MIST FLOWER FUNGUS

Entyloma ageratinae

White smut lesions

The history of mist flower fungus in New Zealand

A white smut fungus, native to Jamaica and Mexico, was used successfully in Hawai'i in a biological control programme against mist flower (see *Biological control success stories*). It was imported from Hawai'i by Landcare Research on behalf of the Auckland Regional Council in 1998. The fungus was released at nine sites in some of the worst mist-flower-infested areas at the top of the North Island (from Northland to Waikato) towards the end of 1998, establishing readily and quickly becoming common.

How would I find mist flower fungus?

You are most likely to see infected plants during the warmer months, as the fungus will probably be inactive during the colder months. This is because the optimum conditions for infection are warm temperatures (16–20°C) and high humidity. Under favourable conditions the symptoms show up after about 10–14 days, and the infected plants die a few months later. During active periods the white smut spores germinate and penetrate the leaves of mist flower plants. The plants develop angular reddish-brown lesions with yellow margins on the upper surfaces of leaves. If you turn these leaves over, the undersides of each lesion may have a powdery white appearance because large numbers of white spores have been produced there. These characteristic white spores give rise to the common name white smut. The spores are spread mainly by wind, but also by rain and splashing water over smaller distances. As the disease progresses, the lesions on the upper surfaces of the leaves coalesce and become dark brown.

White smut spores

There is another fungus (*Phoma* sp.) that causes similar disease symptoms on mist flower in New Zealand, except that it does not produce white spores. Unless the characteristic white spores of the white smut fungus are present, only an experienced plant pathologist will be able to tell symptoms caused by the two fungi apart.

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MIST FLOWER

How does mist flower fungus damage mist flower?

The fungus causes the leaves to die and fall from the plant prematurely. Under favourable conditions the fungus also invades stem tissue and causes dieback of shoots. After several months most, if not all, plants at a site may eventually become infected, leading to a decline in weed cover over wide areas.

Will mist flower fungus attack other plants?

No, mist flower fungus will only attack mist flower (*Ageratina riparia*). In laboratory tests the closely related Mexican devil weed (*Ageratina adenophora*) developed slight disease symptoms, but the fungus was unable to complete its life cycle on this host. In the field in Hawai'i and South Africa no disease symptoms have been seen on Mexican devil weed, even when the plant is growing beside infected mist flower.

How effective is mist flower fungus?

Mist flower fungus established readily everywhere it was released. It spread quickly without human intervention, reaching Great Barrier Island (about 80 km from the nearest release site) in less than 2 years. By June 2004 (5 years after release) the fungus had reached just about every mist flower population in the North Island, including small, isolated clumps in New Plymouth, Napier and Wellington. However, the fungus has not yet been recovered from Nelson, the only known mist flower infestation in the South Island.

In its first year the white smut caused considerable damage to mist flower plants at the nine sites where it had been released. Infected plants were heavily defoliated. Mist flower responded with strong regrowth, but rates of infection remained high (around 48%). During the second and third years following release there was less regrowth by the plants and infection levels remained high (about 50%). Successive defoliation and regrowth is costly for the plants and their ability to bounce back was expected to decrease with time. The percentage of ground covered by mist flower at each release point has steadily been declining. It was on average 90% when the fungus was released, and just 3 years later it had dropped to 35% .

A survey was undertaken in the Waitakere Ranges to monitor the impact of the white smut. In 1998 plots were established along walking tracks within the park and the cover of mist flower in each was estimated. The plots were assessed again in 1999, 2001 and 2003. In the

The Brookby release site before (left) and after (right) the release of the fungus.

Mist flower cover in the Waitakere Ranges 1998–2003

Estimated percentage cover of mist flower within 5 m of walking tracks	1998	1999	2001	2003
	24,110m^2	33,010m^2	11,220m^2	4,660 m^2

first year mist flower was obviously still spreading quickly; however, once the white smut established and began attacking plants it decreased sharply (see table).

We predicted that the gall fly (*Procecidochares alani*) released in 2001 would complement the fungus because it attacks stems rather than leaves (see *Mist flower gall fly*). A glasshouse study has compared the impacts of the two agents on mist flower. Surprisingly, the two agents together did not appear to do much more damage to the weed than each agent on its own. Fortunately they also don't appear to interfere with each other and were able to significantly reduce the growth of the plant and amount of flowering whether they were together or alone. Outdoors, the activity of the fungus varies throughout the year, being most severe in spring when warm and damp conditions are ideal for disease development. It is hoped that the fly will add pressure to the plant towards the end of summer, because it may tolerate hotter and/or drier conditions.

Additional plots were set up in the Waitakere Ranges in 1999/2000 so any changes that occurred when mist flower declined could be documented. Initially plots infested with mist flower had significantly fewer native plant species and greater cover by exotic plant species (over and above mist flower) than plots without the weed. Four years into the trial the average percentage cover of mist flower had decreased from 74% to 1.5% (see photos). Overall, data to date suggests that biological control of mist flower is benefiting native species more than other weedy exotics.

Expectations of the white smut in New Zealand were high, as this was the most effective of the three agents used in the successful programme against mist flower in Hawai'i (see *Biological control success stories*). The fungus appears to be meeting those expectations, with other forms of control no longer required.

How can I get the most out of mist flower fungus?

Redistribution is unnecessary in the North Island. However, if you do come across any infestations that have not yet been infected (on an outlying island, or in the South Island), then it may be worth taking action. To move the fungus, try soaking infected leaves in a small amount of water (e.g. 2 cm in the bottom of a bucket), and then spraying the spore suspension onto uninfected plants. This spore suspension should keep for up to 30 hours if refrigerated. You may also be able to infect mist flower by simply dragging a bundle of infected stems through wet, uninfected plants. Afterwards, leave the infected leaves and stems scattered amongst the uninfected plants. Likewise, wiping a damp sponge over the underside of infected leaves, and then wiping both sides of uninfected leaves with the sponge on the same day, may be sufficient for transferring the fungus. If you try this method be sure to keep the sponge cool and wet during transit.

If transfer has been successful, characteristic white smut pustules should appear on the underside of mist flower plants after about 4 weeks.

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