



Larvae and Pupae of the Genera *Microdon* and *Mixogaster* (Diptera, Syrphidae)

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Source: *Transactions of the American Entomological Society (1890-)*, Vol. 81, No. 1 (Mar., 1955), pp. 1-20

Published by: American Entomological Society

Stable URL: <https://www.jstor.org/stable/25077694>

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TRANSACTIONS
OF THE
AMERICAN ENTOMOLOGICAL SOCIETY

VOLUME LXXXI

**LARVAE AND PUPAE OF THE GENERA
MICRODON AND MIXOGASTER**

(DIPTERA, SYRPHIDAE)

BY CHARLES T. GREENE

College Park, Maryland

INTRODUCTION

The genus *Microdon* is one of the most peculiar genera in the family Syrphidae, in fact in all the Diptera, both in its adult and larval forms. The larvae are so unusual that in three instances *Microdon* larvae have been described as mollusks, first by von Hayden (1823), by von Spix (1824), and again von Hayden (1825) published his second paper on *Microdon*, still thinking it a mollusk. To add to the confusion, Conrad (1842) described a genus of Silurian bivalves under the name *Microdon*. In 1839 Schlotthauber presented before German naturalists assembled at Pymont a carefully written paper, with illustrations, to prove that the organisms described by von Hayden and von Spix, as mollusks, were really the larvae of *Microdon mutabilis* (L.). This paper was not published but was mentioned in a brief reference in *Iris* von Oken, 1840, pp. 922-23.

Wheeler (1908) gives an interesting historical outline of these larvae, including a fine bibliography.

(1)

TRANS. AMER. ENT. SOC., LXXXI

The three genera *Microdon*, *Mixogaster* and *Rhopalosyrphus* are closely related in the adult forms but the two latter genera with their petiolate abdomen, slender legs and wasp-like appearances, show a greater relationship to each other than to *Microdon*. In *Microdon* the abdomen is usually very broad and robust on the basal half and the legs are incrassated. The exceptions show the base of the abdomen at least as broad as the apical portion.

Larvae of *Microdon* and *Mixogaster* show a resemblance. In *Microdon* the larva is usually only a little longer than its width, flat ventrally and usually has a marginal band with fringe. The only exception is in *M. wheeleri* Mann where the larva is cylindrical, much longer than its diameter and both marginal band and fringe are absent. In *Mixogaster* the larva is shaped like that of *Microdon* with the marginal band but without the fringe. The larva is much longer than wide and in general the shape corresponds to the slenderness of the adult fly. The dorsal reticulation is typical of the two genera mentioned above but there are a few species without it. Its presence or absence is of specific value only.

The immature stages of the genus *Rhopalosyrphus* are unknown.

The larvae of *Microdon* are of the metapneustic type and are usually but slightly longer than wide. In shape they are similar to a box tortoise, broad, highly convex above and flattened below. They are extremely slow in their movements and so far as known all live as commensals in the nests of ants. The larval habits of *Mixogaster* are identical with those of *Microdon*.

The anterior spiracle shown in the drawings is absent in the larval stage. It develops in the pupal stage only.

The marginal band is interrupted in a V-shaped fashion in the middle of the anterior end of the larva. Ordinarily the band seems to be continuous, but when the head is protruded the V interruption disappears.

Species 1 to 4 have not been reared successfully to adults. The drawings are included with the hope that some interested person may collect them again and rear them to the adult stage.

The material used in this study is in the collection of the U. S. National Museum.

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Microdon lanceolatum Adams

Kans. Univ. Sci. Bull. 1903, II: 222.

Larva (Fig. 1).—Length 12 mm.; width 7 mm.; height 5.75 mm. Large, opaque, smooth, yellowish brown; nearly twice as long as wide; marginal band very narrow; surface granular; along the outer edge of this band is a row of pale yellowish, marginal fringe, slightly longer than width of band. Posterior spiracular tubercle (Fig. 1a) cylindrical, a little longer than the basal diameter; tapering slightly towards the tip; this tubercular cone is covered with short, bristly, yellow hairs of equal length; this cone is located on a very short, cylindrical neck at the base of which is a darker brown, smooth elevated ring; each spiracle (Fig. 1b) is shining, reddish yellow, much darker around the edges and a series of small reddish beads arranged in rows. For details see drawing; the button is a small, circular depression located on the inner, upper half of the spiracle; the buttons are separated by a space equal to the diameter of one button.

Pupa.—Like the larva with the following differences: Much more rigid and slightly darker; anterior spiracles missing. Boulder, Colorado (no date) Hazel Andrews, collector.

Microdon manitobensis Curran

Psyche, 1924, 31: 227.

Larva (Fig. 2).—Length 10 mm.; width 7.5 mm.; height 5 mm. Medium sized, dull, smooth, deep luteous with a cinnamon brown tinge; no reticulation; two marginal rows of long reddish yellow fringe; one row just above the other, separated by a distance slightly greater than the length of the fringe in the bottom row; fringe in the upper row slightly shorter, pressed against the body. Posterior spiracular tubercle (Fig. 2a) located above the margin, a distance about twice the length of the tubercle; tubercle cylindrical, broadly constricted in the middle, pale, dull, luteous with numerous small, reddish, shining dashes; from the side, the apex extends obliquely

downward; around the base numerous small, reddish ridges arranged like the teeth of a ratchet; this tubercle located on an elevated circular ring of dark reddish brown color; spiracular plates shining, reddish yellow, widely separated; each plate is more reddish along the edge, with numerous small, reddish beads arranged obliquely in groups (see drawing), the buttons are round, slightly concave, deep reddish brown; they are separated by a space equal to the diameter of one button; ventral surface of larva deep reddish yellow.

Pupa.—Like the larva with the following differences: Much more rigid, slightly darker in color. Anterior spiracles lost.

Emboro, Sask. May 28, 1915, T. E. Jewsbury, collector.

Microdon marmoratus Bigot

Ann. Soc. Ent. Fr. 1883, 3, 6 ser.: 320.

Larva (Fig. 3).—Length 7 to 8 mm.; width 6 mm.; height 3.5 to 5 mm. Medium sized, pale, dull, luteous yellow; a very narrow, granular, pale yellow, mid-dorsal line, extending from the posterior spiracles to the anterior edge; around the entire latero-ventral edge is a narrow band of small tubercles; along the entire outer edge of this band is a row of yellow bristles about as long as this band is wide. Posterior spiracular tubercle (Fig. 3b) about as long as its greatest width; located on a round, slightly elevated ring, about the length of the tubercle above the margin; from above, there is a slight constriction on each side; the sides reddish yellow, smooth, shining, transparent chitin; the central area, broader on the dorsum, dull granular, opaque area yellowish white; end view arcuate, both sides are nearly circular; each spiracle (Fig. 3c) has four slightly curved, radiating slits, each with reddish granular edges; button nearly circular, deeply depressed, separated by a space nearly equal to the width of one button.

Pupa (Fig. 3).—Like the larva, with the following differences: Much more rigid, slightly darker in color. With a pair of anterior spiracles (Fig. 3a) separated by a space equal to twice the length of one spiracle and located above the anterior edge at a distance three times as great as the length of one spiracle; each spiracle twice as long as its diameter, reddish yellow, and tapering towards the apex with a small tubercle at the tip; the basal half has numerous rounded depressions, the upper half with numerous microscopic tubercles (see drawing).

Collected in San Francisco County, California, in May.

Microdon globosus (Fabricius)

Syst. Antil, 1805, 185, no. 7.

Larva (Fig. 4).—Length 7.5 mm.; width 6 mm.; height 3.75 mm. Medium sized, smooth, dull, luteous, with no reticulations; ventral surface pale luteous, faintly shining; around the outer edge is a broad, granular, reddish

band; upon the outer edge of this band is a row of reddish yellow fringe slightly shorter than the width of the band. Posterior spiracular tubercle (Fig. 4b) a little longer than the greatest width of the outer end; this tubercle is located above the margin, a distance not quite as long as the length of the tubercle; sides of tubercle shining, semi-transparent, reddish yellow with a dark stripe around the basal portion; pale yellow between the ends of the slits; middle portion is dull, pale, luteous with numerous microscopic, reddish granules; from behind, the basal portion of the tubercle is cylindrical while the outer end is flattened transversely with a depression in the middle, forming a rounded knob on each outer end; each knob (Fig. 4c) has four slightly curved slits; the buttons are rounded depressions on the inner side of each knob, separated by a space a little greater than the diameter of each button; pale luteous and faintly shining.

Pupa (Fig. 4).—Like the larva, with the following differences: Much more rigid, darker in color. Anterior spiracles (Fig. 4a) cylindrical, slightly bent in the middle, the outer half tapering towards the tip; each spiracle about twice as long as its diameter; located above the anterior margin about three and one-half times the length of one spiracle and separated by a space nearly equal to twice the length of one spiracle; a deep yellowish red in color; the basal half with rows of small, elliptical depressions; the outer half with numerous small, granular tubercles.

Reared by C. T. Greene from larvae collected by Robert Woodbury, at Lucketts, Va. (12 miles from Leesburg), May 16, 1938, pupated May 18 to June 1, emerged June 11, 1938. Associated with the ant *Tapinoma sessile* (Say).¹

Microdon coarctatus Loew

Centuria 1864, part V: 47.

Larva (Fig. 5).—Length 5 mm.; width 3 mm.; height 2.5 mm. Small, smooth, opaque, milky-white; on the ventral surface near the margin, but not visible from above, is a row of fine, soft, delicate fringe encircling the ventral surface. Around the margin, above the fringe is a row of thirty small cone-like yellowish brown projections; on the dorsum are numerous others of the same cone-like projections arranged in pairs; each projection is located on a small, short stem with a diameter about equal to its length; the cone portion has the basal diameter nearly equal to the height. These cones are very easily knocked off but there is always a definite scar at the point of attachment. Posterior spiracles are located on top of a large tubercular cone (Fig. 5b) which is located well above the margin; this cone is medium dark, brownish yellow, sclerotized and pointing obliquely from the ventral surface. This cone rests on a broad circular base, brownish yellow, tapering slightly upward, and at the top is a narrow, constricted

¹ Unless otherwise noted, the ants mentioned in this paper were identified by Dr. M. R. Smith.

space and then the cone; on this constriction are red, vertical, narrow ridges, resembling the teeth on a ratchet; the cone is a little longer than its basal diameter; on each side, near the middle is a round, raised, reddish bead; the surface of the cone with numerous short, very delicate, crinkly, microscopic hairs; in certain lights the surface is microscopically reticulate; the top of the cone is flattened and upon this surface are located the posterior spiracles (Fig. 5c); each spiracle has a round, raised, pointed button; radiating around this button are eight reddish slits.

Pupa (Fig. 5).—Like the larva, with the following differences: Much more rigid, pale luteous yellow. A pair of anterior spiracles (Fig. 5a) developed just above the margin; spiracles are widely separated, the space equal to twice the length of one spiracle; they are reddish in color; the surface at the base has a microscopical checkered appearance; apical half with numerous small, round tubercles scattered over the surface.

Larvae and pupae with small black ants, *Monomorium minutum* (Buckley), under bark and in decayed sapwood of a log of chestnut-oak.

Collected at Difficult Run (Arlington County) Virginia, July 4, 1916, by T. E. Snyder. Adults emerged July 10-12, 1916, Hopkins No. 12994a. Also collected at Palm Grove, Texas. Adults emerged June 4, 1917, Hopkins No. 15120a. Skyland, Va. April, 1923, W. M. Mann, collector.

In nest of the ant *Aphaenogaster fulva* (Roger) variety.

Microdon wheeleri Mann

Psyche, 1928, 35: 168.

Pupa (Fig. 6).—Length 7 mm.; diameter 2.75 mm. Elongate, very pale yellow, nearly cylindrical and very slightly smaller near the middle; smooth, no reticulation; both ends rounded. Anterior spiracles (Fig. 6a) are cylindrical, shining dark red, faintly darker near the base and a small tubercle at the tip; the surface has numerous fine depressions resembling reticulation, the depressions near the base slightly larger and deeper; these spiracles are located on the anterodorsal surface above the margin, about twice the length of one spiracle; they are separated transversely at their bases, by a space nearly equal to twice the length of one spiracle. Posterior spiracular tubercle (Fig. 6b) is blackish red in color, nearly cylindrical, slightly longer than its basal diameter, with the sides microscopically granulose and tapers slightly towards the tip; the tubercle is located on the posterior end of the pupa just above the horizontal diameter; viewed from behind, the posterior end or tip is somewhat square with the corners rounded and with deep depressions on the upper and lower sides; the two spiracular plates (Fig. 6c) are shining, reddish yellow, each plate somewhat elliptical with four finger-like projecting areas, two above and two below; the space between these pale areas is a little less than the width of one area; between

these is a slender, whitish spine, slightly curved upward; the buttons are round, deep, depressions located just above the base of this spine.

Red Tank, Canal Zone, March 27, 1923. Dr. W. M. Wheeler, collector. Pupa collected in nests of *Crematogaster* (*Orthocrema*) *brevispinosa* Mayr. subspecies *tumulifera* Forel in *Cordia alliodora* Ruiz and Pavon.

Microdon pictipennis (Macquart)

Dipt. Exot. 1850, Suppl. 4, part 1, p. 433, pl. 12, fig. 12.

Larva (Fig. 7).—Length 7 mm.; width 5.5 mm.; height 2.85 mm. Medium sized, dull, luteous, without reticulation; the entire upper surface of the larva with numerous small, rounded, reddish tubercles (Fig. 7b) about as long as their diameter; each tubercle slightly shining, microscopically granulose; ventral surface pale luteous with a faint reddish tinge; marginal band slightly roughened; along the outer edge is a closely set whitish fringe, a little longer than the width of the band. Posterior spiracular tubercle (Fig. 7c) located above the margin, a distance about one and one-half times the length of the entire tubercle; the basal half of the tubercle spherical, dull, luteous, with numerous small, flattened, tubercles; the outer half is bifid, deep, shining, yellowish red; each fork is covered with numerous minute, tubercles arranged in rows; on the tip of each fork is located a spiracle (Fig. 7c); the center has a rounded, roughened, depression and along the edge of the fork are eleven curved slits extending slightly upon the side of the fork.

Pupa (Fig. 7).—Like the larva, with the following differences: Much more rigid, darker in color. Anterior spiracles (Fig. 7a) cylindrical, shining, yellowish red, located above the anterior margin, about twice the length of one spiracle; they are separated by a space about one and one-half times the length of one spiracle; each spiracle is little more than three times as long as the basal diameter; basal half granulose, with the granules arranged in rows; the outer half slightly larger in diameter, tapering slightly at the tip; surface smooth with numerous small, pointed, tubercles.

Hobart, Tasmania, A. M. Lea, collector (no date).

Microdon Species # 3

Larva (Fig. 8).—Length 7 mm.; width 5 to 5.9 mm.; height 3.5 mm. Dull, pale, luteous with dark brown, granulose, reticulation; ventral surface dull, pale, luteous; marginal band flat, narrow, granular; around the outer edge is a row of yellowish white fringe. Posterior spiracular tubercle (Fig. 8a) located above the margin, about twice the length of the tubercle which is circular at the base and somewhat quadrate at the tip; slightly wider than long; the surface is finely granulose. Posterior spiracle (Fig. 8b) located on the outer portion of this tubercle; each spiracular plate is smooth, pale, yellowish, with large, broad, sinuose area with five small finger-like

branches on the lower half, one on the outer side above the middle and two more at the top; this pale spiracular area has numerous small, bead-like openings around the edge; the button is small, circular, concave, located near the upper, inner branch of the spiracle. Ventral surface of larva dull, pale, luteous.

Topeka, Kansas, October, 1933, C. H. Popenoe, collector.

Microdon Species # 4

Pupa (Fig. 9).—Length 6 to 8 mm.; width 3 to 3.5 mm.; height 2.5 to 3 mm. Smooth, dull, deep reddish yellow with a row of pale yellowish bristless along the latero-ventral edge. Each side of the pupa has two longitudinal rows of six rounded clusters of short, yellowish, spine-like bristles (Fig. 9b), each cluster on a faintly raised elevation. Anterior spiracle (Fig. 9a) located between the first and second clusters of bristles in the upper row; this spiracle is about twice as large as its diameter and slightly darker colored towards its apex; there are several large tubercles on the apical third with several smaller tubercles on the anterior surface; basal two-thirds of spiracle is microscopically reticulate. Posterior spiracle (Fig. 9c) cylindrical, about one and one-half times as long as its diameter; a narrow basal portion is slightly constricted; the large central portion dull, reddish, vertically rugose; apical portion shining, more reddish, with numerous very small, elliptical slits on the apical surface.

Beverly, West Australia, J. Clark, collector (no date).

In nest of ant *Iridomyrmex rufoniger* Lowne (Ident. by J. Clark.)

Microdon ruficrus Williston

Synop. N. A. Syrph. 1886, p 7.

Larva (Fig. 10).—Length 85 mm.; width 6.75 mm.; height 4 mm. Medium sized, dull, yellowish red; ventral surface pale luteous; marginal band with the dorsum covered with minute tubercles, arranged in transverse rows; around the edge of this band are twenty-two pencils of long bristles located at regular intervals; the anterior pair and the two posterior pairs are smaller and closer together; between these pencils is a row of short, yellowish fringe; in the middle of the dorsum are three broad, longitudinal bands extending forward from the posterior spiracular tubercle; the middle band reaching about three-fourths the distance to the anterior edge, the other two extending about two-thirds the distance; these bands are separated by spaces of about the same width as one band; each side and across the anterior portion the dorsum is definitely reticulated. Posterior spiracular tubercle (Fig. 10a) located above the margin, a distance nearly equal to the width of the tubercle; viewed from behind, this tubercle is raised in the middle of the dorsum, with a shallow depression on each side; the surface is covered with numerous small, reddish yellow tubercles; each spiracle

(Fig. 10b) is pale reddish yellow with seven lobes, three above and four below; these lobes are more reddish along the edge; each lobe has a series of small reddish beads along the edge; inner edge of spiracular plate has a deep, rounded, emargination; the buttons are large, circular concavities and separated by a space equal to the diameter of one button.

Pupa.—Like the larva, with the following differences: Much more rigid, slightly darker in color. Anterior spiracles lost.

Clark's Valley, Pa. (no date), collected by A. B. Champlain.

Microdon champlaini Curran

Kans. Univ. Sci. Bull. 1925, 15: 71.

Larva (Fig. 11).—Length 8 mm.; width 5.5 mm.; height 3.5 mm. Medium sized, dull, smooth, cinnamon brown; reticulation is composed of irregular, roughened, granules; ventral surface reddish yellow, a little paler than the dorsum; marginal band narrow with an irregular row of very small granules, each of which bears a short, yellow, bristle; marginal fringe yellow, as long as the width of the band. Posterior spiracular tubercle (Fig. 11a) located above the margin, a distance slightly more than the length of the tubercle; this tubercle is cylindrical, about as long as its diameter, slightly concave above and below near the outer end; it is yellowish red with very minute tubercles above, and larger ones on the sides; it joins the body by a very short neck of a little smaller diameter and more reddish in color; the tubercle is located on a rounded area faintly elevated; spiracular plates (Fig. 11b) are shining, pale yellow in the middle and deep reddish around the edges; along the edges of the yellow portions are a series of small reddish beads; between the plates is a vertical concavity on each side of the center of which are the circular, concave, buttons which are separated by a space a little more than the diameter of one button.

Pupa (Fig. 11).—Like the larva, with the following differences: Much more rigid, slightly darker in color. Anterior spiracles lost.

Harrisburg, Pa. no date, A. B. Champlain, collector, and Linglestown, Pa. June 14, 1920, A. B. Champlain and J. N. Knull, collectors.

Microdon Species # 2

Larva (Fig. 13).—Length 11 mm.; width 8 mm.; height 3 mm. Dull, dark yellowish red with irregular reticulations, made up of rounded tubercles, each with a sharp spine at the tip (Fig. 13a); ventral surface dull, reddish, luteous; marginal band is broad, flat, slightly paler, with numerous tubercles slightly longer than their diameter; around the edge of this band is a row of short, yellowish-white fringe. Posterior spiracular tubercle (Fig. 13b) located above the margin a distance about one and one-fourth times the length of the tubercle; from behind it is somewhat quadrate, slightly broader at the base; around the edge is a ruff; on the upper half is another ruff

which disappears at the middle on each side; the spiracular plates pale, reddish yellow; each plate has four lobes on the lower half and two large, rounded lobes at the upper end; the small, elliptical, pale-yellow spiracular openings are arranged in double rows (Fig. 13a); in the central portion of the plate the openings are much larger; between the two posterior plates is an elevated ridge with an enlarged, granular swelling at the upper end and a smaller enlargement at the lower end.

Ashburn, Ga. R. 2, September 23, 1929, F. R. Knight, collector.

Microdon Species # 1 (near **robusta** Telford)

Larva (Fig. 14).—Length 10 mm.; width 7 mm.; height 4 mm. Dull, dark, yellowish red with irregular reticulation, made up of small tubercles, slightly concave on the tip; ventral surface dull, reddish yellow; marginal band is broad, flat, granulose; around the edge of this band is a row of short, pale, yellow fringe with a length about one-fourth the width of the band; a reticulated ridge encircling the edge of the larva has a small tubercle in the middle of each reticulated area; in the middle of the dorsum is a longitudinal ridge extending from the posterior spiracular tubercle forward, for about three-fourths the distance to the anterior end of the larva; this ridge is reticulated with a small tubercle in the middle of each of most of the reticulated areas. Posterior spiracular tubercle (Fig. 14a) is located above the margin, a distance about equal to the length of the tubercle; this tubercle is slightly longer than broad, covered with granular tubercles, some of which are longer than others (Fig. 14c), the spiracular plates (Fig. 14b) are smooth, deep red with blackened edges; they are separated by a space nearly equal to the width of one plate; the spiracular openings are arranged in four yellowish-red bands with small, yellowish bead-like areas on each side; between the two spiracular plates is a short, thick spine; below the plates is a transverse depression; below this depression the tubercles are flattened and spinulose (Fig. 14c).

Mariposa Big Tree Grove, California, no date. Larva from rotten wood. W. H. Dall, collector.

Microdon robusta Telford

Univ. Minn. Agr. Exp. Sta. Bull. 140, 1939, p. 14.

Larva (Fig. 15).—Length 11.5 mm.; width 6.75 mm.; height 3.75 mm. Deep yellowish red, with the two longitudinal areas, between the middle ridge and the lateral ridge, more luteous; reticulation small, the lines made up of small, rounded elevations, each with a spine at the tip (Fig. 15a); ventral surface pale luteous, faintly reddish; marginal band broad, finely granulose; along the edge of this band is a row of yellowish-white fringe; a broad, marginal, rounded ridge with reticulations; in the middle of the dorsum is a broad, rounded ridge, extending longitudinally from the spiracular tubercle almost to the anterior end of the larva; anterior end of this

ridge sloping downward and fading out. Posterior spiracular tubercle (Fig. 15b) located just above the margin from behind, the tubercle nearly circular and from either side, the apical half of the tubercle is of a slightly smaller diameter than the base; the surface is covered with small, slender tubercles, those on the basal half of the tubercle each with a minute spine at the tip; the spiracular plates (Fig. 15c) reddish yellow, somewhat elliptical, about two and one-half times as long as wide, the ends broadly rounded and on the outer side of each plate, at the middle, it is slightly rounded; on each plate is a series of elliptical bead-like openings; buttons are circular depressions located along side and just above the middle of each plate; between the spiracular plates are two large tubercles, one above the other; each tubercle has several pointed, prong-like projections at the tip.

Pupa (Fig. 15).—Like larva, with the following differences. Much more rigid, darker in color. The anterior spiracles were lost.

Mosherville, N. Y. April 13, 1893. From a poplar log. Collector unknown. Lyme, Conn. October 30, 1915, A. B. Champlain, collector.

Found in a nest of the ant *Camponotus herculeanus* sub-species *pennsylvanicus* (DeGeer), Hopks. U. S. No. 12977m.

Microdon megalogaster Snow

Kans. Univ. Quart., 1893, I: 34.

Larva (Fig. 16).—Length 10.5 mm.; width 8 mm.; height 5.75 mm. Large, dull, brownish red with the surface faintly reticulate; venter deep reddish; two rows, one above the other, of reddish yellow, crinkly marginal fringe. Posterior spiracular tubercles (Fig. 16b) prominent and forked at the apex, located just above the margin; the tubercle is round, with concave sides, the smaller diameter in the middle; it is located on a circular elevation, only slightly raised above the surface; where the tubercle joins this elevation is a row of small, sharp ridges encircling the base, these ridges resemble the teeth in a cog or ratchet; the surface of the tubercle is a dull, brownish yellow with fine, transverse, red lines or dashes; transversely across the apex the small red dashes are much broader and more prominent; the buttons are circular depressions separated by a space about equal to the diameter of the button; the stigmal plates (Fig. 16b) are reddish yellow, shining, much wider at the base than at the apex; they are separated by a space a little more than the width of one plate; there are numerous small, elliptical ridges or elevations upon the surface of each spiracular plate; upon each small ridge is located a longitudinal slit (Fig. 16b).

Pupa (Fig. 16).—Like the larva, with the following exceptions: Much more rigid; color slightly darker; anterior spiracles (Fig. 16a) located above the margin a distance about three and one-half times as long as one spiracle; separated by a space about equal to four times the height of one

spiracle; height of each spiracle about equal to one and one-half times the diameter; spiracles are cylindrical, dark red and deeply reticulate on the sides; apical surface a little more yellowish with numerous close set cone-shaped tubercles. See drawing Fig. 16a.

Larva collected at Falls Church, Va. May 5, 1922, pupated May 6 and adults emerged May 17, 1922. C. T. Greene, collector.

Found in nest of the ant *Formica fusca*, subspecies *subsericea* Say.

Skyland, Va. April, 1923, W. M. Mann, collector.

Pupa in nest of ant *Formica fusca* (L.) variety.

Whitetop Mt. Va. June 15, 1915, C. T. Greene, collector.

Pupa in nest of ant *Formica fusca* var. *subgenescens*, Hopks. U. S. No. 12893.

Microdon cothurnatus Bigot

Syn. N. A. Syrph., 1886, p. 8.

Larva (Fig. 17).—Length 8 to 11 mm.; width 6 to 8 mm.; height 4 to 5 mm. Medium to large sized, dull, dark, yellowish brown; reticulation well defined, the lines composed of fine granules; marginal band broad, having the upper surface granular, arranged in transverse rows; marginal fringe reddish yellow, about as long as the width of the band; venter flat, pale luteous. Posterior spiracular tubercle (Fig. 17b) located above the margin about the length of the tubercle; it is one and one-half times as wide as long; on the dorsum, the central basal portion is elevated, with a faint depression on each side; around the base of this tubercle is a row of short ridges, resembling the teeth in a ratchet; this tubercle is dull, luteous, the surface is covered with scale-like projections which are microscopically roughened along the upper edges; the tubercle is located on an elevated, dark, red ring; from behind, on the tip of the tubercle are the spiracular plates separated by a space almost equal to the width of one plate, each plate (Fig. 17c) is shining yellowish red, with nine small lobes along the outer edge; five lobes above and four below; each lobe has a series of small, bead-like openings or slits (see drawing); the buttons are circular, deeply concave and separated by a space about one and one-half times the diameter of one button; below the buttons is a slight depression.

Pupa (Fig. 17).—Like the larva, with the following differences. Much more rigid, darker in color. Anterior spiracles (Fig. 17a) are cylindrical, tapering slightly towards the tip; the length is about equal to the basal diameter; yellowish red, with the basal half smooth and with numerous very small tubercles on the tip; spiracles are separated by a space about seven times the diameter of the spiracle; they are located above the anterior margin, a distance equal to about ten times their diameter.

North Cheyenne Canyon, Colorado Springs, Colo. A. B. Champlain, collector. Adults emerged from April 24 to May 18, 1914. Lyme, Conn. reared May 28, 1918, A. B. Champlain, collector.

Larkspur, Douglas Co. Colorado. April 12, 1914, larvae in dead stump of *Salix* sp. A. B. Champlain, collector.

All above reared by C. T. Greene.

Microdon tristis Loew

Synop. N. A. Syrph. 1886, p. 6.

Larva (Fig. 18).—Length 8.5 to 9 mm.; width 6.5 mm.; height 3 mm. Dull, reddish yellow with an irregular, granular, reticulation; marginal band broad, granulose; on the outer edge of this band is a row of yellowish fringe, each strand is broader at the base and about as long as the width of the band; below this band, is a second row of fringe, similar to those described above; venter deep reddish yellow. Posterior spiracular tubercle (Fig. 18b) located above the margin, a distance about twice the length of the tubercle; this tubercle is a little broader than long with a depression on each side; the surface is covered with small, slightly flattened, granulose tubercles; from behind, there are two broad, elliptical, flattened areas, rounded on their edges with a central, vertical depression separating these two areas; each area represents a posterior spiracular plate (Fig. 18c) with several broad, pale, yellow areas radiating out from the center; between each pale area is a darker, pointed depression; each pale area has a row of small, paler yellow, rounded beads; each spiracular plate has two pale yellow bristles near the base and one on the upper, inner surface; the buttons are circular depressions separated by a space about one and one-half times the diameter of one button; they are located in the depression between the two spiracles and are slightly above the horizontal diameter.

Pupa (Fig. 18).—Like the larva, with the following differences: Much more rigid, darker in color. Anterior spiracles (Fig. 18a) are cylindrical, slightly curved, yellowish red, tapering slightly towards the tip; each spiracle is about two and one-half times as long as its diameter; base with short, narrow, faint, longitudinal ridges with numerous small, pointed tubercles on the surface; located above the anterior, latero-ventral edge about two and one-half times the length of one spiracle; they are separated by a space nearly twice as long as one spiracle.

Reared to the adult stage by C. T. Greene, from a larva found in a chestnut stump, North of the District of Columbia line, Wash. D. C. March 28, 1920, A. N. Caudell, collector.

Microdon piperi Knab.

Proc. Biol. Soc. Wash., 1917, 30: 136.

Larva (Fig. 19).—Length 10 mm.; width 7 mm.; height 4 mm. Medium sized, dull, yellowish red; marginal band broad; the dorsum covered with minute tubercles, arranged in transverse rows along the outer edge of this band is a row of yellowish fringe, each strand is thicker at its base; entire dorsum distinctly reticulated, the lines of reticulation made up of small tubercles, each with a small depression at its summit; venter flat, very pale luteous. Posterior spiracular tubercle (Fig. 19b) located above the margin, about the length of the tubercle; the basal portion is rounded, covered with numerous yellowish bristles; this basal portion is located on a very short, cylindrical, neck which has numerous short ridges like the teeth in a ratchet; there is a flat, circular, dark red ring at the base; the spiracles are elevated about the height of one spiracle (Fig. 19c), flattened across the top; in an end view each spiracle is rounded, with a deep depression below; deep yellowish red with the slits orange color; buttons round, deeply concave and close together.

Pupa (Fig. 19).—Like the larva, with the following differences: Much more rigid, slightly darker. Anterior spiracle (Fig. 19a) shining, deep yellowish red; slightly longer than its diameter at base; basal half strongly reticulate; upper portion with numerous small, rounded tubercles; spiracles located above the anterior margin a distance about four times as long as one spiracle, separated by a space equal to three times the length of one spiracle.

Seattle, Washington. An adult emerged April 27, 1901, C. V. Piper, collector.

Mixogaster variegata (Walker)

Insecta Saundersiana, Dipt. 1856, I: 220. Syn. *Microdon daveyi* Knab. Trans. Roy. Soc. So. Austr., 1912, 36: 233.

Pupa (Fig. 12).—Length 8 to 9 mm.; width 4.5 to 5 mm.; height 3 mm. Medium sized, pale, shining, luteous; reticulation distinct; the reticulated lines are formed by microscopic, scale-like, white hairs; a broad, V-shaped, longitudinal groove in the middle of the dorsum, extending from the posterior spiracular tubercle to the anterior edge of the pupa; each small area within the reticulated lines depressed in the middle; marginal rounded ridge (Fig. 12b) is covered with small tubercles arranged in transverse rows; each tubercle has three microscopic bristles at the apex; underneath this ridge is a single row of microscopic white bristles extending around the entire pupa.

Anterior spiracles (Fig. 12a) dark reddish brown, faintly shining, with the entire surface microscopically granular; about one and one-half times as long as its basal diameter, tapering very slightly toward the tip; basal half with several longitudinal ridges, fading out at their tips, separated by a space about as wide as one ridge; on the tip of the spiracle are several small blackish beads with a narrow pale yellow slit in the middle; these beads

arranged in a double row with space between pale yellow. Posterior spiracular tubercle (Fig. 12c) located above the margin about the length of the tubercle; the tubercle is about twice as long as the basal diameter; slightly concave beyond the middle and with a longitudinal depression on each side of the basal half, causing a prominent ridge in the middle of the basal half of the dorsum; the surface is microscopically granular with a frosted white coating; apical portion (Fig. 12d) is shining, yellowish red and quite rough looking on the tip; on the outer side of each half are five small, nearly round, shining bead-like elevations (Fig. 12e) each with a central, longitudinal spiracular slit; the buttons are circular concavities separated by a space equal to the diameter of one button.

Ararat, Victoria, Australia, no date. H. W. Davey, collector.
From ants nest, (name not given).

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EXPLANATION OF FIGURES

(All drawings by C. T. Greene)

(All drawings are dorsal views except No. 9 which is the lateral view)

- Fig. 1.—*Microdon lanccolatus* Adams. Pupa, *a.* posterior tubercle; *b.* posterior spiracular plate.
- Fig. 2.—*Microdon manitobensis* Curran. Pupa, *a.* posterior spiracular tubercle; *b.* posterior spiracular plate.
- Fig. 3.—*Microdon marmoratus* Bigot. Pupa, *a.* anterior spiracle; *b.* posterior spiracular tubercle; *c.* posterior spiracular plates.
- Fig. 4.—*Microdon globosus* (Fabr.) Pupa, *a.* anterior spiracle; *b.* posterior spiracular tubercle; *c.* posterior spiracular plate.
- Fig. 5.—*Microdon coaretatus* Loew. Pupa, *a.* anterior spiracle; *b.* posterior spiracular tubercle; *c.* posterior spiracular plate.
- Fig. 6.—*Microdon wheeleri* Mann. Pupa, *a.* anterior spiracle; *b.* posterior spiracular tubercle; *c.* posterior spiracular plate.
- Fig. 7.—*Microdon pictipennis* (Macq.) Pupa, *a.* anterior spiracle; *b.* dorsal tubercle; *c.* posterior spiracular tubercle; *d.* post. spiracular plate.
- Fig. 8.—*Microdon* Species No. 3. Larva, *a.* posterior spiracular tubercle; *b.* posterior spiracular plate.
- Fig. 9.—*Microdon* Species No. 4. Pupa, lateral view, *a.* anterior spiracle; *b.* lateral tubercle; *c.* posterior spiracular plate.
- Fig. 10.—*Microdon ruficrus* Williston. Pupa, *a.* posterior spiracular tubercle; *b.* posterior spiracular plate.
- Fig. 11.—*Microdon champlaini* Curran. Pupa, *a.* posterior spiracular tubercle; *b.* posterior spiracular plate.
- Fig. 12.—*Mixogaster variegatus* (Walker). Pupa, *a.* anterior spiracle; *b.* section thru latero-ventral band; *c.* poster spiracular tubercle; *d.* end view of posterior spiracular tubercle; *e.* posterior spiracular plate.
- Fig. 13.—*Microdon* Species No. 2. Larva, *a.* enlargement of a reticulated line; *b.* posterior spiracular tubercle; *c.* posterior spiracular plate.
- Fig. 14.—*Microdon* Species No. 1. Larva (near *robusta* Telford); *a.* posterior spiracular tubercle; *b.* posterior spiracular plate; *c.* enlarged view of one of the lower tubercles.
- Fig. 15.—*Microdon robusta* Telford. Larva, *a.* enlargement of a reticulated line; *b.* posterior view of the spiracular tubercle; *c.* posterior spiracular plate.
- Fig. 16.—*Microdon megalogaster* Snow. Pupa, *a.* anterior spiracle; *b.* posterior spiracular plate.
- Fig. 17.—*Microdon cothurnatus* Bigot. Pupa, *a.* anterior spiracle; *b.* posterior spiracular tubercle; *c.* posterior spiracular plate.
- Fig. 18.—*Microdon tristis* Loew. Pupa, *a.* anterior spiracle; *b.* posterior spiracular tubercle; *c.* posterior spiracular plate.
- Fig. 19.—*Microdon piperi* Knab. Pupa, *a.* anterior spiracle; *b.* posterior spiracular tubercle; *c.* posterior spiracular plate.





