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## Order Diphyllidea van Beneden in Carus, 1863

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### Introduction

The validity of this order has been controversial. Hyman (1951), Rees (1959), Yamaguti (1959), Joyeux & Baer (1961) and Schmidt (1970, 1986) accepted the order for cestodes from elasmobranchs having a scolex with or without an armed rostellum but with only two sessile bothridia. Southwell (1925), Wardle & McLeod (1952) and Wardle, McLeod & Radinovsky (1974) did not recognize it. The problem centred on the genus *Echinobothrium* van Beneden, 1849, the only genus of the Diphyllidea until recently. Southwell (1925) created the order Heterophyllidea to include this genus and four other genera, while Wardle & McLeod (1952) grouped it with eight other *genera inquirenda* which could not be fitted into established orders. Wardle *et al.* (1974) complicated the situation further by declaring the Diphyllidea van Beneden in Carus, 1863 to be a *nomen oblitum*, since it was not presently occupied and proposed a new order, Diphyllidea, for the family Diphyllbothriidae. This suggestion was ignored by the majority of workers, and Schmidt (1986) concluded that Wardle *et al.*'s order should be considered a 'junior synonym' of Pseudophyllidea Carus, 1863.

Until recently the Diphyllidea included only the family Echinobothriidae Perrier, 1897, with one genus, *Echinobothrium* with more than 20 species from elasmobranchs. All species of this genus have a scolex with an armed rostellum and a cephalic peduncle armed with longitudinal rows of straight hooks with roots except *E. reesae* Ramadavi, 1969 and *E. deeghae* Gupta & Parmar, 1988 (see Ramadavi, 1969; Gupta & Parmar, 1988). These two species, from the coastal waters of India, were described as having no hooks on the cephalic peduncle. As the presence of hooks on the peduncle is one of the main characteristics of the genus, the assignment of these two species to *Echinobothrium* requires further investigation and the examination of new material. Despite extensive work on marine fish of Indian coastal waters, these species have never been reported again.

Rees (1959) erected a new genus, *Ditrachybothridium*, for the species *D.*

*macrocephalum* from elasmobranchs caught off the west coast of Scotland and assigned it to the Diphyllidea. Schmidt (1970) erected a separate family, the Ditrachybothridiidae for this monotypic genus. Khalil & Abdul-Salam (1989) erected *Macrobothridium* for *M. rhynchobati* from elasmobranchs in the Arabian Gulf and assigned this monotypic genus to a new family Macrobothridiidae attached to the Diphyllidea. The validity of the Diphyllidea is now generally accepted and three families, each with a single genus, are assigned to it.

## ORDER DIPHYLLIDEA VAN BENEDEN IN CARUS, 1863

**Diagnosis:** Scolex consisting of head proper and cephalic peduncle; two sessile bothridia present; armed rostellum present or absent, peduncle armed or unarmed. Proglottids acraspedote. Genital pore mid-ventral in posterior part of proglottid. Testes numerous, pre-ovarian. Cirrus-sac large, pyriform, opens ventrally immediately in front of vaginal pore. Ovary bilobed, posterior. Vitelline follicles lateral or surrounding proglottid. Uterine pore absent. Parasites of elasmobranchs.

### Key to families and genera

1a. Cephalic peduncle long, armed with powerful straight hooks with roots ..... *Echinobothriidae* Perrier, 1897.

**Diagnosis:** Scolex with well-developed rostellum armed on dorsal and ventral surfaces with hooks diminishing in size outwardly. Two oval bothridia present, covered with very small hair-like spines. Posterior proglottids longer than broad. Cirrus armed. Vitelline follicles in two lateral bands. Uterus median. Eggs round, may have short filament. In elasmobranchs. Cosmopolitan. Type and only genus *Echinobothrium* van Beneden, 1849.

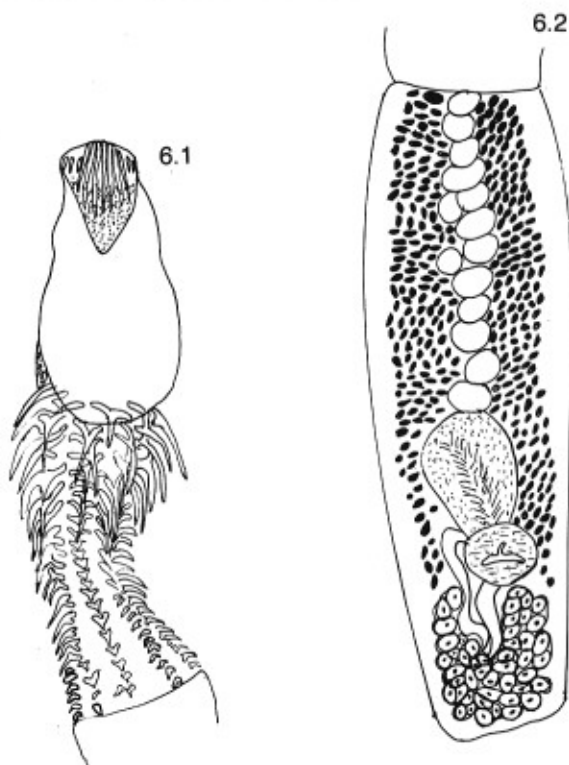
### Genus *Echinobothrium* van Beneden, 1849 (Figs 6.1, 6.2)

**Diagnosis:** With the characters of the family. Type-species *E. typus* van Beneden, 1849.

1b. Cephalic peduncle short, unarmed ..... 2.

2a. Scolex with well developed rostellum, armed on dorsal and ventral surfaces with two alternating rows of large hooks ..... *Macrobothridiidae* Khalil & Abdul-Salam, 1989.

**Diagnosis:** Rostellar hooks largest in middle row, decreasing in size towards extremities. Two unarmed bothridia present. Cephalic peduncle unarmed. Proglottids acraspedote, posterior proglottids longer than wide; last proglottid with long extension terminating in sucker-like structure, becomes detached from strobila and continues development in gut of host. Cirrus-sac large; cirrus armed



**Figs 6.1, 6.2** *Echinobothrium bonasum* Williams & Campbell, 1980. 6.1. Scolex. 6.2. Mature proglottid. (After Williams & Campbell, 1980.)

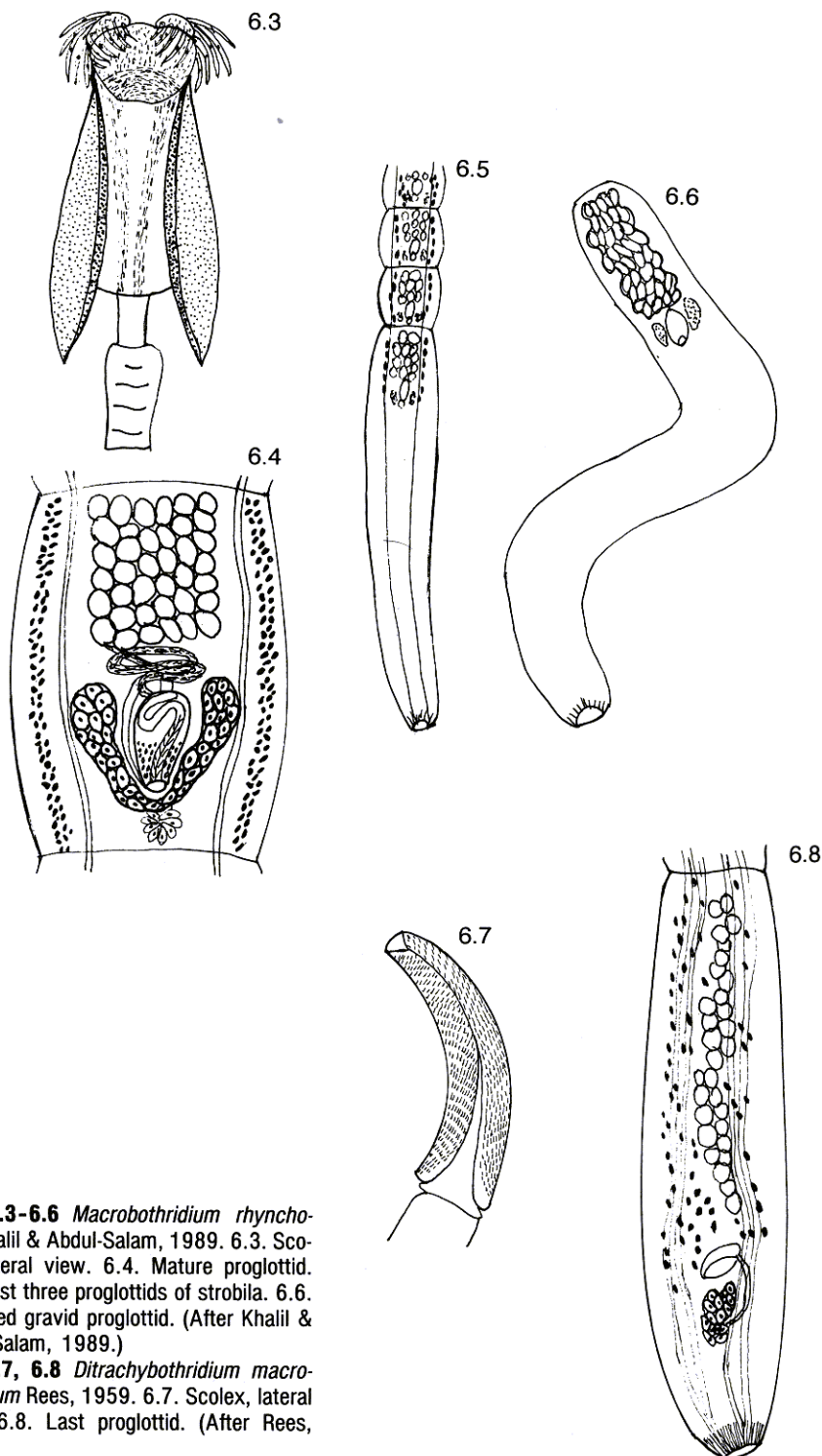
with rose-thorn spines. Vitelline follicles in two lateral bands. Uterus initially sac-like but later expands to fill anterior part of detached gravid proglottid, developing small simple lateral diverticula. Eggs small, spherical, without filaments. In elasmobranchs in Arabian Gulf. Type and only genus *Macrobothridium* Khalil & Abdul-Salam, 1989.

**Genus *Macrobothridium* Khalil & Abdul-Salam, 1989 (Figs 6.3–6.6)**

**Diagnosis:** With the characters of the family. Type and only species *M. rhynchobati* Khalil & Abdul-Salam, 1989.

**2b. Scolex with bluntly pointed apex with feebly developed apical organ lacking any hooks** ..... *Ditrachybothridiidae* Schmidt, 1970.

**Diagnosis:** Scolex with two bothridia, one dorsal and one ventral; bothridia armed along border and outer convex surface with rows of small, backwardly directed spines; cephalic peduncle unarmed, terminated by velum. Strobila cylindrical, with poorly marked external segmentation anteriorly; posterior proglottids



**Figs 6.3-6.6** *Macrobothridium rhynchobati* Khalil & Abdul-Salam, 1989. 6.3. Scolex, lateral view. 6.4. Mature proglottid. 6.5. Last three proglottids of strobila. 6.6. Detached gravid proglottid. (After Khalil & Abdul-Salam, 1989.)

**Figs 6.7, 6.8** *Ditrachybothridium macrocephalum* Rees, 1959. 6.7. Scolex, lateral view. 6.8. Last proglottid. (After Rees, 1959.)

four or five times longer than broad; last proglottid terminates in sucker-like structure. Cirrus-sac large, pyriform. Vitelline follicles inconspicuous, diffuse, surrounding most of the genitalia. Uterus and eggs not known. Parasite of elasmobranchs in Scottish waters. Type and only genus *Ditrachybothridium* Rees, 1959.

Genus *Ditrachybothridium* Rees, 1959 (Figs 6.7, 6.8)

**Diagnosis:** With the characters of the family. Type and only species *D. macrocephalum* Rees, 1959.