

An antigen from *Parthenium hysterophorus* Linn.

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The increasing incidence of contact dermatitis due to the wild growth of the weed *Parthenium hysterophorus* Linn. in many parts of India has prompted chemical analysis coupled with clinical testing to isolate the offending agent. Results are presented to show that parthenin, a sesquiterpene lactone, is the major antigen which produces contact dermatitis in sensitive human beings.

Key words: allergen – Compositae family – contact dermatitis – sesquiterpene lactone.

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Parthenium hysterophorus Linn. (Compositae family) was first noted in Poona in the Western part of Maharashtra State of India in 1956 and was identified and reported by Rao (1956). This plant found the soil and climatic conditions in the Poona area very favourable and it spread rapidly. Within a few years it covered all uncultivated land, vacant plots, sides of streets and roads and pastures. The plant was so aggressive that it crowded out other useful vegetation and caused serious problems in agricultural and dairy industries.

Parthenium hysterophorus Linn. also created a new problem for human health. Hundreds of patients suffering from a peculiar dermatitis of previously unknown pattern were encountered. Subsequently the cause-effect relationship between this plant and the dermatitis was established and reported (Lonkar & Jog 1968, 1972). In the initial publication (Lonkar & Jog 1972) only the leaf and the flower were used for patch-testing. Later on many related plant extracts supplied by Hollister Stier Ltd. of

Spokane, Washington, U.S.A. were also included (Lonkar et al. 1974). An attempt has now been made to analyse the various parts of the plant and to pinpoint the offending agent.

The chemistry of *Parthenium hysterophorus* Linn. has been studied only with special reference to sesquiterpene lactones by many workers (Herz et al. 1962; Rodriguez et al. 1971). It is also known that the same plant growing in different parts of the world has variations in its chemical constituents. It was therefore decided to analyse the *Parthenium hysterophorus* Linn. growing around Poona and to test the patients with the constituents isolated. This is a collaborative study of natural products chemists and a dermatologist.

Methods and Materials

The clinical picture of allergic dermatitis to parthenium is now well established. All such patients attending the skin clinic were included in this investigation. The extracts

supplied by the chemists were tested by the closed patch test method. The interpretation of the reaction occurring after 48 hours was strictly followed according to the standard of the International Contact Dermatitis Research Group. This was done to maintain uniformity in the reading of patch tests.

The extracts were given code numbers. The dermatologist did not know the composition. Similarly the chemist did not know the results of the patch tests. Only after the study was completed was the information exchanged. Each patient was also simultaneously tested with the leaf and the flower to confirm the clinical diagnosis.

Some patients suffering from atopic dermatitis, asthma-eczema syndrome and drug allergies, and blood relatives of patients of parthenium dermatitis were also included in the series, although they were not suffering from parthenium dermatitis.

Clinical Picture

The clinical picture of allergic contact dermatitis due to parthenium dermatitis is well-known. The typical patient is an adult male. The initial symptom is itching around the eyes which gradually affects the face, the V of the neck, the antecubital and popliteal fossae, and finally may become generalized. Patients pass through various stages of eczema such as acute, sub-acute and chronic. The clinical picture has a strong superficial resemblance to photo-allergic dermatitis. But in parthenium dermatitis the upper eyelids are invariably involved. Similarly the antecubital rather than antero-lateral and dorsal parts of the forearms are affected.

There is a gradual change in the clinical picture over a period of years. Initially the patients were predominantly adult males engaged in outdoor work like farming. But recently many white-collar workers who never come in direct contact with the plant

are being affected. Similarly, initially women were rarely affected but now their proportion is increasing. No children are yet known to be affected.

Chemical Analysis

Petroleum ether and ether extracts of the stem, leaves and flowers obtained separately were found to be essentially similar in composition as shown by thin-layer chromatography. All of them contained the known sesquiterpene lactone (Herz et al. 1962), parthenin, as one of the constituents (fig. 1). Similarly, ethanol extracts of the above pre-extracted stem, leaves and flowers showed almost identical sugars such as glucose, arabinose and polysaccharides as revealed by paper chromatography. Table 1 shows the scheme followed for the chemical analysis of the petroleum ether extract of the whole plant; Table 2 shows the patch test results.

Results of Patch Tests

All patients presenting the typical picture of parthenium dermatitis showed positive results to patch tests with flower, leaf and to

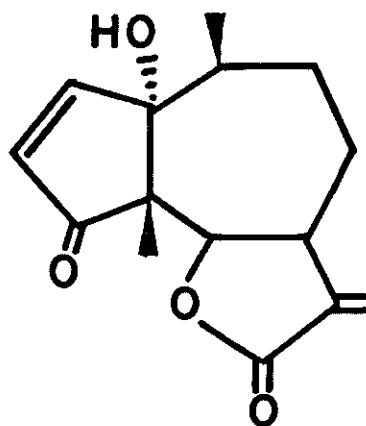


Fig. 1. Parthenin.

Table 1. *Parthenium hysterophorus* Linn.

Whole plant			
Extraction			
Petroleum ether SiO ₂ ↓	Benzene* SiO ₂ ↓ chromatography	Acetone* TLC ↓	Ethanol Paper chromatography ↓
1. Saturated straight chain hydrocarbons and alcohols	1. Straight chain alcohols unsaturated	1. Parthenin	1. Glucose
2. Unsaturated straight chain alcohols and esters	2. Sterols	2. Gummy mixture	2. Arabinose
3. Sterols	3. Parthenin		3. Poly-saccharides
4. Parthenin	4. Gummy mixture		
5. Gummy mixture			

* The composition of these extracts is identical to the chromatographic fractions Nos. 5 → 10 of the petroleum-ether extract (Table 2).

Table 2. Patch test results of the chromatographic fractions of petroleum-ether extract

Chromatography ↓ SiO ₂			
Fr.no.	Code no.	Nature of the compound/mixture	Clinical analysis
1	—	Saturated straight chain hydrocarbons and alcohols	Not supplied
2	—	(negligible)	Not supplied
3	1	Straight chain esters	—ve
4	2	Unsaturated straight chain alcohols	—ve
5	3	Unsaturated straight chain alcohols	—ve
6	4	Unsaturated straight chain alcohols	—ve
7	5	Phytosterols (mainly stigmasterol and sitosterol)	—ve
8	6	Mixture containing hydroxy ketone	+ve
9	7	Parthenin	+ve
10	8	Complex gummy mixture	+ve
	9	Steam volatile fraction from leaves	—ve

parthenin. Other patients such as atopics, blood relatives of parthenium patients, those suffering from the asthma-eczema syndrome and drug allergies showed negative results.

Discussion

From the above analysis, it is evident that the fractions containing parthenin and compounds of similar polarity are the active allergens. These fractions might possibly contain sesquiterpene lactones similar to parthenin. Attempts are under way to isolate and characterize them.

It has been postulated that the conjugated lactone ring in these sesquiterpene lactones is responsible for the biological activity (Dupuis et al. 1974). Experiments leading to the modification of this lactone ring to study its relation to the activity are in progress and will be reported shortly.

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