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Review Article

# The Most Common Allergenic Tree Pollen Grains in the Middle East: A Narrative Review

CME Article

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## Abstract

Allergy is becoming a major disease burden globally. Pollens are considered as the main component of aeroallergens that lead to rhinitis and asthma. Due to the lack of a comprehensive investigation on most allergic pollens of trees in the Middle East, the present study aimed to conduct a comprehensive literature review on this topic. The main goal of the study was to provide a checklist for allergists and patients to easily identify the commonest allergic pollens in their locality. The present review provides a broad range of information on the types and geographic locations of the most common allergic pollens of trees in each studied country. In general, among the 23 studied countries, palm and mesquite trees were the common producers of pollen allergen in the Persian Gulf region. Olive tree is common in Turkey, Palestine, and Israel, whereas sycamore tree is the common allergen pollen in Iran. Considering the uneven geographical distribution of these trees in the world, allergists are unable to accurately select the appropriate extracts for the skin prick test based on the information from the neighboring countries. This scenario becomes more complicated if one adds the imported ornamental trees in the picture.

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## What's Known

- Allergy is a growing burden worldwide. Tree pollens are considered as one the most important sources of allergy. Pollens lead to rhinitis and asthma, especially in cities with ornamental trees in public areas.

## What's New

- The commonest tree pollens among the 23 studied countries in the Middle East have been reported.

## Introduction

Allergy is the hypersensitive reaction of the immune system of the body to an unknown substance. It follows with symptoms such as itching, allergic rhinitis, red eyes, eczema, hives, or even an asthma attack. The reaction of the immune system to normally harmless materials in the environment is the production of IgE by basophils and mast cells. Among the four types of hypersensitivity, allergy is categorized as type I (immediate) hypersensitivity.[1,2] The spectrum of manifestations in this inflammatory reaction can range from mildly uncomfortable to dangerous phenomenon,[3] such as sensitization to aeroallergens of plants that may be associated with serious morbidity.[4]

There are two general categories of risk factors for allergy, namely patient characteristics and environmental factors. Genetic makeup, age, sex, and race are the most significant factors of patient characteristics. Among environmental factors, exposure to infectious disease during the newborn period and early childhood, and pollutants in the environment are the most important causes.[5] However, pollens play a major role in the

onset of allergies.[6] It is approximated that about 40% of allergic patients have been affected by pollens.[7] On the other hand, global climate change occurs around the world, including the Middle East. A number of studies have shown a significant impact of climate fluctuation on the status of plants of each area and also on aeroallergens and their public and clinical healths.[8] This reality urges the need for an up-to-date, frequency, and distribution of allergenic tree pollens in each region.

Pollen is a fine powder-like substance released by weeds, scrubs, shrubs, grass, and trees. Wind is one of the main sources of pollen dispersal. Plants pollinated by animals are more frequent. However, in terms of allergy, people are more exposed to pollen dispersed by the wind. Usually, flowers that have brightly colored petals and sugary scents (to attract insects) are less allergic, while the pollens of flowers with drab colors and small flowers without an obvious scent (mainly dispersed by the wind) mostly cause hay fever or allergies.

Specific selection of aeroallergens for the skin prick test by allergists is not always evidence-based.[9,10] In the medical literature, there is no comprehensive report that describes the global status of allergenic pollens of trees in the Middle East (e.g. plants, distribution and allergenicity of pollen grains, or other plant attributes). The current literature review is aimed to cover the gap and present a checklist on the status of trees and pollens in the region. Herein, we report the allergenic pollens of trees in 23 Middle Eastern countries, including Afghanistan, Azerbaijan, Bahrain, Cyprus, Djibouti, Egypt, Eritrea, Ethiopia, Kuwait, Iran, Iraq, Libya, Oman, Palestine, Israel, Pakistan, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Turkmenistan, United Arab Emirates, and Yemen. It is intended to provide recommendations on aeroallergens of pollens in the Middle Eastern countries to allergists who are often required to give advice to patients that plan traveling to the region. We trust that the included information (e.g. distribution map of allergenic trees and pollens) would be helpful to allergists, health authorities, research scientists, and patients concerned with tree pollen allergies.

The search strategy was developed based on the guidelines of the NHS center for reviews and dissemination (CRD) (https://www.york.ac.uk/crd/).[11-14] The frequency of reported allergenic tree pollens varied from an adequate number of reports (17 from Iran, 12 from Turkey) to no reports from some countries (Afghanistan and Azerbaijan). A summary of the reported surveys is described below.

*Iran*

To identify all related published studies, Persian and English databases such as SID, IranMedex, PubMed, Scopus, and ScienceDirect were searched. In total, 17 articles on allergenic tree pollens were identified. Among the 31 provinces in Iran, only 16 (51.6%) provinces covered the topic. Furthermore, some of the reports provided information on a province over different time periods.[15-31]

Positive reaction to tree mix was reported in Mazandaran (50%), Tehran (26%), Fars (data not cited), Sistan and Balouchestan (41.2%), Khorasan-Razavi (24.8%), East Azerbaijan (11.3%), Kermanshah (18.9%), and Karaj (50%). As shown in table 1, the most common allergic pollens were Mesquite, Ash, Acacia, Eucalyptus, Cedar, Sycamore, Maple, Fraxinus excelsior, Pinus, Birch, Hazel, Alder, Pine, Elm, Plane tree, Olive, Botrytis, Salicaceae, Frene, Salix babylonica, and Ailanthus altissima. For convenience, common and scientific names of the relevant trees are provided in table 2.

The review of reported aeroallergens of pollens shows that most current studies from Iran were during 2003 to 2014. Although the geographical distribution of reports does not show a certain pattern, most are related to the western provinces of Iran (figure 1). The most commonly studied trees were 8 reports on White or European Ash (Fraxinus Americana and excelsior); 5 reports on Sycamore (Platanus orientalis); 4 reports on Birch (Betula betulaceae), Oak (Quercus robur), and Pinus (Pinus pinaceae); 3 reports on Elam (Ulmus ulmaceae) and Olive (Oleaceae); 2 reports on Maple (Acer pseudoplatanus), Willow (Salicaceae), Mesquite (Prosopis julifera), Eucalyptus (Eucalyptus globulus), and Hazel (Alnus serrulata); and 1 report on Weeping willow (Salix babylonica), Beach (Fagaceae), and Cedar (Cupressus sempervirens).

A synthesis of reported contributions showed that the most allergenic tree pollens according to the current reports were White or European Ash (min. 6%, max. 53.5%, mean 29.1%), Sycamore (min. 1%, max. 57%, mean 25%), Birch (min. 4%, max. 7.6%, mean 5.2%), Oak (min. 1%, max. 16.3%, mean 6.1%), Pine (min. 1%, max. 9.6%, mean 3.8%), Elm (min. 3%, max. 3%, mean 3%), Maple (3%), Willow (min. 8.3%, max. 13.5%, mean 10.9%), Olive (min. 9.6%, max. 22%, mean 15.8%), Mesquite (min. 65.1%, max. 65.9%, mean 65.5%), Eucalyptus (min. 21%, max. 21.7%, mean 21.3%), Hazel (5%), Weeping (37%), Beach (3.8%), and Cedar (27%). The cited percentages for each tree depict the frequency of allergy to tree pollens among the studied groups.

**Table 1:** The list of published papers on tree pollens aeroallergens based on the prick test in Iran with relevant details before November 2015

| Authors | Year of publication | Year of study | Sample size | Province | Reported allergic pollens (%) |
|---|---|---|---|---|---|
| Ahmadiafshar[15] | 2008 | 2003-2005 | 164 | Zanjan | Olive (22%), Salicacea (13.5%), Ash (20%) |
| Hedayat[16] | 2000 | 1998 | 1,077 | Isfahan | Salix babylonica (37%), Fraxinus excelsior (26%), Platanus orientalis (23%), Ailanthus altissima (14%) |
| Assarehzadegan[17] | 2013 | 2010-2011 | 299 | Ahwaz | Mesquite (Prosopis Juliflora) (65.9%), Acacia (Acacia longifolia) (48.2%), Eucalyptus (Eucalyptus globulus) (21.7%), White Ash (Fraxinus Americana) (52.5%) |
| Behmanesh[18] | 2010 | 2008-2009 | 133 | Mashhad | Tree mix (24.8%) |
| Bonyadi[19] | 2014 | 2010-2012 | 150 | Tabriz | Street trees (11.33%) |
| Farhoudi[20] | 2005 | 2002-2003 | 226 | Karaj | Tree mix (50%), Ash (40%), Cedar (27%), Sycamore (57%) |
| Fereidouni[21] | 2009 | 2006 | 356 | Khorasan Razavi | Fraxinus americana (53.5%), Pine (9.6%) |
| Fouladseresht[22] | 2014 | 2007-2010 | 157 | Kerman | Salicaceae (8.3%), Fagaceae (3.8%), Oleaceae (9.6%), Betulaceae (7.6%) |
| Ghaffari[23] | 2010 | 2006-2007 | 375 | Mazandaran | Maple (3%), Oak (1%), Fraxinus excelsior (6%), Birch (4%), Ulmus (3%), Pine (1%), Platanus orientalis (1%) |
| Ghaffari[24] | 2012 | 2006-2009 | 375 | Sari | Tree mix (3%), Platanus orientalis (1%), Oak (1%), Maple (3%), Hazel (Alnus serrulata) (5%), Fraxinus excelsior (6%), Ulmus ulmaceae (3%), Pine (1%), Birch (4%) |
| Hosseini[25] | 2014 | 2006-2009 | 313 | Tehran | Tree mix (26%) |
| Kashef[26] | 2003 | 2001-2002 | 212 | Shiraz | Acacia, Ash, Birch, Hazel, Oak, Elm, Pine, Plane tree |
| Nabavizadeh[27] | 2013 | 2011-2014 | 184 | Yasouj | Oak (16.3%), Tree mix (18.9%) |
| Shakurnia[28] | 2012 | 2010 | 354 | Ahwaz | Prosopis juliflora (65.1%), Eucalyptus (21%) |
| Khazaei[29] | 2003 | 1996-2003 | 1,286 | Sistan-Balouchestan | Tree mix (41.2%) |
| Mohammadi[30] | 2008 | 2005-2007 | 206 | Tehran | Tree mix |
| Pazouki[31] | 2008 | 2008 | 19 | Mashhad | Platanus orientalis (43%) |

*Other Middle Eastern Countries*

As shown in figure 2, among the 23 Middle Eastern countries, 8,071 article titles were observed, 181 abstracts read, 87 full-text articles studied, and eventually, 36 articles were selected. The distribution of the selected articles per country in terms of the number of reports, the most important allergenic tree pollens, and frequency of their allergenicity is described below.

- Cyprus: 2 reports; Acacia (29.4%) and Olive (23.7%).[32,33]
- Egypt: 1 report, Olive (12.5%).[34]
- Kuwait: 1 report; Eucalyptus (42.9%), Cajuput (53.5%), and Palm (39.6%).[35]
- Oman: 2 reports; Prosopis juliflora (10.4%), Queen palm and Cupressus (7%), and Willow (0.5%).[36,37]
- Pakistan: 2 reports; Morus alba (7%), Qatar the Beach (0.4%), Birch (1.1%), White mulberry (1.4%), Cypress (0.4%), and Olive (1.4%).[38,39]
- Palestine and Israel: 8 reports; Olive (37.2%), Pistacia (29%), Cedar (29.4%), and Pecan (30.3%).[40-47]
- Qatar: 1 report; Fagaceae (0.4%), Betulaceae (1.1%), Mulberry white tree (1.4%), Cypress (0.4%), Oleaceae (1.4%), Salicaceae (0.5%), and Tree mix (2.1%).[48]
- Saudi Arabia: 6 reports; Mesquite (42.3%), Palm (40%), Olive (35.8%), and Acacia (17%).[49-54]
- Turkey: 12 reports; Birch (23.4%), Beach (22.5%), Olive (30.2%), Acer (14.2%), Sycamore (20.3%), Oak (19.9%), Pine (8.2%), Pussy willow (16%), Elm (18%), Alder (19.1%), White mulberry (19.8%), Hazel (19.5%) and Horse chestnut (57.4%).[55-67]
- United Arab Emirates: 2 reports; Ricinus communis (6.3%)[53] and (23.5%),[67] Prosopis juliflora (12.6%)[53] and (12%).[67]

As indicated in table 3, there were no reports from Afghanistan, Azerbaijan, Bahrain, Djibouti,

**Table 2:** The common and scientific names of reported trees with allergen pollens in the Middle East

| Common name | Binomial name |
|---|---|
| Mesquite | Prosopis juliflora |
| Acaci | Acacia longifolia |
| Eucalyptus | Eucalyptus globulus |
| White ash | Fraxinus Americana |
| Cedar | Cupressus sempervirens |
| Sycamore | Platanus orientalis |
| Oak | Quercus robur |
| Maple or Acer | Acer pseudoplatanus |
| Hazel | Alnus serrulata |
| Elm | Ulmus ulmaceae |
| Pinus | Pinus pinacaea |
| Birch | Betula betulaceae |
| Olive | Olea europaea |
| Willow | Salicaceae |
| Beach | Fagaceae |
| European ash | Fraxinus excelsior |
| Tree of heaven | Ailanthus altissima |
| Weeping willow | Salix babylonica |
| Cajeput tree | Melaleuca cajuputi |
| White mulberry | Morus alba |
| Queen palm or cocos palm | Syagrus romanzoffiana |
| Pecan | Carya illinoensis |
| Alder | Alnus glutinosa |
| Pussy willow or goat willow | Salix caprea |
| Horse chest | Aesculus x carnea |

Eritrea, Ethiopia, Iraq, Libyan, Somalia, Sudan, Syrian, Turkmenistan, and Yemen.

## Discussion

Awareness of airborne pollens in each country and region can be regarded a necessity due to increasing mobility for leisure time and business activities.[68]

On the other hand, it is becoming clear that allergenic tree species may be considered as a problem within subtropical climate zones.[68] It has been shown that in some types of trees, pollen grains can exacerbate respiratory symptoms in allergic patients and result in hospitalization.[69,70]

Commercially, there are about more than 200 pollen grains, extracts of allergens for trees, grass, and weeds that are distributed by vendors worldwide.[71]

These extracts of allergens are used in the diagnosis of allergic disorders in prick tests and immunotherapy.[70] A selection of extracts for the skin prick test is done according to clinical data, regional distribution of plants, inter alia, season, regional distribution, and flowering cycles. Awareness of common aeroallergens of pollens in each area can assist allergists in choosing the most suitable allergens for the prick test and immunotherapy, as well as to address the


**Figure 1:** A schematic map illustrating various provinces of Iran with and without a report of aeroallergen pollens with common type in each region before January 2015.


**Figure 2:** The Middle Eastern countries tagged with the number(s) of reported reference(s) of allergenic pollens. NR: Not reported.

**Table 3:** The list of published papers on pollens of trees in countries located in the Middle East based on prick test before November 2015

| Authors | Year of publication | Year of study | Sample size | Country province | Reported allergic pollens (%) |
|---|---|---|---|---|---|
| Dalkan et al.[37] | 2014 | 2010 | 97 | Cyprus Nicosia | Acasia dealbata (29.4%), Olea europaea (23.7%) |
| Priftis et al.[38] | 2007 | 1996-1999 | 1,038 | Cyprus Maroussi, Aliartos | Olea europaea (N) |
| Elshabrawy et al.[39] | 2014 | 2012 | 96 | Egypt Qassim | Olea europaea (12.5%) |
| Ezeamuzie et al.[40] | 2000 | 1997-1998 | 553 | Kuwait | Cajuput tree (53.5%), Eucalyptus tree (42.9%), Phoenix dactylijera 39.6% |
| Al-Tamemi[41] | 2008 | 2004-2006 | 384 | Oman | Prosopis juliflora (10.4%) |
| Al-Amiri et al.[42] | 2002 | N | 71 | Oman | Queen palm and Cupressus trees (7%) |
| Ahmad et al.[43] | 2011 | N | 650,067 | Pakistan | Sensitive to pollens has been reported only (58.9%) |
| Abbas et al.[44] | 2012 | 2005-2007 | 1,000 | Pakistan | Morus alba (7%) |
| Sharif EI et al.[45] | 2003 | 2000-2001 | 273 | Palestine | Olea europaea, Betula verrucosa, Alnus glutinosa, Corylus avellana trees (N%) |
| Keynan et al.[46] | 1997 | N | 216 | Israel | Pistacia vera (31.5%), Pistacia atlantic (29.9%), Pistacia lentiscus (30.3%), Pistacia Plastina (24.6%) |
| Geller-Bernstein et al.[47] | 1996 | N | 1,573 Jews 90 Arab | Israel Sardinia | Olea europaea (40% in Jews and 16% in Arab) |
| Bibi et al.[48] | 2002 | 1998 | 448 | Israel Ash, kelo | Olea europaea (28.1%), Cupressus sempervirens (28.1%) |
| Geller-Bernstein et al.[49] | 2002 | N | 86 | Israel Shearam | Olea europaea (21%) |
| Tamir et al.[50] | 1991 | N | 19 | Israel | Olea europaea (100%)* |
| Graif et al.[51] | 2006 | N | 127 | Israel | Olea europaea, Cttpressus sctnpervirctis, Carya illinocsis (49%)** |

(*Contd...*)

**Table 3:** (*Continued*)

| Authors | Year of publication | Year of study | Sample size | Country province | Reported allergic pollens (%) |
|---|---|---|---|---|---|
| Rachmihl et al.[52] | 1996 | N | 395 | Israel Netzer, Tzireni | Carya illinocsis (11.6%), Cupressus sempervirctis (11.1%), Phoenix dactylijera (6.3%), Olea europaea (6.3%) |
| Sattar et al.[53] | 2003 | 2001-2003 | 1,106 | Qatar Doha | Fagaceae (0.4%), Betulaceae (1.1%), Mulberry white tree (1.4%), Cypress (0.4%), Oleaceae (1.4%), Salicaceae (0.5%), Tree mix (2.1%) |
| Almogren[54] | 2009 | 2003-2004 | 139 | Saudi Arabia Riyadh | Prosopis juliflora (72.1%), Phoenix dactylijera (23%) |
| Harfi et al.[55] | 1992 | N | 60 | Saudi Arabia | Phoenix dactylifera (25%) |
| Al-Frayeh et al.[56] | 1999 | 1995-1996 | 420 | Saudi Arabia Abha, Qassim, Hofuf, Gizan | Prosopis juliflora (38.8%), Olea europaea (35.8%), |
| Suliaman et al.[57] | 1997 | 1992-1994 | 806 | Saudi Arabia | Mesquite 46%, Acacia 29% |
| Hasnain et al.[58] | 2012 | N | 492 | Saudi Arabia, United Arab Emirates, Sudan | Ricinus communis (6.3%), Prosopis juliflora (12.6%), Phoenix dactylifera (12%) |
| Al-Frayh et al.[59] | 1992 | N | 240 | Saudi Arabia Riyadh, Mecca | Acacia SP (5% and 17%), Salix caprea (5% and 9%) |
| Geçer et al.[60] | 2012 | N | 100 | Turkey | Betulecea (alder, birch, hazel, hornbeam) N%, Salicacea (poplar, willow) N% |
| Aydin et al.[61] | 2009 | 2002-2006 | 1,552 | Turkey Istanbul | Betulaceae (23.5%), Fagaceae (19.4%) |
| Can IH et al.[62] | 2010 | 2007-2008 | 43 | Turkey | Acer (3%), Betulaceae (18.1%), Oleaceae (4.5%), Salicaceae (3%), Fagaceae (25.7%) |
| Senol M et al.[63] | 2006 | N | 246 | Turkey | Tree mix-1 (13%), Tree mix-2 (12%)≤ |
| Gokmen et al.[64] | 2012 | N | 437 | Turkey | Olea europaea (48.5%) |
| Sin et al.[65] | 2008 | 2003-2004 | 455 | Turkey | Cupressus sempervirens (14.3%) |
| Dursun et al.[66] | 2008 | 2004 | 54 | Turkey Ankara | Olea oleaceae (olive) (59.2%), Pinaceae (14.5%), Acer (25.5%), Populus (21.5%), Oak quercus (14.5%), Betula (18.2%), Salix (16.4%), Fraxinus (20%), Ulmus (18.2%), Aesculus (horse chestnut) (57.4%), Tilia (linden) (42.5%), Platanus (plane) (29.6%) |
| Tezcan et al.[67] | 2003 | 1994-2001 | 5,055 | Turkey Izmir | Alnus glutinosa, Corylus avellana, Populus alba, Ulmus scabra, Salix caprea, (overall 14%) |
| Yazicioglu et al.[68] | 2004 | 2000-2002 | 539 | Turkey Trakya | Olea europaea (8.9%), Corylus avellana (8.3%), Fraxinus excelsior (8.3%), Salix caprea (7.2%), Alnus glutinosa (5.9%), Populus alba (5.8%), Quercus robur (3.8%), Juglans regia (5%), Ulmus campestris (3.5%), Pinus sylvestris (2%), Platanus vulgaris (3.8%), Tilia platyphyllos (2.8%) |

(*Contd...*)

**Table 3:** (*Continued*)

| Authors | Year of publication | Year of study | Sample size | Country province | Reported allergic pollens (%) |
|---|---|---|---|---|---|
| Erkara et al.[69] | 2009 | 2000-2001 | 130 | Turkey | Alnus glutinosa (32.3%), Corylus avellana (30.8%), Populus alba (32.3%), Ulmus scabra (32.3%), Salix caprea (24.6%), Betula verrucosa (33.8%), Fagus sylvatica (26.2%), Quercus robur (41.5%), Platanus orientalis (27.7%) |
| Misirlioğlu et al.[70] | 2007 | 1995-2000 | 539 | Turkey Ankara | Betulacae, Moist zone frees, Park tree pollens, Fagaceae, Eastern trees, Mediterranean trees (overall 16.5%) |
| Cavkaytar et al.[71] | 2015 | 2013 | 318 | Turkey | Robinia pseudoacacia (9.7%), Cupressus arizonica (7.5%), Tilia platyphyllos (6.3%), Alnus glutinosa (0.3%) |
| Lestringant et al.[72] | 1999 | N | 263 | United Arab Emirates | Prosopis juliflora (23.5%) |

[N]Not determined, *Skin prick test has been done on selected community and has not been done on the general population, **Positive skin prick test for at least one tree pollen, [£]Tree mix-1: Willow, beech, maple, black mulberry, lime-tree, juniper, pine. Tree mix-2: Betula pendula, olive tree, poplar, peanut, oat, black alder, white ash. Cypress: Cupressus sempervirens, Olive: Olea europaea, Palm: Phoenix dactylijera, Pecan: Carya illinocsis, Mesqquite tree: Prosopis juliflora, Castor bean: Ricinus communis

source of the patient's allergy better. In addition, prevention and better treatment options can reduce the financial burden allergies placed on the healthcare services.

In central, north, west, and Eastern Europe, birch (Betula) has been reported as the most allergenic tree pollen grains in the months of June and July. While in central Alpine regions, pollen grains of Alnus virdis are common in the months of May and June.[71] The Middle East is a transcontinental region centered in Western Asia and Northeast Africa (figure 2), where that climate is dry in summers and mild in the winters. This fact has caused special vegetation with various types of allergenic pollen that are different from allergenic pollens in Europe.[68] The largest ethnic populations in the region include Arabs, Azeri, Persians, Kurds, and Turks. The climate of the Middle East is usually dry, although winters are mild with rain. According to the current literature review, we could not find any reports for allergic pollens of trees for 13 countries in the Middle East (56.5%). This may be due to our unfamiliarity with the local languages such as Arabic and Turkish and/or because such articles have only been published in domestic journals in local languages. Moreover, it seems that countries with lower economic status have few publications in the field of allergens whereas more contributions are found in PubMed from countries with a better economic ranking. The coverage of domestic trees varies in each area of the Middle East while palm and mesquite trees are common in countries located in the Persian Gulf area, olive is common in Palestine, Israel, and Turkey, and sycamore in Iran. The diversity of reported allergenic pollens in different areas of some countries should be taken into consideration and creating a panel of allergen extracts for the skin prick test that is decision-based according to locally reported allergic pollens can be more effective in the treatment of type I allergies. Furthermore, it is particularly notable that with an increasingly common practice of planting imported ornamental trees in public parks, highways, and streets, special attention should be paid to these new sources of pollens.

Iran is a large territory situated between the Persian Gulf and the Caspian Sea in western Asia, and its 1,648,195 km$^2$ area has a changeable climate. According to FAO reports, about 7% of the country is covered by forests. The forest slopes rising from the Caspian Sea are mostly covered with ash, oak, elm, and cypress, and at the same time, the central and western parts of the country are predominately covered with oak. However, the country has mostly semi-desert areas.[72] This pattern of vegetation coverage emphasizes the necessity of separately identifying domestic pollen grains aeroallergens in each region. The current review has shown that there are different types of allergic pollens in many Iranian provinces and areas; this needs to be investigated thoroughly. Although the reported allergic pollens in some

provinces are vague and need to be addressed in detail (figure 1), we should keep in mind that due to the special types of trees that are growing in specific climates, reported common allergic pollens of neighboring areas in the country may not accurately represent the adjacent geographical area.

The present literature review has shown that a severe allergy to tree pollens fluctuate from 1% to 65.9% (table 1). These findings emphasize the importance of pollens in causing allergic reactions in the inhabitants of the relevant regions of the country. Although mild symptoms of allergic reactions do not lead to hospitalization or absence from work, they may influence the sufferer's quality of life and bother individuals to such an extent that drug intervention may be needed. Hence, the main step in the management of allergy sufferers is to avoid sources of allergic pollens. This requires a vast survey to identify the type of pollen grains aeroallergens and severity of the allergic reaction.

A major concern about the published contributions in Iran is that the investigators have not indicated the ingredients of pollens used in the mixes extracts of tree allergens that they used for the skin prick tests. This information is important because pollen grains and extracts that are used in prick tests are supplied commercially and imported from other countries, hence they may not completely cover local pollens. In such cases, the skin prick test may not be a reliable tool for identifying allergies in patients.

## Conclusion

Although it was attempted to map a complete picture of allergenic pollens in the Middle East, this review showed that the available data are still fragmentary. Hence, it is still difficult to draw a clear and perfect map of allergenic pollen grains of the trees across the region. Owing to the span of countries and the various species of flowers grown on trees in each region, it seems that allergists who are trained in identifying and managing allergic sensitivities should be aware, not only of the history of the patients but also be aware of the common allergenic pollens in each area and their seasonal air dispersion. The potential of climate changes in the distribution of allergenic tree species should be noticed by allergists. Furthermore, distribution and frequency of various allergens of pollen grains of newly imported trees need to be given more consideration and included in future studies.

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