

Spurgia esulae



Classification

Phylum: Arthropoda

Class: Insecta

Subclass: Pterygota

Division: Endopterygota

Order: Diptera

Suborder: Nematocera

Superfamily: Mycetophiloidea

Family: Cecidomyiidae

Subfamily: Cecidomyiinae

Supertribe: Lasiopteridi

Tribe: Oligotrophini

Genus: *Spurgia*

Species: *Spurgia esulae* Gagné

General Life History

Spurgia esulae overwinters in the soil as a mature larva (Pecora *et al.*, 1991). Overwintered larvae pupate in the spring, and adults emerge from the soil from April to June, depending on location. *S. esulae* adults are small (<2 mm) flies that probably live only two or three days under field conditions. However, adult females appear able to actively or passively (via wind dispersal) move at least 10 m from the pupation site (Hansen, unpubl. data). After mating, adult females deposit groups of orange-colored eggs on leafy spurge leaves near the apical buds. Generally, female flies produce 20-150 eggs, laid in groups of eight to twenty (Solinas and Pecora, 1984).

After hatching, first-instar larvae migrate to leafy spurge buds, where they begin feeding on the meristematic tissue. Larval feeding induces hypertrophy in the bud tissues, causing the formation of a gall. *S. esulae* induced galls are somewhat cabbage-like in appearance, and consist of a tight cluster of abnormal warty and flattened leafy spurge leaves among which are found the developing *S. esulae* larvae. Larvae are legless, orange in color, and complete three stadia (Solinas and Pecora, 1984). Larval development generally requires two to four weeks, depending on local weather conditions.

Mature larvae of the final generation drop from the galls and burrow into the soil, where they spend the winter. During earlier generations, *Spurgia esulae* larvae construct white silken cocoons inside the gall, within which pupation occurs. The pupal stage lasts about a week, after which adult flies emerge from the galls.

Spurgia esulae is multivoltine, but the number of generations completed per year varies with location. *S. esulae* was reported to complete four or five generations in northern Italy (Pecora *et al.*, 1991). In the United States, three generations occur per year in southwestern Montana (Hansen, unpublished data), while *S. esulae* completes four generations in eastern North Dakota (Nelson, 1994).

After gall formation, leafy spurge buds lose their meristematic activity, so development of flower buds and further stem elongation are prevented. In addition, gall formation appears to disrupt apical dominance, which stimulates the formation of lateral branches on galled spurge stems. Buds on these lateral branches provide attack sites for subsequent *Spurgia esulae* generations (Solinas and Pecora, 1984).

Host Range in the Field and Greenhouse Tests

Spurgia esulae appears to occur only on the various "forms" of leafy spurge, *Euphorbia esula* L., in its native Europe (Pecora *et al.*, 1991). To date, introduced United States populations of *S. esulae* have also been reported only from *E. esula* L.

Laboratory and garden plot experiments showed that *Spurgia esulae* will oviposit, and complete development, on *Euphorbia esula* from several European and United States populations, and on several other *Euphorbia* species in the subgenus *Esula* (Pecora *et al.*, 1991).

The native North American spurges, *Euphorbia incisa* Engelm., *E. palmeri* Engelm., *E. robusta* (Engelm.) Small, and *E. spatulata* Lam. supported development under controlled conditions, but other native spurges in the subgenus *Esula* (the rare species *E. purpurea* (Raf.) Fernald and *E. telephoides* Chapm.) were not suitable hosts (Pecora *et al.*, 1991). It is not yet known if these host utilization patterns will be observed under field conditions in the United States. In any event, host range of *Spurgia esulae* appears restricted to leafy spurge and, potentially some, but not all, other native and introduced *Euphorbia* species in the subgenus *Esula*.

List of known parasitoids or predators of *Spurgia esulae*

Spurgia esulae larvae are reportedly parasitized by *Tetrasticus* spp. (Hymenoptera: Eulophidae) in Italy (Solinas and Pecora, 1984). A native wasp, *Zatropis nigroaenus* (Hymenoptera: Pteromalidae), parasitizes *S. esulae* in North Dakota (Lym and Carlson, 1994), but has not yet been observed among Montana *S. esulae* populations (Hansen, unpubl. data). Other arthropods, including adult and nymphal thrips (Thysanoptera) and mites have been collected from *S. esulae* galls at the Bozeman FIS, but they appear to be commensals rather than predators.

Impact of *Spurgia esulae* on Leafy Spurge

Spurgia esulae will reduce flower and seed production by, and perhaps reduce the vigor of, leafy spurge plants. However, attacks by this insect should rarely, if ever, directly kill the weed. Thus, the primary role of this agent in leafy spurge control lies in reducing the seed pool available for long-range dispersal.

The host range of *Spurgia esulae* is limited to a subset of plant species in the subgenus *Esula* of the genus *Euphorbia*, including the target weed (leafy spurge). Under experimental conditions, *Spurgia esulae* has been shown to cause galls on several native *Euphorbia* species, though it is not yet known if these plants will be suitable hosts under field conditions. The two federally protected native spurges (*Euphorbia garberi* Engelm. ex Chapm. and *E. deltiodes* Engelm. ex Chapm. subgenus *Chamaesyce*) and two rare native spurges being considered for protection, *E. purpurea* (Raf.) Fernald and *E. telephiodes* Chapm. (Pemberton, 1985), are not suitable hosts for *Spurgia esulae*.

Location where *Spurgia esulae* was originally collected

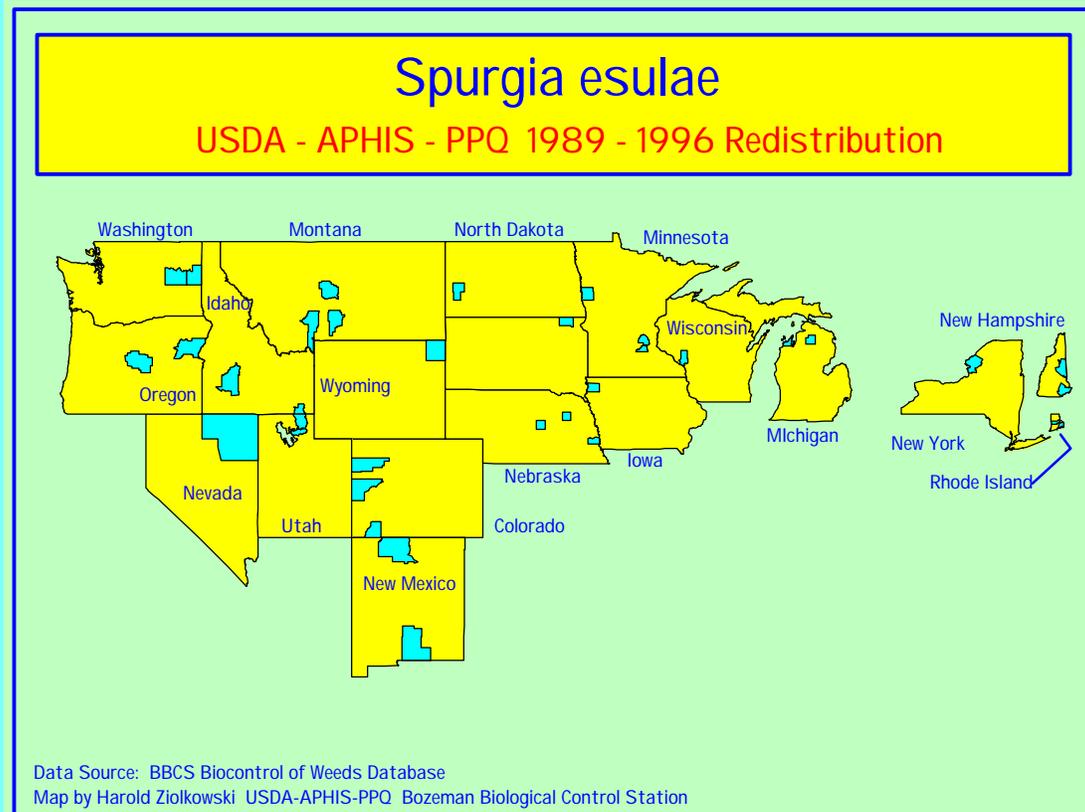
Insects initially released in the United States were collected by USDA-ARS scientists near Pisa, in northern Italy.

Current North American Distribution

Spurgia esulae was approved for United States release in May of 1985, under the obsolete name of *Bayeria capitigena* Bremi. During the summer of 1985, initial field releases were made at several Montana locations by USDA-ARS personnel. Additionally, this insect was lab reared at the USDA-APHIS Bozeman Biological Control Station over the winter of 1989-1990 and field released in 1990. From the subsequent established field population many new field releases were made. Through 1996, *Spurgia esulae* has been released in 19 states and 35 counties. Established populations are present in Montana, North Dakota, Oregon and South Dakota, while the status of populations in the remaining states is not yet clear. The insect has not been released in Canada.

Expected North American Range

There appear to be no climatic or ecological barriers to survival and establishment of *Spurgia esulae* in most or all of the spurge-infested areas of the United States and, at least, in southern parts of Canada. Of course, the ultimate North American range of this insect will reflect the extent of human redistribution activities.



Specific References on *Spurgia esulae*

- Gagné, R.J. 1990.** Gall midge complex (Diptera: Cecidomyiidae) in bud galls of Palearctic *Euphorbia* (Euphorbiaceae). *Ann. Entomol. Soc. Am.* 83: 335-345.
- Lym, R.G. and R.B. Carlson. 1994.** Effect of herbicide treatment on leafy spurge gall midge (*Spurgia esulae*) population. *Weed Tech.* 8: 285-288.
- Pecora, P., R.W. Pemberton, M. Stazi and G.R. Johnson. 1991.** Host specificity of *Spurgia esulae* Gagné (Diptera: Cecidomyiidae), a gall midge introduced into the United States for control of leafy spurge (*Euphorbia esula* L. "complex"). *Environ. Entomol.* 20: 282-287.
- Solinas, M. and P. Pecora. 1984.** The midge complex (Diptera: Cecidomyiidae) on *Euphorbia* spp. I. *Entomologica* 19: 168-213.