

THE BIOLOGY OF *TRICHOPODA PENNIPES* FAB.
(DIPTERA, TACHINIDÆ), A PARASITE OF THE
COMMON SQUASH BUG.*

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PART II.

MORPHOLOGY

In the study of the adult anatomy, pinned dried specimens were used. For the definition of the mouth parts, sclerites of the thorax, and the genitalia, however, it was found necessary to relax the parts and examine them in liquid. For this purpose, specimens were soaked for about an hour in a cold 10 per cent solution of caustic potash (boiling often causes distortion of the parts) washed in water and treated with weak acetic acid to stop the action of the caustic potash. They were then placed in 70 per cent alcohol.

The parts were examined under a Zeiss binocular microscope, at magnifications varying from sixteen to sixty-five diameters. Many structures were obscure except under the brightest illumination, and therefore most of the examinations were made in the rays from a powerful lamp. A Ford headlight was mounted on a ringstand and connected through a transformer with the ordinary one hundred and ten volt circuit. This lamp proved to be quite satisfactory, since it was placed on the desk at a distance of two feet from the binocular, allowing plenty of room to work. A lamp of this kind, focussed upon the microscope stage by means of the set-screw in the lamp, throws little light into the eyes and develops little heat, while the object under observation is brought into strong relief.

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Adult.

The adult fly is about the size of the common house fly¹ but it is much more gay in appearance. It may be seen on sunny days hovering about squash plants, or resting with half-spread wings upon the foliage of squash and upon certain wild flowers as well. It is strikingly colored, with deep reddish brown eyes on a head marked with black, gold and silver. The thorax is golden in front, with four longitudinal black stripes, clear black behind, and gray at the sides. The abdomen is of a brilliant orange color, except at the extreme tip, which is darker. The conspicuous abdomen, and the fringe of feather-like setæ along the outer side of the hind tibiæ, immediately catch the eye of the observer, and serve to make this species one of the most striking among Tachinid flies.

A discussion of the adult anatomy is complicated by the diversity of terms which may be applied to the different structures. Taxonomists have applied names which, in many cases, are morphologically inaccurate, and morphologists themselves have differed both in the nomenclature and in the interpretation of parts. The source of the terms used in this paper is indicated in the text of the different sections, and in many cases duplicate names for the various structures are given in the list of abbreviations used in the figures.

Head. Pl. 1, figs. 1 and 2. In describing the head, the terms used are those of Peterson (1916), except the chætotaxy, which follows Coquillett (1897) and Walton (1909).

Viewed from in front, the head is elliptical in outline, and broader than deep (3.2 mm. by 2.4 mm.). Its most conspicuous feature is perhaps the frontal suture (fs),² which extends in a dark, shining, inverted U-shaped band from just above the insertion of the antennæ to a point midway between the vibrissæ (vib) and the curve of the compound eyes (ce), where it tapers out. Within the curve of the frontal suture lies the frontoclypeus (fc), termed by Coquillett the "facial depression" and

²Letters in parenthesis are those used in labeling the figures, and are explained in the list of abbreviations preceding the plates at the end of this paper.

by Walton the "facial plate." The tentorial thickenings (tt) arising at each side near the oral margin and running upward nearly to the insertion of the antennæ, are easily seen, lying just within the facial or vibrissal ridges, which are not pronounced. The vertex (v) is all that portion of the head, viewed is the ocellar triangle, bearing on its raised surface three ocelli (oc). From the region of the ocelli to the frontal suture runs a median broad velvety-black band or "vitta" (mv), which is demarked from the rest of the vertex only by its color, which strongly contrasts with the golden-yellow tomentum of the lateral portions of the vertex. The genæ (ge) are those portions of the vertex lying below the ends of the frontal suture, and between the oral margin and the eyes. Their color is silvery-gray, which shades into the gold of the rest of the vertex above, and into the brownish-yellow of the fronto-clypeus.

Viewed from the side the head is quadrate in shape. The postgenæ (pge) are those regions behind the genæ and extending backward and upward along the curve of the compound eyes to a point midway between the oral margin and the ocellar triangle. The occiput is designated as that portion of the caudal aspect of the head extending from a line drawn midway across the occipital foramen upward to the vertex. The edge of this area can be seen from the side (ocp).

Chaetotaxy of the Head. On either side of the median vitta is a row of frontal bristles (fb) which, since they bend inward across the vitta, may be called "transfrontals."¹

On the ocellar triangle, just behind the anterior ocellus, lie the great ocellar pair (ob), while behind these, and passing between the two lateral ocelli, follow three or more pairs of "lesser ocellar" bristles, which in *T. pennipes* are very small.

¹Here is one instance of the confusion of terms mentioned at the beginning of this paper. The area bearing the frontal bristles, although it has been called the "front" by taxonomists, is morphologically not the front at all, but the vertex. The true front, which lies below the antennæ and is fused with the clypeus, also bears a double row of macrochaetae which, to one not a specialist, might readily be mistaken for the frontal bristles. The writer does not recommend here any reconciliation between the terms of the morphologists and the usage of the taxonomists, but merely wishes to point out the true relation of parts. To his mind, any attempt to modify the terminology other than by concerted action among taxonomic workers and morphologists would only result in "confusion worse confounded."

Behind the ocelli and on the edge of the occiput is a transverse row of four macrochætæ. The inner, larger pair are the post-vertical bristles (pvt), and the smaller, outer ones, the inner vertical bristles (ivt). The outer verticals, present in some forms, are not represented in this species. The fronto-orbitals, which lie between the frontal bristles and the curve of the compound eyes, are also absent.

On the fronto-clypeus, disposed along each facial ridge, is a short row of facial bristles, the vibrissal row. The uppermost pair are the vibrissæ (vib) which in *T. pennipes* do not assume from the front, which lies between the compound eyes, and between these and the frontal suture. At the very top of the vertex their typical position immediately above the oral margin, but are shifted upward to lie halfway between the oral margin and the tips of the antennæ. The smaller bristles accompanying the vibrissæ extend on either side in a single line along the oral margin to the region of the postgenæ, where they mingle with the silvery-white beard which depends from this region. A single row of short macrochætæ extends around the edge of the occiput from the inner vertical bristles downward to the region of the postgenæ. These are called the cilia of the posterior orbit (cpo).

Appendages of the Head.

Antennæ. The antennæ (ant) reach halfway between the base of the frontal suture and the oral margin. The first two segments are velvety-black in color, with a silvery sheen. The second segment bears a few macrochætæ. The third segment, which is much larger than the other two, is bean-shaped and varies from black to mouse-colored, with the base sometimes slightly tawny. This segment bears the arista (ar), a large bristle which is inserted on the outer edge about one third the distance from base to tip of the segment. The arista is practically bare, having but a few very tiny hairs near its base.

Proboscis. The proboscis (pb), usually folded well back in the oral cavity, is a very much modified structure, the parts of which it is very difficult to homologize with the mouth parts of

generalized insects. The work of Peterson (1916) on the mouth parts of Diptera was very thorough, and his figures correct and intelligible, but since he derives his hypothetical dipterous mouth parts from a consideration of Orthoptera while Crampton (1921, p. 91) would evolve Diptera from ancestors like Mecoptera, the homologies of dipterous mouth parts still constitute a disputed question.

The membrane of the basiproboscis (bpb) is largely composed of the mentum and sub-mentum, according to Peterson. The maxillary palpi; (mxp) lie on this membrane in front. Above the maxillary palpi lie the exposed portions of the tormæ (to), and below lie the external plates of the stipes (st). The galeæ (ga) lie on the surface, and are continuous with the lower ends of the ental portions of the stipes. The large chitinous internal structure of the basiproboscis is the fulcrum (ful) and is composed of the basipharynx, or united portions of the epipharynx and hypopharynx, and the ental portions of the tormæ. At the distal end of the basipharynx lies the hyoid (hy), which articulates with the distal portion of the hypopharynx as well, and through which passes the alimentary canal.

The mediproboscis (mpb) bears the chitinized plate, the theca (the), on its caudal aspect, and the hypopharynx (hyp) and labrum-epipharynx (lep) lie in a chitinized groove on the upper surface of the labium.

The distiproboscis (dpb) is composed of a pair of lobes or labella, which Peterson interprets as the paraglossæ (pg). Crampton, however, calls them the united labial palpi. Various other structures can be seen in the distiproboscis, such as a Y-shaped plate called the furca (fu) and the structures called pseudotrachæ (pst).

Thorax. Pl. I, figs. 3 and 4. The structure of the thorax in *Trichopoda pennipes* is typical of the order Diptera as a whole, in which the mesothorax, which is the only wing-bearing segment, is greatly enlarged and distorted, evidently for the purpose of accomodating the great wing muscles. The prothorax (P) is very small, and the metathorax, which bears the halteres(ha), is very much reduced.

In naming the sclerites of the thorax the terminology used by Young (1921), which is largely based on Crampton (1914), is employed.

The dorsal aspect of the thorax is completely covered by the notum of the mesothorax, as defined by Snodgrass (1909a), or the mesonotum. This is divided by two transverse sutures into three sclerites, the prescutum (psc²), scutum (sc²) and scutellum (sl²). The prescutum, including the humeral calli (hc) is yellow in color, with four longitudinal bands of velvety-black. In the males the yellow coloration extends backward onto the scutum where it merges with the black of that sclerite. The scutellum of both sexes appears black to the naked eye, but under the binocular most specimens show a faint tinge of very dark orange. The scutum is produced laterally into an anterior wing process, the suralare (sur), and a posterior wing process, the adanale (ad). The scutellar bridge of Walton (sb) is seen as a lateral overlapping of the scutellum onto the scutum. Below this is the axillary cord (axc) of Snodgrass (1909a), which is produced to form the margin of the calypteres. A posttergite (pt²) is demarked behind the scutellum. The pseudonotum or postnotum of Snodgrass, which he would recommend calling the "postscutellum", in this case is located ventrad of the scutellum, and cannot be seen from above. It is divided into a median plate, the meditergite (mt²), and two pairs of lateral plates, the anapleurotergites (aplt²) and the katapleurotergites (kplt²). Mention may logically be made here of the character recently reported by Malloch (1923) for differentiating muscoid flies. In Malloch's own words, "It is invariably possible to distinguish between the Sarcophagidæ, Muscidæ and Calliphoridæ on one hand, and the Tachinidæ and Dexiidæ on the other, by the shape of the metanotum. In the last two this is biconvex in profile, there being a small but distinct convexity just below the scutellum which is absent in the other three families known to me." The use of the term "metanotum" by Malloch follows the usage of older taxonomic workers, and is morphologically inaccurate. It is really the meditergite (mt²) of the postscutellum which is meant, and the "biconvexity"

apparent in Tachinidæ and Dexiidæ is conditioned by the presence of the posttergite (pt^2), which, as a glance at the figure will show, lies just below the scutellum. An examination of figures 38, 39, 40 and 41 of Young bears out this point.

The pleural region of the mesothorax is pollinose gray in color, and is much distorted. The pleural suture, which in generalized insects runs a nearly straight course from the coxal cavity to the wing base, thus dividing the pleuron into an anterior episternum and a posterior epimeron, is here bent twice at right angles, so that while the two ends are nearly vertical, the middle is horizontal. In addition a portion of the anepisternum (aes^2) has been split off from the rest by a secondary invasion of membrane, and has become closely associated with the anepimeron or pteropleurite ($ptp.^2$). The katepisternum has fused with the sternum to form the sternopleurite (stp^2). It is the enlargement of this sclerite which has evidently caused the bending of the pleural suture, and has crowded the meropleurite (mep^2), which is composed of katepimeron plus meron, back against the pleuron of the metathorax.

The numerous small plates which lie in the membrane surrounding the base of the wing are very difficult to see, but are easily identified with those sclerites outlined by Crampton (1914) in his ground plan of a typical thoracic segment in winged insects. The tegula (tg) lies in the angle between the scutum and the anepisternum. The notale (n) is a detached portion of the scutum lying just above the base of the wing. The basalar plates are two in number, the anterior one (aba) not demarked from the posterior portion of the anepisternum, the posterior one (pba) very small and lying between it and the pleural wing process (wp). The subalar plates are two in number, the anterior one (asa) lying behind the wing process and above the pteropleurite, the posterior one (psa) which is much smaller lying just below a posterior lateral process of the scutum. These basalar and subalar plates are the pre and post paraptera of Snodgrass (1909a).

The tergum of the metathorax, or the metanotum (n^3) is reduced to a narrow band connecting the halteres (ha), and visible only at the sides where it is produced to form points of

attachment for the abdomen. The pleuron of this segment is divided into metaepisternum (es³) and metaepimeron (em³). A spiracle (sp) is present just before the metaepisternum, as before the mesoepisternum. The region around the base of the haltere is so modified that it is impossible to tell whether pre and post alar bridges connect the metanotum with the meta-pleuron.

Some of the terms used above are different from those in common use among taxonomists. The mesoanepisternum (aes²) has been called by dipterists the mesopleura. The mesosterno-pleurite (stp²) is equivalent to the sternopleura of authors, while the meropleurite (mep²) plus metapleuron plus meta-sternum equals the hypopleurite, so-called.

Chaetotaxy of the Thorax. The thorax of *T. pennipes* is not heavily armed with macrochætæ. However, representatives of most of the groups mentioned by Walton are present. Two humerals (hu) adorn each humeral callus. Posthumerals are wanting, as are anterior acrosticals. The anterior dorsocentral rows are represented by two very variable bristles (adc) placed near the hinder margin of the prescutum, while at each rear corner of this sclerite are borne two notopleural bristles (np). On each side, between the notopleurals and the anterior dorso-centrals, lies a single bristle, the presutural (psu).

On either side of the scutum a single bristle (sa) represents the supra-alar row, and another (ia) each intra-alar row. Two post alars (pa) are present, and each of the posterior dorso-central (pdc) and posterior acrostical (pac) rows is represented by a single bristle. It will be seen that these last four bristles form a transverse row near the hind margin of the scutum. This is called the prescutellar row.

On the scutellum an anterior bristle and a posterior bristle mark the position of the marginal scutellar row (ms). The anterior bristle was seen to be accompanied by a smaller one in one or two specimens. No discal scutellars are present.

The mesoanepisternum bears a vertical row of bristles called the mesopleural row (mr), situated just before the membrane which divides it. Below the anterior spiracle are two

bristles, one on the prothorax, the propleural bristle (pp), and one on the sternopleurite, which the writer has called the sub-stigmal bristle (ss). The sternopleurite bears typically two sterno-pleurals (stb), although a third was found to be present on some individuals. A curved row of three to five hypopleurals (hp) is located on the meropleurite. A single pteropleural bristle (ptb) was present in some specimens examined, while others bore as many as four.

Appendages of the Thorax.

Legs. Pl. I, fig. 4; Pl. II, figs. 7 and 8. The coxa (cx) is tawny in color, with a grayish bloom, while the trochanter (tr) and the proximal portion of the femur (fe) are yellowish. The distal portion of the femur and the tibia (tb) and tarsus (ta) are black. The claws are yellowish tipped with black, and are fringed with very fine light-colored hairs. There is a bristle-like empodium (ep) which, since it is a prolongation of a ventral plate, is a true empodium according to Crampton (1923). The pulvilli (pv) are buff-colored, and in the male are quite large and conspicuous. The first two pairs of legs display no features of particular interest. The tibiae of the hind legs, however, exhibit on the outer side a peculiar row of black, feather-like setae, which stand nearly erect, and the longest of which are at least one third the length of the tibia itself. This row is in reality double, since a row of smaller scales is appressed to the larger ones on the outside. The hind tibia also bears on its inner face a single bristle of a size noticeably larger than any of the surrounding hairs.

Wings. Pl. II, figs 5 and 6. The wings of the female are dusky, with the posterior margin sub-hyaline. Those of all the males examined bear a somewhat variable yellowish area in the forepart of the wing, the extent of which is indicated in figure 5. According to Coquillett (1897) this character is not constant.

The figure of the wing of the female (fig. 6) explains the venation of the wings, while the cells are labeled in the figure of the wing of the male. The chief point of interest in the wing venation of *T. pennipes* is that M_3 is bullate or weakened basally, making M_3 appear as a stub sticking up from Cu.

Abdomen. Pl. II, figs. 9-14. Pl. III, fig. 15. The abdomen in both sexes is of a bright orange color and is destitute of macrochætæ. It is sparsely clothed, however, with short black hairs. Seven pairs of spiracles (sp) are present, borne at the lateral margins of the tergites (t_1 , t_2), etc.). Those of the sixth and seventh segments are hidden beneath the posterior edge of the fifth tergite (t_5). The tergites of the first and second segments are fused, the fusion being denoted by an area of weaker chitin, which is demarked in the figures by a pair of dotted lines between t_1 and t_2 . The adventitious suture (as) in the first tergite, mentioned by Young, is readily seen.

The tip of the abdomen in the female is wholly black, this coloration including the fifth tergite and in some individuals extending further forward to include part of the fourth tergite. The terminal abdominal segments of the male in specimens examined by the writer were in no case wholly black, although t_5 and t_6 were darker than those preceding.

*Genitalia.*¹ Pl. II, figs. 13-14; Pl. III, fig. 15. In both sexes the segments beyond the fifth abdominal may truly be called genital segments. In the male these segments curve downward and come to lie beneath the fifth tergite. In the female those beyond the fifth are telescoped when at rest, being extended for oviposition.

In the male the fused tenth and eleventh tergites, which are ventral in position, act as a cover for the cedeagus (oe), being tucked beneath the edge of the fifth sternite (s_5) when at rest. When the cedeagus is extruded, however, this flap lifts up, allowing the ninth sternite (s_9) to push forth. This latter segment is very much modified. Its fused cerci are median in position and form the cedeagus, a very complicated structure which encloses the membranous penis. At the base of the cedeagus are seen two pairs of lateral projections, called gonopophyses (go), the inner pair of which are hyaline. They are well-chitinized, however, feeling hard to the touch of a dissecting needle. At the base of the cedeagus the ninth sternite is

¹The writer has based his description of the genitalia largely on the condition of these structures in generalized insects. It is apparent that the study of a series of dipterous genitalia may reverse some of his decisions regarding the true character of the parts.

rather more heavily chitinized than elsewhere, resulting in the appearance of a chitinized box (chb) from which the *ædeagus* protrudes and on which the gonopophyses are borne. This chitinized box also bears a median dorsal hook-like projection, called by the writer the genital prong (gp). The styli of the ninth segment, which in some insects function as outer claspers, are here much reduced in size and are apparently non-functional, since when the genitalia are extruded they barely appear beyond the posterior edge of the eighth tergite. A peculiar structure, which the writer is at a loss to homologize with any genital appendage of generalized insects, appears in the "genital furca" (gf). This is a fork-like chitinized rod which lies between the sides of the ninth sternite, to which it is connected by muscles. It splits at the base of the *œdagus*, one arm extending to either side of the latter organ. Its function is quite evidently that of guiding the movements of the *œdagus*.

In the female the eighth segment is a narrow ring, bearing below the median ventral valve (vv) of the ovipositor and laterally the two inner valves (iv). Dorsally this segment seemed to bear a median dorsal valve (dv), but this may prove to be a modified portion of the ninth segment, which is supposed to bear the dorsal valve. This point could not be definitely determined from the dried material at the writer's disposal, even after soaking in caustic potash and gently extending the ovipositor by pushing from within by means of a blunt needle.

Secondary Sexual Characters. The foregoing account of the external anatomy of *Trichopoda pennipes* contains scattered references to certain differences which were apparent between the two sexes. These differences were constant in a series of eight males and seven females. Scarcely any difference in size could be noticed, the males averaging 8.6 mm. in length, the females 8 mm. Both the largest and the smallest were males, the one 10 mm. long, the other measuring 7 mm. To a certain extent the size of the adult fly is affected by the abundance of food available to the larva which preceded it, and when contained in keys for the identification of species may be found misleading.

Two characters were found by which the sex of living flies can be determined without undue handling. These are the ferrugineous spot in the wing of the male as against the evenly dusky wing of the female, and the black tip of the female abdomen as against the dark orange of that of the male.¹ A minor difference was in the size of the pulvilli, these being shorter than the last tarsal segment in the females, and inconspicuous. In the males the pulvilli were longer than the last tarsal segment, and quite broad and conspicuous. This is a character, however, that is not readily noticed unless a male and a female are examined at the same time, and it is therefore of little practical use, in a taxonomic sense.

EGG. Pl. III, fig. 16.

The eggs of *Trichopoda pennipes* vary in color from clear shining white to dirty gray, the coloration seeming not to depend on the age of the egg. The individual egg is ovate in outline, being slightly larger at one end. It is strongly convex, and is flattened on the side next the body surface of the host. This flattened surface is covered by a colorless cement, by which the egg is affixed to the body of the host. The egg measures .56 mm. in length by .37 mm. in breadth, and its greatest height is .25 mm. The surface of the chorion appears smooth except under high magnification, when it is seen to be faintly reticulate in tiny hexagons. The chorion is comparatively thick and "leathery", and remains rigid after hatching. The micropyle appears to be borne on a small papilla at the smaller end of the egg. Eggs which have hatched show a circular hole on the flattened side near the broader end. Since it is this flattened side which is pressed against the host, it is impossible to tell if an egg has hatched without first removing it from the body surface of the host.

LARVA. Pl. III, figs. 17 and 18.

The larva has not been examined in all instars. When fullgrown, it is a dead-white maggot, with black hook-like

¹Drake (1920) published recognizable photographs of both sexes, but his designations are erroneous. Osten Sacken, in a foot-note to the work of Say (1829), also has confused the sexes.

rasping mouth parts (mh) and a pair of black anal stigmata. (ans) It is quite robust, and although its greatest circumference is about midway of its length, it can hardly be called fusiform, since it tapers away to a point in front, while the anal end is blunt. It is about 10 mm. long by 3.5 mm. in diameter, a surprising size when one considers that the adult host measures but 15 mm. in length.

The structure of the cephalo-pharyngeal skeleton, and the arrangement of the slits in the anal stigmata vary in the different species, and figures of these organs are therefore included in the plates. No sign of the parastomal sclerites mentioned by Banks (1912) as occurring in certain muscoid larvæ could be found in the cephalo-pharyngeal skeleton of *T. pennipes*.

PUPARIUM. Pl. III, figs. 19, 20, 21.

The pupa itself has not been observed. The puparium which encloses it, however, is of a deep reddish-black color, cylindrical in shape, and rounded at both ends. It is formed from the skin of the mature larva, and upon it the anal stigmata appear as twin tubercles at the posterior end. The puparia average about 7.5 mm. in length and 3.5 mm. in diameter. At the anterior end, before the emergence of the adult fly, a transverse split occurs, reaching backward nearly a quarter of the length of the puparium. The split then extends around the circumference, this resulting in the formation of two flaps which are pushed aside by the ptilinum of the emerging adult.

Some time after the examinations of the puparium had been finished by the writer, the work of Greene (1922) on the puparia of muscoid flies came to hand. The puparium of *T. pennipes* is there figured and discussed, and significant characters compared with those of the puparia of other species.

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EXPLANATION OF FIGURES.

Plate I.

- Fig. 1. Head of male—front view.
Fig. 2. Head of male—side view, showing mouth parts.
Fig. 3. Dorsum of male thorax.
Fig. 4. Thorax of male—side view.

Plate II.

- Fig. 5. Wing of male, showing extent of ferrugineous spot. Cells labeled.
Fig. 6. Wing of female. Veins labeled.
Fig. 7. Tibia of metathoracic leg, showing fringe of feather-barbed setæ.
Fig. 8. Terminal segments of tarsus of male.
Fig. 9. Abdomen of male—side view.
Fig. 10. Abdomen of female—side view.
Fig. 11. Abdomen of male—ventral view.
Fig. 12. Abdomen of female—ventral view.
Fig. 13. Male genitalia.
Fig. 14. Female genitalia.

Plate III

- Fig. 15. Ninth abdominal sternite of male.
Fig. 16. Egg. a, outline from side; b, from top; c, showing hole in ventral surface after hatching.
Fig. 17. Mature larva.
Fig. 18. Cephalo-pharyngeal skeleton of larva. a and b, of second stage (?) larva, side and top views; c and d, mature of larva, side and top views.

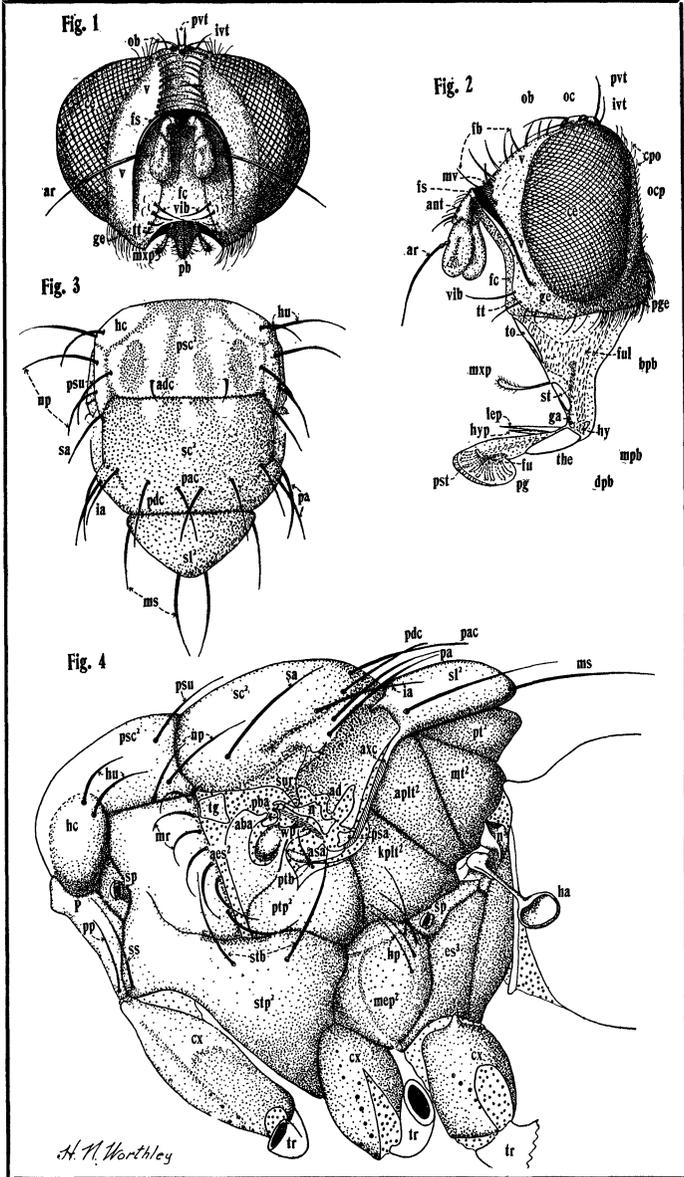
- Fig. 19. Puparium, from the top.
 Fig. 20. Empty puparium, from the side.
 Fig. 21. Anal stigmata of puparium.

Plate IV

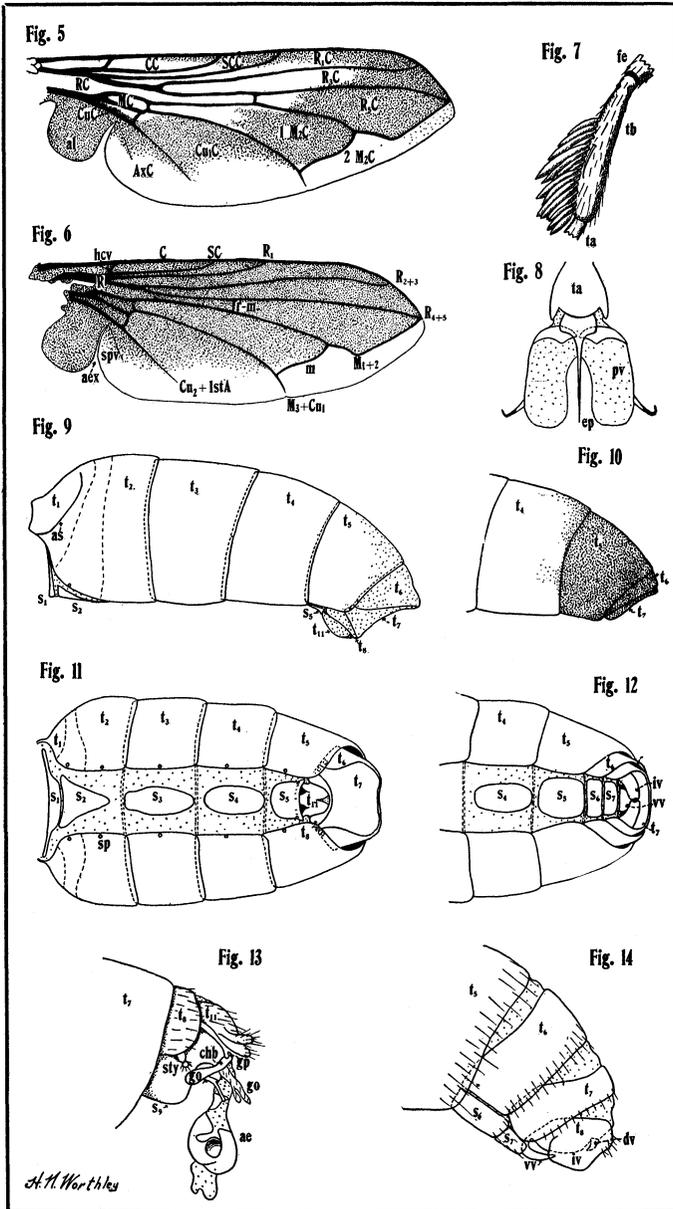
Dorsal view of male fly.

ABBREVIATIONS

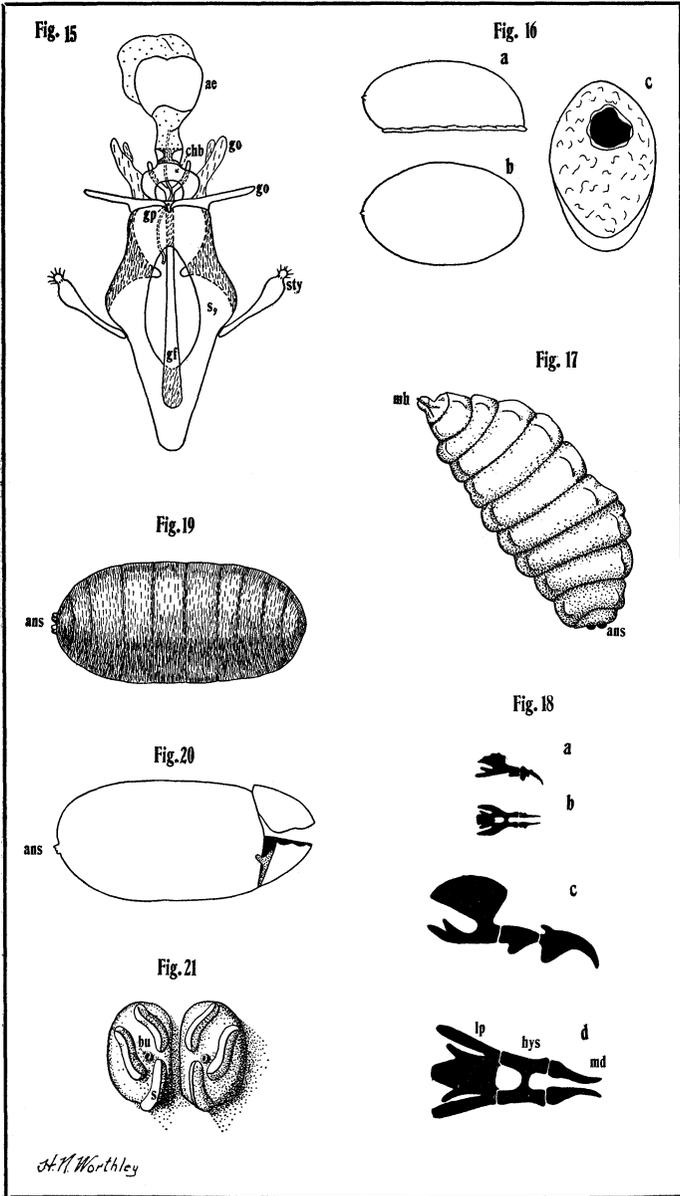
1st A	—anal or 6th longitudinal vein	fb	—frontal bristles
aba	—anterior basalar plate	fc	—fronto-clypeus (facial depression, facial plate)
ad	—adanale	fe	—femur
adc	—anterior dorso-central bristle	fs	—frontal suture
ae	—oedagus	fu	—furca
aes ²	—mesoanepisternum or mesopleura	ful	—fulcrum
aex	—axillary excision	ga	—galea
al	—axillary lobe	ge	—gena (cheek)
ans	—anal stigmata	gf	—genital furca
ant	—antenna	go	—gonopophyses
apl ^{t2}	—anapleurotergite of post-scutellum	gp	—genital prong
ar	—arista	ha	—halter
as	—adventitious suture	hc	—humeral callus
asa	—anterior subalar plate	hcv	—humeral cross-vein
AxC	—axillary (or anal) cell	hp	—hypopleural bristles
axc	—axillary cord	hu	—humeral bristles
bpb	—basiproboscis	hy	—hyoid
bu	—button	hyp	—hypopharynx
C	—costal vein	hys	—hypostomal sclerite
CC	—costal cell	ia	—intra-alar bristle
ce	—compound eye	iv	—inner valve of ovipositor
chb	—chitinized box	ivt	—inner vertical bristle
cpo	—cilia of posterior orbit	kpl ^{t2}	—katapleurotergite of post-scutellum
CuC	—cubital (3rd basal or anal) cell	lep	—labrum-epipharynx
Cu ₁ C	—3rd posterior cell	lp	—lateral plate
cx	—coxa	M	—media
dpb	—distiproboscis	m	—medial (posterior) cross-vein
dv	—dorsal valve (?) of ovipositor	M ₁₊₂	—4th longitudinal vein
em ³	—metaepimeron	M ₂₊ Cu ₁	—5th longitudinal vein
ep	—empodium	MC	—medial (2nd basal) cell
es ³	—metaepisternum	1M ₂ C	—discal cell
		2M ₂ C	—2nd posterior cell



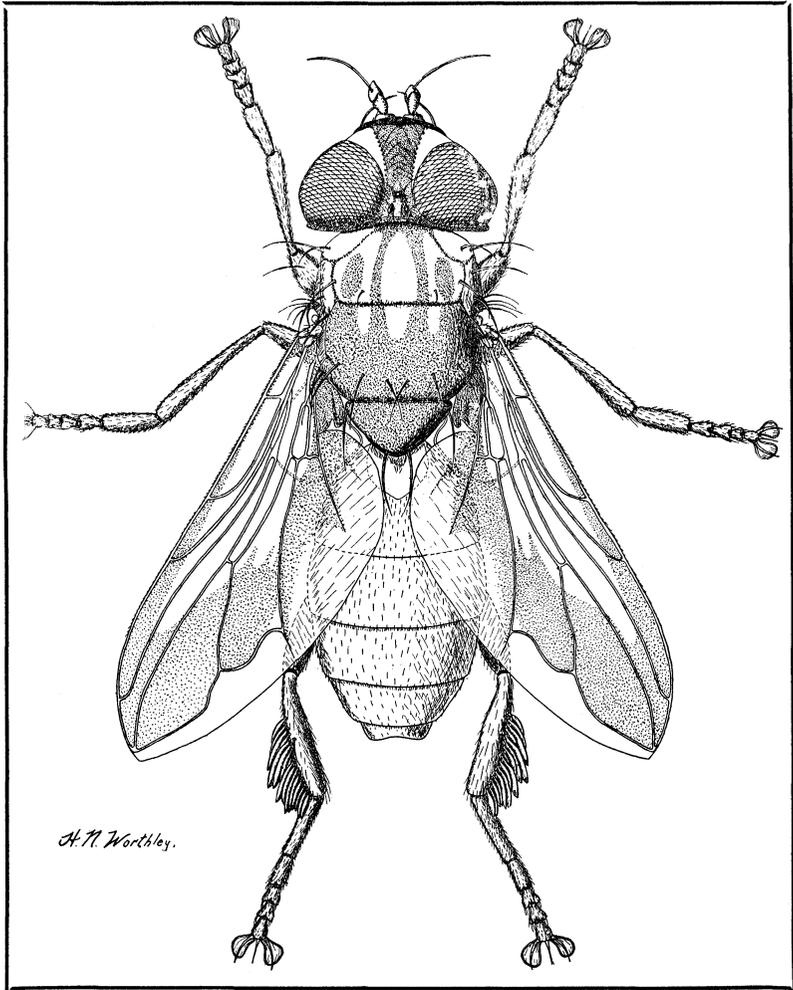
WORTHLEY—Biology of *Trichopoda pennipes*



WORTHLEY—Biology of *Trichopoda pennipes*

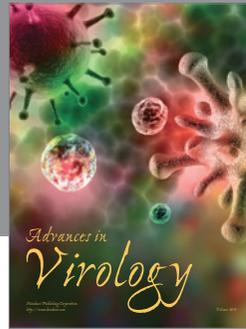
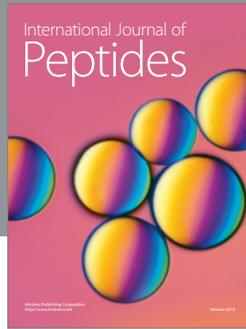
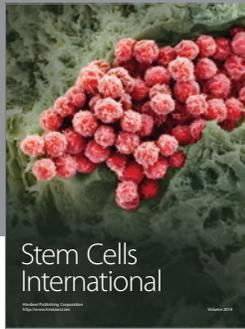


WORTHLEY—Biology of *Trichopoda pennipes*



WORTHLEY—Biology of *Trichopoda pennipes*

md	—mandibles (great hooks) of larva	R ₁	—1st longitudinal vein
mep ²	—meropleurite	R ₂₊₃	—2nd longitudinal vein
mh	—mouth hooks (or mandibles) of larva	R ₄₊₅	—3rd longitudinal vein
mpb	—mediproboscis	RC	—radial (1st basal) cell
mr	—mesopleural row	R ₁ C	—marginal cell
ms	—marginal scutellar bristles	R ₂ C	—submarginal cell
mt ²	—meditergite of postscutellum	R ₃ C	—1st posterior or apical cell
mv	—median vitta of vertex	r-m	—radio-medial (anterior) cross-vein
mvp	—maxillary palpus	s	—slit
n	—notale	s ₁ , s ₂ , etc.	—abdominal sternites
n ³	—metanotum	sa	—supra-alar bristle
np	—notopleural bristles	sb	—scutellar bridge
ob	—ocellar bristles	SC	—subcosta (auxiliary vein)
oc	—ocelli	sc ²	—mesoscutum
ocp	—occiput	SCC	—subcostal cell
P	—prothorax	sl ²	—mesoscutellum
pa	—postalar bristles	sp	—spiracle
pac	—posterior acrostical bristle	spv	—spurious vein
pb	—proboscis	ss	—substigmatal bristle
pba	—posterior basalar plate	st	—stipes
pd	—posterior dorso-central bristle	stb	—sternopleural bristles
pg	—paraglossae	stp ²	—mesosternopleurite (sternopleura)
pge	—postgenae	sty	—stylus
pp	—propleural bristle	sur	—suralare
psa	—posterior subalar plate	t ₁ , t ₂ , etc.	—abdominal tergites
psc ²	—mesoprescutum	ta	—tarsus
pst	—pseudotrachae	tb	—tibia
psu	—presutural bristle	tg	—tegula
pt ²	—posttergite of mesoscutellum	the	—theca
ptb	—pteropleural bristle	to	—tormae
ptp ²	—pteropleurite or mesoanepimeron	tr	—trochanter
pv	—pulvillus	tt	—tentorial thickenings
pvt	—posterior vertical bristles	v	—vertex
R	—radius	vib	—vibrissae
		vv	—ventral valve of ovi-positor
		wp	—wing process



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