

SIXTEEN NEW SPECIES OF DACTYLOGYRUS FROM  
THE GENUS PUNTIUS HAMILTON (CYPRINIDAE)

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**Abstract.** Sixteen new species of *Dactylogyrus* are described from seven species of *Puntius*: *P. bulu*, *P. partipentazona*, *P. fasciatus*, *P. binotatus*, *P. orphoides*, *P. schwanenfeldi* and *P. gonionotus*. They are *Dactylogyrus bului*, *D. pentabrachiatus*, *D. fasciculi* and *D. pahangensis* from *P. bulu*; *D. pentabrachileithrium* and *D. partipentazonae* from *P. partipentazona*; *D. fasciatus*, *D. helicoidus* and *D. iskanderensis* from *P. fasciatus*; *D. sclerovaginalis*, *D. crescentileithrium* and *D. binotatus* from *P. binotatus*; *D. puntii* from *P. schwanenfeldi* and *P. gonionotus*; *D. cristatoleithrium*, *D. orphoides* and *D. perakensis* from *P. orphoides*.

A survey of the monogeneans recorded from *Puntius* reveals 15 *Dactylogyrus* species from five Indian *Puntius* (Gussev 1978), three *Dactylogyrus* species from two Sri Lankan *Puntius* (Gussev 1963) and one *Dactylogyrus* species from South-east Asian *Puntius* (*P. schuberti*) (Lucky 1970). Due to the scarcity of specimens, three new species of *Dactylogyrus* from *P. bulu* will not be described in this paper.

## MATERIAL AND METHODS

The fish hosts were collected from two freshwater bodies, Tasek Bera and Bukit Merah Reservoir, in Peninsular Malaysia. The monogeneans were collected alive from freshly removed gills and mounted in either ammonium-picrate glycerine or glycerine-jelly. These monogeneans were diagnosed using sclerotized structures only and compared with previous records of Oriental monogenean species especially those from related host species. The measurement techniques and terminology followed in this paper are according to Gussev (1976) with some modifications (dorso-apical length = inner length; ventro-apical length = outer length). The enumeration system for marginal hooks is Llewellyn's (1963) system which was officially adopted at ICOPA IV in Warsaw (1978; Gussev, pers. comm.). The dimensions of the holotypes and minima—maxima ranges of paratypes (in parentheses) are given in micrometers. The holotypes of the new species are deposited in the Department of Zoology, University of Malaya, Kuala Lumpur, while some of the paratypes are deposited in the National Museum of Natural Science, Ottawa, and in the helminthological collection of the Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice. Due to the variability of the lengths of the marginal hooks only the ranges of the species will be given in the descriptions.

## Descriptions

*Dactylogyrus bului* sp.n.Host: *Puntius bulu* (Bleeker)

Locality: Tasek Bera, Pahang

No. collected: 28 specimens from 2 host individuals

No. measured: 15

Type specimens: Holotype (UMMD 10) and 5 paratypes (UMMd 51—UMMd 55) in the collections of the Department of Zoology, University of Malaya, Kuala Lumpur (DZUM), 1 paratype (UMCIC (D) 1982—1621) in the National Museum of Natural Sciences, Ottawa, Canada (NMNS), 7 paratypes in the Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice (IPCAS).

Body size 666 (586—693) × 150 (106—160). Anchors: inner length 46 (43—46), outer length 35 (34—37), inner root 15 (14—19), outer root 4 (3—6), main part 31

Fig. 1

(30–33) and recurved point 15 (15–17). Two connective bars: basin-shaped dorsal bar size 4 (3–4)  $\times$  29 (28–31) and stick-like ventral bar size 3 (2–4)  $\times$  39 (35–40). Marginal hooks of variable length (19–35), handle slightly demarcated. Copulatory organ consisting of a coiled (three-four times) tube with funnel-like initial size 8 (7 to 8)  $\times$  8 (6–9) and a slightly sclerotized plate-like accessory piece. Vaginal armament tubular, usually not easily observed.

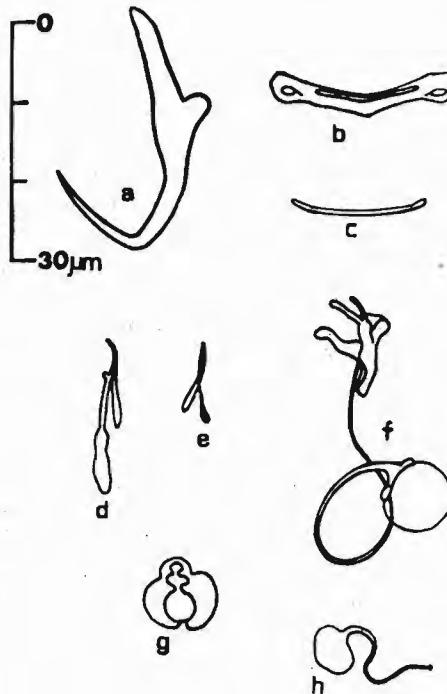


Fig. 1. Hard parts of haptor, copulatory apparatus and vaginal armament of *Dactylogyrus bului* sp. n. (a = anchor; b = dorsal bar; c = ventral bar; d = marginal hook; e = „needle”; f = copulatory organ; g = en-face view of vaginal opening; h = vaginal armament). (Illustrations from both holotype and paratypes).

**Differential diagnosis:** Besides the present species there are five species of *Dactylogyrus* from the Oriental zoogeographical region with the combination of V-shaped dorsal bar and stick-like ventral bar (*D. varicorhinoides* Gussev, 1976; *D. dubii* Gussev, 1976; *D. lori* Gussev, 1976; *D. barbi* Gussev, 1976; *D. subtilis* Gussev, 1976), however, they differ from the present species in the structure of the copulatory organs (short, slightly curved tube with relatively simple accessory piece, compared to the coiled tube of the present species). This species is similar to *D. quangfami* Ha Ky, 1971 in gross morphology of the anchors, hooks and coiled copulatory tube, however, in finer details they are different.

The name proposed is *Dactylogyrus bului* sp.n. after its host *Puntius bulu*.

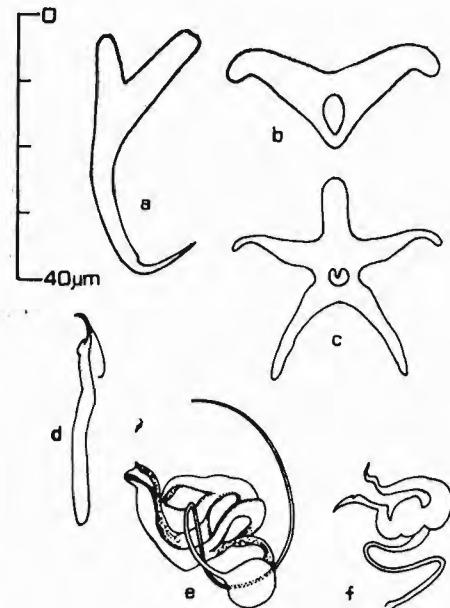


Fig. 2. Hard parts of haptor, copulatory apparatus and vaginal armament of *Dactylogyrus pentabrachiatus* sp. n. (a = anchor; b = dorsal bar; c = ventral bar; d = marginal hook; e = copulatory organ; f = vaginal armament). (Illustrations from holotype).

#### *Dactylogyrus pentabrachiatus* sp.n.

Fig. 2

Host: *Puntius bulu* (Bleeker)

Locality: Tasek Bera, Pahang

No. collected: 6 from 2 host individuals

No. measured: 6

Type specimens: Holotype (UMMD 11) and 3 paratypes (UMMd 56—UMMd 58) in DZUM, 2 paratypes in IPCAS.

Body size 450 (373–799)  $\times$  83 (53–139). Anchors: inner length 37 (37–45), outer length 37 (35–38), inner root 13 (10–18), outer root 8 (6–8), main part 29 (28–29) wide, 4 (4–5) thick at ends and 10 (9–10) thick in middle; 5-rayed ventral bar, length 29 (28–29), anterior process 10 (9–11), lateral process 13 (12–13) and posterior process 13 (12–13). Marginal hooks 23–34 in total length. Copulatory organ consisting of a simple S-shaped tube, diameter of initial part 6 (5–6), and slightly sclerotized accessory piece. Vaginal armament tubular, slightly coiled.

**Differential diagnosis:** There are four other species of *Dactylogyrus* from the Oriental region that possess 5-rayed ventral bars (*D. lohanii* Gussev, 1976, *D. vicinus* Gussev, 1976, *D. mrigali* Gussev, 1976 and *D. crucitrabu*s Gussev, 1976). The present species, however, differs from these previously described species in the structures of the 5-rayed ventral bar, dorsal bar, vaginal armament and accessory piece of the copulatory organ.

The species is named *Dactylogyrus pentabrachiatus* sp.n. because of the 5-rayed ventral bar.

#### *Dactylogyrus fasciculi* sp.n.

Fig. 3

Host: *Puntius bulu* (Bleeker)

Locality: Tasek Bera, Pahang

No. collected: 10 from 3 host individuals

No. measured: 10

Type specimens: Holotype (UMMD 12) and 4 paratypes (UMMd59—UMMd 62) in DZUM, 3 paratypes in IPCAS.

Body size 552 (469–672)  $\times$  96 (64–106). Anchors: inner length 35 (32–36), outer length 33 (32–34), inner root 13 (10–13), outer root 4 (4–6), main part 29 (27–30) and slightly recurved point 13 (10–13). Two connective bars: basin-shaped dorsal bar 33 (31–33) wide, 4 (4–5) thick at ends and 10 (10–11) thick in middle; ventral bar V-shaped, size 4 (3–4)  $\times$  25 (24–26). Marginal hooks, total length variable (22–29). Copulatory organ consisting of a curved tube, and accessory piece consisting of several sclerotized pieces; diameter of initial part of copulatory tube 6 (5–6). Vaginal armament in form of a funnel-shaped tube (not illustrated in Fig. 3).

**Differential diagnosis:** This species is similar to *D. varicorhinoides* Gussev, 1976 in the gross morphology of anchors, marginal hooks and copulatory organ, but differs in finer details and in the structures of connective bars and vaginal armament.

This species is named *Dactylogyrus fasciculi* sp.n. because of its accessory piece.

#### *Dactylogyrus pahangensis* sp.n.

Fig. 4

Host: *Puntius bulu* (Bleeker)

Locality: Tasek Bera, Pahang

No. collected: 13 from 3 host individuals

No. measured: 10

Type specimens: Holotype (UMMD 13) and 5 paratypes (UMMd 63—UMMd 67) in DZUM, 1 paratype (NMCIC (P), 1982—1622) in CMNS, 1 paratype in IPCAS.

Body size 916 (640–1,460)  $\times$  185 (149–213). Anchors: inner length 75 (60–76), outer length 45 (43–46), well developed inner root 37 (31–41), outer root 4 (3–7)

(i.e. the inner root is about 8 times the outer root), main part 40 (39–42) and recurved point 25 (23–26). One connective bar, bone-like, size 7 (5–9)  $\times$  48 (45–50). Marginal hooks 29–31 in total length with distinct thick handle and thinner pivot. Dorsal bar bone-like, 46 (45–46) wide, thickness varying from 8 (7–8) at both ends to 6 (6–7) in middle. Copulatory organ, 72 (70–75) consisting of a simple tube, size of initial 10 (9–11)  $\times$  14 (14–15) and fork-like accessory piece. Vaginal armament possibly a small rounded structure.

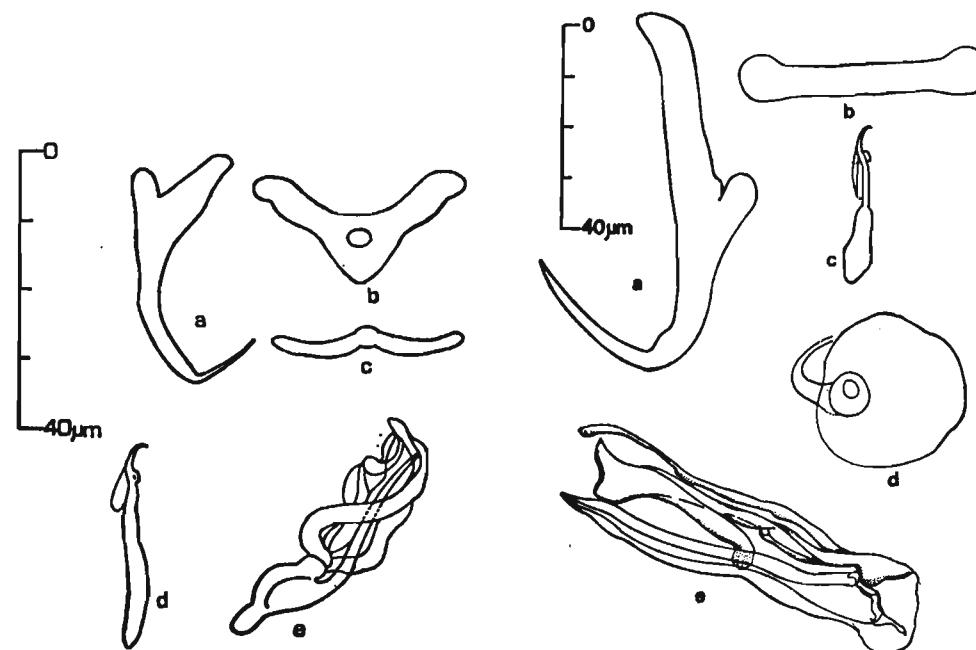


Fig. 3. Hard parts of haptor and copulatory apparatus of *Dactylogyrus fasciculi* sp. n. (a = anchor; b = dorsal bar; c = ventral bar; d = marginal hook; e = copulatory organ). (Illustrations from both holotype and paratypes).

**Differential diagnosis:** None of the previous species described from *P. bulu* possesses copulatory organ comparable to that of this species. Only *D. alatocirrus* Gussev, 1955 has similar copulatory organ, but accessory pieces are different in the two species. Although the anchors of *D. saranae* Gussev, 1976 are similar to that of the present species, they differ in the structures of the marginal hooks, copulatory organ and vaginal armament.

The proposed name is *Dactylogyrus pahangensis* sp.n. after the State of Pahang, where Tasek Bera is situated.

Fig. 4. Hard parts of haptor, copulatory apparatus and vaginal armament of *Dactylogyrus pahangensis* sp. n. (a = anchor; b = dorsal bar; c = marginal hook; d = vaginal armament; e = copulatory organ). (Illustrations from holotype).

### *Dactylogyrus pentabracileithrium* sp.n.

Host: *Puntius partipentazona* (Fowler)

Locality: Tasek Bera, Pahang

No. collected: 7 specimens from 3 host individuals

No. measured: 7

Type specimens: Holotype (UMMD 18) and 2 paratypes (UMMd 68—UMMd 69) in DZUM, 2 paratypes in IPCAS.

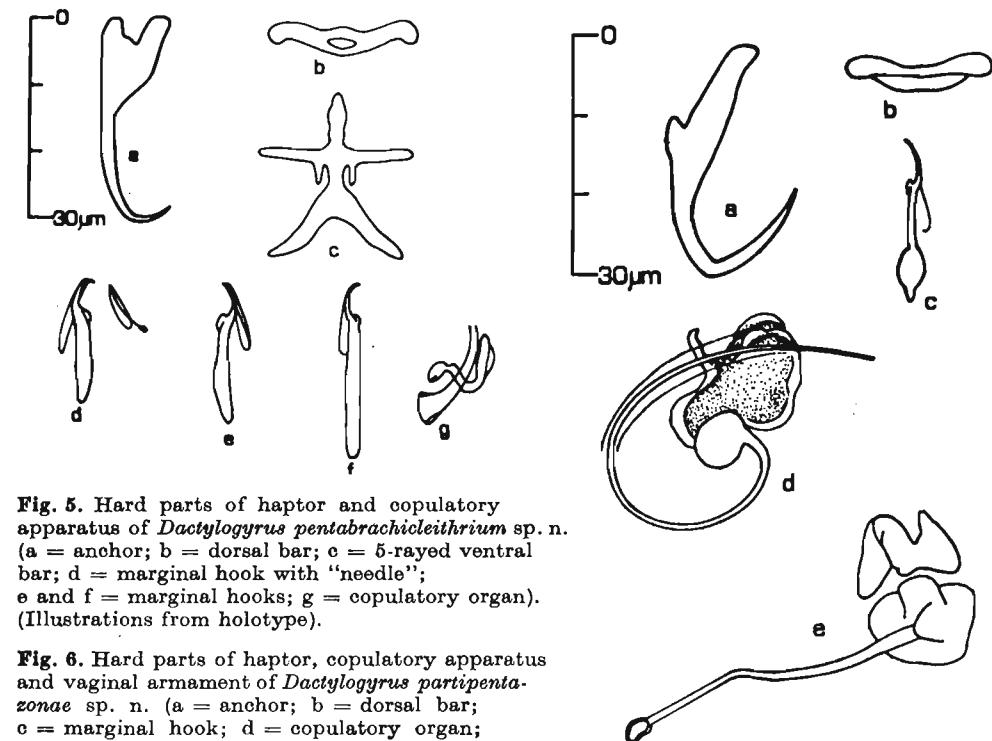


Fig. 5. Hard parts of haptor and copulatory apparatus of *Dactylogyrus pentabracileithrium* sp. n. (a = anchor; b = dorsal bar; c = 5-rayed ventral bar; d = marginal hook with "needle"; e and f = marginal hooks; g = copulatory organ). (Illustrations from holotype).

Fig. 6. Hard parts of haptor, copulatory apparatus and vaginal armament of *Dactylogyrus partipentazonae* sp. n. (a = anchor; b = dorsal bar; c = marginal hook; d = copulatory organ; e = vaginal armament). (Illustrations from holotype and paratypes).

Body size 375 (313–437)  $\times$  92 (42–95). Anchors: inner length 31 (29–31), outer length 30 (28–30), inner root 6 (4–7), outer root 3 (3–5), main part 27 (26–29) and very short point 4 (3–5). Two connective bars: basin-shaped dorsal bar, size 3 (2–3)  $\times$  21 (18–22), and 5-rayed ventral bar, total height 23 (22–24), anterior process 8 (7–9), lateral process 12 (11–13), posterior process 15 (14–16). Marginal hooks 15–33 in length, demarcation of handle not very clear. Hooks 1 and 2, smaller (15–23). Copulatory organ consisting of a simple tube, length 15 (14–17) and a rod-like accessory piece, initial 5 (4–6). Vaginal armament not observed.

**Differential diagnosis:** The 5-rayed ventral bar is structurally different from the 5-rayed bars of other *Dactylogyrus* species (see: Differential diagnosis of *D. pentabraciliatus* sp.n.). The copulatory organ and the anchors of this species are also different from the previously described species.

The species is named *Dactylogyrus pentabracileithrium* sp.n. because of the 5-rayed ventral bar.

*Dactylogyrus partipentazonae* sp.n.

Host: *Puntius partipentazona* (Fowler)  
Locality: Tasek Bera, Pahang  
No. collected: 7 specimens from 3 host individuals  
No. measured: 7  
Type specimens: Holotype (UMMD 19) and 3 paratypes (UMMd 70—UMMd 72) in DZUM, 2 paratypes in IPCAS.

Body size  $550 (313-542) \times 83 (73-104)$ . Anchors: inner length 30 (29-31), outer length 20 (19-21), well developed inner root 12 (10-13), underdeveloped stumpy outer root 1 (1-2), main part 19 (17-21) and recurved point 15 (13-17). One basin-shaped connective bar, size  $2 (2-3) \times 19 (17-21)$ . Marginal hooks 15-21 in length, with spindle-shaped handle well demarcated from thin pivot. Hooks 1 and 2 smaller (15-17). Copulatory organ consisting of a coiled tube and a slightly sclerotized accessory piece. Vagina prominent, with heavily sclerotized opening and a short vaginal tube.

**Differential diagnosis:** The present species is similar to *D. longiacus* Gussev, 1976 in the structures of the copulatory tube, vaginal armament and anchors, however, it differs in having marginal hooks with spindle-shaped handle and differently shaped accessory piece.

This species is named *Dactylogyrus partipentazonae* sp.n. after its host.

*Dactylogyrus fasciati* sp.n.

Host: *Puntius fasciatus* (Bleeker)  
Locality: Tasek Bera, Pahang  
No. collected: 34 specimens from 5 host individuals  
No. measured: 20  
Type specimens: Holotype (UMMD 20) and 5 paratypes (UMMd 75—UMMd 79) in DZUM, 5 paratypes in IPCAS.

Body size  $333 (198-417) \times 117 (52-120)$ . Anchors: inner length 31 (25-32), outer length 23 (19-25), long inner root 10 (8-12), short outer root 2 (1-3), main part 21 (17-22) and recurved point 13 (10-14). Two connective bars: V-shaped dorsal bar, size  $2 (2-3) \times 25 (24-27)$  and thin, stick-like ventral bar, size  $17 (16-19) \times 1.0$ . Marginal hooks 14-26 in length, with handle well demarcated from pivot. Copulatory organ 23 (22-25) long, consisting of a simple curved tube, size of initial  $4 (4-5) \times 6 (4-7)$  and an accessory piece with numerous processes. Vaginal armament in form of a simple tube, size  $8 (7-9) \times 15 (14-16)$ .

**Differential diagnosis:** It is similar to *D. subtilis* Gussev, 1976 in the types of anchors, dorsal and ventral bars and marginal hooks, but differs in the structures of copulatory organ and in having vaginal armament, which is not observed in *D. subtilis*.

This species is named *Dactylogyrus fasciati* sp.n. after its host.

*Dactylogyrus helicoidus* sp.n.

Host: *Puntius fasciatus* (Bleeker)  
Locality: Tasek Bera, Pahang  
No. collected: 9 specimens from 2 host individuals  
No. measured: 9  
Type specimens: Holotype (UMMD 21) and 5 paratypes (UMMd 80—UMMd 84) in DZUM, 1 paratype in IPCAS.

Body size  $534 (469-625) \times 76 (63-94)$ . Anchors: inner length 25 (23-26), outer length 15 (13-16), long inner root 13 (9-14), short stumpy outer root 2 (1-2), main part 13 (11-14), and sharply recurved point 13 (11-14). One V-shaped connective bar, size  $2 (2-3) \times 21 (19-22)$ . Marginal hooks 16-25 in length, with spindle-shaped handle demarcated from thin pivot. Hooks 4, 3 and 2, smaller (16-18). Copulatory

Fig. 6

organ 50 (47-52) long, consisting of a coiled tube (5×), size of initial part  $8 (6-10) \times 10 (8-12)$  and an accessory piece which runs in the middle of the coils, giving off supporting "spokes" at intervals to support the coils and terminating as a forked structure. Vaginal armament in form of a highly convoluted tube which opens into a sclerotized region. **Differential diagnosis:** The coiled copulatory tube and the medial accessory piece with "spokes" are unique features, not found in any of the Oriental *Dactylogyrus* hitherto described.

This species is named *Dactylogyrus helicoidus* sp.n. because of the copulatory organ which is spirally twisted in the manner of a snail shell.

Fig. 7

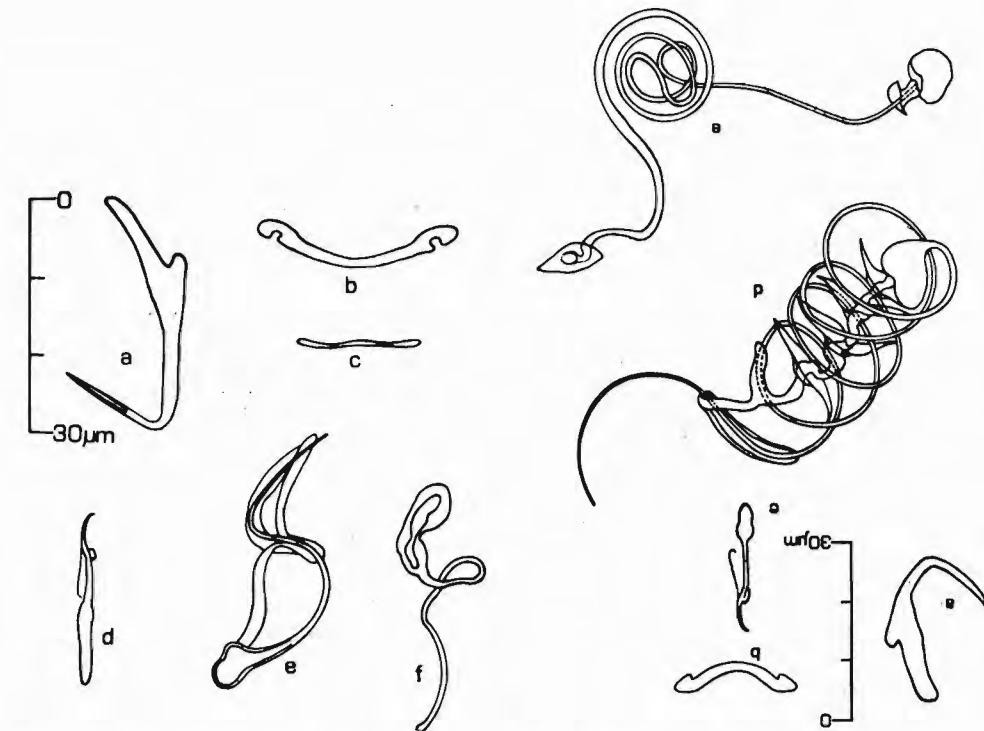


Fig. 7. Hard parts of haptor, copulatory apparatus and vaginal armament of *Dactylogyrus fasciati* sp. n. (a = anchor; b = dorsal bar; c = ventral bar; d = marginal hook; e = copulatory organ; f = vaginal armament). (Illustrations from both holotype and paratypes).

Fig. 8

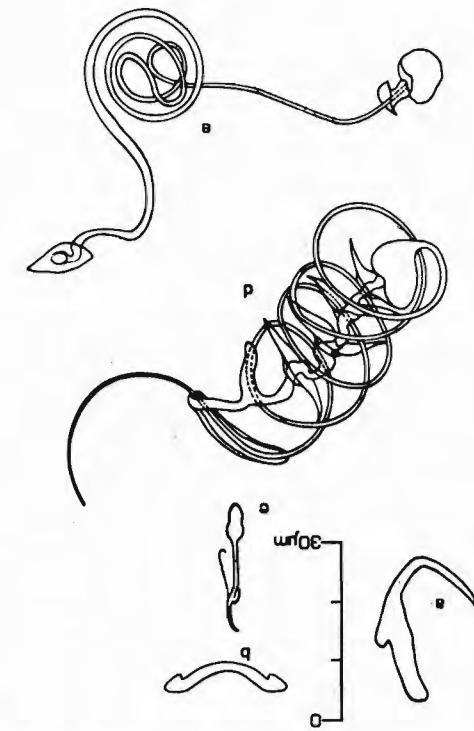


Fig. 8. Hard parts of haptor, copulatory apparatus and vaginal armament of *Dactylogyrus helicoidus* sp. n. (a = anchor; b = dorsal bar; c = ventral bar; d = marginal hook; e = copulatory organ; f = vaginal armament; g = vaginal armament). (Illustrations from holotype).

*Dactylogyrus iskanderensis* sp.n.

Host: *Puntius fasciatus* (Bleeker)  
Locality: Tasek Bera, Pahang  
No. collected: 35 specimens from 5 host individuals  
No. measured: 20  
Type specimens: Holotype (UMMD 22) and 5 paratypes (UMMd 85—UMMd 89) in DZUM, 1 paratype in IPCAS.

Body size 429 (365–521)  $\times$  65 (52–83). Anchors: inner length 25 (25–29), outer length 19 (17–21), long inner root 10 (9–10), stumpy outer root 2 (1–3), main part 17 (15–18) and recurved point 15 (13–16). One V-shaped connective bar, size 2 (2–3)  $\times$  15 (13–17). Marginal hooks 12–21 in length, with pearl-shaped handle demarcated from thin pivot. Hooks 4, 3 and 2, smaller (12–13). Copulatory organ consisting of a coiled tube (2  $\times$ ), diameter of initial 8 (7–10), and a rod-like accessory piece with several branches and a grooved pipe-like structure. Vaginal armament consisting of a tube with a cup-shaped structure, associated with several sclerotized pieces.



**Fig. 9.** Hard parts of haptor, copulatory apparatus and vaginal armament of *Dactylogyurus iskanderensis* sp. n. (a = anchor; b = dorsal bar; c = marginal hook; d = copulatory organ; e = vaginal armament). (Illustrations from holotype).

**Fig. 10.** Hard parts of haptor, copulatory apparatus and vaginal armament of *Dactylogyurus sclerovaginalis* sp. n. (a = anchor; b = dorsal bar; c = small second marginal hook with "needle"; d = marginal hook; e = vaginal armament; f = copulatory organ). (Illustrations from both holotype and paratypes).

**Differential diagnosis:** This species and *D. longiacus* Gussev, 1976 have similar types of accessory piece, anchors and bar, but the present species differs in having longer copulatory tube, marginal hooks with pearl-shaped handle, and vaginal armament with sclerotized structures. This species is also different from *D. partipentazonae* sp.n. in having longer copulatory tube and marginal hooks with pearl-shaped handle.

This species is named *Dactylogyurus iskanderensis* sp.n. after Pos Iskander in Tasek Bera.

#### *Dactylogyurus sclerovaginalis* sp.n.

**Host:** *Puntius binotatus* (Cuv. et Val.)  
**Locality:** Bukit Merah Reservoir, Perak  
**No. collected:** 15 specimens from 1 host individual  
**No. measured:** 15  
**Type specimens:** Holotype (UMMD 23) and 5 paratypes (UMMd 90–UMMd 94) in DZUM, 1 paratype (NMCIC (P) 1982–1625) in NMNS, 1 paratype in IPCAS.

Body size 750 (375–782)  $\times$  83 (83–125). Anchors large, inner length 48 (41–52) outer length 37 (34–38), long inner root 19 (12–19), short outer root 6 (3–6), main

part 31 (30–33) and recurved point 21 (20–23). One thick connective bar, size 4 (4–6)  $\times$  19 (17–21). Marginal hooks of 2 types: longer hooks (7, 6, 5 and 1) 21–26 long, with gourd-shaped handle well demarcated from pivot; smaller hooks (4, 3 and 2) 13–18 long, with spindle-shaped handle. Copulatory organ consisting of a curved tube, length 42 (40–44), size of initial 8 (7–9)  $\times$  13 (10–14), and a solid accessory piece. Vaginal armament consisting of a tube, length 46 (43–48) and a J-shaped sclerite, 15 (13–17) long. No sclerotized connections between the two structures (see later). **Differential diagnosis:** The other *Dactylogyurus* species with J-shaped or Y-shaped sclerites associated with the vaginal armament are a *Dactylogyurus* species from *Hampala macrolepidota* (Lim and Furtado, in preparation) and *D. osteochili* Lim et Furtado, 1984 (from *Osteochilus hasselti* and *O. melanopleura*). The Y- or J-sclerites of *Dactylogyurus* sp. from *H. macrolepidota* and the present species are not connected by sclerotized pieces as in *D. osteochili*. The J- or Y-sclerites are structurally different in all three *Dactylogyurus* species.

This species is named *Dactylogyurus sclerovaginalis* sp.n. because of the J-shaped sclerites.

#### *Dactylogyurus crescentileithrum* sp.n.

**Host:** *Puntius binotatus* (Cuv. et Val.)  
**Locality:** Bukit Merah Reservoir, Perak  
**No. collected:** 46 specimens from 1 host individual  
**No. measured:** 20  
**Type specimens:** Holotype (UMMD 24) and 5 paratypes (UMMd 95–UMMd 99) in DZUM, 1 paratype (NMCIC (P) 1982–1625) in NMNS, 1 paratype in IPCAS.

Body size 500 (334–521)  $\times$  100 (83–125). Anchors: inner length 33 (33–39), outer length 31 (29–33), long inner root 10 (10–13), short outer root 4 (3–5), main part 27 (25–29) and recurved point 10 (9–12). Two connective bars: rod-like dorsal bar, size 4 (3–5)  $\times$  31 (29–33) and crescent-shaped ventral bar, size 4 (3–5)  $\times$  21 (19–23). Marginal hooks 16–26 in length, with handle demarcated from pivot. Copulatory organ consisting of a simple coiled tube, length 17 (15–19), diameter of initial part 4 (3–6), and an accessory piece terminating in claws. Vaginal armament not observed.

**Differential diagnosis:** The copulatory organ of this species is quite similar to that of *D. bucinus* Gussev, 1976 and *D. longiacus* Gussev, 1976, except that there are two bars in the present species. The anchors of the present species resemble that of *D. longiacus*, but differ from that of *D. bucinus*.

The present species is named *Dactylogyurus crescentileithrum* sp.n. after the crescent ventral bar.

#### *Dactylogyurus binotati* sp.n.

**Host:** *Puntius binotatus* (Cuv. et Val.)  
**Locality:** Bukit Merah Reservoir, Perak  
**No. collected:** 24 specimens from 1 host individual  
**No. measured:** 20  
**Type specimens:** Holotype (UMMD 25) and 5 paratypes (UMMd 100–UMMd 104) in DZUM, 1 paratype in IPCAS.

Body size 458 (261–625)  $\times$  83 (52–94). Anchors: inner length 35 (34–36), outer length 31 (30–33), long inner root 10 (9–10), short outer root 4 (3–5), main part 27 (26–29) and short recurved point 8 (7–10). Two connective bars: basin-shape dorsal bar, size 4 (3–6)  $\times$  21 (19–23) and lightly sclerotized Y-shaped ventral bar, size 2 (2–3)  $\times$  29 (27–31). Marginal hooks 21–30 in length, with slight demarcation of handle from pivot. Copulatory organ consisting of a coiled tube, size of initial part

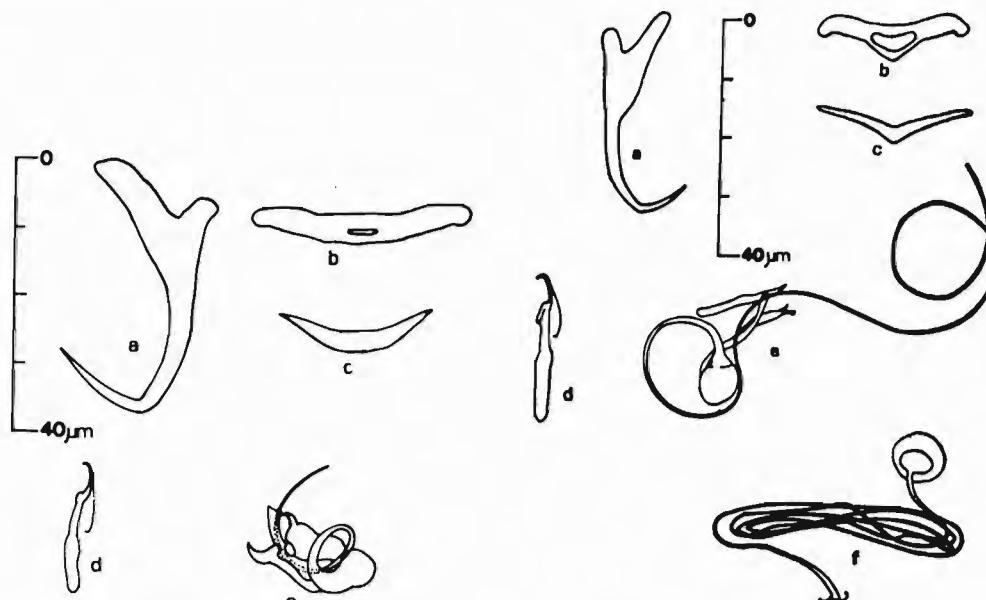
Fig. 11

Fig. 12

6 (5–7) × 8 (6–10) and an accessory piece formed by several sclerotized pieces. Vaginal armament in form of a coiled tube.

**Differential diagnosis:** None of the present and previously described *Dactylogyrus* species possesses the combination of sclerotized structures found in the present species, although the structures of the marginal hooks, connective bars and anchors are of relatively common type.

This species is named *Dactylogyrus binotati* sp.n. after its host *P. binotatus*.



**Fig. 11.** Hard parts of haptor and copulatory apparatus of *Dactylogyrus crescenticoleithrium* sp.n. (a = anchor; b = dorsal bar; c = ventral bar; d = marginal hook; e = copulatory organ). (Illustrations from paratypes).

#### *Dactylogyrus puntii* sp.n.

Host: *Puntius schwanenfeldi* (Bleeker) (Type host)  
*Puntius gonionotus* (Bleeker)

Locality: Bukit Merah Reservoir, Perak  
No. collected: 150 specimens from 3 host individuals

No. measured: 20 specimens from each host species

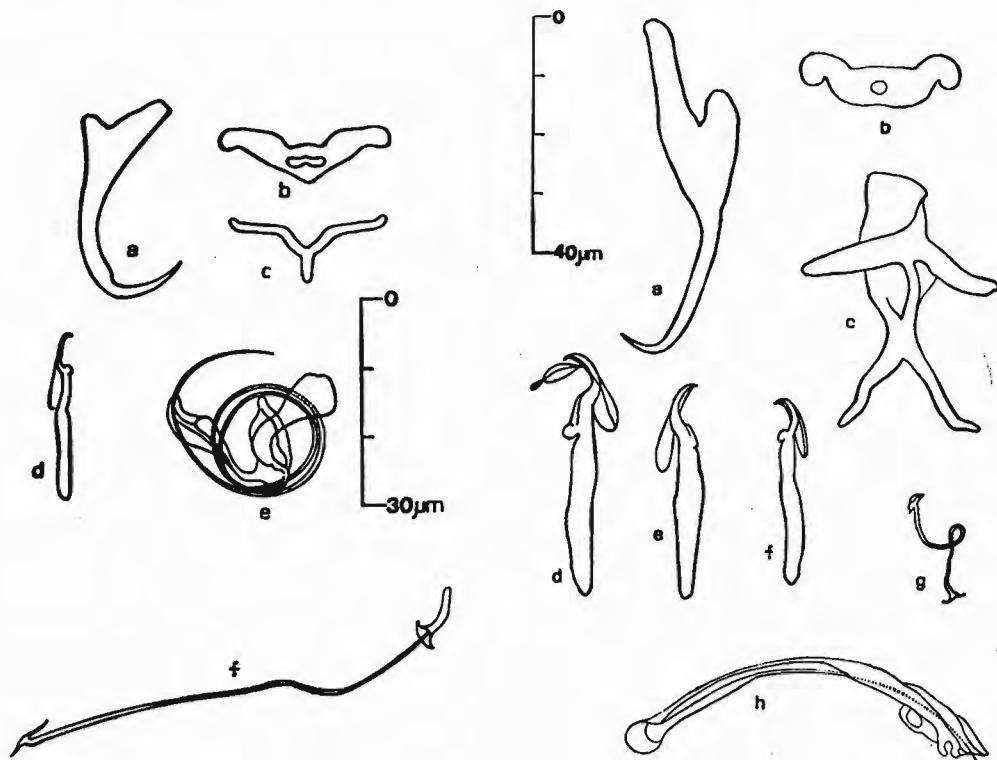
Type specimens: Holotype (UMMD 25) and 5 paratypes (UMMD 105—UMMD 109) in DZUM, 1 paratype (NMCIC, (P) 1982—1628) in NMNS, 1 paratype in IPCAS.

Body size 547 (521–573) × 125 (104–135). Anchors: inner length 32 (30–34), outer length 29 (27–30), inner root 8 (8–9), outer root 2 (1–2), main part 27 (25–28) and point 8 (8–10). Two connective bars: basin-shaped dorsal bar, size 10 (9–11) × 25 (24–27) and -shaped ventral bar, width 23 (22–25) and height 8 (7–9). Marginal hooks with slight demarcation of handle from pivot, length (16–26). Copulatory organ consisting of a coiled tube (3 ×) (21) (19–22), initial 8 (7–9) × 8 (6–9) and a slightly

Fig. 13

sclerotized accessory piece. Vaginal armament being a simple tubular structure, 67 (65–68) long.

**Differential diagnosis:** The present species is similar to *D. quangfami* Ha Ky, 1971 in the type of anchors, marginal hooks and copulatory tube (except that it is more coiled in *D. quangfami*). However, *D. quangfami* differs from the present species in the shape of the two connective bars, more coiled vaginal tube and accessory piece. Coiled arrangement of the copulatory tube as in this species is not found in any of the Indian or



**Fig. 12.** Hard parts of haptor, copulatory apparatus and vaginal armament of *Dactylogyrus binotati* sp.n. (a = anchor; b = dorsal bar; c = ventral bar; d = marginal hook; e = copulatory organ; f = vaginal armament). (Illustrations from both holotype and paratypes).

**Fig. 13.** Hard parts of haptor, copulatory apparatus and vaginal armament of *Dactylogyrus puntii* sp.n. (a = anchor; b = dorsal bar; c = ventral bar; d = marginal hook; e = copulatory organ; f = vaginal armament). (Illustrations from both holotype and paratypes).

**Fig. 14.** Hard parts of haptor, copulatory apparatus and vaginal armament of *Dactylogyrus cristatocleithrium* sp.n. (a = anchor; b = dorsal bar; c = ventral bar; d = second marginal hook; e and f = marginal hooks; g = vaginal armament; h = copulatory organ). (Illustrations from both holotype and paratypes).

Sri Lankan *Dactylogyrus*, but is found in *D. quangfami* (from Vietnam), *D. bului* sp.n., *D. binotati* sp.n., *D. helicoidus* sp.n. and *D. iskanderensis* sp.n.

The same species is also found in *Puntius gonionotus*, which is only slightly different in having larger anchors (inner length 38 (36–39), inner root 12 (10–13), outer root 2 (1–3) and larger marginal hooks (18–31). These size differences may be host-induced, and the species from *P. gonionotus* is identified as *D. puntii* sp.n.

*Dactylogyrus cristatocleithrium* sp.n.

Host: *Puntius orphoides* (Cuv. et Val.)  
Locality: Bukit Merah Reservoir, Perak  
No. collected: 100 specimens from 1 host individual  
No. measured: 20

Type specimens: Holotype (UMMD 27) and 5 paratypes (UMMd 110—UMMd 114) in DZUM, 1 paratype (UMCIC (P) 1982—1623) in NMNS, 2 paratypes in IPCAS.

Body size 740 (521—1,261)  $\times$  96 (63—115). Anchors: inner length 52 (52—60), outer length 44 (40—47), inner root 13 (13—18), outer root 2 (2—5), main part 42 (39—44) and short point 4 (3—7). Two connective bars: basin-shaped dorsal bar, 25 (23—28) wide, 4 (4—6) thick at ends and 8 (8—11) in middle; 5-rayed ventral bar with a backwardly extended medium piece like a “keel”, 46 (44—50) long. Marginal hooks 23—44 in length with handle demarcated from shorter pivot. Hooks 2, the largest hook (39—44) being different in having an extended heel giving it a double-chin appearance. Copulatory organ consisting of a short tube, length 62 (59—65), with a slightly sclerotized grooved accessory piece. Vaginal armament being a short tubular structure.

**Differential diagnosis:** A comparison of the present species with other *Dactylogyrus* species with 5-rayed ventral bars (see: Differential diagnosis of *D. pentabrachiatus* sp.n.) shows that the present species differs from the others in the structures of the 5-rayed ventral bar, anchors and marginal hooks.

The species is named *Dactylogyrus cristatocleithrium* sp.n. because of the “keel” on the 5-rayed bar.

*Dactylogyrus orphoidis* sp.n.

Host: *Puntius orphoides* (Cuv. et Val.)  
Locality: Bukit Merah Reservoir, Perak  
No. collected: 12 specimens from 1 host individual  
No. measured: 12

Type specimens: Holotype (UMMD 28) and 5 paratypes (UMMd 115—UMMd 119) in DZUM, 1 paratype in IPCAS.

Body size 308 (250—313)  $\times$  133 (83—104). Anchors: inner length 29 (26—30), outer length 21 (19—22), long inner root 13 (10—13), short outer root 2 (1—3), short recurved point 13 (12—15) and main part 19 (17—21). Two connective bars: V-shaped dorsal bar, size 3 (2—5)  $\times$  23 (21—24) and thin, stick-like ventral bar, size 1 (1—2)  $\times$  17 (15—19). Marginal hooks 13—21 in length with spindle-shaped handle demarcated from pivot. Copulatory organ 13 (12—15) long, made up of a coiled tube and an accessory piece with a robust claw-like structure. Vaginal armament in form of a simple tube.

**Differential diagnosis:** Marginal hooks of the type found in the present species are also observed in *D. partipentazonae* sp.n., *D. helicoidus* sp.n. and *D. iskanderensis* sp.n., but in other aspects all four species are different. Similar marginal hooks are also found in *D. tonkinensis* Ha Ky, 1971, however, *D. tonkinensis* differs from the present species in having only one bar and in the structures of the anchors and accessory piece.

The species is named *Dactylogyrus orphoidis* sp.n. after the host.

*Dactylogyrus perakensis* sp.n.

Host: *Puntius orphoides* (Cuv. et Val.)  
Locality: Bukit Merah Reservoir, Perak  
No. collected: 160 specimens from 1 host individual  
No. measured: 20  
Type specimens: Holotype (UMMD 29) and 5 paratypes (UMMd 120—UMMd 124) in DZUM, 1 paratype (UMCIC (P), 1982—1624) in NMNS, 1 paratype in IPCAS.

Body size 200 (125—261)  $\times$  108 (63—104). Anchors: inner length 27 (25—28), outer length 17 (15—20), long inner root 10 (9—10), stumpy outer root 1 (1—2), main part

Fig. 14

48 (46—50) and point 17 (15—19). Two connective bars: V-shaped dorsal bar, size 2 (2—4)  $\times$  8 (7—10) and thin stick-like ventral bar, size 1.5 (1.2)  $\times$  7 (6—9). Fine marginal hooks 13—18 in length, with spindle-shaped handle and long pivot. Copulatory organ consisting of a very thin coiled tube (diameter of initial part 2 (2—3) and an accessory piece with numerous processes. Vaginal armament tubular.

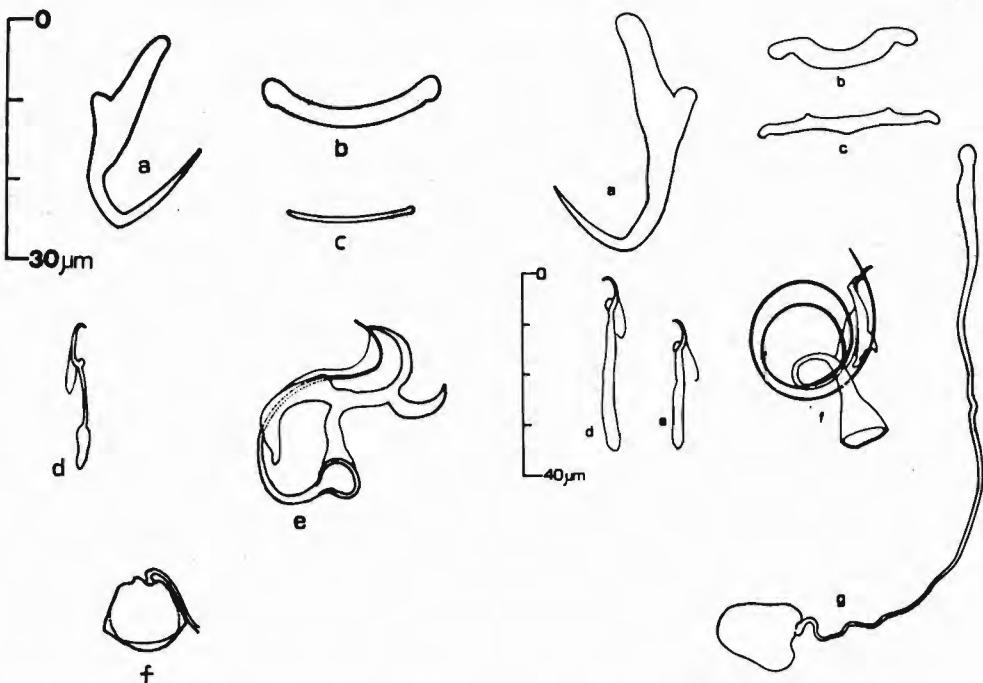


Fig. 15

**Fig. 15.** Hard parts of haptor, copulatory apparatus and vaginal armament of *Dactylogyrus orphoidis* sp.n. (a = anchor; b = dorsal bar; c = ventral bar; d = marginal hook; e = copulatory organ; f = vaginal armament). (Illustrations from both holotype and paratypes).

**Fig. 16.** Hard parts of haptor, copulatory apparatus and vaginal armament of *Dactylogyrus perakensis* sp.n. (a = anchor; b = dorsal bar; c = ventral bar; d and e = marginal hooks; f = copulatory organ; g = vaginal armament). (Illustrations from holotype).

**Differential diagnosis:** This species resembles *D. orphoidis* sp.n. in the morphology of the marginal hooks, anchors and connective bars, but differs in the structures of the copulatory organ and vaginal armament (cf. Figs. 15 and 16).

The present species is named *Dactylogyrus perakensis* sp.n. after the State of Perak, in Peninsular Malaysia.

**Remarks.** This paper gives the descriptions of sixteen new species of *Dactylogyrus* from seven of the ten species of *Puntius* found in Peninsular Malaysia: *P. bulu* (4 species), *P. partipentazona* (2 species), *P. fasciatus* (3 species), *P. binotatus* (3 species), *P. orphoides* (3 species), *P. schwanenfeldi* (1 species) and *P. gonionotus* (1 species). *D. pahangensis* sp. n., *D. partipentazonae* sp. n., *D. helicoidus* sp. n., *D. iskanderensis* sp. n. and *D. sclerovaginalis* sp. n. possess one connective bar, while the other 12 *Dactylogyrus* species have two connective bars. The single-bar species *D. partipentazonae* sp. n., *D. iskanderensis* sp. n. and *D. sclerovaginalis* sp. n. also have Y- or J-shaped accessory vaginal sclerite, a feature not observed hitherto in any of the previous oriental *Dactylogyrus* species. The presence of three species with 5-rayed ventral bar, *D. pentabrachiatus* sp. n.,

*D. pentabrachileithrium* sp. n. and *D. cristatocleithrium* sp. n., increases the number of Oriental *Dactylogyrids* with 5-rayed ventral bar to seven (see: Gussev 1976).

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## ШЕСТНАДЦАТЬ НОВЫХ ВИДОВ МОНОГЕНЕЙ РОДА *DACTYLOGYRUS* ОТ РЫБ РОДА *PUNTIUS* HAMILTON (CYPRINIDAE)

Л. Х. С. Лим и Й. И. Фуртадо

**Резюме.** Описано 16 новых видов trematod рода *Dactylogyrus* от 7 видов рыб рода *Puntius*: (*P. bulu* *P. partipentazona*, *P. fasciatus*, *P. binotatus*, *P. orphoides*, *P. schwanenfeldi*, *P. gonionotus*). *Dactylogyrus bului*, *D. pentabrachiatus*, *D. fasciculi* и *D. pahangensis* от *P. bulu*; *D. pentabrachileithrium* и *D. partipentazonae* от *P. partipentazona*; *D. fasciatus*, *D. helicoidus* и *D. iskandarensis* от *P. fasciatus*; *D. sclerovaginalis*, *D. crescenticleithrium* и *D. binotatus* от *P. binotatus*; *D. puntii* от *P. schwanenfeldi* и *P. gonionotus*; *D. cristatocleithrium*, *D. orphoides* и *D. perakensis* от *P. orphoides*.

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