AN OLD PROBLEM REVISITED: BIOLOGICAL CONTROL OF TOADFLAXES

Locations  Canada, United States

Dates  01/01/1987 - Ongoing

Summary  Native to Europe, toadflaxes were introduced to the USA and Canada over 100 years ago as ornamental plants. They now occur over much of temperate North America and are declared noxious in eight US states. CABI identifies specific natural enemies that can be introduced into North America as biological control agents to reduce the vigour, density and spread of these invasive plants.

The problem  Yellow toadflax (*Linaria vulgaris*) and Dalmatian toadflax (*L. dalmatica*) are short-lived forbs that spread both by seeds and vegetatively. Both perennial plant species originate from central Europe and were introduced to North America in the 17th and 19th centuries, respectively, as ornamental plants. They now occur in much of temperate North America. The plants grow best on disturbed soils,
grasslands, roadsides and areas after a wildfire has broken out. Dalmatian

toadflax in particular is mainly a problem weed in dry, rocky or gravelly habitats,

whilst yellow toadflax can be a problem when growing crops.

So far, six insect species have been released in North America to control the

plants as biocontrol agents; three others were accidentally introduced. Our

studies show that cryptic speciation (morphologically similar individuals that
cannot interbreed) is occurring together with a high degree of host-plant

specialization in several biocontrol agents associated with the genus Linaria in

southeastern Europe, meaning that closely related but different insects that can’t

breed with each other specialize either on yellow toadflax or Dalmatian toadflax.

This is the case with shoot-galling weevils in the genus Rhinusa and with shoot-

mining weevils in the genus Mecinus. A combined morphological, molecular and

biological study has shown that the weevil species presently named M. janthinus

is actually composed of two species, M. janthiniformis sp. n., which attacks

Dalmatian toadflax and M. janthinus, which attacks yellow toadflax.

Based on work conducted at CABI’s centre in Switzerland, both species were

introduced to North America in the 1990s. Impact of M. janthiniformis reported

shortly after its introduction showed significant reductions of Dalmatian toadflax

at several release sites. M. janthinus is also now increasing in density and

showing promise in both the USA and Canada.

More biocontrol agents are needed however if these two weeds are to be

successfully tackled.

What we are doing

As a result, several other European insects have been investigated by CABI

since 2000. Our scientist, Ivo Toševski, has been working on this in Serbia. He

has been studying several additional insects that can control Dalmatian toadflax

at sites where M. janthiniformis did not establish or is not successful, and insects
to control yellow toadflax.

Results so far

Following our research, the shoot-galling weevil Rhinusa pilosa, which

specializes on yellow toadflax, was released in Alberta and British Columbia,

Canada in 2014. It established and produced galls at all release sites and also

overwintered successfully, but has not reached outbreak densities yet. In 2018,

its release was also approved in the USA, and first field releases happened in

2019 in Montana. Testing with its sister species, R. rara, on Dalmatian toadflax

has been completed and a petition to Canadian and US authorities will be

submitted soon.

Safety testing has also been completed for three additional stem-mining weevils

in the genus Mecinus, ie M. laeviceps and M. peterharrisi for Dalmatian toadflax

and M. heydeni for yellow toadflax and the hybrid between both species. No-
choice tests (where weevils are confined to either test or target plants) showed

that egg-laying and larval development of both species are restricted to species

in the Linaria genus and a few native North American species in the genera

Nuttallanthus and Sairocarpus. In subsequent multiple-choice tests offering the
test species together with the respective toadflax species, no or only very limited

attack occurred on these species. In addition, we could show that the weevils
cannot survive when only provided with a test species for aestivation and

overwintering, confirming their restricted host range. None of the adults of the

three species overwinter in the stems of toadflax itself, but spend the winter in

leaf litter which should increase their survival and help build up their populations.
M. peterharrisi occurs at higher elevations in Europe and should therefore be

particularly suited for more northern regions in North America.

Currently, rearing colonies of all five agents are maintained at CABI and regular

shipments are being made of selected species to North America for rearing in

quarantine and subsequent field releases.
COVID-19 severely impacted our work with biocontrol agents associated with toadflaxes, however, work did start again in 2021 and rearing continues for both agents.

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