

Field Release of the Exotic Moths, *Eteobalea intermediella* and *E. serratella* (Lepidoptera: Cosmopterigidae), for Biological Control of Dalmatian toadflax, *Linaria dalmatica*, and Yellow Toadflax, *L. vulgaris* (Scrophulariaceae)

Environmental Assessment

April 1996

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I. Proposed Action--Description and Statement of Need

The Animal and Plant Health Inspection Service (APHIS) of the United States Department of Agriculture (USDA) has received an application (Appendix 1) from Montana State University (MSU) for a permit to release two, nonindigenous moths, *Eteobalea intermediella* Riedl and *Eteobalea serratella* Treitschke (Lepidoptera: Cosmopterigidae) in Montana. These insects feed on the roots of Dalmatian toadflax, *Linaria dalmatica* (L.), and yellow toadflax, *Linaria vulgaris* Mill., two weeds in the family Scrophulariaceae.

The applicant proposes to import eggs of *E. intermediella* and *E. serratella*, produced from moths originally collected by IIBC from Novi Beograd, Yugoslavia, and Rome, Italy, respectively, to the Insect Quarantine Laboratory, Montana State University, Bozeman, Montana where their species identity will be confirmed and where they will be checked for diseases, parasitoids, and other contaminants. After having been screened, eggs will be transferred to caged toadflax plants in the laboratory and an outdoor garden. Moths taken from the cages will be released in infestations of Dalmatian toadflax at Bozeman, Lodge Grass, and Boulder, MT. After moth populations build up, the insects will be collected and distributed to other release sites in Montana and other states.

Voucher specimens will be deposited in the Department of Entomology Museum, Montana State University, Bozeman, MT. Specimens have already been deposited in the collection of the International Institute of Biological Control (IIBC), European Station, Delemont, Switzerland. Identification of *E. intermediella* and *E. serratella* was confirmed by Dr. S. Whitebread, Maden, Switzerland, a taxonomic expert of Lepidoptera.

If a permit to release *E. intermediella* and *E. serratella* is issued, these moth species will be the second and third exotic biological control agents approved for release against the two toadflax species in the United States.

The pending application was submitted in accordance with the Federal Plant pest Act (7 USC 150aa *et seq.*) and the Plant Quarantine Act (7 USC 151aa *et seq.*). This EA was prepared in compliance with the National Environmental Policy Act (NEPA) (42 USC 4321 *et seq.*) as described in implementing regulations adopted by the Council on Environmental Quality (40 CFR 1500-1509), by USDA (7 CFR

1b), and by APHIS (60 CFR 6000-6005).

II. Purpose and Need for the Proposed Action

The purpose of the proposed releases of *E. intermediella* and *E. serratella* is to reduce the severity of infestations of Dalmatian toadflax and yellow toadflax.

Dalmatian toadflax has become an important weed of pastures, cultivated fields, and disturbed rangelands throughout the northern and western United States, mainly because of its adaptiveness and ability to spread (Montgomery, 1964; Reed and Hughes, 1970; Lajeunesse *et al.*, 1993). It is listed as a noxious weed in Montana, Oregon, and Washington. Increasingly severe infestations are displacing forage plants to the detriment of the cattle industry. The native flora is suffering as well.

Yellow toadflax occurs throughout the United States except for certain parts of Texas, Louisiana, and Florida (Jordan, 1994; Reed and Hughes, 1970). It colonizes disturbed habitats rapidly by seed and creeping roots and does particularly well on fallow land. It is causing increasing economic losses in perennial crops such as mint (H. J. Hopen, pers. comm.)

III. Alternative to the proposed action

The "no-action" alternative to issuing a permit for the release of *E. intermediella* and *E. serratella* is to deny the permit. If the permit is denied, chemicals will be used to control Dalmatian toadflax and yellow toadflax in croplands. Chemicals are not a practical means of control in rangelands.

IV. Environmental Impacts of the Proposed Action and

Alternative

The intended environmental impact of the proposed action is a reduction in severity of infestations of Dalmatian toadflax and yellow toadflax with consequent improvement in range conditions and the return of a mixed community of native herbaceous plants. Sales of ornamental toadflax are expected to decrease.

If successful biological control agents are not released, Dalmatian toadflax and yellow toadflax will invade new areas, and infestations will increase in severity. More herbicides will be required for weed control in certain areas, especially in croplands and in sandy-gravelly soils. Groundwater may become contaminated to the extent that it is no longer safe to drink. Where toadflax is controlled by herbicides, native plants and associated fauna will suffer from chemical treatments. In areas where herbicides are not a practical means of control, native plants and the associated fauna will suffer from competition with toadflax.

Biological control agents such as *Eteobalea* spp. frequently spread even without the agency of man. Release of these species in Montana therefore is considered to be equivalent to release in the United States as a whole.

The proposed introductions of *E. intermediella* and *E. serratella* into Montana raise the question of environmental safety since the moths might conceivably harm nontarget species. Evidence for the host specificity of these insects comes from the entomological literature and from recent field observations in Europe and laboratory tests conducted in Europe.

Eurasian surveys by Riedl (1969) and Saner *et al.* (1990) revealed the host range of five species of Eurasian *Eteobalea* (Table 1). Plants in the Scrophulariaceae (tribe Antirrhineae) were the usual hosts, although one species (*E. teucris*) attacked a species of Labiatae. Four species, including *E. serratella*, were recorded from only one host genus--*Antirrhinum*, *Linaria*, or *Teucrium*. *E. intermediella* was recorded from *Linaria*, although one spurious record exists from *Anarrhinum*.

Table 1. Hosts of *Eteobalea* species.

<u>Eteobalea sp.</u>	Host Plant <u>Genus</u>	Host plant <u>family</u>
<i>E. beata</i>	<i>Antirrhinum</i>	Scrophulariaceae
<i>E. intermediella</i>	<i>Anarrhinum</i> ¹	Scrophulariaceae
	<i>Linaria</i>	Scrophulariaceae
<i>E. serratella</i>	<i>Linaria</i>	Scrophulariaceae
<i>E. sumptuosella</i>	<i>Antirrhinum</i>	Scrophulariaceae
<i>E. teucriti</i>	<i>Teucrium</i>	Labiatae

¹ Record considered spurious by Saner *et al.* (1990).

In the field *E. intermediella* attacked only the target weeds and *Anarrhinum bellidifolium* (Riedl, 1975) (record considered spurious). *E. serratella* attacked only the target weeds.

Field observations were supplemented by host-specificity tests conducted in Italy and Yugoslavia in 1988 and 1989. Oviposition tests were conducted in the field using nine to 30 uncaged plants of each test species--*Antirrhinum majus*, *L. vulgaris*, *L. dalmatica*, and *L. genistifolia*. Tests of feeding and larval development were conducted at the European laboratory of IIBC using potted plants of 40 species listed in the following paragraphs and Table 2. Whenever possible, ten or more plants were used for each species of Antirrhineae, and five were used for Scrophulariaceae species in other tribes (see Saner *et al.*, 1990).

Plant species tested: Scrophulariaceae other than Antirrhineae.

Calceolaria crenatiflora Cav. (ornamental), *Castilleja miniata* Dougl. ex Grah. (native), *Chelone obliqua* L. (ornamental native), *Collinsia parviflora* Lindl. (native), *Digitalis purpurea* L. (ornamental and medicinal), *Gratiola neglecta* Torr. (native), *Mimulus lewisii* Pursh. (ornamental native), *Pedicularis groenlandica* (Ratz.) (native), *Penstemon procerus* Dougl. ex Grah (native), *Scrophularia nodosa* L. (introduced), *Verbascum thapsus* L. (weed), *Veronica spicata* L. (naturalized ornamental).

Results: No oviposition or feeding.

Plant species tested: Species other than Scrophulariaceae.

Chenopodiaceae: *Beta vulgaris* L. (beet). **Compositae:** *Solidago canadensis* L.

(weed). **Cruciferae:** *Raphanus sativus* L. (radish). **Cucurbitaceae:** *Cucumis sativa* L. (cucumber). **Graminae:** *Zea mays* L. (corn). **Lauraceae:** *Persea americana* Mill. (avocado). **Labiatae:** *Salvia coccinea* L. (ornamental). **Leguminosae:** *Medicago sativa* (alfalfa). **Pedaliaceae:** *Sesamum indicum* L. (sesame). **Plantaginaceae:** *Plantago major* L. (common alternate host of *Linaria* insects). **Polygonaceae:** *Rheum rhaponticum* L. (rhubarb). **Solanaceae:** *Ipomoea batatas* L. (sweet potato), *Lycopersicon esculentum* L. (tomato), *Petunia grandiflora* L. (ornamental), *Solanum tuberosum* L. (potato).
 Results: No oviposition or feeding.

Table 2. Results of host-specificity tests of *E. intermediella* and *E. serratella* using plants in the tribe Antirrhineae.

<u>Plant species</u>	<u>Egg deposition</u>		<u>Larval feeding</u>		<u>Complete larval development</u>	
	<u>inter.</u>	<u>serr.</u>	<u>inter.</u>	<u>serr.</u>	<u>inter.</u>	<u>serr.</u>
<i>Anarrhinum bellidifolium</i> (L.) (introduced weed)	--	--	+	0	+	0
<i>Antirrhinum majus</i> L. (introduced snapdragon)	--	--	+	0	+	0
<i>Antirrhinum orontium</i> L. (introduced weed)	--	--	+		+	+
<i>Chaenorrhinum minus</i> (L.) (introduced weed)	--	--	0	0	0	0
<i>Cymbalaria muralis</i> Baumg. (ornamental)	--	--	0	0	0	0
<i>Kickxia elatine</i> (L.) (introduced weed)	--	--	+	0	+	0
<i>Linaria alpina</i> Mill. (introduced ornamental)	0	--	0	+	0	+
<i>Linaria dalmatica</i> (L.) (Dalmatian toadflax)	+	+	+	+	+	+
<i>Linaria genistifolia</i> (L.) (narrow-leaved Dalmatian toadflax)	+	0	+	0	+	0
<i>Linaria maroccana</i> Hook. (introduced ornamental)	0	0	0	0	0	0

Table 2 (cont.).

<u>Plant species</u>	<u>Egg deposition</u>		<u>Larval feeding</u>		<u>Complete larval development</u>	
	<u>inter.</u>	<u>serr.</u>	<u>inter.</u>	<u>serr.</u>	<u>inter.</u>	<u>serr.</u>
<i>Linaria repens</i> (L.) (introduced weed)	--	--	+	+	+	+
<i>Linaria vulgaris</i> (L.) (yellow toadflax)	+	+	+	+	+	+
<i>Nuttallanthus canadensis</i> (Chpm.) (common native)	0	0	0	0	0	0

0 = no oviposition, feeding, or development.

+ = oviposition, feeding, or development.

-- = no data.

¹Laboratory studies.

Table 2 indicates that larvae of *E. intermediella* completed development on seven introduced, weedy species of Antirrhineae (including the target weeds) and common snapdragon. Larvae of *E. serratella* completed development on four weedy species of Antirrhini (including the target weeds) and the introduced ornamental, *E. alpina*.

In separate tests both *Eteobalea* species fed upon common snapdragon when that plant was mixed with a stand of *Linaria*. However, such a combination is very artificial and not likely to be found either in gardens or in nature. Furthermore, the moist soil conditions in a flower bed are likely to kill larvae hatching from eggs laid on snapdragons. There are no European records of common snapdragon as a host of either *E. intermediella* or *E. serratella*.

No *Linaria* species are native to the United States, and no plant species in the tribe Antirrhineae which includes *Linaria* are listed by the U. S. Fish and Wildlife Service as threatened or endangered in the United States. Three native U. S. species formerly placed in the genus *Linaria*, *L. canadensis* (L.), *L. floridana* (Chapman), and *L. texana* (Scheele), have been transferred to the genus *Nuttallanthus*.

The biological characteristics of *G. intermediella* and *E. serratella* preclude any direct impact on humans.

In summary, all available evidence clearly indicates that *Eteobalea intermediella* and *Eteobalea serratella* are safe to introduce as biological control agents of

Dalmatian toadflax and yellow toadflax in the United States.

V. References

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VI. List of Preparators, Consultants, and Reviewers

This document was prepared by **Robert M. Nowierski**, Department of Entomology, Montana State University, Bozeman, MT, and by **Ronald Hennessey**, USDA--APHIS, Riverdale, MD.

This EA is based largely on a petition submitted by **Robert M. Nowierski** to the Technical Advisory Group (TAG) on the Biological Control of Weeds. The following TAG members approved the petition: **Alfred F. Cofrancesco**, U.S. Army Corps of Engineers, Vicksburg, MS; **Jack R. Coulson**, USDA--ARS, Beltsville, MD; **James Kryson**, USDA--APHIS, Riverdale, MD; **Dale Meyerdirk**, USDA--APHIS, Riverdale, MD; **Janine E. Powell**, USDA--Forest Service, Washington, DC.; **James G. Saulmon**, U. S. Environmental Protection Agency, Washington, DC; **David Sisneros**, U. S. Bureau of Reclamation, Denver, CO; **Charles Turner**, USDA--ARS, Albany, CA; **B. D. Wright**, Oregon Dept. Agriculture, Salem, OR.

This EA was reviewed by **Robert Flanders**, Ph.D., USDA--APHIS, Riverdale, MD; **Kenneth Lakin**, Ph.D., USDA--APHIS, Riverdale, MD; **James Story**, Ph.D., Montana State University, Corvallis, MT; **Charles Turner**, Ph.D., USDA--ARS, Albany, CA.

VII. Appendix

Appendix 1. Application for a permit to release *Eteobalea intermediella* and *Eteobalea serratella* in Montana.

FINDING OF NO SIGNIFICANT IMPACT

USDA--APHIS--PPQ is reviewing an application for a permit to release *Eteobalea intermediella* and *E. serratella* (Lepidoptera: Cosmopterigidae) in Montana. These nonindigenous moths are potentially useful for the biological control of Dalmatian toadflax, *Linaria dalmatica*, and yellow toadflax, *Linaria vulgaris*, two rangeland weeds in the family Scrophulariaceae. The proposed releases are expected to have no significant impacts on the quality of the human environment in the United States. This finding is based on the following considerations:

- In Europe, the native home of *E. intermediella*, the only recorded host plants are certain species of *Linaria* and *Anarrhinum* (tribe Antirrhineae). *Linaria* species are the only recorded hosts of *E. serratella* in Europe. No members of the genus *Linaria* are native to North America.
- In laboratory tests, larvae of *E. intermediella* completed development only on seven species of perennial weeds and common snapdragon, all in the Antirrhineae. Since snapdragon is not attacked by *E. intermediella* in Europe, it is not expected to be attacked by that species in the United States. Larvae of *E. serratella* completed development only on five species of perennial weeds in the Antirrhineae.
- No species of Antirrhineae are listed by the Federal government as threatened or endangered; hence releases of *E. intermediella* and *E. serratella* are expected to have no negative impacts on threatened or endangered species.
- Overall impacts of the released insects on wildlife and native vegetation are expected to be highly beneficial.

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Date