STANDARDS FOR COMPARISON OF INSECTS INFESTING FRUIT IN MICHIGAN

THESIS FOR THE DEGREE OF M. S.

M. G. Farleman

1930

Insects

Fruit - Diseases + pest.

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Introduction.

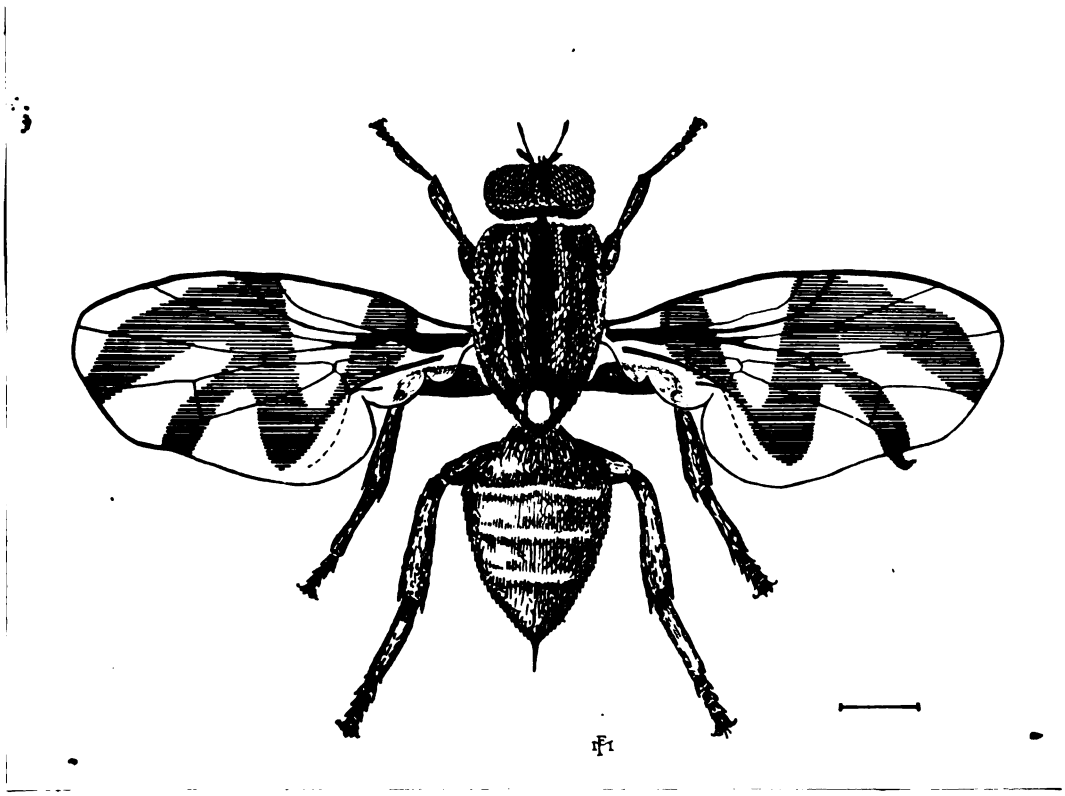
The professional entomologist, engaged in service work, is constantly required to differentiate between insects that closely resemble one another. Insects whose habits and whose potentialities for harm may be different one from another but which are nevertheless very similiar in appearance. The descriptions, on which the entomologist has to depend, are often printed in languages other than English and the illustrations accompying such descriptions are often vague. It would therefore appear that a description, well illustrated, would be highly desirable for use among professional entomologists where extreme technical accuracy is paramount and where speed is of importance. The present thesis is the outcome of an attempt to establish certain standards for comparison, by means of drawings and descriptions, in order to facilitate so far as it goes, rapid and accurate determinations of certain important fruit pests now working in Michigan. The drawings and descriptions are originals, having been taken direct from the insects under consideration.

The writer wishes to acknowledge with gratitude the interest and hearty aid of Professor R. H. Pettit and Associate E. I. McDaniel, who at every step, gave assistance.

APPLE FRUIT FLY

Rhagoletis pomonella Walsh

PLATE 1.



ORIENTAL PEACH MOTH

Laspeyresia molesta Busck

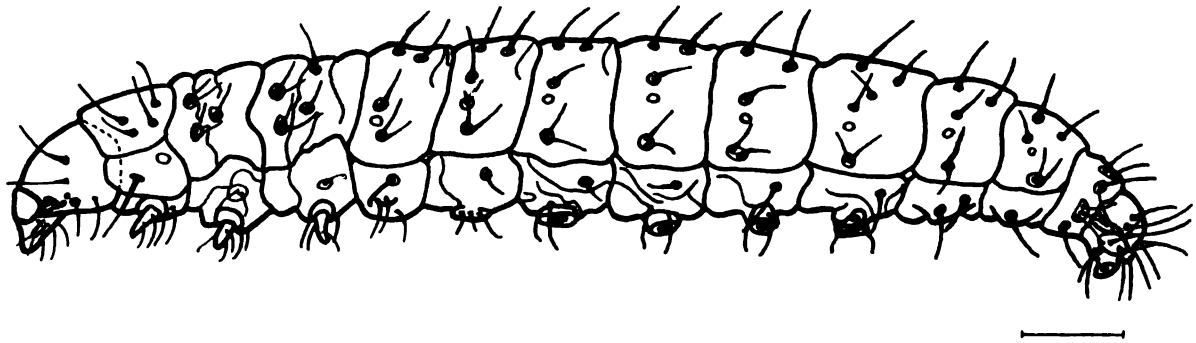
Larva

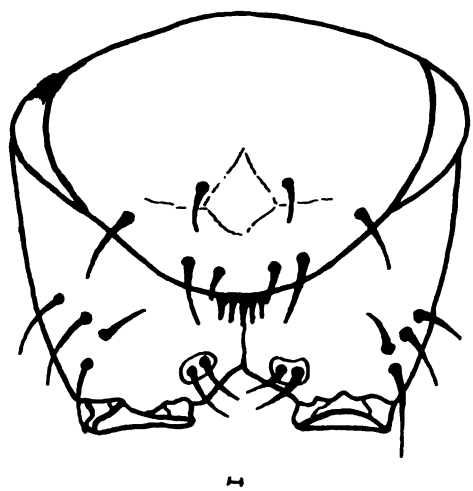
Anal
Dorsal Plate

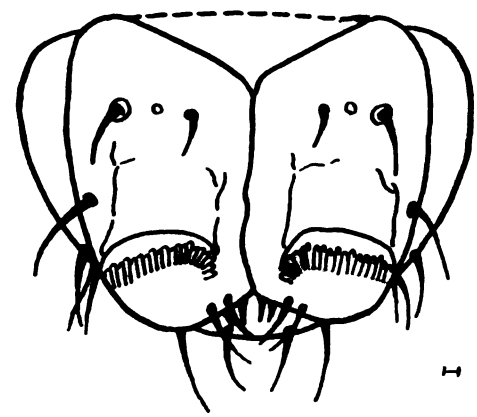
Anal
Ventral Plate

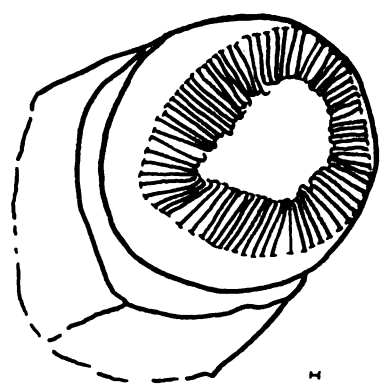
Crochets

PLATE 2.









ORIENTAL PEACH MOTH.

Laspeyresia molesta Busck.

DISTRIBUTION

Now infests much of the Eastern United States having spread from the Atlantic seaboard south to and including the south-central states, and north to Canada including the north-central states and Ontario.

ORIGINAL HOME

The original home of this insect was in Australia. It came to the United States from Japan in shipments of flowering cherries, received sixteen or eighteen years ago.

HOST LIST

It was first thought that the only plants attacked were peach, cherry, plum, quince, apricot and several varieties of flowering cherry, but recently the insect has been reared also from pear, apple and flowering quince.

- CHARACTERISTICS -

ADULT

The head of the adult is dark, smoky-fuscous,

the face a shade darker or nearly black; labial palpi lighter fuscous; antennae simple, rather stout, about half as long as the fore-wing. Thorax blackish-fuscous. Fore-wing normal in form; termen with slight sinuation below apex; dark-fuscous, obscurely irrorated by white-tipped scales; costal edge blackish. Hind-wings dark-brown with costal edge broadly white; cilia whitish; underside of wing lighter fuscous with strong iridescent sheen. Abdomen dark-fuscous with silvery white underside; legs dark-fuscous with inner sides silvery; tarsi blackish with narrow, yellowish-white annulations.

EGGS

Scalelike, oval, slightly convex flattened toward the edge; color grayish-white somewhat iridescent.

Average measurement .59 to .72 mm.

LARVA

Cylindrical, without secondary hair, color varying from white to deep pink, usually a stronger pink on dorsum. Legs and prolegs normal. Crochets (31.46) arranged in a complete circle. Anal fork developed and prominent; yellow to black in color, three to six pointed. Setal areas broadly

chitinized, grayish-brown. Thorocic shield light-yellow edged with yellowish-brown. Spiracles, small, circular, dark-brown or black. Spiracle on prothorax and that on abdominal segment 8, very little larger than those on abdominal segments 1 to 7. Head light-brown, with darker brown mottling, hind margin, ocelar area, and tips of trophi black. Head capsule nearly spherical, slightly flattened, appearing broadly oval in outline when viewed from above; a little wider than long; the greatest width distinctly behind the middle ocelli of which there are six.

Length of full-grown larva varies from 11 to 13 mm.

PUPA

The pupa is yellowish-brown, without pubescence. Metathoracic legs and tips of hind-wings reaching just beyond the cephalic edge of the fourth abdominal segment; antennae extending about 2/3 of the wing length. A double row of dorsal spines on abdominal segments 2 to 7.

Average length 6.26 mm. and width 1.8 mm.

- DISCUSSION -

The adults of the several broods emerge from the middle of April to the middle of October. The

eggs are sometimes laid directly following emergence, and the incubation period varies from 3 to 8 days. When the young larva hatches, it immediately starts its search for a favorable feeding place, such as the tender growth of a "terminal" where it bores into the interior of the peach shoot. The larva requires from 8 to 16 days to develop fully, at which time it leaves the twig or fruit where it has been working, in search of a favorable place for spinning its cocoon. Such a place is found in the axil between twigs or on the fruit where it is attached to the stem. The time from spinning the cocoon until pupation varies from 2 to 9 days. The pupal-case then splits open in the cephalic and thorocic regions, permitting the moth to emerge.

- REFERENCES -

Bailey - Vt. Com. Agr. R. 10, 27, 1920.

Berly - S. C. Clemson Col. C. 3?, ??, 1924.

Blake - N. J. St. Hort. Soc. News 5, 73, 75, 1924.

Britton - Conn. B. 256, 284, 1924.

Champlain and Guyton - J. Ec. Ent. 7, 415, 1924.

Cory, Peninsula Hort. Soc. Trans. 32, 31-34, 1919.

Felt - Mass. Fr. Gr. Assoc. R. 24, 152, 1918.

Fernald - J. Ec. Ent. 13, 210, 1920.

- REFERENCES -

Flint - Ill. Hort. Soc. Trans. 57, 474, 1924.
Forbes - N. Y. C. M. 68, 390, 1923.

Frost - J. Ec. Ent. 16, 383, 1923.
Frost - J. Ec. Ent. 16, 461, 1923.

Fulton,- N. Y. Geneva B. 475, 13, 1920.

Headlee - N. J. R. 42, 364, 1921. R. 43, 434, 1923. C. 167, 1924.
Headlee - N. J. Hort. Soc. Proc. 47, 49, 1922; 49, 61, 1923.

Lyle Miss. St. Pl. Bd. Quar. B. 4: 3, 19, 1924.

Marlett - Nat. Geog. Mag. 40, 509, 1921.

Peterson - N. J. Agr. 5:10, 6, 1923.

Sanderson - Ins. Pests. ed. 2, 510, 1921.

Sasscer - J. Ec. Ent. 13, 182, 1920.

Schoene - Va. Crop. Pest Com. Quar. B. 1, 4, 11, 1920; B. 3, 4, 10. 1923; B. 5, 4, 19, 1924.

Scholl Texas Dept. Agr. B. 72, 73, 1922.

Seigler - Ind. Hort. Soc. Fr. 63, 54, 1924.

Stearns - J. Ec. Ent. 13, 364, 1920.

Stearns - Ba. Crop. Pest Com. Quar. B. 9, 1, 1920.

Stearns - J. Ec. Ent. 14, 336, 1921.

Strong - Cal. Agr. Mo. B. 11, 869, 1923.

Summers - J. Ec. Ent. 16, 392, 1923.

Wilson Miss. Ext. B. 16, 85, 1920.

Wood and Selkregg - Jr. Agr. Res. Vol. 13 #1 1918.

CODLING MOTH

Carpocapsa pomonella Linn

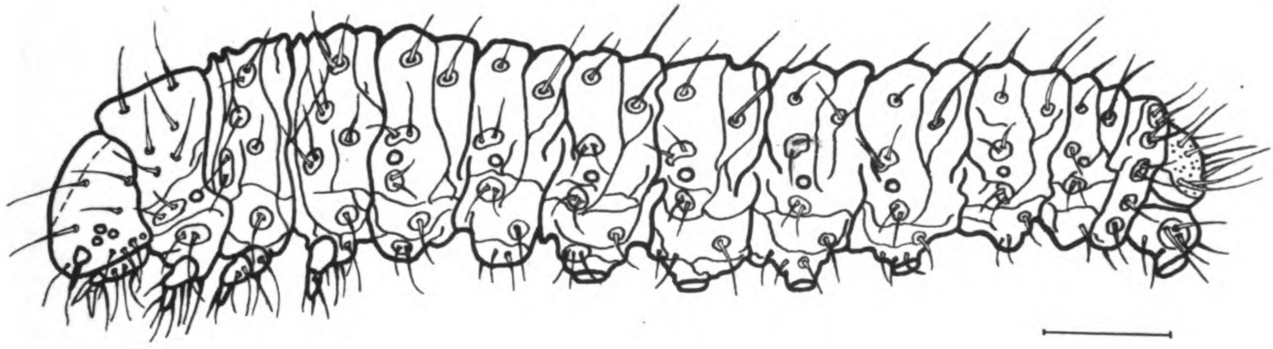
Larva

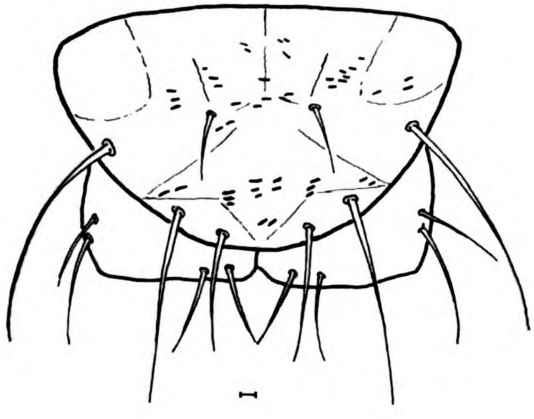
Anal
Dorsal Plate

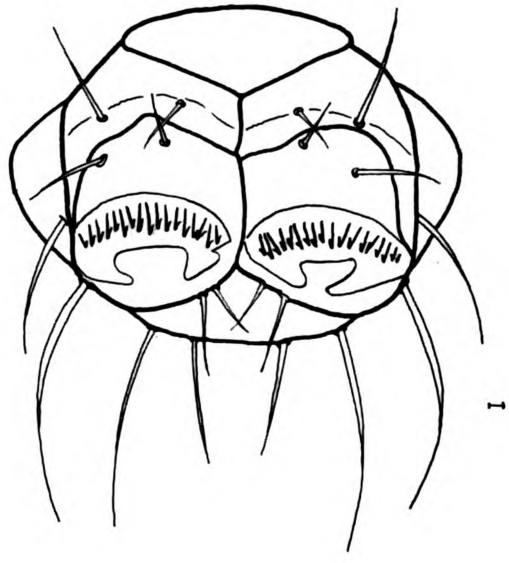
Anal
Ventral Plate

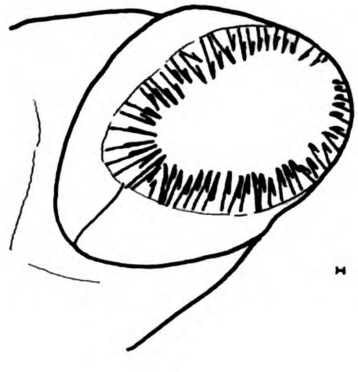
Crochets

PLATE 3.









CODLING MOTH

Laspeyresia pomonella

Carpocapsa pomonella Linn.

DISTRIBUTION

The original home of this insect is in southeastern Europe but now it has become nearly cosmopolitan, occuring in all the apple-growing regions of the world. It was first introduced into the United States, through New England, sometime before 1750 and since that time, it has spread rapidly westward reaching Iowa about 1860, Utah in 1870 and California about 1874.

HOST LIST

Apple, pear, quince, wild haw, crab, English Walnut and several other fruits.

- CHARACTERISTICS -

ADULT

Wings gray with fine striation, showing under a lens as white tips to blackish scales; base slightly darker; margin curved and scalloped at outer boundary; speculum of two bronz bars, the outer one more or less broken up, filled with chocolate brown, the brown extending to form a large oval area almost reaching the costal and outer margin;

costa and extreme outer margin striate and gray like the base. No black in speculum, but speculum preceded by a heavy vertical black bar. Fringe with a black line and sometimes cut with white. Hind-wing brown, the scale covering in the male, lead color; the hair on the fringe blackish.

Size varies from 15 to 20 mm.

EGG

Glistening white in color; flat, oval, scale-like in shape and 1/25 inch in diameter.

LARVA

The larva is whitish when young but becomes pinkish or flesh-colored as it approaches full growth. When young, the head is blackish but when full grown, it is brown with darker markings along the sutures. The spots in which the minute short hairs are situated are but little darker than the body wall and slightly elevated. There are eight hairs on each segment, two on the back each side of the middle line, and a somewhat larger pair above and below each spiracle. The mandibles are noticeable prominent. The larva has eight pairs of legs; the first three pairs, or true legs are situated on the thorax and are three jointed. The five pairs of fleshy abdominal legs are armed with circles of hooks known as crochets

while the pair of prolegs at the extreme rear end have the hooks or crochets arranged in a semi-circle. The spiracles or breathing-apertures are arranged on either side one pair to each segment, of the body with the exception of the two thoracic segments which bear the second and third true legs.

The full grown larva measures from 15 to 18 mm. in length.

PUPA

Just before the pupal stage, the larva spins a silken cocoon, white inside and grayish outside, usually covered somewhat with pieces of bark and other small fragments on which the worm happens to spin. The larva remains in this cocoon for an average of six days during the summer, or in the case of the fall brood over winter, after which the larval skin is shed and the insect becomes a pupa. The pupa at first is yellow, becoming dark brown with age. The head, eyes, mouthparts, antennae, legs and wings of the moth are apparent in sheaths which are immovably attached to the body. The abdominal segments, which are movable, are each armed with two rows of spines, except the terminal segments which bear one each. The last abdominal segment has a number of long spines with terminal hooks, these hooks fasten in the silk and aid the

pupa in holding its place in the cocoon.

Pupae vary from 13 to 14 mm. in size.

- DISCUSSION -

In Spring the moths emerge from their pupa-cases, or so called winter quarters, to mate and the females lay their eggs. The eggs of the first generation are almost entirely laid on the upper side of the leaves. The eggs hatch in from 6 to 20 days. The worms feed lightly on the foliage but crawl very soon to the young apples and chew their way into the fruit. When full-grown, they burrow to the outside of the fruit in search of a suitable place for pupation, generally hiding away among the bark flakes.

The second generation is usually found in the later varieties of apples. Many of the larvae reach full growth before late fall and seek the same places for pupation as did those of the early brood.

- REFERENCES -

Alwood - Va. St. Hort. Soc. R. 35, 151, 1920.

Barlow - B. C. Dept. Agr. R. 17, W. 47, 1923.

Barnett - Kans. St. Hort. Soc. Bien. R. 36, 106 1922.

Barss and Lovett - Oreg. Ext. B. 369, 4, 1924.

Bartlett - briz. Com. Agr. and Hort. R. 11, 42, 1921.

Batchellor - Cal. B. 332, 203 1921.

Black - B. C. Dept. Agr. R. 17 W. 62, 1923.

Bourne - Mass. Fr. Gr. Assoc. R. 29 200, 1923.

Britton, Zappe and Stoddark, Conn. B. 235, 218, 1922.

Brues - Amer. Nat. 58, 131, 1924.

Caesar - Ont. Fr. Gow. R. 44, 22, 1923.

Childs - Oreg. B. 171, 7-31, 1920.

Christie - Ind. R. 33, 22, 1920.

Cooley - Mont. B. 133, 12, 1919.

Cullinan and Baker - Ind. B. 183, 17, 1924.

Darlington, Wash. Hort. Soc. Proc. 15, 14, 1920.

Darlington, Wash. Hort. Soc. Proc. 17, 93, 1922.

Dean Mont. Hort. Soc. R. 24, 76, 1921.

Dean - Kans. ft. Hort. Soc. Bien R. 36, 179, 1922.

Dean - Ida. Dept. Agr. Bien. R. 3, 43, 1924.

Dean and Martin - Kans. Hort. Soc. Bien R. 35, 89, 1920.

Dutton - Mich. Hort. Soc. R. 51, 69, 1922.

Evans - B. C. Dept. Agr. R. 17 W 46, 1923.

Felt - N. Y. R. 54, 17, 1920.

- REFERENCES -

Felt - N. Y. St. Mus. B. 239-240, 37, 1920.

Felt - N. Y. R. 35, 29, 1923.

Fernald - Mass. Dept. Agr. Mass. Agr. for. 2, 85, 1921.

Fernald and Bourne - Mass. R. 32, 35 a, 1920.

Fite - N. M. B. 127, 5-183, 1921.

Forbush - Mass. Dept. Agr. Econ. Ornithol. B. 4, 15, 1920.

Fraser - Amer. Fruits 164, 1914.

Frost - Pa. St. Cal. B. 169, 10, 1921.

Fulton - N. Y. Geneva B. 475, 10, 1920.

Garcia - N. Mex. R. 31, 27, 1920.

Gibson - Can. Ent. R. 1919-1920, 21, 1923.

Gillette - Colorado Ent. C. 13, 15, 1920.

Gillette - Colo. R. 25, 17, 1922.

Gillette and List - Soc. Prom. Ag. Sci. Proc. 39, 113-123, 19191

Gillette and List - Colo. Ent. C. 38, 21, 1923.

Glick - Ariz. Com. Agr. and Hort. R. 14, 55, 1922.

Gossard - Ohio Hort. Soc. Proc. 56, 60, 1923.

Gossard - Ohio Mo. B. 8, 5 and 6, 73-78, 1923.

Harris and Butt - Utah C. 46, 34, 1921.

Haseman - Mo. B. 176, 19, 1920.

Haseman and McBride - Mo. B. 189, 36, 1921.

Haseman and McLane - Mo. B. 179, 28-39, 1921.

Haseman, Sullivan and McBride - Mo. B. 197, 61, 1922, B. 210, 49. 1924.

Headlle - J. Ec. Ent. 13, 166, 1920.

Headlle - N. J. R. 1919, 401, 1920.

- REFERENCES -

Headlle - N. J. St. Hort. Soc. Proc. 45, 62-65, 1920.
" N. J. Hort. Soc. Proc. 47, 54, 1922.
" N. J. " " " 48, 62, 1923.
49, 56, 192 .

Herrick - J. Econ. Ent. 14, 156, 1921.
" Rur. N. Y. 80, 356 1921.

Hewitt - Can. Ent. and Z ool. R. 1917-1918, 14, 1920.

Hood - Farm Hort. ed. 2, 250, 1921.

Horne - Essig and Herms - Cal. C. 265, 4, 1923.

Hough - Va. St. Hort. Soc. R. 27, 60, 1923.

Howard - U. S. Ent. R. 1920, 8 1920.

Howard - Neb. Ext. C. 1231, 24, 1922.

Howard - U. S. Ent. R. 6, 1924.

Hunt - B. C. Dept. Agr. R. 17, W 59, 1923.

Isely and Ackerman - J. Ec. Ent. 13, 159, 1920.

Jardine - Oreg. C. 26, 22, 1922.

Knight - N. Y. C. B. 410, 363, 1922.

Leach and Roberts - Peninsula Hort. Soc. Trans. 23, 14-22, 1920.

List - Colo. Ent. C. 34, 27-35, 1921.
List and Newton - Colo. B. 268, 1921.

Lovett and Fulton - Oreg. C. 22, 7-13, 1920.

McHatton and Peacock - Ga. Ext. B. 239, 22-23, 1921.
Mackie - Cal. Agr. B. 9, 429, 1920.

Melander - Jr. Ec. Ent. 13, 456, 1920.
Melander - Wash. R. 30, 21-22, 1920, B.167
24 1922, B. 175, 22, 1922: B. 180, 27, 1923.

Murray - B. C. Dept. Agr. R. 17 W. 55, 1923.

Newcomer - Jr. Ec. Ent. 13, 441, 1920.

- REFERENCES -

Newcomer, Wash. Hort. Soc. Proc. 16, 86, 1920: 17, 76, 1921: 18, 39, 1923.

Newcomer and Whitcomb, U. S. D. A. B. 1335, 76, 1924.

Newton - Colo. Ent. C. 43, 39, 1924.

Parks - N. Y. Dept. Farm and Markets B. 147, 164, 1923.

Pettit - Mich. R. 34, 186, 1921.

Pettit - Mich. Hort. Soc. R. 51, 101, 1922.

Quaintance and Siegler - U. S. F. B. 1270, 3, 1922.

Robertson - B. C. Dept. Agr. R. 17, W. 30, 1923.

Ross and Caesar - Ont. Ent. Soc. R. 50, 95, 1920.
" " " " " R. 54, 57, 1924.

Ruhmann - B. C. Dept. Agr. Ann. R. 18, 143, 1924.

Sonborn - Okla. R. 29, 43, 1930.

Sonderson - Insect, Pests ed. 2 552, 1921.

Severien - So. Dak. Ent. R. 13, 18, 1922.

Siegler and Plant - U. S. F. B. 959, 1921.

Smith - Va. Crop. Pest Com. Quar. B. 1:4, 18, 1920.

Strickland Proc. N. Y. Hort. Soc. 67, 65-73, 1922.

Troop - Ind. Hort. Soc. TR. 1919, 32, 1920.

Tukey - N. Y. Geneva B. 495, 13, 1924.

Urbahns - Col. Agr. B. 12, 361, 1923.

Walker - bcadian Ent. Soc. Proc. 9, 50, 1924.

Whitcomb - Wash. Hort. Soc. Proc. 18, 35, 1923.

Wood - Mont. St. Bd. Hort. Bien R. 11, 43, 1919-20.
Wood - Mont. Hort. Soc. R. 24, 11, 1921.

FRINGED-WING APPLE BUD-MOTH

Holcocera maligemmella Murtfeldt

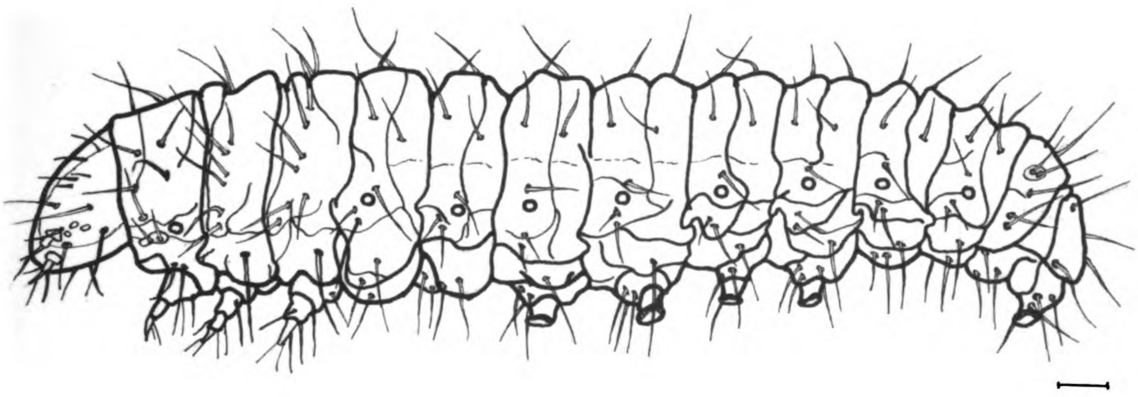
Larva

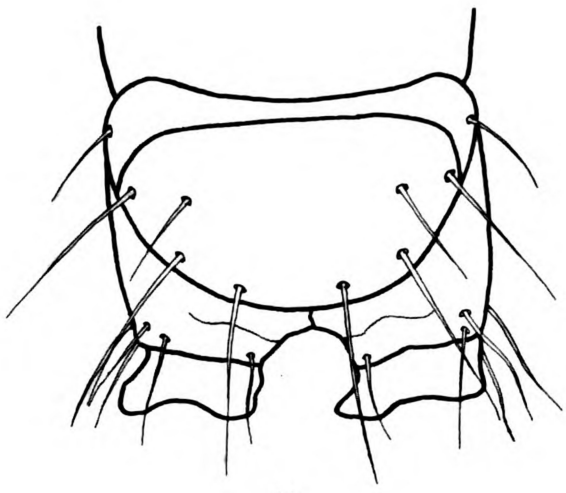
Anal
Dorsal Plate

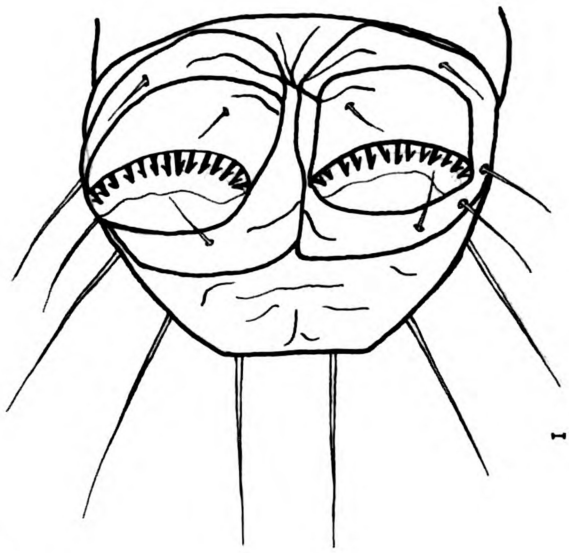
Anal
Ventral Plate

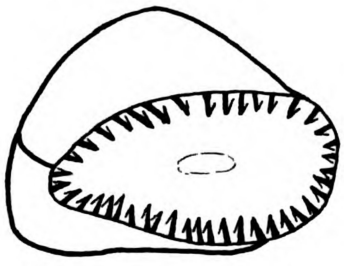
Crochets

PLATE 4.









Fringe-wing Apple Bud-moth.

Holcocera maligemmella Murtfeldt

DISTRIBUTION

Generally known throughout the central part of the United States. First recorded in Missouri and Kansas in 1898, but now we have evidence of this insect in some parts of Michigan.

HOSTS

Apple

- CHARACTERISTICS -

ADULT

General color,- satiny brownish-buff with a trend toward a leaden shading on the thorax, wings and body. Head buff and shaggily scaled with purple-black eyes very prominent. Antennae two-thirds as long as wings; basal joint long and stout; second joint, long and peculiarly excavated. Palpi long, concealed basal joint, second joint more thickened while the terminal is tapering and slender. Thorax broad, bordered with leaden-gray. Fore-wings vary in color from light to dark buff presenting a smudged effect. Hind-wing rather

broad, paler and more lustrous than the front wing. Fringe, similiar in color with wing surface. Body yellowish-gray. Legs of the same color as the under surface, hind pair of tibia densely clothed with hairs.

Alar expanse 14 to 15 mm.

EGG

Light-yellow and oval with the surface distinctly marked by shallow depressions and elevations which become larger and deeper at one end, in the center of which there is a very short peduncle.

LARVA

When first hatched the larva is light-yellow in color, with the head shining black; the thoracic shield is seal-brown. With age this shield becomes shining black similiar to the head, and the body becomes greenish-yellow in color. The body sparsely covered with short, light-colored hairs. The three pairs of true legs are brown, while the five pairs of prolegs are the same color as the body; the true legs are borne by the first, second and third segments while the prolegs are attached to the sixth, seventh, eighth, ninth and last body segments.

Full-grown larvae measure 6 to 8 mm. in length.

PUPA

Uniform brown in color with a row of small, almost

round, depressions along each side of the sutures between the last five abdominal segments.

Size is about 5.5 mm. in length and 2 mm. in width.

- DISCUSSION -

The moths emerge from the ground early in April and begin laying their eggs singly in the opening buds. The eggs hatch in a week or two and the young larvae begin working their ways down into the center at the base of the opening flower, leaf buds, and developing shoots, to feed, often causing the bud or flower to break off at its base or sometimes to stop the growth of the shoot. The terminal leaves once killed, the prospective crop of fruit is destroyed. The larvae obtain their growth in about four weeks, at which time they crawl into the ground an inch or two, spin cocoons, and then pupate in the middle of July, after which moths appear and lay eggs for a second generation. This generation, less destructive than the first, becomes full grown in August, the larvae transform to pupae in the ground and remain there until the following spring.

- REFERENCES -

Busck - Jr. N. Y. Ent. Soc. x, 96, 1902.

Forbes - N. Y. C. M. 68, 310, 1923.

Mo. Agr. Exp. Sta. B. 48 1898.

Slingerland and Crosby - Man. Fr. Ins. 45, 1914.

Stedman - Mo. St. Col. B. 48, 1898.

Stedman - Can. Ent. 109, 1898.

POMACE FLY

Drosophila melanogaster Meigen

Larva

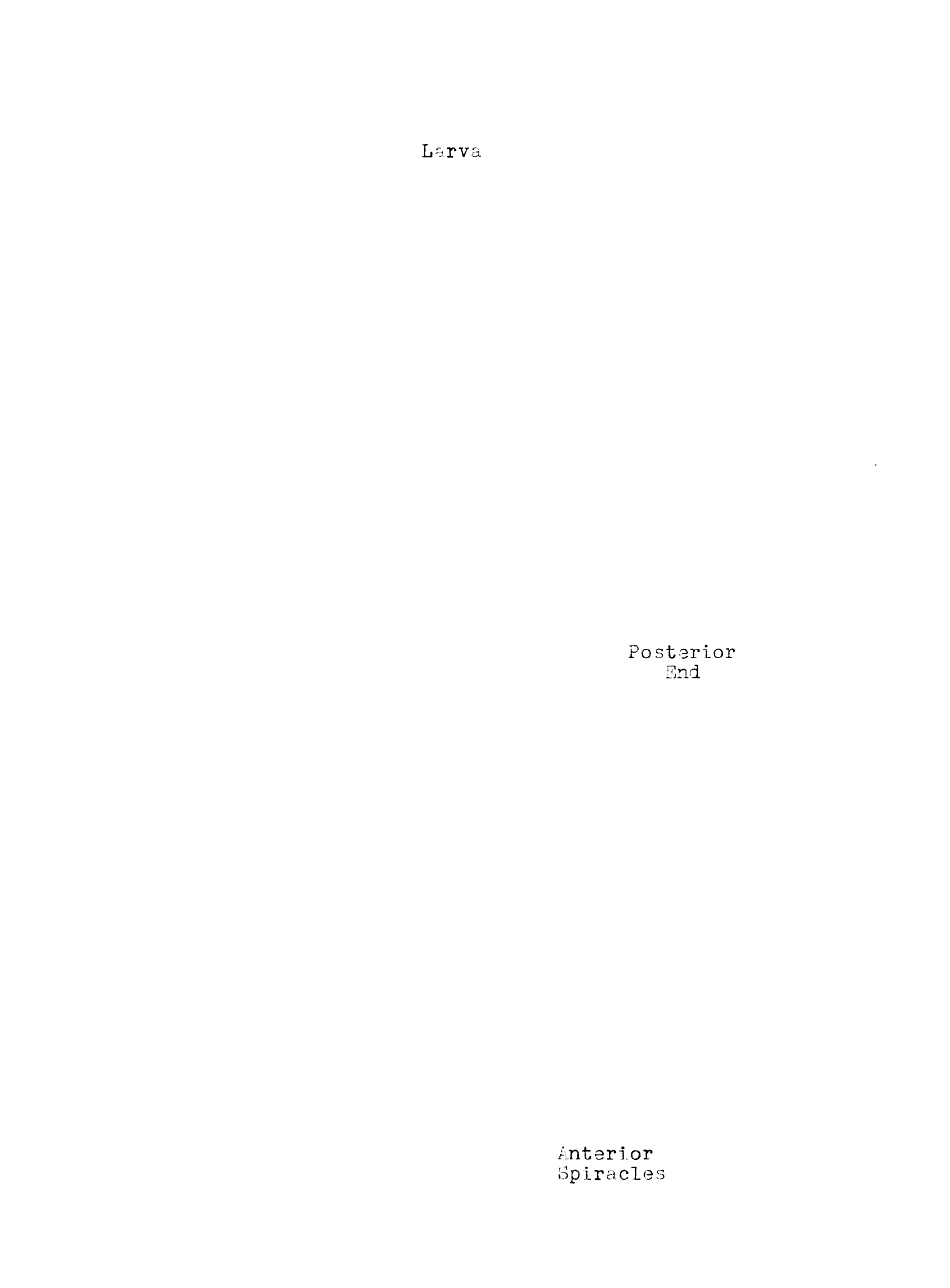
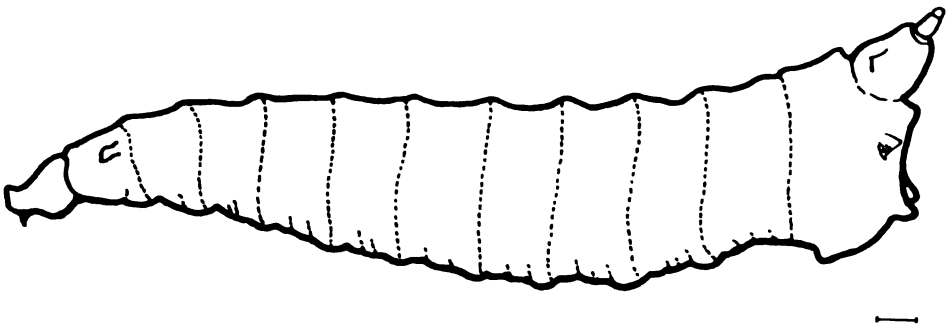
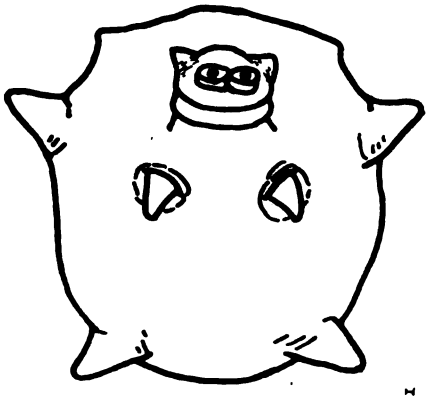
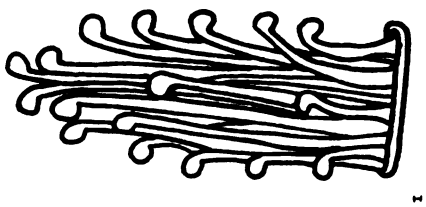


PLATE 5.







Drosophila melanogaster Meigen

DISTRIBUTION

This insect is cosmopolitan, although no record has thus far been received of its presence in the Orient aside from Australia. It is apparently absent in the colder, far nothern regions.

HOST LIST

Primarily a fruit eater, having been bred from the following hosts; apple, blackberry, fig, grapefruit, grape, guanabana, huckleberry, marinon, papaya, peach, pineapple, plantain, potato, tomato and zapote besides stale beer.

- CHARACTERISTICS -

ADULT

Arista with about five branches above and three below. Antennae yellow. Front nearly one-half the width of the head, wider above and yellow in color. Carina rather broad and flat; face yellow. Cheeks yellow. Eyes with rather thick pile. Acrostichal hairs in eight rows. Mesonotum and scutellum shining reddish-yellow. Pleurae

and legs pale yellow. The inner distal surface of the basal tarsal segment of the first leg possessing a comb-like row of about ten short curved black bristles. Abdomen shining black, with a basal reddish-yellow band on each of the first three segments. Wings clear.

Length of body 2 mm.; Length of wing 2mm.

EGGS

White, with a fine meshwork of raised lines over their surfaces. The anterior end bearing two filaments, which normally lie in contact with the surface of the food and apparently keep the anterior end of the egg from sinking below the surface.

Average length .6 mm.

LARVA

The body is divided into 12 visible segments. The oral opening being on the first or head segment. This segment also bears a pair of small papillae known as antennae and two pairs of small sensory organs. The anus and posterior spiracles are on the twelfth segment.

The larva is white in color and measures from 4 to 6 mm.

PUPARIUM

The anterior portion of the pale brown puparium is

flattened.

The pupa itself is enclosed in a very delicate white membrane which is left behind when the adult emerges.

- DISCUSSION -

The adult deposites her eggs on the surface of fermenting or decaying fruit. In a few days the larva emerges, after which it passes through three larval stages separated by two larval molts. When the larvae are feeding they lie buried in the food with only the tips of the spiracular processes exposed to the air. When full grown the larvae crawl out of the food and pupate in the loose surface soil from which the adults emerge in a very short time.

- REFERENCES -

Aldrich - Cat. of N. Amer. Dipleca.
Smithson Misc. Call. 46, No. 1444
pp. 680, 1905.

Babcock - Amer. Nat. 54, 270, 1920.

Baumberger - Ann. Ent. Soc. Amer. 7;323-52, 1914.

Bridges - Jr. of Exp. Zool. 28;337-384, 1919.

Bridges - Nat. Acad. of Sci. Proc. 7:127, 1921.

Johnson - Psyche 20; 203-4, 1913.

- REFERENCES -

Lancefield - Amer. Nat. 52;556-58, 1918.

Loeb - Science N. S. 41: 169-170, 1915.

MacDowell - Jr. Exp. Zool. 19:61, 1915.

Malloch - Bul. Ill. State Lab. Nat. Hist. 11, 346-48, 1915.

Marcovitch - J. Ec. Ent. 14, 61, 1921.

Metz - Amer. Nat. 48, 675-711, 1914.

Reeves - Univ. of Calif. Publ. Zool. 13:495.

Sturtevant - Psyche 26:153-155, 1919.

Ward - Genetics 8, 276-360, 1923.

Warren - Genetics 9, 1-69, 1924.

CHERRY FRUIT FLY

Rhagoletis cingulata Loew

Larva

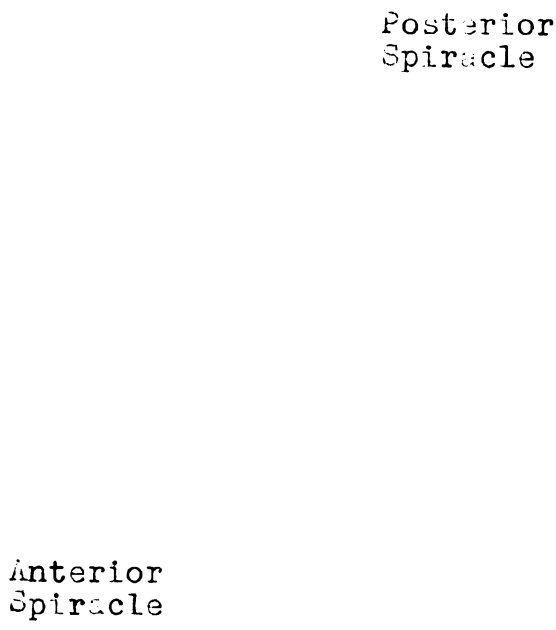
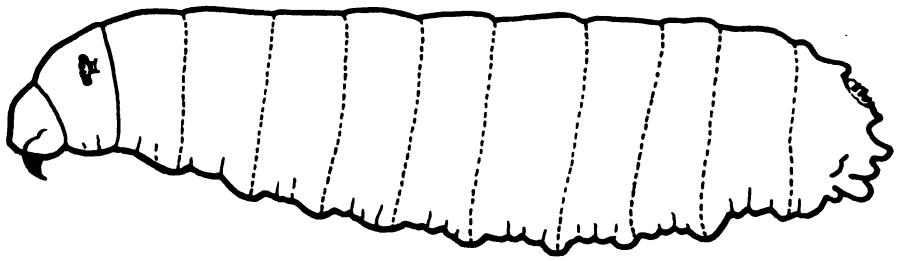
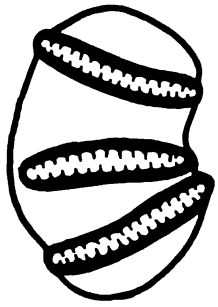
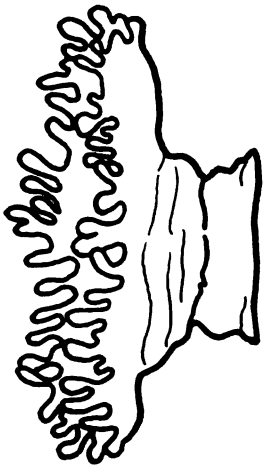


PLATE 6.







Cherry Fruit Fly

Rhagoletis cingulata Loew.

DISTRIBUTION

Northeastern United States and Canada.
Found in Michigan wherever cherries are grown.

ORIGINAL HOME

Native insect.

HOST LIST

Cherries both sweet and sour, pear, plum and prune.

- CHARACTERISTICS -

ADULT

A small two-winged fly measuring about 3/16 of an inch from the head to tip of the abdomen. The body is shiny and polished, with a coloration of amber and black with the exception of the abdomen which is definitely marked with four transverse, narrow, white bands; also, extending longitudinally along the thorax at the wing base, there is an additional white band. The wings are transparent possessing several dark, smoky, transverse bands.

EGGS

Very tiny, dirty yellow in color and elongate. Each one deposited in slit cut in fruit.

LARVA

Pale yellowish-white, cylindrical, tapering slightly toward the cephalic end, eleven segments of about equal length in addition to the head. The latter small and partly retractile. Anterior spiracles small, yellow, chitinized and with a number of small rounded processes arranged in two irregular rows. Posterior spiracles small, in groups of three.

Length of larva varies from 7.5 to 8 mm. with diameter about 1.5 mm.

PUPA

Small, cylindrical, dull luteous, with eleven segments. Anterior spiracles similiar to those of larva but slightly darker. Posterior spiracles of medium size and reddish-brown, in groups of three.

Length of pupa varies from 3 to 4 mm. Diameter from 1.5 to 1.75 mm.

- DISCUSSION -

The flies emerge about the middle of June and busy themselves feeding for 7 to 10 days, after

which the female begins laying her eggs, each egg being placed in a small slit in the fruit. The eggs hatch into larvae or maggots in a very few days. These larvae feed inside of the fruit and rapidly attain full size. They then leave the fruit, drop to the ground, burrow underneath the surface, and pupate. They remain in this pupal condition, buried about one inch beneath the ground, until the following summer, at which time the fly emerges and the process is repeated.

- REFERENCES -

Baldwin - Ind. Ent. R. 5, 108, 1912.

Barss and Lovett - Ore. Ext. B. 369, 7, 1914.

Caesar - Ont. Ent. Soc. R. 43, 79, 100, 1913.
" Can. Hort. 37, 281, 1914.

Crosby - N. Y. Dept. Farm and Markets B. 147, 226, 1922.

Duruz - Poc. Rur. Press 103, 203, 1924.

Felt - N. Y. R. 26, 43, 1911.

Gossard - Ohio B. 233, 139, 1911.

Herrick - J. Ec. Ent. VI 79, 1913.
" Western N. Y. Hort Soc. Proc. 63, 78-81, 1918.
" N. Y. Fr. Growers Assoc. 41, 1913.

Illingworth - N. Y. C. B. 325, 191, 1912.

Lockhead - Syn. Ec. Ent. 91, 1914.

Lovett - Oreg. C. 35, 1913.
" Oreg. Bd. Hort. Bien. R. 17, 166, 1913.

- REFERENCES -

McIntosh - Pac. Homestead 48:6, 11, 1923.

Moore - Wis. B. 190, 28, 1910.

O'Hare - Inj. Ins. 345, 1914.

Parrott - N.Y. Fr. Grow. Assoc. 254, 1913.

Phillips - J. N. Y. Ent. Soc. 31, 135, 1923.

Ross and Caesar - Ont. Ent. Soc. R. 54, 59, 1924.

Sanderson - Ins. Pests Ed. 2 596, 1921.
" " " 667, 1912.

Severin - Can. Ent. 311, 1914.

Slingerland and Crosby - Man. Fr. Ins. 304, 1914.

Treherne - Pr. Ent. Soc. B. C. 4, 22, 1914.

Wilson - Ore. Bien. Crop. Pest R. 160, 1911-12.

APPLE FRUIT FLY

Rhagoletis pomonella Walsh

Larva

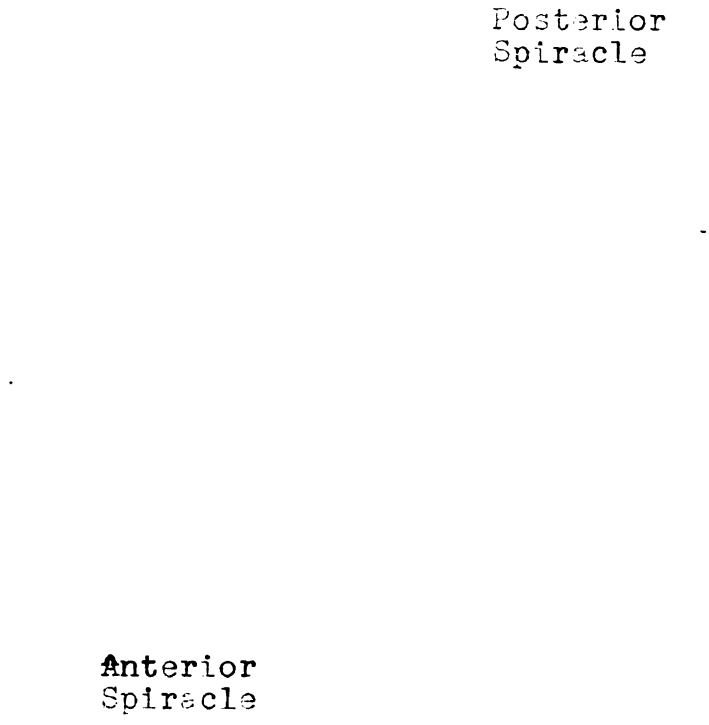
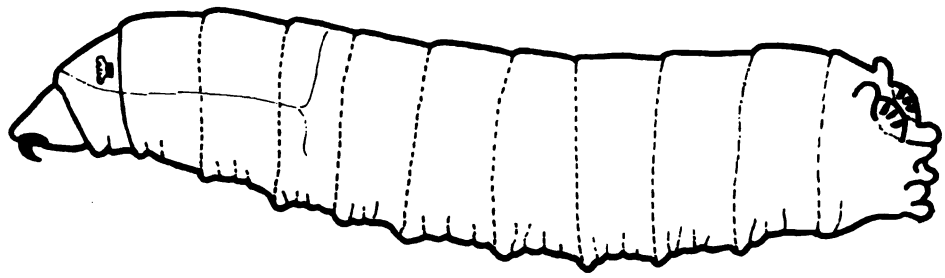
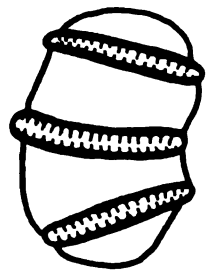
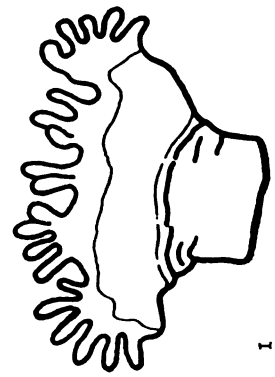


PLATE 7.







Apple Fruit Fly

Rhagoletis pomonella Walsh

DISTRIBUTION

A native of America. Found in the Eastern and Nothern States and in Canada.

HOST LIST

The several varieties of *Pyrus* and *Crataegus*; huckleberry, blueberry, snowberry, prune and cranberry.

- CHARACTERISTICS -

ADULT

A small two-winged fly, not quite as large as the common house-fly, in color amber and black with the head and legs yellowish. The abdomen is marked by four transverse white bands and the wings are crossed by four dark confluent bands. The apple and cherry fruit fly are quite similiar in color and markings, although the former is slightly larger.

EGGS

Minute in size; whitish in color and elongate in form.

LARVA

Pale, yellowish-white, cylindrical, tapering slightly toward the cephalic end; eleven segments of about equal length in addition to the head. Head small, partly retractile. Oral hooks small. Anterior spiracles small, tubular in form, yellow, chitinized and bearing at the extremity a number of small rounded processes. Posterior spiracles small, each spiracle with three narrow yellowish openings.

Length of larvae varies from 7.25 to 8 mm., with a diameter of about 1.5 mm.

PUPA

Cylindrical, dull luteous; eleven segments. Anterior spiracles like those of the larva but slightly darker. Posterior spiracles small and reddish-yellow.

Length of Pupa varies from 4 to 5 mm. and diameter from 1.5 to 2 mm.

- DISCUSSION -

The adult fly deposits each egg in a slit cut in the fruit, about mid-summer or late summer. This follows a feeding period of from 7 to 10 days. The eggs hatch from 2 to 6 days later and the young larvae begin feeding inside of the fruit. The larvae

grow rapidly and by the time they have obtained full size, the apple falls to the ground allowing an easy exit. The full-grown larvae then bury themselves about one inch below the surface of the ground and remain there in a resting state or pupal condition until the following summer, at which time the fly emerges, to lay her eggs.

- REFERENCES -

Baldwin - Ind. Ent. R. 5, 88, 1912.

Barre and Conradi - S. C. B. 141, 23, 1909.

Bethune - Ont. Agr. Coll. B. 158, 4, 1907.

Bethune - Ont. Agr. Coll. R. 34, 31, 1909.

Bourne - Mass. Fr. Gr. Assoc. R. 29, 199, 1923.

Britton - Conn. R. 5, 260, 1906.

Brues - Amer. Nat. 58, 130, 1924.

Buckley - Me. Dept. Agr. B. Vol. x, 3, 6, 1911.

Caesar - Farm and Dairy Can. Sept. 15, 1910-14
" Ont. Ent. Soc. R. 40, 18, 1910.
" " " " " 42, 29, 1912.
" " " " " 43, 80, 1913.
" " " " " 44, 50, 1914.

Card - R. I. R. 20, 211, 1908.
Card and Blake - R. I. R. 18, 197, 1906.

Clinton and Britton - Conn. R. 1909, 1910, 593, 1911.

Cook - Minn. St. Hort. Soc. R. 50, 342, 1922.

Cory - Md. Agr. Soc. R. 6, 163, 1923.

Crandall - Ill. Hort. Soc. 1911, 343, 1912.

- REFERENCES -

Curran - Can. Ent. 56, 63, 1924.
" Ont. " Soc. R. 54, 56, 1924.

Dean and Pairs - Kan. Agr. Educ. VI, 2, 60, 1913.

Dudley - Me. Com. Agr. R. 18, 37, 1919.

Felt - N. Y. R. 21, 91, 1906.
" U. S. B. 60, 89, 1906.
" C. Gentl. 1907, 640
" N. Y. R. 23, 33, 1908.

Fernald - Mass. Dept. Agr. Mass. Agr. Sev. 2, 87, 1921.
Fletcher - Ont. Ent. Soc. R. 37, 84, 1907.

Fraser - Amer. Fruits 1914, 167.

Fulton - N. Y. Geneva B. 475, 14, 1920.

Funk - Pa. Dept. Agr. B. 152, 228, 1907.

Gardner - Me. Com. Agr. R. 1913, 61, 1914.

Garman - Ky. B. 133, 62, 1908.

Gibson - Ont. Ent. Soc. R. 41, 17, 1911.
" Can. Ent. R. 1919-20 20, 1923.
" " Hort. 35, 254, 1912.

Gossard - Ohio B. 233, 104, 1911.

Hoseman - Mo. Hort. Soc. 1911, 248.

Henry - Ont. Agr. Col. R. 44, 17, 1919.

Herrick - Rur. N. Y. 1911, 558.
" Western N. Y. Hort Soc. Proc. 63, 81-4, 1918.
" Amer. Agr. 108, 50, 1921.
" Rur. N. Y. 80, 458, 1921.

Hitchings - Me. Dept. Agr. B. Vol. 9, 1, 8, 1910.

Hood - Mass. C. 3, 1907.

Johnsen and Patch - Me. B. 195, 238, 1911.

- REFERENCES -

Kendall - N. H. B. 208, 23, 1923.

Knight - N. Y. C. B. 410, 488, 1923.

Lockhead - Ont. Agr. Coll. B. 144, 32, 1905.
" Ont. Ent. Soc. R. 36, 135, 1906.

Melander - Wash. B. 103, 43, 1911.

Morris - Ont. Ent. Soc. R. 44, 23, 1914.

Munson - Me. Dept. Agr. Quart. B. Vol. 4, 17, 1905.

O'Kand - Jr. Ec. Ent. 4, 173, 1911.

Osborn - U. S. B. 52, 51, 1905.

Parrott - N. Y. Dept. Agr. B. 50, 1742, 1913.

Patch - Me. B. 134, 221, 1906.
Patch and Munson - Me. B. 109, 169, 1905.
Patch and Woods - Me. B. 308, 77, 1923.

Patch - Ont. Ent. Soc. R. 43, 73, 1913.

Patch - Can. Dept. Agr. C. 28, 1924.

Phillips - J. N. Y. Ent. Soc. 31, 136, 1923.

Quaintance - U. S. C. 101, 1, 1908.
Quaintance and Siegler - U. S. F. B. 1270, 13, 1923.

Rilly - Minn. R. 30, 70, 1923.

Ross - Can. Hort. 34, 278, 1911.
Ross and Caesar - Ont. Ent. Soc. R. 54, 58, 1924.

Ruggles - Minn. Ent. R. 19, 6, 1923.

Sanderson - Insect Pests 632, 1912.

Severin - So. Dak. Ent. R. 13, 24, 1922.
Severin - So. Dak. Ent. R. 14, 11, 1923.

Slengerland and Crosby - N. Y. C. B. 252, 238, 1903.
" " Man. Fr. Ins. 31, 1914.

- REFERENCES -

Snodgrass - J. Agr. Res. 28, 1-36, 1924.
" J. Wash. Acad. Sci. 13, 160, 1923.

Swaine - Ont. Ent. Soc. R. 41, 94, 1911.
" " " " " 42, 79, 1912.

Walker, Acadian. Ent. Soc. Proc. 9, 49, 1924.

Woods - J. Ec. Ent. VII 398, 1914.