

## THE CAMBIUM MINER IN RIVER BIRCH

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The species of the family Agromyzidæ generally mine in the leaves and stems of various plants, while some mine in their roots. The species presented in this paper, *Agromyza pruinosa* Coq.,<sup>1</sup> is quite out of the ordinary in that it mines in the cambium of the living tree, the mine leaving a scar known as a "pith-ray fleck."<sup>2</sup> These flecks in the various kinds of wood have been known for many years to be the result of the work of insects, and extensive investigations have been carried on in Europe as well as in this country in order to determine the species causing the damage. Investigations in Europe have proved that at least the pith-ray fleck in birch may be accredited to *Agromyza carbonaria*,<sup>3</sup> which is closely related to the American species. The pith-ray flecks in birch in America have been studied carefully, and it has been decided that *Agromyza pruinosa* is at least one of the insects that produce flecks and is possibly the only one. *Agromyza pruinosa* taken from river birch has just been reared to maturity. This is the first record in America of the production of flecks in birch by a definitely known species. (Pl. LX, fig. 2.)

### SEASONAL HISTORY

During July and the early part of August, 1912, the work of this dipterous larva was very common in river birch at the Chain Bridge, in the District of Columbia, every tree that was examined containing new work; but in 1913, in the same locality, only a few trees disclosed new work. A dipterous larva and similar work were found frequently in red maple (*Acer rubrum*), but not so commonly as in birch. In 1913 Mr. T. E. Snyder found in wild cherry (*Prunus* sp.) on the Virginia shore of the Potomac River at the Chain Bridge two larvæ which are identical with the larvæ of *Agromyza pruinosa* in the birch, except that they are only two-thirds as long, although to all appearances full grown. The work of this species in wild cherry is identical with that in red maple and black birch, but the mines are correspondingly smaller.

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<sup>1</sup> Thanks are due to Mr. J. R. Malloch for assistance in determining the species.

<sup>2</sup> Brown, H. P. Pith-ray flecks in wood. U. S. Dept. Agr., Forest Serv., Circ. 215, 15 p., 6 pl. May 7, 1913.

<sup>3</sup> Nielsen, J. C. Zoologische Studien über die Markflecke. Zool. Jahrb., Abt. System., Geogr. u. Biol. Tiere, Bd. 23, Heft 6, p. 725-738, pl. 30. 1906.

## CHARACTER OF TREES ATTACKED

The trees attacked are apparently healthy, and infested ones can not be detected by their outward appearance. The only way in which to detect the larva is to remove the bark and expose the cambium, where at a glance you can generally recognize the new galleries from the old ones, since new larval mines are only faintly darker than the living cambium; in fact, they are sometimes of a delicate pink color, whereas all the old work is generally dark brown. In Vilas and Oneida Counties, Wis., the trees in the vicinity of Tomahawk and Trout Lakes were carefully examined by Mr. S. A. Rohwer last fall (1913), and no evidence of the cambium miner was found in white birch (*Betula populifolia*), red oak (*Quercus rubra*), red maple (*Acer rubrum*), or sugar maple (*Acer saccharum*).

Pith-ray flecks were found in red oak (*Quercus rubra*) at Charter Oak, Pa., by Mr. T. E. Snyder and in mountain holly (*Ilex monticola*) at Endeavor, Pa., by Mr. F. C. Craighead, but the particular insect or insects causing them are not yet known.

## LIFE HISTORY OF THE SPECIES

## METHODS OF REARING

Numerous experiments were conducted while rearing this species. All the breeding jars were placed in a pasteboard box, which was put in an ordinary soap box lined and covered with about five thicknesses of newspaper. This box was kept outside during the winter in an inclosed shed. The frost penetrated all the protective coverings, but not so thoroughly as though the boxes had been completely exposed. Jars containing earth and sand gave the best results in these rearing experiments. From April 15 to May 12, 1913, six adults emerged. On May 1 a single adult which was reared from the larva emerged, a hymenopterous parasite emerging from another pupa case on May 13.

## THE EGG

The writer unfortunately did not succeed in securing the egg of this species, but it is apparently deposited in the fork of two branches which are about 5 to 8 years old and near the top of the tree. From the shape of the ovipositor (Pl. LXI, fig. 4) the egg is more than likely deposited on the outside of the bark, as the mine, which has been traced from a twig to the base of the tree, a distance of 40 feet, starts from this point like a hair line and, increasing in width as it goes down the trunk, reaches a width of one-eighth of an inch at the base.

THE LARVA<sup>1</sup>

The larva (Pl. LXI, fig. 1) is white, opaque, and cylindrical, averaging from 20 to 25 mm. in length and 1 mm. in diameter. One larva, collected

<sup>1</sup> The larva of this species was discovered by Mr. H. P. Brown and was first shown to the writer by Mr. T. E. Snyder.

on June 19, 1913, was 30 mm. in length and 1 mm. in diameter. The hooklet is shiny black and chitinized, the exposed portion being more highly chitinized than the rest. The hooklet complete (cephalopharyngeal skeleton) dissected out is shown in Plate LXI, figure 1, *a*. Back of the large hooklet are two smaller toothlike processes, one on each side, the position of these being shown at *b*. The anterior spiracles at *c* and the posterior pair at *d* are a very pale yellow, and their position is shown in outline. At the caudal end of the larva are two padlike surfaces, very faintly raised from the surface of the body, reaching nearly around the circumference of the body and covered with numerous brown, hooklike hairs or bristles. Several stages of the larvæ were observed, and the only noticeable difference was in their size.

If the larva reaches the base of the tree before the time to pupate, it will turn and mine up the cambium for some distance; on one occasion the larva retreated for 6 feet, then returned, thus encircling the root, and followed it for 2 feet from the trunk. The exit hole is sometimes made on the side of the root, but generally it is on the underside, and the larva pupates immediately on emergence. The pupæ were found from one-half to one inch from the exit hole. A portion of river birch (*Betula nigra*) with the bark removed is shown in Plate LX, figure 1, to illustrate the larval mines, while figure 2 is part of a cross section showing the "pith-ray flecks" from above.

The only larva that was reared by the writer, and in fact the only one that reached maturity, was placed in a large vial July 30, 1912, with a piece of freshly cut river-birch bark, the inner surface of which was covered freely with fresh sap. A piece of gauze was placed over the opening of the vial. On August 6, 1912, at 8.30 a. m., the larva commenced pupation, first becoming rigid and then changing to deep yellow at both ends, while the central portion remained the natural white color. It was 25 mm. in length and 1 mm. in diameter, but by noon it had decreased to about 10 mm. in length and increased to 2 mm. in diameter. Both ends had changed to dark brown and were perfectly formed, as in the pupa, and the middle was a light yellowish. At 5 p. m. the pupa was perfectly formed and dark brown all over, its dimensions now being 5 mm. in length and 2 mm. in diameter. The larva pupated under the thin folds of the outer bark, as there was nothing else in the vial.

#### THE PUPA<sup>1</sup>

The pupa (Pl. LXI, fig. 2) is of the usual cylindrical type and dark reddish brown in color, averaging from 4 to 5 mm. in length by 2 mm. in diameter, and is formed by the shrinking of the larval skin. The anterior spiracles are slightly more prominent than the posterior pair.

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<sup>1</sup>The pupa of the species was discovered and first shown to the writer by Mr. T. E. Snyder.

## THE ADULT

The adult (Pl. LXI, figs. 3 and 4) of *Agromyza pruinosa* Coq.,<sup>1</sup> six specimens of which were reared by the writer in the spring of 1913, is closely related to *Agromyza carbonaria* Zett. of Europe. *Agromyza pruinosa* remains in the pupal stage in the ground during the winter and emerges from the pupa case in one of two ways: Either the end of the pupal case is pushed off completely, or emergence is accomplished by tearing the end of the pupal case into shreds. Of the six specimens just referred to five were males and one a female. This species of *Agromyza* is represented in the United States National Museum collection by Coquillett's type, a single male specimen (Catalogue No. 6659, U. S. National Museum). The writer's specimens agree perfectly with the type, except that they are very slightly larger.

The general appearance of the adult female corresponds to that of the male, with the exception that it is slightly more robust. The ovipositor is slightly over one-half of a millimeter in length, chitinized, and somewhat shiny on the sides and edges of the dorsal surface. It is slightly flattened and a little broader at the apex than at the base. On the dorsal surface is a granular space, rounded toward the base of the ovipositor.

The total length of the female is 4 mm., and of the male about 3 mm. The abdomen of the female is shown in figure 4 of Plate LXI.

In an adult that had just emerged from the pupal case, the eyes were brownish and the frons and face a pale yellow or orange color. The thorax was pale gray, the legs yellowish, and the wings opaque white, clearing to hyaline in about two hours. The abdomen was of a dull orange color, with a faint gray line along the edge of each segment. The whole insect assumed its natural color in two and a half hours.

## A HYMENOPTEROUS PARASITE

On May 13, 1913, a hymenopterous parasite, *Symphya agromyzae* Rohwer<sup>2</sup> (Pl. LXI, fig. 5), issued from a pupa case of *Agromyza pruinosa* Coq. This parasite is nearly as large as its host. Apparently it deposits its egg within the egg of the host. The apparently normal dipterous larva mines down the tree trunk and enters the ground; the pupa is perfectly formed, outwardly exhibiting no signs of parasitism, but about the time the host should emerge the parasite issues instead. At maturity the end of the pupal case is pushed open by the parasite in the same manner as the host would do it.

<sup>1</sup>Coquillett, D. W. New acalyprate Diptera from North America. Jour. N. Y. Ent. Soc., v. 10, No. 4, p. 177-191. Dec., 1902. "*Agromyza pruinosa*, sp. nov.," p. 189.

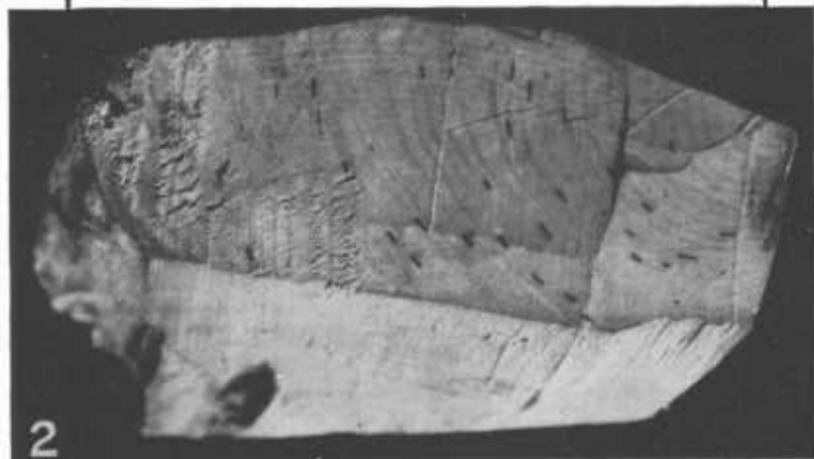
<sup>2</sup>"*Symphya agromyzae*, n. sp. Female. Length 3 mm. Notauli well defined; prescutum with a foveolate furrow; face sparsely punctured; propodeum with a transverse carina; hind tarsi pale. Type Cat. No. 16474 U. S. Nat. Mus." (S. A. Rohwer). A detailed description will appear later in the Entomological News.

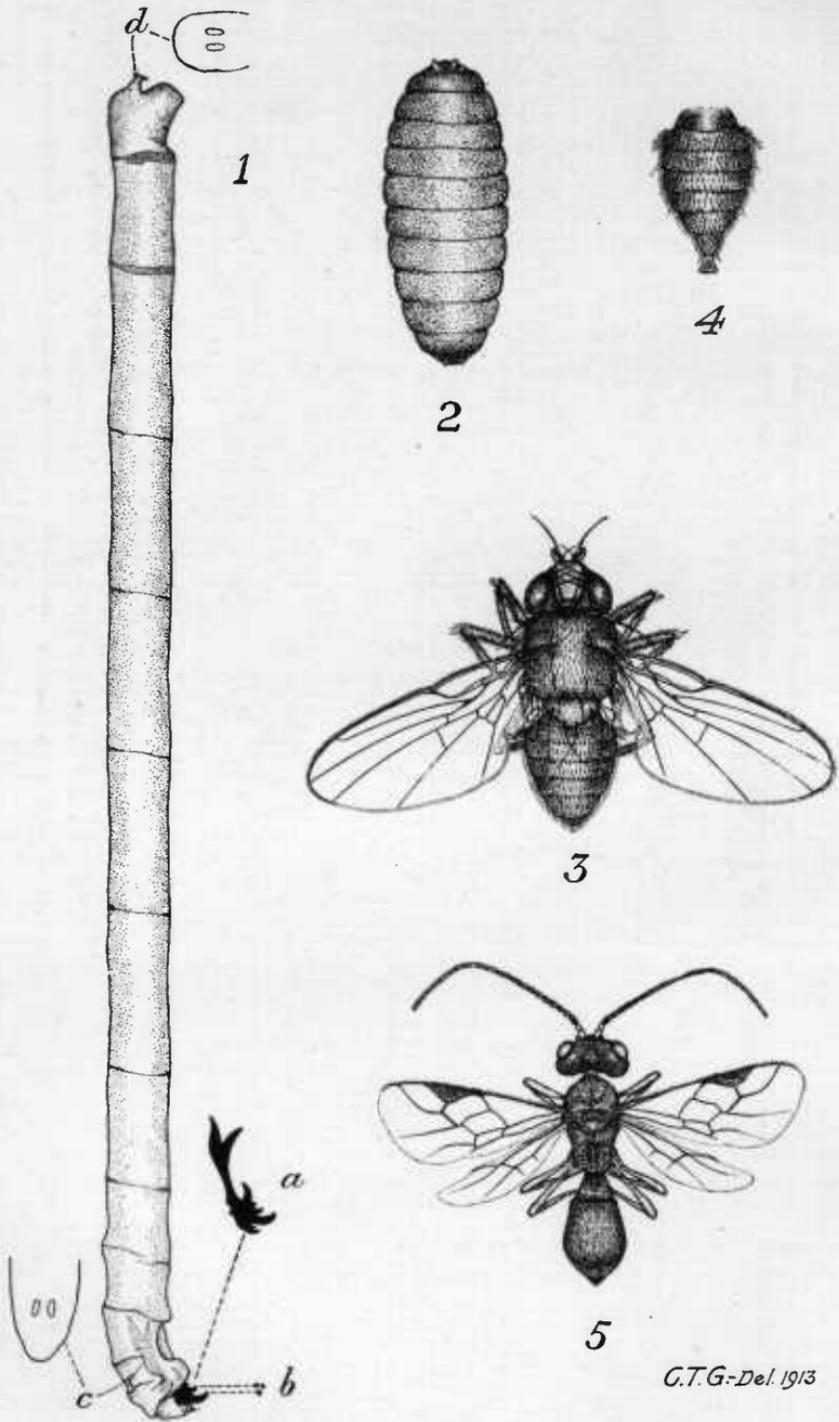
PLATE LX

Fig. 1.—River birch with bark removed, showing larval mines of *Agromyza pruinosa*.

Fig. 2.—Section through wood of river birch, showing "pith-ray flecks" produced by the work of *Agromyza pruinosa*.

Photographed by H. B. Kirk.





*C.T.G.-Del. 1913*

PLATE LXI

- Fig. 1.—*Agromyza pruinosa*: Larva and details.  
Fig. 2.—*Agromyza pruinosa*: Pupa.  
Fig. 3.—*Agromyza pruinosa*: Adult male.  
Fig. 4.—*Agromyza pruinosa*: Abdomen of adult female, showing ovipositor.  
Fig. 5.—*Symphya agromyzae*: Adult.