ECO CHRONICLE
ISSN: 0973-4155
RNI No. KERENG/2006/19177
Vol. 15, No. 1, March, 2020
PP: 17 - 22

Review Article

POLLEN ALLERGY AND ITS MANAGEMENT: AN ACCOUNT OF COMMON ALLERGENIC PLANTS FROM SOUTHERN INDIA - A REVIEW

Raman Verma
Department of Botany, Maharani Lakshmi Ammanni College for Women Autonomous, Science Institute Post, 18th cross, Malleshwaram, Bengaluru, Karnataka, India.
Corresponding author: ramangemini09@gmail.com

ABSTRACT

The incidence of respiratory allergy is increasing all over the world with India being no exception. The air we breathe today is intoxicated with chemical pollutants and also loaded with bio pollutants. Pollen is well studied as allergens among all other aeroallergens. Pollen allergy is one of the most widespread diseases among urban populations. Hence it is necessity to know various pollen allergens, plants producing allergic pollen, and also the seasonal periodicity of pollen. This review article aims to evaluate the published literature for understanding the different aspects of pollinosis, to list out various plants responsible for pollen allergy from South Indian cities, and to develop prominent guidelines for allergy management. A total of 29 species of pollen types were documented. Of the total, 25 species belong to dicotyledons and 4 species belong to monocotyledons. A majority of the pollen that cause allergy are from trees. In conclusion, the present work elaborates on the impact of pollinosis, factors triggering pollinosis in urban areas, the measures to be taken to avoid allergic symptoms, and healthy practices that can be followed to treat pollinosis.

Key Words: Southern India, Pollinosis, Aeroallergens

INTRODUCTION

India is a climatically diverse country and possesses great variety of flora owing to different geographical and edaphic factors (Singh & Pawan Kumar, 2002). As described by the Botanical Survey of India, the country stands tenth in the world and fourth in Asia in plant diversity with 47,000 species. This diverse vegetation attributes discrete pollen concentration in the atmosphere. Apart from this, different plant species have been introduced in towns and cities as part of various afforestation practices. Such unscientific urban planning activities have led to various allergic diseases.

Pollen as Allergens

Pollen grains caught the attention of scientists in the 18th century, when J. Koelreuter reported the dispersal of pollen by wind (Singh & Dahiya, 2008). Several scientists in the 19th century devised equipment to examine airborne biological particles. Aerobiological monitoring became standardized during the 20th century owing to the increased prevalence of respiratory diseases (Gill *et. al.*, 2017). Modern advances in the molecular analysis could improve the information for allergy sufferers and healthcare professionals (Smith *et. al.*, 2014). At present, various aerobiological surveys reveal that pollen grains from plants are among the most important allergens loaded in the air and the major source of morbidity among sensitive individuals (Singh & Dahiya, 2008). During flowering seasons, pollen concentration increases in the air and as people breathe in these pollen, their body's immune system gets triggered to release antibodies and attack the allergens. Among all the allergic reactions, pollinosis is the most common type of allergic response in humans, wherein histamines are released in the blood which leads to symptoms like itchiness, watery eyes, sneezing, runny nose, itchy sinuses or throat, ear congestion and postnasal drainage.

From more than 2,00,000 known plant species, about 50 are registered in the official allergen list of International Union of Immunological Societies (IUIS) (Singh & Pawan Kumar, 2004). The All India Co-ordinated Project sponsored by the Ministry of Environment and Forests, provides up-to-date information on seasonal and annual concentrations of air borne pollen and spores of indoor and outdoor air of different geographical regions of India (Singh & Dahiya, 2008). The pollinosis-associated plants are characterized

by the production of high amounts of mostly anemophilous pollen and these are grouped as (i) Trees (Pinales, Rosales, Myrtales, Arecales, Salicales, Junglandales, Fagales, Scrophulariales) (ii) Weeds (Asteraceae, Chenopodiaceae and Urticaceae) and (iii) Grasses (Poideae, Bambusioidaeae, Arundinoideae, Chloridoideae) (Michael *et. al*., 2010).

Factors triggering pollen allergy in Urban Areas

The extensive pollen allergenicity in urban areas is due to low species diversity at planting, the overabundance of given species, the planting of exotic species, the choice of dioecious species, wide-spreading nature of invasive species and the interaction between pollen and air pollutants (Paloma & Manuel, 2011). Meteorological parameters like air temperature, wind, sunlight, and rainfall together with carbon dioxide are crucial in suspension, transportation, and spread of pollen grains. An increase in temperature and humidity results in 'allergen load' in the air mass. Hence, a review has been made to study various aspects of the most commonly occurring allergy, allergic rhinitis (Pollinosis), in the urban areas of Southern India, particularly with reference to its aetiology. The specific objective of the review is to go for a compilation of useful guidelines, which can be followed for effective allergy management.

MATERIALS AND METHODS

A detailed review of literature on pollen allergy was undertaken. An assessment of data on various aerobiological surveys and pollen calendars in Southern India was carried out. The taxa were identified with the help of floras. The All India Co-ordinated Project (AICP) on "Aeroallergens and Human Health" has been referred, which provided inputs for the evaluation of facts and to derive valuable conclusions. The guidelines are proposed after compilation of available data. The photographs of the species are also provided.

RESULTS AND DISCUSSION

The pollen morphology of 29 plant species has been identified and studied. The allergic pollen types include 10 species of herbs, 3 species of shrubs and 16 species of trees. 24 species belong to dicots and 4 species to monocots and 1 Gymnosperm species. Majority of the pollinosis associated pollen are from the family Fabaceae, with 5 species, followed by 4 species of Asteraceae and Mimosaceae each. Of the total dicots, 6 species belong to Polypetalae, 3 to Gamopetalae and 4 to Monochlamydeae. The pollen characteristics and seasonality of the species identified are enumerated. A list of important allergenic plants from Southern India is provided in Table 1. The photographs of the species are provided in Plate I. Various guidelines for allergy management are also listed.

Enumeration:

1. *Acacia arabica* (Lam.) Willd. (Plate Ia)
   Pollen grains in polyad, polar outline circular, equatorial outline elliptic, surface foveolate. Fl.: spring season
2. *Ageratum conyzoides* L. (Plate Ib)
   Pollen grain in monad; polar outline triangular obtuse convex, prolate spheroidal; radial symmetry; tricolporate; sculpturing spinulate, densely and faintly distributed; spine blunt at tip. Fl.: August - February
3. *Ailanthus excelsa* Roxb. (Plate Ic)
   Pollen grain oblate spheroidal, amb sub-triangular, 3-zonocolporate, angulaperturate, Lalongate, exine finely reticulate. Fl.: February - June
4. *Albizia lebbeck* (L.) Benth. (Plate Id)
   Pollen grains clustered in spherical polyads, heteropolar, outline quadrangular in polar view, 3-zonoporate, exine-psilate, perforate, foveolate. Fl.: March - May
5. *Amaranthus spinos*us L. (Plate Ie)
   Pollen grain spherical, aperture-dicolpate and monolete, microrugulate and psilate ornamentation. Fl.: December - April
6. *Artemisia sieversiana* (Ehrh.) Willd. (Plate If)
   Pollen grain oblate spheroidal, exine somewhat echinate, spines minute and rudimentary. Fl.: August - October
7. *Brassica nigra* L. (Plate Ig)
   Pollen grain oblate or suboblate, tricolpate, exine surface reticulate, endexine warty, regular-heterobronchate pattern. Fl.: June - August
8. *Cassia fistula* L. (Plate Ih)
   Pollen grain oblate spherical, amb circular, 3-zonocolporate, circulaperturate, Os Lalongate, exine punctitegillate. Fl.: May - June/July
9. *Casuarina equisetifolia* L. (Plate Ii)
   Pollen grain oblate spheroidal, amb triangular with slightly convex sides, 3-zonoporate, occasionally 4-zonoporate, exine psilate. Fl.: February - June
10. *Cedrus deodora* (Roxb.) G. Don (Plate Ij)
    Pollen grain diploxylonoid type, bisaccate, reticulate pattern. Fl.: September - October
11. *Chenopodium album* L. (Plate Ik)
    Pollen grain isopolar, radially symmetrical, peripolyporate, spherical and 3-12 conical tuberculate on pore of pollen surface, exine perforate. Fl.: February - April
12. *Delonix regia* (Boj. ex Hook.) Raf. (Plate Il)
    Pollen grain oblate, spheroidal, amb circular to

Table 1. List of plants causing Pollinosis

SL No.	Binomial	Common Name	Family
	DICOTS		
a.	*Acacia arabica* (Lam.) Willd.	Indian gum Arabic tree	Mimosaceae
b.	*Ageratum conyzoides* L.	Billy goat weed	Asteraceae
c.	*Ailanthus excelsa* Roxb.	Indian tree of heaven	Simaroubaceae
d.	*Albizia lebbeck* (L.) Benth.	Woman's tongue tree	Mimosaceae
e.	*Amaranthus spinosus* L.	Mexican poppy	Amaranthaceae
f.	*Artemisia sieversiana* (Ehrh.) Willd.	Sieversian worm wood	Asteraceae
g.	*Brassica nigra* L.	Black mustard	Brassicaceae
h.	*Cassia fistula* L.	Golden shower tree	Caesalpiniaceae
i.	*Casuarina equisetifolia* L.	Beefwood tree	Casuarinaceae
j.	*Cedrus deodora* (Roxb.) G. Don	Deodar cedar	Pinaceae
k.	*Chenopodium album* L.	Goosefoot	Amaranthaceae
l.	*Delonix regia* (Boj. ex Hook.) Raf.	Royal poinciana	Caesalpiniaceae
m.	*Eucalyptus globulus* Labill.	Blue gum tree	Myrtaceae
n.	*Gynandropsis gynandra* (L.) Briq.	Spider flower	Cleomaceae
o.	*Holoptelea integrifolia* (Roxb.) Planch.	Indian elm	Ulmaceae
p.	*Marchamia lutea* (Benth.) K. Schum.	Nile tulip tree	Bignoniaceae
q.	*Mallotus philippensis* (Lam.) Muell.-Arg.	Kamala tree	Euphorbiaceae
r.	*Mimosa pudica* L.	Sensitive plant	Mimosaceae
s.	*Parthenium hysterophorus* L.	Congress grass	Asteraceae
t.	*Peltophorum pterocarpum* (DC.) K. Heyne	Copper pod tree	Caesalpiniaceae
u.	*Prosopis juliflora* (Sw.) DC.	Mesquite	Mimosaceae
v.	*Ricinus communis* L.	Castor	Euphorbiaceae
w.	*Salvadora persica* L.	Tooth brush tree	Salvadoraceae
x.	*Syzygium caryophyllatum* (L.) Alston	South Indian plum	Myrtaceae
y.	*Tridax procumbens* L.	Coat buttons	Asteraceae
	MONOCOTS		
1.	*Cocos nucifera* L.	Coconut tree	Arecaceae
2.	*Pennisetum pedicellatum* Trin.	Desho grass	Poaceae
3.	*Phoenix dactylifera* L.	Date palm	Arecaceae
4.	*Sorghum vulgare* Pers.	Indian millet	Poaceae

triangular, 3-zonocolpate, circulaperturate, exine retipilate. Fl.: April - July

13. *Eucalyptus globulosus* Labill. (Plate Im)
Pollen grain triangular, radially symmetrical, isopolar, polporate, angulaperturate, 3-parasyncolporate, with a distinctive slightly arcurate apocolpical field with broken edges, exine regulate. Fl.: September - December

14. *Gynandropsis gynandra* (L.) Briq. (Plate In)
Pollen grain in monad, spherical/oval, yellow, prolate, tricolpate, reticulate. Fl.: March - April

15. *Holoptelea integrifolia* (Roxb.) Planch. (Plate Io)
Pollen grain suboblate, amb circular, 4-5 zonoporate, circulaperturate, exine coarsely granular. Fl.: February - March

Plate I

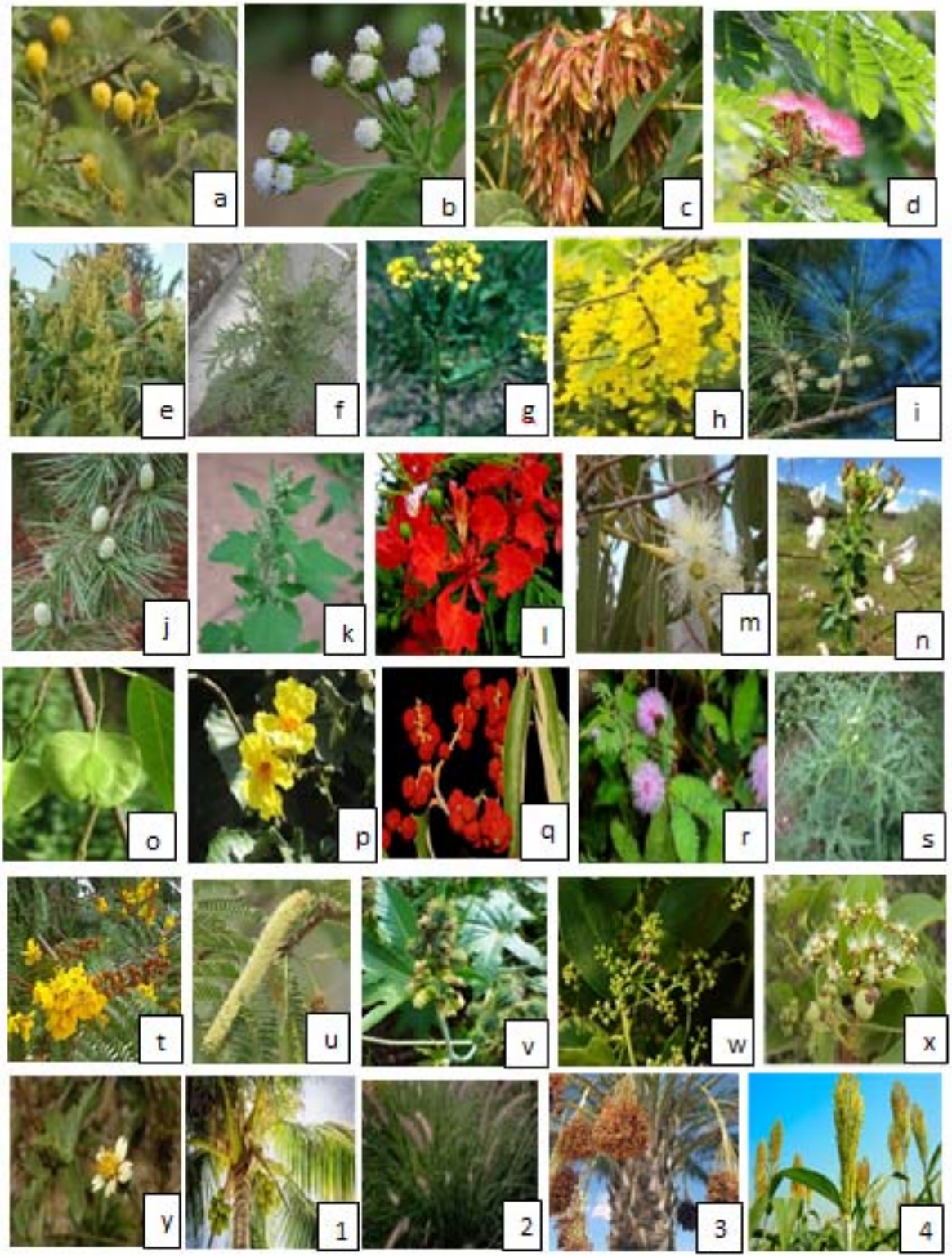

Plate I: *a. Acacia arabica; b: Ageratum conyzoides; c: Ailanthus excelsa; d: Albizia lebbeck; e: Amaranthus spinosus; f: Artemisia sieversiana;* g: *Brassica nigra; h: Cassia fistula: i: Casuarina equisetifolia; j: Cedrus deodora; k: Chenopodium album; l: Delonix regia; m: Eucalyptus globulus; n: Gynandropsis gynandra; o: Holoptelea integrifolia; p: Marchamia lutea; q:Mallotus philippensis; r: Mimosa pudica; s: Parthenium hysterophorus; t: Peltophorum pterocarpum; u: Prosopis juliflora; v: Ricinus communis w: Salvadora persica; x: Syzygium caryophyllatum; y: Tridax procumbens; 1: Cocos nucifera; 2: Pennisetum pedicellatum; 3:Phoenix dactylifera; 4: Sorghum vulgare.*

16. *Marchamia lutea* (Benth.) K. Schum. (Plate Ip)
Pollen grain 3-4 colpate, isopolar, radiosymmetric, prolate, circular with intruded colpi, exine reticulate. Fl.: February - April
17. *Mallotus philippensis* (Lam.) Muell.-Arg. (Plate Iq)
Pollen grain tricolporate, oblate sphaeroidal, 3-colporate & 3-zonocolporate, tectum verrucate. Fl.: October - November
18. *Mimosa pudica* L. (Plate Ir)
Pollen grain in tetrad, spheroidal, polar outline circular, equatorial outline quadrangular, obtuse plane, tetra pantoporate; sculpturing psilate. Fl.: August - January
19. *Parthenium hysterophorus* L. (Plate Is)
Pollen grain circular, radially symmetrical, isopolar, trizonocolporate, non- lacuriate and echinate. Fl.: May - March
20. *Peltophorum pterocarpum* (DC.) Backer. ex Heyne (Plate It)
Pollen grain in monad, polar outline circular, equatorial outline elliptic, isopolar, radial symmetry, tri-colporate; sculpturing reticulate. Fl.: January - May
21. *Prosopis juliflora* (Sw.) DC. (Plate Iu)
Pollen grain in monad, spherical or triangular in shape, radially symmetrical, subisopolar, with zonocolporate aperture, exine punctuated, scabriculate. Fl.: March - May
22. *Ricinus communis* L. (Plate Iv)
Pollen grain in monad, spheroidal, colporate, isopolar, prolate, aperture sunken, tricolporate, ornamentation-microreticulate, microgemmate. Fl.: February - June
23. *Salvadora persica* L. (Plate Iw)
Pollen grains prolate, tricolpate, colpus tending deeply sunken forming elongated fold or sutures, foveate, shallow and deep pits with wavy ridges, thick sexine. Fl.: March - April
24. *Syzygium caryophyllatum* (L.) Alston (Plate Ix)
Pollen grains are suboblate, isopolar, radially symmetrical, 3-(para)syncolporate, and weakly scabrate. Fl.: March - April
25. *Tridax procumbens* L. (Plate Iy)
Pollen grain in monad; polar and equatorial outline circular, prolate spheroidal; radial symmetry; tricolporate; sculpturing spinulate, densely distributed; spine narrowly triangular and pointed at tip. Fl.: Throughout the year.
26. *Cocos nucifera* L. (Plate I 1)
Pollen grain in monad; oblate spheroidal, hetropolar bilateral symmetry, monosulcate; sculpturing microreticulate. Fl.: Throughout the year.
27. *Pennisetum pedicellatum* (L.) Schult. (Plate I 2)
Pollen grain in monad, polar and equatorial outline circular, bilateral symmetry, heteropolar, monoporate, sculpturing psilate. Fl.: February - June
28. *Phoenix dactylifera* L. (Plate I 3)
Pollen grains elliptic and boat-shaped with one deep germinal furrow, ends of the grain smooth, rough exine showing tectate-perforate pattern, irregular and semi-circular lumina. Fl.: February - May
29. *Sorghum vulgare* Pers. (Plate I 4)
Pollen grain spherical, operculate-annulate pore, brevicerebro ornate exine pattern. Fl.: kharif and rabi season.

Ensuing from the data on allergenic plants, following guidelines are proposed for allergy management:

- The knowledge of diurnal, seasonal and annual fluctuations in airborne pollen in any geographical area is essential for effective diagnosis and treatment of pollen allergy, as the flowering seasons of allergenic plants span over the whole year, starting from early spring (trees), going over summer (grasses) to late autumn (weeds).
- In case of any visible allergic symptoms, it is important to consult allergists and immunologists to determine which type of pollen a person is sensitive to. This helps them to decide on medications and the best time to avoid outdoors.
- If cold symptoms prevail for more than 10 days, it is considered as an allergy.
- Pollen allergen data to be made public to facilitate patients to adapt their daily outdoor activities concerning the pollen peaks and off-peaks.
- Doctors should be circulated with periodic inputs on pollen watch from researchers and scientists.
- Certain preventive measures to be adopted are: keeping windows closed when pollen counts are high, using special HEPA filters in central air conditioning vents helps to filter out pollen from the air system, changing clothes each time after coming inside from the outdoors can limit pollen exposure, taking bath or shower each night before going to bed to rid the skin and hair of pollen built up, washing bed covers in hot, soapy water at least once per week, drying clothes in closed spaces.
- Useful home remedies to fight a pollen allergy include: drinking herbal tea infused with Ginkgo, milk thistle, red clover, stinging nettles.
- Avoid intake of milk, milk-based products.
- Other allergen avoidance methods include wearing sunglasses, using air-conditioners, where possible, and installing a car pollen filter.

CONCLUSION

A review of important plants responsible for producing allergenic pollen will help us in a preliminary screening of

the selected plant species before planting them for various purposes as it is not possible to get rid of plants that are already there and they cannot be removed completely. Of the total number of species studied many are introduced species. In urban cities most of the species are cultivated as avenues. It is hereby recommended to consider cultivation of native species in order to develop Green Park in urban areas which in turn reduce the menace of invasive species. Furthermore, the proposed guidelines for the management of pollinosis and other common allergic reactions will guide us in combating the effects of the disease and make us aware of being more vigilant.

ACKNOWLEDGEMENT

The author is thankful to Dr. M. Reema Kumari, Assistant Professor, Dept. of Botany, Maharani Lakshmi Ammanni College for Women Autonomous, Science Institute post, 18th cross Malleshwaram, Bengaluru, and Dr. K. Sasikala, Assistant Professor, PG. Dept. of Botany, Mahatma Gandhi Govt. Arts College, Mahe, Puducherry, for the support and necessary guidance in preparing the manuscript.

DISCLOSURE STATEMENT

The author declares no conflict of interest.

REFERENCES

Gill, N.K., Kumar, K., and Rai, N.K. (2017). Risk assessment of outdoor airborne biological allergens in India: A Review, *Journal of Entomology and Zoology Studies*, 5(4): 1069-1075.

Michael Hauser, Anargyros Roulias, Fatima Ferreira and Matthias Egger (2010). Panallergens and their impact on the allergic patient. *Allergy Asthma and Clinical Immunology*, 6: 1 - 14.

Paloma Carinanos and Manuel Casares-Porcel, (2011). Urban green zones and related pollen allergy: A review. Some guidelines for designing spaces with low allergy impact. *Landscape and urban planning,* 101(3): 205-214.

Singh, B. (2017). Glimpse of Clinical Aerobiology in India: An Overview, *Global Journal of Otolaryngology*, 12(3): 555840.

Singh, B. and Dahiya, P. (2008). Aerobiological researches on pollen and fungi in India during last fifty years: An Overview, *Indian Journal of Allergy, Asthma and Immunology*, 22 (1): 27-38.

Singh B. and Pawan Kumar, (2002). Common environmental allergens causing respiratory allergy in India, *Indian Journal of Pediatrics*, 69(3): 245-250.

Singh B. and Pawan Kumar, (2004). Aerial pollen diversity in India and their clinical significance in allergic diseases, *Indian Journal of Clinical Biochemistry*, 19(2): 190-201.

Smith, M., Berger, U., Behrendt, H., and Bergmann, K.C. (2014). History of Allergy in Bergmann, K.C. & Johannes R. (eds.) *Chemical Immunology and Allergy Series*, 100: 228-233.