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Description of *Bianium arabicum* sp. n. (Trematoda, Lepocreadiidae) from the pufferfish, *Lagocephalus lunaris* (Bloch et Schneider, 1801) in Kuwait and a review of the genus *Bianium* Stunkard, 1930

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Abstract. A new species, *Bianium arabicum* (Lepocreadiidae, Diploproctodaeinae) is described from the pufferfish, *Lagocephalus lunaris* off the coast of Kuwait. It differs from the other members of the genus in having lateral folds along the whole body length and in the structure of the terminal part of the male reproductive organ. Keys to the subgenera, species and the amended description of the genus *Bianium* are also added. The new species represents a new host and locality records in the Arabian Gulf.

Key words: *Bianium arabicum*, Lepocreadiidae, Trematoda, *Lagocephalus lunaris*, Kuwait Bay

INTRODUCTION

During a survey of helminth parasites of Kuwaiti coastal fishes carried out in the period between October 1992 and December 1994, a collection of metazoan parasites was obtained. In the pufferfish numerous specimens of lepocreadid trematodes were found which proved to be a new species of the genus *Bianium*. The new species represents the first record of the genus from the Gulf fishes (Al-Yamani and Nahhas 1981, Saoud et al. 1986, Abdul-Salam and Khalil 1987, Abdul-Salam et al 1990, El-Naffar et al. 1992, Abdul-Salam and Sreelatha 1993).

MATERIALS AND METHODS

Nineteen fresh specimens of pufferfish, *Lagocephalus lunaris* were obtained from anglers near the "Towers" coastal waters. Live worms were washed in saline and later fixed in AFA, stored in 70% ethanol and stained in alum carmine. Specimens for SEM examination were dried, using the critcal point technique and coated with gold-palladium. They were observed and photographed using a JEOL, JSM-6300 SEM. Drawing was made with the help of a Leitz drawing tube. All measurements are in micrometer unless otherwise stated.

RESULTS

LEPOCREADIIDAE (Odhner, 1905) Nicoll, 1935

DIPLOPROCTODAEINAE Park, 1939

Bianium Stunkard, 1930

Syns *Diploporus* Ozaki, 1928 preoccupied; *Amarocotyle* Travassos, Freitas at Bührnheim, 1965; *Diploproctodaeum* La Rue, 1926 (in part)

Bianium arabicum sp. n.

Host: *Lagocephalus lunaris* (Tetraodontidae)
Site: intestine
Distribution: Kuwait Bay (near Towers)
Prevalence: 89.5%
Mean intensity: 7.5
Abundance: 8.5

This description was based upon the examination of 36 gravid whole-mounted worms and specimens examined under scanning electron microscope (Fig. 1).

Description: Body elongate and uniform, rounded at both ends. Body 650–1,025 in length, 300–380 in width, widest just beyond the ventral sucker. Along the lateral sides of body longitudinal folds present, bending ventrally and ending at posterior extremity (Fig. 1.). Tegumental spines minute, seen on ventral side of body anterior to ventral sucker. Numerous parenchymal gland cells found in anterior part of body, extending to ventral sucker. Oral sucker subterminal 70–104 by 65–113. Pharynx 65–95 by 65–78, prepharynx and oesophagus very short, often unrecognizable. Caeca bifurcate in front of ventral sucker. Intestine thick, opening outside through separate ani one on each side of excretory pore (Fig. 1). Ventral sucker smaller than the oral one, measuring 67–90 by 65–90. Testes almost entire, tandem, in posterior half of body; anterior one 85–104 by 88–130; posterior one 104–130 by 85–130. Cirrus pouch club-shaped, 120–128 by 40–50, cirrus thick, protrusible; internal seminal vesicle ellipsoidal, pars prostatica claviform; external seminal vesile curved, lying free in parenchyma. Genital atrium small; genital opening sinistral at level of bifurcation. Ovary deeply lobed, median, pre-testicular, composed of 7 to 10 lobuli; measuring 80–100 by 45–60. Metraterm simple, along left side of cirrus pouch, opening separately in genital atrium. Vitellaria strongly developed, vitelline follicles big, filling all available place in hindbody, extending to anterior part of ventral sucker, some follicles confluent medially. Uterus arranged in a few intercaecal coils. Eggs few, thin shelled, operculated and not embryonated; measuring 59–65 by 34–36.

DISCUSSION

Bianium arabicum sp. n. belongs to the species group the members of which are allocated to the subfamily Diploproctodaeinae Park, 1939. This subfamily comprises the following 11 genera: *Diploproctodaeum* La Rue, 1926; *Bianium* Stunkard, 1930; *Diploporus* Ozaki, 1928; *Diplocreadium* Park, 1939; *Amarocotyle* Travassos, Freitas et Bührnheim, 1965; *Cotylocreadium* Madhavi, 1972; *Diploproctodaeoides* Reimer, 1981;

Sphincterostoma Oshmarin, Mamaev et Paruchin, 1961; *Anterovitellosum* Gupta, 1967; *Caecobiporum* Mamaev, 1970 and *Diploproctia* Mamaev, 1970. From the point of view of the taxonomic position of the newly described species and the formulation of the scope of the genus *Bianium,* an analysis of the former 7 genera schould be done because the opinions on the validity of the genera in question have changed due to the diverse notions on stability of the generic and specific characters. The debate has especially focused on the validity of the genera *Diploproctodaeum* and *Bianiuim* (Sogandares-Bernal and Hutton 1958, Gupta 1968, Shimazu, 1989 etc.).

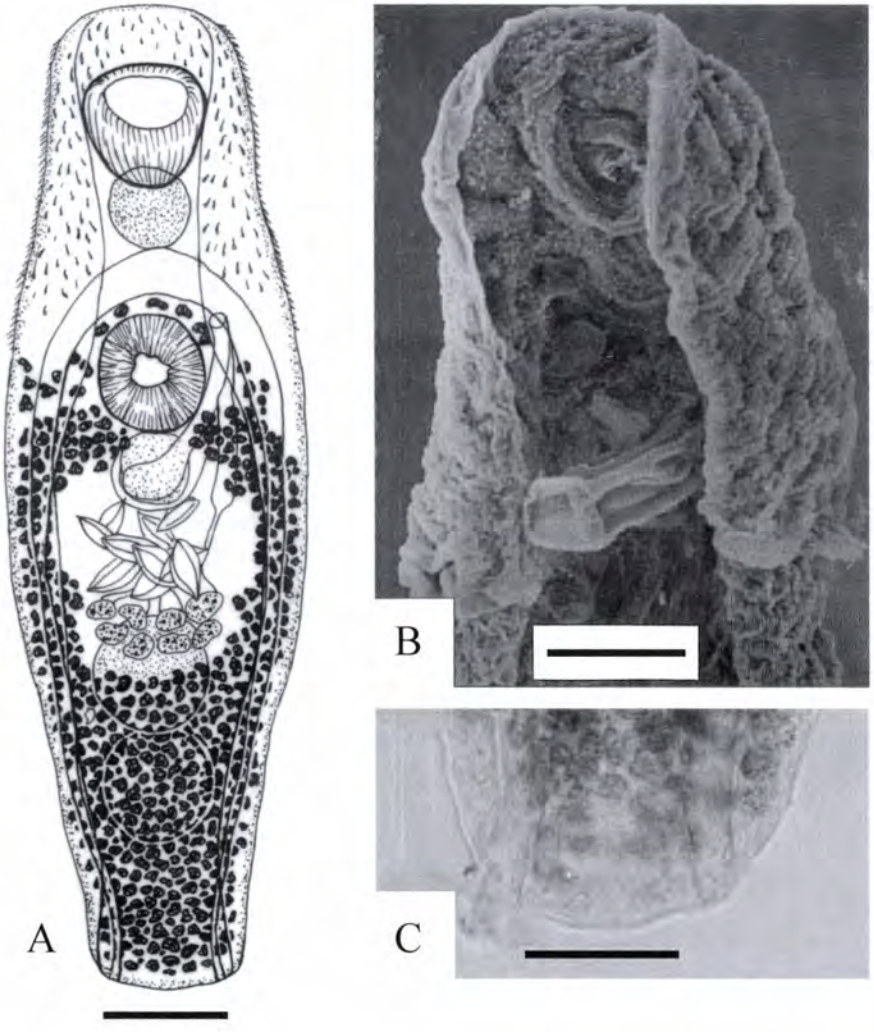

Fig. 1. A – *Bianium arabicum* sp. n., ventral view, bar 100 micrometer, B – SEM micrograph of the anterior part of the body of *Bianium arabicum* sp. n., bar 50 micrometer, C – Openings of ani of *Bianium arabicum* sp. n., bar 55 micrometer.

When La Rue (1926) described the genus *Diploproctodaeum* (on the basis of MacCallum's (1918) species, *Hemistoma haustrum)*, he designated the dividable body (with a spoon-like anterior and a cylindrical posterior part) and, among other things, the presence of the ani (whose existence was only known in some species at that time, Odhner 1911, Ozaki 1925) as its generic characters. On the basis of the species described later (Oshmarin et al. 1961, Shimazu 1989), it became evident that the morphology of these species, involving even the presence of ani, showed considerable variability (Shimazu 1994) but the special structure of the anterior extremity seemingly proved to be a reliable generic character of this genus.

The other debatable genus *Bianium* was set up by Stunkard (1930) for Linton's (1898) species *Distomum* sp. Later Stunkard (1931) found that this species showed similarities to another species, *Psilostomum plicitum* Linton, 1928, and he regarded the former to be a synonym of the latter and it was placed in the genus *Bianium* as its type species, *B. plicitum* (Linton, 1928) Stunkard, 1930. In the generic diagnosis Stunkard (1936) has listed the following characters in comparison with those of the genus *Diploporus* (= *Diploproctodaeum* in part): diverse shape and portion of body; the presence of lateral folds which are not confluent midventrally; suckers are closer in position; testes are less oblique. In the species described later, out of these generic characters, the presence of the lateral folds which are not confluent midventrally proved to be of generic diagnostic value. Other morphological characters displayed considerable variability (Bilqees 1974, Hafeezullah 1970).

A major reorganisation among the species of the two genera (*Diploproctodaeum, Bianium*) was the taxonomic operation when the then known species of the latter genus were transferred to the former genus by Sogandares-Bernal and Hutton (1958) who stated that there was not a single character by which these two genera could be differentiated. This opinion, however, was not shared by several subsequent authors (Gupta 1968, Hafeezullah 1970, Yamaguti 1971, Reimer 1981, Shimazu 1989) and the present author is of the opinion that the two genera in question are closely related but distinct ones.

Recently, Reimer (1981) has modified further the scope of the diploproctodeid species setting up the new genus *Diploproctodaeoides* for his species *D. soleaticus* and for those having a bulging rim in the spoon-like structure of the anterior extremity. Taking this character into account, Reimer (1981) transferred the species *Diploproctodaeum plataxi* Mamaev, 1979; *D. macroacetabulum* Oshmarin, Mamaev et Paruchin, 1961 and *D. longipygum* Oshmarin, Mamaev et Paruchin, 1961 to the genus *Diploproctodaeoides*. Apparently, Reimer (1981) did not consult Paruchin's paper in which he had described the species *Diploproctodaeum chelodoni* having the same anterior body structure (bulging rim). Therefore, it should be allocated to Reimer's (1981) genus as *Diploproctodaeoides chelodoni* (Paruchin, 1979) n. comb.

The geus *Diploporus* was designated by Ozaki (1928) for the species *D. hemistomum* and *D. cryptosomum*. This genus proved to be preoccupied; therefore, *D. hemistomum* was transferred by Yamaguti (1934) to the genus *Bianium* and *D. cryptosomum* by Manter (1947) to the same genus. Later, Sogandares-Bernal and Hutton (1959) transferred *D. cryptosomum* to the genus *Diploproctodaeum*.

Park (1939) created the genus *Diplocreadium* for his species *D. koreanum* and in the generic diagnosis the absence of the ani and the vesicula seminalis interna were designated as the principal generic characters. Later, Hafeezullah (1970) described the second species of the genus (*D. triacanthi*) in which, however, the presence of the vesicula seminalis interna has been observed. Apparently this state has no generic value similar to the presence or absence of the

ani, because recently Shimazu (1994) has pointed out that the actual existence of the ani is rather rare in species of *Diploproctodaeum* and *Bianium* studied; it can be variable even in specimens belonging to the same species. As these states, on which the creation of the genus *Diplocreadium* was based upon, are variable, the present author regards that genus as a synonym of *Diploproctodaeum*.

Travassos, Freitas and Bührnheim (1965) described the genus *Amarocotyle* for the species *A. simonei* on the basis of the absence of the vesicula seminalis interna and the shape and position of the testes. As these characters seem to be variable (See above) and as the general body structure is similar to that of the genus *Bianium*, hence, agreeing with Yamaguti's opinion (1971), *Amarocotyle* should be suppressed to a synonym of *Bianium*.

The genus *Cotylocreadium* was created by Madhavi (1972) for diplocreadid speciemens collected in *Triacanthus strigilifer* and they were regarded to be conspecific with *D. triacanthi* Hafeezullah, 1970. Madhavi (1972) described a "peculiar course of the caeca" attributing to it considerable generic value. If this character is indeed a valuable trait, then it is rather of specific importance because it is not found in Hafeezullah's (1970) species. Other characters reported (body shape, position of cirrus pouch etc.) fall in the category of species variability. Therefore, this genus is regarded by the present author to be a synonym of the genus *Diploproctodaeum*.

Bearing in mind the generic diagnostic characters of the genera *Diploproctodaeum* and *Bianium* formulated here and the conclusions concerning the revised genera, in the present author's opinion these genera comprise the following valid species:

Diploproctodaeum La Rue, 1926

Syns *Diploporus* Ozaki, 1928 (in part), *Diplocreadium* Park, 1939, *Cotylocreadium* Madhavi, 1972

D haustrum (MacCallum, 1919) La Rue, 1926
D. cryptosoma (Ozaki, 1928) Sogandares-Bernal and Hutton (1958)
D. koreanum (Park, 1939) n. comb.
Syn. *Diplocreadium koreanum* Park, 1939
D. triacanthi (Hafeezullah, 1970) n. comb.
Syns *Diplocreadium triacanthi* Hafeezullah, 1970, *Cotylocreadium triacanthi* (Hafeezullah, 1970) Madhavi, 1972
D. diodontis Nahhas et Cable, 1964
D. bombayensis (Gupta, 1968) n. comb.
Syn. *Bianium bombayensis* Gupta, 1968
D. ghanense (Fischtal et Thomas, 1970) Nasir, 1976
Syn. *Bianium ghanense* Fischtal et Thomas 1970
D. oviforme Shimazu, 1989
D. hakofuqu Shimazu, 1989

Remarks: *D. diodontis* Nahhas et Cable, 1964 should be excluded from this geus due to its diverse gross-morphology and internal anatomy even if with the presence of the ani. The latter character is not a valuable generic or specific character (see above) although it had emerged several times during the evolution of trematodes (Ozaki 1925, 1928, Stunkard 1931) in phylogenetically removed trematodes. It is rather similar to the members of the genus *Pseudocreadium* Layman, 1911 or it should be placed into a newly created genus.

Bianium Stunkard, 1930

Syns *Diploproctodaeum* La Rue, 1926 (in part), *Diploporus* Ozaki, 1928 (in part), *Amarocotyle* Travassos, Freitas et Bührnheim, 1965

B. plicitum (Linton, 1928) Stunkard, 1930
Syns *Bianium concavum* Stunkard, 1930
B. adplicatum Manter, 1940
B. madrasi Gupta, 1968
B. hemistoma (Ozaki, 1928) Yamaguti, 1934
Syns *Diploporus hemistoma* Ozaki, 1928
Bianium holocentri Yamaguti, 1942
B. lecanocephalum Perez-Vigueras, 1955
B. tetradontis Nagaty, 1956
B. vitellosum (Soganderas-Bernal et Hutton, 1959) Gupta, 1968
Syn. *Diploproctodaeum vitellosum* Soganderas-Bernal et Hutton, 1959
B. simonei (Travassos, Fraitas et Bührnheim, 1965) Yamaguti, 1971
Syn. *Amarocotyle simonei* Travassos, Freitas et Bührnheim, 1965
B. puri Gupta, 1968
B. abalistidis Reimer, 1981
B. arabicum sp. n.

The newly described species, *Bianium arabicum* sp. n., differs from all of the known species of the genus in having lateral folds along the margins of the body. This species is closest to the species *B. simonei* but distinguishable from it by its shorter lateral folds (they end at the level of the anterior testis), ratio of suckers, position of vitellaria and the structure of the distal part of the male reproductive organ. Its name refers to its locality.

Among the species now allocated to the genus *Bianium*, two morphologically different species-groups can be easily recognized. One of them includes the species *B. hemistoma* and *B. lecanocephalum* in which the forebody is well distinguished (spoon-like) but the lateral folds are not confluent midventrally. In species of the other group, the body is uniform and not dividable. Therefore, an effort towards the application of the monophyletic group designation of two subgenera (*Bianium* Stunkard, 1930 subgen. n. and *Pseudobianium* subgen. n.) is recommended. Taking the present framework and extent of the genus *Bianium* into account, an amended description of it is proposed.

Lepocreadiidae, Diploproctodaeinae. Body either dividable or uniform; forebody with lateral folds, turn over ventrally and posteriorly but not unite in midventrally. Oral sucker, pharynx and ventral sucker well developed, prepharynx and oesophagus short or absent. Ani either present or absent; if present, caeca opening outside at posterior excremity. Testes tandem or slightly diagonal. Vesicula seminalis interna and externa present. Cirrus pouch claviform extending posterior to acetabulum, including seminal vesicle, pars prostatica and eversible ductus ejaculatorius. Genital opening at acelabular zone, sinistral or rarely dextral. Ovary lobed, rarely spherical, median or submedian, pretesticular. Uterine coils between ovary and acetabulum, metraterm simple but well differentiated, left side of cirrus pouch. Vitellaria strongly developed, in lateral fields from oral sucker to posterior exctremity, confluent behind testes. Excretory vesicle tubular, reaching to acetabulum. Intestinal parasites of marine fishes.

Key to subgenera of genus *Bianium* Stunkard, 1930

Type subgenus *Bianium* Stunkard, 1930 subgen. n.

1a. Body uniform, lateral folds along edges of body	*Bianium*
1b. Body dividable, lateral folds in anterior part of body, turn ventrally, not confluent	*Pseudobianium*

Key to species of subgenus *Bianium*

1a. Lateral folds extend to posterior extremity	*B. (B.) arabicum*
1b. Lateral folds end before posterior extremity	2
2a. Ventral sucker bigger then oral sucker	5
2b. Oral sucker bigger than ventral sucker	3
3a. Caeca simple along their length	4
3b. Caeca with pocketing on shoulders	*B. (B.) tetrodontis*
4a. Ejaculatory duct straight	*B. (B.) plicitum*
4b. Ejaculatory duct winding	*(B.) puri*
5a. Ratio of suckers not considerably diverse	6
5b. Ratio of suckers considerably diverse	*B. (B.) abalistidis*
6a. Vitelline follicles extend to oral sucker	*B. (B.) vitellosum*
6b. Vitelline follicles extend to pharynx	*B. (B.) simonei*

Key to species of subgenus *Pseudobianium*

1a. Cirrus pouch dextral, ovary spherical	*B. (P.) leucanocephalum*
1b. Cirrus pouch sinistral, ovary lobed	*B. (P.) hemistoma*

Sey, O.: A *Lagocephalus lunaris* (Bloch et Schneider, 1801) halfajban Kuvaitban talált *Bianium arabicum* sp. n. leírása és a *Bianium* Stunkard, 1930 genusz áttekintése

A szerző leírja a *Lagocephalus lunaris* halfajban talált *Bianium arabicum* új métely fajt; megállapítja, hogy a genusz többi fajától a test egész hosszában meglévő oldalredő és a hím szaporítószerv végdarabjának eltérő szerkezete különbözteti meg. Kulcsot közöl a szubgenuszok és fajok meghatározásához, valamint a *Bianium* genusz új leírását adja. Az új faj előfordulása új adatot jelent a gazda és az Arab öböl faunájára vonatkozóan.

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