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Stanley G. Wellso  
*USDA, East Lansing, MI*

Roland L. Fischer  
*Michigan State University*

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## INSECTS TAKEN AT JAPANESE BEETLE TRAPS BAITED WITH ANETHOLE-EUGENOL IN SOUTHERN MICHIGAN IN 1968<sup>1</sup>

Stanley G. Wellso<sup>2</sup> and Roland L. Fischer<sup>3</sup>

A survey of the populations of Japanese beetles, *Popillia japonica* Newman, is made each year in southern Michigan to determine the abundance and distribution of this pest insect. Since little information is available about the insects that are attracted by Japanese beetle attractants in Michigan or anywhere in the United States, a study was made of the insects captured in Japanese beetle traps.

Insects recovered from Japanese beetle traps baited with a geraniol-eugenol solution in New Jersey were tabulated by Richmond and Metzger (1929) who reported that 200 specimens of *Chauliognathus marginatus* F. (Cantharidae) were recovered from two traps in the summer of 1926. In addition, in 1925, 17 specimens of *Ophistomis luteicornis* F. and 15 *Typocerus velutinus* (Olivier) (Cerambycidae) were recovered. Additional information on insects of the Order Coleoptera recovered from 400 similarly baited traps sampled for five days in late June near Woodstown, New Jersey was published by Metzger and Sim (1933). This list included identified species from the following families: Cantharidae (1 species), Carabidae (3), Chrysomelidae (4), Curculionidae (1), Elateridae (1), Hydrophilidae (2), Scarabaeidae (23) and Silphidae (1). The species of Hymenoptera taken at Ellisco® traps baited with lures to attract Japanese beetles on Nantucket Island, Mass. from mid-June to mid-October 1965-67 were reported by Hamilton et al. (1970). They noted that 80% of the bumble bees taken in 1965 were identified as *Bombus bimaculatus* Cresson, *B. impatiens* Cresson, and *B. terricola* Kirby. In addition, Hamilton et al. (1971) list the orders of arthropods taken in 1965. They note that 45% of the captures other than Japanese beetles and bumble bees were Hymenoptera, about 30% were Coleoptera, and more than 17% were Lepidoptera. In addition, 28 species of Scarabaeidae were taken and identified during the three year study.

The insects recovered from standard Japanese beetle traps baited with anethole-eugenol in southern Michigan in 1968 are listed here. In addition, information is presented about the occurrence, sex ratio, and number of Japanese beetles taken in the 1968 Michigan survey.

### METHODS AND MATERIALS

In 1968, ca. 17,500 Japanese beetle survey traps (Fleming 1969) were used by the Michigan Department of Agriculture in cooperation with the Plant Protection Division, Agr. Res. Serv., U. S. Department of Agriculture to survey for the Japanese beetle in Michigan. About 2,000 of these traps were baited with phenyl ethyl butyrate-eugenol (9:1) and located in rural Monroe, Lenawee, and Berrien Counties. These traps were not surveyed for insects other than the Japanese beetle. The other 15,500 traps were baited with anethole-eugenol (9:1) and located in or near the cities of Detroit, Ypsilanti, Lansing, Battle Creek, Grand Rapids, and Kalamazoo and in rural Cass County in southern Michigan. These traps were tended by 18 trap tenders each instructed to collect insects daily from late June to early September from ten traps that had representative good catches. These collections were placed in 70% alcohol, and the species were subsequently identified if more than ten specimens were collected. In addition, all Japanese beetles collected during the 1968 survey program in Michigan were sexed and counted by the date of capture.

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<sup>2</sup>Entomologist, Entomology Research Division, Agr. Res. Serv., USDA, East Lansing, Mich. 48823.

<sup>3</sup>Professor of Entomology, Michigan State University, East Lansing, Mich. 48823.

## RESULTS AND DISCUSSION

JAPANESE BEETLE IN MICHIGAN.—During 1968, 1256 Japanese beetles, 644 males and 612 females, nearly a 1:1 sex ratio, were collected from all Japanese beetle traps (Table 1). The sex ratio was similar for beetles from traps baited with anethole-eugenol or with phenyl ethyl butyrate-eugenol. Collections were made from 30 June to 7 September, but the largest number, nearly one-third of the trapped beetles, was collected between 28 July and 3 August.

Table 1.—Numbers of Japanese beetles taken in Japanese beetle traps in southern Michigan baited with either anethole-eugenol or phenyl ethyl butyrate-eugenol. 1968.

| Dates            | Males | Females |
|------------------|-------|---------|
| June 30–July 6   | 2     | 1       |
| July 7-13        | 8     | 20      |
| July 14-20       | 112   | 71      |
| July 21-27       | 89    | 100     |
| July 28–August 3 | 238   | 173     |
| August 4-10      | 63    | 81      |
| August 11-17     | 57    | 68      |
| August 18-24     | 44    | 58      |
| August 25-31     | 1     | —       |
| September 1-7    | 29    | 37      |
| No date          | 1     | 3       |
| Total            | 644   | 612     |

OTHER INSECTS.—The species of insects represented by more than 10 specimens taken in traps baited with anethole-eugenol from late June to early September 1968 are presented in Table 2. Insects occurring in fewer numbers than ten specimens were not identified. We do not want to imply in this paper which species are attracted to the traps and/or the bait, or which species were accidentally trapped. A detailed study of insect populations in the trapped area, as well as control traps of various colors and without baits, would have to be compared to determine attractiveness. The insects identified from the traps were from six Orders with insects from the Orders Coleoptera and Hymenoptera representing 58.7 and 29.4% of the species, respectively. Five of the 23 species of Coleoptera were previously reported by Metzger and Sim (1933) (Table 2). In addition to being an attractant for the Japanese beetle (Fleming 1969), anethole-eugenol in Japanese beetle traps appears to attract the corn leaf aphid, *Rhopalosiphum maidis* (Fitch); a soldier beetle, *Chauliognathus pennsylvanicus* De Geer; the rose chafer, *Macrodactylus subspinosus* (F.); and, unfortunately, the honey bee, *Apis mellifera* L. The four species listed accounted for nearly 90% of all of the insects other than the Japanese beetle taken at the Japanese traps surveyed.

It is impossible from our data to separate those species which were attracted to the yellow color of the trap from those attracted by the odor of the attractant. Our data indicates that about 26 honey bees were captured per trap (Table 2). Hamilton et al. (1970) also noted that large numbers of bumble bees, *Bombus* spp. were captured in yellow traps baited with anethole-eugenol. The attractant phenyl ethyl butyrate-eugenol now used by Plant Protection Division, ARS, USDA in their survey and detection programs (McGovern et al., 1970) is much less attractive to honey bees and bumble bees than anethole-eugenol (Hamilton et al., 1970).

Table 2.—Species of insects represented by more than ten specimens in samples of insects taken in Japanese beetle traps baited with anethole-eugenol from late June to early September 1968 in southern Michigan.

| Order              | Family        | Species  | No.  |
|--------------------|---------------|--|------|
| <i>Dermaptera</i>  | Forficulidae  | <i>Forficula auricularia</i> L.                      | 11   |
| <i>Hemiptera</i>   | Phymatidae    | <i>Phymata erosa</i> (L.)                            | 22   |
| <i>Homoptera</i>   | Aphididae     | <i>Rhopalosiphum maidis</i> (Fitch)                  | 1276 |
|                    | Cicadidae     | <i>Tibicen canalicularis</i> (Harris)                | 15   |
| <i>Coleoptera</i>  | Carabidae     | <i>Harpalus compar</i> LeConte                       | 11   |
|                    |               | * <i>Harpalus pennsylvanicus</i> De Geer             | 12   |
|                    | Cantharidae   | <i>Chauliognathus pennsylvanicus</i> De Geer         | 577  |
|                    | Meloidae      | <i>Epicauta pennsylvanica</i> (De Geer)              | 14   |
|                    | Elateridae    | <i>Hemicrepidius memnonius</i> (Herbst)              | 54   |
|                    | Coccinellidae | <i>Adalia bipunctata</i> (L.)                        | 16   |
|                    |               | <i>Anatis quindecimpunctata</i> (Olivier)            | 14   |
|                    | Scarabaeidae  | ‡* <i>Macrodactylus subspinosus</i> (F.)             | 980  |
|                    |               | * <i>Pelidnota punctata</i> (L.)                     | 104  |
|                    |               | ‡ <i>Phyllophaga anxia</i> (LeConte)                 | 11   |
|                    |               | ‡ <i>Phyllophaga crenulata</i> (Froelich)            | 11   |
|                    |               | ‡ <i>Phyllophaga gracilis</i> (Burmeister)           | 23   |
|                    |               | <i>Phyllophaga rugosa</i> (Melsheimer)               | 26   |
|                    |               | <i>Popillia japonica</i> Newman†                     | 646  |
|                    |               | <i>Serica iricolor</i> (Say)                         | 10   |
|                    | Chrysomelidae | * <i>Chrysochus auratus</i> (F.)                     | 10   |
|                    |               | * <i>Leptinotarsa decemlineata</i> (Say)             | 10   |
|                    | Cerambycidae  | <i>Megacyllene robiniae</i> (Forster)                | 13   |
|                    |               | <i>Parandra brunnea</i> (F.)                         | 18   |
|                    |               | <i>Tetraopes tetrophthalmus</i> (Forster)            | 40   |
| <i>Hymenoptera</i> | Tiphiidae     | <i>Myzinum quinquecinctum</i> (F.)                   | 58   |
|                    | Vespidae      | <i>Polistes fuscatus</i> (F.)                        | 13   |
|                    | Halictidae    | ‡ <i>Agapostemon virescens</i> (F.)                  | 27   |
|                    | Apidae        | ‡ <i>Apis mellifera</i> L.                           | 4472 |
|                    |               | ‡ <i>Bombus impatiens</i> Cresson                    | 38   |
|                    |               | ‡ <i>Bombus bimaculatus</i> Cresson                  | 47   |
|                    |               | ‡ <i>Bombus fervidus</i> (F.)                        | 43   |
|                    |               | <i>Melissodes bimaculata bimaculata</i> (Lepeletier) | 53   |
|                    |               | <i>Melissodes desponsa</i> Smith                     | 12   |
|                    |               | <i>Melissodes illata</i> Lovell & Cockerell          | 44   |

\*Previously reported by Metzger and Sim (1933).

†The number of Japanese beetles is the total caught in all traps in the 1968 survey program that were baited with anethole-eugenol.

‡Previously reported by Hamilton et al. (1970, 1971).

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