



## ***Dario kajal*, a new species of badid fish from Meghalaya, India (Teleostei: Badidae)**

RALF BRITZ<sup>1</sup> & SVEN O KULLANDER<sup>2</sup>

<sup>1</sup>Department of Life Sciences, The Natural History Museum, Cromwell Road, London, SW75BD, United Kingdom.

E-mail: [r.britz@nhm.ac.uk](mailto:r.britz@nhm.ac.uk)

<sup>2</sup>Department of Zoology, Swedish Museum of Natural History, POB 50007, SE-104 05 Stockholm, Sweden.

E-mail: [sven.kullander@nrm.se](mailto:sven.kullander@nrm.se)

### **Abstract**

*Dario kajal*, new species, is described from Seinphoh stream in the Jaintia Hills of Meghalaya, India. It can be distinguished from all other congeners by the presence of a postorbital stripe that continues behind the eye in line with the pre-orbital stripe and by the presence in males of a series of double bars restricted to the upper half of the body. The discovery of *D. kajal* in the Meghna River drainage raises the number of *Dario* species to five and raises interesting questions about the biogeography of the genus.

**Key words:** Northeast India; disjunct distribution; vicariance; Indo-Burma biodiversity hotspot

### **Introduction**

The percomorph fish family Badidae comprises 21 species distributed in freshwater in southern Asia, from eastern India and Nepal east to the Mekong drainage in Thailand and Laos. The family was revised by Kullander & Britz (2002) who distinguished two genera, *Badis* and *Dario*. The latter is characterized by its small size (maximum standard length between 15 and 28 mm) and various reductions, such as absence of the postcranial lateral line. Three species of *Dario* (*D. dario* Hamilton, *D. dayingensis* Kullander & Britz, *D. hysginon* Kullander & Britz) are distributed in the Brahmaputra and Ayeyarwaddy drainages in India and Myanmar (Kullander & Britz 2002), and an unusual, recently-described, fourth species (*D. urops* Britz, Ali & Philip) is known from streams in south India (Britz *et al.* 2012). We recently obtained material of a differently-looking *Dario* collected from Meghalaya in northeast India, which prompted a closer study. The present paper demonstrates that this is a new species, the fifth in the genus, and the formal description is given herein.

### **Material and methods**

Ten measurements and 12 counts were taken from a series of ten specimens following Kullander & Britz (2002). Measurements are point to point and were taken with a digital caliper, usually under a stereomicroscope, and were recorded to the nearest 0.1 mm. Vertebrae and fin rays of dorsal and anal fin of BMNH.2006.8.2.1 (holotype) and BMNH 2006.8.2.2-26 (25 paratypes) were counted from radiographs. Presence of teeth in the oral cavity was checked with the stereomicroscope on alcohol specimens. Presence and shape of the parasphenoid tooth patch was observed in a dissected specimen stained with an alcoholic alizarin solution. Colour pattern terminology follows Kullander & Britz (2002). Specimens of *Dario* used in this study are deposited in the collections of The Natural History Museum (BMNH), London, the Swedish Museum of Natural History (NRM), Stockholm, and National Museum of Natural History (USNM), Smithsonian Institution, Washington DC. The distribution map in figure 4 is based on *Dario* material listed in Kullander & Britz (2002), Britz *et al.* (2012), USNM 376118, 376120, 376433, 376434, and the type series of *Dario kajal*.

## *Dario kajal*, new species

(Figures 1–2)

**Holotype.** BMNH 2006.8.2.1, male, 17.8 mm SL. India, Meghalaya, Jaintia Hills, Seinphoh stream at Umolong, 7 km from Jowai town, 25°31'36"N 92°08'27"E, 1320 m asl; A. Rao and P. Cottle, 2 Feb 2006.

**Paratypes.** BMNH 2006.8.2.2-26, 25, 14.4–20.0 mm SL; same data as holotype.—NRM 47440 (2), 47441 (1), 47442 (2), 5, 11.4–16.8 mm SL. India, Meghalaya, Jaintia Hills, Seinphoh stream at Umolong; H. Bleher, 22 Sep 2009.

**Diagnosis.** A small badid species, not exceeding 20 mm SL, distinguished from all other species of *Dario* by the presence of a postorbital stripe that continues behind eye in line with preorbital stripe (vs. postorbital stripe forming an oblique angle with the preorbital stripe in *D. dario* and *D. urops* or postorbital stripe absent in *D. hysginon* and *D. dayingensis*) and by the presence in males of a series of double bars restricted to the upper half of the body (vs. complete bars across the body in *D. dario*, complete bars restricted to the posterior body in *D. urops* and bars absent in *D. hysginon* and *D. dayingensis*). It differs further from *D. urops* in the absence of a caudal-peduncle blotch and the absence of a horizontal suborbital stripe, by dorsal-fin lappets in males extending beyond the spine tip (vs. not extending beyond the spine tip) and a lower vertebral number (24–26 vs. 28–29). It can be distinguished further from *D. urops* and *D. dayingensis* in having a lower transverse scale count (8 vs. 9–10) and by the absence of palatine teeth (vs. presence), from *D. dario* by the presence in males of a black spot anteriorly in the dorsal fin and modally 7 (vs. 6) anal-fin rays, and from *D. hysginon* by the absence of an anguloarticular lateral-line canal (vs. presence).

**Description.** For general appearance see Figs. 1–2; morphometric data are provided in Table 1. Body elongate, moderately laterally compressed. Predorsal contour straight to slightly convex, prepelvic contour convex. Eye situated in anterior half of head, snout short. Mouth terminal, directed slightly obliquely upwards with lower jaw projecting. Angle of jaws situated at vertical through anterior third of eye. Dorsal contour of body slightly arched, convex, less so in females, ventral contour of body straight; both contours slightly converging towards caudal peduncle. Caudal peduncle only slightly attenuated posteriorly. Teeth developed in a circular posterior patch on parasphenoid, also present on vomer, but absent from palatine, basihyal and hypobranchial 3.

**TABLE 1.** Selected morphometric characters of 10 specimens (5 males and 5 females) of *Dario kajal* including holotype (values for the holotype are in parentheses).

BMNH 2006.8.2.1 + BMNH 2006.8.2.2-26 (n=10)	range	mean ± SD
Standard length (SL) in mm	14.4–20.0 (17.8)	
In percent of standard length		
Head length	30.1–33.3 (30.9)	31.9 ± 1.1
Snout length	4.2–6.1 (5.6)	5.1 ± 0.6
Eye diameter	10.0–11.5 (10.7)	10.8 ± 0.5
Interorbital width	9.8–10.6 (9.8)	10.2 ± 0.3
Upper-jaw length	8.2–10.4 (8.4)	9.3 ± 0.7
Lower-jaw length	11.8–13.1 (12.4)	12.4 ± 0.5
Body depth	30.5–32.6 (32.6)	31.4 ± 0.7
Pelvic fin-length	23.4–32.8 (32.6)	27.5 ± 3.5
Pelvic to anal distance	28.2–33.8 (29.2)	30.5 ± 1.7
In percent of head length		
Snout length	13.7–18.9 (18.2)	16.3 ± 2.0
Eye diameter	31.3–35.7 (34.5)	33.8 ± 1.4

Lateral-line canal pores present only on head, absent from body. Head canal pores comprise: preopercular pores 6 (p1–p6), nasal pores 2 (n1–n2), supraorbital pores 5 (f1–f5), extrascapular pores 3 (ex1–ex3), posttemporal pores 2 (po1–po2), coronalis pore 1 (cor), lachrymal pores 2 (l1, l3); no dentary, angulo-articular or infraorbital

pores, instead series of free neuromasts developed. Scales ctenoid on sides, cycloid on top of head. Tubed lateral-line scales absent. Scales in longitudinal row 24. Scales in transverse row 8. Circumpeduncular scales 16.

Dorsal-fin lappets in males slightly prolonged, rising distinctly above spine tips, in females about as long as spines; soft dorsal fin rounded, extending to about caudal-fin base or beyond. Soft anal fin rounded, often not reaching to caudal-fin base in females, reaching beyond caudal-fin base in males. Caudal fin subtruncate. Pectoral fin rounded, extending about  $\frac{2}{3}$  to vertical from anal-fin origin. Pelvic fin pointed, first and second ray equally long, forming tip, sexually dimorphic: reaching to vent or shorter in females, to base of first or second anal-fin spine in males.

Vertebrae 12+12 (3), 12+13 (19), 13+13(1), 12+14 (2), and 13+12(1), total 24–26. Dorsal-fin spines and rays XIV+7 (14), XIII+8 (1), XIII+7 (2), XIV+6 (3), XV+6 (4), XIII+6 (1), or XV+7 (1). Anal-fin spines and rays III+6 (6), III+7 (19), and III+8 (1). Caudal-fin with 11–13 principal and 3–4 dorsal and 3–5 ventral procurent rays: 4+6+6+3 (4), 4+6+6+4 (17), 3+6+6+3 (2), 3+7+6+4 (1), 4+6+5+5 (1), and 4+6+6+5 (1).

**Coloration in preservative.** Background colour on head and body beige. Preorbital and postorbital stripes well developed, black. A number of dark-brown to black scales on nape. A series of five faint, dark-brown double-bar saddles originating from base of dorsal fin and extending ventrally for up to three scales on body and one incomplete double bar on caudal peduncle. Anterior dorsal fin with dark blotch covering membranes between dorsal-fin spines 1–3. Rest of dorsal fin, anal and pelvic fins, and base of caudal fin with dusky interradiation membranes. Spinous dorsal fin, leading edges of pelvic and anal fins and ventral edge of caudal fin with white rim. Pectoral fin translucent.

**Coloration in life.** Overall pattern of colour markings in specimens right after capture similar to preserved specimens (Fig. 2). Subdistal white rim of spinous dorsal fin bordered distally by black narrow band. Cheek, opercle and cleithrum with some iridescence.



**FIGURE 1.** *Dario kajal*, new species, BMNH 2006.8.2.1, male, holotype, 17.8 mm, above; BMNH 2006.8.2.2-26, female, paratype, 15.4 mm SL, below: Seinphoh stream, Jaintia Hills, Meghalaya, India.



**FIGURE 2.** *Dario kajal*, coloration in life. Above, one of the types immediately after capture (photo: Peter Cottle). Below, acclimatized specimen from aquarium import, reportedly from Meghalaya (photo: Andreas Werth).

In acclimatized specimens subdistal band in dorsal fin, leading edge of pelvic fins, and distal rim of anal fin bright bluish white (Fig. 2). Pre- and postorbital stripes conspicuous. Double bar saddles orange brown, belly region a uniform lighter brown. Anteriormost two membranes of dorsal fin up to subdistal band with dense covering of melanophores. More posterior fin membranes of dorsal fin and those of caudal and anal fins with fewer melanophores and more orange-brown chromatophores.

**Distribution and habitat** (Figs. 3, 4). *Dario kajal* is currently known from the type locality, Seinphoh stream near Jowai in the Jaintia hills in Meghalaya, India. Seinphoh stream is a tributary of the Myntdu River. The fish were collected from a small, shallow pool with stagnant to slow-flowing water. The pool was turbid at the time of collection and had no aquatic vegetation. Because the Myntdu River continues into Bangladesh, this species is also likely to occur there.

**Etymology.** The species name is derived from the Hindi word *kajal* meaning black eyeliner, especially used by traditional Indian dancers, in allusion to the prominent orbital stripes of the new species.

**Remarks.** This species has been referred to as *Dario* sp. “Jaintia Hills” in the aquarium literature (see Werth 2009).



**FIGURE 3.** Seinphoh stream near Jowai, Jaintia Hills, Meghalaya, India, type locality of *Dario kajal*. The new species was collected from the clearer stretch of water on the left side of the pool.

## Discussion

*Dario kajal* is the fourth miniature species in the genus along with *D. dario*, *D. hysginon*, and *D. dayingensis* (Kullander & Britz 2002). The recently described *D. urops* from southern India (Britz *et al.* 2012) reaches at least 28 mm SL and therefore does not qualify as a miniature fish *sensu* Weitzman & Vari (1988). Based on a number of shared reductive similarities, the miniature *Dario* species may represent a monophyletic taxon even with the inclusion of *D. kajal*, and *D. urops* is most likely the sister group to this miniature clade.

The distribution of *Dario kajal* in comparison with the other three miniature *Dario* species is noteworthy. While *D. dario* is known from the Brahmaputra basin in India, *D. hysginon* and *D. dayingensis* are restricted to the Ayeyarwaddy basin in Myanmar. *Dario kajal* has been collected from Seinphoh stream, a tributary of Myntdu River and thus part of the Meghna River basin. The Meghna River basin is located between the two major tributaries, the Brahmaputra and the Ayeyarwaddy, in which the other three miniatures are found. This pattern suggests either a wide ancestral distribution subject to fragmentation (Rüber *et al.* 2004), or extensive river captures between the Brahmaputra, Meghna and Ayeyarwaddy. *Dario* is absent from the Ganga. The absence of *Dario* in all eastern rivers of the Indian Peninsula except the very small headwater in the Western Ghats in which *D. urops* is found may be an artifact of incomplete sampling of these small secretive freshwater fishes, especially in the region of the Eastern Ghats. It could also be a real absence caused by the establishment of a large dryzone between the wetzone areas of the Western Ghats and the north of India (Karanth 2003). The exact species-level relationships will, however, need to be worked out before any meaningful biogeographic hypothesis for the distribution of *Dario* can be formulated.

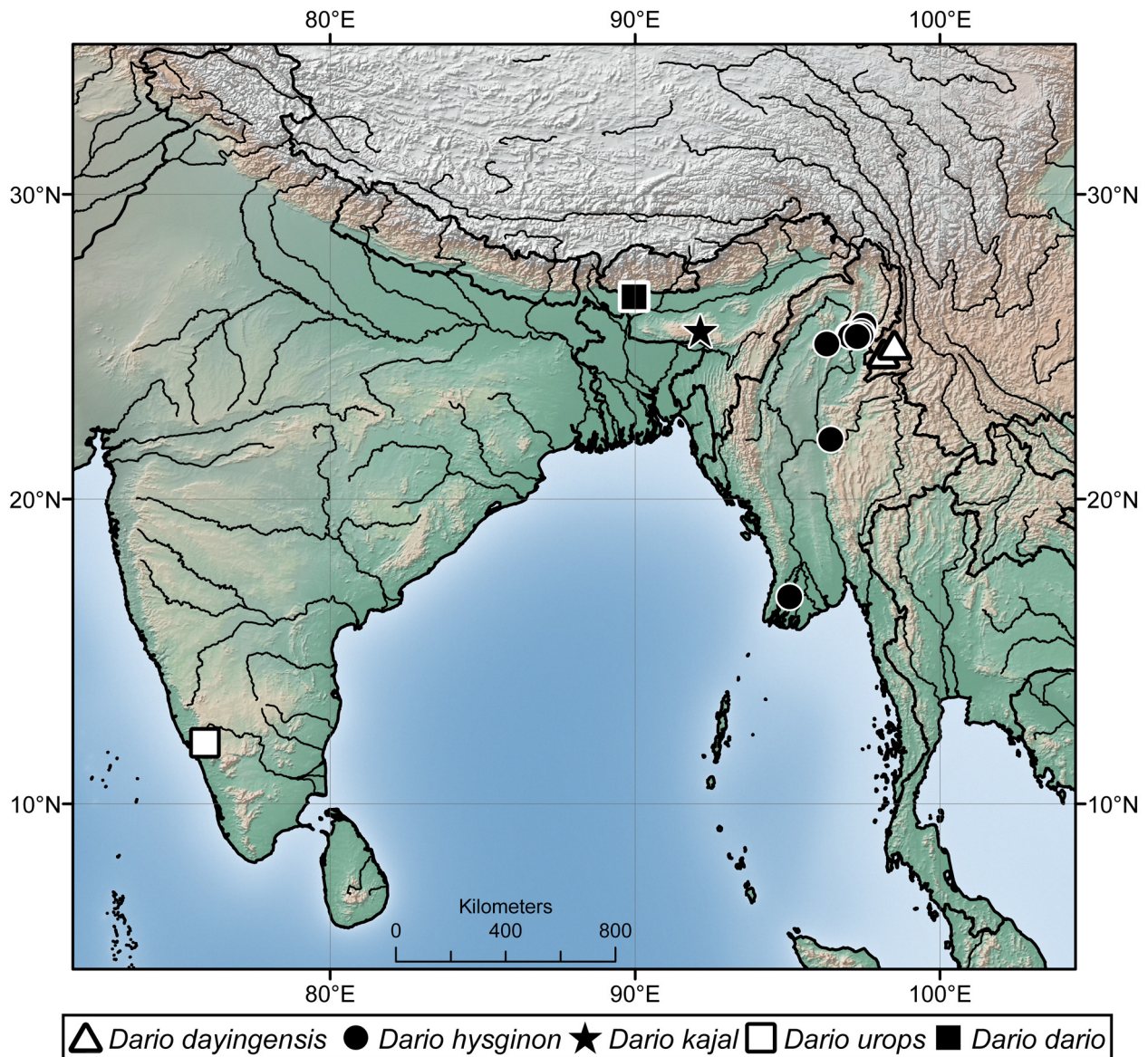


FIGURE 4. Distribution of *Dario* species in India and Myanmar.

### Acknowledgements

We are grateful to Andrew Rao, Malabar Tropicals, Calcutta, and Peter Cottle, Cliffe Woods, U.K., who discovered the new species and provided a large part of the type series via Keith Lambert, Wildwoods, Crews Hill, and to Heiko Bleher, who collected additional specimens that he made available to us. We further thank Peter Cottle and Andreas Werth, Köln, Germany, for allowing us to reproduce their photos of live *Dario kajal*. Oliver Crimmen, Fish Group, The Natural History Museum, London, helped with radiography. Critical comments from two anonymous reviewers helped improve the paper.

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