Habitat fragmentation increases vulnerability to disease in wild plants

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This image depicts *Podosphaera plantaginis* on a *Plantago lanceolata leaf*. Credit: Susanna Kekkonen

Proximity to other meadows increases disease resistance in wild meadow plants, according to a study led by Anna-Liisa Laine at the University of Helsinki. The results of the study, analyzing the epidemiological dynamics of a fungal pathogen in the archipelago of Finland, will be published in *Science* on 13 June 2014.

The study surveyed more than 4,000 *Plantago lanceolata* meadows and their infection status by a powdery mildew fungus in the Åland archipelago of Finland. The surveys have continued since 2001, resulting in one of the world's largest databases on disease dynamics in wild plant populations.

"Contrary to expectations of ecological laws, there was less disease in those areas of the landscape that supported dense meadow networks. This suggests that disease resistance has increased in these areas where there's more gene flow between the plant populations. This hypothesis was confirmed in a laboratory study where we measured a higher susceptibility to infection in plants originating from isolated meadows. The results are a powerful demonstration that while plants stand still, their genes don't. Landscape structure strongly impacts how pollen and seed travel, shaping the genetic diversity of local populations," says Laine.

In nature, Laine says, diseases appear to be "between the devil and the deep blue sea" – either their host populations are small and fragmented or, when abundant, they have evolved higher levels of disease resistance.

Pathogens and pests are not unique to agricultural environment as wild populations also host diverse pathogen communities. However, devastating epidemics that are characteristic of agricultural pathogens are rarely documented in nature.

According to Laine, the mechanisms that keep diseases "in check" in nature are poorly understood. Most epidemiological research targets the phase of rapid disease spread. However, much could be learned by studying the mechanisms that enable long-term persistence of infection at moderate levels. The Plantago meadow network is ideal for this purpose as typically less than 10 per cent of the meadows are infected.

More information: Jousimo, J., Tack, A. J. M., Ovaskainen, O., Mononen, T., Susi, H., Tollenaere, C. & Laine, A.-L. Ecological and evolutionary effects of fragmentation on infectious disease dynamics. *Science*, DOI: 10.1126/science.1253621