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TWO DIGENETIC TREMATODES OF A MARINE FISH, *KYPHOSUS CINERASCENS* (FORSKAL), FROM THE GULF OF MANNAR WITH A NOTE ON THE SYSTEMATIC POSITIONS OF THE GENERA *ENENTERUM* LINTON, 1910, *CADENATELLA* DOLLFUS, 1946 AND *JEANCADENATIA* DOLLFUS, 1946

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ABSTRACT

Two new species, *Enenterum mannarense* and *Jeancadenatia dollusi*, collected from the marine fish, *Kyphosus cinerascens* (Forskål) from the Gulf of Mannar, are described. The genera *Enenterum* Linton, 1910 and *Jeancadenatia* Dollfus, 1946 are reported for the first time from India. Contrary to the opinion of Nahhas and Cable (1964) and concurrence of Overstreet (1969), the genera *Cadenatella* and *Jeancadenatia* are considered distinct from each other on the basis of structural pattern of the oral lobes, body form, and absence or presence of long esophagus. Thought has also been given to the much disputed problem regarding the family allocation of the genera *Enenterum*, *Cadenatella*, and *Jeancadenatia* in view of the new facts mentioned in the paper.

During the survey of the Gulf of Mannar, three specimens of digenetic trematodes were recovered from the intestine of the fish, *Kyphosus cinerascens* (Forskål), at Tuticorin. One of them belongs to the genus *Enenterum* Linton, 1910 and the remaining two (one immature and the other adult) to *Jeancadenatia* Dollfus, 1946. The two genera are reported for the first time from India. Specimens of *Kyphosus cinerascens* occur in the catches of shore seine and hook and line between October and March. This fish is a coral inhabitant and is not found in abundance.

All measurements are in micrometer unless otherwise stated. The drawings have been made with the aid of a camera lucida.

Family ENENTERIDAE Skrjabin and Koval, 1966
Subfamily ENENTERINAE Yamaguti, 1958

Enenterum mannarense n. sp.

(Fig. 1)

Host *Kyphosus cinerascens* (Forskål), (Pisces : Kyphosidae)
Location : Intestine
Locality : Tuticorin (Gulf of Mannar), India
Number of specimens : 1, collected on November 9, 1975
Specimen deposited : Z. S. I. Reg. No. W 7297/1

Description : Body 9.439 mm long measured from tip of oral lobes, 1.238 mm wide, elongate, slightly tapering anteriorly, posterior

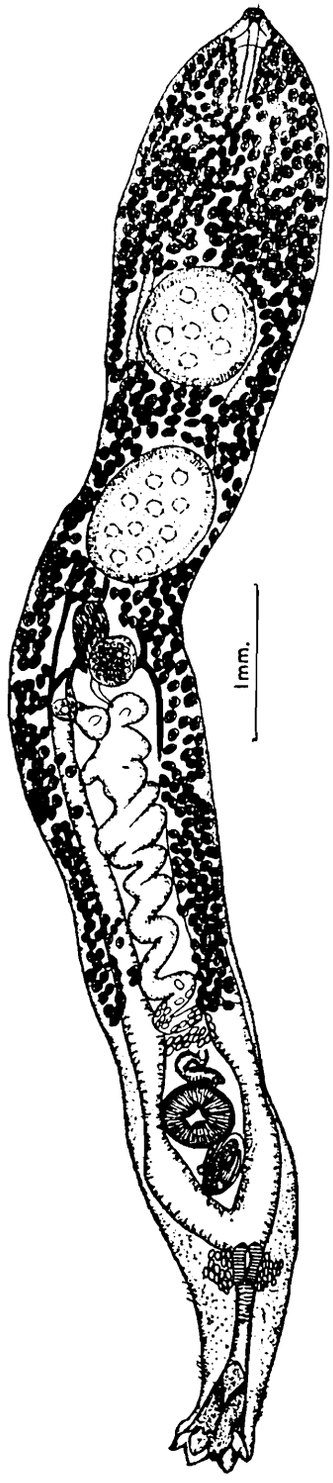

Fig. 1 *Enenterum mannarense* n. sp. Ventral View.

portion broad, end pointed. Tegument spinose, seen only in anterior region, probably lost during processing from rest of body. Acetabulum 413 long, 468 wide, spherical, situated at 2.145 mm from anterior end of body. Oral sucker funnel-shaped, terminal, directed anteriorly, 701 long, 481 wide, margin produced into five basic muscular conical broad-based lobes (one ventral, one on each side, two dorsal), ventral lobe notched into two to give a total of six lobes. Prepharynx 536 long, wide : pharynx 234 long, 193 wide, muscular, pear-shaped ; esophagus absent , intestinal bifurcation immediately behind pharynx ; ceca wide, extending laterally, united near posterior end of body ; anus opening near posterior end of body.

Testes two, entire, tandem, situated in posterior part of body, anterior testis 921 long, 688 wide, posterior testis 784 long, 756 wide, separated from each other. No external seminal vesicle. Cirrus sac thin-walled, ovate, intercecal and anterodorsal to acetabulum, reaching cecal bifurcation, containing saccular seminal vesicle becoming narrow and coiled anteriorly, pars prostatica surrounded by well developed prostate gland cells, and probably a protrusible cirrus rather than ejaculatory duct, Genital pore behind cecal bifurcation, submedian to left. Accessory sucker present behind genital pore.

Ovary globular, entire, almost in middle of body, pretesticular, median, 322 in diameter, separated from anterior testis. Seminal receptacle large, 413 long, 248 wide, posterodorsal to ovary. Mehlis' gland and Laurer's canal present. Vitellaria follicular, extensive, from posterior end of body nearly to posterior margin of acetabulum, follicles intruding between gonads. Uterus preovarian, winding anteriorly between ceca ; metraterm muscular, coiled behind acetabulum, straight dorsal to acetabulum. Eggs 56—63 μ ×42—45 μ.

Excretory vesicle tubular, traceable up to ovary ; pore terminal.

Discussion : The genus *Enenterum* Linton, 1910 has the following valid species : *E*,

aureum Linton, 1910 ; *E. pimelepteri* Nagaty, 1942 (Syn, E. pseudaureum Dollfus, 1946) ; *E. elongatum* Yamaguti, 1970 ; and *E. kyphosi* Yamaguti, 1970. Manter (1947) indicated the synonymity of *E. pseudaureum* Dollfus. 1946 to *E. pimelepteri* Nagaty, 1942. Nagaty (1948) made it clear that Dollfus (1946) was not aware of his (1942) publication of the species, and considered Dollfus' species as synonym of his own. Fischthal and Thomas (1972) corrected the spelling of the name of Nagaty's species as *E. pimelepteri* instead of *E. pimelopteri* because the spelling of the host genus is *pimelepterus* Lacépède and not *Pimelopterus.*

The new species, *E. mannarense,* is characterised by the presence of five basic anteriorly directed conical oral lobes with broad bases, and only the ventral lobe is sub-divided into two by a deep notch making a total of six lobes. In this respect it differs from all the above listed known species. *E. aureum* has six basic oral lobes. Of these (2 dorsal, 2 ventral and 2 lateral), the two dorsal and two laterals are sub-divided to give ten lobes in total. The new species is also comparable to *E. pimelepteri* and *E. elongatum* in having unlobed gonads, but in *E. pimelepteri* an esophagus is present and vitellaria extend up to the posterior margin of acetabulum, whereas in *E. mannarense* an esophagus is absent and vitelline glands remain restricted short of the posterior margin of acetabulum. Even in these two characters, *E. mannarense* and *E. elongatum* are very close to each other. The differences between them may be found in the basic number of oral lobes and their notching pattern. In the latter the lobes are five, each of which is subdivided into two, making a total of ten lobes.

Jeancadenatia dollfusi n. sp.

(Fig. 2)

Host - *Kyphosus cinerascens* (Forskål), (Pisces : Kyphosidae)

Location : Intestine
Locality : Tuticorin (Gulf of Mannar), India
Number of specimens : 2, one adult and one immature ; collected on November 19, 1975
Specimens deposited : Z. S. I. Reg. No. W 7298/1

Description : (with measurements of mature specimen only) : Body long, filiform, posterior part tapering gradually, 7.665 mm long (excluding oral lobes), 0.343 mm wide. No ventral accessory suckers. Tegument spinose, not seen on posterior part of body. Eye-spot pigment present. Acetabulum 284 in diameter, situated in anterior region of body. Oral sucker 147 long, 123 wide, terminal with ten oral lobes (two pairs of long pointed anterolateral and three pairs of short ones), of which, probably one pair dorsomedian and one pair each dorsolaterally ; shorter lobes contracted and pouch like with striations and incurved tips not discernible in all the three pairs, contracted in others ; some of them discernible with difficulty, completely retracted in immature specimen. Longer oral lobes 646-798 long, 247-285 wide at base. Prepharynx present, 348 long ; pharynx 261 long, 151 wide, elongated pear-shaped ; esophagus long (actual lengths preacetabular body, prepharynx and esophagus cannot be given because this part of body is contracted) ; bifurcation preacetabular ; ceca extending laterally, united posteriorly ; anus opening near posterior end of body.

Testis single, 1004 long, 193 wide, elongate, tapering towards ends, situated in posterior part of body. Vasa efferentia long, coiled at places. External seminal vesicle very long, extending from dorsal to acetabulum upto middle of space between acetabulum and testis, consisting of a posterior swollen and elongated part constricted at places, and a very long, narrow anterior part describing small coils at places on way, lying dorsal to broad uterus, surrounded by thick muscular wall,

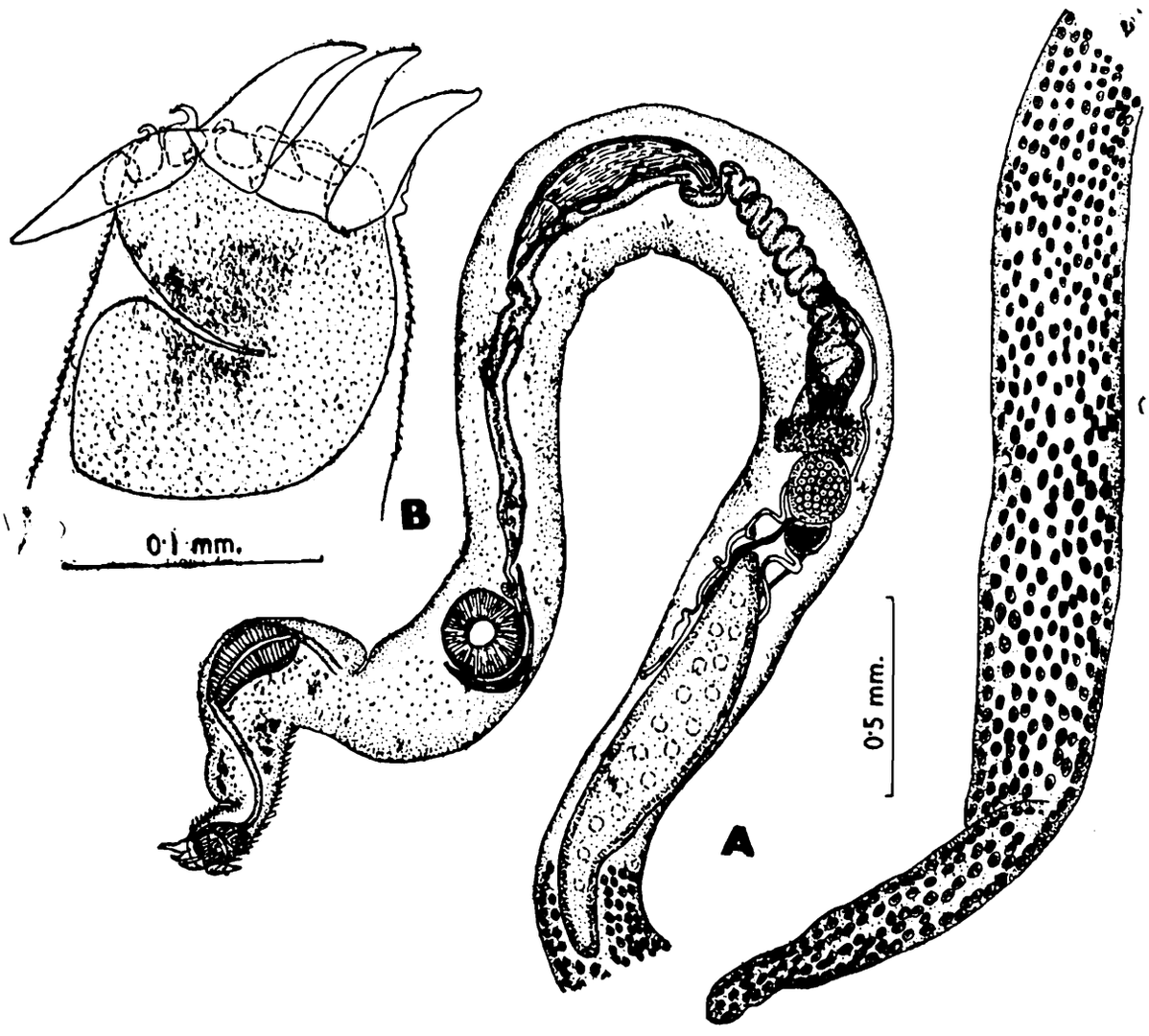

Fig. 2 A—B *Jeancadenatia dollfusi* n. sp., A—Ventral View, B—Ventral View of anterior end showing oral lobes.

Cirrus sac short, narrow, lying along antero-dextral margin of acetabulum, enclosing short tubular internal seminal vesicle. a pars prostatica surrounded by prostate gland cells, and an ejaculatory duct. Genital pore immediately preacetabular.

Ovary globular. 179 in diameter, pretesticular, separated from testis. Laurer's canal runs posteriorly, opening on dorsal surface of body at level of middle testis. Mehlis' gland anterior to ovary. Seminal receptacle large, anterior to Mehlis' gland. Uterus preovarian, posterior part wide describing close lateral coils up to posterior end of external seminal vesicle distal part narrow and rather straight ; running forward in middle field of body, filled with sperm cells throughout. Metraterm differentiated behind acetabulum. Vitellaria follicular, extensive, extending up to posterior part of testis. Vitelline reservoir globular, situated posterodorsal to ovary. Eggs collapsed. 59-63 × 35.

Excretory vesicle tubular, extending upto ovary ; pore terminal.

Discussion : *Jeancadenatia dollfusi* n. sp. is characterised by the presence of two pairs of long pointed, horn-like ventrolateral and three pairs of short (one pair mediodorsal and one pair each on dorsolateral sides) oral lobes which are pouch like with incurved pointed ends like hooks, and the absence of ventral accessory suckers. The pattern of oral lobes seems to be like that of *J. brumpti* with which the present species resembles closely. However, it differs from *J. brumpti* in much shorter body size, absence of ventral accessory suckers, and reverse sucker ratio as the Dollfus' description of his species states. There is no need of comparing the present species with *J. pacificus*. The differences between them are obvious.

Nahhas and Cable (1964) "believe that the presence of accessory suckers is a generic character whereas their number distinguishes species ; the same is concluded for the oral lobes some of which may be more or less distinctly subdivided in some species and not in others. *Jeancadenatia* is thus considered a synonym of *Cadenatella* which has page priority." Overstreet (1969) concurs with this. In *J. brumpti* Dollfus, 1946 accessory suckers number 14 to 17 (Sogandares-Beral, 1959) ; in *J. pacifica* they (number not given) are present in only one paratype, none in the others including the type. In *J. dollfusi* accessory suckers were absent in the immature and adult specimens. Thus, the deseriptions of *J. dollfusi* and *J. pacifica* show that the accessory suckers may be absent altogether in a species of *Jeancadenatia* while in other species some specimens of the population may or may not have them at all, *i. e.*, the number of accessory suckers may vary from nil to one or two or many in a single species. Therefore, in the light of the new facts, the presence of accessory suckers does not seem to form a generic character. The structural pattern of the oral lobes may be genus determining and their number and type may be species determining. The same should be true with *Cadenatella*. In contrast with Nahhas and Cable (1964) and Overstreet (1969), the author believes that *Jeancadenatia* Dollfus, 1946 is distinct from *Cadenetalla* Dollfus, 1945, at least in the filiform body, long esophagus and structural pattern of the oral lobes. As a matter of fact, all species with oral lobes of one type and uniform size should be grouped under *Cadenatella*, irrespective of their number.

Thus *Jeancadenatia* should have the following species ;

J. brumpti Dollfus, 1946 which has 10 conical oral lobes (3 pairs of short and 2 pairs of long ones), 14 to 17 ventral accessory suekers, long esophagus, and short cirrus sac in the acetabular region ;

J. pacifica Yamaguti, 1970 which has 6 oral lobes (one pair of short ones which are bifid at tips. and 2 pairs of long ones), accessory suckers may or may not be present in the specimens of the same population, long esophagus, and no cirrus sac ; and

J. dollfusi (present paper) which has 10 oral lobes (3 pairs of short ones whlch are pouch-like and curved inward at free ends like hooks, and 2 pairs of long ones), no ventral accessory suckers, long esophagus, and short cirrus sac in the acctabular region.

Jeancadenatia dohenyi Winter, 1957 does not have a filiform body, has 10 conical oral lobes of almost uniform size, has almost no esophagus and has vitelline follicles extending upto ovary as in the type species of *Cadenatella*, viz., *C. cadenatia* Dollfus, 1946 While giving the differential diagnosis of *J. pacifica*, Yamaguti (1970) also remarked, "No comparison is necessary with *J. dohenyi* Winter, 1957 from *K. elegans* from Isla Maria Magdalena, Nayarit of Mexico, because

of great differences in general anatomy". The author, therefore, feels that Winter's species should be transferred to the genus *Cadenatella*, the new combination being *C. dohenyi.* (Winter, 1957).

The literature notes that a cirrus sac is present in *Enenteum* but the same may or may not be present in *Cadenatella* and *Jeaneadenatia.* The presence of a cirrus sac in *C. americana* Manter, 1949 was originally reported but on reexamination of the holotype by Nahhas and Cable (l. c.) it was found to be absent. Sogandares-Bernal (1959) reported the presence of a circus sac in *J. brumpti. Enenterum* has two testes whereas *Cadenatella* and *Jeancadenatia* have one. The structural pattern of the oral lobes is different in the three gefnera In *Enenterum* the oral lobes are simple extensions of the wall of the oral sucker, there being no joints at their bases. On the contrary, in *Cadenatella* and *Jeancadenatia* the oral lobes may be digitate or horn like or tentacle like with joints at their base. In *Cadenatella* the oral lobes or tentacles are all of one kind and size whereas in *Jeancadenaia* they are of two types and therein lies the basic difference between the latter two genera.

Yamaguti (1971) gave a key to the genera of the subfamily Enenterinae Yamaguti, 1958 which does not seem to be working well. However, basic differences separating the three genera are provided below :

Testes double ; oral loes simple extensions of oral sucker without joints at their base ..... *Enenterum* Linton, 1910

Testis single ; oral lobes of the same size with joints at their base ; esophagus either short or absent ..... *Cadenatella* Dollfus, 1946

Testis single ; oral lobes of two sizes with joints at their base ; body filiform ; esophagus long ..... *Jeancadenatia* Dollfus, 1946

Linton (1910) placed his papillose species *Enenterum aureum* Linton, 1910 in the subfamily Allocreadiinae, and Poche (1926)included it in the family Allocreadiiae. Hopkins (1934) has convincingly discussed that *Enenterum* materially differs from "the true Allocreadiinae in many respects and therefore it "certainly cannot properly be included in the subfamily (Allocreadiinae) of which *Allocreadium* is the type". The genus does not belong to the family Allocreadiidae. Hopkins further observed that "Perhaps it is more closely related to the Opecoelidae". Manter (1947) considered *E. aureum* in the Lepocreadiidae "inspite of the lack of eye-pigment even in young specimens. Perhaps it belongs in the Opecoelidae but it has a spiny cuticula, seminal receptacle and large pros atic glands", Manter (1954), Winter (1957), Sogandares-Bernal (1959) Nahhas and Cable (1964), and Overstreet (1969) included the three genera *Enenterum, Cadenatella* and *Jeancadenatia* in the family Lepocreadiidae Nicoll, 1934. Yamaguti (1958) placed his subfamily Enenterinae in the family Allocreadiidae but later (1970, 1971) placed it in the family Opecolidae Ozaki, 1925 because of lhe similarity of the internal anatomy to Opecoelinae. Preacetabular accessory suckers, a tubular excretory vesicle, and the formation of a cloaca are found in Opecoelinae as well as in Enenterinae. He (1970) stated that "the oral appendages in Enenterinae are analogous to the acetabular in Opecoelinae". Admittedly these genera form a group which share characters of both the Opecoelidae and Lepocreadiidae. In the present chaotic condition of the classification of the Digenea and particularly the fact that the life-history is not known for any species of the present group, it is safe and convenient to maintain the family Enenteridae Skrjabin and Koval, 1966. Yamaguti (1971) did not mention this family. Fischthal and Thomas (1972) have accepted Enenteridae, and the present author concurs.

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