Auch im Habitus und daher in der Gestaltung der Rumpfringe macht sich die isolierte Stellung der Diplomaragnidae einerseits und die nähere Verwandtschaft der beiden übrigen Familien anderseits bemerklich. Die letzteren ähneln einander ebenfalls mehr im Bau der Beine und Antennen, während diese Gliedmaßen abermals bei den Diplomaragnidae schon infolge ihrer Länge abweichender gebildet sind.

Es ist bemerkenswert, daß gerade die isolierten Diplomaragnidae nur aus Ostasien bekannt sind, während die Conotylidae die östliche und westliche Halbkugel gemeinsam bewohnen, die Brachychaeteumidae aber die äußersten westlichen und östlichen Gebiete von Eurasien. Die starke Eigenart der Diplopoden-Faunen wird durch die vorbeschriebenen japanischen Ascospermophoren insofern wieder bestätigt, als von den drei Familien nur eine in unserm an Ascospermophoren so reichen Europa vertreten ist, aber selbst bei dieser einen Familie für Japan eine sehr abweichende Unterfamilie vorliegt.

4. On "Crithidia" fasciculata in hibernating mosquitoes (Culex pipiens) and the question of the connection of this parasite with a Trypanosome.

By H. M. Woodcock, D. Sc., Lister Institute of Preventive Medicine, London.

(With 41 figures.)

eingeg. 23. Oktober 1913.

In the course of my work on the blood parasites of birds and the manner of their transmission, I have been able, recently, to give some attention to the above subject. Towards the end of September, 1912, Mr. Bacot, the Entomologist at the Lister Institute, brought me some female individuals of *Culex pipiens* from the cellar of his house; the Insects had entered upon their period of hibernation in the cellar, which is dark and relatively humid. No male individuals occurred in this situation. I take this opportunity of thanking Mr. Bacot warmly for his kind assistance in supplying me with both adult Insects and larvae on numerous occasions, and for his helpful advice and suggestions.

On examining one of these females, I was greatly surprised to find the intestine crammed with Flagellates, the great majority of which were undoubtedly the much-discussed "*Crithidia*" *fasciculata*, of Léger. I examined more of the *Culex* to see whether the infection was common, and found that nearly half (i. e. 4 out of 9) were infected. So far as I know, this is the first occasion on which the occurrence of Flagellates in hibernating *Culex* has been noted since the publication of Schaudinn's celebrated work. The only reference bearing on the subject of

which I am aware is a brief mention by Léger and Duboscq[1] of the presence of Crithidiae in a hibernating *Anopheles*. The earliest notice of Flagellates in *Culex* is the graphic description of Ronald Ross[2], with which the general condition of the parasites and their behaviour under observation, in the present case, agree very well, leaving aside for the moment the question of the exact nature of the forms seen by Ross. The vast majority of the Flagellates were in the resting, attached phase; they formed a carpet along the surface of the wall of the intestine, with their flagellar ends in contact with this, and also constituted large "free" rosettes, blocking the lumen to a very considerable extent, and sometimes causing distension of the wall. In one or two mosquitoes, the digestive tracts of which were immediately looked at whole, without having been ruptured at all, a few free, actively moving Flagellates were seen, about the pyloric region of the stomach. Nearly all the resting forms had the typical appearance of a barley grain, as it was first characterized by Léger[3]. In most, a very short free flagellum was present, little more than a spike-like projection (figs. 4, 18), but some individuals had practically no free flagellum. In such, however, the attached, or body-portion of the flagellum was always present, and is clearly seen in the stained preparations (figs. 1—3).

A remarkable feature of the parasites which was noticed by Ross but the significance of which has not been pointed out by more recent workers, is their behaviour when brought into contact with water. As soon as the infected part of the digestive tract was teased up, either in ordinary water or in salt-solution, and the liquid had access to the Flagellates, these became active; many of them broke away immediately from the cluster of which they formed part and swam about vigorously, others following suit after a short interval. This resumption of the active condition took place in nearly all the individuals which came into contact with the water, only a small proportion of those hemmed in, as it were, in the middle of a large clump remaining motionless. In the great majority, the flagellum must have developed almost at once to its full length. This process appeared to take place just as much in the parasites situated in the rectal part of the digestive tract as in those in other parts of the intestine, numbers of active individuals swimming out of the cut, anal end of the rectum, behind the glands. No encysted forms were observed in the living preparations studied (but cf. below).

While most of the active parasites were fairly short, a few elongated, more herpetomonad-like ones were seen. In neither form, however,

[1] C. R. Ass. franc. avanc. sci., 31. 1902. p. 703.
[2] Vide his resumé in J. Hyg. 6. 1906. p. 101.
[3] C. R. soc. biol. 54. 1902. p. 354.

could anything like an undulating membrane be made out; nor did the movement of the parasites suggest the presence of one, the body being held rigid and progression being in a straight or slightly zig-zag course, produced entirely by the vibrations of the flagellum.

In the stained preparations, the shape of the body and the general morphology of the short forms agree entirely with the original descrip-

Fig. 1—6.

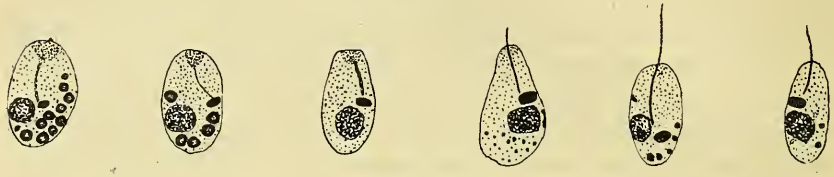

Fig. 7—12.

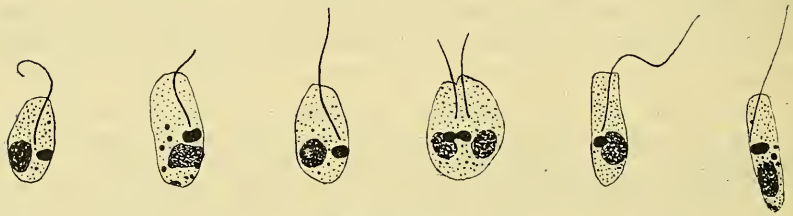

Fig. 13—17.

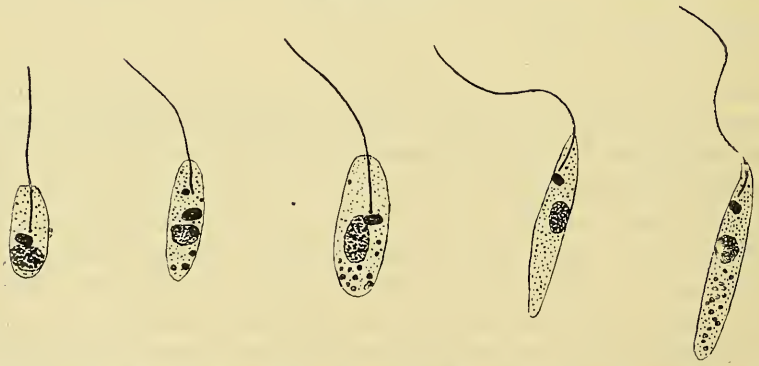

Fig. A. (All figs. are magnified about 2500 times linear.) All the parasites are from mosquitoes at the commencement of the hibernating period (autumn). 1—3, typical resting forms; 4, individual with very short spike-like flagellum; 5—14, active individuals with the typical truncated or oval shape (grain d'orge); 10, a parasite undergoing division; 15, rather larger, stouter form; 16 and 17, herpetomonad (semi-herpetomonad) forms. Note the conspicuous granules in many of the parasites.

tion of Léger, and with the account and microphotographs of this parasite given subsequently by Novy, Mc-Neal and Torrey[4]. The

[4] J. infect. diseases, vol. 4. 1907. p. 223, many pls.

two nuclei are usually very close together, situated often in the posterior half of the body; the kinetonucleus is generally alongside of (opposite to) the trophonucleus, but it may be slightly in front of, or even behind the latter (cf. figs. 5, 18, 21, 23). As a result of this, the attached

Fig. 18—22.

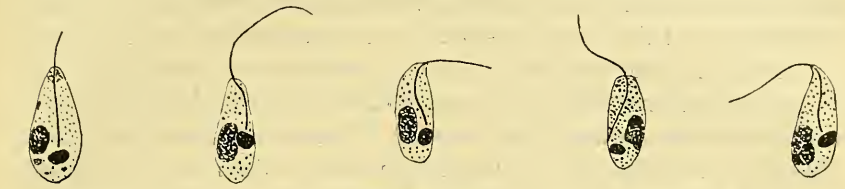

Fig. 23—28.

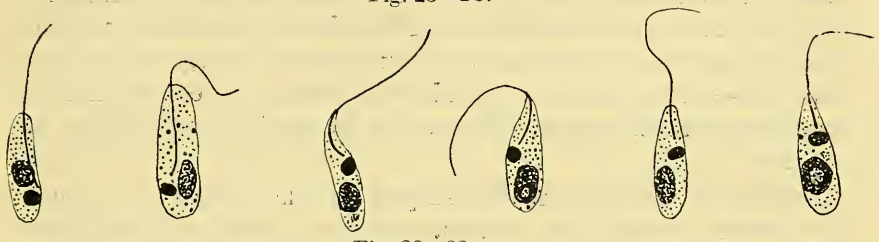

Fig. 29—33.

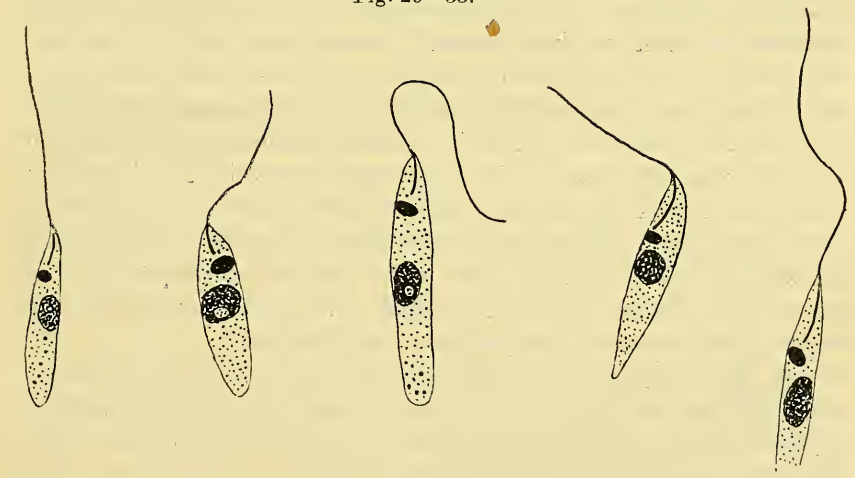

Fig. B. (All figs. are magnified about 2500 times linear.) All the parasites are from mosquitoes after hibernation (in spring). 18, form with short, spike-like flagellum; 19—26, typical "crithidial" individuals; 27 and 28, transitional forms between the last and, 29—33, herpetomonad or semi-herpetomonad parasites. Note the general absence of conspicuous grains in the cytoplasm.

portion of the flagellum is frequently of considerable length; even in such cases, however, it appears to be closely attached to the side of the body and I cannot note any indication of a membrane. In some indivi-

duals, the anterior end of the body, instead of being abruptly truncated (figs. 9—13, 21), at its anterior end, tapers gradually, being drawn out, as it were, along with the flagellum (figs. 25, 26, 28); one can hardly call this, however, a rudimentary membrane. In the longer individuals, the tendency is to a more herpetomonad condition; the kinetonucleus is always well in front of the trophonucleus and may sometimes be near the anterior end (figs. 16, 17, 29—31), the trophonucleus remaining, however, near the middle of the body. The anterior end usually thins out along the flagellum and in this respect differs from the blunt extremity characteristic of a typical *Herpetomonas*. These forms recall, I may note, certain cultural phases of an Avian Trypanosome which I have described[5], though I do not wish to lay any stress upon the point. Although I have not found these elongated forms in all the preparations made of infected parasites, I think there can be no doubt that they belong in the same life-cycle as the short "crithidial" forms. A regular series of transitional phases between the two can be readily found (cf. figs. 14, 27—29).

Many of the fixed and stained parasites shew a cytological peculiarity which probably stands in some relation to the rapid development of the free flagellum. In individuals caught in the resting phase, which have no free flagellum, there is usually a conspicuous pink-staining area or patch at the anterior end of the body (figs. 1—3); this does not appear to me to be a vacuole. The attached, or body-portion of the flagellum, which is always well-defined in resting (non-encysted) forms, runs from the neighbourhood of the kinetonucleus to this area, in which it seems to merge. The same pink-staining substance is frequently present also in individuals which have a short, spike-like flagellum, but its area is much less (cf. figs. 5, 18). In the forms with fully developed flagellum there is rarely any sign of it. Apparently, this area represents the substance of the retracted, free portion of the flagellum.

In the preparations made in the autumn, many of the parasites, both short and elongated forms, contain numerous large, deeply staining granules, situated chiefly in the posterior region of the cytoplasm. These probably represent reserve food-material.

I will mention here that in one of the preparations made of the four infected digestive tracts in the autumn, a few cysts have been found after much searching, but these will be more suitably described after considering the infection in the mosquitoes in the subsequent spring, when the cysts were first observed.

With a view to seeing whether the Flagellates would persist alive

---

[5] Vide Quart. J. Micr. Sci. vol. 55. 1910. pl. 30, figs. 140, 141.

and in the same condition in the infected mosquitoes throughout the winter, I refrained from examining more in the autumn, but endeavoured to keep a number alive, which Mr. Bacot brought me. The mosquitoes were placed, some in small cardboard boxes, and the rest in stiff paper rolls, loosely plugged at both ends with cotton-wool. Both lots were covered over with fine sand, to retain dampness. Some of both lots were placed in a fairly damp spot in a cool greenhouse, others were kept in a room, cold but comparatively dry. Half-a-dozen or so of the mosquitoes were left to their own devices in an ordinary mosquito cage in the same room. These last were observed at intervals during the course of a month, remaining motionless during this time. At the end of October one of them was examined and just the same condition of affairs was found, the parasites being abundant. All were then left undisturbed over the winter, and at the end of March I looked to see how they had fared. Three were found still alive in the cage, but unfortunately not one of the others, specially cared for, remained alive. They had all been destroyed by a blue mould. This was entirely unexpected, both by Mr. Bacot and myself. It was certainly neither the effect of temperature nor of the degree of humidity, for, as just noted, some were still alive in my (relatively) dry room and Mr. Bacot found also some still in his (relatively) very damp cellar, although here, too, the mortality had been very high. In the case of those I kept, it was probably the confining of the air, even to the extent caused by the loose cotton-wool, which had sufficed to kill them.

In one of the three which remained alive in my cage and in about 40 % of those examined which Mr. Bacot was again able to obtain from his cellar in the spring, the parasites were present, and broadly speaking, in the same condition as they were in at the beginning of the hibernation, both as regards numbers, form and behaviour. One point of difference, which is well seen in the permanent preparations, is that the parasites now lack the large conspicuous granules which occur in many in the autumn preparations. At the most, a few fine granules are observable in some individuals (figs. 24, 29). For this reason, it is probable that the large granules represent reserve food material which has been used up by the parasites during the winter. During the whole of this period, of course, the intestine of the mosquito is empty.

The most surprising feature about the parasites is that after this long quiescent period, they practically all become just as active when the alimentary canal is broken up, as those did which were present in the females examined in the autumn. I did not at this time see any cysts in the living examinations, any more than I did in the autumn. When I found that the parasites, although motionless, were merely in the same

resting condition and swarmed out actively from any part of the ruptured intestine or rectum just as before, on the liquid reaching them, I did not expect to find any encysted forms. It was naturally to be expected that, if the Flagellates were going to encyst, the great majority would be encysted after that lapse of time, especially in the hinder part of the digestive tract. As a matter of fact, however, in studying the permanent preparations made in the spring, of these infected digestive tracts, with a view to making drawings for this paper, I have recently come across a few encysted forms from one gut, as well as a certain number of parasites commencing to encyst. Nevertheless, in view of the enormous number of individuals actually present, the encystment is taking place to a surprisingly small extent, and it is no wonder that the few cysts were not observed in life. Moreover, in two other cases, preparations have been thoroughly searched with out a single cyst being found. On the other hand, in one of the 4 infected digestive tracts preserved in the autumn, renewed search has shewn the presence also of a few cysts. The important point therefore, is that both at the end of the period of hibernation, as at the commencement, the vast majority of the parasites are unencysted.

The cysts of "*Crithidia*" *fasciculata*, which are described here for the first time, so far as I am aware, are very similar to those of other Flagellates occurring in Insects, which are already known. They are oval or slightly pear-shaped (figs. 37, 39), in the latter case, the hinder end of the body forms the broader end of the pear. They vary somewhat in size, being usually rather larger than the small truncated, "crithidial" parasites, and are apparently formed by intermediate-sized individuals (cf. figs. 4, 15), or by semi-herpetomonad forms (fig. 30). The cyst-wall is fairly thick, especially at the posterior end, where it is often much thicker than at other parts. It stains deeply with Giemsa and its external contour is at times rather irregular (fig. 40); it is most probably formed of the same kind of semi-granular, semi-viscid secretion which constitutes the wall of the "Schleimcysten" of Prowazek. In some cases, the wall stains so intensely that the cyst appears very dark and opaque (fig. 41). The body of an encysted parasite is often very granular, now and again rendering it difficult to distinguish the limit of the trophonuclear area (fig. 40). The kinetonucleus, which is always quite definite, is situated close to the trophonucleus. Sometimes the basal part of the attached flagellum (rhizoplast?) can be made out in the completed cyst (figs. 38, 41), but in other cases, it is no longer distinguishable (figs. 39, 40). Stages in cyst-formation are seen in figs. 34—37. The outline of the body becomes less sharply defined, with fine granules adhering to it, which perhaps represent the commencing secretion

(fig. 34). In some individuals the cyst-wall is secreted first at the posterior end and attains its full thickness there before it is completed around the body (figs. 36, 37); but in other cases it appears to be formed first at the sides (fig. 35). I have no indication as to whether the free flagellum is absorbed (retracted) or breaks off; the encysting parasites of figs. 34, 36, 37 may have been, of course, forms without any free portion of the flagellum.

Fig. 34—37.

Fig. 38—41.

Fig. C. (All figs. × 2250. By an error these have been reduced rather more than was intended.) Encystment. 34—37, different stages in the process; 38—41, complete cysts.

When I examined these infected female mosquitoes in the spring, before knowing of the occurrence of cysts, the subsequent natural destiny of the "Crithidiae" appeared very debatable. I kept two living preparations of "rejuvenated", active Flagellates, from two digestive tracts, one lot in water, the other in normal salt-solution. After 24 hours, only a small number of active individuals were still apparent; others were very languid, the flagellum moving feebly; a large number had died or disintegrated. After 48 hours, only a few solitary individuals could be found alive in the aqueous preparation, free in the water. But the interesting fact was noticed that a considerable number of parasites which had remained enclosed inside a portion of the digestive tract, namely the pyloric end of the stomach and the proximal region of the intestine (which had been left in the preparation), were still quite normal and active at this period; and several of these were still alive the following day, when there was no sign of living individuals in the water around. These observations certainly appear to indicate that the active parasites were not able to live for any length of time in water, outside the host; and this is only what was to be expected, bearing in mind that they were not encysted. There is another fact which makes it difficult to suppose that these individuals succeed in being taken up by larvae. In the great majority of cases, at any rate, there can be no larvae available to

act as hosts, at the time when the parasites would be passed out to the outer world. For the hibernating females have first to develope and ripen their eggs, which have to be laid and undergo further development, before there can be any larvae about. One of the first things a hibernating female does, on waking up in the spring, is to have a meal of blood; for the eggs of *Culex pipiens* will not develope without blood, of this I have assured myself. Undoubtedly, after a female had partaken of blood, a large number of the parasites would be passed out to the exterior with the first faecal evacuations, for some faeces are evacuated very soon after a meal, especially if the mosquito has gorged herself. So far as can be seen, therefore, a great proportion of the parasites must perish. Before I knew of the occurrence of cysts, it seemed to me that it was not by the expulsion of the Flagellates that the survival of the species was ensured; and, as will be mentioned below, another mode of dispersal appeared possible. Now, however, that I have found that encystment does take place, it appears probable that the cysts are destined to infect larvae. Nevertheless, even if this is the case, the chances against successful larval infection seem to be very great. This is shewn by the following fact. After the females had all disappeared from his cellar, Mr. Bacot placed receptacles containing water in his garden, for the larvae to develope in. He brought me up numbers of larvae, of different ages and certainly from different broods, at intervals from these receptacles. All the larvae, without exception, were of *Culex pipiens*. I examined a number and not in a single case have I seen any signs of a Flagellate, whether in the active or resting condition; and it may be reasonably supposed that some of these larvae, at any rate, were the offspring of one or more of the infected females. I may also repeat here, what I have noted on several previous occasions, that I must by now have examined altogether hundreds of larvae and newly emerged imagines, both male and female, of *C. pipiens*, from various sources within a short distance of each other in this same locality, during the last few years, without ever coming upon a Flagellate!

Having regard to the observations recorded above, there are one or two tentative possibilities bearing upon the subsequent history of these flagellate parasites which should not, I think, be overlooked. And this brings me to a subject which I wish to discuss shortly, namely, the question of the connection or otherwise of "*Crithidia*" *fasciculata* with some Trypanosome. *Culex pipiens* is essentially the British mosquito which likes Avian blood; à propos of this point, I may mention that a week or so after Mr. Bacot brought me the last hibernating females, he captured an individual in his garden which contained fresh blood. This I examined and found to be Avian blood. Now one possi-

bility is that faeces containing the parasites may be evacuated while the mosquito is in the act of feeding, and dropping on to some exposed part (in the neighbourhood of the eye or nostril, where the mosquito usually feeds), thus bring about an infection of the bird. We know now of at least one instance where a Trypanosome-infection is brought about by means of the faeces. If this does happen in the present case also an explanation would be furnished of the apparent enormous waste of unencysted individuals. On the other hand, it is quite likely that, as the resting Flagellates would doubtless become active again as soon as fresh liquid (blood) reached the intestine, some of the parasites would be able to pass forwards into the stomach and repopulate it. There is then, of course, the alternative hypothesis that certain of these Flagellates would in turn produce inoculative forms, which could infect a bird (if the right host) at a subsequent meal.

Up to the present, I have not been able to obtain experimental evidence to shew whether either of these possibilities actually occurs. It has been clearly proved, however, by Novy, McNeal and Torrey (l. c.) that "*Crithidia*" *fasciculata* thrives in the mosquitoes in the presence of blood. They state that the Flagellates occurred most abundantly in the stomach at from 40 to 60 hours after feeding, having multiplied rapidly during this interval and "permeated" the stomach. (The mosquitoes used were wild ones, and were fed on pigeon's or guinea-pig's blood.) On the other hand, Patton[6] has pointed out that a true *Herpetomonas* of mosquitoes (*C. fatigans*) is readily found in the male individuals, but only rarely in the females, the reason being that when the latter are fed on blood, the parasites usually disappear (after having been present in the larvae).

With regard to the origin of the Flagellates in the infected hibernating mosquitoes, there are one or two interesting bionomical points bearing upon the question which I may mention. I was able to make a few personal observations during the early summer upon the relation between the food of the female and the development of her eggs and their oviposition. It is possible, however, that a distinction must be made in this connection between "summer"-females, which produce larvae during the season, and "autumn" ones, which hibernate and produce larvae the following year. I found that the former individuals would always take a meal of blood (the conditions being suitable, of course) before being fertilized; indeed, none of the females which I have examined soon after a (first) meal of blood has been fertilized. This refers, however, to females bred in captivity and I am not at all certain

[6] Sci. Mem. Med. India, No. 53. 1912.

whether the same applies to "wild" individuals. At any rate, the paired masses of eggs develope to their full size, ready for fertilization, upon one meal of blood. This summer, I have succeeded in obtaining fertile egg-rafts and larvae from bred-out males and females. I have a strong idea that a second meal of blood is taken normally before the fertile eggs are laid, the eggs being laid, in fact, immediately after the meal, which has perhaps induced the oviposition. I have found this to be the case in at least two instances; and, on the other hand, I have noticed that a gravid female, which has not fed again, will occasionally lay her eggs, but these have not been fertilized. A point to which attention must be drawn is that, as a result of a meal of blood, the eggs always do grow, apparently to their full size.

Now, in the hibernating female mosquitoes, the eggs apparent in the ovarial tubes are quite young (the females were, of course, fertilized). There are, it would seem, two alternative explanations. (a.) These individuals had never taken blood. If this were the case, it is obvious that the "Crithidiae" could not have developed directly from a blood-Trypanosome. (b.) After one or more meals of blood, they had developed and laid a batch of eggs, and the young eggs present represented a succeeding batch. In none of the individuals I dissected could I obtain any definite indication which of the two interpretations was the correct one. But within the last few weeks, Major Perry, I. M. S., who in my absence was examining some females which had entered upon hibernation this (present) autumn, in the same cellar, found in one case a single, full-sized egg, in addition to the customary small ones; *i. e.*, one of the preceding batch which had been left behind when the rest were laid. This shews at any rate that the second alternative noted above does happen; in other words, that these hibernating females may have taken blood. And that is as far as I have been able to carry the problem up to the present.

From the above considerations, it still appears to me quite likely that "*Crithidia*" *fasciculata* is connected with a Trypanosome. Nevertheless, in view of the occurrence of cysts which are probably destined to infect the larvae, it is equally possible that this parasite is solely an Insectan Flagellate, that is, one restricted to the mosquito, which has become adapted to the sanguivorous habit of the female; I may recall that I expressly indicated the possible occurrence of such forms some years ago, though this suggestion of mine has been wilfully overlooked by some of my critics[7].

Up to the present, there is no instance which is definitely established,

[7] Vide Lankester's treatise on Zoology, pt. 1. fasc. 1. Art: Haemoflagellates. p. 244.

of the developmental forms of a Vertebrate Trypanosome producing cysts in the Insectan host, for expulsion to the exterior. But in the case of *Trypanosoma grayi*, in *Gl. palpalis*, it is not improbable, I think, that we have such an instance. It may be pointed out that among the figures given by Kleine and Taute[8] of the forms of *T. grayi* in the tsetse-fly, which were proved by the authors to be derived from the Trypanosome in the crocodile, there are two (figs. 65, 67) of the slender, (so-called) herpetomonad type, which were shown by Minchin[9] to give rise to the cysts. The German workers, it is true, did not observe any actual cyst-formation. Just as "*Crithidia*" *fasciculata* has been seen many times, however, when the cysts have not been found, so it has been with *T. grayi*; thus Roubaud[10] only found cysts on 13 out of 30 occasions, in tsetses infected with *T. grayi*. The last-named author confidently assumes that this parasite is purely an Insectan form; but the series of forms which he figures agree entirely both with those given by Minchin and with those given by Kleine and Taute, — forms which in my opinion do not resemble the types of form generally found in the herpetomonads or trypanosomids of Insects.

There is an important hypothetical point which may be mentioned in this connection. The formation of cysts by a parasite occurring in a blood-sucking Insect does not necessarily mean that this parasite in unconnected with a Vertebrate Trypanosome. For in the case of a Trypanosome derived originally from an Insectan Flagellate, one which most probably formed cysts for its transmission from Insect to Insect (or larva), it is quite comprehensible that in certain cases this primitive mode of transmission may have been retained, in addition to the (secondary) method of transmission by inoculation to the Vertebrate (or possibly even without the latter), where this course proved advantageous to the species. If "*Crithidia*" *fasciculata* is really the developmental form of a Trypanosome, such an explanation would account for the presence of resistant cysts. Of course, this is nothing more than a hypothesis so far; but it is interesting to note that a similar view has been suggested by Chagas[11], in his account of *Trypanosoma* (*Schizotrypanum*) *cruzi*. He puts forward the possibility of the infection of fresh bugs (*Conorhinus*) by means of the excrement of infected ones, and is inclined to suppose this may be effected by the "crithidial" forms of the parasite (without the occurrence of actual cysts being suggested).

In conclusion, although the fact of the occurrence of cysts in

---

[8] Arb. kais. Gesundheitsamt, 31. 1911. S. 321. 5 pls.
[9] Quart. Journ. micr. Sci., 52. 1908. p. 159. 6 pls.
[10] C. R. Soc. Biol. 72. 1912. p. 440.
[11] Mem. Inst. Oswaldo Cruz, 1. 1909. p. 159. pls.

"*Crithidia*" *fasciculata*, is one which, per se, argues in favour of the Insectan Flagellate view, having regard to the observations and suggestion brought forward above, I regard the question whether or not this parasite is connected with a Trypanosome as, at any rate, still an open one; and I consider the case of *T. grayi* is in a similar position.

5. Zum Bau der Spermatophore von Gryllotalpa vulgaris L.

Von U. Gerhardt, Breslau.

eingeg. 26. Oktober 1913.

Fast gleichzeitig mit meiner ersten Arbeit über Copulation und Spermatophoren bei Grylliden und Locustiden[1] erschien in dieser Zeitschrift Boldyrevs[2] Abhandlung über Begattung und Spermatophore von *Gryllotalpa*.

Wie zu erwarten, stimmen unsre Schilderungen der Begattung überein und weichen von der ab, die Baumgartner von dem gleichen Vorgang der amerikanischen Species gibt. In zwei Punkten ergeben sich aber Differenzen in unsern Befunden.

Erstens sah Boldyrev, was mir nicht gelang, daß die *Gryllotalpa*-Weibchen die entleerten Spermatophoren auffraßen, so daß auch bei ihnen der bei manchen Grylliden und allen Locustiden vorhandene »Freßinstinkt« vorkommt. Ich hatte diesen Vorgang zu sehen erwartet, auch nach Baumgartners Bericht, und war erstaunt, ihn nicht sehen zu können. In 2 Fällen ließen Weibchen nach etwa 20 Minuten ihre Spermatophoren spontan aus der Vulva herausfallen, in andern Fällen geschah deren Entfernung für mich unsichtbar tief im Bau. Die beiden ersten Weibchen hatte ich zur besseren Beobachtung des Vorganges in leere Glasgefäße gesetzt. Bei allen beobachteten Weibchen sah ich auch keinen Versuch, die in der Vulva steckende Spermatophore mit den Mundteilen zu erreichen. Boldyrev beobachtete nun das Verzehren der Spermatophore bei Weibchen, die ungestört in ihren Gängen waren, so daß sich aus den immerhin abnormen Bedingungen bei meinen Beobachtungen das abweichende Verhalten erklärt. Mit der Feststellung des »Freßinstinktes« bei *Gryllotalpa* durch Boldyrev ist eine wichtige Lücke in unsrer Kenntnis dieses seltsamen Triebes geschlossen.

Schwerer wiegend ist der zweite Differenzpunkt. Boldyrev beschreibt einen die dicke, kompakte Spermatophore weit überragenden fadenförmigen Kanal, den ich nicht finden kann. Sonst stimmen unsre Schilderungen des Körpers der Spermatophore vollständig überein. Ich selbst habe, wie ich mit aller Bestimmtheit versichern kann,

[1] U. Gerhardt, Copulation und Spermatophoren von Grylliden und Locustiden I. Zool. Jahrb. System. Bd. 35. 1913. S. 416.

[2] B. Th. Boldyrev, Die Begattung und der Spermatophorenbau bei der Maulwurfsgrille (*Gryllotalpa gryllotalpa* L.). Zool. Anz. Bd. 42. S. 592.