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Two species of the fish digenean genus *Rhipidocotyle* Diesing, 1858 (Bucephalidae) reported for the first time from European seas

Pierre Bartoli¹ & Rodney A. Bray^{2,*}

¹Centre d'Océanologie de Marseille, UMR 6540 CNRS, DIMAR, Campus Universitaire de Luminy, Case 901, 13288 Marseille Cédex 9, France

²Department of Zoology, Natural History Museum, Cromwell Road, London, SW 7 5BD, UK

Abstract

Two species of *Rhipidocotyle* are described from waters off the Scandola Nature Reserve, Corsica, France: these are the first records of these species from the Mediterranean Sea. *R. capitata* (Linton, 1940) from *Auxis rochei* and *R. longicirrus* (Nagaty, 1937) n. comb. (originally *Bucephalopsis longicirrus* Nagaty, 1937) from *Seriola dumerili* are also compared with similar species. *R. capitata* is similar to several other species of *Rhipidocotyle* from scombrids, but differs in the structure of the rhyncheal hood and other features. *R. longicirrus* has an angular, sucker-like rhynchus and, although not of a typical *Rhipidocotyle*-type, appears to be closer to this genus than to the other genera in which it has been previously placed.

Introduction

The Bucephalidae Poche, 1907 from fish from the Mediterranean Sea have not received much attention since the studies of pioneers such as Rudolphi (1819), Wagener (1852), Molin (1859), Stossich (1883, 1887) and Nicoll (1910). The few recent contributions include those of Paggi & Orecchia (1965), Maillard (1975), Munoz et al. (1989), Spakulova et al. (2002) and Gargouri-Ben Abdallah & Maamouri (2002). As far as *Rhipidocotyle* Diesing, 1858 is concerned, only three species have been reported from the Mediterranean, namely *R. galeata* (Rudolphi, 1819), *R. pentagonum* (Ozaki, 1928) and *R. genovi* Dimitrov, Kostadinova & Gibson, 1996 (see Gibson, 2001).

During the course of our studies in the Scandola Nature Reserve, off Corsica (western Mediterranean), two previously described species of *Rhipidocotyle*, hitherto unreported from European seas, have been recovered from pelagic piscivorous hosts: *R. capitata* (Linton, 1940) from

the scombrid *Auxis rochei* and *R. longicirrus* (Nagaty, 1937) n. comb. from the carangid *Seriola dumerili*. As they are not often reported and are poorly known, these two species are redescribed and illustrated here.

Materials and methods

Fish were caught by fishermen colleagues near the external limit of the Scandola Nature Reserve, Corsica, and immediately autopsied. Digeneans were collected live, fixed under a slight cover-glass pressure in Bouin's fluid, stained in Borax carmine and mounted in Canada balsam. Only ovigerous specimens were taken into account in the description and measured. Measurements are given in micrometres as the range with the mean in parentheses. Worms were studied using differential interference contrast microscopy and illustrations were made using a drawing tube. The fish nomenclature used was based on Froese & Pauly (2003). Voucher specimens have been deposited in the Natural History Museum, London (BMNH).

*Author for correspondence: (E-mail: rab@nhm.ac.uk)

Family Bucephalidae Poche, 1907
Genus *Rhipidocotyle* Diesing, 1858

***Rhipidocotyle capitata* (Linton, 1940) Manter, 1947**
Syn. *Gasterostomum capitatum* Linton, 1940

Host: *Auxis rochei* (Risso), Scombridae, Perciformes.

Locality: Off Scandola Nature Reserve, Corsica, France (41°25'N, 8°38'E).

Site: Rectum.

Infection: Number of fish examined 1. Intensity 2.

Material studied: 2 adult specimens. Voucher specimens BMNH 2004.6.25.1-2.

Description (Figures 1–5; Table 1)

General morphology (Figures 1, 3). Body flattened, fusiform; anterior half narrowing gradually; posterior half more or less plump; anterior end truncate; posterior extremity tapered. Maximum width at level of ovary, c.1/3–1/2 length.

Tegument. Entire surface of body spinose, except for hood surface at anterior extremity of body. Spines strongly developed, acuminate.

Rhynchus. Rhynchus sucker-like, with oval, ventro-terminal aperture; dorsal surface with heavily developed, muscular, horse-shoe-shaped hood; ventral aspect with 2 extremities bearing distinct lobes (Figures 2–3).

Digestive system. Mouth on ventral surface, more or less equatorial. Feeble conical papilla protrudes through mouth. Oral gland-cells not distinct. Prepharynx short. Pharynx subspherical. Oesophagus shorter than pharynx, thick-walled, surrounded by distinct oesophageal gland-cells (Figure 1). Caecum saccular, directed posteriorly, with thick gastrodermis; posterior extremity reaches level of anterior testis; external surface transversally folded.

Male reproductive system (Figures 1, 3, 4). Testes 2, spherical to sub-triangular, entire, in anterior part of posterior half of body, dextral, tandem, contiguous or nearly so; anterior testis contiguous with or adjacent to ovary. Cirrus-sac conspicuous, thin-walled, cylindrical, rectilinear to slightly curved, sinistral; proximal extremity at level of, but not contiguous with, posterior testis; distal portion forming genital lobe projecting into genital atrium. Seminal vesicle ovoid, twice as long as wide. Pars prostatica

cylindrical, rectilinear to slightly sinuous, lined by thick layer of anuclear structures, surrounded by prostatic cells. Ejaculatory duct passing through genital lobe, opening into genital atrium. Genital lobe voluminous, multilobed; proximal end with dorsal and ventral muscular fibres (at junction between genital atrium and cirrus-sac) radiating into parenchyma of mid-line of body. Genital atrium very large, only slightly smaller than cirrus-sac, thin-walled, with surrounding gland-cells. Genital pore ventral, subterminal.

Female reproductive system (Figures 1, 3, 5) Ovary ovoid or slightly elongated, entire, at mid-body length, dextral, close to body margin, at level of caecum. Oöcapt straight, emerging from median posterior face of ovary. Oviduct tubular, directed posteriorly, prolonged as Laurer's canal. Laurer's canal almost rectilinear, uncoiled, thin-walled, devoid of external glandular cells, post-ovarian, opening dorsally at level of posterior testis. Oötype thick-walled. Mehlis' gland well developed. Uterine seminal receptacle present. Uterine loops fill most of body posterior to vitellarium; distal part differentiated as metraterm, which opens into anterior genital atrium through powerful sphincter. Eggs thin-shelled, operculate, very numerous. Vitelline follicles 32 in total, 14–15 on right side, 17–18 on left, irregular in outline, in 2 lateral groups, not confluent along mid-line of body, in second quarter of body, with posterior limit at level of pharynx; left and right vitelline fields of same length. Vitelline ducts in dorsal parenchyma of body; left longer than right. Vitelline reservoir not developed; common vitelline duct joins oviduct just proximal to oötype.

Excretory system. Excretory vesicle tubular, runs parallel dextral to cirrus-sac; anterior extremity reaches level of posterior testis (Figure 3). Excretory pore terminal

Type-host: *Auxis rochei* (Risso).

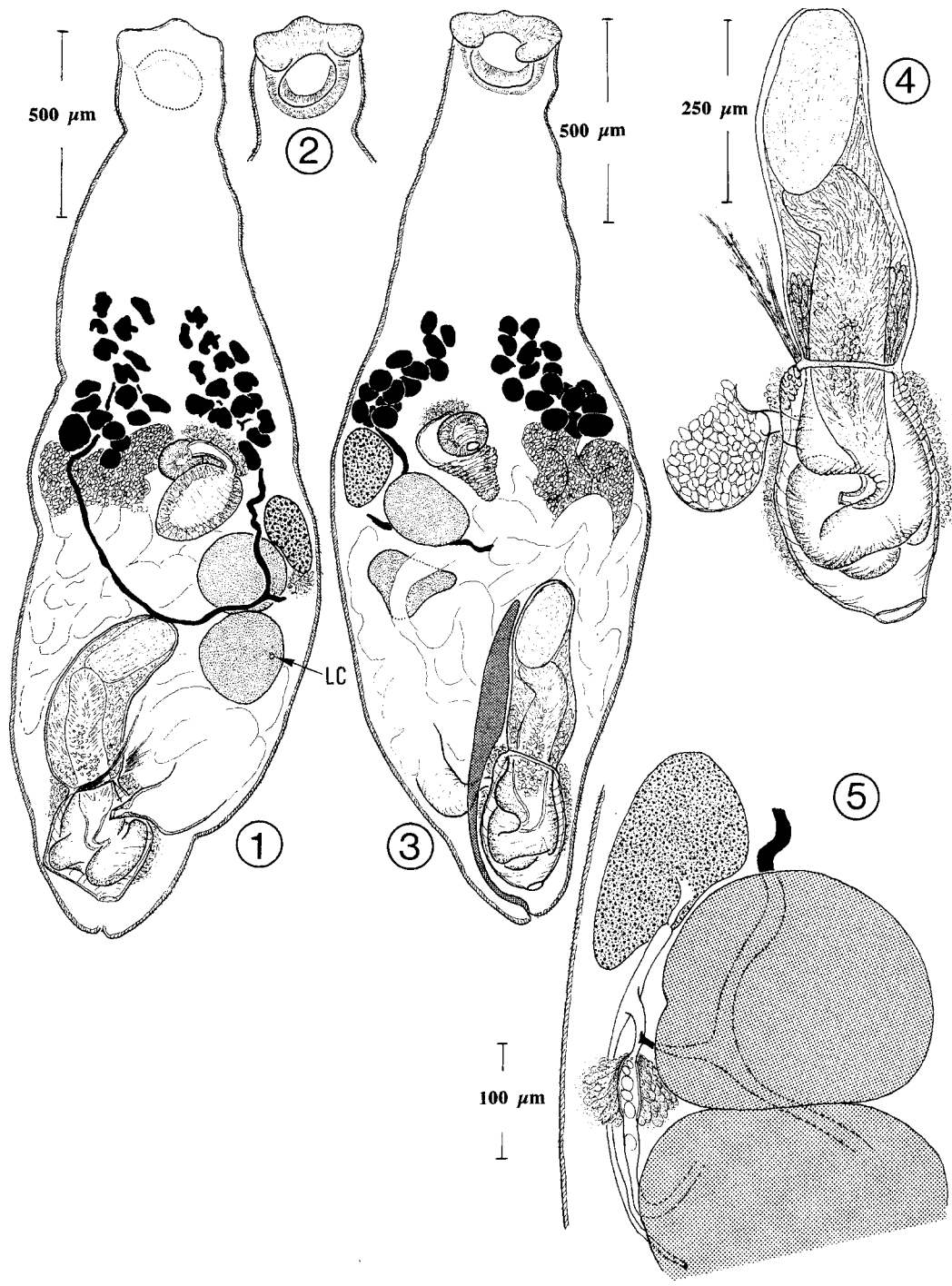
Type-locality: Off Woods Hole, Massachusetts, USA.

Records: 1. Linton (1940); 2. Yamaguti (1970); 3. Present study.

Descriptions: 1, 2, 3.

Definitive hosts: Scombridae: *Auxis rochei* (1, 3), *A. thazard* (2).

Distribution: Off Woods Hole (1); off Hawaii (2); Western Mediterranean (3).



Figures 1–5. *Rhipidocotyle capitata* (Linton, 1940) Manter, 1947. Slightly flattened adult specimens from the rectum of *Auxis rochei*, off Scandola Nature Reserve, Corsica, August 2002 (same data for all figures). 1, Dorsal view; 2, Anterior extremity of the specimen in Figure 1 (ventral view) (Figures 1–2 to the same scale) (the specimen illustrated in the Figures 2 and 5 was initially mounted ventrally; later it was unmounted, inverted and remounted, and redrawn as Figure 1); 3, Ventral view (in Figures 1 and 3, only a small proportion of eggs in anterior uterine loops are shown); 4, Cirrus-sac of the specimen in Figure 3 (ventral view); 5, Proximal female genitalia of the specimen in Figure 1 (ventral view). Abbreviation: LC, aperture of Laurer's canal.

Table 1. Comparative measurements of specimens of the two *Rhipidocotyle* species from off Corsica.

| Species | <i>R. capitata</i> | <i>R. longicirrus</i> |
|---|-------------------------|------------------------------|
| Host family | Scombridae | Carangidae |
| Host species | <i>Auxis rochei</i> | <i>Seriola dumerili</i> |
| Site | rectum | rectum |
| Sample | n = 2 | n = 10 |
| Body length | 2,230–2,440 | 1,288–1,962 (1,646) |
| Body width | 790–760 | 184–343 (240) |
| From anterior extremity of body to: | | |
| Anterior uterine loops | 995–1,074 | 580–1,060 (781) |
| Anterior limit of vitellarium | 743–578 | 527–895 (668) |
| Pharynx | 980–1,106 | 718–1,314 (1,011) |
| Ovary | 1,027–1,248 | 686–1,143 (888) |
| Anterior testis | 1,140–1,343 | 730–1,226 (982) |
| Number of right vitelline follicles | 14–15 | 14–16 (15) |
| Number of left vitelline follicles | 18–17 | 13–18 (16) |
| Length of right vitelline row | 316–458 | 173–256 (219) |
| Length of left vitelline row | 371–427 | 170–300 (225) |
| Diameter of vitelline follicles | 58–63 | 32–42 (37) |
| From pharynx to posterior extremity of body | 1,162–1,209 | 422–775 (635) |
| Post-testicular space | 750–656 | 254–572 (421) |
| Rhynchus | 198–259 × 275–280 | 84–112 × 95–111 (99 × 101) |
| Pharynx | 106–106 × 124–131 | 46–60 × 51–70 (54 × 62) |
| Oesophagus | 160–140 | 55–103 (81) |
| Digestive caecum | 166–240 × 112–159 | 88–144 × 63–140 (125 × 86) |
| Anterior testis | 163–218 × 230–240 | 106–186 × 96–166 (136 × 133) |
| Posterior testis | 182–240 × 192–227 | 122–192 × 95–160 (145 × 128) |
| Ovary | 182–227 × 128–115 | 112–163 × 80–160 (129 × 107) |
| Cirrus-sac | 448–528 × 169–205 | 410–582 × 70–125 (456 × 94) |
| Thickness of cirrus-sac wall | 10 and 10 | 6–15 (10) |
| Seminal vesicle | 218–240 × 106–115 | 92–163 × 35–80 (123 × 53) |
| Pars prostatica | 340–378 × 100–96 | 176–298 × 54–110 (262 × 75) |
| Genital atrium | 320–290 × 217–262 | 86–198 × 74–126 (164 × 100) |
| Eggs (uncollapsed) (n = 50) | 17–19 × 11–13 (18 × 12) | 19–24 × 12–14 (21 × 13) |
| Body width * | 35.4–31.4 | 17.4–23.7 (20.0) |
| Region anterior to pharynx %* | 43.9–45.3 | 55.7–68.6 (61.3) |
| Pre-vitelline field* | 33.3–30.4 | 35.6–47.3 (40.7) |
| Cirrus-sac length* | 20.1–21.6 | 21.3–37.3 (28.3) |
| Cirrus-sac length** | 38.6–43.7 | 53.1–106.2 (73.7) |
| Post-testicular region* | 33.6–26.9 | 19.4–29.7 (25.4) |
| Rhynchus/pharynx length ratio | 1:0.53–0.41 | 1:0.50–0.63 |

* as % of body length.

** as % of body length posterior to pharynx.

Comments

The description and figures of *Rhipidocotyle capitata* given in the present study are in close agreement with those of Linton (1940) for specimens from *Auxis rochei* off Woods Hole

(Massachusetts) and of Yamaguti (1970) for specimens from *A. thazard* off Hawaii. The only difference observed concerns the larger size of the Mediterranean specimens (2,230–2,440 long vs 1,050–1,960 (Linton, 1940) and 1,300–1,500 (Yamaguti, 1970)).

R. capitata is the only species of this genus reported from *A. rochei*. By contrast, three *Rhipidocotyle* species have been reported from *A. thazard*: (1) *R. capitata* off Hawaii (Yamaguti, 1970); (2) *R. pentagonum* (Ozaki, 1924) from the Bay of Bengal (Madhavi, 1974) and the coast of Brazil off Rio de Janeiro (Fernandes et al., 2002); and (3) *R. nagaty* Manter, 1940 from off the north-eastern coast of Africa (Szuks, 1981).

R. pentagonum has been reported not only from *A. thazard*, but also from various other fishes including *Scomberomorus niphonius* (Cuvier & Valenciennes) by Ozaki (1924, 1928) off Japan, *Thynnus* sp. by Eckmann (1932) off the Israeli Mediterranean coast, *Thunnus thynnus* (L.) by Yamaguti (1938) from off Japan, *Euthynnus affinis* (Cantor) by Madhavi (1974) from the Bay of Bengal, *E. lineatus* Kishinouye by Castillo-Sanches et al. (1997) off the Pacific coast of Mexico and *Katsuwonus pelamis* (L.) by Fernandes et al. (2002) off the Atlantic coast of Brazil. *R. pentagonum* has been described and figured by Ozaki (1924, 1928), Eckmann (1932) and Fernandes et al. (2002). Judging from these descriptions, *R. pentagonum* is similar to *R. capitata* as described in the present study, but seems to differ in the narrower body (width about 16% of length – Ozaki, 1928; other descriptions of *R. pentagonum* give greater figures), the shape of the hood of its rhynchus which is definitely pentagonal and provided with more or less pointed lateral lobes, its relatively smaller cirrus-sac (14–16% of body-length) and genital atrium, and its larger eggs (20–22 × 13–15 µm).

R. nagaty, reported and sketched by Szuks (1981) from *Auxis thazard* off Mauritania, was originally described by Manter (1940) from *Euthynnus alletteratus* (Rafinesque) off Florida. It differs from *R. capitata* by its distinctly pentagonal hood, deeply notched mid-ventrally and more or less pointed laterally, by its rather slender cirrus-sac containing a small ovoid seminal vesicle and its longer excretory vesicle extending to the pharynx. Based on the only sketch provided by Szuks (1981), and lacking any written description, it is difficult to establish whether the Mauritanian specimens correspond to *R. nagaty* or to *R. capitata*.

Sey (1970) listed *Bucephalopsis gracilescens* (Rudolphi, 1819) from *Auxis thazard* in the Adriatic Sea. We feel that this could not correspond to a confusion between *B. gracilescens* and

R. capitata, due to the absence in the former species of the hood-like structure characteristic of members of *Rhipidocotyle*, which is so obvious in *R. capitata*.

Sparks (1957) reported *R. capitatum* [sic] from the holocentrid *Holocentrus adscensionis* (Osbeck) from off The Bahamas. He believed that it might be synonymous with *R. nagaty*, but stated that Manter (in personal correspondence) thought they should be recognised as separate until further study was made. Sparks (1958) then reported '*R. capitatum*' from *Euthynnus alleteratus* (Rafinesque) off Louisiana, but made no further comment. Corkum (1968) studied type-specimens of both *R. capitata* and *R. nagaty* and concluded that both were 'good species', *R. capitata* has uterine coils which reach further anteriorly, a longer cirrus [sic, ? cirrus-sac] and much smaller eggs. The anterior hood also 'appears quite different'. Williams & Bunkley Williams (1996) considered *R. nagaty* and, probably, *R. angusticollis* [sic] Chandler, 1941 synonyms of *R. capitata*. They considered that *R. capitata* is 'almost tribe specific to little tunas' [i.e. *Auxis* spp.]. *R. nagaty*, in our view, differs from *R. capitata* in the characters mentioned above. *R. angusticolle* was originally reported from *Sarda sarda* (Bloch) off Texas in the Gulf of Mexico. Chandler's (1941) somewhat perfunctory description suggests that it differs from *R. capitata* in that it has dorsal 'hornlike projections' on the rhynchus, in addition to larger eggs. Fabio (1976) described a worm, under the name *R. angusticolle* from *Scomber colias* Gmelin from off Brazil, with four protuberances on the hood. The status of the group of *Rhipidocotyle* species from scombrids, i.e. *R. pentagonum*, *R. capitata*, *R. nagaty* and *R. angusticolle*, is worthy of further exploration.

The worm described as *R. angusticolle* from the serranid *Epinephelus fasciata* (Forsskål) in the Red Sea by Shalaby & Hassanine (1996) lacks the horn-like projections on the rhynchus and may not be correctly identified.

***Rhipidocotyle longicirrus* (Nagaty, 1937) n. comb.**
Syns *Bucephalopsis longicirrus* Nagaty, 1937; *Bucephaloides longicirrus* (Nagaty, 1937) Hopkins, 1954; *Bucephalopsis arcuatus* (Linton, 1900) of Manter (1940, 1947); *Bucephaloides arcuatus* (Linton, 1900) of Sogandares-Bernal & Sogandares (1961)

Host: Seriola dumerili (Risso), Carangidae.

Locality: Off Scandola Nature Reserve, Corsica, France (41°25'N, 8°38'E).

Site: Rectum exclusively.

Infection: Number of fish examined 7. Prevalence 28.6 %. Intensity 12.5. Abundance 3.6.

Material studied: 10 adult specimens. Voucher specimens BMNH Reg. No. 2004.7.14.27–28.

Description (Figures 6–13; Table 1)

General morphology (Figure 6–8). Body elongate, linguiform, often markedly narrowed at level of or just anterior to vitellarium; maximum body width at level of testes; anterior to vitellarium body is flattened; posterior to vitellarium body is thicker; anterior extremity truncate; posterior extremity rounded.

Tegument. Entire body heavily spined. Near anterior extremity of body spines are not erect and give appearance of honeycomb (Figure 10A); more posteriorly and around aperture of rhynchus, spines are erect and triangular resembling sharks' teeth (Figures 9B, 10B)

Rhynchus. Rhynchus sucker-like with truncate anterior extremity and rounded posterior end; lateral extremities of anterior lip slightly pointed (Figure 9A-B); aperture not well delimited anteriorly in some specimens but well delimited posteriorly in all cases; dorsal face of rhynchus not thickened, devoid of collar or tentacles; hood (if present) not obvious; dorsal wall provided with some longitudinal muscle fibres (Figure 9A). Gland-cells not detected associated with rhynchus.

Digestive system (Figures 6–8,11). Mouth ventral, in anterior part of posterior half of body. Oral lip absent. Prepharynx short. Oral gland-cells large, widespread in ventral parenchyma lateral to mouth; their ducts lead into small prepharyngeal papilla. Pharynx globular, posterior to vitellarium. Oesophagus longer than pharynx. Oesophageal gland-cells not detected. Intestinal caecum sac-like, directed antero-dorsally from pharynx (100%), reaching level of vitelline follicles, then recurving posteriorly near its middle.

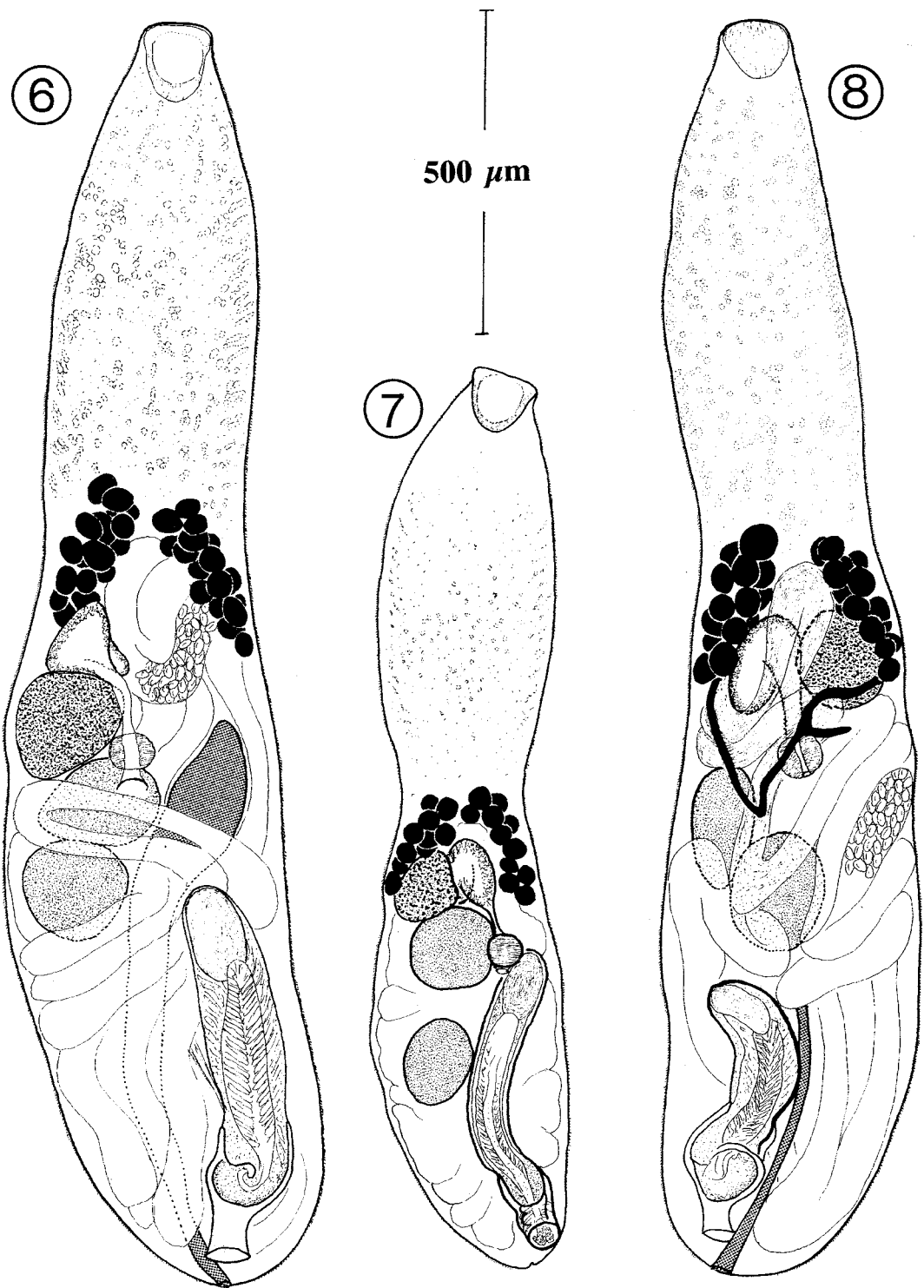
Male reproductive system. Testes 2, post-equatorial, contiguous (90%) or slightly (25 μ m) separated (10%), entire, spherical to ovoid, tandem (60%) or slightly oblique (40%). Anterior testis dextral (50%) (Figure 6), sometimes median (30%), more rarely sinistral (20%) (Figure 8), often

contiguous with ovary (80%), rarely separated (27–150 μ m) (20%). Posterior testis often dextral (80%), more rarely median (20%). Vasa efferentia fuse at base of cirrus-sac. Cirrus-sac conspicuous, rectilinear, thick-walled (6–15 (10) μ m), sinistral (100%), its anterior extremity extends as far as posterior testis (60%) (Figure 6) or to level of anterior testis (30%) (Figure 7) and in 1 case ovarian level (10%). Seminal vesicle ovoid, twice (or slightly more) as long as wide; longitudinal axis parallel to that of cirrus-sac, with distal extremity opening into well-developed, broad, rectilinear pars prostatica (Figure 12). Distal ejaculatory duct opens into genital atrium through fleshy, mitten-shaped genital lobe which acts as intromittent organ (Figure 12A-B). Genital atrium thick-walled, surrounded by numerous small gland-cells. Genital pore ventro-subterminal.

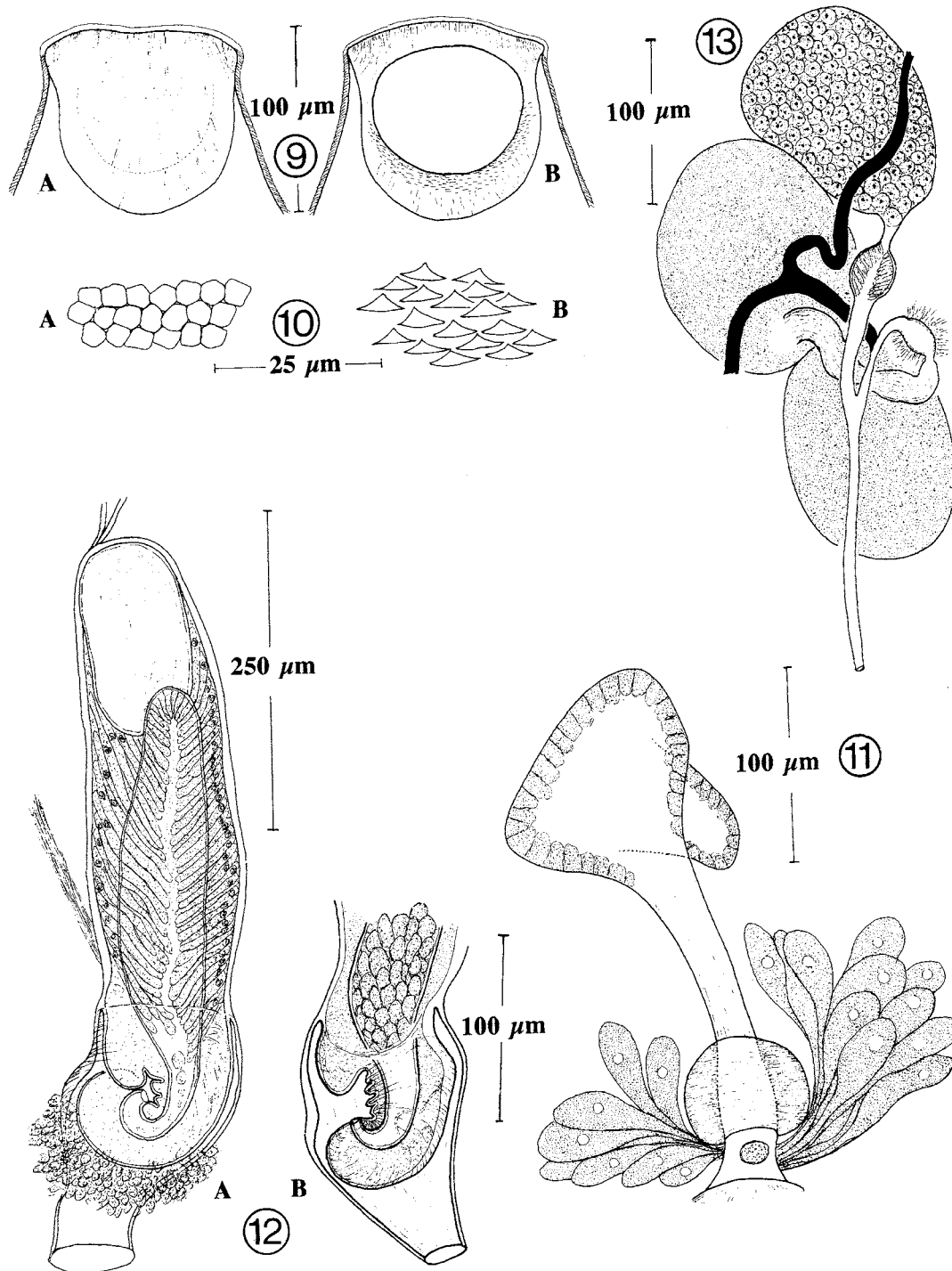
Female reproductive system. Ovary equatorial or just post-equatorial, dextral (100%), anterior to anterior testis, entire, rounded or sub-triangular. Oöcapt posteriorly directed, leads to wide and thick-walled chamber, probably acting as a fertilisation chamber (Figure 13). Laurer's canal rectilinear, opening dorsally posteriorly to hind testis. Oötype thin-walled; Mehlis' gland poorly developed, difficult to detect. Uterine seminal receptacle well developed (Figure 8). Uterus winds between anterior vitelline follicles and level of genital pore; distal portion not differentiated as metraterm; opening into genital atrium not detected. Eggs numerous, relatively thick-shelled, operculate, embryonated; in 30% of specimens, abnormal eggs coexist with normal ones. Vitelline follicles number 29–33 (31) in 2 lateral clusters; right field with 14–16 (15) follicles; left with 13–18 (16); fields of similar length, with posterior limit just anterior to or at level of ovary, almost confluent anteriorly. Vitelline ducts in dorsal body field, directed posteriorly; left vitelline duct describes U-shaped loop, reaches anterior testis (100%) (Figure 8); right vitelline duct distinctly shorter than left, reaches directly to vitelline reservoir. Vitelline reservoir inconspicuous.

Excretory system. Excretory vesicle I-shaped, thin-walled, extends to level of ovary (Figure 6). Excretory pore terminal.

Type-host: '*Sphyraena agam*'. According to Nagaty (1937) this species is locally (i.e. Red Sea) called "Agam". According to Froese & Pauly (2004), in



Figures 6–8. *Rhipidocotyle longicirrus* (Nagaty, 1937) n. comb. Slightly flattened adult specimens from the rectum of *Seriola dumerili*, off Scandola Nature Reserve, Corsica, September 2002 (same data for all figures). 6–7, Ventral views; 8, Dorsal view. (In Figures 6 and 8, only a small proportion of eggs are shown).



Figures 9–13. *Rhipidocotyle longicirrus* (Nagaty, 1937) n. comb. Slightly flattened adult specimens from the rectum of *Seriola dumerili*, off Scandola Nature Reserve, Corsica, September 2002 (same data for all figures). 9, Rhynchus; A. dorsal view; B. ventral view; 10, Tegumental spines: A. Spines near the antero-ventral extremity of the body lying flat on the body-surface; B. Erect spines around the aperture of the rhynchus; 11, Digestive system (ventral view); 12, Distal male reproductive system (ventral views): A. Cirrus-sac; B. Genital lobe and genital atrium; 13, Proximal female reproductive system (dorsal view).

Saudi Arabia (Red Sea), the common name “agam” is given to four *Sphyaena* species: *S. jello* Cuvier, *S. forsteri* Cuvier, *S. flavicauda* Rüppell and *S. obtusata* Cuvier. They do not mention the name *S. agam*.

Type-locality: Red Sea off Koseir, Egypt.

Records: 1. Nagaty (1937); 2. Manter (1940)¹; 3. Manter (1947)¹; 4. Manter (1954); 5. Sogandares-Bernal (1959)²; 6. Siddiqi & Cable (1960)¹; 7. Sogandares-Bernal & Sogandares (1961)²; 8. Corkum (1968); 9. Nahhas & Carlson (1994); 10. Present study.

Descriptions: 1, 2, 6, 7, 10.

Definitive hosts: Sphyraenidae: ‘*Sphyaena agam*’ (1); *S. barracuda* (2, 3, 4, 5, 6, 7, 8, 9); Carangidae: *Seriola dumerili* (10).

Distribution: Red Sea (1); off Florida (2, 3); Gulf of Mexico (4, 8); off Puerto Rico (6); off Jamaica (9); off British West Indies (5); Atlantic coast of Panama (7); Western Mediterranean (10).

Discussion

Specimens from Corsica belong to Rhipidocotyle

The specimens from the rectum of *Seriola dumerili* off Corsica have a rhynchus which is not a regular oval or circular sucker, such as that found in species of *Prosorhynchoides* Dollfus, 1929, but is a feeble anteriorly truncate sucker with slightly pointed lateral extremities and is devoid of a clearly defined dorsal hood. Clearly the rhynchus of this species does not possess the prominent dorsal hood characteristic of most species of *Rhipidocotyle* (see Overstreet & Curran, 2002), but, due to the peculiar shape of the rhynchus, the slightly curved pars prostatica in most specimens and the pre-testicular ovary, we consider that *Rhipidocotyle* is the appropriate genus for our specimens.

Historical review of Rhipidocotyle longicirrus

Bucephaloides longicirrus Nagaty, 1937 was described as a parasite of *Sphyaena ‘agam’*; from the Red Sea by (Nagaty, 1937). Its subsequent history has been confused with that of the species now

known as *Prosorhynchoides arcuatus* (Linton, 1900). Linton (1900) described *Gasterostomum arcuatum* from *Sarda sarda* off Woods Hole, Massachusetts. Later, this author reported the species again successively: in 1901, from the carcharinid shark *Carcharhinus obscurus* (Lesueur) (probably an accidental host); in 1905, from *Scomberomorus regalis* (Bloch) and *Caranx hippos* (L.); and in 1940, from *Scomber scombrus* L., *Trichiurus lepturus* L. and *Gadus morhua* L. The species was placed in *Bucephalopsis* Diesing, 1855 by Eckmann (1932). Manter (1940) added *Sphyaena barracuda* (Walbaum) as a further host for *B. arcuatus*. From *S. barracuda*, Linton (1910) described and illustrated a ‘*Gasterostomum* sp.’ (Linton, 1910, figures 223–225). Manter (1963) pointed out that the species he found earlier (1940) from the barracuda (probably the same species as that of Linton, 1910, figure 223) has an excretory vesicle ending at the level of the pharynx, more separated vitelline fields and a longer cirrus-sac than *B. arcuatus*, and he identified it as *Bucephaloides longicirrus* Nagaty, 1937, basing his opinion on the truncate rhynchus, the location of the organs, the extent of the vitellarium and uterus and egg-size. *B. longicirrus* was transferred to *Bucephaloides* Hopkins, 1954 by Hopkins (1954).

Specimens from off Corsica compared to Rhipidocotyle longicirrus

It is our opinion that our specimens correspond most closely to *B. longicirrus*, as described by Manter (1940) (see also figure 223 of Linton, 1910), although it is known only from *Sphyaena* spp. Rather smaller dimensions are quoted by Nagaty (1937- body-length 662–1,286) and Manter (1940 - body-length 667–1,444). The criteria justifying such an identification are: the truncate rhynchus, the arrangement of the organs, the extent and location of the vitelline fields, the uterine loops and the excretory vesicle. According to Nagaty (1937), and as the etymology of the specific name indicates, the cirrus-sac of *B. longicirrus* from *Sphyaena* sp. from the Red Sea is very long, reaching the ovarian level or further anteriorly. Nevertheless, the specimens from *S. barracuda* off Florida found by Manter (1940), and later identified by him (Manter, 1963) as *B. longicirrus*, show a great variation in body shape (elongate to oval), in the arrangement of the testes (contiguous to separated), in cirrus-sac

¹ As *Bucephalopsis arcuatus*

² As *Bucephaloides arcuatus*

length (anterior extremity reaching the vitellarium or only to the posterior testis) and in the location of the pharynx and the caecum (between or entirely posterior to the vitellarium) (see Manter, 1940, figures 15–16). Corkum (1968) studied, but unfortunately did not illustrate, *B. longicirrus* from *S. barracuda* from the Gulf of Mexico. His specimens, compared with Nagaty's description, 'were noted to have larger overall dimensions but with a relatively shorter cirrus [*sic* - ? cirrus-sac]... the cirrus is not one-half or even more than the length of the whole trematode...'. His specimens from the Gulf of Mexico, compared with the material of Manter (1940) from Florida, were noted to never have a 'cirrus that reached beyond the posterior testis'. Our specimens from Corsica are in close agreement with the observations of Corkum (1968) and our illustrations (Figures 6–8) exhibit the same variations as those pointed out by Manter (1940). We cannot ascertain whether *B. longicirrus* of Manter (1940) from Florida corresponds strictly to *B. longicirrus* (Nagaty, 1937) from the Red Sea, but our Mediterranean specimens show a greater similarity to those of Florida than to those of the Red Sea. Despite these uncertainties, we prefer to retain the specific name of *longicirrus* for the specimens collected in the rectum of *Seriola dumerili* off Corsica. Another source of doubt as to the identity of these worms is the host. Previous records of *B. longicirrus* are all from *Sphyaena* spp. and bucephalids have a tendency to show a higher degree of host-specificity than is implied by our findings.

Other Rhipidocotyle species from Seriola

Three species of *Rhipidocotyle* have been reported from *Seriola* spp.: *R. nagatyi* Manter, 1940 and *R. tonimahnkei* Reimer, 1985 from *Seriolina* (as *Seriola*) *nigrofasciata* (Ruppell) off the Mozambique coast by Reimer (1985), and *Rhipidocotyle* sp. from *Seriola dumerili* off the Spanish Mediterranean coast by Montero et al. (2002).

R. nagatyi, as described by Manter (1940), differs from the specimens described in the present study, with its distinctly pentagonal hood which is deeply notched at the mid-ventral line. The specimens described as *R. nagatyi* by Reimer (1985) are dissimilar from the specimens from Corsica, having the vitellarium contiguous with the rhynchus. *R. tonimahnkei* is distinguished from the specimens

reported in the present study by the uterine loops, which extend well anterior to the vitellarium, the small number of vitelline follicles and much longer eggs. Montero et al. (2002) gave no information on the morphology of their worms.

Other bucephalid species from Seriola dumerili from the Mediterranean

An unidentified species of *Bucephalopsis* has been listed from *Seriola dumerili* from the Balearic Sea (western Mediterranean) by Grau et al. (1999). *Bucephalopsis* is now regarded as a synonym of *Prosorhynchoides* (see Overstreet & Curran, 2002). Because no morphological data and no figures were provided by Grau et al. (1999), and because the site in which they found their specimens in the fish host is too imprecise ("digestive tract"), it is not possible to ascertain whether the specimens from the Balearic Sea correspond to *R. longicirrus* from off Corsica.

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