

Why has ragweed—a highly allergenic plant—been spreading so quickly?

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Ragweed most likely was spread in North America along with settlers who got it right on the bandwagon when they cut down forests to create farmland in large scale. Credit: Thinkstock/Norwegian University of Science and Technology

Why has ragweed – a highly allergenic plant – been spreading so quickly? Researcher Michael Martin took a six-week road trip across the USA and collected 1000 samples of the plant from roadsides and herbaria to answer that exact question.

Common ragweed (*Ambrosia artemisiifolia*) is spreading throughout Europe, and allergy sufferers farther south on the continent now have yet another reason to dread [pollen season](#).

A single plant can produce up to one billion pollen grains in one season. But it is also a weed that can be a nuisance for farmers.

The plant is native to North America, and a big part of why it has become so widespread is probably due to European activity there over the last five centuries.

Before Europeans established themselves on North America in the 1500s, ragweed's range was limited. Today, the plant has spread to every continent except Antarctica.

Settlers

"Ragweed probably spread in North America via settlers who picked it up on their wagons when they cleared farmland and cut down forests," says Michael D. Martin.

He is an associate professor in the Department of Natural History at the Norwegian University of Science and Technology's (NTNU) University Museum in Trondheim and an expert on genetic analysis.

New layers of [plants](#), seeds and pollen constantly land on the ground and turn into soil. The deeper you go into the ground, the older the soil layers are, as long as nothing has disturbed them. By analysing samples from different strata, scientists can see how prevalent different plant species have been in an area at a given time.

Strata samples show a striking correlation between the prevalence of ragweed in different areas in North America in the past 500 years and

where settlers cleared new land. The plant seems to have followed settlers westward from the east coast of today's United States.

For some reason, ragweed appears to establish itself very quickly where the soil has been ploughed up or otherwise exposed.

One of the reasons why it spreads so effectively, including in Europe, may be that it quickly establishes itself on construction sites and along newly built roads. Then it outcompetes native species in areas where it takes over.

Why is this happening so fast?

Martin wants to determine the reason the plant spreads so quickly. Its dispersal has been described as a result of "rapid evolution." But Martin and others' research suggest that the plant had a great ability to adapt to changes well before Europeans settled in North America.

"We found significant changes in the [genetic structure](#) of the plant before it came to Europe. The genetic structure and ability to adapt to local changes may explain why it had such an ability to grow rapidly and spread so effectively when introduced to new areas," says Martin.

In other words: perhaps this ability for rapid adaptation was necessary for ragweed to survive in North America, a continent where conditions change quickly and the climate varies widely. Europeans' agriculture and demand for wood just improved conditions for the plant to spread, because they gave an evolutionary advantage to individual plants and concentrated ragweed populations that grew fast and could otherwise exploit new land to their advantage.

As a result, these particular plants, racing to outcompete other species,

are now spreading over large parts of the world.

Collected 1000 samples

Martin did his doctoral research on ragweed. A few years ago he travelled the eastern US by car for six weeks and collected plants for DNA analysis.

These plants came from 37 different locations, making it possible to see differences in the plants' genetic makeup from a large geographical area. Martin also compared the new specimens with historical ones from herbaria in North America and Europe, all in all totalling about 1,000 samples.

The aim was to map parts of the species' genetic structure and find relationships between ragweed's dispersal and different genes.

Martin received some strange looks from people who observed him picking and carefully keeping the weeds, but once they found out what he was doing, they quickly became favourably inclined. Farmers especially find ragweed bothersome, and Martin's research may one day be of benefit to them.

The analysis of the samples found correlations between the plant's ability to spread and different genes.

"We found dramatic changes in the genetic structure," said Martin.

But the research is far from over. No definitive answers have surfaced yet. The methods he and his colleagues are using are so new that the work would hardly have been possible five or ten years ago.

His latest project is to analyse ragweed from herbaria in many parts of

the world. His team's recent research analysed only parts of the plant's genetic material. This time the goal is to analyse the entire genome, and hopefully find several links between the dispersal of the plant and its genes.

Not in Norway yet

Ragweed has established itself in France, Italy, Switzerland and Hungary, among other places.

Scientists have feared that the plant would make its way to Norway. But so far ragweed has not posed a problem there, even though the pollen season has lasted one month longer in recent years.

The spread of [ragweed](#) to Norway is progressing slowly for the time being, since the growing season is too short for this heat-loving plant species to go to seed, according to pollen analyst Hallvard Ramfjord in NTNU's Department of Biology.

Ragweed "seeds that are spread by sunflower seeds in bird feed can germinate and flower, but don't have time to develop seeds themselves. From year to year we find at most only one or two pollen grains in our samples from these "stowaway" seeds, so we don't anticipate any dramatic development in this area so far," says Ramfjord.

More information: Michael D. Martin et al. The population genomic basis of geographic differentiation in North American common ragweed (*L.*), *Ecology and Evolution* (2016). [DOI: 10.1002/ece3.2143](https://doi.org/10.1002/ece3.2143)

Michael D. Martin et al. Herbarium specimens reveal a historical shift in phylogeographic structure of common ragweed during native range disturbance, *Molecular Ecology* (2014). [DOI: 10.1111/mec.12675](https://doi.org/10.1111/mec.12675)

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