





## United States Department of Agriculture,

## BUREAU OF ENTOMOLOGY,

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**THE ROSE SLUGS.**

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Roses grown in gardens in the United States are attacked by three species of sawflies which live, in their larval stages, on the foliage, skeletonizing the leaves or cutting out holes of variable size and greatly disfiguring the plants. The larvæ, popularly known as "rose slugs," "slugworms," and "roseworms," have been classified as the American rose slug, the bristly roseworm, and the coiled or curled roseworm, respectively. For the sake of uniformity they may all be called rose slugs. The first of these, as its common name indicates, is native to America; the other two are evidently accidental introductions from Europe, as they are now common to both hemispheres. As with most other sawflies,<sup>a</sup> they are found more abundantly in the North, but are quite troublesome as far southward as Maryland and Kansas. They practically confine their depredations to the flower garden, and roses are the only plants that are seriously damaged by them. Injury is due entirely to the larvæ, and the three species, each representing a distinct genus, differ considerably in appearance in all stages, as also in their life history and manner of work.

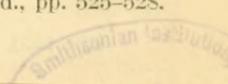
**THE AMERICAN ROSE SLUG.***(Endelomyia rosa Harr.)<sup>b</sup>*

The American rose slug was first identified as a pest about the year 1831, when it did damage in gardens at Cambridge, Mass. At that time the species was somewhat restricted to that locality, but later, according to Harris, who observed and studied its habits,<sup>c</sup> it gradually spread in that vicinity and by 1840 it had become so great a nuisance that a premium of \$100 was offered for the most successful method of destroying it.

<sup>a</sup> Hymenopterous insects of the family Tenthredinidæ.

<sup>b</sup> Synonyms: *Monostegia rosa* and *Selandria rosa*.

<sup>c</sup> Report Ins. of Mass. Inj. to Veget., 1841, pp. 380-382; Flint ed., pp. 525-528.



The female in depositing her eggs turns a little to one side, unsheaths her delicate saw-like ovipositor, and thrusts it between the two cuticles of a leaf, depositing a single egg in each incision. An egg is shown about natural size at *d*, figure 1, and much enlarged at *e*. The egg is of circular outline, much flattened, and measures about one-twentieth of an inch in diameter. Hatching begins in from ten days to two weeks after the eggs are deposited.

The larvæ or slugs are to be found at work as early as the 1st of May in the District of Columbia, but their appearance in numbers is seldom noticed until the second or third week of that month. Observations conducted at Washington, D. C., show that the periods mentioned are subject to considerable variation. In 1905 the first sawflies of the new generation appeared June 2. Owing to the irregularity of appearance of the parent "flies," larvæ of the first generation may be found at work for a period of five or six weeks. Feeding takes place chiefly at night, and always on the upper surface of the leaves, the lower surface, ribs, and midribs remaining as a skeleton (fig. 1, *e*). The leaves are practically always skeletonized, not eaten into as in the case of the other two rose slugs, except when the larvæ are nearly grown. During the daytime the larva usually rests concealed on the under surface of a leaf (fig. 2, *a*).

Sometimes the larvæ are so abundant that not a leaf on a bush is spared, and the foliage looks as though it had been scorched by fire, and eventually drops off. The larvæ are stated to be between two and three weeks in attaining their growth. They cast their skins several times, leaving them fastened to the leaves. After the last molting they lose their greenish hue and become opaque yellowish. They then descend into the earth to a depth of an inch or more, and each constructs for final transformation a somewhat fragile oval cell or cocoon coated with particles of earth. Here the insect remains as larva until the following spring, when it transforms to pupa shortly before issuance in May.

The species is single-brooded, in which respect it resembles many other species of sawflies.<sup>a</sup>

#### REMEDIES.

This rose slug and the others which will be discussed are quite easily controlled by several different methods.

*Sprinkling with water.*—A strong stream of water directed upon the plants from different sides by an ordinary garden hose or large

<sup>a</sup> It is evident from Harris's account (l. c.) that in ascribing two generations to this rose slug he must also have had the bristly rose slug under observation. Miss M. E. Murtfeldt writes on this head that she has disproved Harris's statement "by repeated rearing of the insect under close observation." (41st Annual Rept. State Hort. Soc. Missouri, 1898, p. 288.)

syringe, if applied every day or two, will soon rid rosebushes of the pest. This is at the same time an excellent remedy for rose aphides or plant-lice. The insects are dislodged, fall to the ground, and are unable to return to reinfest the bushes. This remedy was tested practically by Dr. L. O. Howard many years ago.

*Paris green.*—Where it is possible to apply them without danger of poisoning human beings or disfiguring the plants for ornament, different poisonous preparations are useful. Of these, Paris green, either dry or in solution, arsenate of lead, and white hellebore are good remedies. Paris green is best used as a spray in the proportion of an ounce to a gallon of water. Applied dry, it is mixed with 20 parts of flour or similar diluent and puffed on the plants by means of a powder bellows or insufflator. For use in large gardens, however, the poison is employed at the rate of 1 pound to from 75 to 125 gallons of water, lime being added in about the same proportion as Paris green to prevent scorching. For properly mixing and applying this insecticide a sprayer of good quality should be used. Sprinkling with a watering pot or with a whisk broom will not answer the purpose and is, moreover, dangerous to tender foliage. The Paris green is first mixed with a small quantity of water into a fine paste before the bulk of water is added and should be churned in the sprayer or force pump until thoroughly blended. The resulting mixture, being a mechanical one, is not constant and the arsenical sinks to the bottom. The solution should therefore be constantly stirred while being applied in order that an even application may be made. In applying an arsenical spray an effort should be made to reach all of the leaves, which may be accomplished by spraying from two sides. Two or three applications will suffice for the spring generation of rose slugs. Scheele's green and some other arsenicals can be used instead of Paris green.

*Arsenate of lead.*—A still more valuable insecticide for such insects as rose slugs and other leaf feeders is arsenate of lead, but its use is open to the objection that it discolors the leafage, leaving a white deposit, which is not, however, permanent. It is applied in practically the same manner as Paris green and is a less poisonous arsenical, and, being sold in paste form, is used at a considerably greater strength—about 1 pound combined with 15 to 25 gallons of water or Bordeaux mixture. Being adhesive, it adheres more firmly to the leafage and is much less likely to produce scorching.<sup>a</sup>

*Hellebore.*—Hellebore is used at the rate of 1 ounce to from 2 to 3 gallons of water, and kills by contact as well as by its poisonous effects

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<sup>a</sup> Additional information in regard to the preparation and use of arsenate of lead and other insecticides is given in Farmers' Bulletin 127, which may be had gratis on application to the U. S. Department of Agriculture.

when eaten by the insect. It is less poisonous to man than an arsenical, but not so effective to leaf-feeding larvæ. It may also be applied dry mixed with about double its weight, or more, of powdered plaster or cheap flour.

When not in use the receptacles containing poisons should be plainly labeled "Poison!" and placed on a high shelf or in a locker out of the reach of children. Properly applied, there is no danger, in using an arsenical on ornamental plants, of poisoning human beings, or domestic animals other than rabbits or similar pets.

*Soaps and other washes.*—Oily soaps, such as fish-oil or whale-oil soap, and other soaps, and tobacco water will kill these insects, but their use is open to the objection that if applied just before or at blossoming they are apt to injure the petals of delicate flowers, and whale-oil and tobacco also leave an unpleasant odor. A neutral soap, such as castile or that used by physicians and surgeons, leaves no odor.

*Dry powders.*—Fine, sifted road dust, where this can be readily procured, is also of value thrown upon the plants, preferably by means of a powder bellows, as it closes the breathing pores of the larvæ and thus kills them. Finely powdered lime, and buhach (Persian insect powder, or pyrethrum) are also effective.

*Hand picking.*—If rose slugs are picked off by hand upon their earliest appearance this will greatly reduce their numbers for the following year. In the adult or "fly" stage these insects may be easily captured by hand on cool mornings. Hand picking may be tedious, but it is effective.

*Fall cultivating.*—If other means that have been specified have not been utilized for the suppression of the slugs, many individuals may be destroyed by frequent cultivation of the soil between the rose plants during the late summer and autumn. This has the effect of breaking up their pupal cells and otherwise disturbing the insects so as to interfere with proper hibernation.

#### THE BRISTLY ROSE SLUG.

(*Cladius pectinicornis* Fourcr.)

The bristly rose slug, called also the spiny rose slug, is the principal enemy of the rose in and near the District of Columbia, not excepting the rose-chafer. It is believed to have been brought in from Europe some time prior to 1833, since it was mentioned by Harris in his catalogue of Massachusetts insects of that date. In the early seventies it was reported from Connecticut and in after years it made its way westward and southward, doing more or less injury wherever established. Since 1880 it has done much mischief in Wash-

ington, D. C. In 1886 it was reported from Lafayette, Ind. In 1889 it was observed to be injurious at St. Charles, Mo. Soon afterwards it was recognized as a pest at St. Louis, where it attracted considerable attention.

DESCRIPTION AND DISTRIBUTION.

The adult of this species (fig. 3, *a*) differs considerably from that of the American rose slug, as will be readily seen by a comparison of the illustrations of the two forms. It is a larger insect and a member of a different genus. The wing expanse is about one-half of an inch for the female; a little shorter for the male. The ground color is black. The antennæ are rather stout and acutely pointed, and in

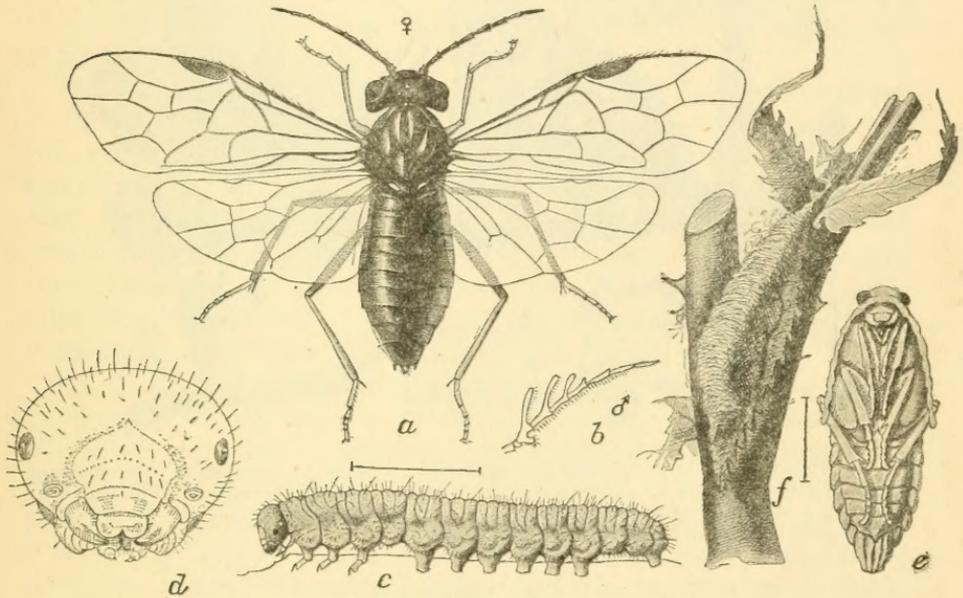


FIG. 3.—Bristly rose slug (*Cladius pectinicornis*): *a*, Adult female; *b*, antenna of male; *c*, larva; *d*, head of same; *e*, female pupa; *f*, cocoon. All enlarged. (Reengraved after Riley, except *d*, original.)

the male the proximal joints, or those nearest the head, are pectinate or comb-toothed (fig. 3, *b*), which has given rise to the specific name *pectinicornis*.

The egg (fig. 4, *a*) is white, flattened, rounded, stoutest at the anterior end, and more pointed at the opposite end. It measures about 0.8 mm. in length.

The larva or slug, shown in figure 3, *c*, and figure 4, *c*, *d*, varies from yellowish to glaucous green, and the whole surface is quite bristly, especially at the sides, a character from which this larva derives its common name and which will distinguish it from the other two that feed upon the rose. The length when full grown is a little

more than three-fifths of an inch and the diameter is between one-tenth and two-tenths of an inch.

The pupa (fig. 3, *e*) is grayish green, the thorax and end of the body are slightly yellowish, and the antennæ, wing-sheaths, and legs are white with a slight greenish tinge.<sup>a</sup>

The distribution includes the States of Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Maryland, the District of Columbia, Indiana, Illinois, and Missouri.

It is generally distributed on the continent of Europe and occurs also in England and Scotland.

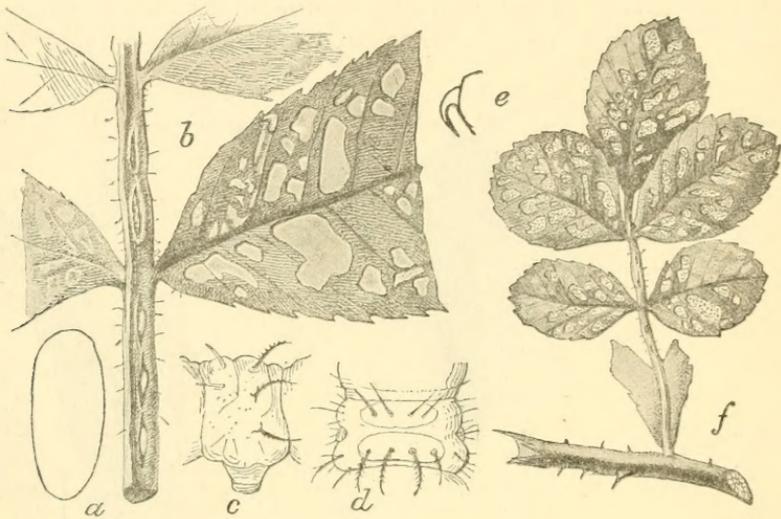


FIG. 4.—Bristly rose slug (*Cladius pectinicornis*): *a*, Egg; *b*, portion of leaf showing eggs in situ and work of young larvæ; *c*, *d*, lateral and dorsal aspects of middle segment of newly hatched larva; *e*, larval claw; *f*, rose leaf showing nature of defoliation. All except *f* enlarged. (Reengraved after Riley.)

#### LIFE HISTORY.

The bristly rose slug differs considerably from the preceding in its life economy. Its appearance at Washington, D. C., and at St. Louis, Mo., has been observed from the latter days of April to the third week of May, beginning about the time that the first rose leaves are put forth. Its eggs are inserted in the upper surface of the petiole of the leaf and are deposited in rows of three or more together.

The slug in its earliest stage skeletonizes the leaves, leaving whitish blotches and small holes (fig. 4, *f*), but with increased growth it eats large, irregular holes in the leaf (fig. 4, *b*), devouring the entire sub-

<sup>a</sup> More detailed descriptions of the stages are furnished in C. V. Riley's article, *Insect Life*, Vol. V, pp. 6-11, which includes accounts of the other two species here treated.

stance, and frequently leaving nothing but the stronger ribs. While feeding, the slug rests in concealment on the lower surface of a leaf, and does not feed on the upper surface, as does the American rose slug. Upon attaining full growth it does not, like the latter, abandon the plant upon which it has fed until the final generation. Indications are that there may be three and, in some seasons in its southernmost range, perhaps four generations produced each year, larvæ occurring as early as the 1st of May and as late as the 1st of November. In northern Europe two generations are recognized.<sup>a</sup> The larvæ of the earlier generations spin their cocoons (fig. 3, *f*), which are composed partly of silk and partly of a glutinous substance, upon the lower surface of the leaves, or on twigs or near-by objects, usually surrounding them with an irregular fringe. The last or autumn generation forms its cocoons among fallen leaves and other rubbish about the base of the rose bushes.

The egg period in late April and early in May has been observed in the District of Columbia to last for from seven to ten days, and the young larvæ begin feeding in the first and second weeks of May. Larvæ grow rapidly, and cocoons have been found by the middle of May. The pupal period observed was fifteen days, so that the second brood of flies may appear before the end of May. This second generation begins work about the second week in June, but during July there is a comparative cessation, presumably between the second and third broods of worms, when fresh growth is little affected.

Mr. G. Pauls, St. Louis Altenheim, St. Louis, Mo., wrote in regard to observations conducted by him on this species at St. Louis in 1904. The sawfly continued depositing eggs up to September 17. October 14 he placed larvæ in a jar; three transformed to pupæ October 17, 19, and 24 and issued March 30 to April 10 of the following year. One larva pupated October 16 and issued March 22, having passed about five months in the pupal stage. This shows considerable variation in the time of issuing indoors, and would probably be duplicated to a certain extent in the open. April 29 he observed the sawfly depositing eggs on the leaves.

#### NATURAL ENEMIES.

No natural enemies of this rose slug appear to have been recognized in America, but in Europe it is preyed upon by two parasites, *Acerotomus lucidulus* Grav. and *Mesochorus cimbicis* Ratz.

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<sup>a</sup> Various European authors have written on this species. One of the most accessible general articles is that by M. S. C. Snellen van Vollenhoven, translated from the Dutch by J. W. May and published in *The Entomologist*, Vol. VIII, 1875, pp. 26-29.

## REMEDIES.

The same remedies advised against the American rose slug are employed against the present species, with the exception of fall cultivation, which is practically useless when applied to it, owing to the fact that the cocoons are formed upon the plants on the surface of the ground and not buried in the earth as with the preceding species. Since there are more than one generation of this slug, sprinkling with water and spraying with poisons must be repeated several times in order to produce the desired results; in short, as often as the insects reappear upon the plants, from April to October, according to locality.

## THE COILED ROSE SLUG.

(*Emphytus cinctus* L.<sup>a</sup>)

The third of the rose slugs under consideration, the coiled rose slug, is a comparatively recent importation. As with the two preceding species, it first attracted attention near Boston, Mass., but not until the year 1887.<sup>b</sup> It is probable, however, as in the case of most European insects introduced into this country, that its importation was accomplished at a considerably earlier date. Reasoning from analogy, this insect might have been brought from the mother country on potted roses ten or twenty years earlier than the date specified, as that length of time is sometimes necessary for a foreign insect to become permanently established so as to attract attention by its injuries.

## DESCRIPTION AND DISTRIBUTION.

From the two preceding species this insect may be readily separated on account of its larger size in the adult stage (fig. 5, *a*). It has nearly transparent wings, and a wide band which crosses its shining black abdomen near the middle. The body is comparatively slender, and the head longer than in the other two species. The wing expanse is about five-eighths of an inch and the length of the body about three-eighths of an inch.

The larva when mature is about three-fourths of an inch long and differs notably from the other two species here considered in being perfectly smooth. It is cylindrical and tapers very slightly toward the posterior extremity. The color is metallic green above, ornamented with small white dots, and the lower surface, including the legs, is grayish white. The head (fig. 5, *c*) is yellowish orange, with a dark brownish-black stripe down the middle. The eyes are black.

<sup>a</sup> *Emphytus cinctipes* Nort. is recognized as a synonym.

<sup>b</sup> J. G. Jack, Garden and Forest, Mar. 26, 1890, pp. 151-152.

The first thoracic segment is blue and the last two are gray.<sup>a</sup> The larva habitually rests in the coiled or curled position shown in figure 5, *b*, one that is never assumed by either of the other rose slugs, and it is from this habit that it derives its English name.

In addition to Boston, it has been authentically reported from Jamaica Plain, Roxbury, and New Bedford, Mass.; portions of Maine; Allegheny, Pa.; New York, and Canada. In the Eastern Hemisphere this species ranges over the major portion of Europe, extending into Siberia.

#### NATURAL HISTORY.

The coiled rose slug is credited with being double-brooded, and as it extends its range southward it will probably produce a third generation, since we know of the appearance of the "worm" from May

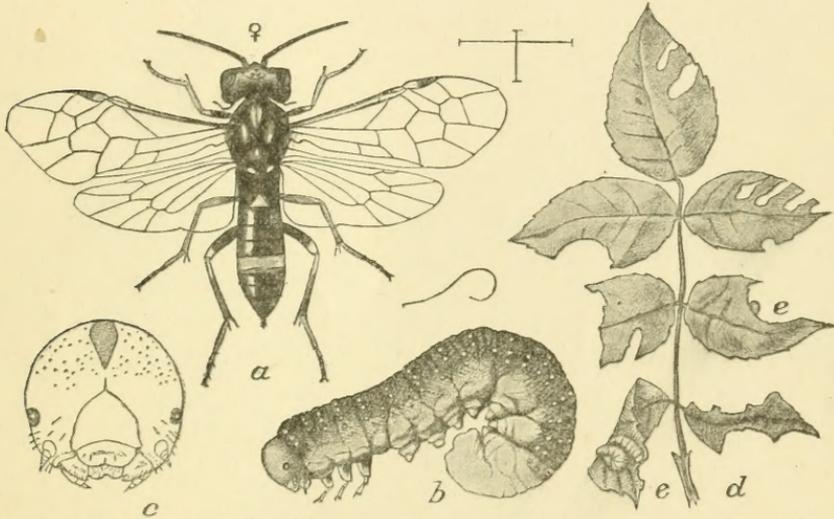


FIG. 5.—Coiled rose slug (*Emphytus cinctus*): *a*, Adult female; *b*, full-grown larva; *c*, head of same; *d*, work on plant; *e, e*, young larvæ at work. *d, e*, Natural size; *a, b*, enlarged; *c*, more enlarged. (Reengraved after Riley.)

to October. Eggs are deposited singly on the underside of the leaves to the observed number of from three to seven. This slug differs from the others in devouring the entire substance of a leaf, feeding along the edges with its body coiled beneath it, and when at rest remaining curled in a ball on the lower surface (see fig. 5, *e*). Upon reaching maturity the slug deserts the leaves and bores into the pith of the stems of dead rose bushes or other available plants, and here the pupal state is passed, the fall generation hibernating to emerge the following May. At Boston, Mass., the adults have also been observed in July, this indicating the first new generation.

<sup>a</sup> A more technical description by Dr. H. G. Dyar is given in the Canadian Entomologist, Vol. XXVI, p. 186.



## NATURAL ENEMIES.

A parasitic enemy of this species was reared by the writer from larvæ received from Allegheny, Pa., in 1904. It issued October 20, and proved to be a tachina fly, *Tachina rustica* Fall.

In Europe an ichneumon fly, *Cryptus emphytorum* Boie., is parasitic upon this sawfly.

## REMEDIES.

The remedies are the same as for the American rose slug, subject, however, to the same changes as for the bristly rose slug.

Approved:

JAMES WILSON,

*Secretary of Agriculture.*

WASHINGTON, D. C., August 4, 1908.

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