History and Ecology in North America

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Bagous nodulosus
Flowering rush leaf-mining weevil

Bagous nodulosus is a biological control agent approved in the USA and Canada for release against flowering rush.

CLASSIFICATION

RANKING	SCIENTIFIC NAME	COMMON NAME
Kingdom	Animalia	Animals
Phylum	Arthropoda	Arthropods
Class	Insecta	Insects
Order	Coleoptera	Beetles
Family	Curculionidae	Weevils
Genus	*Bagous*	
Species	*Bagous nodulosus* Gyllenhal	Flowering rush leaf-mining weevil

DESCRIPTION

Eggs are oval and white to transparent (**Fig. 1a**). Larvae are slender, slightly curved, light yellow, and may be up to 10 mm long (**Fig. 1b,2c,2d**). Pupae (**Fig. 1c**) are creamy-white with fused appendages. Adults are elongate with long snouts, up to 6 mm long, and are a mottled gray-brown (**Fig. 1d**).

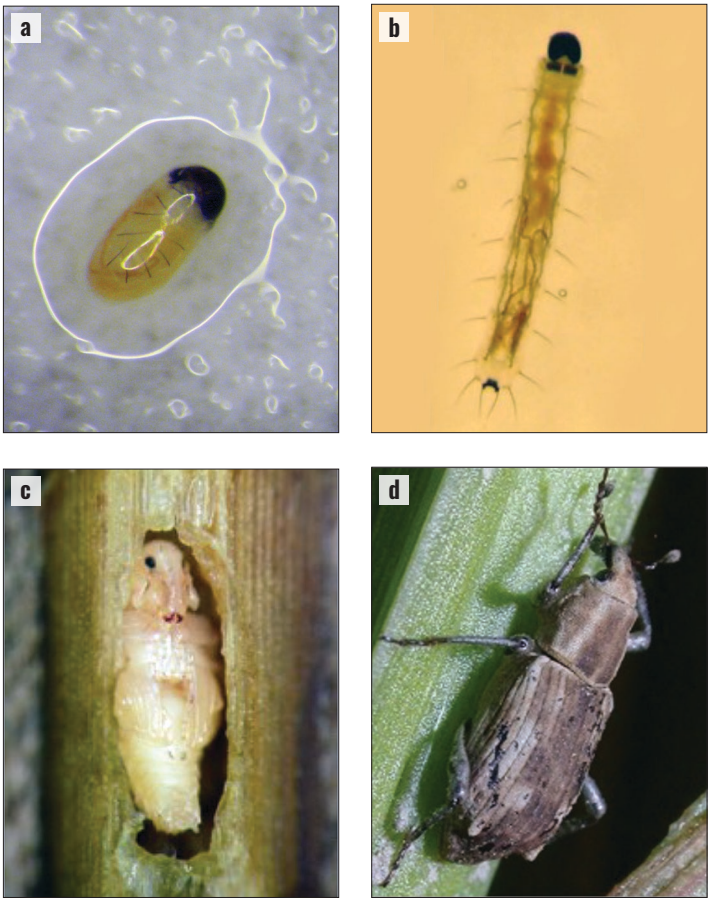

Figure 1. *Bagous nodulosus* (a) egg just prior to hatching; (b) immature larva; (c) pupa in a pupal chamber; (d) adult (a–c: Patrick Häfliger, CABI Switzerland; d: Ivo Toševski, CABI Switzerland)

LIFE CYCLE

Overwintering adults emerge in spring and begin feeding (**Fig. 2a**) and mating on flowering rush leaves, both above and below the water surface. Females chew holes in flowering rush leaves, lay 1–2 eggs per hole, and plug the holes with feces (**Fig. 2b**). Hatching larvae mine down towards the leaf base (**Fig. 2c**), often exit the leaf after a few days, and swim to another flowering rush leaf where they continue to mine down to the top of the rhizome (**Fig. 2d**). Pupation occurs in a pupal chamber in the lower part of leaves and flowering stems. Adults remain inactive in their pupal chamber for several days before emerging. Most emerging adults enter a period of aestivation where they remain inactive for the remainder of the summer before overwintering below water on or in plant debris or soil adjacent to the plant. Adults emerge again in spring and can survive at least two years. Thus, in any given year there are overlapping generations and ages of adult beetles; however, it is suspected only one new generation is produced each year. *Bagous nodulosus* adults have wings but have not been observed to fly during multiple years of rearing in Europe. It is suspected their primary mode of long distance dispersal is via passive spread on water currents.

DAMAGE

While adult feeding causes distinct chew marks on leaves (**Fig. 2a**), larval mining within leaves and upper rhizomes cannot be recognized externally. However, internal larval feeding reduces flowering rush biomass up to 50% compared to unattacked plants.

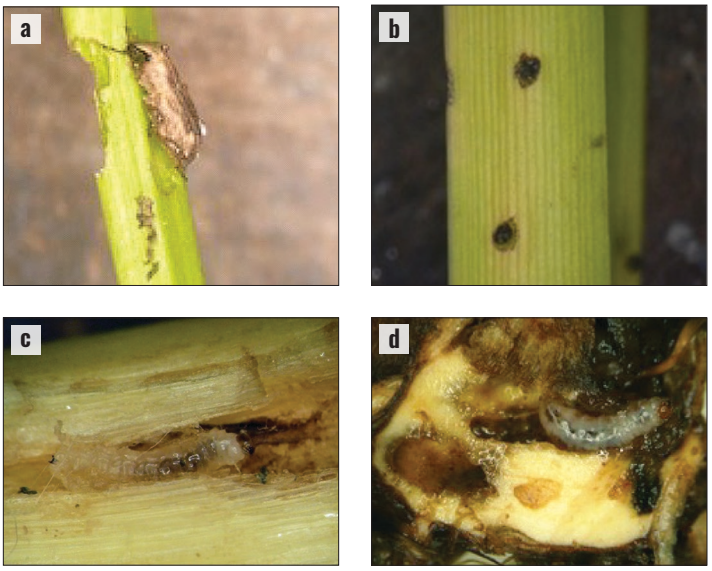

Figure 2. *Bagous nodulosus* (a) adult feeding on an emergent leaf; (b) oviposition holes plugged with feces; (c) larva mining in a leaf base; (d) larva feeding in the rhizome (a–d: Patrick Häfliger, CABI Switzerland)

FIELD IDENTIFICATION

Field establishment has not yet been confirmed in North America. Based on field observations in Europe, it is expected that adult weevils will be observable feeding on emergent leaves on bright, warm days in spring (**Fig 2a**). Oviposition holes filled with feces (**Fig. 2b**), as well as exit holes from pupal chambers, are also indicative of weevil presence. Adults and oviposition/exit holes may sometimes be observed underwater on submerged leaves but are more difficult to identify in underwater conditions. Following dissection, mining larvae may be observed feeding within flowering rush leaves and upper rhizomes (**Fig. 2c,d**). Because damage due to snails or other herbivores may resemble *B. nodulosus* feeding or oviposition damage, the most reliable means for confirming weevil presence is to observe adults on foliage or to dissect leaf bases and rhizomes to find feeding larvae.

PREFERRED HABITAT

Specific habitat preferences in the introduced range are not yet known because this weevil has not yet been confirmed as established in North America. In its native European range, this weevil is uncommon but appears to occur across a wide range of water levels, with a preference for plants growing in shallow, clear water at sun-exposed sites, and the highest densities occurring in water approximately 1 ft (30 cm) deep.

HISTORY AND CURRENT STATUS

A rearing population of *Bagous nodulosus* has been established at CABI Switzerland since 2018 for host-range testing. This screened population that has been approved for release in North America was sourced initially from field collections in Germany, Slovakia, Hungary, and Serbia. The first field releases of *B. nodulosus* in North America were in Ontario, Canada in 2024. *Bagous nodulosus* was approved for release in the USA in late 2024, and releases are anticipated to commence in 2025 or 2026.

NONTARGET EFFECTS

Host-range testing prior to release indicated the weevil is highly host-specific. No nontarget effects have been observed, and release sites will continue to be actively monitored as populations establish and increase.

REFERENCES

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Caldara, R. and C.W. O'Brien. 1998. Systematics and evolution of weevils of the genus *Bagous* VI. Taxonomic treatment of the species of the western Palearctic Region (Coleoptera Curculionidae). Memorie Della Società Entomologica Italiana 76: 131–347.

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SUGGESTED CITATION

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