

## ***Atactorhynchus duranguensis* n. sp. (Acanthocephala: Atactorhynchinae) from *Cyprinodon meeki* (Pisces: Cyprinodontidae) near Durango, Mexico**

Guillermo Salgado-Maldonado, Rogelio Aguilar-Aguilar & Guillermina Cabañas-Carranza

*Instituto de Biología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, CP 04510, México D.F., Mexico*

Accepted for publication 21st August, 2004

### **Abstract**

*Atactorhynchus duranguensis* n. sp. (Acanthocephala: Atactorhynchinae) is described from the intestine of *Cyprinodon meeki* Miller, an endemic freshwater fish from a far-inland locality of Mexico. Diagnostic features include: body small, stout, ventrally curved; small cylindrical proboscis armed with 16 alternating vertical rows of four or five hooks; anterior two or three hooks conspicuous, stout and larger than other hooks, and have large, rod-shaped roots with a markedly and abruptly enlarged base; three posterior hooks of each row are smaller and rootless; single-walled proboscis receptacle; lemnisci equal in length, elongate and robust; and cement gland syncytial, larger than testis. The new species is smaller than *A. verecundus* Chandler, 1935, the only previously described species in the genus. The shape of the proboscis of the new species is strikingly different from that of *A. verecundus*, which is widest at the apex. Likewise, the greatest width of the trunk of the new species is in about the middle, differing from that of *A. verecundus* where the trunk is widest posteriorly. The new species also can be distinguished from *A. verecundus* because of its much smaller hook lengths and slightly smaller proboscis. In addition, the proportion of large apical proboscis hooks in relation to the small basal hooks is different: the basal hooks of *A. verecundus* are about half the size of the anterior hooks and but only about a quarter of the size in *A. duranguensis*. Unlike *A. verecundus*, the base of the roots are markedly and abruptly enlarged in the new species. Finally, the eggs of the new species are smaller ( $23\text{--}27 \times 8\text{--}10 \mu\text{m}$ ) than those of *A. verecundus* ( $27\text{--}30 \times 12\text{--}13 \mu\text{m}$ ).

### **Introduction**

Helminthological examination of 35 *Cyprinodon meeki* Miller (Pisces: Goodeidae) collected from a spring near the city of Durango, Mexico, led to the finding of specimens of a new species of *Atactorhynchus* Chandler, 1935 (Acanthocephala: Atactorhynchinae). The only known species of this genus, *A. verecundus* Chandler, 1935, was described from *Cyprinodon variegatus* Lacepède (Cyprinodontiformes) in Galveston Bay (Chandler, 1935). Later, it was collected from the same host species at other locations on the coasts of Texas (Bullock, 1957), Florida (Bullock, 1960), New York (Bullock, 1962) and Alabama (Williams & Rogers, 1982). The discovery of a new species of

the genus in an endemic Mexican freshwater fish at a location far inland from the coast is a novel event. This is a report of this discovery and the description of the new species.

### **Materials and methods**

In November 2003, 35 *Cyprinodon meeki* were collected from the Abraham González spring ( $24^{\circ}12'45''\text{N}$ ,  $104^{\circ}31'48''\text{W}$ ) near the city of Durango, State of Durango, Mexico. Fish were collected using an electrofishing device; all specimens were transported alive to the laboratory and examined within 6 h of capture. Acanthocephalans were removed and placed in distilled water

and refrigerated for 8 h to evert the proboscis. Worms were fixed in 4% formalin, stained with Mayer's paracarmin and mounted whole. Illustrations were made using a camera lucida. All measurements are in micrometres unless otherwise indicated, with the mean in Parentheses.

Five paratypes (USNM Catalog No. T145-15 and T145-16) of *Atractorhynchus verecundus* collected by A. Chandler from *Cyprinodon variegatus* in Galveston Bay were compared to the new species.

Type-specimens of the new species are deposited in the Colección Nacional de Helmintos, Instituto de Biología, Universidad Nacional Autónoma de México (CNHE) and in the British Museum (Natural History) collections (BMNH) at The Natural History Museum, London.

**Family Neoechinorhynchidae Ward, 1917**

**Subfamily Atractorhynchinae Petrochenko, 1956**

**Genus *Atractorhynchus* Chandler, 1935**

***Atractorhynchus duranguensis* n. sp.**

*Type-host:* *Cyprinodon meeki* Miller (Pisces: Cyprinodontidae).

*Type-locality:* Abraham González Spring (24°12'45"N, 104°31'48"W), Durango, Mexico.

*Site:* Intestine.

*Type-material:* Holotype CNHE 5214; paratypes CNHE 5215 and BMNH 2004.6.2.2-3.

*Infection:* Eight of the 35 fish examined (prevalence 23%) were parasitised by 1–3 acanthocephalans (mean intensity 1.6). A total of 13 acanthocephalans were collected: 9 males and 4 females.

*Etymology:* The name of the new species refers to the type-locality, Durango, Mexico.

*Description* (Figures 1–5)

Based on 13 specimens (6 males and 4 females). Neoechinorhynchidae, Atractorhynchinae, with characters of *Atractorhynchus*. Body small, stout, curved ventrally, with greatest diameter in middle, bluntly rounded posteriorly, tapered anteriorly (Figure 1). With sexual dimorphism; females twice size of males. Shared structures only slightly larger in females than in males. Body-wall contains 5 dorsal and 1 ventral giant hypodermal nuclei

(Figure 1). Proboscis small, cylindrical (Figure 2), armed with 16 almost vertical alternating rows of hooks, with 4 and 5 hooks each. Anterior 2 or 3 hooks equal in length, conspicuous, stout, heavily curved and larger than other hooks on proboscis, rooted, with large rod-shaped roots, in anterior 2/3 of proboscis; hook rows at this level arranged quincuncially. Three posterior hooks in close together in vertical rows, with no or only rudimentary roots (Figures 2, 3). Neck simple, very short, wider than long; no neck girdle. Proboscis receptacle with single muscular wall, about twice as long as proboscis, with large triangular cerebral ganglion at its posterior end. Lemnisci equal, elongate, robust, linguiform, large, extending to about middle of body; one lemniscus with 2 giant nuclei, other with 1.

In male, reproductive system occupies posterior 1/2 of body. Testes large, approximately equal in size, spherical to ovoid, tandem, contiguous with each other. Sperm ducts on ventral side of testis join posteriorly to form common sperm duct, which opens to a large, ovoid seminal vesicle. Seminal vesicle with 2 parallel ducts running posteriorly leading to muscular penis. Cement gland syncytial, spherical, larger than testes, contiguous to posterior testes; with 8 giant nuclei (visible in only 1 specimen). Cement-gland ducts extend lateral to Saeftingen's pouch and join posteriorly at bursa. Cement reservoir conspicuous, spherical. Saeftingen's pouch elongate, robust. Copulatory bursa opens terminally, elongate when everted.

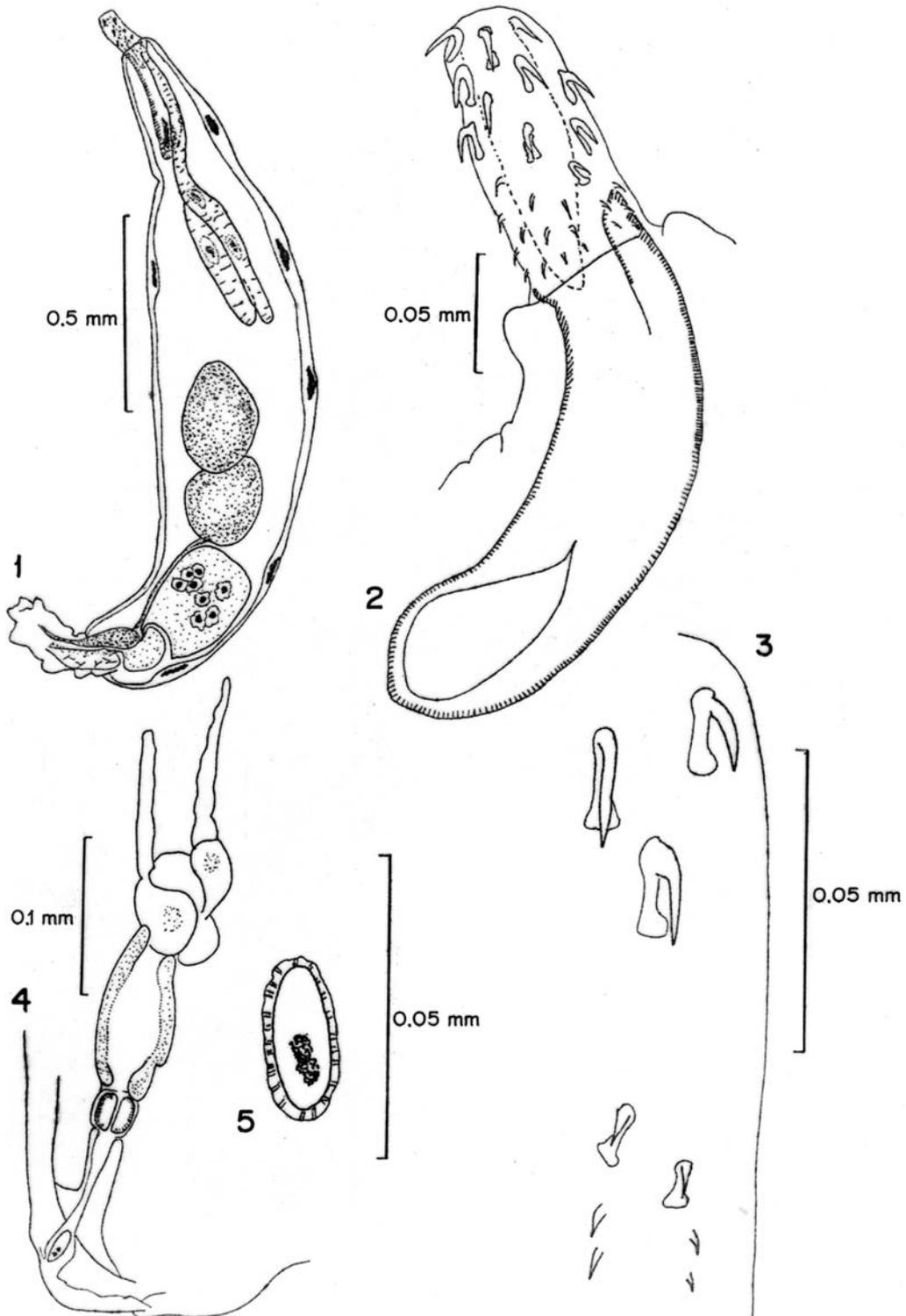
In female, vagina not coiled; gonopore subterminal ventral (Figure 4). Mature eggs ovoid, without polar prolongation of fertilisation membrane (Figure 5).

Measurements of specimens given in Table 1.

**Discussion**

The new species clearly fits the concept of *Atractorhynchus*, as presented by Chandler (1935) and Bullock (1962).

*Atractorhynchus* was previously considered to be monotypic (Amin, 1985; Golvan, 1994). The new species is similar to the type-species, *A. verecundus* Chandler, 1935, in the small size of the body, the number and arrangement of the proboscis hooks, the arrangement of the internal organs, and the dimensions and extent of the



Figures 1-5. *Atactorhynchus duranguensis* n. sp. 1. Holotype (male). 2. Proboscis. 3. Two rows of hooks from a paratype male. 4. Reproductive system of a paratype female. 5. Egg in the body-cavity of a paratype female.

Table 1. Measurements of *Atactorhynchus duranguensis* n. sp. (four males and four females) from *Cyprinodon meeki* near Durango, Mexico (measurements are given, length  $\times$  width, as the range, with the mean in parentheses, in micrometres except where otherwise indicated).

	Males	Females
Trunk (mm)	0.996–1.860 (1.428) $\times$ 0.283–0.360 (0.323)	1.620–3.300 (2.518) $\times$ 0.441–0.691 (0.545)
Proboscis	67–110 (96) $\times$ 45–60 (50)	99–148 (127) $\times$ 63–85 (71)
Proboscis hooks		
Apical	13–15 (14) $\times$ 2–3 (2)	16–18 (17) $\times$ 3–4 (3)
Last large hook in each row	13–15 (14) $\times$ 2–3 (2)	13–16 (14) $\times$ 2–3 (3)
First small hook in each row	5–9 (7) $\times$ 1 (1)	8–9 (9) $\times$ 1 (1)
Basal hook	4 (4) long	4 (4) long
Proboscis receptacle	163–281 (222) $\times$ 38–77 (56)	233–432 (333) $\times$ 65–120 (86)
Uninucleate lemniscus	456–780 (652) $\times$ 41–58 (50)	828–936 (882) $\times$ 60–77 (68)
Binucleate lemniscus	542–828 (671) $\times$ 41–60 (53)	828–912 (870) $\times$ 65–72 (68)
Length of reproductive system (mm)	0.648–1.152 (0.855)	0.348–0.405 (0.376)
Anterior testis	120–264 (196) $\times$ 120–185 (151)	
Posterior testis	108–240 (180) $\times$ 139–221 (171)	
Cement gland	144–300 (236) $\times$ 156–230 (198)	
Cement reservoir	115–144 (126) $\times$ 77–120 (103)	
Seminal vesicle	113–192 (158) $\times$ 41–72 (60)	
Saeftigen's pouch	120–240 (180) $\times$ 31–77 (58)	
Eggs inside body-cavity of female		23–27 (25) $\times$ 8–10 (9)

lemnisci and proboscis receptacle. The paratype specimens of *A. verecundus* examined in the present study are smaller than those in the original description of *A. verecundus*, as most are juveniles. Chandler (1935) reported the maximum size for males as 4.5 mm long and for females as 6.5 mm long, whereas the paratypes studied are considerably smaller (males 2.707–3.325 mm long and 0.598–0.703 mm wide; females 3.448–3.990 and 0.494–0.522 mm), but they are still noticeably larger than *A. duranguensis* n. sp.

Characteristics that serve to distinguish *A. duranguensis* from *A. verecundus* include: (1) the shape of the proboscis and the trunk; (2) the size of the proboscis and hooks; (3) the ratio between the large and small proboscis hooks and the shape of hook roots; (4) the thickness of the body wall; and (5) the size of the eggs. In more detail, with regard to the shape of the proboscis, the proboscis of *A. verecundus* is widest at the apex, whereas that of *A. duranguensis* is uniformly cylindrical. In the case of the trunk, the greatest width of the trunk of *A. duranguensis* is in about the middle, whereas in *A. verecundus* it is widest in the posterior half. The proboscis is larger in *A. verecundus* (150  $\times$  60  $\mu$ m) compared to that of *A. duranguensis* ( $\sigma$  67–110  $\times$  45–60,  $\phi$  99–148  $\times$  63–85  $\mu$ m). The

proboscis hooks in *A. duranguensis* are much smaller in length than those of *A. verecundus*, and the ratio between the size of the large apical proboscis hooks and the small basal hooks is also different: the apical proboscis hooks of *A. verecundus* are larger (18–19  $\mu$ m) than those of *A. duranguensis* ( $\sigma$  13–15,  $\phi$  16–18  $\mu$ m), and the basal proboscis hooks of *A. verecundus* are twice as large (9–10  $\mu$ m) as those of *A. duranguensis* (4  $\mu$ m in both sexes). Therefore, the basal hooks of *A. verecundus* are about half the size of the anterior hooks, but only about a quarter the size in the new species. Moreover, the new species can be distinguished because of the base of the proboscis hook roots is, unlike Chandler's material, markedly enlarged.

Unfortunately, the proboscis of each of the five studied paratypes of *A. verecundus* examined was invaginated or in a poor state of preservation. The original species description reported a very small proboscis, almost cylindrical, with the hooks arranged irregularly in about eight diagonally-transverse rows, the first four or five of which occupy the anterior two-thirds of the proboscis, with about eight hooks in each row, and the last two or three rows are smaller and have more hooks (the last row having *c.*16) which are about

half the size of the anterior hooks (Chandler, 1935). This description suggests a total of 64–88 hooks. The proboscis of *A. duranguensis* has 72 hooks arranged in 16 longitudinal rows which alternate between four and five hooks per row. The arrangement of the hook rows is not perfectly longitudinal and tends to be slightly diagonal. Thus, the number of hooks in both species is not very different. Also, the extent of the large hooks, occupying the anterior two-thirds of the proboscis, and the three basal hooks of each row, occupying only the last third of the proboscis, is an arrangement similar to Chandler's description for *A. verecundus*.

All five paratypes of *A. verecundus* which we examined have a very thick body wall, especially in the dorsal region, while the specimens of the new species from Durango lack this characteristic. Finally, the eggs inside the body-cavity of the females of the new species are smaller ( $23\text{--}27 \times 8\text{--}10 \mu\text{m}$ ) than those of *A. verecundus* ( $27\text{--}30 \times 12\text{--}13 \mu\text{m}$ ).

*A. verecundus* parasitises the sheepshead minnow *Cyprinodon variegatus*, is known to be well-distributed, being reported from Alabama (Williams & Rogers, 1982) and Long Island, New York (Bullock, 1962) to the coasts of Texas and Florida, and may extend along the entire coast of the Gulf of Mexico (Chandler, 1935; Bullock, 1957, 1960). *A. duranguensis* parasitises *C. meeki*, a species endemic to Mexico, and was found in freshwater bodies at an inland locality of the State of Durango in central Mexico.

A very rigid host-specificity of *A. verecundus* to *C. variegatus* has been documented (Bullock, 1957, 1960, 1962). Examination of several hundred fish comprising a wide variety of species from off the Texan coast, including other cyprinodontids, failed to identify a single immature *A. verecundus* specimen in any species other than *C. variegatus* (see Bullock, 1957). In Florida, the examination of the closely related cyprinodontid *Floridichthys carpio* (Günther) failed to yield any acanthocephalans (Bullock, 1960). Reports also exist of strict host-specificity in the case of another atactorhynchine, *Tanaorhamphus longirostris* (Van Cleave, 1913) Ward, 1918, to its definitive host, *Megalops cepedianus* [= *Dorosoma cepedianum*] (Le Sueur) (see Jilek, 1978).

The present results are important because very few acanthocephalan species are known to parasitise Mexican freshwater fishes. In fact, of all the groups of helminths parasites of freshwater fishes in Mexico, the acanthocephalans are the rarest (Salgado-Maldonado et al., 1992; Choudhury & Dick, 2000).

### Acknowledgements

Dr Eric P. Hoberg and Patricia Pilitt lent slides from the U.S. National Parasite Collection, including paratype specimens of *A. verecundus*. Andrés Martínez-Aquino and Miriam Reyna Fabian provided technical assistance during fieldwork.

### References

- Amin, O.A. (1985) Classification. In: Crompton, D.W.T. & Nickol, B.B. (Eds) *Biology of the Acanthocephala*. Cambridge: Cambridge University Press, pp. 27–72.
- Bullock, W.L. (1957) The acanthocephalan parasites of the fishes of the Texas coast. *Publications of the Institute of Marine Science, University of Texas*, **4**, 278–283.
- Bullock, W.L. (1960) Some acanthocephalan parasites of Florida fishes. *Bulletin of Marine Science of the Gulf and Caribbean*, **10**, 481–484.
- Bullock, W.L. (1962) The status of the acanthocephalan genera *Floridosentis* Ward, 1953, and *Atactorhynchus* Chandler, 1935. *Proceedings of the Helminthological Society of Washington*, **29**, 217–218.
- Chandler, A.C. (1935) Parasites of fishes in Galveston Bay. *Proceedings of the United States National Museum*, **83**, 123–157.
- Choudhury, A. & Dick, T.A. (2000) Richness and diversity of helminth communities in tropical freshwater fishes: empirical evidence. *Journal of Biogeography*, **27**, 935–956.
- Golvan, Y.J. (1994) Nomenclature of the Acanthocephala. *Research and Reviews in Parasitology*, **54**, 135–205.
- Jilek, R. (1978) Seasonal occurrence and host specificity of *Gracilisentis gracilisentis* and *Tanaorhamphus longirostris* (Acanthocephala: Neoechinorhynchidae) in Crab Orchard Lake, Illinois. *Journal of Parasitology*, **64**, 951–952.
- Salgado-Maldonado, G., Jiménez-García, M.I. & León-Règagnon, V. (1992) Presence of *Octospiniferoides chandleri* Bullock, 1957 in *Heterandria bimaculata* from Catemaco, Veracruz and considerations about the acanthocephalans of freshwater fishes of Mexico. *Memórias do Instituto Oswaldo Cruz*, **87** (Suppl. 1), 239–240.
- Williams, E.H. & Rogers, W.A. (1982) New host records for Acanthocephala of some Alabama freshwater fishes. *Proceedings of the Helminthological Society of Washington*, **49**, 140–142.