

**Palpozenillia palpalis (Aldr.), a Tachinid Parasite of Sugar Cane
Moth Borers (Castnia and Diatraea)**

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The writer is much obliged to Dr. F. I. van Emden, of the Commonwealth Institute of Entomology, London, for determining as *Palpozenillia palpalis* (Aldrich) several examples of a tachinid parasite which has recently been bred from *Diatraea* larvae in Venezuela and Mexico. Because of its possible importance in the biological control of sugar cane moth borers in these and other countries, it seems desirable to place on record the available information concerning this insect. The drawings illustrating this paper are the work of the writer's colleague at Maracay, Signor Pietro Guagliumi.

History and Ecology

The parasite was discovered in March 1931 by J. G. Myers, who reared it in numbers from the giant larvae of *Castnia licoides* Boisduval boring in a musaceous plant, *Heliconia bihai* L., at Wanaima, North-west District, British Guiana, just south of the Orinoco delta. Some of the flies were sent to J. M. Aldrich, who pronounced the species new to science, and who described it in 1932 (Proc. U. S. Nat. Mus., 81, art. 9, no. 2932, p. 20) under the name *Zenillia palpalis*. In 1934, C. H. T. Townsend (Rev. Ent., Rio de Janeiro, 4, p. 404) created a new genus, *Palpozenillia* Townsend, to accommodate *Z. palpalis* Aldrich.

Myers at once recognized the importance of his discovery, since at that time a specific enemy of *Castnia* was an urgent *desideratum* for the sugar plantations of Trinidad, as well as those of the British Guiana coastlands, which suffered (and so far as Trinidad is concerned, continue to suffer) severe annual loss from the ravages of this giant borer. With very limited funds available, Myers in 1935 made a first attempt to introduce *P. palpalis* into Trinidad, where D. Vesey Fitzgerald cooperated in receiving the parasite and in making urgently needed studies on its biology. The information available to the present writer on this campaign is derived from unpublished reports kindly sent to him at the time by the late Dr. Myers.

During the period June 4 to July 30, 1935, five shipments, totalling 1,600 puparia and larvae, all reared from *Castnia*, were sent by Myers from his original collecting station. Transport was by canoe and river steamer to Georgetown and thence by air. These puparia subsequently yielded 839 flies (sexes about equal) in the laboratory in Trinidad. The difference represents flies that failed to emerge (150), larvae that failed to pupate (200), flies emerging *en route* and dying deformed in the con-

tainers (92), and puparia hyper-parasitized by three species of small Hymenoptera (312), one of which was determined provisionally as *Trichopria* sp. (Diapriidae).

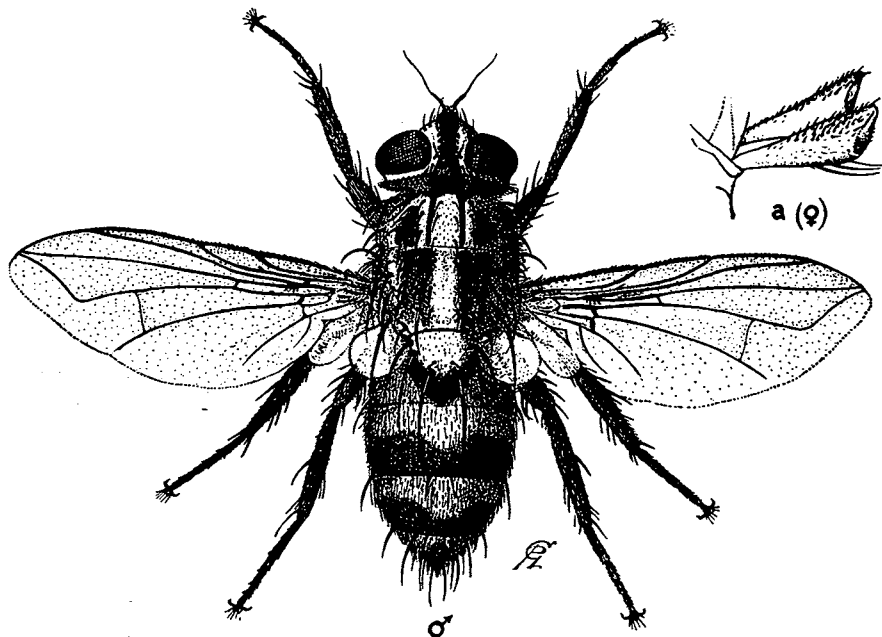


Fig. 1. *Palpozenillia palpalis* (Aldr.)

a, Palpi of female, highly magnified, showing position of sensory pits.

Due to various causes, largely administrative by nature, but also because of the difficulty inherent in attempting to multiply a parasite before the essentials of its life history were known, this first experiment at introducing *Palpozenillia* to civilization was not successful. Beyond the liberation of some of the flies originally imported and the tiny stock of those which had been reared at the cost of much effort in the laboratory, a total of 170 in all, into suitable areas of sugar cane and *Heliconia* heavily infested with *Castnia* larvae, no further attempt was made to exploit the possibilities of this exceedingly promising parasite. It would not be correct, however, to state that *Palpozenillia* was given a fair trial under Trinidad conditions and had failed, thereby conceding another scalp to those who collect and publish records of parasite failures. Nevertheless, during the brief life of the campaign several interesting facts concerning the biology of the parasite were elucidated, and these are incorporated below.

P. palpalis was rediscovered by the present writer in the sub-Andine region of Venezuela in April, 1948. When investigating an interesting new species of *Diatraea* (since described as *D. andina* Box) whose large larvae inhabit the mountain grass, *Pennisetum peruvianum* Nees, near

the village of Guarico, on the watershed of the rivers Guarico and Chabasquen (altitude 1250 meters), close to the boundary of Lara and Portuguesa States, puparia of an unknown tachinid were found in the borer tunnels, and later others developed from the borers collected. Flies were reared from them, and part of the series was determined by van Emden as *Zenillia palpalis* Aldr. Since then, the tachinid has been found on several other occasions in the same locality, which is evidently a permanent breeding ground for it.¹ During March and May, 1951, the average parasitism in larvae of *D. andina* was approximately 50 per cent by *Palpozennillia*, with an occasional example of parasitism by an undescribed *Agathis* (*Microdus*) sp. (Braconidae).

On March 15, 1949, one parasitized larva of *Diatraea canella* Hampson was collected in young sugar cane in a newly established farm in cleared forest at Guanare, Portuguesa State (altitude 180 meters); on March 28 it yielded nine puparia, from which flies emerged between April 8 and 11; they were identified by van Emden as *Z. palpalis*.

It was impossible not to recognize the potential value of a parasite so adaptable that it could maintain itself in the hot steamy jungle of the Orinoco delta, in larvae of *Castnia*, yet also in the cool highlands of sub-Andine Venezuela, in larvae of *Diatraea*, with indications that it might be utilizable for the biological control of two major pests of sugar cane, viz. *C. licoides* and *D. canella*. During 1951, therefore, some preliminary studies were undertaken in our laboratory at Maracay (altitude 450 meters), using material from Guarico, and our results are incorporated in the text below as well as in the figures illustrating this paper.

In October, 1950, L. C. Scaramuzza visited the sugar cane areas of western Mexico, and included in his itinerary a stop at Tepic, Nayarit State (altitude 900 meters), with the object of looking for a *Diatraea* parasite that had been reported from there by R. H. Van Zwaluwenburg in 1926 (Journ. Econ. Ent., 19, p. 667). This had been identified by Aldrich as "*Phorostoma* sp." from a specimen reared by T. E. Holloway from *Diatraea* in sugar cane at Tepic in 1923, and which is still preserved in the U. S. National Museum. The writer is grateful to Curtis W. Sabrosky for tracing this specimen at Washington, and for the information that he identifies it as the well known *Diatraea* parasite, *Paratheresia claripalpis* (Wulp) (originally described from Chilpancingo, Guerrero, Mexico)²; this specimen is labelled "*Phorostoma* n. sp." in Aldrich's ms. However, Scaramuzza's search at Tepic was by no means unsuccessful, for he not only found *Paratheresia* (which he recognized and noted as such) attacking *Diatraea*, but he also discovered another dipterous parasite there, which he naturally concluded (as did the present writer later) must obviously be the "*Phorostoma* sp." reported from that locality by Van Zwalu-

¹ Although *D. andina* has been found at several other places in western Venezuela (in Mérida and Táchira States), at altitudes from 1,150 to 1,850 meters, in stalks of *Pennisetum peruvianum* and *P. bambusiforme* (Fourn.) Hemsl. (Box 1951, Bull. Ent. Res., 42, p. 394), the only locality where the larvae have been found parasitized by *P. palpalis* is the one named above.

² Mr. Sabrosky communicates that the U. S. National Museum has another specimen of *P. claripalpis*, examined and labelled as "*Phorostoma* n. sp." by Aldrich; its provenience is "Colima, Mexico, Aug. 1923 (Van Zwaluwenburg)" and it is undoubtedly the basis of Van Zwaluwenburg's observation (*I.c.*), when he discusses the "*Phorostoma* sp.": ". . . and we have seen what is probably the same species farther south in the State of Colima."

wenburg. He very kindly sent two reared specimens to the writer, and these have been examined by van Emden and identified as *Palpozenillia palpalis* (Aldr.). When the present writer visited Tepic in March, 1951, residual (empty) puparia of *Paratheresia* were very common in old borer tunnels in almost every field of cane ready for harvest, and two puparia (one residual and one from which the adult fly had failed to emerge) of *Palpozenillia* (believed at the time to be "*Phorostoma* sp." and referred to as such in the writer's report³) were found in one dead-heart in a field of young ratoons which had recently suffered from frost damage. The host of the parasite in this region is *Diatraea considerata* Heinrich, the most widespread and injurious sugar cane borer in Nayarit and southern Sinaloa.

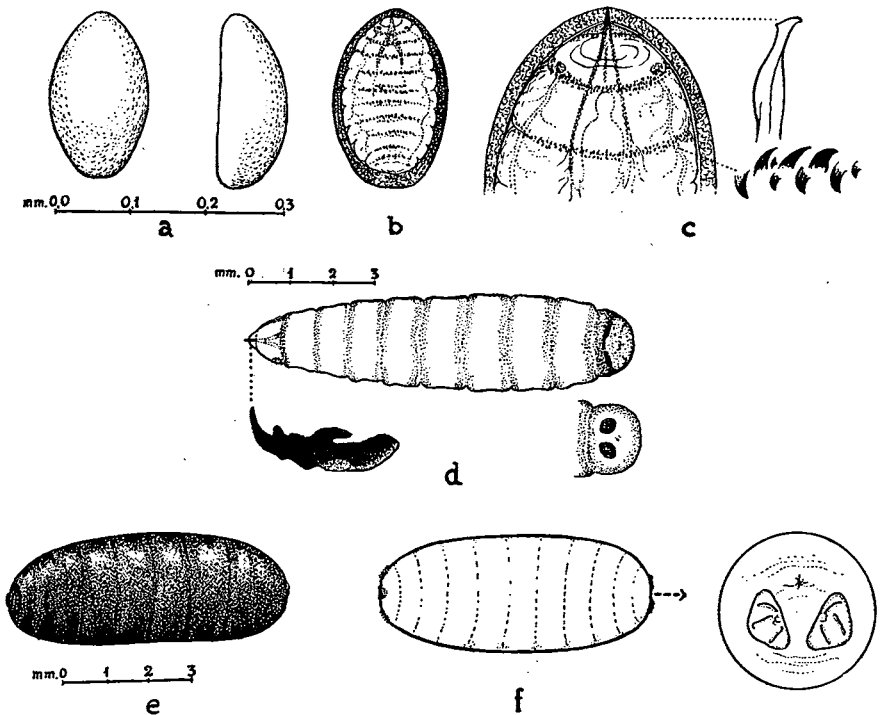


Fig. 2. *Palpozenillia palpalis* (Aldr.)

a, Egg; b, Egg at maturity, showing larva inside; c, Details (magnified) of embryonic larva; d, Mature larva; e, f, Puparium (at right: spiracular group, magnified).

Thus we have confirmation of the extraordinary adaptability of this tachinid and further evidence that climatic factors *per se* are not necessarily of such prime importance as has been supposed in determining the

³ Informe Preliminar sobre los Barrenadores o "Borers" de la Caña de Azúcar (*Diatraea, Chilo*) en México, a base de un Viaje de Reconocimiento efectuado durante marzo-abril, 1951, a las Regiones Cañeras: I—Sinaloa, II—Nayarit, y XIV—Huasteca; con observaciones complementarias. Unión Nacional de Productores de Azúcar, México, D. F., 92 pp., 1951.

establishment of a dipterous parasite⁴. It would indeed be difficult to imagine "general ecological conditions" more contrasting than those of the equatorial swamp-forest region of north-western British Guiana, and those of the parched xerophytic surroundings of Tepic, Mexico, where there may be sharp frosts during the winter months.

The foregoing records of *P. palpalis* may conveniently be summarized, as follows:

Locality	Host Insect	Food Plant of Host Insect
British Guiana: N.-W. District (near sea-level)	<i>Castnia licoides</i>	<i>Heliconia bihai</i>
Venezuela: Guanare, Portuguesa (180 m.)	<i>Diatraea canella</i>	Sugar Cane
Venezuela: sub-Andine region near Guarico, Lara-Portuguesa (1,250 m.)	<i>Diatraea andina</i>	<i>Pennisetum peruvianum</i>
Mexico: Tepic, Nayarit (900 m.)	<i>Diatraea considerata</i>	Sugar Cane

Description⁵ of the Tachinid and Notes on its Biology.

The adult fly (fig. 1) is bristly, with the typical tachinid appearance. Eyes dark reddish; front and sides of head with a bright bronze-golden sheen. Thorax and abdomen similarly bronze-golden, conspicuously marked with longitudinal stripes on the thorax and broad transverse bars on the abdomen. Legs black; wings transparent. Characteristic of the species—and whence both the generic and specific names are derived—is the "peculiar depression, or perhaps a sensory pit" (Aldrich) at the apex of the palpus in the female (fig. 1, a), apparently not found elsewhere in this group of Diptera. The flies vary much in size, depending on the number maturing in an individual host. Small specimens are 4.5 mm. long with wing expanse 9.5 mm.; the largest we have seen is 7.5 mm. long with wing expanse 15.5 mm.; normal specimens are about 5.5 mm. long with wing expanse 12.0 mm. These measurements are based on our series from *Diatraea* spp. in Venezuela and one of Scaramuzza's specimens from Mexico. Aldrich gives 8-9 mm. as the length of the type specimens (reared from *Castnia*).

The egg and post-embryonic larva are minute by comparison with those of *Lixophaga*, *Metagonistylum* and *Paratheresia*. The egg is ovoid, somewhat flattened on one side, and measures 0.22 mm. x 0.112 mm. Eggs laid in glass vials appear glistening pearly-whitish. Larvae dissected from mature eggs (in salt solution) are similarly ovoid; they are very slow of movement.

To obtain mated pairs of flies in captivity, rather large cages are best; those used in the Trinidad campaign were cylindrical, 1.85 m. high x 1.0 m. diameter; a dark green mosquito net proved the most suitable covering. Inside the cage is placed a quantity of cane (or parts of *Heliconia* plants) infested with *Diatraea* (or *Castnia*) larvae. The cages need to be kept constantly humid. The flies feed avidly on sweetened water or freshly expressed cane juice. Mating occurs during early morning hours. The fly is oviparous, but we have not actually observed the act of oviposition; Fitzgerald noted that eggs were laid in the "frass" excreted by the host larva outside its tunnel. The minimum gestation period was calculated to be 10 days, with a possible maximum of 14 days, at Maracay. Eggs

⁴ As was stressed by the writer in a paper, "Some Considerations upon the Dipterous Parasites of the Sugar-cane Moth Borer, *Diatraea saccharalis* (Fabr.)", read at the 23rd Annual Conference of the *Asociación de Técnicos de Cuba*, Habana, November 1949 (see *Proceedings*, pp. 17-27).

⁵ The descriptive notes are intended as a general aid for the field worker and not as a technical description of the insect.

dissected from gravid females and kept in a suitable atmosphere (or floating in salt solution) remain alive for more than two weeks without hatching. Fitzgerald noted how extraordinarily slow is the development of the parasite larva in *Castnia*, and that it may remain in its first instar within the host for as long as 20 days; in one experiment, 72 days elapsed between the date of oviposition and the emergence of adult flies. In Venezuela, using *D. canella*, conditions were more normal, and in one instance where the life-cycle was completed in a cage experiment, flies (two) emerged 25 days after the host larvae had been exposed to attack; in this case the duration of the pupal period is known to have been 12 days. In Trinidad, the pupal period was estimated to be 20 days; in Venezuela, 21 days was the period noted for field-collected parasites from *D. andina*.

A fertile female usually contains from 600 to 800 eggs in the ovisac. In the field, 40 flies were reared by Myers from one individual *Castnia*, and in the laboratory the maximum number reared from one *Castnia* larva was 52. In Venezuela, 9 parasites emerged from one larva of *D. canella* collected from sugar cane, while 13 have been reared from one larva of *D. andina* in *Pennisetum*. The writer is informed that as many as 15 parasites have been bred from a single larva of *D. considerata* from sugar cane in Mexico.