**Tetraodon palustris**, a new freshwater pufferfish (Tetraodontiformes: Tetraodontidae) from the Mekong Basin of Thailand

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Abstract

*Tetraodon palustris*, new species, is described from the Mekong basin of Thailand. *Tetraodon palustris* differs from *T. cochinchinensis* and *T. fangi* in having no ocellus on the flank and spinules dorsally from the interorbital region to the end of the dorsal-fin base. *Tetraodon cochinchinensis* is distinguished from *T. fangi* by having a longer snout (43.5–49.2% HL in *T. cochinchinensis* vs. 37.9–41.1% HL in *T. fangi*) and is covered with spinules dorsally from the front of the nasal organs to the end of the dorsal-fin base (vs. from the front of the eyes to the end of the dorsal-fin base in *T. fangi*).

Key words: *Tetraodon*, new species, Mekong basin

Introduction

Studies on freshwater pufferfishes in the genus *Tetraodon* from the Mekong Basin of Thailand are included in only a few published papers. Sontirat (1989) described two new species, *Tetraodon baileyi* and *T. suvattii*, and Roberts (1998) revised the genus *Tetraodon* from the Mekong basin of Thailand and Laos providing original descriptions of *T. abei* and *T. barbatus*, and redescribing *T. baileyi*, *T. leiurus* and *T. suvatii*. *Tetraodon abei* is found in the Mekong and Chao Phraya basins while *T. barbatus* is known only from the Mekong basin.

An ichthyological survey was conducted from January 2011 to December 2012 in the Mekong basin in the northeastern region of Thailand, during which the authors collected an unknown freshwater pufferfish of the genus *Tetraodon* from marshes and swamps. The shape and colour pattern of these specimens differ from those in previous reports of *Tetraodon* from the Mekong basin, and the new species is described herein as *Tetraodon palustris*.

Material and methods

Most specimens of fishes in the study were from the National Inland Fisheries Institute (NIFI), Kasetsart Museum of Fisheries (KUMF), and those collected by the authors in 2009–2012. Only specimens that were not or barely inflated were measured. Fin-ray counts and measurements were made on the left side of specimens. Measurements were made point to point with dial calipers, and the data recorded to tenths of millimeter. Standard length, total length, dorsal-fin base length, head length, snout length, interorbital distance, eye diameter, mouth width, and pectoral-, dorsal-, anal- and caudal-fin ray counts were made according to Dekkers (1975). Other measurements included internasal distance; interopercular distance; head depth and width at preorbital, postorbital and nape; interpectoral-fin distance; prepectoral-, predorsal- and preanal-fin lengths; pectoral-, dorsal- and anal-fin base lengths; depth and width of body at middle of base of dorsal fin; and caudal-peduncle length, depth and width. Subunits of the head are presented as percents of head length (%HL), while head length and measurements of body.
parts are presented as percents of standard length (%SL). The spinules on the skin were stained with alizarin red S according to the method of Kovitvadhi & Kovitvadhi (2004).

_Tetraodon palustris_ sp. nov.
(Figs. 1–2)

**Holotype.** Mekong basin, Thailand: KUMF 8834, holotype, 72.1 mm SL, Nongkomkoh Swamp, Amphoe Mueang, Nong Khai Province, 7 September 2011, P. Saenjundaeng.

**Paratypes.** Mekong basin, Thailand: KUMF 8835, 6, 54.9–76.9 mm SL, Nongkomkoh Swamp, Amphoe Mueang, Nong Khai Province, 7 September 2011, P. Saenjundaeng; NIFI 00624, 1, 94.6 mm SL, Amphoe Tha Bo,
Nong Khai Province, 6 June 1977, J. Ratanathavee; NIFI 00513, 1, 66.8 mm SL, Nong Khai market, Nong Khai Province, 8 February 1985, S. Sontirat; NIFI 00630, 51.4 mm SL, Amphoe Tha Bo, Nong Khai Province, 3 June 1987, S. Soontornsathit; KUMF 8836, 8, 78.2–91.8 mm SL, Nongkon Swamp, Amphoe Rattanawapi, Nong Khai Province, 25 September 2011, P. Saenjundaeng and R. Mapanao; KUMF 8837, 14, 73.2–84.8 mm SL, Kud-Thing Marsh, Ban Don Ho, Amphoe Mueang, Bung Kan Province, 18 March 2012, P. Saenjundaeng; KUMF 8838, 10, 54.3–70.2 mm SL, Huai Luang Reservoir, Udon Thani Province, 28 December 2011, P. Saenjundaeng; KUMF 8839, 10, 55.8–68.1 mm SL, Huai Luang Reservoir, Udon Thani Province, 29 December 2011, P. Saenjundaeng; KUMF 8840, 13, 65.2–81.2 mm SL, Ban Maet, Amphoe Sang Khom, Udon Thani Province, 13 March 2012, P. Saenjundaeng; NIFI 03425, 4, 37.2–45.9 mm SL, Nong Han Reservoir, Sakon Nakhon Province, 25–28 July 1985, S. Lamlerdecha; NIFI 03628, 1, 40.6 mm SL, Nong Han Reservoir, Sakon Nakhon Province, 25–28 July 1985, S. Lamlerdecha.

**FIGURE 2.** Preserved specimens of *Tetraodon palustris*, KUMF 8840, Ban Maet, Amphoe Sang Khom, Udon Thani Province: A-C) male 78.9 mm SL, D-F) female 77.2 mm SL.

**Diagnosis.** *Tetraodon palustris* differs from *T. cochinchinensis* and *T. fangi* in having no ocellus on the flank and spinules on the dorsum from the interorbital region to the end of the dorsal-fin base.

**Description.** Body stout, dorsal profile from anterior-most part of snout to end of dorsal-fin base convex. In %HL: mouth width 26.7–32.2; short, blunt snout, snout length 39.1–44.6; eye high on head, protruding laterally, round, diameter 19.2–25.0; interorbital distance 54.2–66.9; internasal distance 27.4–33.4; head depth at preorbital 47.8–60.1, width at preorbital 45.1–55.1, depth at postorbital 65.8–77.3, width at postorbital 74.1–85.3, depth at nape 74.3–86.9, width at nape 81.0–93.9. In %SL: head length 39.0–43.1, interpectoral fin distance 27.3–31.2, prepectoral-fin length 41.0–45.8, predorsal-fin length 72.4–77.8, preanal-fin length 77.1–82.6, pectoral-fin base length 9.4–11.4, dorsal-fin base length 8.5–10.8, anal-fin base length 5.8–7.4, body depth at middle of dorsal-fin base 17.4–22.1, body width at middle of dorsal-fin base 16.8–21.6, caudal-peduncle length 13.3–17.1, caudal-peduncle depth 10.6–14.1, caudal-peduncle width 12.3–16.3. Area with spinules: dorsally from interorbital region to end of dorsal-fin base, laterally from nasal organ to between end of dorsal-fin base to origin of anal-fin base, ventrally from chin to anus. Fin-ray counts: pectoral ii,19–22; dorsal ii–iii,10–12; anal i–ii,8–10; caudal ii,6,ii.
**Colour.** Male, live specimen (Fig. 1A–C). The dorsolateral surface of body has a dark greenish black background with numerous round black spots. The belly is gray-black with a white reticulated network. Preserved specimens from Ban Maet, Amphoe Sang Khom, Udon Thani Province, exhibit a yellow and greenish-black background dorsolaterally (Fig. 2A–C). On the female, the dorsolateral surface of the body has a yellow or light greenish-black background with numerous round black spots. The belly has a white background with many small dark spots (Fig. 2D–F). There are several large dark spots on the lateral surface of the body in male and female specimens. Adult specimens of *T. palustris* have no ocellus on the flank while small juvenile specimens show only one ocellated spot with a red center. This ocellus changes to a large round black spot in the adult. The eye is orange to red. Pectoral, dorsal and anal fins are translucent greenish while the caudal fin is opaque and greenish-black.
**FIGURE 5.** Schematic representation of areas covered with spinules (darkest areas) on the dorsum and side of the body. A–B) *Tetraodon palustris*, C–D) *T. fangi*, and E–F) *T. cochinchinensis*.

**Geographic distribution and ecological note.** *Tetraodon palustris* is known from the middle Mekong basin in Thailand. It lives in marshes and swamps with clear and stagnant water in places with many aquatic plants. In Kud Thing Marsh, it occurs with *T. suvattii* and ca. 17 other fish species; i.e., *Clupeichthys aesarnensis*, *Rasbora trilineata*, *Amblyparyngodon chulabhornae*, *Puntius brevis*, *Hampala dispar*, *Osteochilus vittatus*, *Oryzias mekongensis*, *Parambassis siamensis*, *Mystus mysticetus*, *Clarias macrocephalus*, *Brachygobius mekongensis*, *Neodontobutis aurarmus*, *Doryichthys contiguus*, *Indostomus spinosus*, *Nandus oxyrhynchus*, *Pristolepis fasciata*, and *Trichopodus trichopterus*. Eight live specimens of *T. palustris* from Kud Thing Marsh were kept in an aquarium to study their behavior. They spent much of the time hidden among roots and in dense clumps of submerged plants. The diet of *T. palustris* in captivity was primarily juvenile fishes, including Nile Tilapia *Oreochromis niloticus*, and the cyprinids, *Barbonymus gonionotus*, *Cirrhinus siamensis* and *Hypophthalmichthys molitrix*.

**Etymology.** The Latin word, *palustris*, means of the marsh or swamp, referring to the main habitats of this new species, which lives in marshlands, swamps and floodplains.

**Discussion**

In this study, we follow Roberts (1998) and Dekkers (1975) in using *Tetraodon* as the genus for freshwater pufferfishes in the Mekong Basin. If further study verifies separate lineages for Asian puffers distinct from that of African puffers, the name *Monotrete* is available.

*Tetraodon fangi* was considered a valid species by Dekkers (1975), while Roberts (1998) considered *T. fangi* and *T. cochinchinensis* to be synonyms of *T. leiurus*. Kottelat (2001) accepted *T. cochinchinensis* as a valid species and recognized *T. fangi* as a synonym of *T. cochinchinensis*. However, examination of the holotype of *T. fangi* from Xano Canal, Vi-thanh, Rach-Gia Province, southern Vietnam, and other specimens from Tram Chim, Tam Nong,
southern Vietnam (Fig. 3), and from Nakhon Sawan and Lop Buri provinces, Thailand, revealed that T. fangi differs from T. cochinchenensis (Fig. 4) by having a shorter snout (snout length 37.9–41.1% HL in T. fangi vs. 43.5–49.2% HL in T. cochinchenensis) and is covered with spinules dorsally from the front of the eyes to the end of the dorsal-fin base (vs. from the front of the nasal organs to the end of the dorsal-fin base in T. cochinchenensis). Also, T. fangi seems to be a smaller species reaching only 63.9 mm SL, whereas T. cochinchenensis reaches 112.8 mm SL.

The descriptions in Bleeker (1851, 1852 & 1865) and the picture in Bleeker (1865) show that the colour pattern of T. leiurus differs from T. fangi and T. cochinchenensis in having no ocellus on the flank. Tetraodon fangi is a valid species differing from T. leiurus, supporting the opinion of Kottelat (1998).

Dekkers (1975) redescribed T. leiurus based on four syntype specimens (57–79 mm SL, RMNH 7342). These specimens are assumed to be those collected by Bleeker from Jakarta, Java, Indonesia. He gave the data on body spination as following: spines small, not papillated, retracted, covering the head and body from the nasal organs to the end of the dorsal-fin base. This description complies with the illustration of Crayacion (or Tetraodon) leiurus in Bleeker (1865). The area covered with spinules in T. palustris, from the interorbital region to the end of dorsal-fin base distinguishes T. palustris from T. leiurus.

The new species, Tetraodon palustris, differs from T. cochinchenensis and T. fangi in having no ocellus on the flank and spinules dorsally from the interorbital region to the end of the dorsal-fin base (Figs. 5A–B). Similarly, T. fangi is distinguished from T. cochinchenensis by having spinules not extending beyond the nasal organ (Figs. 5C–D). The distribution of spinules has been used in the identification of species of the genus Lagocephalus (Mohsin & Ambak, 1996).

Tetraodon palustris is known only from mashes and swamps in the Mekong basin of Thailand but can be expected to occur in the Mekong basin in Vietnam. Specimens collected from Amphoe Tha Bo and Muaeng, Nong Khai Province (NIFI 00624, NIFI 00513 and NIFI 00630) and labeled as T. leiurus, are reidentified as T. palustris. All of these specimens have a short snout and the dorsolateral surface is covered with round black spots. Specimens from Nong Han, Sakon Nakhon Province (NIFI 03425 and NIFI 03628) were identified originally as T. fangi, but are juveniles of T. palustris.

The colour pattern of T. palustris is sexually dimorphic. Males are darker overall and have a white reticulated pattern on the black belly. The belly of the female is white background with small black spots. Sexual dimorphism has been reported in other fishes in Tetraodontidae, including Carinotetraodon loteri, C. imitator and C. irrubesco (Tan, 1999; Britz & Kottelat, 1999).

Comparative material examined

Tetraodon cochinchenensis (Steindachner, 1866): Mekong basin, Thailand: NIFI 01544, 1, 48.2 mm SL, Ubonrat Dam, Khon Kaen Province, 13 February 1985, S. Soontornsathit; NIFI 3304, 1, 84.9 mm SL, Ubonrat Dam, Khon Kaen Province, 1–5 June 1987, P. Sodsook; NIFI 01520, 1, 64.8 mm SL, Ubonrat Dam, Khon Kaen Province, 12 February 1985, S. Soontornsathit; KUMF 8818, 1, 88.0 mm SL, Ubonrat Dam, Khon Kaen Province, 28 February 2012, M. Singhabud; NIFI 01546, 5, 46.8–81.6 mm SL, Ubonrat Dam, Khon Kaen Province, 13 February 1985, S. Soontornsathit; KUMF 8819, 2, 89.8–103.2 mm SL, Ubonrat Dam, Khon Kaen Province, 8–11 August 1977, J. Ratanathavee; KUMF 1658, 6, 67.2–88.9 mm SL, Nampong Irrigation Dam, 30 km of Khon Kaen, 23 March 1971, P. Wongrat and Party; KUMF 8819, 2, 85.0–112.8 mm SL, Nam Pong river, Ban Hua Dong, Tambon Ban Kham, Amphoe Nam Pong, Khon Kaen Province, 28 February 2012, M. Singhabud; KUMF 8820, 1, 57.2 mm SL, Nam Pong river, Ban Kut Phang Khrua, Tambon Tha Krasoem, Amphoe Nam Pong, Khon Kaen Province, 8 March 2012, M. Singhabud; NIFI 00627, 2, 76.2–87.6 mm SL, Lampao Dam, Kalasin Province, 25 February 1978, N. Sugomol; KUMF 8821, 6, 70.2–82.6 mm SL, Lampao Dam, Ban Tha Ruea, Amphoe Yang Talat, Kalasin Province, 5 August 2012, P. Saenjundaeng; KUMF 8822, 3, 71.0–81.0 mm SL, Chi river, Ban Pak Pla Khao, Tambon Don Ong, Amphoe Pho Chai, Roi Et Province, 29 April 2012, P. Saenjundaeng; KUMF 8823, 8, 70.2–109.4 mm SL, Chi river, Ban Pak Pla Khao, Tambon Don Ong, Amphoe Pho Chai, Roi Et Province, 27 March 2012, S. Juntarasombat; KUMF 8824, 6, 61.2–96.2 mm SL, Chi river, Ban Non Krayom, Tambon Pho Chai, Amphoe Kok Pho Chai, Khon Kaen Province, 26 February 2012, M. Decha; KUMF 8825, 1, 67.8 mm SL, Chi river, Tambon Tha Phra, Amphoe Mueang, Khon Kaen Province, 6 March 2012, M. Singhabud; KUMF 1586, 2, 66.9–88.2 mm SL
SL, Kwan Payao, 5 March 1924, H.M. Smith; KUMF 1656, 1, 54.3 mm SL, Kwan Payao, 21 October 1964, K.F. Lagler and Party; Chao Phraya basin, Thailand: NIFI 02015, 1, 110.8 mm SL, Sirikit Dam, Uttaradit Province, 11 February 1985, S. Lamlerdecha; NIFI 04358, 1, 59.2 mm SL, Kiu Lom Dam, Lamphang Province, 1 June 2008, P. Klaïsuphun; NIFI 4692, 1, 94.2 mm SL, Phra Prong Dam, Amphoe Wattana Nakhon, Sa Kaew Province, 18 May 2005, A. Hunpongkittikul; NIFI 04693, 1, 79.9 mm SL, Khlong Phra Satung, Sa Kaew Province 19 May 2005, A. Hunpongkittikul; NIFI 4689, 1, 103.2 mm SL, Khlong Si Yat Reservoir, Amphoe Tha Takiap, Chachoengsao Province, 20 January 2005, A. Hunpongkittikul; NIFI 04690, 1, 65.8 mm SL, Bangpakong river, Amphoe Ban Sang, Prachin Buri Province, 17 January 2005, A. Hunpongkittikul; NIFI 04691, 1, 89.2 mm SL, Khlong Si Yat Reservoir, Amphoe Tha Takiap, Chachoengsao Province, 19 May 2005 A. Hunpongkittikul.


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**References**


