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Pollen Allergy: Common Weeds in Telangana and Their Management Measures

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Abstract

Many weeds and trees produce sufficient quantities of lightweight pollen for their pollination. A single plant can produce 1 million to several million pollen grains in a day leading to pollen allergy or seasonal rhinitis/rhinosinusitis, asthma and dermatitis etc. Allergenic response is mainly dependent on the correlation between the onset of symptoms and plant pollination time. According to many studies approximately 60-75% of seasonal rhinitis is attributed to weed pollens, 40% to grass weed pollens, and 10% to tree pollens. The pollinating season of the various plants depends on the individual species and on their geographical location. In this paper common allergenic pollen weeds of Telangana, India, their flowering/pollination periods observed and weed management measures are reviewed. Based on their pollination period, weeds can be removed before flowering and can be utilized as biomass in agriculture/industry.

Keywords: Pollen allergy; Allergenic weeds; Weed/waste management; Pollination period; Biomass

Introduction

Weeds pose a serious threat to society during their pollination period. A single plant can produce 1 million to several million pollen grains in a day leading to allergic seasonal rhinitis/rhinosinusitis, sinusitis and dermatitis etc.

Morphology and allergenic nature of pollen

The pollen grain is produced during sexual reproduction of the flowering plant life cycle and that harbors the male gametes. Its function is to fertilize the female gametophyte. The external wall called exine is composed of sporopollenin. The inner wall called intine is smooth and does not provide structural support to shape the pollen grain. The intine surrounds the pollen cytoplasm, which contains the intracellular organelles including the vegetative and germ nuclei, starch grains and reduced polysaccharide particles. In a dry atmosphere pollen may remain stable for centuries. Anemophilous pollen has allergenic importance. Pollen allergens are water-soluble proteins or glycoproteins, which make them readily available biologically, being capable of evoking an IgE antibody-mediated allergic reaction in seconds. Pollinosis, also known as seasonal allergic rhinitis, pollen allergy or hay fever, is the result of sensitization to pollen components. The pollen allergens produce clinical symptoms after contact with the airway mucosa and the conjunctiva of previously sensitized individuals. Parthenium pollen poses a threat in the form of allergic dermatitis.

Common allergenic weeds

***Parthenium hysterophorus* L. :** Family: *Asteraceae* Fl and fr: August - February

Parthenium hysterophorus L. is accidentally introduced into India from USA, widely spread all over India as an invasive weed. Allergy is caused by direct and indirect contact with Parthenium. Its distribution was supported by the optimal environmental conditions of this country. The pollen of this weed is considered to be a cause of allergic respiratory problems, contact dermatitis [1]. Crop production is drastically reduced owing to its allelopathy [2]. Also aggressive dominance of this weed threatens biodiversity as an invasive weed (Figure 1).

***Ageratum conyzoides* L.:** Family: Asteraceae Fl: and fr. : August-March

Ageratum conyzoides L. is an erect, herbaceous annual, 30 to 80 cm tall; stems are covered with fine white hairs, leaves are opposite, pubescent with long petioles and glandular trichomes. It can gain height up to 2 m. The inflorescence contain 30 to 50 self-incompatible pink, white or violet flowers arranged as a corymb. The fruit is an achene with an aristate pappus and is easily dispersed by wind. *A. conyzoides* causes allergic reactions [3] (Figure 2).

Xanthium indicum Koenig in Roxb: Family: *Asteraceae* Fl. and fr.: August-December

The species is monoecious, with the flowers borne in separate unisexual heads: staminate (male) heads situated above the pistillate (female) heads in the inflorescence. The pistillate heads consist of two pistillate flowers surrounded by a spiny [involucre]. Upon fruiting, these two flowers ripen into two brown to black achenes and they are completely enveloped by the involucres (Figure 3).

***Amaranthus spinosus* L.:** Family: *Amaranthaceae* Fl. and fr. : August-October

Amaranthus spinosus L. is an annual growing to 0.6 m (2 ft). The flowers are monoecious (individual flowers are either male or female, but both sexes can be found on the same plant) and are pollinated by Wind, self. Pollen is found to be allergenic [4] (Figure 4).

***Paspalum distichum* L.:** Family: *Poaceae* Fl. and fr. : August-December

Paspalum distichum L. is known for its prominent V-shaped inflorescence consisting of two spike-like racemes containing multiple tiny spikelets, each about 2.8-3.5 mm long. Pollen represents a major cause of type I allergy. Pollen of this grass induces allergic rhinosis and

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Figure 1: *Parthenium hysterophorus* L.

Figure 2: *Ageratum conyzoids* L.

Figure 3: *Xanthium indicum Koenig in Roxb.*

asthma. This grass is used primarily as a forage. The nutritive value remains high when mature (Figure 5).

***Cynodon dactylon* L.:** Family:*Poacea* Fl. and fr.: All seasons

Cynodon dactylon L. pollen (BGP) is an important worldwide aero allergen (Meyers RL, 1971). The blades are a grey-green colour and are short, usually 2-15 cm (0.79-5.91 in) long with rough edges. The erect stems can grow 1-30 cm (0.39-11.81 in) tall. The stems are slightly flattened, often tinged purple in colour. The seed heads are produced in a cluster of two to six spikes together at the top of the stem, each spike 2-5 cm (0.79-1.97 in) long. It has a deep root system; in drought situations with penetrable soil, the root system can grow to over 2 m deep, though most of the root mass is less than 60 cm under the surface. The grass creeps along the ground and roots wherever a node touches the ground, forming a dense mat. *C. dactylon* reproduces through seeds, runners, and rhizomes. Although this plant is useful as a medicine, pollen is allergenic [5] (Figure 6).

***Chloris barbata* (L.) Sw.:** Family: *Poaceae* Fl. and fr.: All seasons

Terrestrial, annual, tufted erect or prostrate herb, rooting at nodes. Roots fibrous, white or brown. Stems flat, hollow, glabrous. Nodes glabrous. Stipules absent. Leaves alternate spiral, sessile, linear, more than 2 cm long/wide, margin entire or undulate, apex acute, base clasping, parallel-veined. Leaf sheath present, rounded in cross section. Ligule membrano-ciliate. Flowers bisexual, grouped together in a terminal digitate, raceme, sessile, green or brown, petals not visible. Fruit is a nut (Figure 7).

***Eragrostis tenella* L.:** Family: Poaceae Fl. and fr.: September-December

Eragrostis tenella L. is a small densely tufted annual grass, with variable size, usually not much more than 50 cm high. Clums glabrous, spindly, the nodes at the base, may be ramified or not. Leaves up to 10 cm long. Inflorescence usually with many slender spreading branches (Figure 8).

***Argemone mexicana* L.:** Family: *Papaveraceae* Fl. and fr.: November-June

Figure 4: *Amaranthus spinosus* L.

Figure 5: *Paspalum distichum* L.

Figure 6: *Cynodon dactylon* L.

Figure 7: *Chloris barbata (L.) Sw.*

Figure 8: *Eragrostis tenella* L.

The yellow prickly poppy, 8-18 inches tall, has a smooth or slightly prickly stem. The deeply lobed leaves are a whitish green, and the upper ones clasp the stem between their two lower lobes. The upper surface of the leaf is smooth. Flowers are yellow, about 2 1/2 inches across. The sap from this plant is bright yellow. Pollen is found be allergic [4] (Figure 9).

Weed management

Integrated management: These weeds can be controlled by following methods.

A. Chemical B. Mechanical or Manual C. Biological D. Competitive Plants E. Biomass utilisation

A. Chemical control method: Glyphosate or 2,4-D is sprayed to eradicate the weeds.

B. Mechanical or Manual method: Uprooting the weeds mechanically before flowering, is safe and effective although weeds can be manually uprooted by wearing gloves and masks.

C. Biological method: Biological agents specific to the host weeds can be used eg: *Zygogramma bicolorata Pallister* (Mexican beetle) [6] proved to be successful in controlling *Parthenium* weed. Natural weed enemies like insects, rust fungi and nematodes specific to the weeds are used. This method is less expensive and eco-friendly.

D. Competitive plants: *Cassia tora, C.sericea, C.alata, Achyranthus aspera, Tephrosia purpurea* are the natural competitors to the allergenic weeds. These competitors grow in wild and inexpensive. These plants are also non-allergenic/anti-allergenic [7] in nature.

E. Biomass utilisation: Weeds are uprooted manually or mechanically and used as biomass. This is the best approach in weed management as the weed waste is reused.

(i) Composting: Weeds are removed before flowering and dumped in the pit in layers along the cow dung/Trichoderma viridae/Urea on the top. Compost prepared by this method has more nutrients. The high concentration of elements (N, P, K, Fe, Mn, Cu and Zn) in composted *Parthenium* increases the yield of many agricultural crops [8].

(ii) Mulching: Alternatively weeds can be used in mulching. The *Parthenium* weed has the potential to increase the growth and yield of wheat as a green manure.

(iii) Industrial biomass: Weed is also used as biomass for the production of chemicals/enzymes of industrial importance, eg: Biomass use of congress grass (*Parthenium sp.)* and water hyacinth (*Eichhornia crassipes)* as low cost raw materials for xylanase production [9] (Figures 10 and 11).

Conclusions

Facing allergens during/after the pollen season is a major issue concerned with allergy related problems. Although it is difficult to avoid allergenic environmental exposure absolutely, as people work and stay in that same environment, to avoid pollen allergy the allergenic plants should be removed before their flowering season and can be used for the benefit in agricultural growth/yield. Weed management procedures reviewed here play a significant role in avoiding allergenic rhinitis, sinusitis, asthma and dermatitis etc. At the same time if used

Figure 9: *Argemone Mexicana* L.

Figure 10: *Cassia tora* L.

Figure 11: *Achyranthus aspera* L.

under waste management, the weed as biomass for the production of compost, industrial enzymes etc. generates additional resource. When the quantity and propagation of pollen in the atmosphere is significant, such as in dry, warm and windy days, persons who are sensitive to allergens need to remain in closed environments preferably with air filters attached in their rooms.

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