



Journal List > Indian J Dermatol > v.56(4); Jul-Aug 2011

Indian J Dermatol. 2011 Jul-Aug; 56(4): 383–388.
doi: 10.4103/0019-5154.84733

PMCID: PMC3178999

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CLINICAL EVALUATION OF PATIENTS PATCH TESTED WITH PLANT SERIES: A PROSPECTIVE STUDY

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Received August 2010; Accepted November 2010.

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Abstract

Background:

Plants are ubiquitous in nature and are essential for human life, though some do have detrimental effects. In India, there are various indigenous and foreign plants that are well known to cause dermatitis, *Parthenium hysterophorus* being the foremost.

Aims of the Study:

To study the clinical features of patients presenting with plant dermatitis and evaluate plant allergen series patch test results.

Materials and Methods:

50 patients with suspected plant dermatitis were evaluated regarding evolution of dermatitis, precipitating factors and contact with various plants. 31 patients (62%) complained of photo sensitivity and 24 (48%) had involvement of sun-exposed areas. Our provisional diagnoses included allergic contact dermatitis in 16, air borne contact dermatitis in 9, phytophotodermatitis in 7, photodermatitis in 6, airborne contact dermatitis to other causes in 4, phytodermatitis in 3. Patients were patch tested with Indian standard series of allergens as well as plant allergen series consisting of common allergenic plants of local flora in and around Manipal and also with plants strongly suspected by the patient. 35 tested positive with maximum positives (26 patients, i.e., 52%) to *Parthenium hysterophorus* (Compositae).

Results:

The result of patch testing was correlated with the history and clinical examination and relevance established.

Conclusions:

Majority of the patients with clinically suspected plant dermatitis belonged to 3rd or 4th decade and *Parthenium* was the leading plant allergen Sensitization to Leguminosae plants and *Hopea ponga*, seen in 9 cases, have not been reported earlier in literature.

Keywords: Contact dermatitis, plants, agriculturists, patch test

Introduction

Plants are indeed essential to mankind and most plants are harmless, but some cause irritant, allergic and phototoxic dermatitis when in contact with human skin.[1] The incidence of plant dermatitis (phytodermatitis) varies with country and locality. Most dermatitis inducing plants belong to a limited number of families like Alliaceae, Anacardiaceae, Cactaceae, Compositae, Cruciferae, Hennadiaceae, Liliaceae, Orchidaceae, Primulaceae, Urticaceae etc. and most sensitizers are chemicals related to catechols and lactones.[2] In India, *Parthenium hysterophorus* is the leading cause for phytodermatitis and has assumed epidemic proportions, followed by *Nerium variabilis*, *Lantana camara*, *Tradiscantia*, *Calotropis procera*, *Argemone mexicana*, *Cyanodon dactylon*, *Azadirachta indica*, *Acacia nilotica*, *Ficus*, *Hibiscus*, *Arbovitae*, Silver Oak and Bougainvillea.[3] Plant dermatitis can be occupational and non-occupational, the former being common in gardeners, farmers, florists and undertakers. Chrysanthemum and other compositae, Narcissus and Tulip are the most common causes.

Generally, phytodermatitis is seasonal, but with chronicity it may become perennial with seasonal exacerbations. It typically involves hands, forearms, face, neck, genitals and eyelids. Often, it is acute and vesicular but in chronic cases, fissuring and hyperkeratosis may occur, especially in finger tips due to contact. It may also present as a light aggravated or 'exposed site' dermatitis.

Plant dermatitis can be either irritant, allergic or pseudophytophotodermatitis. Patch testing is the only scientific method at present to detect the cause of contact dermatitis and usually the leaves are used, though it is preferable to test with standard concentration of plant extracts.

Aims

1. To study the clinical features of patients presenting with plant dermatitis
2. To evaluate patch test results of a standard battery of plant allergens

Materials and Methods

The study was conducted for a 2 year period from 2001 October to 2003 September after obtaining institutional ethical committee clearance.

A total of 50 patients who presented with dermatitis were selected based on the following inclusion criteria:

1. Patients with history of recurrent dermatitis
2. Those with suspected plant dermatitis and those with history of contact with plants
3. Patients with recurrent dermatitis who were patch tested negative with Indian standard series (ISS)
4. Patients with recurrent dermatitis who were willing to be tested with plant series

Patients with acute severe dermatitis, erythroderma, extremes of age and pregnancy were excluded from the study.

A detailed history was obtained regarding the evolution of dermatitis, precipitating or aggravating factors, type of work, gardening, atopy, past skin disease and previous treatment. By cutaneous examination, morphology and distribution of lesions and predominant areas of involvement were noted. A provisional diagnosis was made and patient was tested with a battery of selected plant allergens. Patch testing with other plants was done based on history of exposure. As and when required, other standard batteries of allergens (ISS and European standard series [ESS]) were also used for patch testing.

If patients strongly suspected any plant as the cause of dermatitis, the particular plant was obtained and scientifically identified and confirmed by a plant taxonomist. If the irritant nature of the plant was proven by a thorough search of literature, it was avoided for patch test. If a patch tested patient had a suspected irritant reaction, it was confirmed by testing in 10 controls.

The final selected plant allergen series consisted of the common allergic plants of the local flora around Manipal [

[Table 1](#)] and also the plants strongly suspected by the patient.

Table 1
The Manipal battery of plant allergens
<i>Parthenium hysterophorus</i> 1, 3% in petrolatum base
<i>Chromola odoratum</i> 5 and 10% in petrolatum base
<i>Holigarna ferruginea</i> 10% in petrolatum base
<i>Smithia saligna</i> in 95% ethanol base
<i>Grassroots cristata</i> 10% in 95% ethanol base
<i>Ischaemum indicum</i> 10% in 95% ethanol base
<i>Hopsea poega</i> 10% in 95% ethanol base
<i>Vanilla planifolia</i> 10% in 95% ethanol base
<i>Oryza sativa</i> 10% in 95% ethanol base
<i>Sesquiterpene lactone mix</i> (SLM)

Table 1

The Manipal battery of plant allergens

The number of allergens were short listed depending on the presence of that particular plant in the locality and the frequency of exposure to that particular plant. Most plants were collected after personally visiting the site with the patient, except for *Parthenium* and *Vanilla* obtained through the patients.

Preparation of the extract

Majority of plant haptens are relatively lipophilic; therefore extracts were prepared using organic solvents in the department of Pharmacognosy, College of Pharmaceutical sciences, Manipal by well trained phytochemists. The plants after identification by a professor of Botany were shade dried and powdered and extracts were prepared using Soxhlet extraction technique using 95% ethanol in different dilutions.

Patch testing was done as per usual protocol and readings were taken after 48, 72 and 96 hours, respectively and graded according to ICRDG recommendations. The result of patch testing was correlated with the history and clinical findings and relevance established.

Statistical analysis

Chi square test and Fishers exact test were used. P value less than 0.05 ($P < 0.05$) was considered significant.

Results

A total of 50 patients with various patterns of dermatitis were patch tested: There were 37 males (74%) and 13 females (36%). 35 patients (70%) showed positive patch test reactions, 3 showed doubtful reactions and 12 (24%) showed negative results. The age ranged from 21 to 86 years, the maximum in the 31-50 range (44%) [[Table 2](#)]. Agriculturists (24 in number, 48%) and housewives (13 in number, 26%) dominated. Duration of employment ranged from one year to 50 years and duration of the disease ranged from 4 months to 26 years. Various precipitating and aggravating factors were noted [[Table 3](#)]. Thirty two patients (64%) complained of photosensitivity, 24 patients (48%) had involvement of sun-exposed areas and 6 (12%) were atopic. The commonest provisional diagnosis made was allergic contact dermatitis to unknown cause (16 patients, 32%) [[Figures 1](#) and [2](#)]. Other diagnoses are listed in [Table 4](#).

Age group		
Age groups	No. (n=50)	Percentage
10-20	0	0
21-30	6	12
31-40	11	22
41-50	11	22
51-60	10	20
61-70	6	12
71-80	5	10
81-90	1	2

Table 2

Age group

Table 3

Aggravating or precipitating factors

Factors	No. (n=50)	Percentage
Sweating	29	58
Summer	18	36
Sunlight	16	32
Parthenium	12	24
Milking cows	4	8
Chromolaena	3	6
Chrysanthemum	2	4
Winter	1	2
Rain	1	2

**Figure 1**

Hand dermatitis in a farmer

**Figure 2**

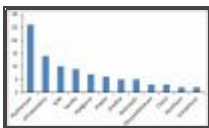
Photocontact dermatitis over face

Diagnosis	No. (n=50)	Percentage
Allergic contact dermatitis	16	32
ABCD to Parthenium	9	18
Phytophotodermatitis	7	14
Photodermatitis	6	12
ABCD	4	8
Phytodermatitis	3	6
Hand dermatitis	3	6
Chronic dermatitis	3	6
Chronic actinic dermatitis	2	4
Atopic dermatitis	2	4

Table 4

Provisional diagnosis

Maximum positives were found with *Parthenium hysterophorus* of the Compositae family with 26 patients (52%) reacting positive, followed by *Chromolaena odorata* (14 patients, 28%) of the same family [Figure 3]. Statistical analysis was found to be significant in Parthenium, Smithia, Salsuginea patch tests with $P > 0.05$. It was not useful for Holigarna, Geissaspis and Ischaemum and not significant in the rest [Figure 4].

**Figure 3**

Patch test positives

**Figure 4**

Patch test with plant series showing multiple positives

Discussion

This is a prospective study which evaluated the clinical features of patients presenting with suspected plant dermatitis and patients with chronic recurrent dermatitis with frequent exacerbations and remissions, in whom

any other specific cause was not established. The study also evaluated patch test results of a new battery of plant allergens. The predominance of dermatitis in male sex (74%) may be related to the likelihood of increased exposure to the antigens in men.

The influence of age in this study population was striking with children and elderly being least affected. In elderly, there are defects in induction and elicitation of allergic dermatitis, whereas children rarely develop ACD due to their immature immune system.[4,5]

Agriculturists, who were the maximum affected in this study comprised 48% of the study population, followed by housewives (26%). The increased incidence of dermatitis in these groups was directly proportional to plant exposure. Other population in the study also was sufficiently exposed to plants, either directly or indirectly. The severity of plant induced contact dermatitis not only depends on the plants' irritant or allergic potential but also on the degree and duration of exposure and the sensitivity of the individual. Even plants which rarely cause contact dermatitis may produce severe eruptions in highly allergic patients. Seventy three percent of the 26 patients who were positive to parthenium gave history of direct exposure, whereas 23% did not, though all who were positive to Parthenium and Chromolaena were hailing from endemic areas.

Avoidance of the causative plants is impractical in most set-ups; therefore prevention plays an important role in reducing the dermatitis. Working habits, hygienic measures and photoprotection are of paramount importance in preventing ACD. The allergic components of the plants are so rapidly absorbed through the skin that highly sensitive people must remove the antigens within minutes of exposure.

In case of Chromolaena odorata, out of the 14 patch test positives, only 7.14% gave history of direct exposure, whereas 2 patients who had direct exposure were patch test negatives.

Out of 9 positives for Vanilla, none were exposed to the plant, and the single person who cultivated vanilla was negative to vanilla, but positive to parthenium and holigarna to which he had indirect exposure.

In Holigarna positives, only one had history of exposure, whereas another was a cashew industry worker. Since both Holigarna and cashew belong to same family, a cross sensitivity is a possibility.

All the patients except those with positive reactions for Leguminosae (*Smithia salsuginea* and *Giessaspis cristata*) and Graminae (*Ishchaemum indicum* and *Oryza sativa*) did not give any active exposure, but might have come in contact during their agricultural work.

The clinical features of ACD in all patients depended on the site of involvement and the duration. Acute eruptions were mostly characterized by itching, erythema, edema, papulation or vesicles. Chronic ACD presented as lichenified, scaly, excoriated or fissured dermatitis with or without papulovesiculation.

Thirty one patients (62%) gave history of photosensitivity, 36% reported sunlight as aggravating factor and 58% had increased itch on sweating.

81.6% of Parthenium, 92.85% of Chromolaena and 100% of SLM positive cases had photosensitivity. Contact allergic sensitivity to oleoresin extracts from Compositae was present in those with photosensitivity dermatitis and Actinic reticuloid syndrome. Compositae sensitivity has been demonstrated in a large group of adults in a study by Frain-Bell *et al.*[6] though Compositae allergens appear not to be photosensitizers per se and usually cause air-borne dermatitis mimicking photodermatitis.

Though dermatitis has been reported to Vanilla, photosensitivity has not been reported. Though all patients patch tested positive to vanilla gave history of photosensitivity, none of these had exposure to vanilla and a majority of these patients had multiple positives and at least one co-positivity of members from Compositae group. The irritant potential of Vanilla was ruled out after testing in 10 normal subjects.

Only 12% gave a history of atopy. These 6 patients did not have any altered reaction pattern as compared to 88% of others who were non atopic. In atopics, many contact allergens can act as marginal irritants under patch

test conditions and thus elicit some degree of skin irritation, which is not seen in normal people. In addition, the imbalance of Th1-Th2 related processes in atopic patients could have an influence on the development of allergic patch test reactions. There are other studies which have shown altered allergic patch test reactions in patients with and without a history of atopic dermatitis.[7,8]

The predominant areas of involvement of dermatitis were strikingly comparable to the established patterns of dermatitis caused by a particular plant. All patients who tested positive to Compositae (*Parthenium*, *Chrysanthemum*, *Xanthium*, *Eupatorium*, *SLM*) showed specific patterns of presentation: Air borne contact dermatitis like, chronic actinic dermatitis like, photodermatitis like and hand dermatitis like patterns.

The patterns of Compositae dermatitis observed were similar to those of earlier reports,[9] but windblown distribution (ABCD) was more common (45.5%) in the present study than the commonly reported hand eczema pattern (21.2% in present study)

Compositae plants are well known for their ability for cross reactions within the family, as well as with members of other families. Common allergenic determinants like sesquiterpene lactones can cause patterns of cross sensitivity between the four Compositae plants *Parthenium hysterophorus*, *Xanthium strumarium*, *Helianthus annuus* and *Chrysanthemum coronarium*, as reported in Indian literature.[10]

Contact dermatitis to *Vanilla planifolia* called as vanillism usually occurs in those who cultivate or trade vanilla. In our series, none of the vanilla positives had exposure to vanilla and the test in 10 normal people ruled out the irritant potential. The relevance of these positives is unknown. This has to be studied further as vanilla is a common household ingredients used in various confectioneries and sweets. Vanilla is also present in Balsam of Peru. Out of the 9 positives to vanilla, 5 were tested with ISS and one of these tested positive to cresol and colophony. He was also positive to Compositae. Out of the 3 doubtful cases of vanilla sensitivity in this study, 2 were tested with ISS and were negative.

Seven patients tested positive to *Holigarna ferruginea*, 6 had no exposure. The active allergen is laccol and it is structurally similar to the allergens of poison oak and ivy.

Holigarna ferruginea belongs to Anacardaceae family, along with mango and cashew, which are natives of this region and there is a high possibility for cross reactivity with these.

ACD to *Hopea ponga* has not been described in literature, though we had 6 patients testing positive to this. The cross reactivity of this plant is not known and we could not establish the relevance of positives.

The Leguminosa plants and grasses were positive only in a minority of patients and there are no reports of patch testing with the above grasses in the literature. All patients who patch tested positive were agriculturists with exposure to various plants and had presence of other positives. Therefore the actual relevance of these positives in relation to their clinical illness is not known.

In cases of *Oryza sativa* (paddy), 3 had positive patch test, and 5 showed doubtful response. All the positives had multiple sensitivities and none were working with paddy. The relevance of the above positives is not known. The plant is cultivated in shallow water till nearly ripe, when the water is drained off. The stagnant water contains putrescent matter, uprooted weeds and the remains of fish and mollusks. Maceration of hands and feet, trauma and infection can produce skin disease in rice-field workers. A major cause of disability is Cercarial dermatitis[11] which has been reported by many. The plant can traumatize the skin by its thin prickly spikes. Contact urticarial[12] and contact dermatitis[13] to the plant have been described including mechanical irritation by rice dust, with allergy to rice protein. Rice starch is considered to be a known allergen and is avoided from cosmetics.

All the ten controls were patch tested negative to all allergens except one patient, a farmer with no direct contact to the plant, who tested a 1 + reaction to *Holigarna ferruginea*. It could possibly be due to latent sensitivity. He did not have history of any other allergies or atopy.

Side effects following patch test

None developed any side effects and none had angry back syndrome in spite of multiple positives. Only two patients had >3 + reaction to parthenium characterized by large bullae, erosions and oozing.

Conclusions

1. Majority of the patients with clinically suspected plant dermatitis belonged to 3rd or 4th decade. Agriculturists were the predominant group
2. the 3S's were the leading aggravating factors: Sunlight, Summer, Sweating
3. Plant dermatitis can have varying presentations: ABCD, chronic actinic dermatitis, photodermatitis, hand dermatitis
4. the leading plant allergen was *Parthenium hysterophorus*, followed by *Chromolaena odorata* and Sesquiterpene lactone mix (all belonging to Compositae)
5. Patch test reaction to common grasses was seen in 10% cases
6. Sensitization to Leguminosae was seen in 20%
7. Sensitization to the following Leguminosae plants: *Smithia salsuginea*, *Geissaspis crsitata* and *Ischaemum indicum* has not been reported earlier
8. Sensitization to *Hopea ponga* has not been reported earlier
9. Sensitization to plant allergens can occur even without direct exposure.

Footnotes

Source of support: Nil

Conflict of Interest: Nil.

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