sneezing for science

To answer the riddles of ragweed allergy, two men go boldly into unbreathable territory – an 18-acre field of the weeds.

by JEFF ESAU

It's mid-July 2009, and while North American allergy sufferers steel themselves for the misery of another August-to-October ragweed season, Mike Martin plans a ragweed road trip that will take him from Nova Scotia to Florida to Illinois. Motoring in his '98 Jetta modified to run on used vegetable oil, the 25-year-old environmental engineering student intends to gather ragweed pollen samples from all over the continent's northeast to identify genetic changes in the pesky plant during the past century.

A major field project the Johns Hopkins University PhD student undertook in 2006 with a fellow doctoral candidate first made him wonder: "What is it about this plant that makes it so successful at invading new territories?" Some of the research of Martin and Marcelo Chamecki will be published this fall in the *American Journal of Botany*, but they continue to tease out still more findings from their many gigabytes and video hours of raw data.

The ragweed field project happened by chance. Martin was searching for a PhD topic at the same time some federal funding became available for pollen-based research. "Everyone said, 'do your research on ragweed pollen – that's a hot topic because so many people are allergic,'" Martin told *Allergic Living*. "We were lucky to find a field outside Baltimore that had been left fallow and overrun by ragweed."

The research plan called for the collection of precise atmospheric and meteorological data in conjunction with ragweed pollen samples, which would reveal exactly how and when this invader released its highly allergenic pollen. Much of the equipment – pollen collectors and instrumentation to record wind, humidity, temperature – was attached to the two six-metre towers the two men erected, while high-powered cameras were aimed at the plants' pollen-releasing organs to get micro-scale video of the pollen exiting the flowers.

Key to the research was a sufficiently dense plume of pollen. That requirement was easily met: their 18-acre (six-hectare) field contained 89 ragweed plants per square metre – for a total of 5.3 million mature plants, each capable of producing one billion pollen grains per season.

Mike Martin (left) and Marcelo Chamecki review data in their quest to understand ragweed's "success" as an invader.

Martin says the threshold of allergic reaction to the pollen occurs when there are 10 grains per cubic metre. Their readings showed densities of 10,000 grains per cubic metre above the plants. To get to their towers and data collection sites, the pair had to cut paths through thick, two-metre high vegetation. Although neither Martin nor Chamecki is allergic to ragweed, they sneezed all the same from the irritating effect of so much pollen. From head to toe, they were covered with pollen, which stained their clothes yellow. "I had to throw away my shoes," Martin notes.

Reviewing their data, Martin and Chamecki began to understand why ragweed is such a invader. First, they were able to confirm that peak pollen release occurs in the early morning and is spread by wind currents throughout the day until plants have expended all their pollen. But the researchers discovered something new: ragweed tends to shed its pollen in giant clumps of up to 500 grains. Such clumping usually happens with plants that rely on insects, not the wind, to pollinate. Pollen clumps are usually heavy and settle near the plant.

However, Martin and Chamecki determined that the pollen clumps of ragweed begin breaking apart in air turbulence and, as they do, increasingly small clumps travel farther and farther from the parent plant – some travel up to 400 miles. Populations of the weeds, the researchers say, are healthy and genetically diverse.

Chamecki, who's now a meteorology professor at Pennsylvania State University, says the wind and pollen-release patterns observed in the ragweed data could help predict how pollen and other particles are spread in relation to weather systems, climate change and even land use. "If we have a good [computer]model that can predict pollen release and dispersion, we can actually start looking at how our actions on the environment will affect ragweed pollen concentrations in different areas." Chamecki has already developed a model of ragweed pollen dispersal. Now he's diving back into the field data to discover, with Martin's help, how a specific part of the ragweed flower plays a role in pushing the pollen out of the flower cavity.

While the pair's findings will be useful to those who seek to improve the public's health and quality of life, Martin sees ragweed continuing to thrive. The weed can thank humans for its evolutionary leg-up. "It's a species in transition," he says, noting that until Europeans started clearing land, the plant was uncommon. Now that it is propagating on a global scale through massive pollen emissions, and humans continue to spread its seed and literally prepare the ground for further colonization, there's no hope of getting this genie back in the bottle any time soon.

Read about Ragweed Allergy at allergicliving.com

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