Imago.

The imago has already been completely described by Meyrick (Trans. N.Z. Inst., xvi, p. 62) and by Hudson (N.Z. Moths and Butterflies, p. 53, pl. 6, figs. 30 and 31).

Distribution.

Waitakarei Ranges (Auckland); Wanganui, very common from August to May; Wellington; Christchurch and Dunedin, from October to May; Ashburton; West Plains; Invercargill, taken at light in April.

ART. XXIX.—*Contributions to the Study of New Zealand Entomology, from an Economical and Biological Standpoint: No. 4*—Phorocera nefaria *Hutton; No. 5*—Psychoda conspicillata *Hudson; No. 6*—Syrphus ropalus *Walk.; No. 7*—Phytomyza albiceps Mg. (Diptera).

By DAVID MILLER and MORRIS N. WATT, F.E.S.

[*Read before the Wanganui Philosophical Society, 23rd November, 1914.*]

Plates II, III.

No. 4. Phorocera nefaria Hutton.

For the original description of this fly see Trans. N.Z. Inst., vol. 33, p. 59, and vol. 36, p. 151.

Since nothing has yet been published concerning the habits and life-history of this Dipteron, which belongs to the parasitic family *Tachinidae*, the following note may be not uninteresting. The larva is an internal parasite of the larva and pupa of the common cabbage-tree moth, *Venusia verriculata* (see Trans. N.Z. Inst., vol. 47, p. 271). The larvae of this moth feed in the crevices between the innermost leaves of the cabbage-tree (*Cordyline australis*), and so it is difficult to see how they become attacked. It is quite possible that the fly deposits its ova on the leaves, and the young maggots on hatching seek out and penetrate their host. But this is only speculation. Only actual observation will reveal the secret, and so it is likely that some little time will elapse before we can complete this very interesting life-history.* The larva, when full-grown, emerges from the pupa of its host, and pupates, being protected by the light cocoon spun by the moth-caterpillar just prior to its final moult and for its own protection.

The pupa is dark red in colour; cylindrical, and smooth; the anterior end slightly smaller than its nadir, which is somewhat pointed. Length of case, $\frac{5}{16}$ in.; greatest diameter, $\frac{3}{16}$ in. In the specimen described the pupal stage lasted from the 10th August till the 1st October—that is to say, sixty-one days. Only one was obtained, and its puparium was almost as large as the pupa of its host, from which it had emerged by bursting through the head. On one occasion at least fifteen imagines were reared

* In all other cases observed a single host has reared but one parasite.

from a single pupa of *Oeseticus omnivorus*.* From this it appears likely that the fly may attack other lepidopterous larvae besides, and also tends to confirm the remarks above regarding oviposition.

Hab.—Christchurch (Hutton); Wanganui, October (M. N. W.).

No. 5. Psychoda conspicillata Hudson.

Psychoda conspicillata Hudson, Man. N.Z. Ent., p. 46, pl. iv, fig. 6.

This species may be the *Psychoda phalaenoides* Linn. described by Hutton, Trans. N.Z. Inst., vol. 34, p. 179.

As the adult fly has already been fully described and figured, it is unnecessary to do so again here. The following notes are new: During the last few years this beautiful little fly has been found breeding throughout the year in tins of disused liquid horse-manure. The family *Psychodidae* is represented by only a few species in New Zealand. Mr. Marshall (Trans. N.Z. Inst., vol. 28, p. 222) says that the larvae live in fungi and rotten wood. Our New Zealand species are, however, very little known.

Ova and details of oviposition not yet known.

The larva is aquatic, of an elongate form; yellowish-white in colour (description from specimens preserved in 3-per-cent. formol solution); length when full grown, about ½ in., but variable; number of segments, about 25 (?) (fig. 1).

The terminations consist of a downturned anterior and an upturned posterior chitinous-like process, the former very short and stout when compared with the latter, which is elongate, narrowing apically. On the

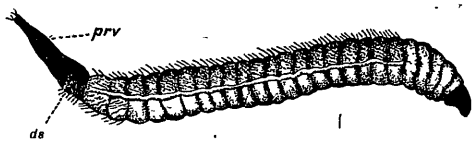


FIG. 1.—Larva of *Psychoda conspicillata*. *ds*, ventral hairs; *prv*, respiratory vesicle.

dorsal surface—exclusive of the first five segments—extending on each side to the medio-lateral line is a vestiture of short reclinate hooked bristles, which, below this lateral line, merge into indistinct and minute delicate hairs, except on the two apical segments, where the bristles form a complete covering. The medio-lateral line is a distinct fold of the cuticle, extending from the anterior margin of the 6th to the terminal segment. This fold is thrown into a series of wrinkles by the contractions of the body-wall.

The respiratory vesicle—the posterior process (fig. 1, *prv*)—is an elongate brownish structure, darker at the apex, and broadened toward the base.

* Since writing the above some larvae of the moth *Melanchra insignis* were being reared from ova sent to me from Dunedin by Mr. W. G. Howes. At no time during the oval, larval, or pupal stage was it at all possible for flies or other insects to attack the specimens, which were kept in glass dishes with flat glass lids. A fortnight after the pupal stage had been assumed a single larva of *P. nefaria* emerged from one of the pupae by bursting through the 4th abdominal segment, near the dorsum, and pupated. The only possible way in which the victim could have become infected was by means of an egg, or very young larva, of the fly being conveyed into the breeding-glass along with the leaves of the food plant, in this case the common plantain, on which the egg must have been deposited. It is well known that other *Diptera* of similar parasitic habits lay their eggs in this way.

When viewed from the side a swelling is seen upon the ventral surface, from which, at its base, arise numerous short and stiff bristle-like hairs (fig. 1, *ds*). Within the vesicle, and completely filling it apically, are a pair of large tracheae (fig. 2). Arising from the truncated apex, and apparently connected with the tracheae are a number—at least 3—of triangular structures bearing numerous long and sinuated hair-like appendages, each of which is broad and hollow (?) on the basal half but terminates distally in a whip-like filament.

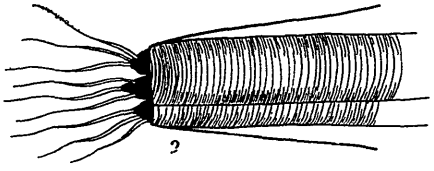
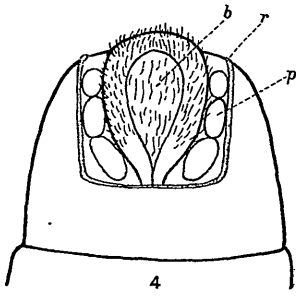


FIG. 2.—Apical tracheae.

The head—anterior process—is roughly triangular in profile, and bears at the downcurved apex a rounded process beset with small hooked bristles (fig. 3, *a*). When viewed from beneath, the head is dome-shaped (fig. 4),



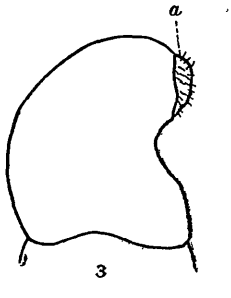


FIG. 3.—Profile of head.
FIG. 4.—Head of larva, ventral view.

with a large square notch on the anterior middle half, in which is seen the apical process already referred to (fig. 3, *a*). This notched cavity is bounded by a distinct ridge (fig. 4, *r*). The apical process (fig. 3, *a*) is now seen to be more or less almond-shaped, its centre being occupied by a similarly shaped cavity lined with delicate hairs (fig. 4, *b*). Separating this apical structure from the margin of the square cavity is, on each side, a row of 3 contiguous cup-like depressions, the posterior ones being more or less elongate (fig. 4, *p*).

These larvae feed immersed, but for their posterior process, in the slush, and are continually on the move. If disturbed they curl around any small obstacle that may be handy, and remain quiescent till the disturbing element is removed. The larval period extends into several weeks, but the total number of moults is uncertain.

The pupa rests embedded in the semi-liquid material on the surface of the slush, its two spiracles free to the air. Its power of movement is restricted, being able only to twist and twirl its abdomen to a slight extent, and it is quite unable to swim or otherwise care for itself. Like the larva, it varies in length, the longest being about $\frac{1}{2}$ in. In colour it is yellowish-white; in shape elongate, but broad and rounded anteriorly, and narrowing considerably toward the terminal segment (fig. 5). There are 9 segments, each connected by a membranous intersegmental membrane, visible only when the body is fully extended. Anteriorly is

a pair of well-separated club-shaped two-jointed respiratory appendages (fig. 5, *ra*). One of these is shown greatly enlarged (fig. 6). Each one, excepting the first short joint, consists of a roughly ridged sheath (fig. 6, *sh*), the ridges extending over the whole surface, exclusive of the proximal ventral area, which is smooth. Along the ventral surface, and occupying the whole of the apex, are rows of numerous pits, the margins of which are raised above the level of the sheath. Within the sheath is a tracheal-like structure (fig. 6, *tr*).

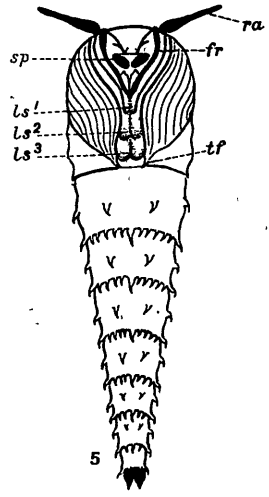
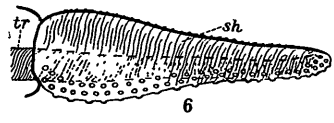


FIG. 5.—Pupa of *Psychoda conspicillata*. 1, 2, 3, 1st, 2nd, and 3rd pair of legs; *tf*, ventral extremity of wing-case; *fr*, antenna; *ra*, respiratory appendage; *sp*, ovate discs.

Ventrally the folds of the 1st segment terminate in sharp convergent points at the centre of the posterior margin of the 3rd segment (fig. 5, *tf*). The inner margins of these folds — the wings — are ridged and separated by a set of 3 lobe-like structures—the limbs, *i.e.*, the 1st, 2nd, and 3rd pairs of legs — notched on the posterior margins, and possessing a medio-longitudinal fissure (fig. 5, *ls*). More anterior still, about the middle line of the first pair of ridges (the antennae) (fig. 5, *fr*), are a pair of ovate discs (fig. 5, *sp*), beset with numerous pits and short delicate hairs. The body segments from the 3rd to the penultimate are thrown into hollows and ridges, the posterior margins carrying an armature of stout reclinate spines (fig. 5), three of which (a central and two laterals) are considerably enlarged, and are borne upon protuberances. There are also 4 large and similarly formed discal spines. Dorsally the spines are less stout, less numerous, proclinate, the discal set being absent.

The apical segment has no discal or dorsal spines, but a half-whorl of stout claws.* Arising from this segment is the terminal appendage, consisting of 4 dorsally curved massive claws (figs. 7 and 8). The



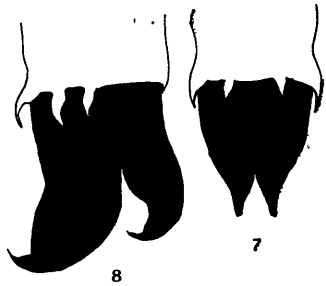


FIG. 6.—Respiratory appendage (greatly enlarged). *tr*, trachea; *sh*, sheath.
FIGS. 7, 8.—Terminal claws.

ventral pair are the smaller, and do not extend as far as the dorsal. Both the anterior and posterior appendages are dark brown.

The duration of the pupal stage is four days.

The emergence of the adult fly is a most beautiful sight to watch through the low powers of a microscope. The pupa-case splits anterio-

* In fig. 8 these claws have been drawn on the dorsal instead of the ventral side.

dorsally, and a second later the perfect fly is outside and standing upon it. The wings begin to expand with a kind of uncurling movement, gradually extending outwards and up till they are held straight above the abdomen, their upper surfaces turned inward and together; then with a sudden relaxing motion they fall to their natural position across and on either side of the dorsum. The whole operation of emerging and drying the wings takes less than a minute. The fly is rather a sluggish insect, but quick of flight, and is often to be met with indoors. It is, however, harmless to man and beast, and probably destroys a great amount of unhealthy and decaying matter.

Hab.—Wellington (Hudson), Wanganui (M. N. W.); probably to be found in most parts of New Zealand.

"*P. phalaenoides*, Christchurch (Hutton), Auckland (Suter); introduced from Europe."

No. 6. Syrphus ropalus Walk.

Syrphus ropalus Walker, Cat. Dipt. Brit. Mus., p. 593 (1849): Hutton, Cat. Dipt. N.Z., p. 44; Trans. N.Z. Inst, vol. 33, p. 41.

The family to which this fly belongs is a very common one—Syrphide, or hover-flies—and of great value from an economic point of view. As far as can be seen, nothing has been published concerning the habits and life-history of the present species. The egg stage is, unfortunately, still unknown, but may not differ very much from that of other flies of the same family, several of which are quite well known.

The larva is of a light-green colour, and attains a length of about $\frac{1}{2}$ in. when full grown, and is greatly attenuated towards the head; it is soft-skinned and moist; the skin transparent, displaying clearly the whole alimentary system. Specimens were invariably found in the narrow spaces between the outer leaves of the heart of the cabbage-tree (*Cordyline australis*). The larva dislikes the light, and, when exposed, quickly makes off into the dark crevices between the leaves. The mode of progression is the same as in all other arboreal larvae of this family. It is a mystery how the blind larva finds his way, and is able to hunt out his prey, which in the present cases consists of the larvae of a Lepidopteron (*Venusia verriculata*) which also breed in the cabbage-tree. The reader is referred to No. 3 of this series of contributions for full notes on the breeding of this moth (Trans. N.Z. Inst., vol. 47, p. 268). It seems hardly likely that the prey is captured fortuitously. When a caterpillar is discovered, the larva, with a lightning toss of the head, plunges his beak into its body. The caterpillar will not submit quietly to this, but writhes and twists and twirls its body about, and even frequently attempts to bite its antagonist, sometimes in this way forcing the maggot to beat a hasty retreat. It is wonderful to see the way in which the larva sticks to his prey in spite of all the heaving convulsions; this he manages by ejecting a quantity of sticky mucus which practically cements him to the caterpillar. In the meantime, while the prey is still living, the maggot is rooting luxuriously amid its entrails, till nothing but the empty skin remains. The larval stage exists some length of time, probably several months. They feed on the larvae of *Venusia verriculata*, but in captivity also took readily to the larvae of another moth, *Tortrix postvittana*, which also feed in the head of the cabbage-tree, curling the tips of the leaves.

The pupa is tear-shaped; the posterior end, bearing the two respiratory tubes, is much flattened and constricted. Anteriorly it is much swollen, well rounded, and corpulent.

The colour is light brown, with a broad conspicuous dark medio-dorsal stripe extending the whole length of the pupa. On the sides are several (about 4) very faint narrow lines, much broken and interrupted, running

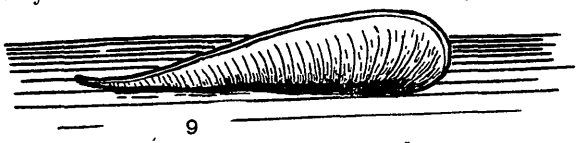


FIG. 9.—Pupa of *S. ropalus.*

parallel with the medio-dorsal. The integument is hard and roughened by numerous minute transverse rugae. Length of pupa, $\frac{11}{32}$ in.; breadth at posterior extremity, $\frac{1}{16}$ in.; at anterior end, $\frac{3}{32}$ in.

The pupa is to be found, as a rule, near the butts of the leaves, on the underside. The duration of this stage is about three weeks.

Hab.—Auckland (Dr. Sinclair); Kekerangu, 3,000 ft. (Hudson); Dunedin (Hutton); Wanganui, October (M. N. W.); Marlborough, December (D. M.)

No. 7. **Phytomyza albiceps** Mg. Plates II and III.

As far as it has been possible to ascertain, this little fly has not till now been recorded from New Zealand. It is necessary, therefore, that a detailed description be included in the present paper.

The adult fly (Plate III, fig 6) is small, black in ground-colour, but with a covering of minute silvery-grey pubescence. Length of imago, ♂, 1 mm.; wing, 1·25 mm. Length of imago, ♀, 1·5 mm.; wing, 2 mm.

Eyes reddish-brown, broadly dichoptic, with minute scattered silvery hairs; vertex and front broad and yellowish, this colour (absent on the darker frontal lunule) being due to the presence of a dense and minute pubescence. On the front are a pair of parallel longitudinal depressions, assuming in certain lights an orange colour. Ocellar triangle dark reddish brown, more or less circular, the ocelli shiny dark orange and well separated. A pair of strong parallel proclinate ocellar bristles, one on each side of the anterior ocellus (fig. 10, *ob*); a pair of strong reclinate divergent post-ocellar bristles (fig. 10, *pob*) placed more closely than ocellar pair. Inner and outer vertical bristles strong, the latter divergent (*o*), the former convergent (*i*). A row of strong shorter post-orbital bristles (fig. 11, *po*) extending to lower margin of head; 3 strong reclinate upper fronto-orbital bristles (fig. 10, *ufo*); a single strong convergent frontal bristle (fig. 10, *f*); a row of smaller orbital bristles (fig. 10, *or*). *Antennae* inserted

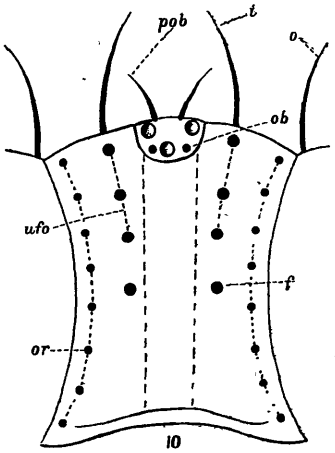
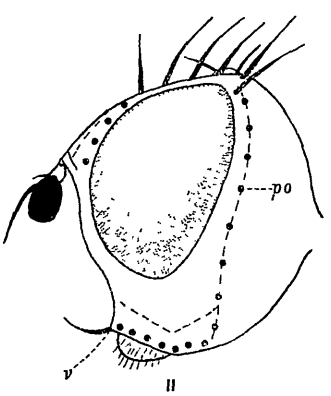


FIG. 10.—Dorsal portion of head of *P. albiceps*. *ob*, ocellar bristles; *pob*, post-ocellar bristles; *o*, outer vertical; *i*, inner vertical; *f*, frontal; *ufo*, upper fronto-orbital; *or*, orbital bristles.

at middle line of eye, three-jointed, slightly separated at the origin, not elongated, almost black, and covered with a short dense pubescence; 1st joint short; 2nd about half as long as 3rd, and bearing on the anterior margin a number of short bristle-like hairs, with a single strong bristle on upper anterior angle; 3rd joint orbicular in profile, but laterally flattened; arista dorsal, of moderate length, its 2nd joint short, the whole pubescent.

Face and cheeks yellow, the former depressed in front view but sinuated in profile (fig. 11); facial grooves extending well under the eye, are angulated before reaching the posterior orbital margin; vibrissae and vibrissal angles



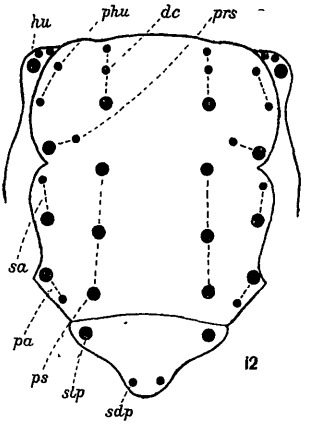


FIG. 11.—Lateral view of caput. *po*, post-orbital bristles; *v*, vibrissae and vibrissal angles.

FIG. 12.—Chaetotaxy. *hu*, humeral bristles; *phu*, post-humeral; *dc*, dorso-centrals; *prs*, pre-suturals; *sa*, supra-alars; *pa*, post-alars; *ps*, post-suturals; *slp*, scutellar lateral; *sap*, small apicals.

distinct (fig. 11, *v*); oral margin bristly, angulated, yellow, but darker in certain lights at the vibrissal angles, posterior orbits yellow, sinuated, broad, but narrower above; occiput rounded, piceous in certain lights. Proboscis withdrawn, yellow, and with a few yellowish hairs.

Thorax not elongate, black in ground-colour, with a minute grey pubescence; dorsum anteriorily humped in profile. Chaetotaxy (fig. 12): Dorso-centrals (*dc*) 3 in number, the 2 anterior small, the 3rd (towards the suture) large and distinct; a large humeral bristle (*hu*) and a few smaller ones; 2 small post-humerals (*phu*); 2 pre-suturals (*prs*), the outer large, the inner small; 3 large post-suturals (*ps*); 2 supra-alars (*sa*), the anterior small, the posterior large; 2 post-alars (*pa*), the anterior large, the posterior small. Scutellum with margin constricted, giving a sinuated and trilobed appearance; a large lateral bristle on anterior lobe near the suture (*slp*), and a pair of small apicals (*sap*). Four meso-pleural bristles, of which 2 smaller ones arise posteriorly along the dorso-pleural suture, a single large one at the upper posterior angle—that is, at the angle of the meso- and dorso-pleural sutures; just beneath this large one, on the meso-pleural suture, is situated the 4th smaller bristle; a single pro-pleural bristle; 3 small sterno-pleural bristles along the sterno-pleural suture, and a number of small ones upon the apex of this pleura.

Wings (fig. 13) moderately broad, colourless except for pale yellow at the articulation; when closed, extending considerably beyond the abdomen; costa (*c*) ending some distance from tip of wing; auxiliary vein (*aux*) indistinct, well separated from the 1st longitudinal vein, but evanescent distally;

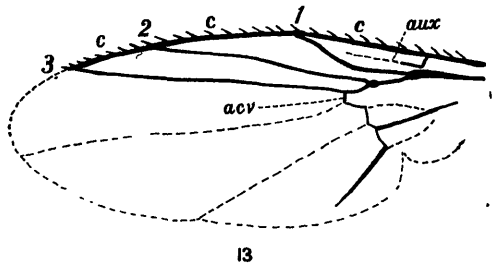


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FIG. 13.—Wing-venation, *P. albiceps*. 1, 1st longitudina l; 2, 2nd vein; 3, 3rd vein; *c*, costa; *aux*, auxiliary vein; *acv*, anterior cross-vein.

1st longitudinal (1) sinuated upward toward the costa; 2nd vein (2) only slightly sinuated; 3rd vein (3) uniting with the distal extremity of the costa; anterior cross-vein (*acv*) situated well before the middle of the wing and the end of the 1st longitudinal vein; posterior veins and basal cells indistinct. Halteres pale yellow.

Legs bristly, black with pale-yellow knees; femora comparatively thickened; tibiae shorter than the femora; tarsi considerably longer than either the femora or tibiae, the metatarsi being about one-third the length of the whole tarsal joint; 2nd tarsal joint about one-half the length of the metatarsus; claws small, pale yellow on proximal half, but black distally, the inner proximal angle of each protruding knob-like; pulvilli pale yellow, with a vestiture of delicate hairs; empodium a strong bristle; a small apical bristle on inner angle of middle tibiae; anterior femora with longer bristles on the lower side.

Abdomen about as long as the thorax, but not as broad, narrowing toward a rounded apex; black in ground-colour, but with a minute greyish pubescence. When ventrally examined the genital cavity is heart-shaped, the margin being beset with short bristles, from among which protrude the pale-yellow copulatory organs.

The female fly appears to deposit her ova on both surfaces of the leaves of the food plant. Close observations show that the upper side is almost invariably preferred, the majority of eggs being laid on the outer margin of the leaf. Having selected a suitable spot for oviposition, the fly lowers her ovipositor till it is at right angles to the surface of the leaf, having to stand on tip-toe for the purpose; with several downward jerks of the abdomen the ovipositor is thrust through the cuticle and pushed beneath its surface, pushing at first directly backwards and later laterally, in this way prizing up the cuticle so as to form a minute semicircular pocket in the leaf (Plate III, fig. 1). After a moment's rest the ovipositor is withdrawn, leaving a single egg within the pocket. Some little time after the cavity has been made the separated cuticle dries, and the whole becomes visible to the naked eye as a minute white spot on the leaf.

While engaged in laying, the fly is very sluggish, and can be closely observed with a magnifying-glass without taking to flight, and can even

be gently transferred from one leaf to another; it is, however, extremely rapid of flight. Almost invariably on the withdrawal of the ovipositor from the leaf the fly will immediaetly turn and eagerly lap the exuding sap. Whether this is merely to satisfy her own immediate wants or is in some way connected with the welfare of the egg is from data in hand a debatable point. Before continuing the process of laying, the ovipositor and body generally are subjected to a thorough cleansing; all extraneous matter is removed. The egg-laying capacity of any individual probably reaches about 200 ova.

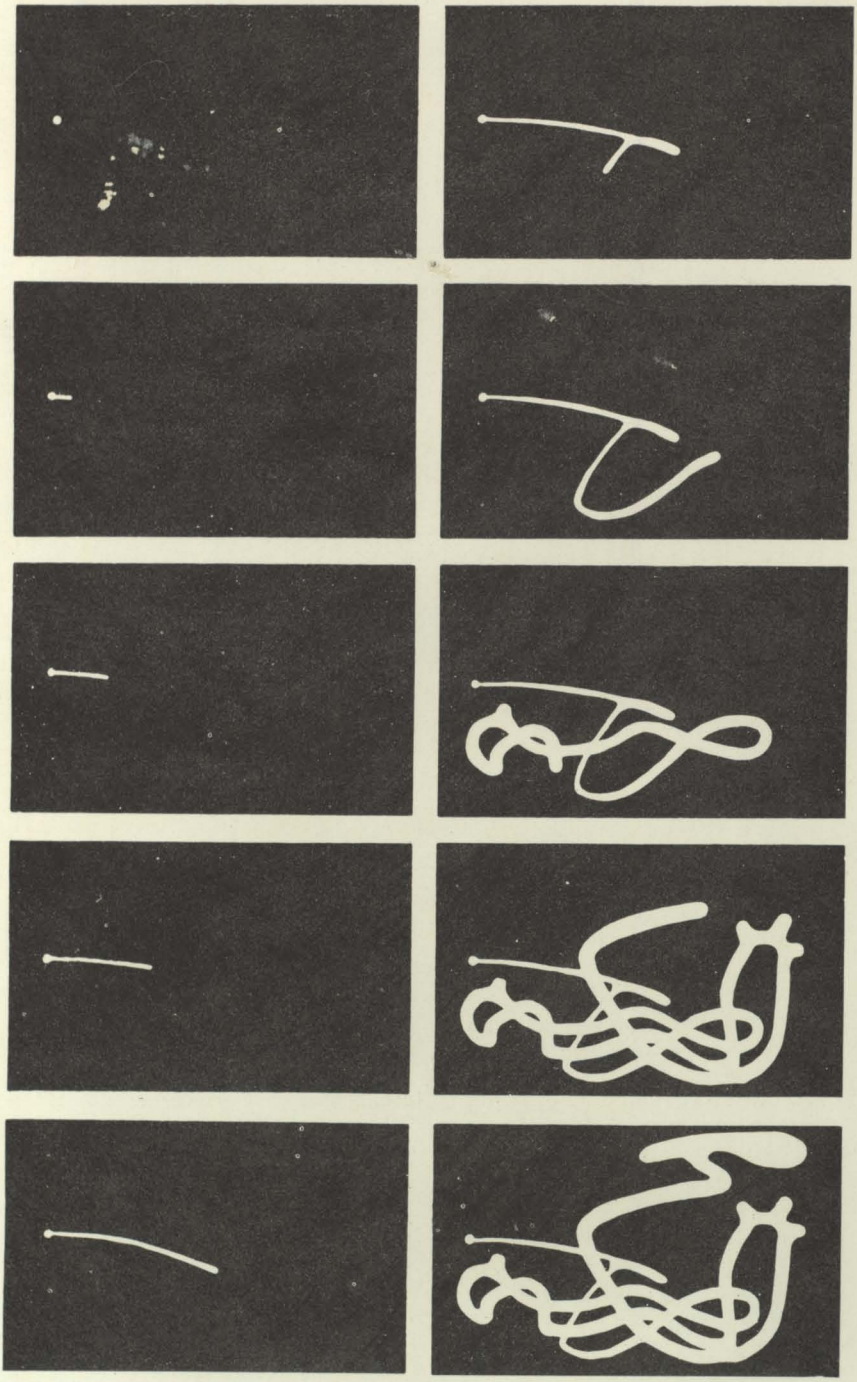
Often cavities that have been carefully probed will be left without an egg. This is hard to explain; probably at the moment the ovum was not ripe within the ovaries. Pockets might be begun in tough portions of the leaves, but in such places they are hardly ever completed, and no eggs are deposited in them. The time taken in probing a cavity and depositing the egg rarely exceeds a minute. During the proceedings the back legs are at times violently stamped upon the leaf. Occasionally leaves are found crowded with these pockets, but in such cases only a few of them will contain eggs.

The ovum is cylindrical, pearly-white, glossy, ends rounded; the shell is very delicate, and devoid of any kind of sculpturing The micropylar (?) end is slightly broader than its nadir. Length, 0·32 mm.; greatest diameter, 0·15 mm.

The larva (Plate III, fig. 2) hatches on the sixth day after the laying of the egg. It at once begins burrowing in the soft inner substance of the leaf, keeping close against the upper cuticle. Burrowing now goes on unceasingly for the next nine days. The mine often assumes fantastic forms, sometimes crossing and recrossing itself many times; as the larva grows, the mine, of course, gradually widens and becomes very conspicuous as a white figure upon the green leaf. A thin line of minute frass granules occupies the middle portion of the floor of all mines. During the last three days the larva pushes ahead with great rapidity, as a glance at Plate II will show. The following figures are from another mine that was kept under careful observation: Distance pierced by larva during the first day of its larval existence, $\frac{1}{8}$ in.; second day, $\frac{1}{4}$ in. in all; third day, $\frac{1}{2}$ in.; fourth, $\frac{3}{4}$ in.; fifth, $1\frac{1}{2}$ in.; sixth, 2 in.; seventh, 3 in , eighth, 5 in.; ninth, $7\frac{3}{4}$ in.—total length of mine.

The larva (Plate III, fig. 2) is a minute cylindrical grub, broadest near the head; white in colour, inclining to light green on account of the assimilated food within the intestines and the transparency of the skin. The head is to a certain extent retractile. The following measurements are from a full-grown larva: Length, 3·0 mm.; greatest breadth, 0·9 mm. Posteriorly there are two minute black respiratory processes; a second pair, situated anteriorly on the head, are slightly longer, and white.

The mouth-armature of the adult larva differs sufficiently, on account of the mode of feeding, from that of other dipterous larvae to warrant a detailed description. It consists of two horizontal plates connected by a slender cross-bar; these are the cephalo-pharyngeal apophyses. Each consists of three processes—an anterior (fig. 14, *a*), narrowing towards the great hooks; a posterior (*p*), broadening slightly towards the extremity; and a mid-lateral process (*ml*), which is spinular, and directed posteriorly. The two great hooks, placed side by side, present three processes—a large anterior curved sickle-like process, a like but smaller mid process, and a broad blunt triangular heel. The whole cephalo-pharynx is deeply



Egg-pocket and Track of Mine made by Larva.
PHYTOMYZA ALBICEPS.

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pigmented, black, excepting the mid-lateral processes, which are lighter in colour. The hooks are directly connected with the mouth, and are used horizontally to scoop the inner substance of the leaf. In all carnivorous larvae, on the other hand, the great hooks are utilized merely as a means of travelling, and are not in direct communication with the mouth.

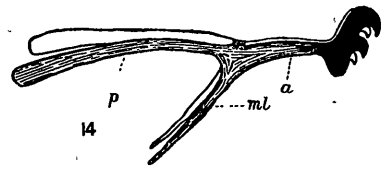

FIG. 14.—Mouth-armature of larva, *P. albiceps*. *a*, anterior process; *p*, posterior process; *ml*, mid-lateral process.

A day prior to pupating the larva forsakes the upper surface and commences burrowing against the lower cuticle of the leaf, scooping out a chamber for itself. The following observations are of interest: Out of a total of 659 mines observed, ninety-one larvae had hatched, mined, and pupated in the upper portion of the leaf, while no less than 521 had descended to the lower surface to pupate. Still more significant is the fact that thirty-six that had been laid on the under-surface had remained to pupate there, while six had come to the upper surface to mine but had descended to the lower cuticle to pupate. Five only hatched on the lower portion of the leaf and pupated on the upper. This clearly demonstrates the presence of some special sense in the larvae unknown to us.*

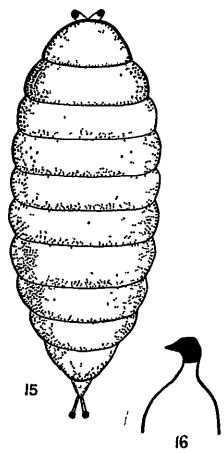

FIG. 15.—Pupa of *P. albiceps*.
FIG. 16.—Anterior process.

The pupa (fig. 15) is destitute of hairs or bristles; is dark-brown; not elongate and narrow, but moderately stout; composed of 10 segments, exclusive of the light-brown tubercles bearing the anterior and posterior appendages. In most healthy pupae the colour is light brown, with a darker medio-dorsal line. The hairs and limbs of the fly within can be clearly distinguished a few days before emergence. The dorsal surface is more or less flat, the ventral slightly convex, while the anterior end is rounded and the posterior pointed when viewed dorsally. Anteriorly the dorsal and ventral lines run about parallel—lateral view—but posteriorly the ventral line is distinctly upturned toward the posterior processess, which, unlike the anterior, arise toward the dorsal line. When the pupa is at rest beneath the lower leaf-

* Several experiments have been carried out since writing the above. Leaves of the food plant containing nearly full-grown larvae burrowing beneath the upper cuticle were placed the right and the wrong way up on damp blotting-paper in shallow glass petri dishes. When the leaves were kept exposed to the ordinary light of the room the larvae pupated in the lower portion of the leaf, whether that happened to be the natural under-surface or not. In complete darkness they, almost without exception, pupated on whatever surface they were burrowing at the commencement of the experiment, oblivious of the fact that the leaves were in many cases the wrong way up. One may safely say, then, that these larvae are influenced by light, and pupate in that portion of the leaf where they will get the most shade. How they are influenced by light remains to be seen.

membrane of the food plant the posterior processes (Plate III, fig. 5) are extruded through the cuticle of the leaf, while the anterior pair, situated as they are toward the ventral line, are embedded in the tissues of the leaf. When viewed laterally under the microscope an anterior process (fig. 16) is seen to consist of a dome-shaped body terminating in a black knob-like head, the lower margin of which is drawn out to a point. Immediately above the anterior process is a pair of contiguous lobes distinguished by a central fissure. Each posterior process consists of a light-brown stalk terminating in a rounded dark-brown head. The pupa, when at rest beneath the leaf-membrane, is easily seen with the unaided eye, but under the microscope presents a unique appearance, due to the cellular structure of the leaf (Plate III, fig. 3). A photograph of the exposed pupa is shown in Plate III, fig. 4. Length of pupa, 2 mm.

Two minute hymenopterous parasites attack this fly, and are very common. They belong to the *Chrysocharis* sp., but neither are as yet further identified. The larger of the two was seen ovipositing in a newly hatched larva of *P. albiceps*, the membrane of the leaf evidently being pierced in the process. Apparently the larva of this parasite lives in the larva and pupa of its host, for specimens were always obtained from infected pupae of the fly. One can tell at a glance whether a pupa is infected or not, since those containing parasites are black and opaque, and are a great contrast to the rich brown and semi-transparent pupae of healthy flies. It appears that not more than one Hymenopteron is reared from any one host.

The smaller of the two parasites has now several times been seen ovipositing in the pupae of *P. albiceps*, often walking over and completely ignoring living larvae. As such pupae were in each case observed infested with the larger parasite, it may be quite possible that this smaller species is in reality a true hyperparasite. A full account of the lives, habits, and life-histories of these two *Hymenoptera* will form the subject of some future contribution.

Food Plants of Phytomyza albiceps.

The common sowthistle (*Sonchus asper*) is the favourite food plant. Also found plentifully on *S. oleraceus*, and *S. arvensis*. Has been found burrowing in dahlia, dandelion (*Taraxacum officinale* var. *glabratus* (?)), large nettle (*Urtica ferox*), Cape-weed (*Cryptostemma calendulacea*), common groundsel (*Senecio vulgaris*).

Hab.—Wanganui, October to April (M. N. W.); Whakamarina, December (D. M.).

EXPLANATION OF PLATES.

Plate II.—*Phytomyza albiceps* Mg.

Showing egg-pocket and track of mine made by the larva during the nine days of its larval period. (Note the progress during the last three days.)

Plate III.—*Phytomyza albiceps* Mg.

Fig. 1. Egg-pocket in leaf. The egg is visible under the thin cuticle of the leaf. (Note the empty pocket above.) × 18.
Fig. 2. Larva, full-grown, uncovered. × 14.
Fig. 3. Pupa beneath cuticle of leaf. × 14.
Fig. 4. Pupa exposed (lateral view). × 14.
Fig. 5. Posterior respiratory processes of pupa pushed through the cuticle of the leaf. × 56.
Fig. 6. *Phytomyza albiceps*. Photographed from life. × 2.

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