

## Ambrosia: A New Impending Disaster for the Israeli Allergic Population

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### Abstract

The pollen of Ambrosia (ragweed) is one of the major causes of pollen-induced allergy worldwide. This genus of plants has apparently evolved in North America but later spread into Europe and Asia. Flowering of the Ambrosias starts in mid-July and continues throughout the autumn and is a cause of major morbidity to allergic sensitized patients. The invasion of new species of Ambrosia into Israel is still in progress. Plants of *Ambrosia artemisiifolia* (American short ragweed), *Ambrosia trifida* (American giant ragweed), *Ambrosia confertifolia*, *Ambrosia grayi* and *Ambrosia tenuifolia* are increasingly found in Israel, mainly in the Hula valley in the eastern Galilee and near the Alexander River in the Sharon plain. From experience it is known that the time it takes to eradicate a new invasive species is limited. Action should be taken immediately or this new invasion will spread and cause a significantly increased burden of morbidity and increased health costs in Israel.

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Pollen-induced allergy is a well-known source of suffering for millions of people around the world, and several plant species are responsible. One of the major causes of pollen-induced allergy is the pollen of Ambrosia (ragweed).

The genus Ambrosia (Asteraceae) comprises 42 species that are distributed over North America and Europe. The plants are robust, having lobed or divided leaves with a characteristic scent. The plants flower in the late summer and autumn. The flowers of Ambrosia are inconspicuous and are organized in small greenish flower heads. Male and female flowers develop in separate heads on the same plant, where the male heads are at the top of the branches and the female ones are lower down. The male flowers produce a large number of pollen grains that are spread by the wind over large distances.

The genus apparently evolved in North America but was later spread into Europe and Asia. One species, *Ambrosia maritima* L., is native to southern Europe as well as to the Israeli coastal plain. It was first reported from the coasts of the Adriatic Sea some 150 years ago [1]. One cannot rule out the possibility that the clones of *Ambrosia maritima* in Israel also came from Europe and were introduced by humans in historic times. By the end of the 19th century three American species of Ambrosia were observed in Western Europe: *Ambrosia artemisiifolia* (short ragweed), which is the most common, *Ambrosia trifida* (giant ragweed) and *Ambrosia psilostachya* (perennial ragweed).

The main invasion of Ambrosia into Europe started after the Second World War, when seeds of Ambrosia contaminated shipments of grains and clover seeds that were sent from the

United States. The spread into Italy was mainly from Genoa to northern Italy and in France the plants spread from Marseille into the Rhone valley. From there the plants spread eastwards into Austria, Switzerland, Germany and Hungary [2]. The spread of Ambrosia plants in Germany occurred later but was extremely fast; the area infested by Ambrosia in 2007 in Germany was 10 times larger than what it was in 2000 [3]. In 2007 Ambrosia pollen was monitored also in northern Greece. Because of its severe health effects, strict regulations demanding the eradication of Ambrosia stands were implemented in France and in Hungary. Ambrosia airborne pollen grains have been monitored in the Rhone valley since 1992 [4,5] as well as in several cities across Italy [6].

The pollination season in Europe begins in July and ends in October. In Israel the pollination season of *Ambrosia maritima* extends from July to September whereas that of *Ambrosia confertifolia* starts in late August and continues until November. Pollen clouds of Ambrosia pollen traverse large distances. For example, pollen clouds of Ambrosia reached Vienna from eastern Slovakia [7], and they even reached Denmark from Hungary [8].

The incidence of Ambrosia allergy is high. Some 15% of the Hungarian population were sensitized to Ambrosia pollen and since 1990 the number has increased dramatically [7].

### The situation in Israel

Flowering of the Ambrosias starts in mid-July and continues throughout the autumn. Airborne pollen grains of Ambrosia have been monitored sporadically in Jerusalem. However, because of their scarcity such information was regarded by allergologists as irrelevant. Moreover, in the flora of Israel one can find the following statement: "The pollen of *Ambrosia maritima* is not allergenic" [9]. This statement was challenged in a later study [10]. Assuming that at least cross-allergenicity should exist between the allergens of all species of Ambrosia that are present in Israel, we skin-prick tested 100 atopic patients in the Tel Aviv area for their response to extracts of three species of Ambrosia (the two American species – tall ragweed and short ragweed – bought from Dome/Hollister Stier, and the local one, *Ambrosia maritima*, was extracted and prepared in our laboratory). Twenty-nine of the tested patients showed positive skin-prick test responses to *Ambrosia maritima*, 21 were positive to *Ambrosia trifida* (tall ragweed) and 24 were positive to *Ambrosia artemisiifolia* (short ragweed). Some 21% of the patients who were sensitive to *Ambrosia maritima* responded to the local species only, whereas 5–10% of those patients responded also to the two American species. Forty-



**Figure 1.** [A] A stand of *Ambrosia*. [B] A flowering branch of *Ambrosia confertifolia*

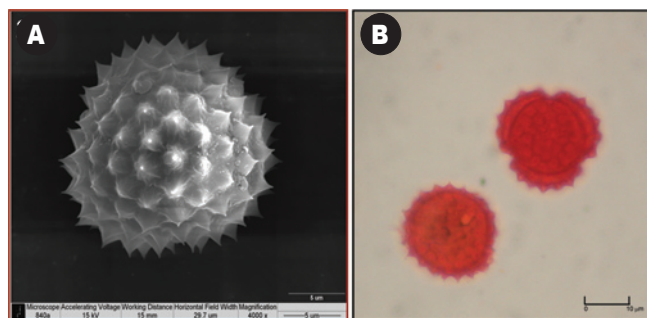
three percent of the patients who were sensitized to *Ambrosia* responded to the pollen extracts of all three species. This irrefutably indicates the similarity of the allergens of the pollen of the different species. However, apart from the common allergens of all three species, some specific allergens seem to exist in the pollen of the local *Ambrosia* plants and these are identified by local patients.

The invasion of new species of *Ambrosia* into Israel is still in progress. Plants of *Ambrosia artemisiifolia*, *Ambrosia trifida*, *Ambrosia confertifolia*, *Ambrosia grayi* and *Ambrosia tenuifolia* were found in Israel [Figure 1]. *Ambrosia confertifolia* has invaded the Hula valley in the eastern Galilee and the central coastal plain on a large scale and has now established dense stands there.

The flowering of *Ambrosia maritima* starts already in July whereas that of *Ambrosia confertifolia* starts only in late August. Pollen production by the coastal plain (Emek Hefer) population of *Ambrosia confertifolia* is extremely high and counts of some 3000 airborne pollen/m<sup>3</sup> of air were monitored early in October 2008. The release of the pollen starts early in the morning and peaks at noon. The distance that such pollen traverses depends of course on air turbulence, wind velocity and wind direction. Nevertheless, despite the fact that pollen concentration decreases with time and with distance from the source, it presumably remains far above the threshold concentration for induction of allergy responses (10–20 pollen/m<sup>3</sup> air) over a large area of the immediate environment.

The pollen size (projection area) of *Ambrosia confertifolia* seems to be somewhat smaller (~275  $\mu^2$ ) than the pollen of *Ambrosia maritima* (~330  $\mu^2$ ) [Figure 2]. Nevertheless, it is practically impossible to identify the two species by optical microscopy on the tapes of the common pollen traps.

The recently invading American ragweed species have spread rapidly and is now established in disturbed habitats, along road and railroad sides, mechanically cleared open areas, stream banks, and field margins. The main centers of invasion are the Hula Valley in the Upper Galilee and near the Alexander River in the Sharon plain. Attempts to eradicate the invading species were made only on a very small scale and were discontinued due to damage to agricultural crops that were caused by improper handling of the herbicides. Currently, not one of the regional or



**Figure 2.** Pollen of *A. maritima*. [A] By a scanning electron microscope. [B] Acetolized pollen grains by a light microscope

government authorities, Ministry of Health, Ministry of Agriculture, Ministry of the Environment or the Nature and National Parks Authority are taking any action aimed at eradicating or at least limiting the spread of this invasive species in Israel. This is a clear case where the impotency of the authorities will result in serious health problems that will cause great suffering to thousands of people and high costs to the public health system. From experience it is known that the time it takes to eradicate a new invasive species is limited. Once it spreads over too large an area it will be out of control. The time to take action is right now if we want to limit future damage to thousands of people caused by this aggressive allergenic invader.

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