

OCCUPATIONAL ALLERGIC CONTACT DERMATITIS FROM MIOGA (*ZINGIBER MIOGA ROSC.*) IN GREENHOUSE CULTIVATORS

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Mioga (*Zingiber mioga* Rosc.) is a member of the ginger family (Zingiberaceae), which is native to tropical Asia. In Japan, the young flower buds are used as a spice, and hand dermatitis suspected as being an allergy to mioga has been recognized in mioga greenhouse cultivators. To investigate the extent of the problems and the causes of dermatitis, 20 householders cultivating mioga in their greenhouses were asked to participate in a questionnaire study. Consecutive patch tests were performed on some subjects with dermatitis. Self-reported questionnaires were distributed to the main cultivator in each household who attended a lecture of mioga cultivation methods held at an agriculture cooperative association in the area. Some subjects who answered as presenting or having had hand dermatitis were patch tested for mioga (as is), four kinds of mioga extracts, and three kinds of natural rubber gloves. Results: 35 cultivators from 16 households answered the questionnaire. Eight of the 35 subjects (22.9%) answered that they had experienced hand dermatitis since they started mioga cultivation. Four of the 8 subjects were patch tested. Two of the 4 subjects showed allergic reactions to mioga (as is) and the extracts. The other two cases showed irritation to mioga (as is). The first two cases also showed allergic reactions to natural rubber gloves. To our knowledge, there is no previous report of allergic contact dermatitis from mioga.

Mioga (*Zingiber mioga* Rosc.) is a member of the ginger family (Zingiberaceae), native to tropical Asia (1), and in Japan, the young flower buds are used as a spice or vegetable. Outside of Japan, almost no other people consume mioga. Mioga grows outdoors and it is not difficult to harvest from a garden in the summer in Japan. In the early 1990s, cultivation technology was established and enabled the flower buds to be supplied to markets year round. Since then, the number of mioga greenhouses has increased in Japan and hand dermatitis suspected to be due to allergy to mioga has been recognized in mioga greenhouse cultivators. To investigate the extent of the problems and the causes of the dermatitis, subjects from 20 households involved in mioga greenhouse cultivation were questioned about their skin problems and patch tests were performed on some of the subjects who had experience the skin symptoms.

MATERIALS AND METHODS

Questionnaire study. Self-reported questionnaires to inquire about periods of cultivation, cultivation area, working time, kinds of work involved, history of allergic diseases, skin protecting measures, and experience of skin problems were distributed to the main cultivator in each household who attended a lecture on mioga cultivation methods and health education held at an agriculture cooperative association in the area where 20 households were cultivating mioga in greenhouses. About the skin problems, the phrase "Have you experienced skin eruption or itching since you started mioga cultivation?" was used.

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Questionnaires were also provided for other family members involved in mioga cultivation and a stamped, self-addressed envelope was given to each main household cultivator to return the completed questionnaires.

Patch tests. Four subjects who answered they have or had experienced dermatitis or itching agreed to take patch tests to investigate the causes of their dermatitis. The patch tests were performed with mioga (as is), four kinds of extracts and three kinds of natural rubber gloves (Table II). Extracts A and B were prepared with diethyl ether and water, respectively, and were diluted at 1% in petrolatum according to Hausen B.M. (2-3). Extracts C and D were prepared by soaking mioga in 10 times water and ethanol in weight, respectively, for 2 days (4). Natural rubber gloves (A) were purchased from the market by the authors. A new pair of natural rubber gloves (B) actually being used was brought by case 1. A new pair of disposable natural rubber gloves (C) actually being used was brought by case 2. Readings were performed at day 3 according to ICDRG standards.

Observation of mioga cultivators working in a greenhouse. The subjects who took the patch tests were asked to allow the authors to visit their mioga greenhouses and observe the condition inside the mioga greenhouses, the way in which mioga flower buds were harvested, and the protective measures used for their skin.

RESULTS

Questionnaire study. Sixteen of the 18 main household cultivators, all male, who attended the lecture of mioga cultivation methods and health education agreed to answer the questionnaires and in total, 36 cultivators,

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Table I. Characteristics of the 4 subjects and the history of their skin symptoms.

	Case 1	Case 2	Case 3	Case 4
Sex	Male	Male	Male	Female
Age	44	51	36	56
Area under cultivation (100m ²)	27	36	35	20
Number of persons per household	1	2	4	2
Area per person (100m ² /person)	27	18	8.8	10
Cultivation period (years)	8	12	2	8
Working hours (hours per year)	2240	1848	1728	720
Other kinds of crops cultivated	-	-	-	kidney bean
Atopy history	-	asthma, allergic rhinitis	allergic rhinitis	-
Atopy family history	asthma (a child)	hay fever, cat allergy (a child)	Hay fever, allergic rhinitis (parents)	-
Symptoms reported	itching, papules, swelling, fissure, scale	dry skin, fissure, itching	itching, erythema, papules, swelling, dry skin, fissure and scale	itching, papules, fissure (cured when observed)
Affected region	hands and forearms	hands	fingers, upper extremities, neck	hands
Period from the beginning of the cultivation to the development of skin symptoms (years)	1	7	0 (immediately)	5
Causing agents the subjects claimed	leaves, stems and leaves, roots, water used for washing	buds, stems and leaves, roots	buds, stems and leaves	stems and leaves
Steps of work involved	all	all	all	almost all the steps
Causing steps of work claimed by each subject	All the steps to touch mioga	harvest, packing	harvest	harvest, packing
Treatment	prescribed corticosteroid ointment and internal medicine (corticosteroid and antihistamine agents)	ointment on the market	prescribed corticosteroid ointment and antihistamine agents	none
Glove use	almost always since skin problems occurred	almost always for the last 2 years since dermatitis was exacerbated	never	sometimes
Glove materials	natural rubber gloves or vinyl chloride gloves	disposable natural rubber gloves as inner gloves and thick cotton gloves	-	thin disposable plastic gloves

Table II. Patch test results (D3).

Substances	Conc./vehicle	Case 1	Case 2	Case 3	Case 4
Mioga	as is	++	++	IR	IR
Mioga extract A (water 1h) ^{*1}	1% pet.	++	++	-	-
Mioga extract B (diethyl ether 90s) ^{*1}	1% pet	++	++	-	-
Mioga extract C (water 2 days) ^{*2}	water 1:10	++	++	-	-
Mioga extract D (ethanol 2 days) ^{*2}	ethanol 1:10	++	++	-	-
Latex gloves A (outer)	as is	++	nt	-	-
Latex gloves A (inner)	as is	++	nt	-	-
Latex gloves B (outer)	as is	++	nt	nt	nt
Latex gloves B (inner)	as is	-	nt	nt	nt
Disposable thin latex gloves C	as is	nt	++	nt	nt

including the main cultivators answered the questions, although one worker just gave the information about her sex and age but did not answer in detail. Of the 35 cultivators who answered to the questions completely, 20 (57%) were male and the mean age was 53.8 (sd 11.9) years (range 28-78). The mean number of workers in each household was 2.4 persons. The mean cultivation area per each household was 30.1 (sd 8.1) (range 12-48) are (100 m²) and the mean period of cultivation of each household was 7.8 (sd 3.2) (range 2-12) years. The mean working time per year was 1395.9 (sd 702.8) (range 168-2856) hours. For the 16 main cultivators, the mean working time per year was longer: 1852 (sd 538.5) (range 448-2856) hours. Twenty-one of the 35 workers said

that they were involved with all aspects of the cultivation steps, 9 said some steps and 5 said they were only involved in harvesting. Nine of the 35 workers (25.7%) had a history of allergic diseases (asthma, allergic rhinitis, hay fever, allergic conjunctivitis). Nine workers answered they used gloves always, 4 almost always, 5 sometimes, and 17 said they never used gloves. Eight of the 35 (22.9%) cultivators consisting of 4 males and 4 females had experienced dermatitis.

Among the 8 workers who had experienced skin problems, the mean time from starting cultivation to the development of dermatitis was 5 (range 0-7) years. All 8 workers answered that their hands were affected and 6 claimed mioga flower buds as the cause, 5 claimed leaves

and stems, 2 claimed roots, 2 claimed water that was used to wash mioga, 1 claimed gloves, and 1 claimed sweat (multiple answers were allowed).

The mean working time was longer and the mean age was younger in the subjects with the skin symptoms than those without skin symptoms (1611.8 versus 1331.9 hours and 49.0 versus 55.2 years, respectively). The subjects with skin symptoms had history of allergic diseases more frequently than those without the symptoms (37.5% versus 22.2%). None of these differences showed statistical significance.

Observation of the patch-tested mioga cultivators working in a greenhouse. Four of the 8 cultivators who experienced dermatitis agreed to take patch tests. Table I shows the characteristics and history of skin symptoms of the 4 subjects. The greenhouses of cases 1, 2 and 3 and the shed of case 4 where harvested mioga was kept temporarily were visited by the authors and observed. Case 1 reported wearing natural rubber gloves on his hands. Case 2 reported wearing disposable natural rubber gloves as inner gloves and thick cotton working gloves over them. Young flower buds of mioga sprouting on the mud surface in a greenhouse and the cultivators were harvesting the buds by breaking them off with their fingers (Fig. 1, Case 2). Case 3 reported wearing short-sleeves without any gloves while working in the greenhouse. The inside of the greenhouse was kept very humid and warm for adequate growing of mioga. The harvested mioga was put in a plastic container and washed with water outside of the greenhouse. Case 4 reported wearing thin disposable plastic gloves when she trimmed the neck of mioga with scissors in her shed, which she did to adjust for market requirements. Cases 1, 2, and 3 were the main cultivators in each household.

Patch test results and prognosis. Case 1 reported dermatitis on his hands and forearms and that he had started wearing natural rubber gloves or polyvinyl chloride gloves almost always since he developed the symptoms. He showed positive results to mioga (as is), all four kinds of mioga extracts, and two types of natural rubber gloves (Table II), and therefore it was recommended that he use inner thin cotton gloves and nitril rubber gloves. In the following year, using the skin protecting measures, his dermatitis was alleviated.

Case 2 also showed positive results for mioga (as is) as well as all the extracts and disposable thin natural rubber gloves. After he followed our recommendations to use inner thin, cotton gloves with petrolatum as protecting ointment, he no longer experienced dermatitis.

Case 3 complained of itching and eruption on the hands, upper extremities and neck immediately after he started cultivating mioga. He had not used any skin protective measures. His symptoms were alleviated with ointments bought from the market. He showed some

Fig. 1. *Mioga* greenhouse of case 2. Young flower buds of *mioga* (*Zingiber mioga* Rosc.) sprouting on the mud surface in greenhouses. *Mioga* cultivators harvest the buds, breaking their necks with their fingers.



positive results only to mioga (as is) but the reaction could not be confirmed as an allergic reaction.

Case 4 said her symptoms, scales with slight erythema mainly on her right fingers and palms, when observed, were different from the dermatitis on her hands one year ago, which was more severe. Her skin eruptions were diagnosed as tinea manus with direct microscopic examination and cured with topical antifungal ointment. She showed irritation to mioga (as is) and has been free from dermatitis on her hands since her tinea on her right hand disappeared.

Eleven normal controls were patch tested for mioga (as is) and four of them showed irritation. Nine normal controls were patch tested with mioga extract (A) using diethyl ether and did not show any reaction.

DISCUSSION

The questionnaire study showed that among the 35 cultivators from 16 households, 8 (22.9%) workers experienced skin problems since they started cultivating mioga in their greenhouses. Four of the 8 cultivators with skin symptoms were investigated with patch tests. Two cases (case 1 and 2) of the four cultivators were thought to show allergic reactions to mioga. Mioga is a ginger family (*Zingiberaceae*) and ginger (*Zingiber officinale*), galangal (*Alpinia officinarum*, *Alpinia galangal*), turmeric (*Curcuma longa*) and cardamom (*Elletaria cardamom*) are in the same family and reported to cause allergic contact dermatitis (5). However, to our knowledge, there have been no previous reports of allergic contact dermatitis from mioga.

Ginger, one of the most common spices used in the world, is well known to cause irritation dermatitis. Four of the twelve normal controls showed irritation to mioga (as is). The patch test results of case 3 and 4 were thought to be due to irritation because they did not show any reaction

to the mioga extracts patch tested.

Mioga cultivators can be thought of as a high-risk group for developing occupational dermatitis because it is wet work and the working environment of a greenhouse is very hot and humid all year round. Furthermore, for harvesting mioga efficiently, the workers are exposed to mioga intensely for a long time, which can be one of the causes of occurrence of occupational allergic contact dermatitis (6).

Case 1 and 2 also showed positive results to natural rubber gloves. The two cases may have been sensitized by wearing gloves after developing allergies to mioga. The damaged skin is vulnerable to sensitization to any substances.

After the patch tests, the two subjects with delayed-type hypersensitivity were able to alleviate their symptoms following our recommendations. However, establishing adequate preventive methods to avoid sensitization from mioga for mioga greenhouse workers are still needed.

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REFERENCES

1. **Makino T.** 1982. 2303 Mioga. In: *Makino's illustrated flora in colour*. Tokyo, p.768 (in Japanese).
2. **Hausen B.M.** 1991. A simple method of isolating parthenolide from Tanacetum and other sensitizing plants. *Contact Dermatitis* 24:153.
3. **Hausen B.M.** 1977. A simple method of extracting crude sesquiterpene lactones from compositae plants for skin tests, chemical investigations and sensitizing experiments in guinea pigs. *Contact Dermatitis* 3:58.
4. **Pigatto P.D., A.S. Bigardi, F. Daris and F. Kokeji.** 1995. Occupational allergic contact dermatitis from nickel in an aquatic plant (*Ludwigia repene*): pseudophytopodermatitis. *Contact Dermatitis* 32:245.
5. **Lovell C.R.** 1993. Plants and the skin. Ed. Blackwell Scientific Publications. Oxford, p. 213.
6. **Ueda A.** 1995. Vinyl-greenhouse cultivation and allergy. *Allergology & Immunology* 2:459 (in Japanese).