
pers.atopy-asthma			0.5326
seniority			0.5332
age			0.4988
S*fam.atopy-asthma			0.4512
S*occup.symptoms of eyes			0.4505
S*hayfever			0.4177
S*skilled gardener			0.3488
S*seniority			0.4095
S*age			0.4003
S*childhood eczema			0.4018
S*occup.contact Compositae			0.3607
occup.contact Compositae			0.2832
S*occup.symptoms of nose			0.2093
S*asthma			0.1050
S*history other eczema			0.1070
history other eczema			0.1152
fam.atopy-childhood eczema			0.0977

OR="odds ratio"=exp.logistic coefficient.

CI=95% confidence interval.

S*=interaction between sex and the variable in question.

pers.atopy=personal history of atopy.

fam.atopy=family history of atopy.

occup.contact Compositae=occupational contact with Compositae plants.

The p-values for the rejected risk factors are the values at the point of rejection, listed in order of rejection.

*216 of the 1657 respondents were withdrawn because of unemployment and 4 because of insufficient filling in of single questions.

in Table 4. A history of occupational mucosal symptoms and work involving contact with Compositae plants were significantly associated with the occurrence of an occupational eczema in both sexes. Approximately 1/2 of the respondents had worked with Compositae plants. On the other hand, training as a gardener was significantly associated with the response variable in women only. As an exception, sex was retained in all regressions because of the well-known association between this variable and eczema, but it turned out not to be an independent risk factor. The 21 rejected factors were also jointly insignificant. The assumption of homogeneity was tested in the logistic model and could not be rejected, χ^2 with 6 degrees of freedom being 4.90. The above-mentioned predictor variables and a history of either occupational eczema or another kind of eczema (including both non-occupational and possible occupational) were ana-

lysed in a model with occupational eczema in present work as response variable. The model (Table 5) showed a significantly positive association between training as a gardener, occupational mucosal symptoms and a history of previous occupational eczema and the response variable in both sexes. On the other hand, men had a significantly lower risk of having an occupational eczema in present work compared to women. The 24 rejected factors were also jointly insignificant. The assumption of homogeneity could not be rejected, χ^2 with 5 degrees of freedom being 6.78.

Discussion

Participation in the study

We know that some declined participation because they had no problems and, theoretically, a healthy worker effect may be more prevalent in males over

35 in the Gardeners' Trade Union. Male respondents of this age group had a far higher median seniority, compared to females of the same age and to younger respondents of both sexes, without their prevalence of occupational eczema being higher. If this applies to male non-respondents over 35 too, the reason for the higher dropout rate may be that many considered participation irrelevant. Alternatively, florists often know the causes of their dermatitis (6) and such knowledge may diminish the motivation for participation. At any rate, knowledge of causal relations between symptoms and exposure will most likely lead to selection bias because of a differentiated dropout rate. Therefore, the respondents cannot be considered representative of all potential participants and to avoid overestimation of the prevalence, all non-respondents have been regarded as healthy without eczema.

The significantly higher attendance rate in women has in all probability not induced bias in the estimation of the prevalence of occupational eczema, since most of the non-attendants were contacted by telephone or letter to assess the validity of information on eczema.

Estimation of the prevalence of occupational eczema

Different types of information bias may have influenced the frequency of self-reported occupational dermatitis. Some of the immigrant workers of the Gardeners' Trade Union found it difficult to understand the questions to a degree that rendered withdrawal of questionnaires necessary. Other important sources of error are the lack of specification concerning the minimum duration of skin symptoms classified as eczema and, in general, the lack of knowledge as to the subjective criteria on which the respondents have based their diagnosis. However, subsequent contact with the respondents revealed that both transitory symptoms, such as urticaria, and chronic diseases, such as psoriasis and dermatophytosis, were reported as eczema. Self-employed gardeners reported fewer, and sometimes too few, cases of occupational eczema than members of the Gardeners' Trade Union, but their information was more valid, at least in the group examined. This could be due to a greater knowledge based on their experience, or the newspaper publicity on greenhouses as dangerous pesticide-polluted workplaces could have influenced employers and employees differently with regard to reporting symptoms. The different methods of information have probably not induced additional bias, since the most important response variable – lifetime prevalence of occu-

pational eczema – was not significantly different in comparable groups.

Information on a negative questionnaire diagnosis of eczema was more valid than information on a positive and this is in accordance with the results of Smit et al. (8). Evaluation of the positive questionnaire diagnoses, however, is also based on an estimate. Relatively few persons had eczema at the clinical examination and genetic disposition, the high prevalence of personal atopy in the group examined and environmental factors besides the work may contribute to the development of eczema and make classification difficult. The reliability of a diagnosis of eczema and of the occupational origin of the eczema was assessed for the 150 examined persons who had an occupational eczema in present work and the results (Table 6) reflect the uncertainty even after careful history taking. The change, however, in the overall prevalence of occupational eczema after contact with a majority of respondents was moderate. Altogether, the uncertainty of the self-reported occupational eczemas may be more than counterbalanced by the eczemas reported as possibly occupational and the eczemas among non-respondents, so that the estimated lifetime prevalence is a minimum figure and probably an underestimation.

Lander et al. (9) demonstrated a 2-year period prevalence of eczema/rash of 23% among 1173 members of the Gardeners' Trade Union, Odense, in a postal questionnaire study in the 1980s. The lower lifetime prevalence in our study is in accordance with this, taking into account a probable overestimation of self-reported eczemas and a lower risk of information bias because of the shorter time span in the former study. Likewise, Santucci & Picardo (7) reported occupational dermatoses, including mechanical, irritant and allergic contact dermatitis, in 25% of 200 workers from 4 floriculture centers after clinical and allergologic evaluation. In a questionnaire study among 65 randomly selected persons of 260 workers in a flower company, the 1-year period prevalence of

Table 6. Validity of a diagnosis of occupational eczema in present work in 150 examined persons where the diagnosis was not changed

Eczema	Occupational	No. patients
yes	yes	75
yes	possible	22
possible	yes	39
possible	possible	8
probably not	yes	2
probably not	possible	2
yes	probably not	2
total		150

hand eczema was 26.3% in the 57 respondents (10). Other studies have reported lower prevalences, but they had a high dropout rate (5, 11). The results of the 2 Danish investigations point in the same direction. The prevalence of occupational eczema among Funen – and probably also other Danish – gardeners is so high that floristry must be considered a potentially hazardous occupation. This is consistent with the fact that agriculture/forestry is no. 14 among the 19 grouped occupations that most frequently reported occupational eczemas from 1984 to 1991 (4).

Association between occupational eczema and possible risk factors

The association between lifetime occupational eczema and occupational mucosal symptoms may be explained by the presence of toxic substances in the working environment such as pesticides or certain plant saps that cause irritation of both skin and mucous membranes. The association with Compositae plants partly reflects the fact that they are common culture plants and partly their well-known allergenic and irritant potential concerning both skin and mucous membranes. Since we attached importance to occupational symptoms caused by Compositae, we cannot conclude that Compositae plants are more frequently occurring sources of occupational problems than other plant families, but the results emphasize that contact with Compositae plants is an occupational risk factor. The difference between the 2 sexes concerning association between lifetime occupational eczema and training as a gardener is difficult to explain. It is possible that the self-employed gardeners, who were mainly males, were more engaged in management than practical work or they were less often affected due to selection through the healthy worker effect, as opposed to skilled female gardeners who were younger than males ditto and nearly all of them employed. The higher dropout rate among males over 35 years is of course another explanatory factor if males with eczema were more inclined to refuse participation. The registration of training may be slightly biased, since unemployed of unknown training were registered as unskilled and the 193 with another occupation may have worked as skilled/unskilled gardeners before. The difference between the sexes disappears if only persons with eczema in present work are included. Maybe skilled gardeners are generally more reluctant to give up their job than greenhouse workers if they get an occupational eczema. Different tasks could be another reason for the higher prevalence in gardeners, but they are not included in the analyses.

The fact that males have a significantly lower prevalence of occupational eczema in present work is due to chance, since sex was not an independent risk factor in the previous analysis (Table 4). The association between a history of occupational eczema and occupational eczema in present work may be explained by an increased risk due to damage to the skin barrier on exposed sites. On the other hand, non occupational eczema, which was not associated with the response variable, often affects exposed skin. Therefore another possibility is information bias. Persons with an eczema in present work may be more inclined to remember previous occupational eczemas, while the opposite applies to persons without current eczema. The well-known association between childhood eczema and risk of (hand) eczema as a grown-up (12) was also established in this study, but did not apply to occupational eczema. In conclusion, the prevalence of occupational eczema, defined as dermatitis lasting more than 24 hours in Danish gardeners and greenhouse workers, is high enough to confirm that floristry is a dermatologically hazardous occupation. Personal characteristics such as sex, age, family history of or personal atopy seem to be of less importance for the development of occupational eczema than environmental factors, i.e., contact with certain plant cultures and training. The results emphasize the importance of recognition of the latter in order to reduce the sickness rate.

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References

1. Rycroft R J G. Occupational exposure to plants. In Lovell C R: *Plants and the skin*, 1st edition. Oxford: Blackwell Scientific Publications, 1993: 6–15.
2. O'Malley M A, Toby Mathias C G. Distribution of lost-work-time claims for skin disease in California agriculture: 1978–1983. *Am J Indus Med* 1988; 14: 715–720.
3. Diepgen T L, Schmidt A, Schmidt M, Fartasch M. Berufsektzeme und Berufskrankheitsverfahren – epidemiologische Aspekte. *Allergologie* 1994; 17: 84–89.
4. Halkier-Sørensen L, Thestrup-Pedersen K, Haugaard Petersen B. *Anmeldte og anerkendte arbejdsbetingede hud-*

- sygdomme i Danmark*. Copenhagen: Industriens Forlag, 1994.
5. Bethea L K, Schuman S H, Smith-Phillips S E, Kelly J W. South Carolina florists dermatitis: Case report and survey results. *J South Carolina Med Ass* 1988; 84: 446-448.
 6. Merrick C, Fenney J, Clarke E C, Hodnett T, Fletcher G. A survey of skin problems in floristry. *Contact Dermatitis* 1991; 24: 306.
 7. Santucci B, Picardo M. Occupational contact dermatitis to plants. *Clin Derm* 1992; 10: 157-165.
 8. Smit H A, Coenraads P J, Lavrijsen A P M, Nater J P. Evaluation of a self-administered questionnaire on hand dermatitis. *Contact Dermatitis* 1992; 26: 11-16.
 9. Lander F, Jeune B, Skytthe A. Prævalensen af allergiske og irritative symptomer blandt gartneriarbejdere. *J Danish Med Assoc* 1986; 149: 44-46.
 10. Thiboutot D M, Hamory B H, Marks J G. Dermatoses among floral shop workers. *J Am Acad Dermatol* 1990; 22: 54-58.
 11. Hausen B M, Oestmann G. Untersuchungen über die Häufigkeit berufsbedingter allergischer Hauterkrankungen auf einem Blumengrossmarkt. *Dermatosen* 1988; 36: 117-124.
 12. Meding B. Epidemiology of hand eczema in an industrial city. *Acta Dermato-venereologica* 1990 (suppl 153): 1-43.

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