MASS EGG PRODUCTION BY THE COCCINELLID HIPPODAMIA CONVERGENS GUER.

GORDON W. HAUG,
The Ohio State University,
Columbus, Ohio

Methods for obtaining egg production by the convergent ladybeetle through the use of frozen aphids have been reported by the writer in another paper (1938). By using frozen aphids, satisfactory egg production can be maintained at any time of the year.

Frozen aphids desiccate quickly after being removed from storage. The technique developed calls for the use of a humidifier and a special type of feeding cage that keeps the beetles close to the food supply at all times, resulting in a minimum of food wastage.

However, it is more convenient and practical to use living aphids as food during times of the year when they are very abundant.

During the growing seasons of 1935 and 1936 the writer experimented in detail with methods of obtaining most efficient egg production by *convergens* when fed living aphids. The methods developed are reported in this paper. As the work was prompted by the need of a daily egg supply for *convergens* ovicide tests by Haug and Peterson (1938), the writer's interest at all times was in working out methods for obtaining these eggs. It was not the purpose of the work to make a study of *convergens* oviposition.

METHODS

Species of Aphids Used.—Among the species of aphids used as food for *convergens* were the following: elm-leaf curl aphid (*Georgiaphis ulmi*), elm cock's comb gall aphid (*Colopha ulmicola*), bean aphid (*Aphis rumicis*), giant hickory aphid from sycamore (*Longistigma caryae*), aphid on wild carrot (*Rhopalosiphum melliferum*), false cabbage aphid (*Rhopalosiphum pseudobrassicae*), aphid on willow (*Clavigerus smithiae*), poplar gall aphids (*Pemphigus populi-transversus* and *P. populicaulis*), green peach aphid (*Myzus persicae*), pea aphid (*Illinoia pisi*), green apple aphid (*Aphis pomi*) and an aphid from spiraea (sp. undet.).

Convergens adults will feed readily on the above species, and produce eggs when fed a strict diet of any one of them.

The writer has worked with only one aphid species that will not support egg production. It was a woolly aphid from elm (sp. undet.).

During the 5 days it was being used, egg production in the laboratory fell from 600 per day to none.

Of the many species that serve as food, it is advisable to use only those that can be collected in large quantity. Rather than depend on small daily aphid collections, it is more practical to collect them by the gallon and store them in the laboratory at 2 degrees Centigrade, under high humidity. This method assures an uninterrupted supply for one or more weeks, depending on the number of beetles being fed.

Three species have been found particularly acceptable. They are the two poplar gall aphids *P. populi-transversus* and *P. populicaulis*, and the elm-leaf curl aphid *G. ulmi*. Of these, the two poplar gall aphids are by far the most satisfactory. In Columbus, the galls have been collected at the rate of several hundred per hour. Also, they store well. Galls are clipped from the leaves, packed loosely in paraffined Sealright containers (pint) containing saturated cellucotton, and having a small hole in the lid for aeration. At the end of two months there is no appreciable mortality among the aphids (*P. populi-transversus*) of galls stored at 0 and 2 degrees C.

An average-sized gall of *P. populi-transversus* will contain more than 500 aphids.

Laboratory Apparatus.—*Convergens* adults have been kept in many kinds of cages, including glass vials, flower-pot saucers with glass tops, and Petri dishes. None of these is satisfactory when quantity egg production is desired. Glass vials could be made acceptable if one were interested in individual egg records. A satisfactory cage must provide special conditions of light and humidity.

In the case of cages such as flower-pot saucers, adults collect on the upper edge of the cage on the side of the light source. They fall repeatedly to the bottom of the dish. Being distended with eggs they are not able to right themselves, and die. Egg production is very low. Glass vials and Petri dishes, as such, do not allow for proper aeration or humidity.

The standard cage is one-half of a Petri dish with a cheese-cloth top. The cheese-cloth is stretched between two hoops made of one-half inch aluminum stripping. In diameter the hoops are not much more than that of the Petri dish half (Figs. 1 and 2).

There is no condensation of moisture in this cage. The source of light is directed from below, keeping the beetles in the bottom of the cage, next to the source of food. A series of cages is shown in place on the light-box in Fig. 2.

Because of the cloth tops, there is considerable loss of aphid food through desiccation. To prevent this loss a humidifier is used. It fits over the cages on the light-box. The light-box and humidifier have been described and illustrated by the writer elsewhere (1938). Both are standard equipment in this work. Potassium sulfate is used in the humidifier.

Daily Treatment.—The beetles are fed twice daily. At each feeding the glass Petri dish is cleaned thoroughly. A piece of cellucotton saturated with water is placed in the center of the cage to provide moisture for the beetles. A supply of leaves of *Spiraea Vanhouttei* Zabel is kept in the cage at all times for the beetles to oviposit on. Sufficient poplar galls are introduced to provide an excess of food. In Fig. 1 a cage is shown with top removed and containing spiraea leaves bearing egg clusters, opened poplar galls and beetles.

At each feeding, the spiraea leaves bearing egg clusters are removed. This is how eggs are collected for the ovicide tests. The spiraea leaves are especially satisfactory. Beetles oviposit on them readily, they remain turgid a long time, and are very smooth. In Fig. 3 is shown a spiraea leaf with egg clusters in various stages of hatch. The larvae have hatched and migrated from two of the clusters.

Overwintering females retain their fertility of the previous season. For that reason, males are not kept in the oviposition cages, because they not only consume valued food, but they tend to interfere with egg deposition because of their copulation instinct.

OVIPOSITION DATA

Time has not been available for making extensive egg counts using the equipment developed and described above.

As a sample of what can be expected from *convergens*, laboratory egg production for the period July 6 to July 15, 1936, is recorded. The beetles used were overwintering adults of the 1935 season, collected near Placerville, California, during February, 1936, and stored since, in California and Ohio. The beetles had been used in the laboratory for some time previous for egg production. Their energies were reduced, as is evidenced by the fact there were 48 beetles at the beginning of the ten day period, and only 16 living at the end.

17,933 eggs were collected in the 10 days. The daily average number of females was 35. The number of eggs per female-day was 51.2. When frozen aphids were used as food (Haug, 1938), egg production was much lower, partly because the food supply was less plentiful.

CONCLUSIONS

Unless the proper methods are used, *convergens* females will not produce eggs. If methods are only partly satisfactory, all or a part of the eggs are eaten a short time after deposition. Equipment and methods have been developed that obtain egg-laying efficiency.

When fed an excess of living poplar gall aphids (*Pemphigus populicaulis*), a daily average of 35 overwintering females deposited 17,933 eggs in 10 days, an average of 51.2 eggs per female-day.

LITERATURE CITED

Haug, G. W. 1938. Rearing the coccinellid *Hippodamia convergens* Guer. on frozen aphids. Ann. Ent. Soc. Amer. 31: 240–248.

Haug, G. W., and **Peterson, Alvah.** 1938. The effect of insecticides on a beneficial coccinellid, *Hippodamia convergens* Guer. Jour. Econ. Ent. 31: 87–92.

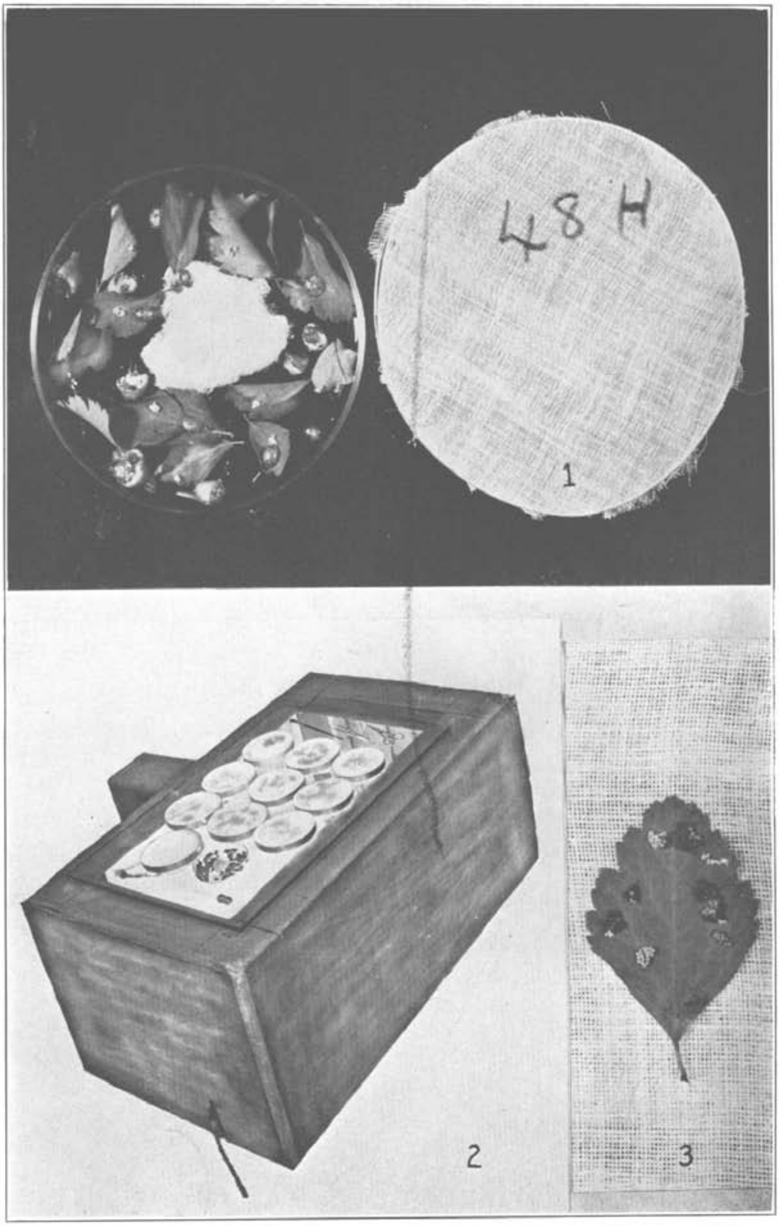

Fig. 1. Standard feeding and oviposition cage, with cheesecloth top, removed. Note the egg clusters on the spiraea leaves.

Fig. 2. Feeding cages in place on light-box.

Fig. 3. A spiraea leaf with egg clusters in various stages of hatch. The larvae have hatched and migrated from two of the clusters.