



ON A NEW SPECIES OF OXYMONAS FROM THE INTESTINAL
CONTENTS OF THE BRAZILIAN TERMITE *NEOTERMES*
HIRTELLUS (SILVESTRI).

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INTRODUCTION

The genus *Oxymonas* was created by JANICKI in 1915 for the sp. *O. granulosa* JANICKI, parasite of *Neotermes connexus* SNYDER (Hawai), wrongly classified at first as *Neot. castaneus* BURMEISTER. (1).

GRASSI found somewhat similar forms in the intestine of *Neot. erythreus* SILV. (Erytrea), which he named *forme a fiasco* and believed to be the young, uninucleated forms of a *Calonymphid* (2).

BERNSTEIN (3) studying the uninucleated forms of *Stephanonympha dogieli* par. of *Hodot. (Anacanthot.) murgabicus* from TURKESTAN, was the first to state the mistake of GRASSI and to suggest that these *forme a fiasco* belonged probably to the genus *Oxymonas*, a hypothesis which was seconded by KIRBY (4).

KOFOID & SWEZY (5) describe in 1926 three new ssp.: *O. projector*, par. of *Glyptotermes perparvus* EMERSON, *O. pediculosa*, par. of *Lobit. nigriceps* EMERSON and *O. gracilis*, par. of *Rugit. magninotus* EMERSON. In all these ssp. the authors find two blepharoplasts connected by a interblepharoplastic rhizoplast, and three flagella emerging from each blepharoplast.

In 1926 KIRBY describes his *O. parvula* (6), changes the previous designation of *proboscis* into that of *rostellum* and points out as *two* — and not *three*, as supposed by KOFOID & SWEZY — the number of flagella arising from each blepharoplast.

In 1930 CONNELL (7) describes his *O. dimorpha*, par. of *Paraneot. simplicicornis* Banks (California, Arizona) and shows that it possesses two phases: 1) flagellated, motile, subovoidal in form, two flagella at each side and the anterior portion blunt or slightly extended in a rudimentary rostellum; 2) attached phase, with gradual elongation of rostellum clinging through a holdfast to the interna of the hindgut of the host. All motile organelles, except axostyle and rostellum, disappear.

ZELIFF in 1930 (8) describes 11 new ssp. of *Oxymonas*; CLEVELAND in 1935 (9) describes *O. grandis*, par. of *Neot. dalbergiae* and *Neot. tectonae* from Java, Sumatra, and CROSS (10) in 1946 gives a full account of the family *Oxymonadinae*. He makes a revision of the ssp. previously described and introduces in the nomenclature of the organelles new terms such as *nuclear matrix* instead of *nuclear sleeve* of CLEVELAND, in describing the *O. grandis*, *O. megakaryosoma* and *O. notabilis*. Moreover, he divides the axostyle into *anterior portion*, *recurvent portion*, *shoulder of the axostyle* and *axostyle confined to the body* of the parasite.

DESCRIPTION OF THE PARASITE

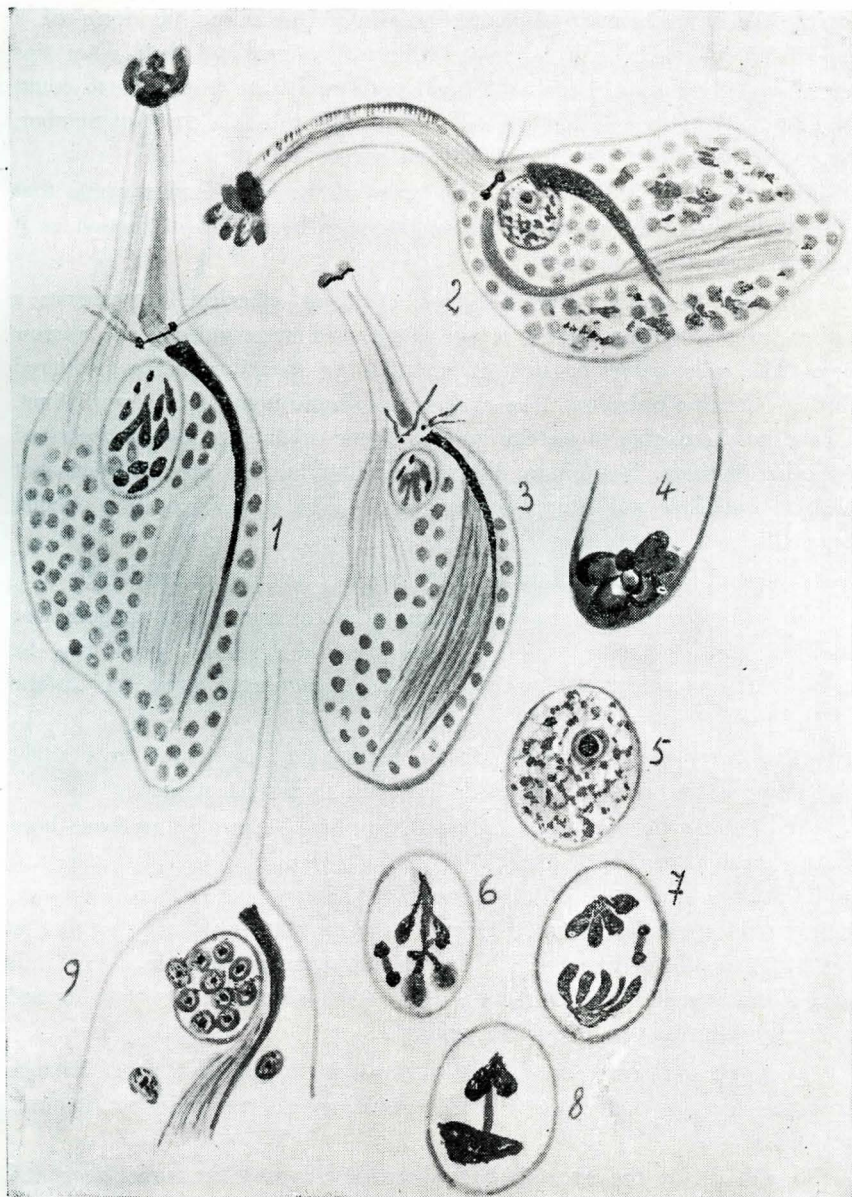
Form — In the text illustrations, various morphological aspects of the parasite are figured. From them we see that the number of non-rostellate forms, or of those showing a rudimentary rostellum, is very small in comparison with that of rostellate forms. The general configuration of the body, not taking into consideration the rostellum, is subovoidal, with the posterior pole pointed or not, and often with irregular contour, as this part, specially, is fairly metabolic. Particularly interesting was the resemblance to a cricket bat which is drawn in the illustration.

The various aspects and sizes of the rostellum are also illustrated: shorter than or more or less equal to the body, often, however, 2 to almost 3 times longer. I agree with the authors who do not take the trouble of measuring the size of the rostellum, such are the variations it shows.

In general, the anterior pole of the body gradually tapers on and gives rise to the rostellum as an appendage which becomes more and more narrow on its distal part. Often, however, it emerges abruptly as a spike from the roundish outline of the anterior pole. Sometimes a delicate transverse striation is seen in the wall of the rostellum (myonemma?) (Pl. I., fig. 2).

The important feature of the rostellum is its holdfast which deserves a special description.

PLATE I



Oxymonas hirtelli
(explanations in the text)

Holding fast apparatus — It has a peculiar constitution: at the tip of the rostellum there is a rather strongly siderophyl knob from which emerge some uniform appendages, the whole resembling the form of a calyx with its sepals. They are not uniformly stained and their outer tips are often lighter stained than the basal portion. I have been able to count as many as 7 of such sepals but will not say that this is a constant number. No special fibers were seen in the sepals or between them.

The fig. 4 Pl. I represents a top view of the calyx and suggests that the attachment of the rostellum to the intima is by a kind of suction as it happens with a suction cup.

Nucleus in resting stage — Large, ovoid or spherical, it possesses a rather large karyosom which is subcentral and surrounded by a narrow halo. The chromation consists of granules or irregular masses scattered through the fine reticulum. The nuclear membrane is thin but very distinct. I have not been able to see the nuclear sleeve or nuclear matrix described by other authors. Sometimes, the surrounding nuclear area is somewhat clearer, but does not show any structure to be considered as a special organel.

The nucleus is located in the very anterior portion of the body.

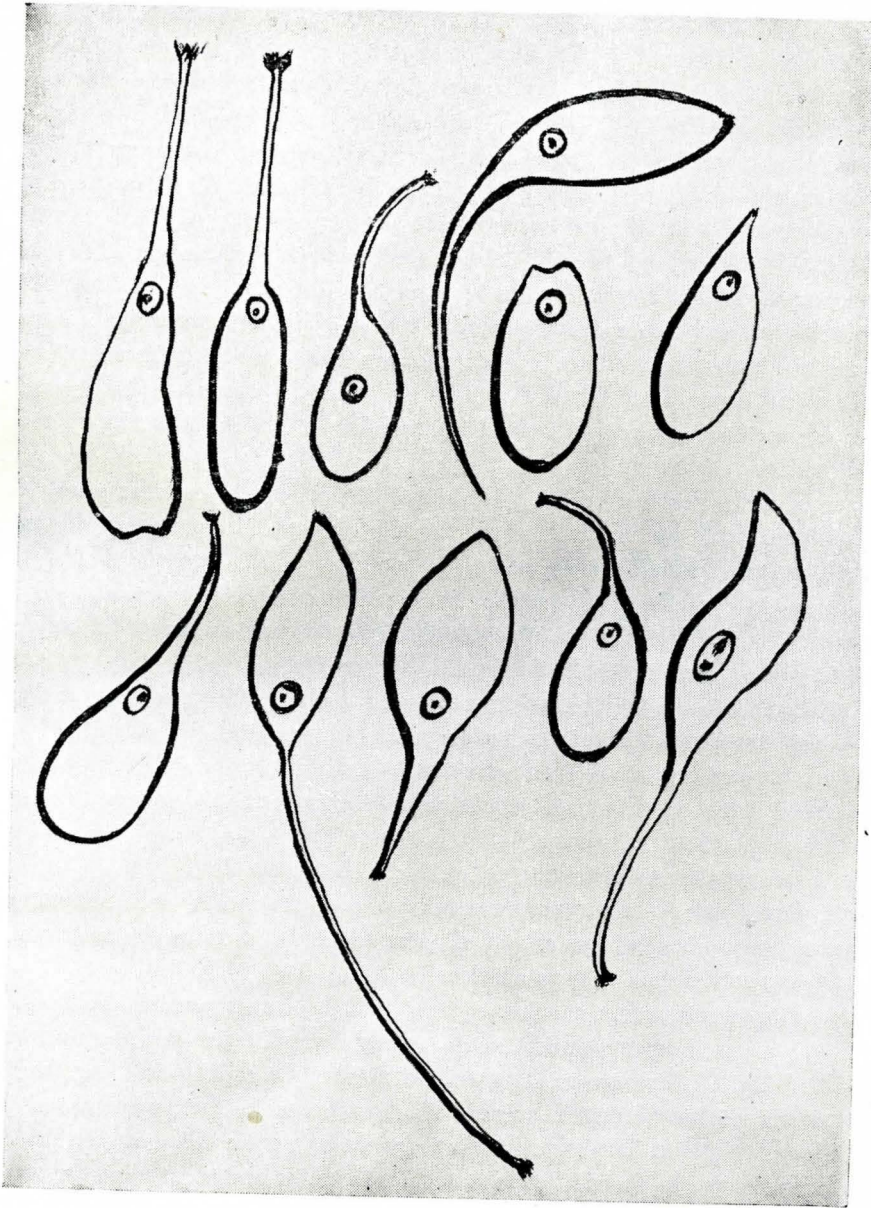
Mitotic figures — In no case a migration of the mitotic nucleus was seen going till the more or less posterior part of the body. There may be a slight displacement downwards, but never attaining even the middle of the body.

The only modification which the mitotic nucleus shows is a slight elongation as it becomes more elliptical then in resting stage.

All mitotic figures — and they are very few — seen by me have been figured in the Plate. They are self-explanatory (figs. 1, 3, 6, 7, 8). In figs. 6 and 7 one might be inclined to suppose that the karyosom suffers a division; but in reality, the karyosom disappears during mitosis. It may be that in fig. 6 the dumbbell like body is only a chromosome while in fig. 7 it is probably a degenerated karyosom, as the chromosomes are perfectly formed and assembled in two telophasic groups.

Axostyle — It runs through the whole body, ending to a short distance from its posterior boundary, variable according to the individuals. It never protrudes.

I will divide the axostyle into three parts: *rostellar*, *prenuclear* and *body axostyle*.



Morphological aspects of *Oxymonas hirtelli*
(Text figure)

The rostellar axostyle fuses with the holdfast apparatus. Its constitution seems to be fibrous but not homogeneous, as one part appears generally as a ribbon faintly stained with hematoxylin, while the other part is undoubtedly composed of fibers whose number and disposition is variable and which, crossing the nuclear region, come downwards and are lost in the anterior part of the body. Often they form a kind of ribbon ending downwards in a bunch of fibers resembling the tail of a horse (Pl. I, fig. 2). This part corresponds to what CROSS described under the name of recurrent axostyle, but I have not found enough evidence to conclude that the rostellar axostyle, on reaching the region of the holdfast, bends in a curve and originates these fibers. I rather believe that such structures are superadded fibers, inserted in the rostellar axostyle at various levels and whose number, extension in the body and length varies according to the individuals.

In the prenuclear region the ribbon-like part of the rostellar axostyle continues with the body axostyle through very faint connective fibres. In this region which corresponds to the *shoulder of the exostyle* of CROSS, the axostyle of the body begins: it is ribbon-like, more compact, more siderophyl and not seldom attached to fibers forming an irregular bunch descending downwards (Pl. I, fig. 3).

Flagella — In the prenuclear zone there are two very minute granules — blepharoplasts — from which emerge the 4 flagella of the parasite. The blepharoplasts which are interconnected by a fibril, are very difficult to be detected and it may be that each of them is composed of 2 granules, as in other parasites of this genus.

The flagella are definitely 4, two for each blepharoplast.

Endoplasm — Alveolar, containing wood fragments and numerous yellow-brownish spherules spread all over the body, even in the rostellum, however not in such a large number.

I have seen some specimens parasitised by some roundish bodies of $2-2\frac{1}{2}$ micra diameter, which, show a special predilection for the nucleus (Pl. I, fig. 9), however existing two in the body's endoplasm. They have a minute central chromatic granule which seems to be their nucleus and a reticular structure. Their form is circular, however some elliptical, elongated specimens may be found. They are not *Nucleophaga* and their precise nature is for me unknown for the present.

Ectoplasm — A rather thin periplastic membrane allowing the metabolic changes of the parasite. No symbionts attached, either rodlets or spirochetes.

Measurements — Some specimens measured gave me the following numbers:

Length/width: 120/100; 90/40; 160/40; 120/50; 120/25; 110/30; 110/35; 60/40; 90/40; 80/20; 110/30; 110/30; 100/40; 90/30.

Nucleus: 18/16; 18/15; 20/14; 22/18; 20/15; 20/18; 18/12; 18/15; 20/12.

Rostellum: absent; less than body's length; same as body's length; longer than the body; $2\frac{1}{2}$ or somewhat more longer than the body.

Karyosom: 2 micra; *halo* very narrow.

Classification — The actual species belongs undoubtedly to the genus *Oxymonas*.

It can be differentiated at once from the small species hitherto described, such as *granulosa* JANICKI 1915, *projector*, *pediculosa*, and *gracilis* KOFOID & SWEZY 1926, *parvula* KIRBY 1926, *clevelandi*, *brevis*, *snyderi*, *barbouri*, *jouteli*, *rotunda*, *minor*, *hubbardi* ZELIFF 1930, *diundulata* NURSE 1945, and *caudata* CROSS 1946.

Its comparison with the larger species gives the following results:

A) *Dimorpha* CONNELL 1930, possesses, besides the big forms, some small ones of 17/14, its nucleus is much smaller (4-12,3, av. 7,7 of diameter). Its karyosom is central, the rostellum short and the axostyle slightly protruding.

B) *Megakaryosoma* CROSS 1946, possesses also small forms of 24,9/9,3. Its nucleus is smaller (6,7-17,3, av. 10,7/6-15,2, av. 8,7) and has an unusually big karyosom (2-8,7, av. 4/1,3-6, av. 3,3). Its axostyle slightly protrudes.

C) *Notabilis* CROSS 1946 possesses also small forms of 27/12,7. Its nucleus is smaller (7,3-14, av. 9,3/6,7-13,3, av. 8,7) and is a species binucleate specimens are frequent and 4-5-6 nucleate ones are not rare.

D) *Grandis* CLEVELAND 1935, more fully described by CROSS 1946, deserves a special attention. Parasite of *Neotermes dalbergiae* KALSHOVEN (Java) and *Neot. tectonae* DAMMERMANN (Java, Sumatra), it has a length of 76-183, av. 121 (CLEVELAND) or 41-241, av. 109 (CROSS). Its width goes from 31 to 79, av. 52 (CLEV.) or 15,3-78,3, av. 36,4 (CROSS). Its nucleus is ovoid (8,7-24,9, av. 16/8-20, av. 12,6) according to CROSS while CLEVELAND gives for the nucleus a diameter of 20-23 av. 21. But the most important differential characteristics are: a) the axostyle protruding;

b) the karyosom present only during late reorganisation of the nucleus, and absent in the resting nuclear stage.

CONCLUSION

Our species does not resemble the *Oxymonas* hitherto described. We consider it a new species which will be named *Oxymonas hirtelli* n. sp.

RESUMO

O termite brasileiro *Neotermes hirtellus* (SILVESTRI), apanhado em Campinas e identificado pelo Prof. A. EMERSON para quem os nossos melhores agradecimentos, contém no seu intestino um grande *Oxymonas*, cujos exemplares são em geral providos de rostellum de tamanhos variados, podendo mesmo atingir um comprimento $2\frac{3}{4}$ vezes maior que o corpo. A organela mais característica é o aparelho que fixa o parasita à íntima da mucosa intestinal do hospede e tem a forma de um cálix com mais ou menos 7 sepalas. O parasita tem a forma subovoide com a parte posterior metabólica, possui um núcleo ovoide ou esférico muito grande, situado bem na parte anterior do corpo e provido de um kariosoma subcentral com um halo muito estreito. Este núcleo não migra ou migra muito ligeiramente durante a mitose. O axostilo percorre todo o corpo: a sua porção rostelar é composta de uma faixa ligeiramente corada à qual estão ligadas algumas fibras que descem para baixo, em feixe, em extensão variável segundo os indivíduos; a sua parte prenuclear é constituída por finas fibras que ligam a parte rostelar ao axostilo do corpo; este axostilo tem a forma de faixa mais ou menos compacta, muitas vezes fortemente siderófila e não raro ligada a fibrilas formando um tufo que desce para baixo. Numerosas esferulas amarelo-acastanhadas no endoplasma. Alguns parasitas esféricos de $2-2\frac{1}{2}$ microns de diâmetro, atacando especialmente o núcleo, mas não pertencentes ao género *Nucleophaga*. Quatro flagelos, emergindo de 2 blefaroplastes, situados na zona prenuclear. Nenhum cutículo-simbionte. Dimensões (sem contar o rostellum): 60-120/25-100. Núcleo 18-22/12-18. Kariosoma 2 microns.

A espécie descrita é comparada com todas as *Oximonas* até hoje estudadas e considerada uma espécie nova que é intitulada *Oxymonas hirtelli* sp. n.

São Paulo, Janeiro 1953.

RÉSUMÉ

Le termite brésilien *Neotermes hirtellus* (SILVESTRI), récolté à Campinas et identifié par le Prof A. EMERSON à qui nous remercions sa précieuse collaboration, porte à son intestin un grand *Oxymonas* dont les spécimens sont en général munis de rostellum des formes variées, pouvant même atteindre une longueur de $2\frac{3}{4}$ plus grande que le corps. L'organelle plus caractéristique est l'appareil que fixe le parasite à l'intérieur de la muqueuse intestinale de l'hôte et a la forme d'un calice avec plus ou moins 7 sépales. Le parasite a la forme subovoïde avec la partie postérieure métabolique, a un nucléole ovoïde ou sphérique très grand, bien situé à la partie antérieure du corps et muni d'un kariosoma subcentral avec un halo très étroit. Ce nucléole ne fait pas des migrations ou les fait très légèrement pendant la mitose. L'axostyle parcourt tout le corps: sa partie rostellaire est composée d'une bande faiblement colorée à laquelle sont attachées quelques fibrilles qui descendent en bas, en faisceau, en une extension variable selon les individus; sa partie prénucleaire est formée par des fines fibrilles lesquelles attachent la partie rostellaire à l'axostyle du corps; ce axostyle a la forme d'une bande plus au moins compacte souvent solidement sidérophylle et non rarement attachée à des fibrilles formant une touffe qui descend en bas. Des nombreuses sphérules jaune-brunâtres à l'endoplasme. Quelques parasites sphériques de $2.2\frac{1}{2}$ microns de diamètre, atteignant, spécialement le nucléole, mais n'appartenant au genre *Nucleophaga*. Quatre flagelles, émergeant de 2 blefaroplastes, situés à la zone prénucleaire. Aucun cuticule-symbiote. Dimensions (excepté le rostellum): 60-120/25-100. Nucléole 18-22/12-18 Kariosoma 2 microns. L'espèce décrite est comparée avec toutes les *Oxymonas* jusqu'hui étudiées et est considérée une nouvelle espèce intitulée *Oxymonas hirtelli* sp. n.

SUMMARY

The Brazilian termite *Neotermes hirtellus* (SILVESTRI) — identified by Prof. A. EMERSON — harbours in its intestine a large *Oxymonas* whose forms are mostly provided with a rostellum of various sizes, reaching up to $2, 2\frac{3}{4}$ times the length of the body. The most characteristic organell is the holdfast to the intima of the host gut, under the form of a calyx with more or less 7 sepals. Subovoidal with the posterior part metabolic, its

nucleus is ovoid or spherical, very large, located in the very anterior portion of the body and possesses a subcentral karyosom, with a narrow halo. It does not migrate or migrates very slightly during mitosis. The axostyle runs through the whole body: its rostellar portion is constituted by a faintly stained ribbon to which are attached some fibers descending downwards as a bunch, to a certain extent of the body; its prenuclear part is composed of faint connective fibers uniting the rostellar portion to the body axostyle; the latter is ribbon-like, more compact, often strongly siderophil and not seldom attached to fibrils forming a bunch descending downwards. Numerous yellow brownish spherules. Peculiar round parasites, $2.2\frac{1}{2}$ microns diameter, attacking specially the nucleus, but not belonging to the genus *Nucleophaga*. Four flagella emerging from 2 blepharoplasts located in the prenuclear zone. No symbionts. Measurements (not counting the rostellum): 60-120/25-100. Nucleus 18-22. Karyosom 2.

The species is compared with the *Oxymonas* hitherto described and considered a new species which will be named *Oxymonas hirtelli* n. sp.

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