

Short communication

Allergy symptoms and IgE immune response to rose: an occupational and an environmental disease

Background: Turkey is one of the four major producers of rose. Cultivation of rose is the main economic activity of many villagers in the Lakes region. Rose allergy has not been reported before. We investigated the prevalence of allergy symptoms and specific-IgE immune response due to rose in villagers who had been cultivating rose in Güneykent village in the Lakes region.

Methods: A screening questionnaire including respiratory and allergic symptoms was administered to 290 villagers. The investigation team visited and studied 75 randomly selected villagers with an interviewer-administered questionnaire, pulmonary function testing, skin prick testing and serum total IgE. Specific IgE against *Rosa rugosa* was measured in 41 villagers.

Results: Villagers reported asthma/allergy symptoms outside the rose season (17.6%), during the rose season (6.2%), and both during the rose season and outside the rose season (whole the year) (17.6%). Atopy and specific IgE against *Rosa rugosa* were detected in 12 (19%), and 8 (19.5%) of the villagers tested. Villagers who had symptoms whole the year reported wheeze more frequently than those who reported symptoms only outside the rose season (41.2% vs 11.1%).

Conclusions: IgE-mediated allergy could occur due to rose and/or its pollen. Symptoms mainly affect the upper airways. Further studies in the rose handlers, florists and workers of the rose industry would help elucidate the occurrence of rose allergy.

**A. U. Demir¹, Gül Karakaya²,
A. F. Kalyoncu²**

¹Department of Chest Diseases; ²Department of Chest Diseases, Adult Allergy Unit, Hacettepe University, Ankara, Turkey

A.U. Demir, MD
Hacettepe University Hospital
Department of Chest Diseases
06100 Sıhhiye Ankara
Turkey

Accepted for publication 27 January 2002

Turkey is one of the four major producers of rose; the others include Bulgaria, Morocco and China. In Isparta, a city in the interior Mediterranean region (the Lakes region), the rose season is in early summer from the middle of May to the middle of June. The economy of the villagers in this region mainly depends on cultivating rose. During the rose season, the whole family collects rose petals in the early morning to avoid sunlight which can decrease the oil product of the roses. Usually the women and children, who use their hands rather than scissors or other cutting devices, pick the flower heads and put them into baskets. These baskets are transferred to factories where the rose heads are tipped into pans of water and boiled for several hours. Rose oil is removed by syringe and kept in dark glass bottles. This process requires patience as only one gram of oil is produced from four kilos of rose petals (1).

Turkey exports rose oil, which has beneficial effects on skin, to other countries for production of cosmetics. According to the State Statistics Institute of Turkey, during 1998–99 the annual export was more than 43 tons, mainly to USA and France. Rose petals are also used in jam and desserts.

Rose pollens can induce allergic symptoms like other pollens do. Eriksson et al. in their study of 680 adult patients with asthma and/or rhinitis reported asthma and rhinitis symptoms that were related to rose species in 11% and 22% of atopic and nonatopic patients, respectively (2). However, allergy to rose has not been investigated before. This could be a public health problem since vast numbers of people earn their living from cultivating and processing rose in the Lakes region.

We conducted a survey in Güneykent village in the Lakes region to assess the occurrence of allergy and respiratory diseases in the villagers who had been cultivating rose.

Material and methods

The population of Güneykent is 1200, and inhabitants who stay in the village for most of the year only comprise almost half this number. We asked the health center physician to approach all resident villagers and administer a screening questionnaire. The nurse from the village health center administered the questionnaire to a total of 290 adults. The questionnaire was adapted from the ECRHS questionnaire (3), and included questions on smoking

habits, agricultural activities, and allergic and respiratory symptoms as current (present in the last 12 months), and as rose-related (present during the rose season). The nurse, who was born locally and had good communication with the villagers, provided brief explanations of the symptoms which the villagers could understand. Definitions of the allergic symptoms were adapted according to the "EAACI Revised Allergy Nomenclature" (4).

Our research team, including three physicians and a respiratory technician, visited Güneykent village in April 2000, before the rose season. A physician from the team (A.U.D.) administered the screening questionnaire to a randomly selected sample of 30 villagers and an additional 45 villagers who asked to be examined by our team. The sample was matched according to the presence of symptoms in the rose season. Our technician took blood samples for total and specific IgE measurements and kept them within ice blocks for transportation. Sera obtained from 41 villagers were sent to the Allergopharma Laboratory in Germany for testing of specific IgE against *Rosa rugosa* and *Artemisia vulgaris* via a radioallergosorbent (RAST) method. Allergopharma Laboratory collected rose pollens from dried flower heads, which had a purity of 85%.

Skin prick testing was administered with common aeroallergens (*Phleum pratense*, *Artemisia vulgaris*, *Parietaria officinalis*, *Corylus avellana*, *Betula verrucosa*, *Olea europae*, *Dermatophagoides pteronyssinus*, *Vesputia species*, *Alternaria alternata*, *Cladosporium herbarum*, cat and dog allergen extracts) according to Österballe et al. (5). A mean wheal diameter of 3 mm or more than the negative control was considered as positive. Atopy was considered if there was at least one positive reaction as defined above.

Pulmonary function testing was performed according to the ATS guidelines with a portable spirometer (Gold Pulmonary Analysis Computer, and Pulmograph, The Netherlands) (6). Predicted values based on height and age were adopted from Knudson et al. (7). A ratio of predicted FEV₁ (forced expiratory volume in one second) to predicted FVC (forced vital capacity) less than 80% was considered as airway obstruction.

A *P*-value of less than 0.05 was considered to be statistically significant. *Chi*-squared tests and *t*-tests were used for categorical and continuous variables, respectively. Fisher's exact test was preferred when the expected cell count was below 5. For comparisons

of more than two groups, a one-way ANOVA was used. The statistical package SPSS 9.0 for Windows was used for the analysis. Logarithmic transformation of total IgE levels was performed to obtain a normal distribution.

Results

The "visit" population, as compared to the screening population, included a higher percentage of women (58.7% vs 42.3%), respiratory or allergic symptoms (66.7% vs 24.2%), and rose-related symptoms (34.7% vs 19.1%). Villagers in the "visit" survey were selected according to their symptoms, giving equal weight to those who had any symptom and those who had no symptom. Therefore this was the expected result of sampling.

Villagers who reported respiratory or allergic symptoms were grouped as follows: no symptom (58.6%); asthma/allergy symptoms outside the rose season (17.6%); asthma/allergy symptoms during the rose season (6.2%); asthma/allergy symptoms both during the rose season and outside the rose season (whole the year, 17.6%). Comparison of the groups is shown in Table 1. There was a higher percentage of female gender, current or ex-smoker, and family atopy among the subjects who reported any asthma/allergy symptom as compared to the subjects who reported no asthma/allergy symptom. Age distribution of the groups was similar. Subjects who reported symptoms outside the rose season and the whole year had a higher prevalence of livestock breeding, agricultural activities and gardening than the subjects who reported no symptom. Villagers mainly produced their own vegetables and fruits or bred animals for themselves. Twelve of the 70 villagers (19%) who were skin tested had positive

Table 1. Comparison of the villagers with and without rose related symptoms

	Asthma and allergy symptoms				Total	<i>P</i>
	No symptom	Outside rose season	During rose season	Whole year		
<i>n</i>	170	51	18	51	290	
Women	69	21	11	34*	135	0.005
Age: mean (SD)	44.1 (15.9)	40.5 (15.8)	39.6 (17.3)	43.2 (13.8)	43.0 (15.6)	0.40
Never smoked	99	25‡	14	35*	173	
Ex-smoker	35	5	0	7	47	
Current smoker	36	21	4	9	70	
Other pollen allergy	0	4	0	13*†	17	<0.001
Family atopy	8	9	1	9	27	0.005
Agriculture	27	15‡	0	22‡	64	<0.001
Livestock breeding	31	34‡	0‡	33‡	98	<0.001
Gardening	36	31‡	1	35‡	103	<0.001
Skin tested	12	23	1	34	70	0.18
Any +	2	1*	0	9	12	
Total IgE tested	9	16	1	30	56	
Log mean (SD)	1.5 (0.5)	2.0 (0.8)	1.1 (NA)	1.9 (0.6)	1.8 (0.6)	0.19
PFT tested	16	31	1	35	83	
FEV ₁ /FVC < %80	4	8	1	8	21	0.24

**P* < 0.05, symptoms outside rose season vs whole year.

†*P* < 0.05, symptoms during rose season vs whole year.

‡*P* < 0.05, vs no symptom.

Table 2. Asthma and allergy symptoms and rose-related symptoms

	Asthma and allergy symptoms				<i>P</i>
	Outside rose season	During rose season	Whole year	Total	
	Year				
Asthma/allergy symptoms	51	0	51	102	
Current wheeze	27		24	51	0.69
Woken up with cough	22		26	48	0.55
Woken up with shortness of breath	8		16	24	0.10
Woken up with chest tightness	10		19	29	0.08
Diagnosis of asthma	1		9	10	0.02
Asthma attack	2		7	9	0.16
Asthma medicine	5		11	16	0.17
Perennial rhinitis	17		21	38	0.54
Seasonal rhinitis	20		28	48	0.16
Rose-related symptom	0	18	51	69	
Itching hands		8	16	24	0.90
Nose symptoms		8	30	38	0.44
Eye symptoms		6	19	25	0.99
Shortness of breath		3	19	22	0.19
Cough		3	20	23	0.15
Wheeze		2	21	23	0.04

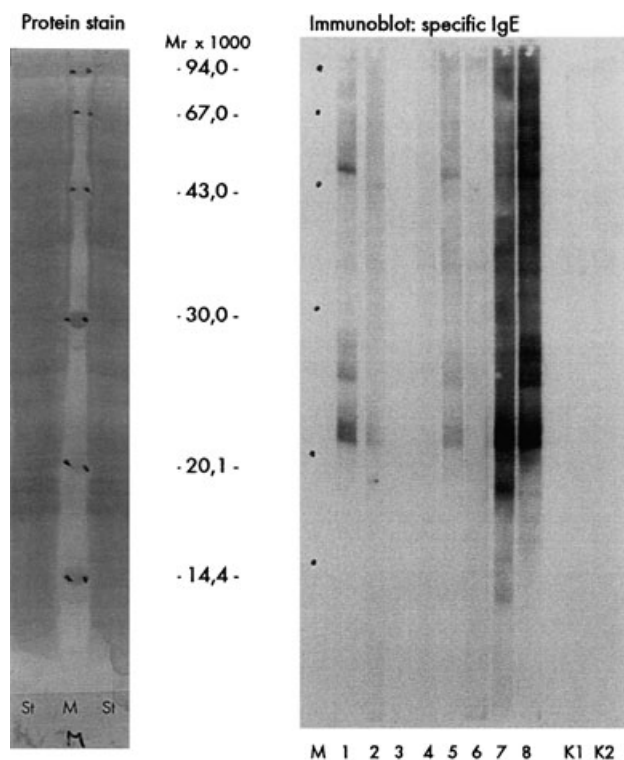


Figure 1. Immunoblot with *Rosa rugosa* allergen extract and patients' sera. Specific IgE binding protein fractions of pollen extracts of *Rosa rugosa*. RAST class and (IU/ml) results were: 1) 2 (0.78); 2) 1 (0.48); 3) 1 (0.40); 4) 1 (0.36); 5) 1 (0.47); 6) 2 (2.26); 7) 4 (30.30); 8) 4 (22.52); K1 and K2: control sera. M=Pharmacia low marker proteins.

results. Prevalence of atopy in the group with symptoms outside the reason was significantly lower than that of the group with symptoms the whole year. Prevalence of airway obstruction ($FEV_1/FVC < 80\%$) was not significantly different between the groups.

Prevalence of respiratory or allergic symptoms and -symptoms were shown in Table 2. Fifty-one villagers (17.6%), 24 (8.3%) of those who had symptoms during the rose season reported current wheeze. Being woken up by cough, shortness of breath and chest tightness in the last 12 months was reported by 48 (16.6%), 24 (8.3%) and 29 (10.0%) villagers, respectively. Diagnosis of asthma by a physician was reported more frequently in villagers with symptoms for the whole the year than those with symptoms outside the rose season (nine vs one). Thirty-eight (13.1%) and 48 (16.6%) of the villagers reported perennial and seasonal rhinitis symptoms, respectively. Rose-related symptoms were reported by 69 (23.8%) villagers, and these included itching hands ($n=26$, 9.0%), nose symptoms ($n=38$, 13.1%), eye symptoms ($n=25$, 8.6%), shortness of breath ($n=22$, 7.6%), cough ($n=23$, 7.9%), and wheeze ($n=23$, 7.9%). Wheeze was reported more frequently in the villagers who had symptoms the whole year than in those who had symptoms during the rose season (21 vs two).

Sera from eight of the 41 (19.5%) villagers gave a positive reaction to *Rosa rugosa* pollen. Two were strong positive reactions with RAST class 4, two with class 2 and two with class 1. Twenty-one sera were positive for *Artemisia vulgaris*, six of which were also positive for *Rosa rugosa*. Nonparametric correlation between the two reactions was 0.37 ($P=0.016$). The SDS (sodium dodecyl sulfate) electrophoresis immunoblot test results of the eight RAST-positive and two RAST-negative sera are shown in Fig. 1. The most frequent bands appeared at 21, 25 and 48 kDa. Percentage of men (5/8 vs 6/33), skin test positivity (5/8 vs 3/32, among the tested), other pollen allergy (4/8 vs 4/33) and seasonal rhinitis (6/8 vs 10/33) were significantly higher in the subjects with rose-specific IgE than subjects without rose-specific IgE.

Discussion

We investigated the occurrence of allergic symptoms due to rose and/or its pollen in this pilot study of villagers who had been cultivating rose. Exposure to rose among the villagers may be encountered both occupationally (rose season) and environmentally (whole year). Six percent of villagers reported asthma/allergy symptoms only during the rose season, which could be defined as rose handlers' disease. Seventeen percent of villagers reported asthma/allergy symptoms during the whole year, which could be defined as rose-aggravated symptoms. The above distinction is similar to that cited for occupational asthma and work-aggravated asthma (8).

Villagers who had symptoms over the whole year included mostly women, as it was mainly their task to collect the roses. Prevalence of wheeze during the rose season was also higher in this group. Development of nonspecific bronchial hyperresponsiveness and airway inflammation could have induced bronchial sensitivity to rose pollen, similar to the findings reported for grass pollen (9).

Villagers were frequently involved with other agricultural activities, which could be one of the causes of lower prevalence of atopy in our survey (10). In the study by Eriksson et al. prevalence of flower-elicited symptoms were similar in both atopic and nonatopic patients (2). Higher prevalence of atopy in the villagers with symptoms over the whole year, as compared to those with symptoms outside the rose season, could indicate a higher likelihood of chronic disease and rose-aggravated symptoms in the atopic villagers. The low prevalence of atopy observed in our study could be due to the migration of mostly atopic workers to work in big cities, or to inadequate skin testing which did not include allergenic extracts of rose pollen.

Enzyme-linked immunosorbent assay (ELISA) has been used to detect serum IgE or IgG antibodies, but

lacks sensitivity and specificity (11). Specific immunoblot testing against *Rosa damascena*, which is the prominent type of rose used for production of oil, would provide stronger evidence for rose allergy in the Lakes region. Weak but significant correlations between positive reactions to *Rosa rugosa* and to *Artemisia vulgaris* could indicate a cross-reaction, as previously reported for other flowers (12).

Villagers with rose-related symptoms frequently had other allergic, asthmatic symptoms and symptoms due to other types of pollens. Association of specific IgE with atopy, other pollen allergy and seasonal rhinitis is also consistent with the possibility of IgE-mediated allergic reaction to rose. Pollen grains or small fragments of the pollens could penetrate the upper airways and induce type I hypersensitivity (13). The allergenic part of the rose is most likely to be the fresh

flower and/or its pollens. Cooking the flower during industrial preparation of rose oil, jam, juice or liqueur would cause denaturation of the protein.

In summary, IgE-mediated allergy could occur in the villagers who were exposed to rose and/or its pollen. Symptoms due to rose mainly affect the upper airways. Further studies in the rose handlers, florists and rose industry workers would help to elucidate the occurrence of rose allergy.

Acknowledgments

We wish to give our special thanks to Mr Şinasi Olgun, the Directory, General of Association of the Trades of Rose and Rose Oil; Mr Ali Erdem, the Municipal of Güneykent; Dr Suat Sincan and the health center staff; Güneykent's residents; Associate Professor Dr Ayşe Akinci; Professor Dr Ahmet Kart; and health technician Mr Hikmet Öztürk. We would like to acknowledge the kind assistance of Allergopharma (Germany) for testing specific IgE against *Rosa rugosa* extracts.

References

1. Gülcülük (Cultivating Rose). Ankara: Turkish Ministry of Agriculture and Forestry, and Gülbirlik the Association of the Trades of Rose and Rose Oil, 1995, (in Turkish).
2. ERIKSSON NE, LÖWHAGEN O, NILSSON J-E, NORDLIND K, WIHL J-A. Flowers and other trigger factors in asthma and rhinitis - an inquiry study. *Allergy* 1987;**42**:374-381.
3. BURNEY RGJ, LUCZYNSKA S, CHINN S, JARVIS D, , for the EUROPEAN COMMUNITY RESPIRATORY HEALTH SURVEY (ECRHS). The European Community Respiratory Health Survey. *Eur Respir J* 1994;**7**:954-960.
4. JOHANSSON SGO, O'B HOURIHANE J, et al. Position paper - A revised nomenclature for allergy. An EAACI position statement from the EAACI nomenclature task force. *Allergy* 2001;**56**:813-824.
5. ÖSTERBALLE O, WEEKE B. A new lancet for skin prick testing. *Allergy* 1979;**34**:209-212.
6. AMERICAN THORACIC SOCIETY. Standardization of spirometry. *Am Rev Respir Dis* 1987;**13**:287-298.
7. KNUDSON RJ, LEBOWITZ MD, HOLDBERG CJ, BURROWS B. Changes in the normal expiratory flow-volume curve with growth and aging. *Am Rev Respir Dis* 1983;**127**:725-734.
8. NEWMAN TAYLOR AJ. Occupational asthma. *Thorax* 1980;**45**:241-245.
9. DENTE FL, BACCI E, DIFRANCO A, GIANNINI D, VAGAGGINI B, PAGGIARO L. Natural exposure to pollen reduces the threshold but does not change the pattern of response to the allergen in allergic subjects. *Respir Med* 2000;**94**:1073-1078.
10. KILPEALAINEN M, TERHO EO, HELENUS H, KOSKENVUO M. Farm environment in childhood prevents the development of allergies. *Clin Exp Allergy* 1999;**30**:201-208.
11. AMERICAN THORACIC SOCIETY. Respiratory health hazards in agriculture. *Am J Respir Crit Care Med* 1998;**158**:S1-S76.
12. DE JONG NW, VERMEULEN AM, GERT VAN WIJK R, DE GROOT H. Occupational allergy caused by flowers. *Allergy* 1998;**53**:204-209.
13. MICHEL FB, QUET L, COUR P. Penetration of inhaled pollen in the respiratory tract. *Am Rev Respir Dis* 1977;**115**:609-615.