



The biologic cycle of *Limnocyclus tanganyicae*

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Funny of small bestioleses, nothing of comparable to those that we know in our seas. Here is how been presented in 1955, the account returned of the *Limnocyclus tanganyicae* analysis,

Not so simple that that!

I. Introduction.

Representative by the institute for the Scientific Research some Central Africa, to the center of Uvira, during years 1952-1954, we had the possibility, during investigatings dedicated to invertebrates of the

Tanganika lake and of the Mohasi lake, to discover the biologic cycle of jellyfishes living in these lakes and belonging to the kind *Limnocoñida*. Before giving a summary of our observations, we are anxious to express our gratitude to the I. R. S. A. C. and to his/her/its Council of administration without the generous intervention of which these research would not have been able to to be undertaken.

It is in the Tanganika lake that the *Limnocoñida*, jellyfish dulcicole, has been signalled for the first time by R. BOHM in 1883. GUNTHER the describes in 1893 and named it *Limnocoñida tanganicae*. The discovery of this jellyfish made sensation at the time and acted as argument in favor of the hypothesis of the navy origin of the Tanganika lake. This conception given out by MOORE (1903) is quit at the present time so much for reasons geological that zoological (us let's send back to the previous studies: PELSENEER, 1886, 1906; POLL, 1950) many authors recovered *Limnocoñida* in the Tanganika lake, notably VON WISSMAN (1887), MOORE (1899-1903), GUNTHER (1906), CUNNINGTON (1904, 1905), STAPPERS (1914), L. SIEVE DEN BERGHE (1933), HUBERT (1934), LESTRADE (1934-36), SCHOUTEDEN (1934-39), BEAUCHAMP (1946), LELOUP (1946-47).

This jellyfish is spilled in all the lake Tanganika of the North to the South and, as signals it LELOUP (1951), as well close to the coasts and of the elevated funds that to the large, toward the big depths.

The daily harvests that we have done in the north bay of the lake, during years 1953-54, show that if the frequency of jellyfishes observed in surface varies a place to the other of the bay, these animals are always present, whatever is the season, in the deep waters of the, lake.

Limnocoñida langanyicae was also harvested in other African hydrographic basins: in the basin of Niger (French Sudan), by the doctor TAUTAIN in 1888 (described by J. OF GUERNE, 1893-94), to the Coast of Ivory, close to Assay (harvest of BUDGETT, survey of BROWNE, 1906--1907). According to MONOD (1947), she/it would exist can - to be to the Tibesti. She/it was found in the basin of the Zambèze, the Chobe river to the Kalahari, par JOURDAN (1934). She/it is present in various lakes of the basin of the Nile: in Victoria - Nyanza (ALLUAUD 1903; GUNTHER, 1907). This last author described the Victoria's specimens as being a shape of *Limnocoñida langanyicae*, the

variety *victoriae*. She/it was again harvested in the Mohasi lake, Ruanda, by VERHULST (SCHOUTEDEN, 1939) and PACKED DOWN (1953) and in the lakes Sake and Bilila by DAMASCUS (1953).

Limnocrnida would also have been observed, but non harvested, in the waters of the basin of Congo, to the Stanley - Pool and to the lake Léopold II (SCHOUTEDEN, 1924).

Finally, three other species of the kind *Limnocrnida* have been described, two African and an Asian ; *Limnocrnida rhodesia*, found in Rhodesia in the system of the Zambèze by BOULENGER, 1912, in the system of the Limpopo, by ARNOLD and BOULENGER, 1915, to the Transvaal, in the system of the Limpopo by FENTHOM and To CARRY, 1933, in Rhodesia of the South by BERRY and EDNEY, 1939, *Limnocrnida cydomoce*, JORDAAN, 1934, discovery to the Transvaal in the waters of the Crocodile Rivier around Pretoria, as well as in Johannesburg. *Limnocrnida indica*, ANNANDALE, 1912, harvested to the British Indies in the Jennas rivers, Kistnas and Kaynas.

These four species of *Limnocrnida*, as well as the variety *victoriae*, would not be, according to LELOUP, 1951, that shapes of one only species : *Limnocrnida tanganyicae* KRAMP also brings back the three species African to only one species : *Limnocrnida tanganyicae* (GUNTHER), distinct of the Indian shape *Limnocrnida indica* described by ANNANDALE.

To the systematic view point, GUNTHER, in 1894, himself, basing on the position of gonads and origin endodermique of sense organs, classified *Limnocrnida* in the Narcoméduseses. In 1903, GOTO prétextant origin ectodermique of the statocystes, classified them in the Leptomeduses GUNTHERS, in a new work, in 1907, includes them in the group of the Trachyméduseses *olindiadae* as well as made it MAYER, in 1910.

Finally, KRAMP, in 1918 and 1951, classifies them in one new subordre of the *Leptolina*, the *Limnoméduses*, to equal rank with the Anthoméduses and of the Leptoméduseses.

This systematic position is granted by RUSSEL (1953) TO *Craspedacusta*, very neighbor of *Limnocrnida*.

These conceptions take the survey exclusively as a basis of the jellyfish, because her alone, until

now, was known us. His/her/its origin had escaped the numerous investigations of which she/it was however the object. We had the happiness to discover the essential elements of his/her/its biologic cycle, notably the larva at the expense of which constitutes himself the polyp, and the polyp him –même generating the jellyfish. Our observations were made at a time to the Tanganika and the Mohasi.

II. The Medusa.

We describe the type below exclusively of *Limnocoñida langanyicae* that we could harvest to the Tanganika lake. Referring us to the survey KRAMP, on can consider *Limnocoñida* of the Mohasi lake as being the same species. Differences exist however between these two shapes.

He/it constitutes himself/itself of buds manubriauxes on the jellyfish of the Tanganika. The *Limnocoñida* some Mohasi lake doesn't give out any buds médusaires.

Besides his/her/its tentacles are more numerous and more distribute regularly, the number of his/her/its statocysteses is raised more and their size is bigger (Photos 1 and 2).

The morphology and the anatomy of *Limnocoñida* have been studied mainly by GUNTHER in 1893, 1894 and 1907, by MOORE in 1903, by BOULENGER in 1911 and by LELOUP in 1951. *Limnocoñida tanganyicae* is a gracious animal of shape discoïdale, slightly thickened to the center. He/it measures 10 to 25 mms of diameter, his/her/its thickness reaches about the third of the width. The present exombrelle a ring marginal ectodermique containing many nématocvstes. The *manubrium* is cylindrical and short. His/her/its diameter occupies the two third of the one of the cavity under - ombrellaire. The circular, extensively open mouth, don't pass the level of the *velum*, the one - is here narrow and horizontal, he/it possesses a circular musculature well developed. A bulge lenticulaire mésogléique of the parasol raises the bottom of the gastric cavity and reduces the capacity of it, as would make it the bottom of a bottle. Channels radiaireses, generally to the number of four, sometimes five, six or seven, prolong the gastric cavity until in the circular marginal channel. The

tentacles fit on the exombrelle to him - over of the ring marginal of the nématocystes, at the level of the circular channel of which they are descended. They are hollow, the channel gastric prolongs himself of it. By their basis they adhere on a short distance, to the exombrelle. To the number of 2 or 300 tentacles are arranged on several rows, of 5 to 9 generally, lesperradiaux, interradiaux and adradiaux being longest. Tentacles of *Limnognathia tanganyicae* present many buttons urticants armed of nématocystes. These buttons are dispersed more or less in transverse rings all along tentacles.

However, tentacles the more developed are deprived of battery nématocytaire in their region proximale that is smooth and possess that of the dispersed nématocysteses. The nervous system is represented by two rings situated to the basis of the *velum* and separated one of the other by the blade mésogléenne. He/it exists a variable number of statocystes, of 200 to 400 about. They are situated to the basis of the *velum* at the level of the ring marginal of nématocystes, under the external nervous ring. Every statocyste is formed of an enclosed capsule containing a spherical mass of cells that would come from cells endodermiques of the channel circular. This mass of cells is attached to the capsule of the nearest side of the marginal channel. Buds médusaireses and gonads develop on the partition external of the *manubrium*. *Limnognathia tanganyicae* therefore a structure very neighbor of the one of *Craspedacusta sowerbii*. Us will see that she/it has the biologic cycle of it. She/it differs some however by two - Important features: the formation of buds manubriaux at *Limnognathia tanganyicae*, whereas *Craspedacusta sowerbii* some is always deprived; the site of gonads on the *manubrium* in the kind *Limnognathia* while the genital glands are on channels radiaireses at *Craspedacusta sowerbii*.

III. Reproduction of the jellyfish.

A. The sexless reproduction. Bud médusaire

In the Tanganika, the jellyfish clean to this lake presents one bourgeonnement intense nianubrial. He/it has been studied by GUNTHER in 1894, by MOORE some 1903 and by BOULENGER in 1911, LELOUP, in 1951, recalled the intensity of it. Buds médusaireses develop on the inaitubrium following

a very known process at the other Hydrozoaires (KUHN, 1910, BRIEN, 1912) (Photo 1).

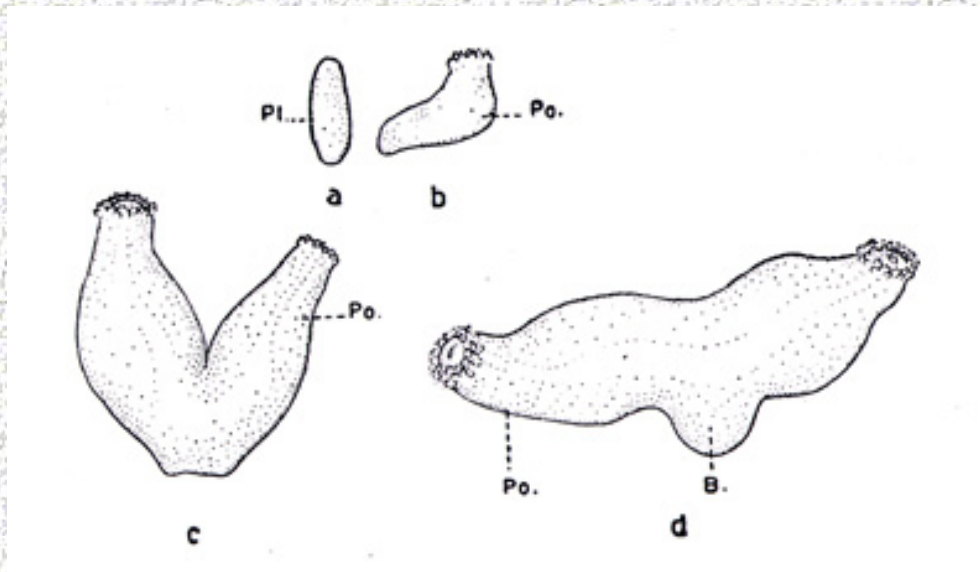


FIG. 1. - has. Larva planula of *Limnocoidea tanganyicae*, coming from to fix itself/themselves on the Phragmites. Pl. = planula

b. Polyp of the *Limnocoidea tanganyicae* descended of larva planula. Po = polyp

c. Colony formed of two polyps (*Limnocoidea tanganyicae*). Po = polyp.

d. Colony Understanding two individuals and presenting to the center a bud of growth - ~ B. bud of growth, Po = polyp.

Signalons however that the blastogénèse manubriale of *Limnocoidea tanganyicae* is accelerated more and present some originalities.

The first indication of the bud consists in a évagination of the manubrium, évagination in which participates the two leaflets. He/it constitutes himself/itself thus a small hernia containing a diverticule of the gastric cavity of the jellyfish. Ectoderme apical of this hernia, instead of first proliferating in a bouton massive, hollow then, himself invagine of a stroke in the endoderme that he/it repulses, forming, directly a cavity opened to the summit. The one - doesn't linger here to close itself/themselves and isolate so an enclosed bladder: under - ombrellaire cavity. She/it is interposed between ectoderme apical of the bud and the endoderme of the gastric cavity. The cavity endodermique so combed the cavity under ombrellaire ectodermique gives out four bag distaux, drafts of the four channels radiaireses that lie down between the leaflet, ectodermique of the bud and leaflet ectodermique of the cavity under - ombrellaire. First arranged in cross, they will be united by a blade endodermique; the blade cathamnale. During this time, ectoderme apical proliferates a massif that depresses the cavity under - ombrellaire. This massif digs himself in a third cavity that us will call tentacular cavity. She/it superimposes herself/itself to the cavity under - ombrellaire and to the gastric

cavity.

Three cavities are therefore present in the bud médusaire. The tentacular cavity is the one in which will form himself tentacles. When she/it opens up, she/it frees tentacles in a way while the cavity under - ombrellaire, by perforation of his/her/its velum communicates to his/her/its tour with the outside. The circular channel forms itself by the fusion of channels radiaires extremities distaleses.

Finally, cavity endodermique presents a median diverticule who repulse leaflet ectodermique of under - ornbreillaire cavity and dresses himself of it. It is the manubrium pierced by the very extensively dilated buckle. Buds médusaireses himself free then, assuring the propagation and the dissemination

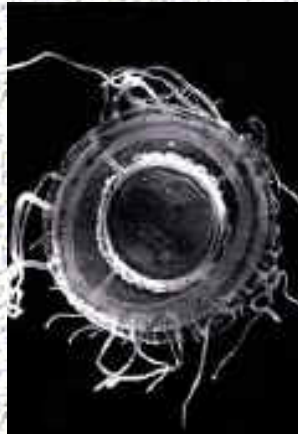


Photo 1. *Limnocyclus tanganyicae* coming from the Lake Tanganika and of which the present manubrium a bourgeonnement intense médusaire



Photo 2. *Limnocyclus tanganyicae* coming from the Mohasi lake. The manubrium carries gonads, but is deprived of buds. This present jellyfish in relation to the one of the Tanganika one more elevated number of tentacles arranged more regularly around the exombrelle

B. reproduction sexuée.

Limnocyclus tanganyicae is gonochorique. To to leave from April - May, appear of individuals sexuéses. Various authors already observed of jellyfishes sexually mûresdans the Tanganika lake

(GUNTHER, 1893-1894 and 1907, MOORE, 1903, LELOUP, 1951), as well as in the Mohasi lake (LELOUP, 1951)

We could observe the presence of eggs impregnated in the under - ombrellaire cavity of jellyfishes. The egg gives birth, probably, to a larva *planula* swimmer; he/it was us impossible to discover some, until now, in the plankton. On the other hand, we recovered her fixed on phragmites and presenting even no differentiation (Fig. 1a) In short, we observed his/her/its phases of transformation in a typical polyp (Fig. 1b).

IV. The Polyp.

Although observations have been made regularly in the north bay of the Tanganika lake, from the center of I' I. R. S. A. C., to Uvira, it is in the waters of the Mohasi that we found, in the first place, hydropolypeses of *Limnocoñida*.

The Mohasi lake, situated to the Ruanda, to an altitude of 1.900 meters, is little a lake deep (maximum depth, 13,80 ms) to quiet water of green color - dull, rich in plankton (PACKED DOWN, 1953).

We could return of it to us at the following times in September 1953, in February 1954 and nearly without interruption of end April until mid - August 1954. The first polyps have been harvested in the month of May. Thereafter, we have them recovered, in the quiet places of the coastal waters of the Tanganika, notably to the bottom of the bay of Burton. The polyp of the Tanganika, is similar the one of the Mohasi except in that that concern his/her/its size, the polyp of the Tanganika being slightly lower to the one of the, Mohasi

These polyps live in small tufts the quiet waters, but aired, to a depth (of 10 to 70 cm, coupled by their périderme basal to stems, (the phragmites. Of are often some - association with (the Bryozoaires Phylactolérnateses, of Sponges or the Hydreses among which they are tangled (Mohasi), what returns their particularly difficult discovery.

He/it is probable that the particular physical conditions of the Tanganika (agitation and depth of waters) prevent larvas swimmers to fix itself/themselves or to remain fixed on phragmitesses or all other support, except in places very sheltered, quiet and little deep, conditions achieved precisely in the bay (the Burton).

Polyps of *Limnocoñida tanganicae* are reduced to one non stalked gastric column of a size varying 0,10 to 0,50 mms and one diameter of 0,06 to 0,15 mms (Fig. 1 b, c, d). Lives, they are translucent. That hydropolype is surrounded with a thin périderme covered of rubbish. The périderme thickens in the region serving basilaire to the fixing. The head of the polyp, more or less bulged, present a hypostome to the summit of which opens up the mouth that is surrounded from two to three rows of buttons urticants, each containing 4 to 5, nématocystes (Fig. 2). Very ravenous and carnivorous, they feed themselves mainly of aquatic larvas (Chironomides) (Fig. 3).

We see therefore that the polyp of *Limnocoñida tanganicae* is in all point morphologically similar to the one of *Craspedacusta sowerbii*. All as this one, he/it presents three types of bourgeonnement: 1) the *bourgeonnement of growth*; 2) the *frustulation*; the *bourgeonnement médusaire*. The bourgeonnement médusaire makes himself however according to a slightly different process in the two kinds.



FIG.2 - Detail of the head of a polyp of *Limnocoñida tanganicae*, showing buttons disposed urticantses around the hypostome, to the summit of which the plugs. Some nématocysteses are évaginéses.

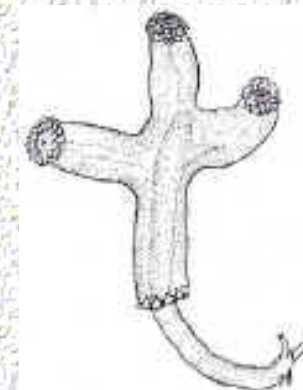


FIG. 3 - Colony of *Limnocoñida tanganicae* composée de four individuals. One among them absorbs a larva of Chironomide that is already partially committed in the general gastric cavity of the Colony.

1. Bourgeoisement of growth.

Every polyp of *Limnognida* can bud of new individuals under shape of lateral hernias (Fig. 1. d). One ever observes only one alone bud polypoidal at has time. To tea extremity of buds constitutes himself tea region hypostomiale. Blastozoideses don't leaves with their stump and form colonies of 2 to 7 individualses (Fig. 1 c and 3)

2. Frustulation

The phenomenon of frustulation is known for a long time at the HYDROÏDES: *Obelia*, *Campanularia*, *Corvinorpha*, and *Craspedacusta*. He/it was describes by BILLIARDS, 1904, PERSHS, 1933 and KUHLS, 1947,

Polyps give out frustuleses by two inflections or lateral partition pinches that isolate of the gastric column a small cylinder massive and capable didermique to move (Fig. 4) The frustule fixes himself by one extremity distale while au opposite pole organizes itself the head.



FIG. 4. - Colony of *Limnognida tanganyicae* composed of four individuals. One among them absorbs a larva of Chironomide that is already partially hired in the general gastric cavity of the colony

From this new polyp, build himself a colony. The frustulation seems to occur mainly on colonies of more than three individuals and especially at the time of the liberation of buds médusaires. PERSH, DEJDARS, KUHL, showed that frustuleses of *Craspedacusta* himself displace. Frustuleses of *Limnognida* are also probably capable of slip on the support. Anyway, frustuleses permit the fast population of a biotope and explain the abundance of jellyfishes in a lake as the Mohasi, where the shape jellyfish of *Limnognida* don't present a buds médusaires.

3. Bourgeoisement médusaire of the polyp.

Buds médusaireses generally appear on the colonies of 3 to 4 polyps. Faces 5 to 10 represent the various phases of development of the jellyfish. The face 5 shows us a colony composed of four individuals. Most powerful among them present, on the basis of the colony a light lateral thickening indicating the birth of a bud.

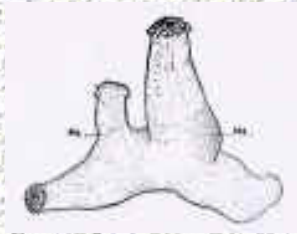
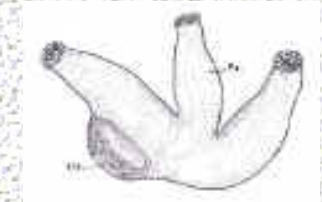


Fig. 5. of four polyps of which most powerful, to the center presents a hernia first indication of the bud médusaire.

Me. = bud, médusaire, Po. = polyp.

Bud médusaire is identical, in the beginning of his/her/its formation, to a bud polypodial. He/it starts under the shape of a boursouffure of the partition that turns into a hernia, donned of the périderme of the polyp. When the hernia is destined to give a jellyfish, she/it distinguishes herself/itself by the apparition of a cavity enclosed of origin ectodermique, the cavity under - ombrelleaire (Fig. 6).

Fig 6 - Colony of three polyps of *Limnocoñida tanganycae* Bourgeoisement médusaire to a stage more advanced, one already distinguishes, to the center of the bud under - ombrelleaire cavity covering the draft of the *manubrium* She/it is surmounted of the tentacular cavity where himself form tentacles. Me = bud médusaire, Po. polyp.



Cette cavity under - ombrelleaire covers the gastric cavity thus. As we told it previously, a third cavity comes soon to superimpose itself/themselves to under - ombrelleaire cavity. Us will call him the tentacular cavity (Fig. 6). Will appear subsequently the four channels radiaires and the circular channel (Fig. 7).

Bud médusaire includes three therefore superimposed cavities; the cavity gastric inclusive endodermique partially in the draft already obvious of the *manubrium* (Fig. 6), the cavity under -

ombrelle, of origin ectodermique that covers the *manubrium*, and in short, the tentacular cavity in which appears the draft of tentacles.

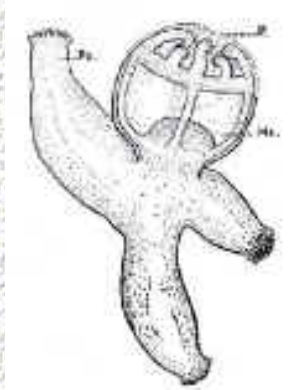


Fig. 7. ~ Médusc of *Limnocoñida tanganyicae* finishing his/her/its formation. The peduncle connecting it to the polyp himself takes in, channels radiaires and the circular channel are formed as well as the *manubrium*

Tentacles are always covered by the thin périderme of the polyp. Me = bud P. médusaire = Po périderme. - Polyp.

Bud médusaire is always donned by the thin périderme of the polyp. In such a way that the tentacular cavity " seems to only be delimited by the périderme

himself (Fig. 7 - 8). When this périderme apical tears itself, the, tentacles can spread and can grow.

On the other hand, the cavity under - ombrelle communicates with the outside and the jellyfish ends according to the very known processes. The peduncle connecting the bud to the

polyp pinches itself more and more, breaks himself then (Fig. 7-8-9).

The jellyfish is freed of the polyp. However, she/it detaches herself/itself of it not in succession. During a certain time, to the course of which she/it finishes his/her/its development, the jellyfish remains adhesive to the polyp by a muff of périderme (Fig. 9-10). By the rhythmic contractions of the parasol, the jellyfish escapes, free himself definitely to the time of his/her/its envelope péridermique and his/her/its polyp stump.



FIG 8. - The peduncle connecting the jellyfish, to the polyp shrinks greatly preparing his/her/its liberation. The polyp and bud médusaires are again surrounded (read périderme. Me. bud médusairepériderine, Po. polyp.

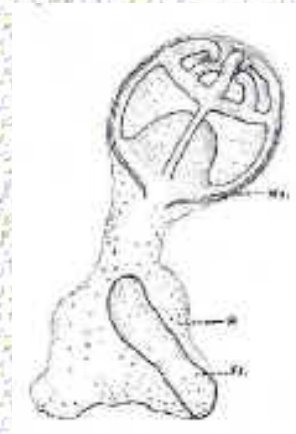


FIG. 9. - Medusa detached of the polyp, simple remaining attachée to that last by him, périderme The greatly reduced polyp turned into frustule. Fr. frustule, Me. = bud médusaire, P. = périderme, Po. polyp.

Elle starts swimming in full water.

The jellyfish so free (Fig. 10) measure about 0,45 mms of height and 0,40 mms of diameter. She/it possesses four channels radiaires, a channel, circular, a well developed ring marginal of nématocystes, 8 tentacles of which 4 radiaires, and 4 interradiaires. The *manubrium* is cylindrical and short; the mouth extensively open is circular.



FIG. 10. - Medusa nearly completely free, but adhering to the polyp again by a thin bridle of périderme. The polyp first reduced increased all over again and present three individuals adults and a bud of growth.

B. = bud of growth, Med. = jellyfish, P. = périderme, Po. = polyp.

Very rounded, she/it presents to this stage the aspect of one anthoméduse, aspect that she/it will lose besides during his/her/its growth. The polyp is exhausted by the bourgeonnement, is also Him greatly reduced after the liberation of the jellyfish. However he/it is capable either to increase all over again, and to give birth to new colonies (Fig. 10), either to turn into one or several frustules (Fig. 9). Some polyps give out frustules and buds at a time médusaires.

V. Conclusion.

Limnocrnida of the Tanganika lake and the Mohasi lake, takes origin therefore from a polyp.

His/her/its biologic cycle superimposes himself surprisingly to the one of *Craspedacusta sowerbii*. The polyp of which drifts *Limnocrnida* has the same structure that the one of *Craspe dacusta*. He/it presents the same phase of sexless reproduction, the bourgeonnement of growth, achieving small colonies, as at *Craspedacusta*. He/it propagates himself/itself asexuellement by frustules having the same behavior, the same destiny that those given out by polyps of *Craspedacusta*. Finally, he/it generates in the same way of jellyfishes sexuées organization that jellyfishes of *Craspedacusta*. The kind *Limnocrnida* differ however of *Craspedacusta sowerbii* by the following characters:

has) *At the jellyfish*, the formation of buds manubriaux not existing at *Craspedacusta*; *the*. Position of gonads on the *manubrium* of *Limnocoidea* while they are situated on channels radiaireses at *Craspedacusta*; the structure of sense organs different endodermiques in the two kinds.

b) *At Polyps*, the bourgeonnement médusaire takes place according to the different modes in the two kinds, notably with regard to 1 has formation of tentacles and the *manubrium*

The phylogenetic affinities of these hydropolypeses of soft water (*Craspedacusta Limnocoidea*) will be able to be established definitely that by a survey histologique, object of our present studies.

15 January 1955.

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