

## INTRODUCTION

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The pernicious weed Parthenium hysterophorus L. (Fig. 1) of the family Asteraceae (Compositae) is a native of tropical South and North America and West Indies (Fernald 1970, Hegde and Patil 1979). It is mainly distributed in the United States of America from Florida to Texas and also found in the States of Massachusetts, Pennsylvania, Ohio, Michigan, Illinois, Missouri and Kanas (Gleason and Cronquist 1963, Fernald 1970). In U.S. it has been found growing on ore piles stocked at Canton, Port of Baltimore, Maryland and Virginia in Eastern United States (Reed 1964). It has also been reported from Mexico (Fernandes 1942), Minnesota (Mackoff and Dahl 1951) and Louisiana (Ogden 1957). The weed has also established itself in South Africa, Islands of Mauritius and in North Vietnam (Krishnamurthy et. al. 1977).

This weed has spread like a wild fire after its entry in India through imported wheat grains from U.S.A. in 50s. (Vartak 1968), both in cities and rural parts of many states. There are reports that in 1956 Prof. H. V. Paranjpe, retired horticulturist of the then Bombay State while taking a stroll in his garden in Poona he noticed a strange plant. Although he had spent all his life studying plants and trees, he could

Fig. 1 : Parthenium hysterophorus L. growing  
in natural habitat.

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Fig. 1

not able to recognize this plant and his curiosity aroused. Looking up into the books in his library he found no record of it. Fortunately the Botanical Survey of India (BSI) had their office in Poona and with the help of Dr. R. S. Rao, the then Regional Director of BSI, the identification of this plant was established. Subsequently the identity of the weed and its occurrence as a new adventive plant to Poona was confirmed by several senior botanists.

From the available records it is now clear that the weed was entered in India in 50s and it was first reported in the vicinity of Poona in 1956 (Rao 1956, Santapau 1967). The weed was found growing in abundance along the bank of river Mutha and in the scattered places all along the dried fields in and around Poona. Having not known that it would cause grave problem, it was first ignored, but within couple of years it spread very fast covering almost all wastelands, railway yards, marshy places, cultivable fallow lands, grass lands, road sides, along the canals and other areas (Maheshwari 1966, Santapau 1967). The floods in Poona during 1958-59 initially helped the spreading of this weed (Roberts 1967). Subsequently in 1961 when Panshet dam gave way, the godowns on the river banks washed out. With this, there was rapid spread of this weed all over Maharashtra within a period of few years (Ranade 1975). Later in 1961 it got introduced as a

rare weed in Dharwar (Karnataka) which is situated on the Eastern fringe of the Western ghats (Ladwa and Patil 1961). By about 1965 it covered most of the agricultural lands in Maharashtra. Now it is known almost all over India from Jammu to South of Tamil-Nadu (Hakoo 1963, Maheshwari 1966, Ellis and Swaminathan 1969, Jayachandra 1971, Hosmani and Setty 1973, Bidhas Ray 1975, Krishnamurthy et al. 1977, Hegde and Patil 1980). It is also reported from Gujrat, Rajasthan, and Calcutta. Having spread in the planes and hilly areas of Maharashtra and Karnataka the weed has made further entry into newer geographical areas and is become known by various colloquial names such as "Congress" or 'Carrot grass' in Maharashtra, 'Billihullu' in Karnataka, 'Tikkapulakku' in Andhra and 'Mugtippu' in Tamil-Nadu (Patil 1980). Similarly 'worm weed', 'white head', 'Mutter Kraut', 'Absinthe marron', 'Yerba amarga' are also the common names used elsewhere (Kranz et al. 1977).

The rapid encroachment of the weed caused agricultural damage all over India (Vartak 1968, Krishnamurthy et al. 1975). According to reliable sources from progressive agriculturists in Maharashtra well developed pastures, once yielding many cart loads

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of grass, are now producing only a few carts of grass bails due to heavy encroachment of Parthenium (Vartak 1976). As high as 90% reduction in forage production in the grazing land has also reported by Vartak (1968). Earlier the weed was seen only in association with groundnut, potato and cotton and is now reported to be hampering their production considerably. It has also made its entry in vegetable and floricultural crops. Over and above the weed has also created a menace in many forest nurseries (Chandras 1970).

The weed has not only resulted in suppression of crop but even threatened the very existence of human life. It is not only known to cause new kind of eczema to various parts of body (Maheshwari 1968) but also the allergic diseases such as dermatitis, fever and asthma (Chandras and Vartak 1970, Sundra Rajulu et al. 1976) and even some times the death of the individuals in extreme cases (Lonkar et al. 1974). Khan and Grothaus (1936) have reported that the seasonal eruption of the exposed skin surface coincide with growing season of this weed. Shelmire (1939, 1940) observed chronic lichenified eczema caused due to Parthenium to the exposed skin surfaces. In Poona Lonkar and Jog (1972) observed dermatitis of the exposed skin surface in

adult engaged in agricultural work. Further Lonkar et al. (1974) have clinically confirmed the reports of the symptoms caused by P. hysterothrips and reported as follow.

"During early stage, acute eczematous dermatitis affect the face, antecubital and Popliteal fossae, the V of the neck and hands. The skin showed vesiculation with exudation and pruritus was intense. There was uniform failure of response to topical corticosteriod drugs and the dermatitis progressed to chronic dermatitis with lichenification and spread to affect the wrists, fore arms and upper trunk. In chronic stage systemic corticosteroid drugs were ineffective. The secondary changes included impetiginization, fissuring of the skin and various pigmentry changes. Both post inflammatory hyperpigmentation and hypopigmentation were seen, the former predominating in most instances. The course of disease was progressive with exacerbations during the growing seasons of the plants and was uninfluenced by therapy. However, in every case in which follow up was possible, complete remission was observed following a transfer of residence to geographic area not infested with the weed. Only pigmentry changes



persisted after such a change of residence. The patients with generalised or universal dermatitis, particularly if serum exudation and impetiginization were severe, become ill. They suffered fatigue associated with intense nocturnal pruritus, malaise and loss of weight. About 12 deaths occurred in severely affected patients, intercurrent infection, cutaneous and pulmonary, were considered to be responsible for death. Associated features of severe dermatitis were loss of scalp and body hairs, the nails showed shiny polished surfaces or transverse ridging but they are rarely shed".

Large seed output, wide ecological adaptation to extreme environment and immunity for fungal diseases and insect attack, are the reasons attributed for its competence with other sturdy weeds and its fast multiplication (Hegde and Patil 1980, 1982). However, there are reports that the weed is attacked by a parasitic fungi Alternaria zinniae Pape and A. tenuis Auct. (Patil 1980), insects viz. Aphis fabae (Sundra Rajulu et al. 1976), the larvae of Diacrisa obliqua (Vaidya and Vartak 1977), a mealy bug Ferrisia virgata (Char et al. 1975), Planococcus citri (Hegde and Patil 1979) and a false spider mite Brevipalpus phoenicis (Vartak 1976).

It has also been noticed that this weed suffers from a disease developing symptoms of phyllody in which the flowers turn into leafy structure and plant appears like a broom (Fig. 2).

Since the weed P. hysterophorus competes with useful crop plants and causes a number of diseases, more attention on its eradication has been given by number of workers (Hegde and Patil 1976, 1979). Even some chemicals are known to control the growth of this weed (Patil et al. 1992). However, there can not be a better method than biological control which is considered to be cheapest, less expensive and long lasting one. Thus from the decade back the possibility of biological control of P. hysterophorus has attracted the attention of some workers and Varma et al. (1974) have reported mycoplasmal etiology causing phyllody disease in P. hysterophorus and proposed its utility in biological control. However, nobody have looked into the morphological and biochemical changes taking place due to mycoplasmal infection in Parthenium hysterophorus.

This has prompted us to study the transformation taking place in leaf and flower morphology due to

Fig. 2 : Phyllody disease of P. hysterophorus showing broom like appearance due to transformation of reproductive parts into leafy structure.



Fig. 2

phyllody disease and also the biochemical changes such as chlorophyll contents, phenolic contents, certain enzymes and amino acid composition in the infected plant in comparison with the healthy one. The earlier study carried out by Patil and Hegde (1988) revealed that the weed contains a principle allergen, 'Parthenin' (sesquiterpene lactone) which cause allelopathic effect. This has also attracted our attention towards isolation of sesquiterpene lactone (SL) from MLO infected P. hysterophorus with a view that whether the principle compound has got similar trend of allelopathic effect or it differs? Thus the study of isolation and characterisation of SL from healthy and MLO infected Parthenium hysterophorus was carried out by using NMR spectra (Nuclear Magnetic Resonance) and HPLC (High Performance Liquid) Chromatography) technique.

The subject matter, therefore, of this dissertation mainly confined to the study of morphological transformation in the weed due to phyllody disease, comparison of pigment composition, polyphenol contents, phenolic compounds and their quantification, the fate of enzymes viz. Polyphenol oxidase and IAA oxidase, amino acid composition and isolation of sesquiterpene lactone, its analysis and allelopathic effects.