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WHAT'S NEW?

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Moth plant beetle

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Galls on Native Broom No Cause for Concern

The emerging success of the broom gall mite (*Aceria genistae*) has people starting to notice galls on other plants too. The highly conspicuous galls now appearing on Scotch broom (*Cytisus scoparius*), in many areas, are deformed lumps of plant tissue that form at the base of the stem buds, where the gall mites attack the plant in spring. The galls range in size from 5 to 30 mm and stunt the growth of the plant. "We are seeing, and hearing reports of heavily galled Scotch broom plants dying, which is very encouraging," said Lynley Hayes. "But we are also getting regular queries from people saying they have seen galls on native broom (*Carmichaelia* spp.) and are concerned that the broom gall mite could have jumped host. But rest assured," she said. "Specimens sent in have been passed on to a mite specialist to confirm their identity, and the galls on native broom are the result of a native gall mite (*Aceria carmichaeliae*), which people just haven't noticed before."

Host range testing undertaken before the broom gall mite was introduced into New Zealand in 2006 showed convincingly that this exotic mite does not attack native broom and is unable to complete its life-cycle without access to Scotch broom. "It is extremely unlikely that the highly host-specific broom gall mite will damage any other plants, although spill-over damage can sometimes occur on the close relative, tree lucerne (*Cytisus proliferus*), if broom gall mites are present in big numbers nearby," confirmed Lynley. The broom gall mites are not able to persist solely on tree lucerne though.

"A similar thing happened about 20 years ago, after we released gorse spider mite (*Tetranychus lintearius*), and people then noticed mites on *Coprosma* a few years later. In this case it turned out to be a very similar-looking mite (*Tetranychus* sp. near *pacificus*), which had self-introduced and was attacking *Coprosma*," said Lynley. It is great for biosecurity in New Zealand that people always report seeing anything unusual, just in case it is a new unwanted invasive species needing to be dealt with promptly or some issue requiring further investigation . "We are always happy to follow up if people have any concerns about weed biocontrol agents being found on other hosts. So please keeping the queries coming," said Lynley.

The Naturewatch website is a helpful resource when people find things and want them identified, or wish to learn more about them. For example, for further details about the native broom gall mite, see: http://naturewatch.org.nz/taxa/384892-Aceria-carmichaeliae

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Native gall mites on native broom

Introduced gall mites on Scotch broom

Japanese Butterfly Takes Flight

New Zealand's newest butterfly, the Honshu white admiral (*Limenitis glorifica*), has established well near the Coromandel Peninsula and is starting to spread its wings in other regions where Japanese honeysuckle (*Lonicera japonica*) is a target weed.

The butterfly was first released near Paeroa, in the Waikato, in November 2015 and the population has continued to thrive there. After initial difficulties trying to rear the butterflies in captivity, suddenly there has been great success. "We tried almost everything to get the butterflies to mate, including hand-pairing them and releasing them in a purpose-built butterfly house, but never got fertile eggs," said Quentin Paynter, who has been leading the project. "Because we couldn't get them to mate in containment, we had to import field-collected adults from Japan that had already mated and release their progeny and hope for the best. Luckily this worked and the butterfly became established," said Quentin.

"We returned to the release site in the spring of 2016 to harvest butterflies for redistribution," he said. "The plan was to collect mated adult females from the field and use their offspring for redistribution, but Chris Winks decided to keep a few larvae, rear them through to adults and release them in one of our shade houses at the Tamaki Campus in January 2017," Quentin said. Amazingly, the conditions in the shade house were conducive to mating, resulting in an astonishing number of caterpillars that chewed through large quantities of Japanese honeysuckle plant material.

"Due to logistics and staffing resources, we decided to shift the butterfly rearing operation from Auckland to Lincoln. But no-one really expected that we would have a glasshouse full of butterflies quite so quickly," said Hugh Gourlay, who has been managing the rearing. "It was an amazing sight, and quite a few of the staff from around the campus came over at lunchtime for a stroll through the glasshouses and an 'out of office' experience," Hugh said.

As a result of this success, 12 more releases in other regions of New Zealand have been made this summer. Hugh and colleagues sent out approximately 60,000 mid-sized caterpillars on cut plant material for regional councils to release. "All going well, we should have populations establishing in Nelson/Marlborough, Wellington, the Bay of Plenty, Taranaki and other parts of the Waikato," said Hugh. More butterflies will be reared for release next summer.

Japanese honeysuckle remains one of the most widespread weeds in New Zealand and grows especially fast in the warmer conditions found further north. "The caterpillars hibernate amongst the plants during the winter months and can withstand cold temperatures in their native range in Japan, so we don't think they will be restricted to the North Island,"


White admiral pupa

said Quentin. "It is really a matter of placing them where they are needed most at this stage," he added.

The other agent being released to control Japanese honeysuckle is the longhorn beetle (*Oberea shirahatai*), which attacks the stems of the plant. "Rearing this agent has also had its challenges," said Hugh. This beetle has a long life-cycle and seems to take 2 years as a rule to complete development. Mass-rearing of this agent is therefore very time-consuming and expensive, so the plan is to rear enough beetles to establish them at two field sites, from which they can be harvested and redistributed to other sites in the future.

As a step towards this goal, the first field release of the stem beetle was made at a site in the Waikato this autumn. Holes were drilled into Japanese honeysuckle stems and the larvae inserted inside and then plugged with vaseline. More beetles will be released over time, including adults, as numbers permit. As well as rearing some beetles for the field releases on whole plants at Lincoln and Auckland, which is a very slow process, we are attempting to rear larvae on a highly nutritious artificial diet, to try to speed up development. "At present, this approach is looking quite promising and we have around 300 beetle larvae in tubes of diet in a controlled temperature room at Lincoln, which is set up to simulate winter conditions," Hugh explained. "We are hoping they will pupate and emerge as adults ready for a field release next summer."

This project is funded by the National Biocontrol Collective. Read more about the white admiral and watch a video at: www.landcareresearch.co.nz/about/news/snippets/hitting-back-at-japanese-honeysuckle

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A Lucky Break in Uruguay

In February, Hugh Gourlay and Hamish Hodgson (Waikato Regional Council) travelled to Uruguay to search for biocontrol agents for moth plant (*Araujia hortorum*) and woolly nightshade (*Solanum mauritianum*). Unsure of what they would find there, this excursion into the unknown has provided some much-needed breakthroughs.

Moth plant and woolly nightshade are mostly problematic in the North Island of New Zealand. Moth plant is an invasive vine, considered one of the worst weeds in Auckland and Northland. Not only is it a threat to native vegetation, but it's also a nuisance in urban areas, where it invades gardens and parks. The latex sap of moth plant is poisonous and can cause skin irritation. Woolly nightshade is a small, invasive tree, which is also poisonous.

A lace bug (*Gargaphia decoris*) introduced to attack woolly nightshade in 2010 is showing great potential. Large populations of the lace bug have already built up at some sites, leading to substantial defoliation and even the death of woolly nightshade plants, especially at shaded sites. However, there has always been a question about whether additional agents might be needed to adequately supress this plant in all situations where it is problematic, and some work has been undertaken to explore potential options just in case they are needed.

No agents have been released against moth plant yet. The prospects of successful biocontrol look good, but challenges have arisen with gaining permission to export potential biocontrol agents from South America, causing frustrating delays. A beetle whose taxonomy is currently being clarified (likely *Freudeita cupripennis*) was approved for release in New Zealand back in 2011. The adults feed on the foliage, but it is the larval stage that is most damaging, feeding on the roots. Efforts to get a shipment of the beetle from Argentina or Brazil, to allow mass-rearing and field releases to get underway, have not been successful. Similarly, efforts to get a shipment of a promising fly (*Toxotrypana australis*) for further study have been unsuccessful. The larvae of this fly feed inside the pods, destroying the seeds and, if suitable for release here, could potentially reduce the billions of wind-borne seeds that lead to new plants and infestations each year. A rust fungus (*Puccinia araujiae*), approved for release in New Zealand in 2015, also remains on hold while export permitting issues are resolved.


Hamish finds beetles!

However, recently an opportunity to try to source the moth plant insects arose in Uruguay, a country in which we have never worked previously. "Thanks to the help of Beatriz Scatoni (Universidad de la República de Uruguay) and Maria Duter (Uruguayan consular representative in New Zealand), we were successful in obtaining a collecting and export permit," explained Hugh. Although a permit was secured, Hamish and Hugh did not know if they would actually be able to find what they were looking for there. A tephritid fly expert in Uruguay, Soledad Delgado-Jorge, who works with Dr Scatoni, agreed to help with the surveys, as did Soledad Vilamill (Universidad Nacional de Sur), who has been assisting with moth plant insect work in Argentina.

"Our first week in the country was unbearably hot, with high daytime temperatures and no breeze, but fortunately the heat didn't last and we were able to cover more ground once it was cooler," said Hugh. While searching around the outskirts of towns and villages in rural Uruguay, Hugh and Hamish were taken to some unpromising sites, such as drainage ditches full of rubbish and debris. However, this is where they struck gold, finding 50 beetles within 5 minutes, and they even found some fly maggots in the moth plant seed pods.

At another site they were accosted by some knife-wielding locals who were enthusiastically pruning grape vines, but despite their offers of help no beetles were collected there. "We weren't so keen to visit vineyards or orchards, because quite often insecticides are used on these properties, which knock back all the insect life in the area, so roadside ditches and reserves are usually better places to look," said Hugh. At another site, after battling with thorny acacia bushes, they were rewarded with another 150 beetles. "We were wary of collecting too many early on since we would have to keep them alive for another 10 days until our departure. We had lots of beetles in plastic boxes sitting in the bedroom of my apartment, and were unsure whether they preferred new or old foliage and how long they would live," Hugh said. Also, the export permit issued by the Ministry of Agriculture in Uruguay only covered insects and not plant material, so Hugh had to be sure the beetles were well fed and would last the journey back

to New Zealand without food. As it turned out, 250 beetles made the journey back, with some even producing eggs in transit. The beetles have continued to pump out eggs ever since, allowing various techniques for rearing the beetles to be explored and for their host range to be checked, in case of regional variation.

The flies proved harder to find. "Despite opening over 100 moth plant pods on one day we found no fly larvae," said Hamish. "Ironically, there was a moth plant growing over the road from our accommodation, which turned out to have some infested pods, but we were only able to bring home a total of 35 pupae," said Hugh. The plan is to rear the pupae through to adulthood and get a colony of the fly going in containment to learn more about their biology. There is very little known about the fly, making it a steep learning curve when it comes to keeping them alive or breeding them in captivity. "We will be drawing on all of our collective experience within the biocontrol group," said Hugh.

The team did not encounter the moth plant rust fungus of interest to New Zealand in their travels. Surveys undertaken previously in Argentina have found that the rust is quite rare in the field because of its requirement for fairly wet weather and discovery that it is commonly attacked by a hyperparasitic fungus. Collaborator Freda Anderson (Centro de Recursos Naturales Renovables de la Zona Semiárida, CCT-CONICET Bahía Blanca) has developed a culture of the rust that is free of the hyperparasite, and is keeping it safe for us until an export permit can be issued to allow her to send it to New Zealand.

Once satisfied with their efforts on the moth plant agents, Hamish and Hugh turned their attention to woolly nightshade. They were hoping to find a stem-boring weevil (*Conotrachelus squalidus*) and a flowerbud-feeding weevil (*Anthonomus morticinus*), but were also on the lookout for other potential agents of interest. Colleagues in South Africa who had previously looked for biocontrol agents for woolly nightshade in the region were able to offer lots of useful tips. "We were advised by them and others that woolly nightshade mostly grew in the northern and east coast regions, so we headed up there for a few days," said Hamish.

"The plants we saw were quite heavily damaged, with large branches dead on them, suggesting there were larvae burrowing inside the stems," Hamish said. "We collected some larvae from these but also noticed a large number of galls on the plants," explained Hamish. "What was really interesting to me was seeing woolly nightshade growing in its native range, where it isn't an invasive weed," said Hamish. "The plants were smaller, with far fewer seeds and much smaller leaves." A number of insects were collected from woolly nightshade and have been sent away to taxonomists for identification. This will

Collected beetles being held prior to shipping.

help to determine whether species of interest to the project can be collected from Uruguay in the future.

"I found the trip extremely valuable from a number of points of view," said Hamish. "It gave me a much better insight into the ups and downs and processes involved with sourcing insects from other countries, and boosted my confidence that biocontrol offers a great opportunity to control invasive weeds like woolly nightshade." Hamish also had the responsibility of bringing the insects back home. "All our hard work was in my hands and it was a relief when all my bags turned up safely in Auckland," he said. Another of the trip highlights for Hamish was managing to order a takeaway coffee without sugar in Spanish!

Since returning to the Waikato he has been thinking about good potential release sites for the moth plant beetles. The approval to release the moth plant beetle in New Zealand has lapsed, so a new application will be prepared soon, and the first field releases might be able to get underway as soon as spring 2019.

The moth plant and woolly nightshade projects are funded by the National Biocontrol Collective.

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Moth plant beetle.

Tradescantia Be Gone!

Brazilian beetles, first released in 2011, haven't wasted any time getting stuck into the swathes of tradescantia (*Tradescantia fluminensis*) that are infesting gardens, reserves and conservation land. Three beetle species have been released – a leaf beetle (*Neolema ogloblini*), a stem beetle (*Lema basicostata*), and a tip beetle (*Neolema abbreviata*) – which were selected to attack different parts of the plant.

This summer Sam Cranwell, a visiting student from the University of Birmingham, Chris Winks, and Quentin Paynter have been revisiting some of the monitoring plots that were established to check on the beetles' progress. "A key purpose of the monitoring plots is to assess the impact the beetles are having on tradescantia biomass, but we are also interested in looking for evidence that native vegetation is starting to recover," said Quentin, who is leading the assessment work. Most of the monitoring has focused on sites where the leaf and stem beetles were released, since fewer plots were set up by regional councils for the tip beetle.

Information about how the beetles are performing in different sites or regions will help to determine where releases of the yellow leaf spot fungus (*Kordyana brasiliensis*) might be most useful. The first release of this fungus was made in March in Rotorua, and releases have also been made in the Waikato, Wellington and Tauranga. This is significant because, like the beetles, it is the first time this fungus has been released as a biocontrol agent in any country. The fungus damages the epidermal layer of the leaf, causing it to turn yellow and shrivel up. "So if it establishes, the fungus should be quite obvious to the casual observer," said plant pathologist Chantal Probst, who has been infecting tradescantia plants, ready for distribution. "In the longer term we will use the monitoring plots to determine how much of an impact the fungus is having in addition to the beetles and whether it is complementary in terms of coexisting with the beetles," said Quentin. "We don't anticipate any issues since the two coexist in their natural range in Brazil," he said.

"The leaf beetle has established at all of the monitoring sites in the upper North Island, but appears to have failed to establish at monitoring sites set up in the Manawatū–Wanganui and Wellington regions," said Quentin. We know the leaf beetle can establish in these more southern localities, as it is doing well at a site in Palmerston North, so failure to establish at the southern monitoring sites might just be bad luck or indicate that getting establishment there is harder. The cooler climatic conditions further south will probably affect the number of generations produced per season, and if a population builds up more slowly, releases may be more susceptible to failure. "Hopefully it's just a case of making bigger or multiple releases to ensure beetle establishment in cooler sites," suggested Quentin. "Or perhaps redistributing the beetles from cooler sites where they are doing well, given they might have adapted to local conditions," he added.

However, the good news is that the leaf beetle has established really well at the northern survey sites, with impressive results already. "At Mt Smart, in Auckland, tradescantia has now all but gone from some of the plots, and has been replaced by a variety of natives," said Quentin. "Even in quadrats where the percentage cover of tradescantia is still quite high, the biomass has reduced considerably. For example, the percentage cover of the first quadrat surveyed at Mt Smart in sampling last February was 71%, versus 93% in the original (pre-biocontrol) sampling done in 2011. However, the mean height of tradescantia recorded for this quadrat was much lower (13.4 cm versus 39.2 cm) than in the original sampling, and we calculated from these measurements that the tradescantia biomass has declined by 74%, from 510 g/m^2 to 133 g/m2 in that plot," Quentin said. Past research has indicated that tradescantia biomass needs to be reduced below 200 g/m2 to give native plants a chance to establish and emerge above the weed. "So even though the reduction in percentage cover looks quite modest, the tradescantia biomass should now be low enough to allow native plants to recover in that plot. It is

The stick in the corner shows the substantial change in height of tradescantia between 2011 (39.2 cm, left) and 2018 (13.4 cm, right).

Mt Smart, Auckland, before (2011) and after (2018) leaf beetles were released, showing tradescantia decline and resurgence of native plants.

still relatively early days and we would expect the impacts of the beetle to become even more apparent over time," said Quentin.

Similar impacts were seen at Whitford (Auckland), Kerikeri and Maungatapere (Northland), indicating that the leaf beetle has already succeeded in reducing tradescantia below the required threshold in these northern sites. "In some places, damage by the beetles had been so extensive that the posts marking the edge of the plots had been left 'high and dry', with no tradescantia remaining, and in other plots native plants were clearly taking over," said Quentin.

The impact of the stem beetle has been monitored at sites in Northland, Auckland and the Bay of Plenty, and this species is also showing impressive biocontrol potential. "The damage is encouraging but somewhat patchy. In wetter sites the percentage cover is still quite high, perhaps because tradescantia stems severed by larval feeding are capable of re-establishing, but bare patches are appearing in drier areas because severed stems likely desiccate and die," said Quentin.

"Longer-term monitoring is needed to see how well the beetles will do in various combinations, and also further south and in wetter areas. But if they don't succeed in these locations, we think the yellow leaf spot fungus might be the answer, based on our observations of habitats where it was most common in Brazil," Quentin added.

"Overall, the results suggest that there is good evidence that the beetles are already achieving the goal of reducing tradescantia biomass to below threshold levels, at least at release sites in the northern half of the North Island. So, once we get all four agents out there working together we are quietly confident of a successful outcome nationwide," said Quentin.

The assessment trials are funded by the Ministry of Business, Innovation, and Employment as part of Manaaki Whenua – Landcare Research's Beating Weeds programme. We acknowledge the assistance of Auckland Council, and the Northland, Horizons and Greater Wellington Regional Councils, with setting up and monitoring plots. Efforts to release the tradescantia yellow leaf spot fungus are funded by the National Biocontrol Collective.

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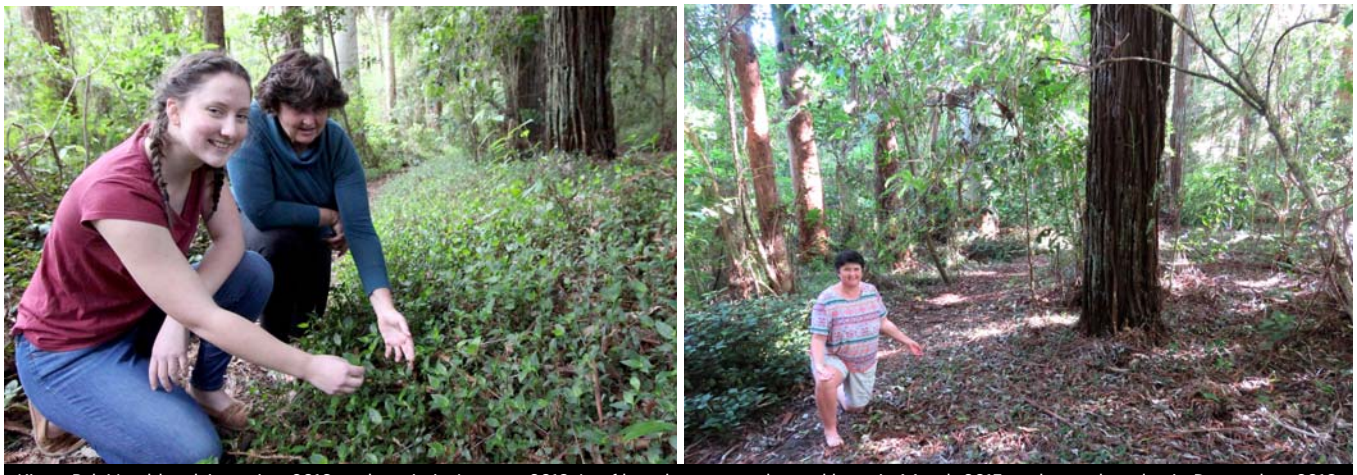

Kings Rd, Northland, in spring 2016 and again in January 2018. Leaf beetles were released here in March 2015 and stem beetles in December 2016.

Jenny Dymock

Old Man's Beard to Face New Attack

Entomologist Lindsay Smith is visiting Serbia in May to look for some small but hopefully 'mighty' biocontrol agents that might be able to finally give old man's beard (*Clematis vitalba*) a much-needed trim. This highly invasive vine smothers native trees and sub-canopy plants, preventing regeneration and modifying the natural interactions necessary for a healthy forest ecosystem. "Although it has no beneficial environmental or economic attributes, old man's beard has been a difficult biocontrol target because of the need to avoid harming our native *Clematis* species," explained Lindsay.

Attempts to introduce biocontrol agents in the 1990s have been less than successful, for a variety of reasons. Initial damage from a fungal disease (*Phoma clematidina)* looked promising, but the disease died out. A leaf-mining fly (*Phytomyza vitalbae*) established well, but it is being attacked by its own natural enemies and so is not putting enough pressure on the plants to significantly stunt their growth. A sawfly *(Monophadnus spinolae)* was also introduced, but despite being released at a number of sites around New Zealand, it has only been detected in low numbers at one site near Nelson. "We don't fully understand why the sawfly didn't establish well," said Lindsay. It was a difficult insect to rear and, with hindsight, the material released may have been significantly genetically bottlenecked."

"We are facing an uphill battle with this plant and it remains a serious threat, so we aren't giving up just yet," said Lindsay. "We recently ruled out a beetle (*Xylocleptes bispinus*), which kills whole vines because it posed too great a risk to native *Clematis*. However, we are planning to have another go at establishing the sawfly, which can cause substantial defoliation when present in large numbers," he added. The sawfly will be re-released, in much bigger numbers and with better genetic diversity, at a site carefully chosen to be as be safe as possible from disturbance. "We will also take steps to ensure that wasps don't impact on the newly released sawflies, although we don't think that is a key reason for the poor establishment previously, since the larvae readily ooze haemolymph when threatened, which deters predators," he explained. The sawfly population in Serbia may also have a better climate match with New Zealand than earlier introductions, allowing it to do better.

Old man's beard, showing stunting caused by a leaf- and bud-galling mite after 60 days

Biljana Vidovic

Another option currently being pursued is a leaf- and bud-galling mite (*Aceria vitalbae*), which damages and stunts growing tips. Host range testing of this tiny mite has recently been completed by Dr Biljana Vidovic from the University of Belgrade. "Eriophyid mites typically have a very narrow host range, and this one proved no exception," explained Lindsay. Fourteen species or hybrids of *Clematis* were sent to Serbia, and galls with viable mite populations only developed on old man's beard. "We are now at a point where we can apply to the Environmental Protection Authority for permission to release the mites," said Lindsay.

Horizons Regional Council will be the applicant on behalf of the National Biocontrol Collective. The application process involves consulting with iwi and a large range of organisations. The application discusses some of the potential implications for existing food-webs that occur in New Zealand. "One of the scenarios we look at is what might happen if the new mite species builds in number, creating an abundant food source for predatory mites, which then build in number, with downstream effects on other prey species," said Richard Hill, who is preparing the application. "In this case, we know that the leaf- and bud-galling mite forms galls on old man's beard, which offer a great deal of protection from predators, so we don't expect them to become a major new food source for predators," he said. A summary of the results from host range testing conducted in Serbia as well as responses following consultation with relevant organisations will be included in the application and made available to the public.

Lindsay will be attempting to return from Serbia with good numbers of both the sawflies and the mites, which will go straight into the containment facility at Lincoln until they can be released. "Previous experience has shown that there is a very narrow window of opportunity to collect the sawflies and it is easy to miss it! So I am leaving with plenty of time up my sleeve in the hope that I will return home with some very welcome new tools with which to battle old man's beard," he said.

This project is funded by the National Biocontrol Collective. For more information about the leaf- and bud-galling mite EPA application, see: www.landcareresearch.co.nz/science/plants-animals-fungi/plants/weeds/biocontrol/approvals/current-applications/old-mans-beard.

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