

THE PARASITES OF TSETSE FLIES IN ZULULAND WITH SPECIAL  
REFERENCE TO THE INFLUENCE OF THE HOSTS UPON THEM.

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Our present knowledge of the parasites which infest the puparia of *Glossina* species, is still incomplete despite the enormous amount of research work conducted on the tsetse fly problem in Africa. Very little is known of the types of parasitic insects attacking tsetse in Zululand, the most southerly and somewhat isolated haunt of this genus.

The three tsetse species inhabiting the area concerned, are *Glossina pallidipes* Aust., *G. brevipalpis* Newst. and *G. austeni* Newst. During the course of the tsetse fly eradication campaign a systematic pupal survey, covering the fly belt of Northern Zululand, was commenced in 1947 in order to establish the extent of the breeding grounds, as well as to indicate the influence of the synthetic insecticides applied on the breeding activity of the Glossinae. The mass of tsetse pupae collected during this operation, was retained for further studies with the object of determining the hatching rate of flies and parasites. Most of the parasites found in the different host species represent new records for Zululand. Furthermore, a new parasitic Bombylid, very common in the tsetse region and apparently more or less confined to that part of the African continent, was discovered.

All the parasites recorded together with their hosts are given in the following table:—

Parasite.	Host.	Authority.
Diptera—		
<i>Bombyllidae</i> —		
1. <i>Thyridanthrax brevifacies</i> Hesse.....	<i>G. brevipalpis</i> <i>G. pallidipes</i>	New record. New record.
2. <i>Thyridanthrax abruptus</i> Loew.....	<i>G. austeni</i> <i>G. brevipalpis</i> <i>G. pallidipes</i>	New record. New record. Harris.
Hymenoptera—		
<i>Mutillidae</i> —		
3. <i>Mutilla auxiliaris</i> Turner.....	<i>G. brevipalpis</i> <i>G. pallidipes</i> <i>G. austeni</i>	New record. Harris. New record.
<i>Eulophidae</i> —		
4. <i>Syntomosphyrum glossinae</i> Waterst.....	<i>G. brevipalpis</i> <i>G. pallidipes</i>	New record. Harris.
<i>Diapriidae</i> —		
5. <i>Trichopria capensis robustior</i> Silv.....	<i>G. brevipalpis</i> <i>G. pallidipes</i>	New record. Harris.

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1. *Thyridanthrax brevifacies* Hesse (in press) is the name given to the recently described parasite discovered during the course of the campaign as parasitising *G. brevipalpis*, *pallidipes* and *austeni*. The adults of this species do not show any sexual dimorphism, the base of their wings being infuscated in both sexes. This Bombyliid is very abundant and comprises more than half of all parasites hatched from *G. brevipalpis* and *pallidipes*. Its frequency in these two hosts supports the assumption that the parasite is endemic in Natal, the more so as the dispersion areas of the two flies mainly attacked in Zululand are separated by 70 and 300 miles respectively from their nearest habitats in Portuguese East Africa. Furthermore the parasite appears to make very little use of the more continuously distributed *G. austeni*. It can be stated from the data compiled that *T. brevifacies* shows a certain degree of dependence on *Glossina* pupae, and therefore, very seldom seems to parasitise the puparia of other Diptera. The incidence of this species depends directly on the density of its two main hosts, as it disappeared long before the tsetse flies were eliminated in all heavily infested areas treated successfully with insecticidal smoke. The parasite has not reappeared again in those localities, nor has it invaded them from the untreated neighbouring valleys soon after smoking operations were discontinued, as was the case with many other muscoid flies which have persisted. Recently, however, *T. brevifacies* was reared from *G. austeni* pupae collected in the untreated False Bay bush.

*Habitats:* Umfolozi and Hluhluwe Reserve, West of False Bay. (The types are in the South African Museum, Cape Town).

2. *Thyridanthrax abruptus* Loew (1860). The types of this species were captured in "Kaffraria", the hinterland of East London in the Eastern Cape Province. Tsetse flies have never been recorded from this part of the Union, which is approximately 350 miles away from the nearest fly belt in Zululand. *T. abruptus* occupies a considerable portion of South Africa outside the tsetse fly-infested area but is comparatively rare and depends solely on other dipterous pupae. For the rest the parasite is distributed over the eastern part of the African continent and has been recorded in all countries from Eritrea down to Southern Rhodesia where it became known firstly as a parasite of *G. morsitans* Westw. It does not occur in the South African tsetse species as frequently as does *T. brevifacies*, and has not yet been recorded from *G. austeni*.

Experience indicates that this parasite seems to be by no means as closely dependent on the *Glossinae* as is the previous species. *T. abruptus* was found breeding in *G. brevipalpis* for the first time.

*Habitats:* Umfolozi and Hluhluwe Reserves.

Harris (1930) reported the occasional occurrence of bombyliid parasites in *pallidipes* pupae. These were determined as *T. lineus* Loew and *T. transiens* Bezz. Hesse was able to prove that *T. lineus* is nothing more than the male of *T. abruptus* and, therefore, a synonym of this species, which shows a marked sexual dimorphism, the bases of the wings being infuscated in the female and more or less transparent in the male. *T. transiens*, on the other hand, could not be traced throughout the entire survey, and the conclusion appears to be justified that the odd specimens recorded by Harris were wrongly identified.

3. *Mutilla auxiliaris* Turner (1919), was described as parasitising the puparia of *G. morsitans* in Portuguese East Africa. Harris recorded this species from *G. pallidipes* in Zululand, but states at the same time that the pupa of the tsetse is apparently not the normally favoured host. *M. auxiliaris* has been recorded recently for the first time as hatching from puparia of *G. brevipalpis* as well as

from *G. austeni* collected in the field. It appears from those records that the parasite may be distributed uninterruptedly throughout Portuguese East Africa and Zululand. Its occurrence in the *morsitans-pallidipes* belt north of the Save River in Portuguese East Africa and in the *pallidipes-brevipalpis* area of Zululand, is obviously connected with the *brevipalpis-austeni* bridge along the rivers Maputo and Pongolo. This species proved to be fairly common in Zululand.

*Habitats:* Umfolozi and Hluhluwe Reserves, Lower Mkuzi River.

The second species of this genus, *M. benefactrix* Turner, recorded from *G. pallidipes* by Harris, could not again be detected in any part of Zululand.

4. *Syntomosphyruun glossinae* Waterst. (1915) has the widest distribution of all species under discussion. Originally found and described from *G. palpalis* pupae in Uganda, it has been recorded from *G. morsitans* in Tanganyika, Nyasaland and Northern Rhodesia, and Nash (1947), bred this parasite from *G. palpalis* in Nigeria. This species makes frequent use of the puparia of *Musca*, *Chrysomyia*, *Dacus*, *Sarcophaga* and other muscoid species, as reported by various authors. As this parasite is able to attack many hosts, the number of tsetse fly pupae infested by it is always very low. *S. glossinae* was recorded for the first time from Zululand by Harris as infesting *pallidipes* pupae, and has been bred from *G. brevipalpis* during the course of the Nagana Campaign.

*Habitats:* Umfolozi and Hluhluwe Reserves.

5. *Trichopria capensis* Kieffer var. *robustior* Silv. (1913). The nominate form of this species was originally described from *Ceratitis capitata* Wied. in South Africa and the variation *robustior* was reared from a *pallidipes* pupa by Harris. This parasite has now been obtained from *G. brevipalpis* in addition, but is too rare to play any rôle in the control of tsetse. The variety *robustior* seems to be confined to Zululand and the record of Lewis (1939) of its occurrence in *G. brevipalpis* and *G. fuscipleuris* Aust. in Kenya, proved to be a different and new species, later named as *T. lewisi*, Nixon (1940).

*Habitats:* Hluhluwe Reserve, Empangeni.

It became apparent during the course of the investigations that the larger types of tsetse fly parasites showed a considerable variation in size corresponding with the size of the puparium of the host species. The measurements of the tsetse fly puparia are indicated in the following table:—

Puparium of.	AVERAGE LENGTH.		AVERAGE VOLUME.	
	In mm.	As per cent.	In cub. mm.	As per cent.
<i>G. brevipalpis</i> .....	7.5	100	95	100
<i>G. pallidipes</i> .....	6.2	80	60	63
<i>G. austeni</i> .....	5.5	73	25	26

Whereas comparatively little difference exists between the lengths of the pupae of the three *Glossina* species, their volumes, however, differ considerably and show a proportion of 1 to  $\frac{3}{5}$  to  $\frac{1}{4}$ . The rapid decrease in volume of the *G. austeni* is due to the more slender structure of their pupae.

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The adults of the two *Thyridanthrax* species hatching from different tsetse puparia show the following difference in size:—

Host species.	Average length of <i>Thyridanthrax</i> sp.	
	In mm.	As per cent.
<i>G. brevipalpis</i> .....	8·0	100
<i>G. pallidipes</i> .....	6·7	84
<i>G. austeni</i> .....	4·8	60

The body lengths of the resulting parasites reveal more or less the same proportions as those seen in the puparia of the host. The slenderness of the pupae of *G. austeni* even further accentuates the diminutive size of the parasite.

A certain dependence upon the size of the host puparium can also be noticed in the adults of *Mutilla auxiliaris*, the largest of the hymenopterous parasites.

Host species.	Average length of <i>Mutilla auxiliaris</i> .	
	In mm.	As per cent.
<i>G. brevipalpis</i> .....	6·5	100
<i>G. pallidipes</i> .....	6·5	100
<i>G. austeni</i> .....	4·5	70

The *Mutilla* specimens emerging from *G. brevipalpis* and *G. pallidipes* are always of the same size, whereas the imagines from *austeni* pupae attain less than three-quarters of the normal length.

No difference in size amongst the small Hymenoptera (*Eulophidae* and *Diapriidae*) breeding in different tsetse species could be observed.

It is interesting to note that the various species of tsetse flies exert this influence on the larger species of their pupal parasites. This phenomenon manifests itself as a direct correlation between the size of the host puparium and the length of the resulting parasite. In this way *Thyridanthrax* specimens reach their largest size only in *brevipalpis* pupae and are not able to attain their potential length in the puparia of *pallidipes*, whereas real midguts hatch from *austeni* pupae (Figure I). The fact that *Thyridanthrax* is able to complete its development successfully in a puparium which only represents a quarter of that of the largest tsetse species available, reveals a remarkable degree of adaptability. Furthermore, it is not known yet whether the measured volumes of the three tsetse puparia represent the upper and lower limits of its potential growth.

With the smaller Hymenopteron *Mutilla*, however, the *pallidipes* pupae are still large enough to produce full-sized parasites, their body size only decreasing in the considerably smaller *austeni*.

As was proved by Lewis (1939) in East Africa, the gravid females of the small hymenopterous *Trichopria lewisi* exhibit a marked preference for the larger-sized tsetse pupae. In fact, the puparia of smaller species are hardly considered in the presence of larger ones. Experiments to confirm these results were not conducted in Zululand, but the parasitic indices of the three tsetse species collected in the field, show a pronounced preference in favour of the

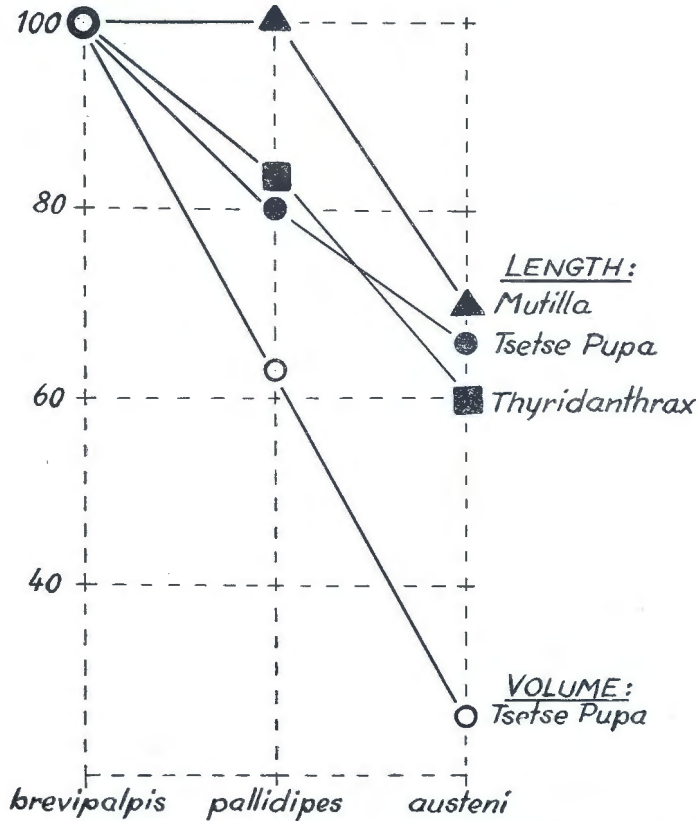


FIGURE 1.—Relative sizes of parasites in proportion to the length and volume of the host puparium expressed as percentages.

larger host puparia. This applies to the larger-sized parasites, at any rate, and the proportion of *Thyridanthrax* incidence in *brevipalpis*, *pallidipes* and *austeni* was found to be 50 to 25 to 1. The same decrease in the extent of parasitism exists in *austeni* for *Mutilla auxiliaris*, whereas the puparia of *brevipalpis* and *pallidipes* which are large enough to assure full-sized growth, are parasitised at equal rates.

If it could be proved that these findings have general validity, it would mean that the parasites would exert a noticeable controlling influence on the larger types of tsetse flies only and that their influence on the small *Glossina* species

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(e.g. *austeni*, *swynnertoni* Aust. and *newsteadi* Aust.) would be more or less negligible. Unfortunately this rather important question can be studied no longer in Zululand, as the density of tsetse and parasites has dropped to such an extent as to render further biological experiments impossible.

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