



<http://dx.doi.org/10.11646/zootaxa.3686.1.4>

<http://zoobank.org/urn:lsid:zoobank.org:pub:3B67211B-6A75-49EE-8524-408F503BC0BF>

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

PASAKORN SAENJUNDAENG¹, CHAVALIT VIDTHAYANON² & CHAIWUT GRUDPUN³

¹Faculty of Applied Science and Engineering, Khon Kaen University, Nong Khai Campus, Nong Khai, 43000, THAILAND.
E-mail: passan@nkc.kku.ac.th

²Environment Division, Mekong River Commission Secretariat Office at Vientiane, LAO People Democratic Republic.
E-mail: chavalit@mrcmekong.org

³Faculty of Agriculture, Ubonrajathanee University, Ubon Ratchathani, 34190, THAILAND. E-mail: chaiwut@agri.ubu.ac.th

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. suvattii*. *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.

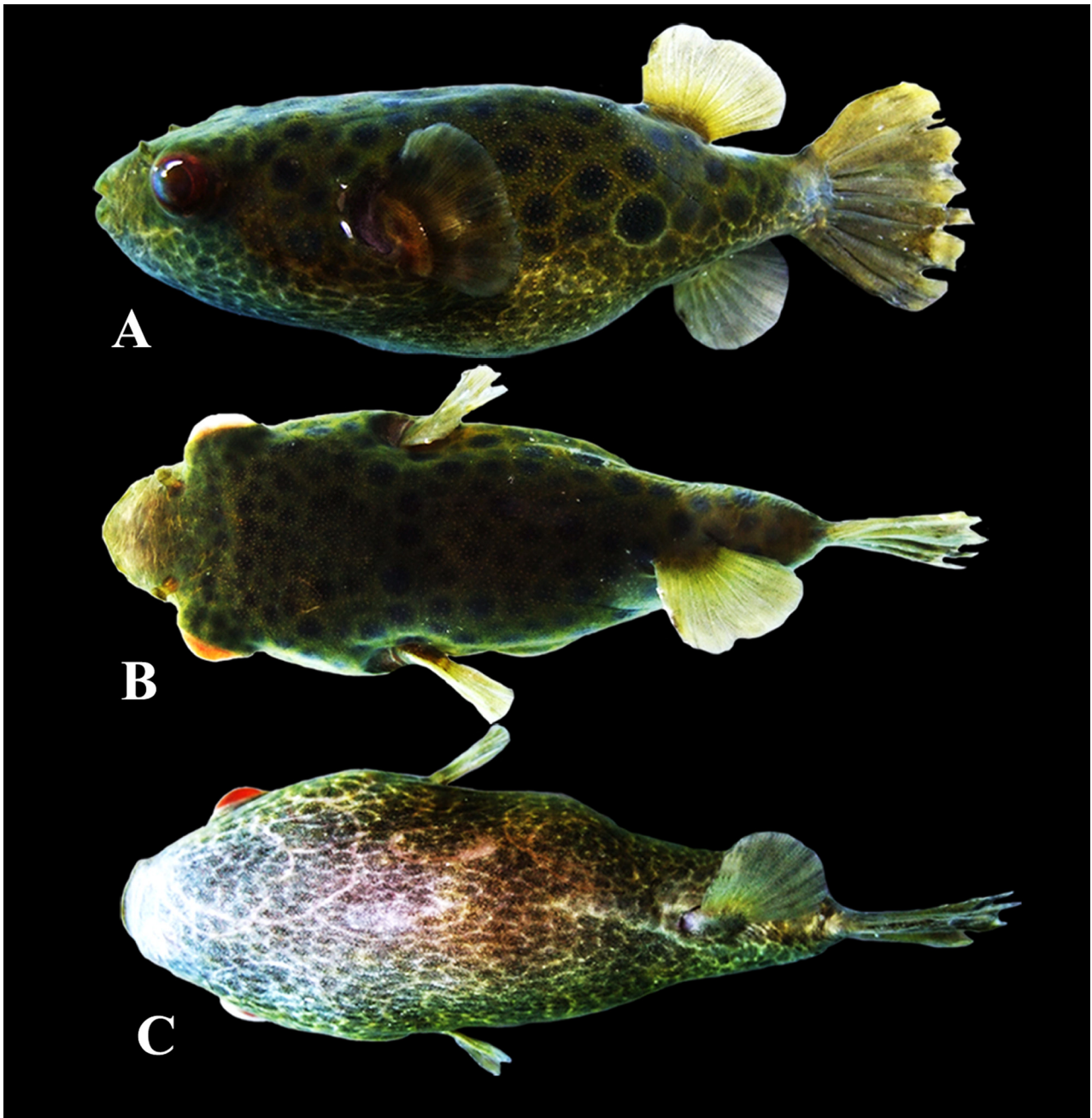


FIGURE 1. Fresh specimen of *Tetraodon palustris*, KUMF 8834, holotype, male 72.1 mm SL, Nongkomkoh Swamp, Amphoe Mueang, Nong Khai Province, Thailand: A) lateral, B) dorsal, and C) ventral views.

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. Lamlerddech; NIFI 03628, 1, 40.6 mm SL, Nong Han Reservoir, Sakon Nakhon Province, 25–28 July 1985, S. Lamlerddech.

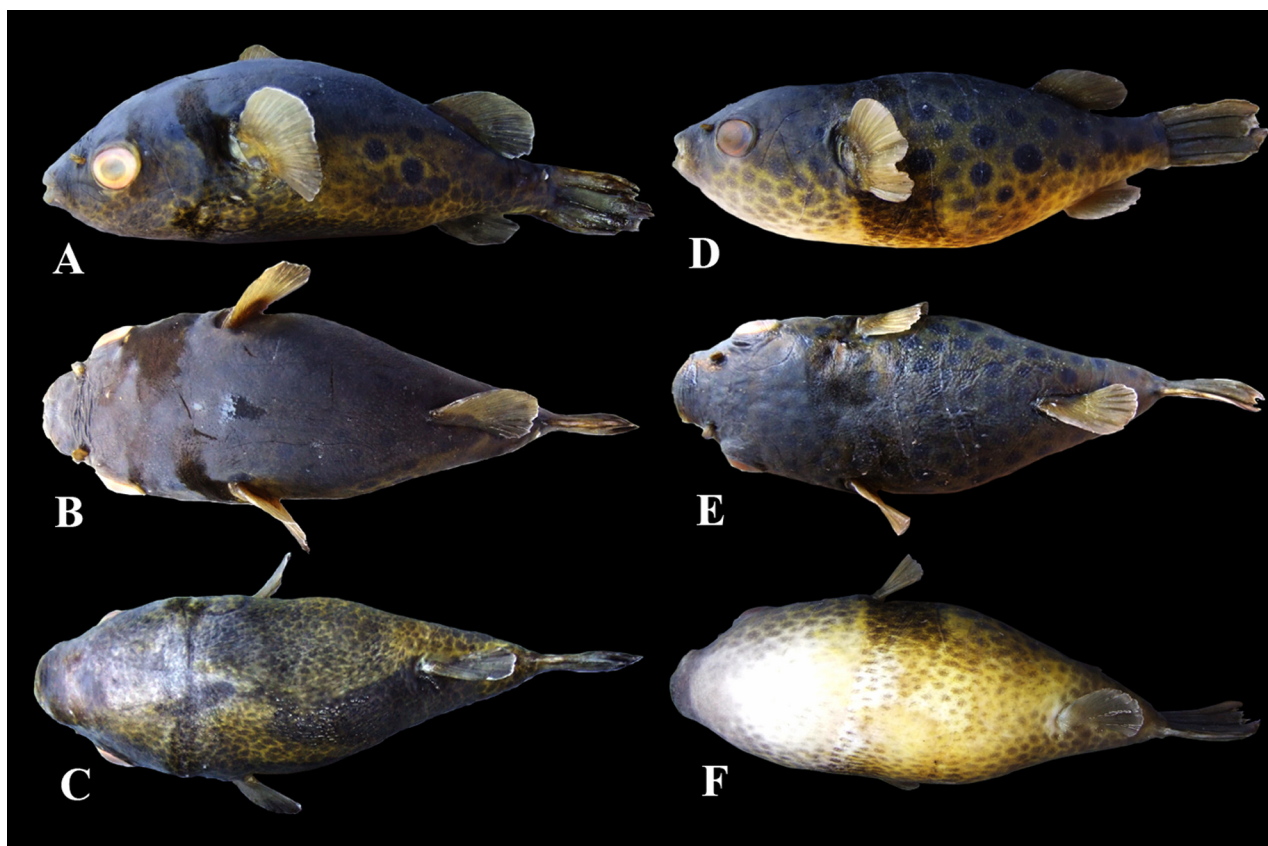


FIGURE 2. Preserved specimens of *Tetraodon palustris*, KUMF 8840, Ban Maet, Amphoe Sang Khom, Udon Thani Province: A-C) male 78.9 mm SL, D-F) female 77.2 mm SL.

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.

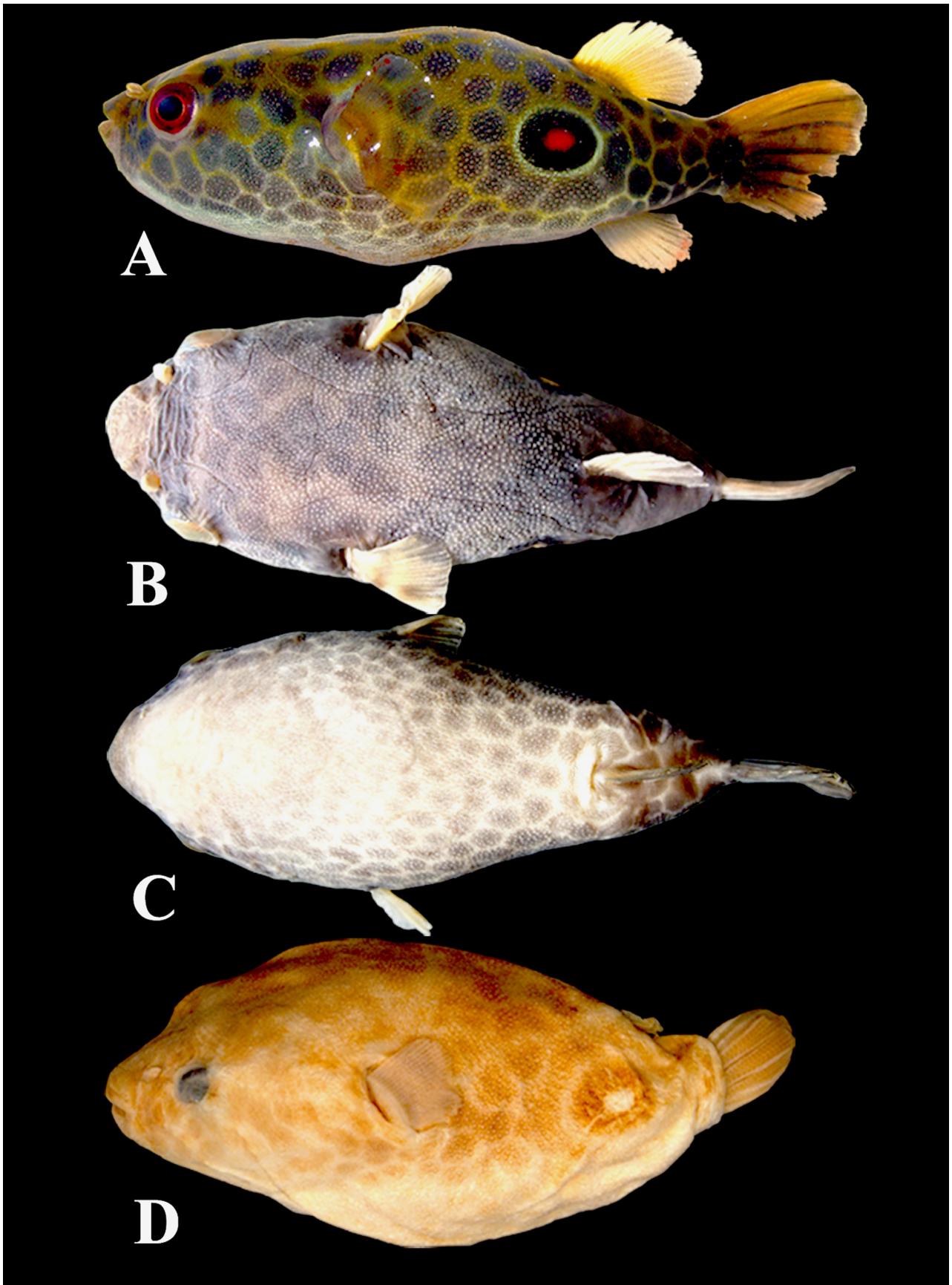


FIGURE 3. *Tetraodon fangi* Pellegrin and Chevey, 1940. A-C) NIFI 04682, 62.8 mm SL, market near Tram Chim, Tam Nong, southern Vietnam: A) lateral, B) dorsal, and C) ventral views; D) MNHN 1940-42, 55.0 mm SL, holotype of *T. fangi*, Xano Canal, Vi-thanh, Rach-Gia Province, southern Vietnam.

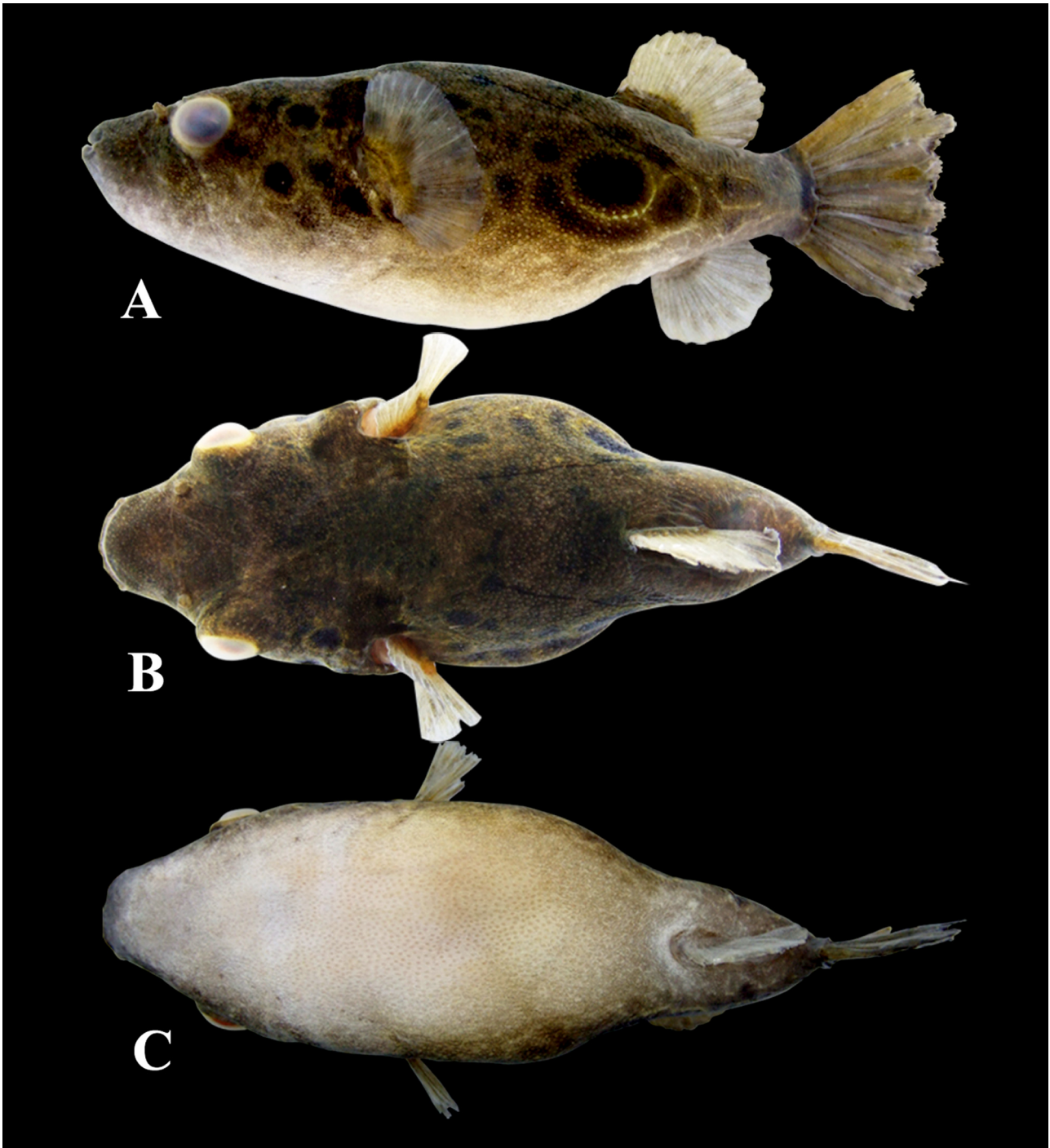


FIGURE 4. *Tetraodon cochinchinensis* (Steindachner, 1866), KUMF 8821, 76.8 mm SL, Lampao Dam, Ban Tha Ruea, Amphoe Yang Talat, Kalasin Province, Thailand: A) lateral, B) dorsal, and C) ventral views.

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.

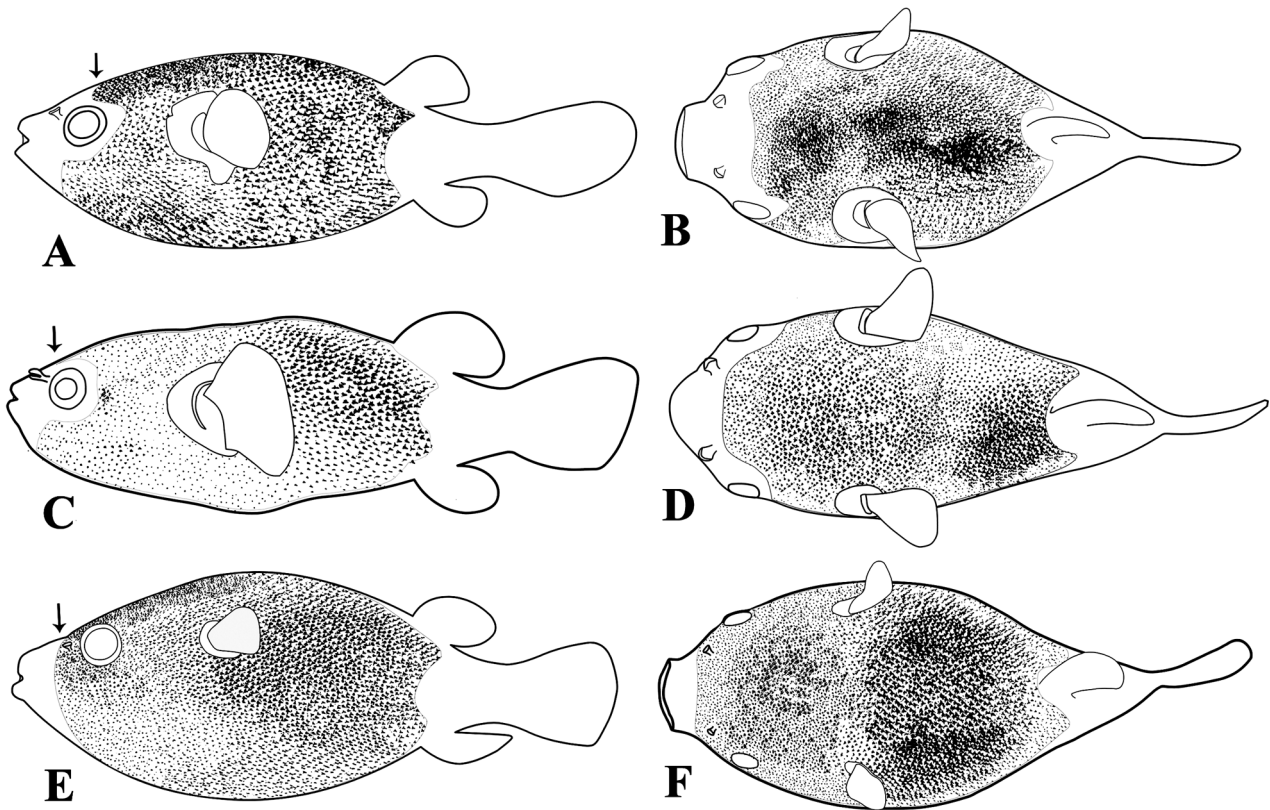


FIGURE 5. Schematic representation of areas covered with spinules (darkest areas) on the dorsum and side of the body. A–B) *Tetraodon palustris*, C–D) *T. fangi*, and E–F) *T. cochinchinensis*.

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*, *Amblypharyngodon 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. cochinchinensis* (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. cochinchinensis*) 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. cochinchinensis*). Also, *T. fangi* seems to be a smaller species reaching only 63.9 mm SL, whereas *T. cochinchinensis* 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. cochinchinensis* 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. 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 (Figs. 5A–B). Similarly, *T. fangi* is distinguished from *T. cochinchinensis* 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 marshes 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 cochinchinensis* (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; NIFI 01148, 8, 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, 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. Lamlerddech; NIFI 04358, 1, 59.2 mm SL, Kiu Lom Dam, Lampang Province, 1 June 2008, P. Klaisuphun; 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.

***Tetraodon fangi* Pellegrin and Chevey, 1940:** Mekong basin, Vietnam: The specimen from Museum National d' Histoire Naturelle, Paris with catalog number MNHN 1940-42 (holotype of *T. fangi* Pellegrin and Chevey, 1940), 1, 55.0 mm SL, South Vietnam: Xano Canal, Vi-thanh, Rach-Gia Province, Collector: Institut Océanographique de l'Indochine (Cauda) or IOI; NIFI 04681, 57.2 mm SL, Market near Tram Chim, Tam Nong, Vietnam, 12 July 2007, C. Vidthayanon; NIFI 04682, 1, 62.8 mm SL, Market near Tram Chim, Tam Nong, Vietnam, 28 May 2007, C. Vidthayanon; Chao Phraya basin, Thailand: NIFI 01097, 1, 59.8 mm SL, Bueng Boraphet, Nakhon Sawan Province, 28 March 1984, S. Soontornsathit; KUMF 1657, 5, 52.8–63.9 mm SL, Fish Market, Lop Buri Province, 12 January 1971, S. Punpuka and Party.

Acknowledgements

This study was supported by the research fund of Khon Kaen University, Nong Khai Campus. The authors would like to thank Dr. Patrice Pruvost of the Museum National d' Histoire Naturelle (MNHN) Paris, France, for his valuable assistance and preparing the holotype of *Tetraodon fangi*. The authors would like to thank all of the fishermen who conducted field collections for us.

References

- Bleeker, P. (1851) Over drie nieuwe soorten van *Tetraodon* van den Indischen Archipel. *Natuurkundig Tijdschrift voor Nederlandsch Indi*, 1, 96–97.
- Bleeker, P. (1852) Zesde bijdrage tot de kennis der ichthyologische fauna van Borneo. Visschen van Pamangkat, Bandjermassing, Praboekarta en Sampit. *Natuurkundig Tijdschrift voor Nederlandsch Indië*, 3, 407–442.
- Bleeker, P. (1865) Atlas ichthyologique des Indes Orientales Néerlandaises, publié sous les auspices du Gouvernement colonial néerlandais. Baudroies, Ostracions, Gymnodontes, Balistes. *Atlas Ichthyologique*, 5, 1–152.
- Britz, R. & Kottelat, M. (1999) *Carinotetraodon imitator*, a new freshwater pufferfish from India (Teleostei: Tetraodontiformes). *Journal of South Asian Natural History*, 4, 39–47.
- Dekkers, W.J. (1975) Review of the Asiatic freshwater puffers of the genus *Tetraodon* Linnaeus, 1758 (Pisces, Tetraodontiformes, Tetraodontidae). *Bijdragen tot de Dierkunde*, 45, 87–142.
- Kottelat, M. (1998) Fishes of the Nam Theun and Xe Bangfai basins, Laos, with diagnoses of twenty-two new species (Teleostei: Cyprinidae, Balitoridae, Cobitidae, Coiidae and Odontobutidae). *Ichthyological Exploration of Freshwaters*, 9, 1–128.
- Kottelat, M. (2001) *Fishes of Laos*. WHT Publications (Pte) Ltd., Colombo, 198 pp.
- Kovitvadh, U. & Kovitvadh, S. (2004) *Preservation of plant and animal specimens*. Kasetsart University Press, Bangkok, 207 pp. [in Thai]
- Mohsin, A.K.M. & Ambak, M.A. (1996) *Marine Fishes and Fisheries of Malaysia and Neighbouring Countries*. Universiti Pertanian Malaysia Press, Selangor Darul Ehsan, 655 pp.
- Roberts, T.R. (1998) Freshwater fugu or pufferfishes of the genus *Tetraodon* from the Mekong basin, with description of two new species. *Ichthyological Research*, 45, 225–234.
<http://dx.doi.org/10.1007/bf02673920>
- Sontirat, S. (1989) Four new species of freshwater fishes from Thailand. *Kasetsart Journal (Natural Science)*, 23, 98–109.
- Tan, H.H. (1999) A new species of *Carinotetraodon* from Sumatra and Borneo and validity of *C. borneensis* (Teleostei: Tetraodontidae). *Ichthyological Exploration of Freshwaters*, 10, 345–354.