Trichodinid Ciliates (Peritrichida: Urceolariidae) from Some Marine Fishes

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Abstract. One of the most widely distributed ectoparasitic trichodinids from marine fishes is *Trichodina rectuncinata* Raabe invading 19 various hosts in different geographical regions. Similarly frequent on marine hosts is *Trichodina ovonucleata* Raabe exhibiting marked morphological variation (also in the extent of development of the adoral ciliary rows) in populations from different hosts. A trichodinid population tentatively assigned to the species *T. borealis* Shulman et Shulman-Albova was found on the gills of *Isistilenius zebra* from Hawaii. *T. jadranica* is recorded from *Callionymus lyra* from the Brittany coast of France; a different population of this species allotted to a new subspecies (*T. jadranica* subsp. *noblei* subsp. n.) was found on *Eleotris sandwicensis* from Hawaii. Another new subspecies, *T. cottidarum* subsp. *oligocotti* subsp. n. was proposed for a population from *Oligocottus maculosus* from the Pacific. From the latter host, a new species was established under the name of *T. lairdi* sp. n. *T. parvula* sp. n. is being described from *Dasycottus setiger* from the same Pacific locality. An accurate interpretation of mutual kinship of separate trichodinid populations is still the most important problem in taxonomy of trichodinid ciliates. Taking into consideration the low host specificity of numerous *Trichodina* species and a wide geographical distribution of many of them, only morphology is to be relied upon in classifying the separate species. Closely related species or even subspecies may occur on not so closely related or even on taxonomically remote hosts.

One of the most distributed and yet still little known groups of parasitic protozoans from marine fish are the urceolariiid ciliates of the subfamily Trichodininae. While the knowledge of the freshwater trichodinids is increasing, species from marine environment have been rather neglected. This is evidently due, among other things, to technical difficulties. The use of the only method which can reveal taxonomically important characters of these ciliates—Klein's silver impregnation technique—has been hampered by the presence of chlorides in sea water. By means of an improved procedure we are, however, able to accomplish fairly satisfactory results with this technique.

This paper presents the results obtained in the study of trichodinids from marine fishes collected on several different localities. We hope it to be one of a series that will contribute to span at least the widest gaps in our knowledge of these ciliates.
MATERIAL AND METHODS

In the years of 1964 to 1966 during short visits to several biological stations located on the coast of France and of United States we had the opportunity to study the trichodinids from the local marine fishes, viz., Institut de Biologie Marine de l'Université de Bordeaux in Arcachon, France; Station biologique de l'Université de Paris in Dinard, France; Friday Harbor Laboratories of the University of Washington, U.S.A., and Institute of Marine science in Woods Hole, U.S.A. I am deeply appreciative of the opportunity for my study I was afforded at these institutions. My special thanks are due to Prof. de Puytorac for arranging my visit in Arcachon, to Prof. J. M. Doby who took care of my visit in Dinard; further, to Prof. R. Fernald, Director of the Friday Harbor Laboratories and Prof. G. Holz who was kind enough to arrange my visit in Woods Hole.

The ciliates scraped off the surface of living fishes by gentle strokes of a scalpel, were first examined in living state. Afterwards, Klein's silver impregnation technique was carried out to reveal details of the adhesive disc, in addition to the Piekarski-Robinow or haematoxylin method to show the shape of nuclei. Klein's technique as used for marine trichodinids was described in detail in our earlier paper (LOM and LAIRD 1969).

RESULTS

Trichodina rectuncinata Raabe, 1958

Hosts and localities: gills of Blennius pholis from Dinard, Brittany coast of France (all specimens moderately invaded); gills of Hippocampus guttulatus from Arcachon, Atlantic coast of France (all specimens moderately invaded). T. rectuncinata was also found on a syn-type slide of a mixed infection of T. decipiens Laird and T. vancouverense Laird, which Dr Laird has kindly lent me; the host was Artemia fenestrata from the Pacific coast of Canada at Nanaimo, B.C.

Dimensions of the ciliates from the first two hosts are summarized in Tab. 1. T. rectuncinata is at first sight conspicuous by its triangular shape of denticles and thus it may be well identified even on non-impregnated preparations. The insufficient data on T. bidentata, described by Fabre-Domergue in 1888, prevent us from identifying T. rectuncinata as a junior synonym of T. bidentata, because of conspicuously similar denticle shape.

Dimensions of ciliates from all populations recorded hitherto more or less coincide. Only in population from Bleilinus pholis the maximum value of denticle number is rather high, as well as the diameter of the adhesive disc and denticulate ring.

This species is the most widely distributed marine trichodinid known thus far; described from Adriatic Sea from Blennius ocellatus, B. tentaculatus, B. pavo, Gobius ophiocephalus (RAABE 1958, also HAIDER 1964), it was later found in Black Sea (Gaidropsarus mediterraneus — LOM 1962; Odontogadus merlangus euxinus, Blennius sanguinolentus, Crenilabrus griseus, C. quinquemaculatus, C. tineca, Symphodus scina, Ctenolabrus rupestris — ZAIKA 1966). Our present findings increase the number of hosts from different oceans to 15. The possible occurrence of different forms on some of the different hosts should be kept in mind, though at present we do not think—contrary to ZAIKA 1966—that we could distinguish any well differentiated taxonomic forms in the material recorded so far.
Trichodina lairdi sp. n. (Plate I, Figs. 2–4)

Host: gills of Oligocottus maculosus; about three fourth of fish investigated was found to be infected. Locality: tide pools in the vicinity of Friday Harbor Laboratories on San Juan Island, Pacific coast of Washington State, U.S.A.

This species is characterized by a large clear area in the center of the adhesive disc, dotted by dark, irregular granules. Denticles have elongated blades, distinctly longer than the thorns, and are set closely one to another. Dimensions of individual parts of the body are summarized in Tab. 1.

There are not many species which exhibit distinct affinities to this Trichodina. T. melanogrammi has similar dimensions as well as denticle number; unfortunately, it is so poorly described that any further comparison is hardly possible. This applies also to T. halli, which is of similar size. The appearance of the central clear area reminds immediately of T. domerguei; closer examination reveals essential differences—denticles have different shape, much longer blades, their number as well as body dimensions are larger than in the type subspecies T. domerguei subsp. domerguei. The dimensions relate T. lairdi also to T. domerguei f. maris-albi; however, in other respects both are quite different. Other trichodinids with the central clear area (T. fultoni etc.) are also quite at variance.

The species under question seems to be identical with the “giant forms” mentioned by Laird (1961) on describing T. decipiens found similarly on a tide-pool fish Arctedias fenestralis at Nanaimo, a locality not too remote from San Juan Island. Though Laird does not give the silver impregnated image of his “giants”, his accurate drawings of the denticle shape speak in favour of such identification as well as the length of the blade (10 μ). Number of radial pins (13) and diameter of the denticulate ring reaching up to 38 μ. We propose to establish this species as a new one, and since Dr. M. Laird was the first to observe it, we name it T. lairdi sp. n.

Trichodina cottidarum subsp. cottidarum subsp. n. (Plate I, Fig. 5)

Host: gills of Oligocottus maculosus; 100% infection, often mixed with the preceding species. Locality: the same as in the preceding species.

The morphology of the adhesive disc of this species is demonstrated on Pl. I, Fig. 5; measurements are summarized in Tab. 1. This Trichodina reveals a close relationship to T. cottidarum (—see redescription of this species in Lom and Laird 1969). There are, however, significant deviations in the shape of denticles: the blades of denticles are not as elongated as in the preceding species; the thorns are as long as in populations of T. cottidarum from Myoxocephalus octodecemspinosus, yet they are straight, gradually tapering to the end. This seems sufficient enough to disprove a complete identity with T. cottidarum, in which the blades are always longer and less crescent shaped, though there may be variation in the length of the thorn in populations from different hosts. We may suppose that T. cottidarum is
Table I. Summary of important data on ten species of trichodiniids.

All of them occur on gills of their hosts. Not expressly stated are the degree of development of marginal cilia and velum, since they do not vary considerably enough to warrant specific distinction. The adoral spiral slightly exceeds 360° in all of them, too. Denticles are measured in the following way: them — length from the tip to the border of the central part of the denticle; central part — width of the central conical part of the denticle; blade — length of the tip to the outer border of the central part; length — distance between the fore rim of the blade and the distal end of the central conical part (see Lom 1958; Welldorn 1967). Symbols indicating the position of microcilia in relation to macronucleus: (+y) — macronucleus outside one end of the macronuclear horseshoe; (−y) — macronucleus facing the very tip of one end of the macronucleus; (−y′) — macronucleus on the inner side of one end of the macronucleus.

<table>
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<tbody>
<tr>
<td><strong>Locality</strong></td>
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<tr>
<td></td>
<td>Arcachon — Atlantic coast of France</td>
<td></td>
<td>Dinard — France, The Channel</td>
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<tr>
<td><strong>Diameter of the body</strong></td>
<td>34 (29-40) µ</td>
<td>37 (31-41) µ</td>
<td>86 (75-99) µ</td>
<td>42 (36-48) µ</td>
<td>35 (30-39) µ</td>
<td>32 µ</td>
<td>35 (41-43) µ</td>
<td>52 (36-60) µ</td>
<td>90 (42-52) µ</td>
<td>36 (28-41) µ</td>
</tr>
<tr>
<td><strong>adhesive disc</strong></td>
<td>26 (23-29) µ</td>
<td>30 (27-35) µ</td>
<td>70 (59-81) µ</td>
<td>33 (29-35) µ</td>
<td>27 (23-30) µ</td>
<td>25-28 µ</td>
<td>28 (25-35) µ</td>
<td>40 (23-48) µ</td>
<td>37 (33-40) µ</td>
<td>27 (22-31) µ</td>
</tr>
<tr>
<td><strong>macronucleus</strong></td>
<td>24 µ</td>
<td>28 µ</td>
<td>46 µ</td>
<td>33 µ</td>
<td>25 µ</td>
<td>30 µ</td>
<td>32 µ</td>
<td>42 µ</td>
<td>36 µ</td>
<td>30 µ</td>
</tr>
<tr>
<td><strong>Number of denticles</strong></td>
<td>24 (21-26)</td>
<td>27 (23-29)</td>
<td>33 (30-33)</td>
<td>24 (23-27)</td>
<td>21 (20-23)</td>
<td>18-21</td>
<td>23 (21-24)</td>
<td>25 (23-28)</td>
<td>27 (25-30)</td>
<td>22 (18-21)</td>
</tr>
<tr>
<td><strong>Number of radial pins to one denticle</strong></td>
<td>6</td>
<td>6 (3)</td>
<td>12</td>
<td>8 (6-8)</td>
<td>6-7</td>
<td>6</td>
<td>7-8</td>
<td>8</td>
<td>7-8</td>
<td>6-7</td>
</tr>
<tr>
<td><strong>thorn</strong></td>
<td>3-3.5 µ</td>
<td>4.5 µ</td>
<td>8-10 µ</td>
<td>4 µ</td>
<td>4 µ</td>
<td>4 µ</td>
<td>4-3.5 µ</td>
<td>4 µ</td>
<td>4-3 µ</td>
<td>2.2-3 µ</td>
</tr>
<tr>
<td><strong>Dimensions blade</strong></td>
<td>2 µ</td>
<td>2.5 µ</td>
<td>4 µ</td>
<td>6 µ</td>
<td>2.5 µ</td>
<td>3 µ</td>
<td>2-3 µ</td>
<td>4 µ</td>
<td>2.5-4 µ</td>
<td>2-2.8 µ</td>
</tr>
<tr>
<td><strong>of a denticle: central part</strong></td>
<td>1.2-1.5 µ</td>
<td>2 µ</td>
<td>3 µ</td>
<td>1.5 µ</td>
<td>1.5 µ</td>
<td>2 µ</td>
<td>1.3 µ</td>
<td>1.8-2 µ</td>
<td>1.5 µ</td>
<td>1.2 µ</td>
</tr>
<tr>
<td><strong>length</strong></td>
<td>3.5-6 µ</td>
<td>5 µ</td>
<td>10 µ</td>
<td>6.5 µ</td>
<td>5.5 µ</td>
<td>4.5 µ</td>
<td>5.6 µ</td>
<td>4.5-5 µ</td>
<td>4 µ</td>
<td>4 µ</td>
</tr>
<tr>
<td><strong>Width of the border membrane</strong></td>
<td>3 µ</td>
<td>3 µ</td>
<td>7 µ</td>
<td>3 µ</td>
<td>3 µ</td>
<td>2.5 µ</td>
<td>2</td>
<td>2.4 µ</td>
<td>2.5 µ</td>
<td>2.5 µ</td>
</tr>
<tr>
<td><strong>Dimensions of microcillum and its position</strong></td>
<td>3x2 µ + y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1x1.5 µ + y</td>
</tr>
</tbody>
</table>

Unidentifiable
a large species comprising many mutually different subunits. The population just described may be regarded as one of them—*T.cottidarium* subsp. *oligocotti* subsp. n., i.e., a separate subspecies.

**Trichodina parvula** sp. n.  
(Plate II, Figs. 1–3)

Host: gills of *Dasyatis setiger*; most of the fishes were found to be infected. Locality: Friday Harbor Laboratories, coast in the proximity of the laboratory.

This species was very difficult to impregnate with silver. After impregnation, the center of the adhesive disc is dark; denticles are characterized by sharply pointed thorns and blades and by a relatively stout central conical part. The shape of denticles reminds of *T. ovonucleata*. Existing descriptions of marine trichodinids yield not many related species to compare with our species. *T. cottidarium* is larger and has a different shape of denticles. The same applies to *T. decipiens* Laird. In *T. vancouverense*, though there may be some resemblance, the denticles have distinctly different shape and particularly less massive thorns (— according LAIRD’s 1961 drawings). *T. jarmitae* and *T. elisabethae* do differ, too, in the dентicle shape. Being unable to identify this species with any of the existing ones, we propose to establish it as *T. parvula* sp. n.

On the gills of *Radulinus aspellus* from the same locality we find rather scarce infections of a ciliate, reminding to a great extent the preceding *T. parvula*. A comparison with existing findings (as thorough as the rather scarce material permitted) proved that the closest relative of this ciliate would be *T. parvula*, indeed (Plate I, Fig. 4). However, our material being not numerous enough for a due comparison, our identification is pending further corroboration.

**Trichodina sp.**  
(Plate II, Figs. 5, 6)

Host: gills of *Myoxocephalus octodecemspinosus*, all specimens were rather heavily invaded. Locality: Woods Hole, Mass., U.S.A.

Morphology of the adhesive disc of this species is very similar to the preceding *T. parvula* sp. n. Dimensions are summarized in Tab. 1, and they are also almost identical with *T. parvula* sp. n. The thorns of denticles in most of the specimens are much finer and the ends of blades are not sharply pointed. In part of the specimens, however, the denticles do resemble *T. parvula* sp. n. The variability of the dентicle shape has a rather wide range and a study of further material is necessary to find out, if these populations from *Myoxocephalus octodecemspinosus* represent an aberrant form of *T. parvula*, or if they are perhaps a separate taxonomic entity.

**T. domerguei** subsp. cf. *domerguei*  
(Plate III, Figs. 1, 2)


The dimensions are summarized in Tab. 1. Though somewhat smaller, this species complies with *T. domerguei* subsp. *domerguei* in the morphology of the adhesive disc—the central clear area with dark dots, the shape and number of
stout denticles are also almost the same. It is far more related to this type subspecies of *T. domerguei* than e.g., *T. domerguei* subsp. *saintjohnsi*; yet we are not sure enough to consider it identical, because of somewhat smaller dimensions and smaller number of radial pins. Unless more comparative material is accumulated, we designate it as *T. domerguei* subsp. cf. *domerguei*.

*T. cf. borealis* Shulman et Shulman—Albova, 1953

(Plate III, Figs. 3, 4)


Preparations—untreated dry smears—with these ciliates were kindly placed at my disposal by Prof. T. R. Noble, to whom I express my sincere appreciation.

The dimensions are summarized in Tab. 1. The species is characterized only by the central clear area of the adhesive disc. Here we find close similarities to *T. borealis* sensu Raabe 1959, and to a certain extent, also to *T. jadranica* Raabe and to *T. domerguei* f. indet. Lom from *Crenilabrus griseus*. We are not going to compare the species under consideration with records of unimpregnated trichodinids of similar size of body organelles—*T. liparisi* Zhukov 1964 or *T. borealis* in Stein’s 1967 description etc., since we probably will never know what species these authors were really dealing with. Most similar is *T. borealis* sensu Raabe 1958 except for the smaller denticle number. *T. jadranica*, in addition to the smaller denticle number has smaller body dimensions and so does *T. domerguei* f. indet. Lom. *T. borealis* from Pleuronectes in Dogiel’s (1940) original description has the denticle number almost identical with our ciliate. For the time being, however, we can not be sure that Dogiel’s was the same ciliate as Raabe’s *T. borealis*. Since no positive evidence is available, a working designation as *T. cf. borealis* seems to be the best solution of the taxonomic position of this ciliate until more impregnated material is known, especially of typical *T. borealis*.

*T. jadranica* (Raabe, 1958) Lom and Laird, 1969

(Plate IV, Figs. 1–4)

*Host:* gills of *Callionymus lyra*, 100% invasion. *Locality:* Dinard on the Brittany coast of France.

The species is again characterized by the appearance of its adhesive disc; the dimensions of body organelles are summarized in Tab. 1. The ciliate has no other diagnostically important features.

We can not compare it with trichodinids described without the use of silver impregnation technique, although the dimensions and counts might be similar (*T. abomae*, *T. arctica* Zhukov, *T. cottidarium* f. *alceichthys* Polyansky etc.). However, a comparison with Raabe’s (1958) and Zaika’s (1966) descriptions and silver impregnated pictures reveals its identity with *T. domerguei* f. *gobii* which has to be considered (Lom and Laird 1969) identical with *T. jadranica* (Raabe) (= *T. domerguei* f. *jadranica* Raabe, 1958).

A very weak invasion by this ciliate was also found on the gills of *Liparis cyclopus* from San Juan Island. Morphology and dimensions and counts of several specimens we could investigate in full completely agree with *T. jadranica* (Raabe).
Plate. V. Figs. 1—2. Impregnated adhesive discs of *T. jadranica* subsp. *noblei* subsp. *n.* Fig. 1. Typical specimen. Fig. 2. Rather aberrant specimen. Figs. 3—7. *Tripartiella globonucleata*. Fig. 4. Part of the denticulated ring of a specimen from *Radulinus asperrus*. Figs. 5—6. Two specimens from *Hippocampus guttulatus*.

*T. jadranica* subsp. *noblei* subsp. *n.* (Plate IV, Figs. 5, 6, Plate V, Figs. 1, 2)

Preparations with these ciliates—dry untreated smears—were kindly supplied by Prof. E. R. Noble, to whom I should like to express my sincere appreciation.

These ciliates closely resemble *T. jadranica*. The dimensions are almost the same, the dentine number is only slightly elevated. The shape of denticles is significantly different—the thorns are shorter, wider and straight, not slightly crooked as in
Table 2. Summary of important data of *Trichodina ovonucleata* and *Tripartiella globonucleata*.

<table>
<thead>
<tr>
<th></th>
<th><em>Trichodina ovonucleata</em> Raabe, 1958</th>
<th></th>
<th><em>Tripartiella</em> (Paratrichodion)</th>
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<tbody>
<tr>
<td>Author</td>
<td>Raabe 1958</td>
<td>Zaika 1966</td>
<td>present findings (see)</td>
</tr>
<tr>
<td>Host</td>
<td>Rhenia tentaculata</td>
<td>Ophidion roehni, Crenilabrus griseus</td>
<td>Rudulinus asperillus, Dasyroctus setiger</td>
</tr>
<tr>
<td>Locality</td>
<td>Adriatic Sea, Split and Rovinja</td>
<td>Black Sea—Sevastopol</td>
<td>San Juan Island, Pacific coast</td>
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<tr>
<td>Diameter of the body</td>
<td>27–40 µm</td>
<td>27–28 µm</td>
<td>24–33 µm</td>
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<tr>
<td></td>
<td>25 (21–30 µm)</td>
<td>25 (22–32 µm)</td>
<td></td>
</tr>
<tr>
<td>adhesive disc</td>
<td>20–28.5 µm</td>
<td>22–26 µm</td>
<td>17–19 µm</td>
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<tr>
<td></td>
<td>20 (17–25 µm)</td>
<td>18 (16–19 µm)</td>
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</tr>
<tr>
<td>denticulate ring</td>
<td>11–17 µm</td>
<td>18–21 µm</td>
<td>16–17 µm</td>
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<tr>
<td></td>
<td>12 (10–14 µm)</td>
<td>11 (9–11 µm)</td>
<td></td>
</tr>
<tr>
<td>Number of denticles</td>
<td>18–21</td>
<td>22–25</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>18 (16–20)</td>
<td>19 (17–23)</td>
<td></td>
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<tr>
<td>Number of radial pins to one denticle</td>
<td>7</td>
<td>5–6</td>
<td>5–6</td>
</tr>
<tr>
<td></td>
<td>2.5 µm</td>
<td>1.8 µm</td>
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<tr>
<td>thorn</td>
<td>–</td>
<td>–</td>
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<tr>
<td>Dimensions of a denticle:</td>
<td>central part</td>
<td>–</td>
<td>1.7 µm</td>
</tr>
<tr>
<td></td>
<td>blade</td>
<td>–</td>
<td>2 µm</td>
</tr>
<tr>
<td></td>
<td>length</td>
<td>–</td>
<td>1.4 µm</td>
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<tr>
<td></td>
<td></td>
<td>–</td>
<td>1.3 µm</td>
</tr>
<tr>
<td>Width of the border membrane</td>
<td>–</td>
<td>2–2.5 µm</td>
<td>2.5 µm</td>
</tr>
<tr>
<td>Size of the macronucleus</td>
<td>14×7–8 µm</td>
<td>9–10×16–19 µm</td>
<td>5–9×8–13 µm</td>
</tr>
<tr>
<td></td>
<td>9–12×16–19 µm</td>
<td>8–11×14–19 µm</td>
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<tr>
<td>Size of the micronucleus</td>
<td>3×1.5 µm</td>
<td>2.5×1.1 µm</td>
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<tr>
<td></td>
<td>2.5 µm</td>
<td>1×1.5 µm</td>
<td></td>
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<tr>
<td>Adoral ciliary spiral</td>
<td>360º</td>
<td>–</td>
<td>360–330º</td>
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<td></td>
<td></td>
<td>300–330º</td>
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*) aberrant measurement of the denticulate ring, not diameter central part to central part of the denticle, but tip of the blade

*T. jadranica.* Blades are more elongated and less crescent-shaped. The nucleus is more stubby, being in form of a bent sausage rather than horse-shoe shaped. Because of these differences and on the other side, because of the general similarity to *T. jadranica*, we propose to classify this species as *T. jadranica* subsp. *nobilis* subsp. *n.*
(See legend to the Tab. 1.)

**T. raabei Lom, 1962**


These specimens were identical with those originally described from *Pleuronectes flesus* from the Black Sea (Lom 1962), both in morphology of the adhesive disc and in dimensions of all body organelles.
**Tripartiella (Paratriochodina) obliqua** Lom, 1963

Host: gills of *Trigla lucerna*. Locality: Dinard, Brittany coast of France.

The invasion was a weak one, but still it was sufficient enough to state the complete identity with type population of *T. (P.) obliqua* described earlier from the Black Sea (Lom 1962).

Prof. E. R. Noble has kindly sent me slides with trichodiniids from the gills of *Butis amboinensis* from Manila. They were haematoxylin stained, so that the image of silver impregnated adhesive disc could not be available. However, the morphology of denticles as well as all other features of this ciliate remind strongly of *T. (P.) obliqua*. The diameter of the adhesive disc was 20 μ (19–24), of denticulate ring 10 μ (8–12), the average number of denticles was 25 (range from 21 to 31).

**Trichodina ovonucleata** Raabe, 1958  
(Plate V, Figs. 3–7)

Populations alloted to this species were found on 5 species of fish from Friday Harbor Laboratories surroundings and from Arcachon (Tab. 2).

Populations of this ciliate invade quite a number of fish from different localities. The principal morphological features are the uncomplete adoral spiral, shape of denticles and oval form of macronucleus and, finally, small body dimensions. Populations from different hosts all have the same shape and almost the same size of macronucleus; the shape of denticles seems to vary to certain extent in separate populations. E.g., populations from *Ophidion barbatum* from the Black Sea (Lom 1962) have relatively shorter thorns than those from *Hippocampus*. The shape of blades of denticles may vary a little even within the same population: in some individuals its end is sharply pointed, in others more blunt. More important is a distinct variation in the length of the adoral spiral of cilia. While in ciliates from *Gaidropsarus mediterraneus* the spiral makes a turn of 220°, in ciliates from *Ophidion barbatum* 220–270° (Lom 1962) in populations from *Crenilabrus nassa* it is 280°, in populations from *Asterolechea 310°*, in *Hippocampus*-ciliates 315°, and, finally, in populations from *Radulinus asperrulus* and *Dasycottus* the spiral makes a turn of 300 to 330°.

*T. ovonucleata* was described originally by Raabe (1958) from Adriatic blennies. Raabe presented an illustration of the oral face of the ciliate showing a complete adoral ciliary spiral slightly exceeding 360° like in a typical *Trichodina*. The shape of denticles and dimensions of the body and nucleus are very similar, almost identical to *Tripartiella (Paratriochodina) globonucleata* which was a species established by Lom (1962) for population of ciliates with an uncomplete adoral ciliary spiral (= accordingly a *Tripartiella*) from the gills of *Ophidion barbatum* and *Gaidropsarus mediterraneus*. The difference in adoral ciliary spiral—a feature important in trichodinid taxonomy—made it impossible at that time to identify both species.

If Raabe has really correctly seen the adoral ciliature—and we are right in supposing this author really had—it means that different populations of *T. (P.) globonucleata* and Raabe’s *T. ovonucleata* all form a series of almost overlapping
populations of one variable species, differing in the degree of development of the adoral ciliary zone. Zaika (1966) described populations of *T. oronucleata* from two hosts from the Black Sea as *f. gracilis* and *f. subtilis*. Unfortunately, he did not pay closer attention to the extent of the adoral ciliary spiral, and thus Raabe's population from *Blennius tentaculatus* is so far the only one known to have a complete turn of the adoral spiral.

We propose to accommodate, for the time being, all mentioned populations within a polytypic species *T. oronucleata* Raabe as separate subspecies as it is the case in *T. domerguei*, *T. cottidarum* and others. *Tripartiella (Paratrichodina) globonucleata*,

Because of the priority law, has to be synonymized as *T. oronucleata* subsp. *globonucleata*. However, for other populations dealt with in this paper the designation as separate subspecies could be postponed until more potential intermediary populations are found and a more complex understanding of this species could be achieved.

Consisting of populations with differing extent of the adoral ciliary spiral—not to mention the minor differences of the adhesive disc—this species constitutes a rather unique case in the family Ureocloidae. This variation can hardly be interpreted against the taxonomic concept of the ureocelarian subfamily Trichodininae in which the extent of the adoral zone is one of the chief differential criteria (Raabe 1963, Lom 1963— a series *Trichodinella* with the extent of the spiral reaching about 180°, *Tripartiella* 180—270°, *Trichodina* about 360°, *Vauclomia* 720° and more) since it is exceptional. In all other species of ureocelarians the variation in adoral spiral length is just insignificant. However, it is good to keep the possibility of variation in mind and avoid going in too fine distinction according to the extent of the adoral spiral (e.g., *Polyanskina, Paravauchomia*—Raabe 1963).

**CONCLUSIONS**

In the taxonomy of fish parasitizing trichodinids, the proper description and identification of species and an accurate interpretation of mutual relations of separate trichodinid populations still remain the most topical problems.

1. A proper description of marine fish trichodinids may be more difficult than of freshwater ones due to special precautions necessary for performing the indispens-
able Klein’s silver impregnation technique (Lom and Laird 1969). It should not be, however, a serious problem.

An important thing to consider on characterising a trichodiniid is the morphological variability of the adhesive disc. Though quite constant in some species, its morphology may vary considerably in others. Trichodinids from individual hosts of the same fish school may exhibit strong variation of the adhesive disc (Lom and Stein 1966) or the appearance of the disc may vary in the course of the year (Kazubski 1968). Therefore for a proper identification it is advisable to investigate at least several hosts, and, if possible, during long periods of time. In our material, because of limited time, we could not follow the possible seasonal variation in the morphology of the disc. The seasonal variation has been recorded in freshwater fishes (Kazubski, op. cit.); in trichodinids from marine fishes evidence is still lacking for such variability, however these organisms are less subject to seasonal changes, if at all. In freshwater fishes, the changing conditions of the fish affect the invasion intensity (Lom 1961) and also can change the morphology to a certain extent (Kazubski, op. cit.).

A proper method of identification reveals interesting facts on the distribution and host specificity of these ciliates. We find that e.g., T. rectuncinata is able to invade 15 species of fish belonging to 6 different families and 3 orders in different parts of the world ocean. More hosts are surely to be expected. This species is a marine counterpart of freshwater T. nigra, T. acuta or T. fultoni, also of a low host specificity.

2. In the present stage of research, one can hardly be quite sure of the correct attribution of a complex of populations to specific or subspecific rank. There should be always a proper relation between the categories. It is impossible to continue allotting two quite different ciliates as forms or subspecies of a single species only because of the central clear area of the disc and at the same time to distinguish as separate species two populations, differing mutually much less in the denticle shape, in dimensions, and other features but lacking this clear center of the disc. We tried to re-establish a proper nomenclatural relation of species in a previously published list of species of marine trichodinids (Lom and Laird 1969).

Separating the populations into specific or subspecific rank (the latter is preferable to “forma”), serves at this still initial stage of research to arrange the vast number of ciliates into a system which should clearly reveal, after sufficient material has been examined, their actual kinship. And then it will be perhaps possible to understand trichodinid speciation.

Thus far, apart from well separated species of marine trichodinids (e.g., T. caspialosae) we find others which will evidently consist of a group of closely resembling ecological subspecies—T. jadranica Raabe, T. domerguei Wall. and T. cottidarum (Dogiel), to quote some marked examples.

At present, we prefer the subspecies solution to a superspecies concept. The latter would require more positive evidence in favour of species rank of separate populations. The objection that it does not seem advisable to describe separate
Plate 1. Fig. 1. Impregnated adhesive disk of a typical specimen of *Trichodina rectuncinata* from *Hippocampus guttulatus*. Figs. 2 - 4. *Trichodina lairdi* n. sp. Fig. 2. A typical specimen; denticles have short, bluntly pointed thorns. Fig. 3. Denticle at a higher magnification. Fig. 4. Specimen of *T. lairdi* with somewhat longer thorns. Fig. 5. A typical specimen of *T. cottidarium* subsp. *oligocoti* subsp. n.
Plate II. Figs. 1–3. Impregnated adhesive discs of *Trichodina parvula* n. sp. Fig. 4. *T. cf. parvula* from *Radulinus asprellus*. Figs. 5–6. *Trichodina* sp. from *Myxocephalus octodecemspinus*. 
Plate III. Figs. 1–2. Impregnated adhesive discs of *T. domerguei* subsp. *domerguei* from *Knophrys bison*. Figs. 3–4. *T. cf. borealis* from the gills of *Istiblemmius zebra*. 
Plate IV. Figs. 1—4. Impregnated adhesive discs of *T. jadranica* from the gills of *Calyxynus lyra*
Figs. 1, 2. Typical specimens. Fig. 3. A ciliate with rather broad thorns of denticles. Fig. 4. A ciliate with narrow thorns of denticles. Figs. 5—6. *T. jadranica* subsp. *noblei* subsp. n. Fig. 5. A specimen soon after division with denticles not fully formed. Fig. 6. A typical specimen.
populations, living on unrelated hosts in remote areas, as subspecies of the same species, is invalid because of the wide distribution of some trichodinids, as mentioned earlier in this paper.

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