Original :

Skin Lesions Due to Okra (*Hibiscus esculentus* L.)

—A Field Survey of Skin Lesions in Workers Cultivating Okra—

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The outbreak of skin lesions in workers cultivating okra (*Hibiscus esculentus* L.) was studied by a field survey. Questionnaire and physical examinations including patch tests with preparations of okra pods were carried out.

Out of 89 workers, 48 (53.9%) reported to have history of skin lesions. The sites of skin lesions were mainly arms (43.8%), dorsal regions of hands (35.4%), neck (33.3%), fingers and fingertips (each 29.2%). Concerning the symptoms of the skin lesions, itching (85.4%) and flare (45.8%) were dominant on picking work, and vanishing fingerprints and fissures on fingers on packing work. These clinical signs appeared shortly after the workers set to work without protective means.

Positive reactions of the patch tests with preparations of okra pods were found in 11 out of 89 okra workers (12.4%). The positive rate in non-okra workers was 3.4%. The results indicated that skin lesions due to okra were caused by primary irritation and allergic sensitization.

(1)okra (2)*Hibiscus esculentus* L. (3)occupational dermatitis (4)patch tests (5)irritant contact dermatitis (6)allergic contact dermatitis

Introduction

Okra (*Hibiscus esculentus* L.) (Gumbo, Gombo, ochra or Ladies finger) is of African origin, and was introduced into Japan in the middle of the 19th century. The immature pod of okra is a rich source of protein or dietary fiber and has a peculiar stickiness owing to abundant mucilage. Recently, it comes into wide use rapidly in Japan as a healthy vegetable. Keeping the price stable on the market, production is increasing. With enlargement of okra cultivation, dermatitis due to okra handling has occurred among the workers. Some affected workers are forced to give up the work because of dermatitis.

There are only brief notes available concerning dermatitis due to okra¹⁻⁵⁾. It is not so clear about the clinical features of okra dermatitis, and it also

remains to be elucidated about the mechanism and causative chemicals. Recently, the authors reported the occurrence of skin lesions in workers engaged in okra cultivation^{6,7)}. The present study was undertaken to clarify the clinical features and to find the cause of the skin lesions due to okra handling.

Materials and Methods

Subjects

A total of 118 subjects (male 42, female 76) were selected from 189 residents who had participated in a mass health examination at a certain district in the southern part of Kagoshima Prefecture where okra cultivation is prevailing. They were classified into 2 groups; the okra group (n=89) consisting of farmers cultivating okra and the non-okra group (n=29). The average age ($M \pm SD$) was 64.6 ± 10.1 in males and 59.9 ± 8.2 in females.

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The subjects were asked to fill out a questionnaire concerning the situation of okra cultivation, subjective symptoms associated with okra growing, symptoms and signs of the lesions and their protective means against skin lesions, etc. The answers were also checked by the interviewers at the examination.

After the questionnaire the subjects were taken the physical examination including the patch tests with the preparations of okra.

Patch tests

The test materials were prepared from okra immature pods. The pods were sliced off and shaken gently with two-fold distilled water. After percolating, exuding juice was diluted with 50-fold distilled water. Two kinds of okra (Misato strain and Blue sky strain) were used for preparations; Misato strain has been cultivated for a long time in this district, but Blue sky strain has only been grown for 1 year prior to this study. Both strains belong to the near artificial variety which possess the same number of ridges (5 ridges) in a pod and deep five lobations in a leaf. The preparations were applied to the flexor surface of the forearms, by using Finn chambers. The patches were removed at 48 hours after the application and skin reactions were evaluated according to the proposal of the International Contact Dermatitis Research Group⁸).

The survey was carried out in July 1988.

Results

Case report 1

A 65-year-old woman developed acute skin lesions on the palmar digital regions of the left hand after picking work in the rain. The affected parts, commonly the fingertips of the thumb and index finger, where the pods touch most frequently were exceptional in this case, because her finger deforms due to past arthritis. As commercial rubber gloves are not fit well to her hand with finger deformity, her hand inevitably touch the wet pods without the protective waterproof gloves.

Fig. 1 The skin lesions due to okra in case 1. It presented the irregular erythema with some erosion on the palmar digital regions where the pods touched most frequently in this case because of her finger deformity.

Table 1. Subjects investigated.

	Okra group (N=89)	Non-okra group (N=29)	Total (N=118)
Sex	(%)	(%)	(%)
Male	31 (34.8)	11 (37.9)	42 (35.6)
Female	58 (65.2)	18 (62.1)	76 (64.4)
Average age (Mean±SD)			
Male	64.5±9.7	62.4±10.1	64.6±10.1
Female	60.2±7.6	59.0±10.1	59.9±8.2
No. of days engaged in agricultural works in a year			
Less than 29	2 (2.2)	7 (24.1)	9 (7.6)
30— 59	4 (4.5)	1 (3.4)	5 (4.2)
60— 99	1 (1.1)	5 (17.2)	6 (5.1)
100— 149	6 (6.7)	1 (3.4)	7 (5.9)
over 150	76 (85.4)	15 (51.7)	91 (77.1)

The dermatitis presented the irregular erythema with some erosion as if the skin rubbing off, and flattening of her fingertip ridges also occurred. (Fig. 1)

She has engaged in okra growing outdoors for 10 years and did not only picking work but also packing work by herself. The skin lesions have been apt to break out in a rainy day.

She had no history of other skin diseases or atopy. Patch tests with the preparation of okra immature pods were all negative.

Case report 2

A 61-year-old woman, who has engaged in okra growing for 15 years, suffered from persistent itchy eczema on the infrascapular region for the last 10 years throughout the harvesting season. The eczema cleared during the periods of absence from picking work.

Sometimes she has also noticed her forearms and dorsal region of the hand to be itching and flare at picking work when her cotton gloves and arm-covers soaked into the rain or dew by some chance.

It has gotten better in the following morning.

Patch tests with the preparations of okra immature pods showed positive reaction against Misato strain which she has cultivated for a long time.

Questionnaire survey

Table 1 shows the outlines of the subjects investigated. The two groups gave a nearly similar constitution in both male and female. The average age of the okra group is slightly older than the other group. In the okra group ($n=89$), 76 subjects (85.4 %) are engaged in agricultural work for more than 150 days in a year, whereas in the non-okra group not so many subjects are engaged in agricultural work. The members of the okra group are engaged in cultivation of broad beans and green peas besides okra. Most of the members of the other group are engaged mainly in sweet potato and they are part-time workers or retired farmers.

The areas of okra growing fields are less than 10 a in 68.5% of the subjects. The average number of years engaged in okra cultivation is 10.0 ± 7.9 , from

Table 2. Okra cultivation.

	Male (N=31)	Female (N=58)	Total (N=89)
Area of okra fields (Are)	(%)	(%)	(%)
1-10	20 (64.5)	41 (70.7)	61 (68.5)
11-20	8 (25.8)	11 (19.0)	19 (21.3)
over 21	3 (9.7)	3 (5.2)	6 (6.7)
Unspecified	0 (0)	3 (5.2)	3 (3.4)
No. of years engaged in okra cultivation			
Less than 5	11 (35.5)	22 (37.9)	33 (37.1)
6-10	8 (25.8)	16 (27.6)	24 (27.0)
Over 11	12 (38.7)	19 (32.8)	31 (34.8)
Unspecified	0 (0)	1 (1.7)	1 (1.1)
Average (Mean $\pm$ SD)	10.5 ± 8.1	9.7 ± 7.8	10.0 ± 7.9

Table 3. History of skin lesions related to okra farming.

	Male (N=31)	Female (N=58)	Total (N=89)
Skin lesion ;	(%)	(%)	(%)
Not experienced	17 (54.8)	16 (27.6)	33 (37.1)
Suffered	12 (38.7)	36 (62.1)	48 (53.9)
Unknown	2 (6.5)	6 (10.3)	8 (9.0)

one year to more than 30 years (Table 2). Most of them (77.6%) leave the packing work of their harvest to the cooperative. Some people (22.5%), who have not much harvest, do it by themselves.

As shown in Table 3, 48 subjects (53.9%) reported to have experienced skin lesions by okra growing. The prevalence is rather higher in females than in males. The main sites of skin lesions at picking work were arms (43.8%), dorsal regions of hands (35.4%), neck (33.3%), finger and fingertips (each 29.2%) and thigh (25.0%) at picking work. While packing work, lesions were nearly localized to fingertips (83.3%) (Table 4). The skin lesions generally developed on the uncovered skin surfaces when picking and packing immature pods. A few cases showed the lesions on the covered thighs and abdo-

men when their clothes have been soaked with rain or dew. In regard to the symptoms of the skin lesions, itching (85.4%) and flare (45.8%) were dominant at picking work, and vanishing fingerprints (50.0%) and fissures on the fingers (50.0%) at the packing work. (Table 5).

Table 6 shows the duration of symptoms and their treatment. 27 out of 48 subjects (56.3%) had the duration of symptoms over 2 days, 9 subjects (18.8%) took a medical treatment and 22 subjects (45.8%) treated by some patent medicine. On the contrary, in 10 subjects (20.8%) the symptoms had already dispersed when the picking work have been over, and 11 subjects (22.9%) healed without any treatment.

Table 7 shows the weather conditions at the outbreak of skin lesions. Most of them were conscious of the fact that touching directly to wet

Table 4. Sites of skin lesions by okra handling.

Site	Picking (N=48)	Packing (N=6)
	(%)	(%)
Face	6 (12.5)	0
Neck	16 (33.3)	0
Arm	21 (43.8)	1 (16.7)
Dorsal regions of the hands	17 (35.4)	0
Fingers	14 (29.2)	1 (16.7)
Fingertips	14 (29.2)	5 (83.3)
Interdigit	7 (14.6)	0
Thigh	12 (25.0)	0
Others	6 (12.5)	0

There are some overlapping in numbers.

Table 5. Symptoms of skin lesions by okra handling.

Symptoms	Picking (N=48)	Packing (N=6)
	(%)	(%)
Itching	41 (85.4)	4 (66.7)
Flare	22 (45.8)	0
Swelling	4 (8.3)	1 (16.7)
Stabbing	16 (33.3)	0
Rash	17 (35.4)	0
Vesicles	2 (2.1)	0
Vanishing fingerprints	3 (6.3)	3 (50.0)
Fissures	0	3 (50.0)

There are some overlapping in numbers.

Table 6. The duration of symptoms and the treatment for the skin lesions.

	Male (N=12)	Female (N=36)	Total (N=48)
	(%)	(%)	(%)
Duration			
While working	3 (25.0)	7 (19.4)	10 (20.8)
All day	1 (8.3)	7 (19.4)	8 (16.7)
Until nextday	3 (25.0)	11 (30.6)	14 (29.2)
Over 3 days	3 (25.0)	10 (27.8)	13 (27.1)
Unknown	2 (16.7)	1 (2.8)	3 (6.3)
Treatment			
Take medical treatment	1 (8.3)	8 (22.2)	9 (18.8)
By patent medicine	4 (33.3)	18 (50.0)	22 (45.8)
Uncared	5 (41.7)	6 (16.7)	11 (22.9)
Unknown	2 (16.7)	4 (11.1)	6 (12.5)

leaves or pods brought skin lesions when it was rainy or dewy. And if they wiped the perspiration from their face with just wearing glove or sleeve, it would be secondarily affected. The outbreak of skin lesions was most frequently found in summer season when it is too hot and stuffy in Kagoshima Prefecture.

There was no remarkable difference in potentiality to cause skin lesions between okra strains.

Table 8 shows the protective means of workers engaged in okra harvesting. Most of them used the gloves made of rubber, wearing underwear with long sleeves, covering forearms with cloth or vinyl cover and taking shower immediately after work.

Clinical survey

Table 9 shows the results of patch tests with preparations of okra in 118 workers. 11 out of 89 workers (12.4%) in the okra group gave positive skin reactions to the 50-fold diluted preparations of Misato strain, whereas only one out of 29 subjects (3.4%) in the non-okra group. The positive rate of patch test reactions with preparations of Misato strain was relatively higher in the okra group than in the non-okra group, and in the females than in the males, but the difference was not significant statistically. Only a few showed the positive reactions to the preparations of Blue sky strain.

There were no remarkable differences between the two groups regarding clinical findings of blood pressure, hematological analysis, urinalysis and so forth.

Table 7. The weather conditions at outbreak of skin lesions.

	Male (N=12)	Female (N=36)	Total (N=48)
	(%)	(%)	(%)
Raining	6 (50.0)	21 (58.3)	27 (56.3)
Sweat-soaked	7 (58.3)	18 (50.0)	25 (52.1)
Dew-covered	5 (41.7)	15 (41.7)	20 (41.7)
Warmth	5 (41.7)	9 (25.0)	14 (29.2)
Unknown	1 (8.3)	5 (13.9)	6 (12.5)

There are some overlapping in numbers.

Table 8. Preventive measures for skin lesions at okra farming.

Preventive measures	Male (N=31)	Female (N=36)	Total (N=89)
	(%)	(%)	(%)
Protect forearms with cloth cover	20 (64.5)	36 (62.1)	56 (62.9)
Protect forearms with vinyl cover	7 (22.6)	14 (24.1)	21 (23.6)
Cotton gloves	17 (54.8)	29 (50.0)	46 (51.7)
Rubber gloves	24 (77.4)	43 (74.1)	67 (75.3)
Other gloves	1 (3.2)	7 (12.1)	8 (9.0)
Cover the neck with towel	4 (12.9)	9 (15.5)	13 (14.6)
Protect cheeks with towel	4 (12.9)	23 (39.7)	27 (30.3)
Long sleeve shirt	28 (90.3)	51 (87.9)	79 (88.8)
Rubber boots	13 (41.9)	24 (41.4)	37 (41.6)
Field sneakers	22 (71.0)	37 (63.8)	59 (66.3)
Take a shower immediately after work	13 (41.9)	25 (43.1)	38 (42.7)
Change gloves every day	9 (29.0)	22 (37.9)	31 (34.8)
Change gloves every work	2 (6.5)	8 (13.8)	10 (11.2)

There are some overlapping in numbers.

Discussion

As seen in our previously reports^{6,7)}, the present study also showed about the same evidence in the questionnaire survey that nearly a half of workers reported to have history of skin lesions by okra handling. The sites of lesions by picking okra were mainly arms, hands and neck that were uncovered parts of the body and were fingertips at packing work. In interview, it was revealed that when they have not taken any suitable preventive measures, almost all workers would suffer from skin lesions. In these cases, the earliest sign is itching on the uncovered fingers, dorsal region of the hands and forearms. The continuous contact with immature pods without protective water-proof gloves caused vanishing fingerprints by removal of the stratum

corneum of the ridges. In actuality, most of them put on protective gloves and arm covers. It is a unexpected occurrence that they suffer from skin lesions, such as when tearing the gloves or soaking underwear with dew or rain. It is common that the open area of the forearm between gloves and sleeves are affected (Fig. 2) and that the face is secondarily affected by wiping the perspiration with gloves or sleeves. The outbreak of skin lesions was found frequently in summer months especially in rainy or dewy days. The above facts indicate the existence of the primary irritation due to okra.

It is generally known that primary irritation from plants is mechanical or chemical and often is both. Mechanical irritation may be produced by spines, thorns, hairs and trichomes. The leaves and pods of okra are covered with the trichomes which

Table 9. Positive reactions to the patch tests with the preparations of okra pods.

Preparation (Strain)	Male	Female	Total
(Okra group)	(%)	(%)	(%)
No. of the subjects	31	58	89
Misato	1 (3.2)	10 (17.2)	11 (12.4)
Blue sky	0 (0)	3 (5.2)	3 (3.4)
(Non-okra group)			
No. of the subjects	11	18	29
Misato	0 (0)	1 (5.6)	1 (3.4)
Blue sky	0 (0)	0 (0)	0 (0)

The test solutions were exuding juice from sliced pods with two-fold distilled water, following dilution of 50-fold distilled water.

Fig. 2 Common skin lesions due to okra in the picking workers.
The open area of the forearm between gloves and sleeves are affected.

Fig. 3 The trichomes on the surface of okra immature pod.

stick to the skin (Fig. 3). Nearly all workers thought that the trichomes of the leaf and pod cause the skin lesions which they expressed "be bitten by okra". In our another study (unpublished), at the peak period of harvest, the average working hours of picking the immature pods was 4.5 ± 1.9 hours in the morning and some workers furthermore engaged in the evening for 2.0 ± 1.8 hours. It is presumable that they contact with about 4,000–5,000 pods per a day.

Therefore, it is likely that the skin lesions by okra handling are, first of all, due to mechanical irritation resulting from the contact with the trichomes directly and in large quantities. Primary irritation from chemical components of okra also seems to play a role in the development of the skin lesions. Our previous animal experiments showed the strong irritant potentiality of a secretion on the surface of pads⁹⁾.

The well-known irritant plant chemicals are unsaturated lacton *protoanemonin*, glucoside *sini-grin*, some proteolytic enzyme and so forth. Bromelain, a proteolytic enzyme in pineapple juice, can cause primary irritant dermatitis among pineapple cut workers¹⁰⁾. This enzyme erodes and dissolves surface keratin, and causes the flattening of fingertip ridges, or induces the itching by increasing skin and capillary permeability. These effects resemble the skin lesions from okra. Further studies are necessary in respect to the responsibility of proteolytic enzyme in okra.

The needle-shaped calcium oxalate crystals in some plants also induce intense itching and irritation on contact with the skin. But in okra, the microscopic observation of sections of the pod ruled out its possibility.

On the other hand, some workers have recurrent itching and flare on their thighs or abdominal region and persistent hand eczema on the thumbs or the index finger throughout the harvesting season. This phenomenon may be resulted from a different mechanism.

In our patch tests, positive rates were higher in the okra-group than in the non-okra group. The applied concentration of the preparations of okra has been confirmed in advance not to bring the primary irritation. These results suggested that the

chemical components of okra caused allergic contact dermatitis as well as primary irritation.

Many studies concerning allergic plant dermatitis have been reported^{11,12)} and some chemical substances have been isolated as plant allergens. The best known are pentadecacatechol and related catechols from *Rhus*, the benzoquinone *primin* from *Primula*, and sesquiterpene lactones from *Compositae* among others.

The clinical features of the skin lesions by okra are far from these well-known plant dermatitis^{13–15)}. Investigations of causative chemicals from okra have been scarcely undertaken.

In conclusion, the present survey has shown that the skin lesions in workers cultivating okra were the results of mechanical irritation by trichoms, of primary irritation by okra components and of allergic sensitization as well. To establish the effective and suitable preventive measures against the skin lesions from okra handling, further studies are necessary to clarify the mechanism and property of causative substances.

Further experimental studies on the responsible chemicals in okra are now in progress in our laboratory.

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オクラ (*Hibiscus esculentus* L.) による皮膚障害 ——オクラ栽培作業者の皮膚障害に関する現地疫学的研究——

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オクラ栽培に起因する皮膚障害について、鹿児島県南部のオクラ栽培地帯における実態を現地調査した。

オクラ栽培作業者89名のうち48名(53.9%)がオクラによる皮膚障害を経験している。障害部位は、腕(43.8%)、手背(35.4%)、首(33.3%)、手指(29.2%)など皮膚の露出部位に生じやすい。症状は、収穫作業時は主に掻痒(85.4%)、発赤(45.8%)であり、袋詰作業時は掻痒(66.7%)のほか、手指の指紋消失(50.0%)や亀裂(50.0%)がみられる。これらは、適切な予防措置を講じない場合にはほぼ全員に発症し、またその発症は作業開始後まもなく出現する。

オクラ英果成分の皮膚貼付試験では、オクラ群(12.4%)が非オクラ群(3.4%)に比べ陽性率が若干高い傾向がみられた。

これらの成績から、オクラ栽培に伴う皮膚障害は主にオクラの一次刺激作用によるものと考えられるが、オクラ成分によるアレルギー性接触皮膚炎の可能性も示唆された。

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