

PREVALENCE RATES AND RISK FACTORS FOR ALLERGIC SYMPTOMS AMONG INHABITANTS IN RURAL DISTRICTS

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農村地区住民のアレルギー症状有訴状況とその要因に関する考察

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In order to determine the prevalence of allergic disorders and their association with agricultural factors, a total of 3,717 inhabitants of rural districts in Kumamoto Prefecture were asked to fill out a questionnaire concerning their allergic status.

The results obtained were as follows:

1) One or more items of allergic symptoms were reported by 44% of the subjects. The prevalence rate of each symptom was 8% for respiratory organs, 5% for delayed type of respiratory disorders, 10% for nasal mucosa, 16% for eyes, 16% for urticaria-like derma and 26% for eczema-like derma.

2) Twenty-one percent of the subjects had past histories of allergic diseases such as asthma (3%), nasal allergy (3%), urticaria (6%), contact dermatitis (9%) and so forth. These allergic conditions were seen to be more common among farmers than non-agricultural workers, and also among subjects with allergic constitution than those without such constitution.

3) The highest (62%) prevalence of allergic symptoms was observed in farmers engaged in poultry raising, followed by those engaged in raising flowers (58%), tobacco (58%), cortinellus shiitake (55%), cucumber in plastic greenhouse (53%) and mandarin orange (53%).

4) Among the symptomatic subjects, 12-38% of those with each symptom gave farm work as the direct causative factor for developing the corresponding symptom. Pesticide spraying was the most common agent among those factors.

Key words: occupational allergy; allergic prevalence symptoms; allergic diseases; epidemiology; questionnaire survey; rural health; agriculture; farmers

INTRODUCTION

A case of carpenter's asthma caused by inhalation of western red cedar dust reported by Seki¹⁾ was the first case of occupational allergy in Japan. Following this, cases of asthma associated with

localized occupations such as processing of konjac "maiko,"²⁾ sericulture³⁾ and oyster shucking⁴⁾ have been investigated.

Recently, in addition to these asthmatic cases, reports on various kinds of occupational allergy caused by agricultural processes have been increasing in number, corresponding to increase of exposure dose and change of exposure mode to allergens following changes in agricultural techniques, such as the introduction of plastic greenhouses in cultivation and the development of various kinds of agricultural chemicals.

In spite of increased knowledge on sporadic occurrences of allergy related to agricultural fac-

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tors, there have been few cases clarifying the epidemiologic status, situation in other districts managing the same crop, and/or essential measures for the prevention of these diseases.

The present study was undertaken to shed light on the prevalence of allergic symptoms and their association with agricultural factors among rural inhabitants, and to discuss the background of allergic disorders related to the agricultural factors mentioned above.

SUBJECTS AND METHODS

1) *Subjects.* As the study population, all inhabitants, 20–79 yr of age in 36 small communities (22–56 households per each community according to the official lists of resident registration) from 18 cities, towns and villages in Kumamoto Prefecture were selected. All subjects received a printed questionnaire for this study at each household, were provided guidance in filling out the form by the investigator before receipt, and returned it after one week from February to March in 1983. Public health nurses of each office were in charge of the distribution and collection of the questionnaires.

A total of 1,251 households, 29–90 per each district (65–100% of the total households selected in each community), responded to the questionnaire. Among the cases, 1,795, males (47.8 ± 15.7 yr) and 1,922 females (50.5 ± 14.1 yr) were finally selected for the present analysis, excluding those persons who quit farming or other occupations because of diseases or disabilities (Table 1).

2) *Questionnaires.* The questionnaires consisted of two forms; one for each household and one for each subject. In the former, such questions as the structure of household, occupation and crops produced were answered by the head of each household. In the latter answers were sought with regard to personal occupation, annual working days for agriculture, kinds of crops produced, complaints of allergic symptoms and their association with work, past and family histories of allergic and other diseases, disorders related to handling of agricultural chemicals, smoking and drinking habits and other health problems.

Allergic conditions consisted of the following five symptoms:

1. Respiratory symptoms (respiratory as below); including cough or phlegm and asthmatic

Table 1. Age distributions of the subjects by occupation.

Occupation	Male					Female				
	20–39	40–59	60 yr	Total	Mean age	20–39	40–59	60–yr	Total	Mean age
					M ± SD					M ± SD
Agriculture #1	244	452	245	941	50.3 ± 14.3	216	564	189	969	49.3 ± 12.6
Agriculture and others #2	132	146	15	293	43.8 ± 12.7	41	77	3	121	44.6 ± 10.6
Others #3	243	107	19	369	37.7 ± 13.0	223	95	11	329	35.9 ± 12.3
No-occupation	15	24	153	192	65.4 ± 14.6△△	97	98	308	503	58.3 ± 17.4
Total	634	729	432	1,795	47.8 ± 15.7△△	577	834	511	1,922	50.5 ± 14.1

△△p < 0.01 Statistical significance in difference of age component in each occupation group [χ^2 -test, df (4-1) (2-1)].

○○p < 0.01, △p < 0.05 Statistical significance in difference of age component between males and females in each occupation group [χ^2 -test, df (2-1) (3-1)].

△△p < 0.01 Statistical significance in difference of mean age between males and females in each occupation group [t-test].

#1 Agriculture: All persons in the household are only full-time farmers (including forestry).

#2 Agriculture: At least one person is part-time farmer (including fishery).

#3 Others: No one is engaged in agriculture in the household.

attack.

2. Delayed type of respiratory reaction (delayed reaction); hypersensitivity pneumonitis-like attack.

3. Nasal symptom (nasal mucosa); rhinitis-like attack.

4. Symptoms of eyes (eyes); conjunctivitis-like attack.

5. Skin symptom (skin); (1) urticaria-like derma (urticaria), (2) eczema-like derma (eczema).

Subjects complaining of one or more of the foregoing symptoms at least one time during the last 5 yr were identified as cases with allergic symptoms.

Subjects having past histories of any allergic diseases diagnosed by a physician up to date and those having relatives in the second degree with allergic diseases were defined as cases with past histories and with family histories, respectively. Those with past or family histories or both were defined as cases having allergic constitution.

Farmers engaged for more than 50 d in agricultural work per year among the groups of agriculture only (full-time farmers) and agriculture+other occupation (part-time farmers) were subdivided into each crop group according to whether they were cultivating at present or more than 10 yr of past experience.

3) *Statistical analysis.* All of the prevalence rates were adjusted to the components of age, sex and occupation of the total subjects, which were as follows:

1. For age component: 20–29 yr, 16.2%; 30–39 yr, 16.5%; 40–49 yr, 18.2%; 50–59 yr, 24.0%; 60–69 yr, 14.1%; 70–79 yr, 11.2%.

2. For sex: male, 48.7%; female, 51.3%.

3. For occupation: full-time farmers, 51.4%; part-time farmers, 11.1%; other occupations (others), 18.8%; no-occupation, 18.7%.

The adjusted numbers of each group (numbers observed) were compared with the expected numbers of symptomatic cases of each group (numbers expected) calculated by the adjustment of sex and age to those rates of the total subjects.

For determination of statistical differences, χ^2 -test [2×2 , $2 \times c$, $m \times n$, (numbers observed—numbers expected)²/(numbers expected)] and *t*-test (differences of mean values, coefficient of correlation) were used.

RESULTS

1. Prevalence rates of allergic symptoms and histories of allergic diseases by sex, age, occupation and district

As shown in Table 2, 43% of males and 45% of females complained one or more allergic symptoms, showing no significant difference in rates between males and females. And, 19% of males and 22% of females had past histories of allergic diseases, showing a higher rate in females than in males ($p < 0.01$). As for family histories, significantly higher rates were observed in males (20%) than in females (11%) and also higher rates in younger group in both sexes ($p < 0.01$).

In comparing the differences by occupation, higher prevalence rates of allergic symptoms were seen among full-time ($p < 0.01$) and part-time farmers ($p < 0.05$) than other groups, especially the prevalences of delayed reaction ($p < 0.01$ for both types of farmers), eyes ($p < 0.01$ for part-time farmers) and eczema ($p < 0.05$ for full-time farmers). Such tendency was also seen in the rates of past histories, especially for asthma, nasal allergy and contact dermatitis ($p < 0.01$).

The prevalence rates of allergic symptoms among the 18 districts ranged from 64% to 22%, showing a significant difference in the prevalence rates between 18 districts ($p < 0.01$) as in the case of the rates of past and family histories (Fig. 1). However, there was no positive correlation between these three items.

2. The prevalence rates of allergic symptoms by smoking habit

Smoking (over 20 cigarettes per day) was observed in 377 among full-time and part-time farmers, being almost the same as other occupational groups. In agriculture groups, higher prevalence rates of respiratory and delayed type symptoms ($p < 0.01$ for both) were seen in the smoker group than in the non-smoker group. The rates of smokers ranged from 34–42% in each crop group, showing no significant differences between the groups.

3. The prevalence rates of allergic symptoms by past and family histories of allergic diseases

Thirty-three percent of the agriculture groups and 31% of other occupational groups were found

Table 2. Prevalence rates of complaints of allergic symptoms and past and family histories of allergic diseases by sex and occupation.

(% #6)

Items	Sex			Occupation			
	Male	Female	Total	Agriculture	Agriculture and others	Others	No-occupation
<i>Allergic symptoms</i>							
With symptoms #1, #2	42.5	44.8	43.7	47.1**,☆☆	47.7☆☆	41.0	39.4*
Respiratory	10.0●●	6.8	8.3	8.8	8.1	9.0	8.3●●
Delayed reaction	4.6	5.1	4.9	5.6☆☆	6.2☆☆	2.2**	3.0
Nasal mucosa	10.7	8.6	9.6	10.5●	11.8	8.9	8.6
Eyes	14.9	16.2	15.6	16.1	21.7**,●●,☆☆	13.3	14.9
Skin	30.3	32.2	31.3	34.1**,☆	31.1	29.3	28.9
Urticaria	16.2	16.2	16.2	16.6	18.8	16.9	14.9
Eczema	24.1	27.2	25.7	28.4**,☆	24.8	24.4○○	22.5
<i>Past histories of allergic disease</i>							
With histories #3	18.7	22.4○○	20.6	21.9	20.9	18.0○○	21.7
Asthma	2.5	2.6	2.6	2.7	3.2	1.7	2.9
Nasal allergy	2.8	2.3	2.5	2.6	3.3	2.2	3.1
Contact dermatitis #4	8.2	9.2	8.7	10.3**,☆☆	9.0☆	5.5**	7.9
Rheumatic arthritis	1.7	4.7○○	3.3	2.6☆☆	1.9☆☆	5.4○○	3.3
Urticaria	5.5	6.1	5.8	5.7	4.0	5.3	7.9*
Food allergy	1.0	1.5	1.3	1.7	1.7	1.0	0.2
Pharmaceutical allergy	1.4	2.6	2.0	2.1	3.9	2.0	1.1
Family histories #5	19.8●●	11.0	15.2	14.6●●	12.7●●	15.4	12.4●●

** $p < 0.01$, * $p < 0.05$ Significant difference in the number between expected and observed in each occupation group [χ^2 -test, $df=1$, (Observed—Expected)²/(Expected)].●● ○○ $p < 0.01$, ● ○ $p < 0.05$ Significant difference in the prevalence rate between males and females [χ^2 -test, $df=1$]. ●: higher in males than in females. ○: higher in female than in male.☆☆ $p < 0.01$, ☆ $p < 0.05$ Significant difference in the prevalence rates between others (non-agriculture) and the other three occupation groups [χ^2 -test, $df=1$].

#1 Subjects complaining of one or more allergic symptoms at least once during the last 5 years.

#2 Each item includes symptoms as follows: respiratory:cough, phlegm and asthmatic attack; delayed reaction:hypersensitivity pneumonitis-like attack; nasal mucosa-rhinitis-like attack; eyes:conjunctivitis-like attack; urticaria:urticaria-like derma; eczema:eczema-derma.

#3 With one or more past histories of allergic diseases diagnosed by a physician.

#4 Diagnosed as eczema and/or contact dermatitis by a physician, but not always confirmed to be allergic.

#5 Having relatives with histories of allergic diseases in the second degree of each subject.

#6 Adjusted to the component of age and occupation for each sex group, and to the component of age and sex of all the subjects studied for each occupation group.

to have allergic constitution. As shown in Table 3, significantly higher rates of six symptomatic items were seen in the allergic constitution group than in the non-allergic constitution group.

Among non-allergic constitution subjects, higher rates of one or more complaints of six symptoms ($p < 0.01$), delayed reaction ($p < 0.01$), eyes ($p < 0.05$) and eczema ($p < 0.01$) were seen in farmers than in others. However, the percentage of subjects with allergic constitution in the group of

farmers with allergic symptoms, from 69% to 50% for each item, was shown to be of the same level as other occupational groups.

4. The prevalence rates of allergic symptoms and past and family histories of allergic diseases by crops produced

Table 4 shows the prevalence rates of each item by crops produced. There were significant differences in the rates of symptoms ($p < 0.01$), past

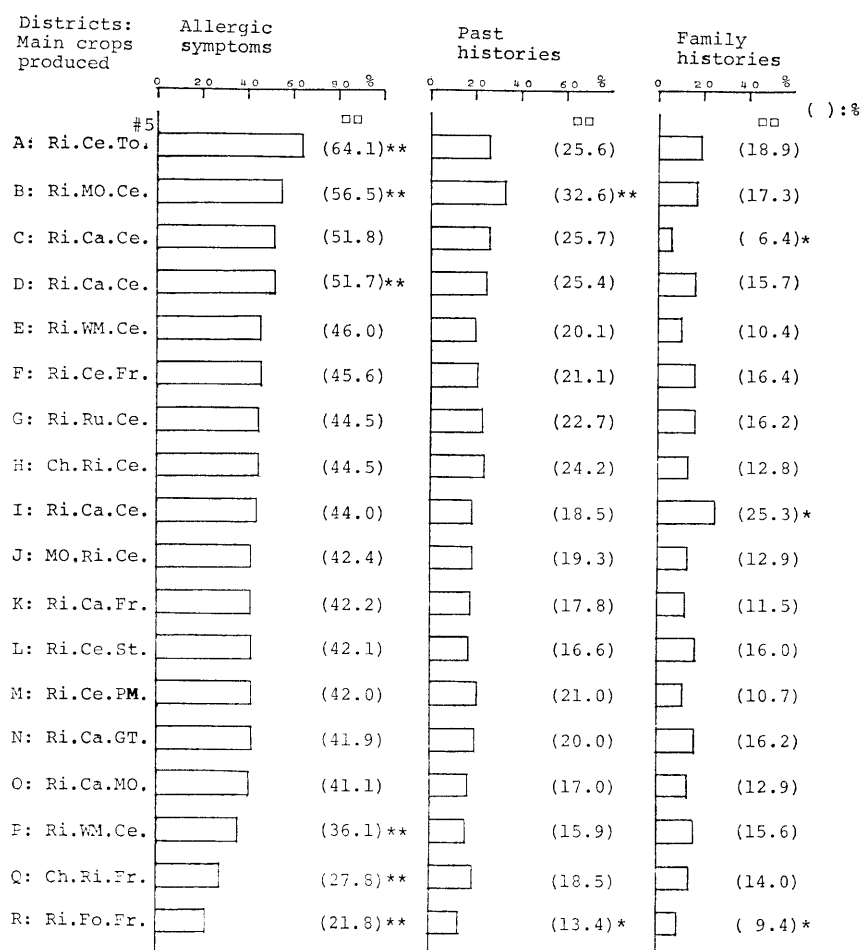


Fig. 1. Prevalence rates #1 of allergic symptoms #2, past #3 and family histories #4 in each district studied.

** $p < 0.01$, * $p < 0.05$ Significant difference in the number between expected and observed in each district [χ^2 -test, (Observed—Expected)²/(expected)]. □□ $p < 0.01$ Significant difference in the prevalence rate of each item between 18 districts [χ^2 -test, $df = (2-1) (18-1)$]. #1 Adjusted the component of age, sex and occupation to that of the total subjects studied. #2, #3, #4 See Table 2. #1, #3, #5. #5 An abbreviation of each crop is as follows: Ri—rice, Ce—other cereals except rice, To—tobacco, Mo—mandarin orange, Ca—dairy or beef cattle raising, WM—water-melon in plastic greenhouse (pla), Fr—other fruits and trees except Mo, Ru—rush, Ch—chrysanthemums, St—strawberry in pla, Gt—green tea, Fo—forestry.

($p < 0.05$) and family ($p < 0.01$) histories between the 22 crop groups.

A significantly higher number of observed cases than expected cases was seen in the prevalence rates of one or more allergic symptoms in the groups raising poultry (62%, $p < 0.01$), other flowers (58%, $p < 0.01$), tobacco (58%, $p < 0.01$), cortinellus shiitake (55%, $p < 0.01$), cucumber in plastic greenhouse (pla.) (53%, $p < 0.05$), mandarin orange (53%, $p < 0.05$), cereals (51%, $p < 0.01$), water-melon in pla. (51%, $p < 0.05$), cattle (48%,

$p < 0.05$) and rice (46%, $p < 0.05$).

The crop groups showing a significantly higher prevalence for each symptom ($p < 0.01$ or 0.05) were as follows;

Respiratory: tobacco, cortinellus shiitake and cereals.

Delayed reaction: tobacco, cucumber, mandarin orange, other fruits, prince melon in pla. and green tea.

Nasal mucosa: poultry raising and swine raising.

Table 3. Comparison of prevalence rate of allergic symptoms between those with and those without past or family histories of allergic diseases (#).

Histories	N	Allergic symptoms							Eczema-like
		With one or more symptoms	Respiratory	Delayed reaction	Nasal mucosa	Eyes	Skin	Urticaria-like	
With both histories									
Agriculture #2	103	93.6♦♦	34.9♦♦	22.5♦♦	22.4♦♦	33.7♦♦	82.6♦♦	54.8♦♦	79.8♦♦
Others #2	47	97.9♦♦	27.3♦♦	15.5♦♦	31.5♦♦	41.7♦♦	81.5♦♦	58.3♦♦	65.7♦♦
With personal histories									
Agriculture	487	84.1♦♦	18.3♦♦	11.1♦♦	20.3♦♦	26.3♦♦	79.5♦♦	42.6♦♦	59.6♦♦
Others	278	71.1♦♦	16.1♦♦	6.6♦♦	29.8♦♦	27.3♦♦	59.2♦♦	37.8♦♦	50.3♦♦
With family histories									
Agriculture	371	66.0♦♦	17.9♦♦	8.5♦♦	15.4♦♦	25.0♦♦	52.7♦♦	30.7♦♦	43.7♦♦
Others	198	49.9♦♦	6.5	6.1♦♦	14.6♦♦	23.5♦♦	41.1♦♦	27.5♦♦	34.9♦♦
Without both histories									
Agriculture	1569	31.4	4.5	3.7	6.1	1.1	19.6	7.7	16.2
Others	963	23.3	4.5	1.8	5.0	0.1	14.3	6.9	11.1

♦♦ $p<0.01$, ♦ $p<0.05$ Significant difference in the prevalence rate between without both and each of the groups [X²-test, df = 1]★★ $p<0.01$, ★ $p<0.05$ Significant difference in the prevalence rate between agriculture and others in each of the groups [X²-test, df = 1]

#1 See Table 2, #1 and #5 for past and family histories of allergic diseases.

#2 Agriculture: Subjects engaged in agriculture only and agriculture + other occupations.

Others: Subjects engaged in non-agriculture only and had no occupation.

#3 Adjusted to the component of age and sex of all the subjects studied.

Eyes: cucumber in pla., cereals, cortinellus shiitake and rice.

Urticaria: other flowers, tobacco and cereals.

Eczema: tobacco, mandarin orange, cereals, swine raising and sericulture.

As for past histories, a significantly higher number of observed cases than expected cases was observed in the crop groups raising tobacco ($p < 0.05$), mandarin orange ($p < 0.01$), cereals ($p < 0.01$), swine ($p < 0.05$), chrysanthemum ($p < 0.01$), other fruit trees ($p < 0.01$) and sericulture ($p < 0.05$).

There was a significant difference in the incidence rates of disorders by spraying pesticides between the 22 crops (3–15% for each) ($p < 0.05$), showing over 10% in the groups raising strawberry in pla., tomato in pla. and tobacco. There was no relationship between the rates of each item and disorders by pesticides in each crop, except that of symptom of eczema and disorders by pesticides ($r = 0.518$, $p < 0.01$).

There was a significant positive correlation between symptoms and past histories in each of the 22 crop groups ($r = 0.680$, $p < 0.01$), while no significant correlation was seen between past and family histories ($r = 0.299$) or between symptoms and family histories ($r = 0.236$). The coefficient correlation between males and females in each crop was $r = 0.426$ ($0.1 < p < 0.05$) for symptoms, $r = 0.198$ (not significant: ns) for past histories, $r = 0.631$ ($p < 0.01$) for family histories and $r = 0.481$ ($p < 0.05$) for disorders by pesticides.

There were positive correlations between symptoms and corresponding allergic diseases, i.e., respiratory and asthma ($r = 0.742$, $p < 0.01$), delayed reaction and asthma ($r = 0.300$, ns), nasal mucosa and nasal allergy ($r = 0.414$, $p < 0.05$), eczema and contact dermatitis ($r = 0.663$, $p < 0.01$), urticaria-like derma and urticaria ($r = 0.599$, $p < 0.01$).

The prevalence rates of each item by groups of mixed crops produced by multiple farming in each subject (mixed crops) are shown in Table 5. The three groups of mixed crops showing the highest prevalence of one or more symptoms were as follows: rice+cattle+poultry (78%), rice+poultry+mandarin orange/other fruits (72%), and rice+chrysanthemum+other flowers (71%). The highest prevalence group in each symptom was as follows:

Respiratory: rice+cattle+vegetables+tobacco.

Delayed reaction: rice+cattle+bamboo+green tea.

Nasal mucosa: rice+poultry+mandarin orange/fruits.

Eyes: rice+plastic greenhouse+green tea.

Urticaria: rice+mandarin orange+vegetables.

Eczema: rice+tobacco+sericulture.

There were 30 groups of mixed crops showing a prevalence rate of 50% or more, and 24 groups among them showed a higher prevalence than that of any component crop.

5. Association with allergic symptoms and agricultural works

Among the subjects with each allergic symptom, 18% (12% of total subjects) of those with respiratory symptoms, 43% (2%) of delayed reaction, 11% (1%) of nasal mucosa, 28% (4%) of eyes, 23% (6%) of urticaria and 38% (10%) of eczema showed a direct association with their farm works for each symptom.

As shown in Table 6, pesticide spraying was given most frequently by symptomatic subjects as the associated work, i.e., 44% of respiratory cases, 62% of urticaria and 64% of eczema. The most common agricultural chemicals among them was Difolatan (captan) (78 cases), followed by, Dithianzineb (14), Topsin-M (thiophenate-methyl) (8), Lunath(methomyl) (4), Delan(dithianon) (4), and Dithane(zineb) (4) in the order given.

According to crops produced, as summarized in Table 6, 41 cases of mandarin orange (9% of total subjects engaged in mandarin orange), 38 cases (13%) of chrysanthemum, 27 cases (1%) of rice and cereals, 21 cases (11%) of forestry works, 18 cases (9%) of tobacco were associated with each corresponding symptom. Moreover, work in plastic greenhouse (3%), raising of cattle and swine (2%), rush (9%), other fruits (2%), vegetables, sericulture, green tea (1% for each) and handling straw or compost and so forth were also causative factors for various symptoms.

DISCUSSION

As the results were obtained from questionnaires, allergic symptoms described above might not be necessarily an accurate manifestation of each corresponding allergic disease, and the prevalence of those symptoms might not necessarily indicate the real prevalence of allergic status of

Table 4. Prevalence rates of allergic symptoms, pesticides

Crops #1	N	Allergic symptoms #2							
		With symptoms	Respiratory	Delayed reaction	Nasal mucosa	Eyes	Skin	Urticaria-like	Eczema-like
Poult	57	61.9**	14.2	4.7	18.9*	21.6	31.9	23.2	18.8
Flower	86	58.3**	5.7	3.2	12.3	11.9	46.7**	29.0**	32.2
Tobac	204	57.8**	16.0**	7.8*	8.0	15.2	45.3**	21.0**	40.9
Cort	204	54.8**	12.1*	5.0	9.0	20.5*	33.3	18.1	28.0
Cucum	111	53.2*	6.5	9.7	8.6	24.9**	29.7	20.4	23.3
M.ora	455	52.5**	9.5●	8.2**	10.1	18.3	41.3**	18.0	35.9**
Cereal	1,109	51.2**	10.0*	6.0	10.1	19.1**	36.9**	19.2**	31.2**
W.mel	216	50.5*	8.9	6.5	12.2	19.1	34.8	18.1	28.9
Veget	265	48.5	10.8	4.7	9.8	16.5	34.1	14.7	26.0
Swine	161	48.1	7.5	4.7	16.3**	19.6○	41.1**	19.8	34.1*
Tomato	64	48.0	3.4	5.0	9.4	21.7	34.1	15.6	30.5
Cattle	767	47.8*	9.5	5.0	9.2	17.0	32.8	15.3	28.4
Chrys	299	47.1	7.3	4.6	7.5	13.1	34.9	18.6	29.8
Fruit	431	46.8	8.9●	7.4*	11.4●	17.4	32.8●	16.6●●	29.2
Rice	2,100	45.9*	8.9	6.0	9.8	17.2*	32.5	16.2	27.3
Seric	204	45.4	9.5	5.0	12.2	19.0	38.4	18.6	31.6*
P.mel	94	44.6	8.9	9.4*	11.2	12.2	33.3	19.3	29.7
Rush	135	43.3	3.6○	4.8	8.7	17.2	24.1	14.0	15.7○
G.tea	321	42.0	9.8	7.4*	7.2	18.2	29.8	14.3	25.0
Fores	188	39.5	8.1	5.3	10.5	12.5	29.2	18.0	25.5
Bamb	175	37.0	10.4	5.5	7.2	13.8	26.5	10.7	23.5
Straw	54	28.1*	4.3	0	11.7	9.6	25.9	17.8	20.9

** $p < 0.01$, * $p < 0.05$

Significant difference in the number between expected and observed in each crop

●●, ○○ $p < 0.01$, ●, ○ $p < 0.05$

Significant difference in the prevalence rate between males and females in

□□ $p < 0.01$, □ $p < 0.05$

Significant difference in the prevalence rate of each item for symptoms, past and

▽▽ $p < 0.01$, ▽ $p < 0.05$

Statistical significant in relative coefficient of prevalence rate of each item between

#1 Abbreviation of each crop is as follows: Poult-poultry (broiler or layer), Flower-other flowers and garden mandarin orange, Cereal-other cereals except rice, W.mel-water-melon in pla. Veget-vegetables in the field, other fruits and trees except M.ora, Rice-rice, Seric-sericulture, P.mel-prince melon in pla. Rush-rush

#2,3,4 See Table 2, #1-#5.

#5 Cases experienced disorders occasionally or frequently by spraying pesticide total number of pesticide

#6 Adjusted the age and sex component to the total subjects studied.

the present population. However, these symptoms in the present study may be considered to have been caused by an allergic mechanism, because of a higher prevalence of these symptoms among subjects with allergic constitution than those without such constitution and because of a significant correlation between the symptoms and corresponding histories of allergic diseases. On the other hand, there have been few reports on allergic conditions of rural populations in such a large group of subjects or agricultural crops. From this point of view, it is reasonable to say that the considerably wide spread of allergic disorders in Japanese farming population and the possibility of detecting other allergic diseases related to the

crops or farm works not yet reported from any place in Japan were clarified from the results of the present study.

There are some reports comparable to our present study, as follows.

Among over 20 allergens of occupational asthma related to agricultural or forestry works being confirmed by immunological investigations,⁵⁾ such as the cases of green tea,⁶⁾ chrysanthemum,^{7,8)} lettuce,⁹⁾ tomato,¹⁰⁾ melon,¹¹⁾ sericulture,³⁾ strawberry,¹²⁾ shiitake (Japanese mushroom),¹³⁾ poultry^{14,15)} and rice hulling¹⁶⁾ must be taken into consideration as possible causes of similar cases of occupational asthma in the subjects of the present study. More careful attention must be

poisoning and past and family histories by crops produced.

(%#6)

Disorders by pesticides spraying #5	Allergic diseases #3					Family histories #4
	With histories	Asthma	Nasal allergy	Contact dermatitis	Urticaria	
4.3	29.5	3.7	4.2	4.7	9.5	8.6
9.0	25.9	2.6	1.7	7.3	9.3	23.5*
11.0	26.8*	3.4	2.4	13.5**,○	10.2**	18.4
3.4	23.7	4.1	0.9	11.6	8.2	16.6●
2.9	21.4	1.3	3.2	10.6○	9.0	13.0
9.9	26.5**	3.8	3.4	13.2**	6.1	16.0●●
7.8	24.5**	3.1	3.2	11.8**	5.6	15.7●●
5.5	19.6	3.7	2.9	8.2	5.2	16.7●●
7.6	21.6	2.7	1.5	11.8*	7.1	13.9●●
6.4	27.1*	0.9	7.1**	10.6	10.1*,○	15.2
11.2	17.7	0	3.4	9.4	6.4	15.0
7.4	21.0	3.1	2.5	8.8	5.2	17.7*,●●
8.2	28.2**	2.6	2.3	14.9**	6.1	23.0**
9.5	24.4*	3.4	3.6	12.9**	6.3	19.0*,●●
8.3	21.4	2.8	3.3*	10.0*	5.2	14.5●●
5.6	26.4*	2.0	1.3	15.5**	4.5	13.5
7.1	16.6	2.0	0	5.3	4.1	10.3●●
2.7	17.9	0.7	2.8	3.7○	6.1	18.8●●
4.7	19.5	2.9	1.6	9.0	4.0	13.7●●
5.2	18.7	3.2	1.6	10.1	5.8	14.5
2.8	20.5	4.9	2.6	7.6	4.9	17.9
12.6	15.6	0	0.1	4.3	8.5	5.6

group [χ^2 -test, (Observed—Expected)²/(Expected)].each crop group [χ^2 -test, df=1]. ●: higher in males than females. ○: higher in females.family histories and pesticides between 22 crops [χ^2 -test, df=(2-1) (22-1)].males and females [*t*-test].

trees, Tobac-tobacco, Cort-cortinuss shiitake (mushroom), Cucum-cucumber in plastic greenhouse (pla), M.ora-Swine-swine raising, Tomato-tomato in pla, Cattle-dairy or beef cattle raising, Chrys-chrysanthemums, Fruit-cultivation and weaving process, G.tea-green tea, Fores-forestry, Bamb-bamboo shoots, Straw-strawberry in pla.

sprayers <100.

paid regarding the allergens of asthma to the silia of fruits and leaves than to pollen which has been generally regarded to be the main allergens of asthma. From this point of view, there may be new cases developing occupational asthma in the present groups growing tobacco and mandarin orange.

After Campbell's report,¹⁷⁾ knowledge about hypersensitivity pneumonitis has increased considerably. In Japan, bagassosis from paper board processing factory in Okinawa¹⁸⁾ was the first case of that disease. To date, cases from dairy farming,¹⁹⁾ cultivation of pholiota nameko,²⁰⁾ shiitake²¹⁾ and so forth had been reported to be cases related to antigens in the agricultural environment. As

for the etiological background of these diseases, the authors have reported previously that a relatively high proportion (17.5–27.5%) of farmers had positive precipitin against various kinds of fungus antigens.²²⁾ However, it may be reasonable to consider that not a few cases with complaints of delayed reaction associated with agricultural works may have developed from the delayed type of asthmatic mechanism rather than from hypersensitivity pneumonitis, because of the rather low possibility of being exposed to extraordinarily high amounts of these fungus spores in their agricultural processing.

The allergenicity of pollen, especially to nasal allergy, was first clarified by Blackley,²³⁾ and vari-

Table 5. Prevalence rates of allergic symptoms, past and family histories of allergic diseases by combination of mixed crops produced by multiple farming.

Mixed crops #1	N	Allergic symptoms			Past histories		Family histories	
		Allergic symptoms			Past histories		Family histories	
Rice+Cattle+Poult	18	77.8	37.3	5.6				
Rice+Poult+M.lora/Fruit	18	72.2	27.8	0				
Rice+Chrys.+Flower	28	71.4	28.6	10.7				
Rice+M.lora+Veget	36	69.4	30.6	8.3				
Rice+M.lora+Vinel	42	66.7	23.3	15.0				
Rice+M.lora+Tobac	27	66.7	20.6	18.5				
Rice+Pla.+Gtea	20	65.0	20.0	5.0				
Rice+Tobac+Serie	17	64.7	35.3	17.6				
Rice+Swine+Pla.	19	63.2	15.8	5.3				
Rice+M.lora/Fruit+Tobac	40	62.5	32.5	12.5				
Rice+Tobac	49	61.2	28.6	16.3				
Rice+Cattle+Bambo.+Gtea	35	60.0	25.7	22.9				
Rice+Pla.+Tobac	25	60.0	28.0	22.0				
Rice+Veget+Pla.	23	60.0	24.0	12.0				
Rice+Fruit+Tobac	17	58.8	41.2	5.0				
Rice+Vinel+Chrys	28	57.1	21.4	28.6				
Rice+Fruit+Cori	57	56.1	22.8	22.8				
Rice+Cattle+Veget+Tobac	25	56.0	24.0	28.0				
Rice+Pla.+Serie	29	55.2	24.1	1				
Rice+M.lora	135	54.8	26.7	14.1				

#1. See Table 4, #1 for the abbreviation of each crop.

ous kinds of trees and plant pollens are known as the most important allergens to nasal allergy.^{21,26)} In Japan, interest in such diseases has been increasing since the confirmation of the existence of Japanese cedar pollinosis in 1963.²⁰⁾ Recently, cases of occupational pollinosis related to agricultural crops such as apple,²⁷⁾ peach²⁸⁾ and pyrethrum²⁹⁾ have also been reported.

As cases of allergic conjunctivitis may have also arisen from the complication of pollinosis, careful attention must be given to crop groups which showed a higher prevalence of eye symptoms complicated with symptoms of respiratory or nasal mucosa.

In case of urticaria, the immediate type of skin disorder due to lettuce cultivation has been reported.³⁰⁾ However, in the present study, no correlation was found between the prevalence of urticaria and the rate of allergic constitution ($r=0.084$). Therefore, many cases of the group of crops showing a higher prevalence of urticaria may be due to non-allergic mechanisms related to agricultural factors.

There are various allergens capable of causing allergic contact dermatitis in industrial conditions. In rural regions, various kinds of agricultural

chemicals³¹⁾ and plants or plant products³²⁾ such as chrysanthemum,³³⁾ lettuce,³⁴⁾ tulip³⁵⁾ and perilla³⁶⁾ have also been known to be allergens. In the present study, three-fourths of the total subjective causative agents of skin symptoms were agricultural chemicals, and few cases were plants or plant products. No relationship was observed between the prevalence of each allergic item and the rate of poisoning by agricultural chemicals, except between the prevalence of eczema-like derma and the rate of poisoning. These facts indicate the important role of handling or spraying these chemicals for the development of contact dermatitis in farmers. On the contrary, the report on the development of asthma due to Difolatan³⁷⁾ must be recognized as a case of immediate type of allergy.

From these considerations, special attention or further investigation should be made to clarify their allergic status and its etiology in farmers of two groups, that is, poultry and tobacco, because of their high prevalence of allergic symptoms. In fact, some interesting reports have been published on allergic diseases associated with these crops.^{14,15,28-31)} In addition to these two crops, the agricultural works that should be studied

immunologically for association to allergic disorders are as follows: the process of cultivating or harvesting mandarin orange, harvesting or forwarding of prince melon, rush dyeing with mud (in harvesting), picking mulberry leaves and process of sericulture, harvesting of Italian rye grass, cultivating shiitake, raising of cattle and swine and spraying or handling agricultural chemicals.

The present analysis has indicated that allergens from agricultural work might be more sensitive to the farmers with allergic constitution than those without such constitution. On the other hand, causative antigens might be generally widespread in the rural environment and not only in the agricultural work itself, because of the increasing prevalence of allergic symptoms associated with allergic constitution in the population of non-agricultural occupation as well as in the agricultural population. Thus the manifestation of cases affected by a single antigen may be modified by various kinds of other antigens arising from the work process or method in each district. The case of pollinosis in Japanese peach production¹²⁾ is an example of an exposure to other antigens on behalf of the antigen from the main causative crop. On the other hand, the cross or inter-reaction of each allergen from mixed crops produced by multiple farming should be also taken into account to clarify the etiology of farmer's allergy. From this point of view, it was a remarkable finding that a relatively high prevalence of allergic symptoms was shown when the production of poultry or cattle raising, mandarin orange or other fruits, tobacco, chrysanthemums or other flowers were mixed with each other when compared to the prevalence rates of each single crop.

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Table 6. Farm works or crops associated with

Respiratory (32 cases)	Delayed reaction (41 cases)	Nasal mucosa (23 cases)	Eyes (91 cases)
Pesticide spraying 14 [Chrys 3] #2 [M.ora 2] [Rice 1] M.ora 5 (Cultivation 2) #3 (Harvesting 1) (Pesticide 2) Chrys 4 (Picking bud 1) (Sorting stub 1) (Pesticide 3) Handling straw 3 Cattle or swine 2 Tobacco leaf (Drying 1) Mowing 1 Rice 1 (Pesticide 1) Rush planting 1 Others #4 3	Pesticide spraying 22 [M.ora 3] [Chrys 1] [Tobac 1] [Rice 1] M.ora 4 (Harvesting 1) (Pesticide 3) Tobac 3 (Cultivation 1) (Handling tobacco leaf 1) (Pesticide 1) Working in the pud 3 (Pesticide 1) Mowing 2 Chrys 2 (Picking bud 1) (Sorting stub 1) (Pesticide 1) Rice-hulling 1 Handling compost 1 Barley reaping 1 Fruit (Cultivation) 1 Cattle and swine 1 Others 8	Pesticide spraying 5 Tobac (Sorting leaf 3) Dairy farming and animal husbandry 3 (Raising cattle and swine 2) (Calf auction 1) Chrys (Cultivation 2) (Forwarding 2) M.ora 3 (Cultivation 1) (Harvesting 2) Japanese pears 1 Rush (Drying) 1 Mowing 1 Handling straw 1 Work in the pla 1 Work in the pud 1 Others 4	Pesticide spraying 33 [M.ora 5] [W.mel 2] [Chrys 1] Forestry 9 Rice and barley 7 (Reaping 6) (Rice hulling 1) Rush 5 (Weaving 3) (Drying 2) Dairy farming and animal husbandry 4 (Work in the pasture 2) (Raising cattle and swine 1) (Calf auction 1) Handling saw dust 4 Handling straw 3 Fruit tree 2 (Loquat 1) (Chestnut 1) Mowing 2 Work in the pla. 2 M.ora 2 (Forwarding 1) (Pesticide 1) Working in the pud 1 Others 16

#1 Cases mentioned the kind of work associated with his symptoms.

#2 [] shows the items of crops associated with pesticide spraying.

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the occurrence of allergic symptoms #1.

Urticaria (76 cases)		Eczema (222 cases)	
Pesticide spraying	47	Pesticide spraying	142
[M.ora 4]		[M.ora 18]	
[Chrys 3]		[Chrys 8]	
[P.mel 1]		[Fruit 3]	
Chrys 8		[Pla 1]	
(Planting 4)		[Rice 1]	
(Forwarding 2)		M.ora 22	
(Pesticide 3)		(Harvesting 4)	
Pla. 5		(Sorting 1)	
(P.mel 3)		(Pesticide 18)	
(Straw 1)		Chrys 21	
(Others 2)		(Planting 10)	
(Pesticide 1)		(Forwarding 3)	
M.ora 5		(Pesticide 8)	
(Harvesting 1)		Work in the pud 11	
(Pesticide 4)		(Planting 6)	
Tobac 4		(Cultivation 1)	
(Planting 1)		(Others 4)	
(Harvesting 1)		(Pesticide 1)	
(Drying 1)		Forestry 9	
Forestry 3		Mowing 9	
Cort 1		Tobac 7	
Cattle, Swine 1		(Cultivation 4)	
Handling straw 1		(Drying 2)	
Cutting radish		(Harvesting 1)	
for pickles 1		P.mel 7	
Work in the pud 1		(Forwarding 4)	
		(Mud drying 4)	
		(Dyeing 1)	
		Fruit 5	
		(Cultivation 2)	
		(Pesticide 3)	
		Working clothes 5	
		(Rubber glove 3)	
		(Waterproof 2)	
		Handling compost 4	
		Cattle swine 2	
		Seric	
		(Picking	
		mulberry 2)	
		G.tea	
		(Cultivation 2)	
		Straw	
		(Cultivation 1)	
		Poult (Raising) 1	
		Cutting radish	
		for pickles 1	
		Handling straw 1	
		Others 1	

#3 () shows the items of works associated with crops.

#4 Include operating agricultural machines, heavy work, work in the cold environment and work in the rain.

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and the absorption of nicotine through the skin in the rat. Jpn J Ind Health 1983; 25: 3-9.

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和 文 要 旨

熊本県下 3,717 名の農業従事者および農村在住者のアレルギー症状およびアレルギー疾患既往の実態をアンケート調査により把握し、農作業に伴うアレルギー疾患の背景因子について考察した。

調査対象者のアレルギー症状有訴率は 44% (42~45%, 95% 信頼限界) であり、症状別には、呼吸器症状, 8%, 遅延型呼吸器症状, 5%, 鼻症状, 10%, 眼症状, 16%, 蕁麻疹, 16%, 湿疹かぶれ, 26% であった。また、アレルギー疾患既往率は 21% (19~22%) で、疾患別には喘

息, 3%, 鼻アレルギー, 3%, 接触皮膚炎, 9%, 蕁麻疹, 6%などであった。アレルギー家族歴は 15% (14~16%) にみられた。

有訴率, 既往率は, 農業および農業+農外群が農外および無職群に比し有意に高率であった。また, これらのアレルギー症状はアレルギー素因者 (アレルギー疾患の既往または家族歴のある者) が非素因者に比し有意に高率であった。

作目別のアレルギー症状有訴率は, 鶏 (62%) に最も高く, ついで他花卉, 煙草, 椎茸, ハウス胡瓜, 柑橘, 他雑穀, ハウス西瓜などが高率で, それぞれ 50% 以上であった。症状別には, 呼吸器症状は煙草, 鶏, 椎茸, 遅延型呼吸器症状はハウス胡瓜, ハウスメロン, 柑橘, 鼻症状は鶏, 豚, ハウス西瓜, 眼症状はハウス胡瓜, ハウストマト, 椎茸, 蕁麻疹は他花卉, 鶏, 煙草, 湿疹, かぶれは煙草, 柑橘, 豚の各作目においてそれぞれ高率であった。

作目の組み合わせ別にみたアレルギー症状有訴率は, 米+牛+鶏 (78%), 米+鶏+柑橘/他果樹 (72%), 米+菌+他花卉 (71%) が高く, その他露地野菜, 豚, 茶などで構成される組み合わせが上位にあり, かつ単独の場

合の有訴率より上昇する傾向を認めた。

各症状有訴者の 12~38% は農作業との関連を認めているが, その 77% は農薬散布であった。原因の農薬としてはダイホルタンが最も多いが, その他実験的, 臨床的にその感作性が確かめられている農薬が多数あげられた。

また, 原因の作目としては, 菊, 柑橘, 煙草, 酪農, 畜産, ハウス作業が主にあげられた。

これらの成績より判断して, アレルギー疾患の発生が強く疑われる農作業として, 柑橘栽培管理および収穫, 菊芽つみおよび選別, 出荷, 煙草栽培管理および収穫, 乾燥, ハウスメロン収穫および出荷, い草泥染, 桑葉収穫 (養蚕), 牧草収穫 (イタリアン) およびサイレイジ作業, 椎茸栽培管理, 農薬散布などがあげられる。

これらの成績は, 農業従事集団にアレルギー疾患の発生する危険性が比較的強いことを示唆するものであるが, それらの障害はそれぞれの地域の農作業および生活関連因子に様々に修飾されて発現するものであることに留意しなければならない。とくに, 複合される作目間のアレルゲンの相乗効果や交差感作性の実態を詳細に分析する必要がある。

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