

**NATURAL HISTORY NOTES ON THE GOLDENROD
BALL GALL FLY,**

***Eurosta Solidaginis* (Fitch), and on its Parasites,
Eurytoma Obtusiventris Gahan and *E. Gigantea* Walsh**

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The fly *Eurosta solidaginis* (Fitch) (Diptera, Tephritidae) causes the round galls commonly seen on the stems of certain species of goldenrod. In the northern United States the fly lays its eggs during the last half of May in the terminal buds of the



1. *Eurosta solidaginis* galls on *Solidago gigantea*.

host. The maggots hatch out after a week or two and feed in the meristem. A gall forms around each larva during the last half of June, and the gall reaches its full size of about an inch in diameter a month or so later (Figure 1).

¹ Now with the Forest Service, U. S. Department of Agriculture; Lower Peninsula Forest Research Center, maintained in cooperation with Michigan State University, East Lansing, Michigan.

The literature on the ball gall and its maker goes back more than a century, but the most comprehensive treatment of both is the recent paper by Uhler (1951). The present paper reports field observations made between 1952 and 1958 mostly in the North Central United States where the gall maker and its parasites have not been previously investigated.

Eurosta solidaginis adults were identified in this study by R. H. Foote of the Insect Identification and Parasite Introduction Laboratories, U. S. Department of Agriculture, and *Eurytoma* spp. by B. D. Burks of the same Laboratories. Goldenrods were identified by E. C. Leonard and L. B. Smith, both of the U. S. National Herbarium, and by S. F. Blake, of the Plant Introduction Section, U. S. Department of Agriculture. Nomenclature of goldenrods in this paper follows Fernald (1950).

The aid which ball galls and their contents can give the biology teacher in the demonstration of phytophagous and zoophagous parasitism, hyperparasitism, the reaction of host tissue to a parasite, and perhaps other biological principles, has already been brought out by Weigel and Dilks (1950).

GEOGRAPHIC DISTRIBUTION

Uhler (1951) showed that the fly occurs across North America from Nova Scotia to British Columbia. In the southern half of the United States, however, only four widely separated locality records have been reported, and large gaps appear elsewhere in its known distribution. The map in the present paper (Figure 2) fills in some of the blank areas between previous points. More observations, especially in the South, will probably extend the limits of the fly's known range and fill in more areas between existing points.

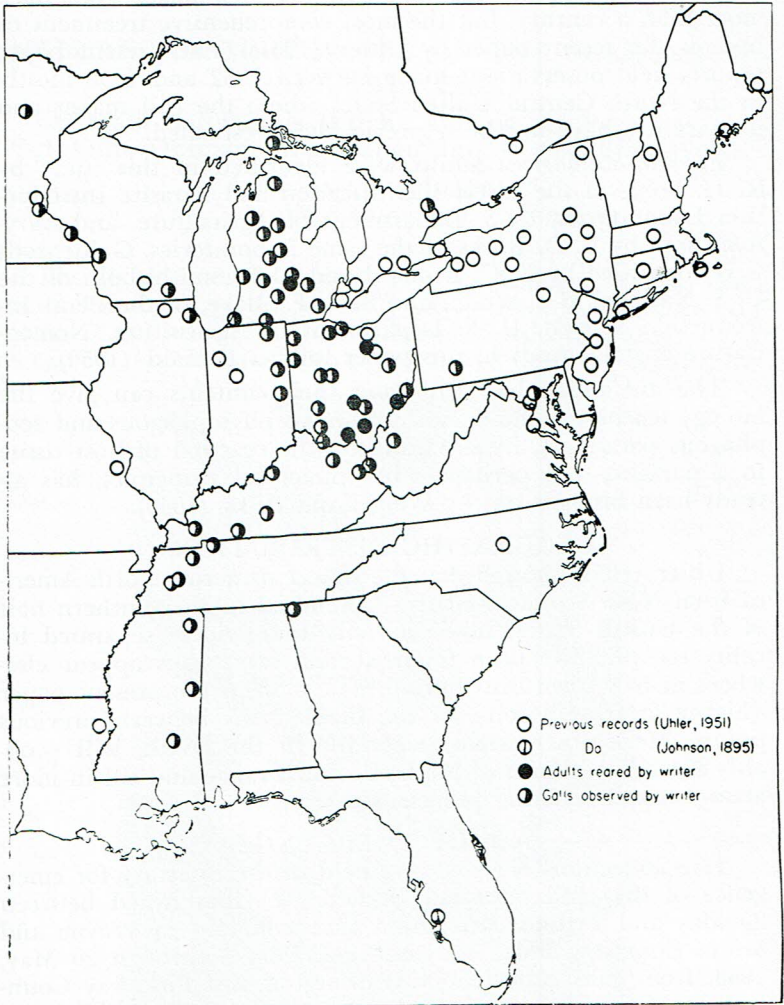
ADULT EMERGENCE

Five collections of galls were held in the insectary for emergence of flies and parasites. In Ohio, 24 flies issued between 20 May and 1 June, 1952, from galls collected in Wayne and Scioto Counties; and 7 flies emerged from 8 through 20 May, 1953, from galls collected in Washington and Pickaway Counties. In Montana, a collection of galls made in Ravalli County produced 48 flies between 15 and 25 May, 1954.

Similar emergence dates have been given in the literature for other areas. Uhler (1951) found emergence in New York to range from about 13 May to 10 June during three years of study, and Baker (1895) said that the flies emerged in Colorado from 7 to 23 May. A graphical presentation of all reported emergence periods (Figure 3) shows a high degree of concurrence.

HOSTS

Adult *Eurosta solidaginis* specimens were actually reared from *Solidago altissima* L. and *S. gigantea* Ait. in Ohio and



2. Partial distribution of records for *Eurosta solidaginis*.

Michigan, respectively. Galls present on particular host species have been noted by the author as follows: on *S. altissima* in Maryland; on *S. gigantea* in Illinois, Minnesota, and Wisconsin; and on *S. ulmifolia* Muhl. in Maryland and Pennsylvania. The galls were at similar densities on all these hosts. However, ball galls were most often met with on *S. altissima* which was one of the commonest goldenrods in the region where the writer worked.

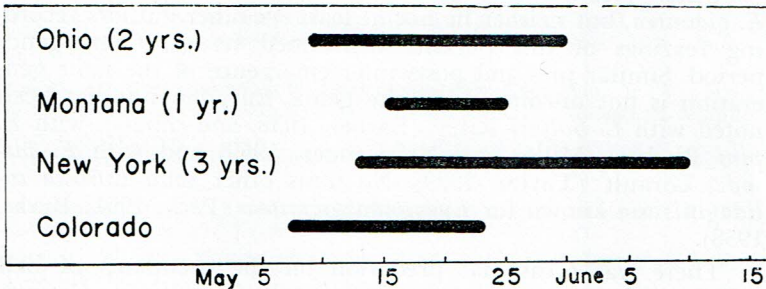
The only earlier mention of any of the foregoing goldenrods as hosts of *Eurosta solidaginis* was by Harrington (1895) who said *Solidago gigantea* was commonly a host at a locality in southern Ontario.

Solidago canadensis L. has been reported as a host by at least four authors, but none stated that the identification of this goldenrod was made by a qualified botanist. *Solidago canadensis* and *S. altissima* are very similar and are often confused.

Several species of goldenrod often found with *S. altissima* but never supporting ball galls were *S. juncea* Ait., *S. nemoralis* Ait., and *S. graminifolia* (L.) Salisb. Uhler (1951) gave both experimental and observational evidence that galls did not normally develop on *S. graminifolia* nor on *S. rugosa* Ait. in New York.

PARASITES AND PREDATORS

During this investigation, two parasite species were reared from the ball gall maker: *Eurytoma obtusiventris* Gahan and *E. gigantea* Walsh (Hymenoptera, Eurytomidae). These two insects have often been reported as parasitizing the gall maker and they are the only ones recorded in the literature as affect-



3. Emergence periods of *Eurosta solidaginis* in various places.

ing it. Of 115 flies and parasites emerging in 1952 and 1953 from galls collected in Scioto, Jackson, Washington, and Wayne Counties, Ohio, 50 percent were *E. obtusiventris* and 4 percent were *E. gigantea*. Of 55 flies and parasites emerging in 1954 from galls collected in Ravalli County, Montana, 13 percent were *E. gigantea*. Neither species of *Eurytoma* has apparently been reported previously from Ohio or neighboring states, nor *E. gigantea* from Montana (Peck, 1951; Burks, 1958).

The emergence period of *E. obtusiventris* lagged behind that of its host. This parasite emerged in Ohio from 8 May to 19 June during 1952 and 1953. It passes the winter as a larva inside the prematurely formed host puparium (Uhler, 1951). Of 7 individuals seen on 2 April, 1953, in Scioto County, 5 were

larvae and 2 were newly transformed pupae. Only one species other than *Eurosta solidaginis* is known as a host of this parasite (Peck, 1951; Burks, 1958).

Although developing but one generation a year on the gall fly, *E. gigantea* had two emergence periods: the first in late summer, and the other the following spring. Pupae and even typical adult exits of *E. gigantea* were found in galls as early as 1 August in Ohio. Three collections totaling 142 galls made in Jackson, Wayne, and Scioto Counties, Ohio, in August, 1952, produced 8 *E. gigantea* adults in the insectary during the remainder of that month. Only the Wayne County galls in this collection failed to produce any wasps during the late summer emergence period. Three-fourths of the Ohio emerging *E. gigantea* population was estimated to have issued during the early period.

Based on insectary emergence from 288 galls collected in Washington, Jackson, and Scioto Counties, Ohio, the spring emerging *E. gigantea* issued from 24 through 30 June, 1952, and 1953. Spring emergence in Ravalli County, Montana, took place from 22 June to 6 July, 1954.

Uhler (1951) reported the larva as the wintering form of *E. gigantea*, but neither he nor at least six other authors recording rearings of this parasite mentioned its early emergence period. Similar pre- and postwinter emergence of the same generation is not uncommon in the genus *Eurytoma*: it has been noted with *E. bolteri* Riley (Barber, 1938, and others), with *E. pini* Bugbee (Miller and Neiswander, 1959) and with *E. pisodes* Girault (Taylor, 1929). No hosts other than *Eurosta solidaginis* are known for *Eurytoma gigantea* (Peck, 1951; Burks, 1958).

There was occasional predation on the occupants of ball galls in Ohio. In one collection of 118 galls from Wayne County, for example, 7 percent of the ball galls had been emptied through a rough, conical hole perhaps by birds. Uhler (1951) stated that there was occasional predation by birds in New York, and Milne (1940) recorded that the occupants of 44.8 percent of ball galls examined in North Carolina had been eaten by birds which he presumed to be woodpeckers and nuthatches.

SUMMARY AND CONCLUSIONS

1. Field and insectary observations were made between 1952 and 1958 on the goldenrod ball gall fly, *Eurosta solidaginis* (Fitch), and on its parasites, *Eurytoma obtusiventris* Gahan and *E. gigantea* Walsh.
2. The gall maker is here reported for the first time from Georgia, Kentucky, Michigan, Mississippi, Tennessee, and West Virginia.
3. Emergence periods of the fly observed in Ohio (8 May

through 1 June) and in Montana (15 through 25 May) are remarkably concurrent with those previously on record, which are from New York and Colorado. The earliest and latest known emergence dates for the gall maker are 7 May and 10 June.

4. Two of the three ball gall hosts observed in this study have not previously been recorded. These are *Solidago altissima* L. and *S. ulmifolia* Muhl. The galls were most commonly found on *S. altissima*. *Solidago altissima* is very similar to *S. canadensis*, with which it may have been confused by some authors reporting *S. canadensis* as a host.

5. *Eurytoma obtusiventris* Gahan and *E. gigantea* Walsh, both well known to be parasitic on the ball gall fly in other areas, are reported here for the first time from Ohio and neighboring states, and *E. gigantea* for the first time from Montana. In Ohio, the same generation of *E. gigantea* emerged partly in late summer and partly the following spring. Dual emergence is known for other species of *Eurytoma*, but it appears to have previously been overlooked in *E. gigantea*.

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