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Freshwater surveys reveal 12 new species of *Indochinamon* from northern Vietnam (Crustacea: Brachyura: Potamidae)

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Abstract. A study of a large collection of freshwater crabs from northern Vietnam yielded 12 new species of the species-rich genus *Indochinamon* Yeo & Ng, 2007: *I. laevimarginatum*, *I. olivaceum*, *I. granulatum*, *I. scimitar*, *I. erythreum*, *I. falx*, *I. hamyenense*, *I. lacertosum*, *I. thienkense*, *I. angustum*, *I. septentrionum*, and *I. yensonense*. The species are differentiated by characters of the overall carapace shape, anterolateral armature, male thoracic sternum, male pleon and structures of the male first gonopod.

Key words. taxonomy, freshwater crabs, diagnosis, Potamiscinae, Indochina

INTRODUCTION

Vietnam is a major hotspot for freshwater crab diversity in Southeast Asia, in particular, the freshwater crab family Potamidae Ortmann, 1896, is especially diverse, with many new taxa described over the last decade (e.g., Do et al., 2016a, b, 2017; Ng, 2021; Ng & Ngo, 2022, 2023a, b; Ng et al., 2023; Dang et al., 2024). The highly heterogenous geographical landscape and favourable climate within Vietnam has not only resulted in an abundance of suitable freshwater habitats, but also created numerous geographical barriers between populations. This is especially so for freshwater crabs which typically have poor dispersal abilities (Cumberlidge et al., 2012). The combination of the above factors may help explain the high diversity of potamid genera and species in Vietnam.

One genus in Vietnam epitomises this diversity, *Indochinamon* Yeo & Ng, 2007. This highly speciose and enigmatic genus currently contains 42 species (see Dang et al., 2024), distributed across Myanmar, Thailand, Laos, Vietnam and China (Ng & Win Mar, 2018), of which 13 have been recorded from Vietnam (Rathbun, 1904; Dang, 1967, 1975; Yeo & Ng, 1998; Naruse et al., 2011; Do et al., 2016a; Ng & Ngo, 2023a; Dang et al., 2024). The genus was established by Yeo & Ng (2007), for relatively large riverine potamids that are defined by the following suite of characters: 1) relatively low, flat carapace, surfaces usually rugose or granulose; 2) the epigastric cristae not confluent with postorbital cristae; 3) the postorbital cristae not confluent with epibranchial tooth; 4) male sternopleonal cavity reaches imaginary line joining median parts of chelipeds coxa; and 5) and a male first gonopod with a relatively short terminal article, with the groove for the male second gonopod in a marginal position and lacking a well-developed dorsal flap. Congeners tend to be rather conservative in terms of external morphologies, and some species can be difficult to distinguish based on external features. Nevertheless, the male gonopods remain a reliable key diagnostic character for distinguishing species. The composition of *Indochinamon*, however, requires elaboration and further study with Ng & Win Mar (2018) highlighting that the genus is heterogeneous, being composed of several groups based on their male gonopod morphology. Unpublished molecular analysis also indicate that the genus is not monophyletic and in need of a revision (Boyang Shi, pers. comm.).

The present paper describes 12 new species that fit well into the diagnosis of *Indochinamon* sensu lato; a full revision of the genus based on morphological and genetic characters will be conducted at a later date (Tan et al., in prep). These new taxa have been discovered as a result of extensive freshwater surveys by the second author in Vietnam as part of various environmental surveys.

MATERIAL AND METHODS

The terminology used follows Ng (1988) and Davie et al. (2015). Measurements provided in millimetres are of the maximum carapace width and length, respectively. The specimens examined are deposited in the Zoological

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Reference Collection (ZRC), Lee Kong Chian Natural History Museum, National University of Singapore; and the Zoological Collection of the Faculty of Science (ZVNU), Hanoi University of Science. The following abbreviations are used: asl = altitude above sea level; coll. = collected by; CL = carapace length; CW = carapace width; G1= male first gonopod; G2 = male second gonopod; s3/4 = suture between male thoracic sternites 3 and 4. Specimens were examined with a Leica M80 and M205c stereomicroscope. Camera lucida illustrations were made using the drawing tube mounted on the stereomicroscopes. Monochrome photographs were taken using an Olympus OM-D E-M1 Mark III mirrorless interchangeable lens camera with M. Zuiko Digital ED 60mm F2.8 lens. Figures were edited and assembled using Adobe Photoshop Lightroom, and Adobe Photoshop.

TAXONOMY

Family Potamidae Ortmann, 1896

Genus *Indochinamon* Yeo & Ng, 2007

Indochinamon Yeo & Ng, 2007: 282.

Type species. *Potamon villosum* Yeo & Ng, 1998, by original designation.

Comparative material. *Indochinamon bhumibol* (Naiyanetr, 2001): paratypes, 2 males (60.5 × 46.5 mm, 53.7 × 42.0 mm) (ZRC 2022.0916), Ban Na Wa, Amphoe Dan Sai, Loei province, Thailand, coll. P. Naiyanetr, 11 April 1987, 3 males (71.4 × 55.3 mm, 62.3 × 48.1 mm, 59.8 × 45.6 mm) (ZRC 2022.0915), Ban Nam Tob, Khao Luang, Amphoe Wang Saphung, Loei province, Thailand, coll. Wisat Senam, 26 October 1982. *Indochinamon boshanense* (Dai & Chen, 1985): paratype, 1 male (50.4 × 37.1 mm) (ZRC 1998.0811), Boshan, Yunnan Province, China, coll. A. Dai, 20 October 1981. *Indochinamon chuahuong* Do, Nguyen & Le, 2016: 1 male (58.7 × 41.8 mm), 1 female (67.1 × 49.3 mm) (ZRC 2024.0274), Hương Sơn commune, Mỹ Đức district, Hà Nội City, Vietnam 20°35.44′N 105°45.38′E, about 100 m asl, coll. V.T. Ngo, 7 August 2022, coll. V.T. Ngo, 7 August 2022. *Indochinamon cua* (Yeo & Ng, 1998): holotype, male (46.9 × 36.6 mm) (ZRC 1998.0267), Tam Dao, Vinh Phu Province, northern Vietnam, coll. X.Q. Nguyen, 8 June 1997. *Indochinamon dangi* Naruse, Nguyen & Yeo, 2011: 4 males (48.4 × 37.6 mm – 29.6 × 23.0 mm), 2 females (45.2 × 33.9 mm, 36.7 × 28.1 mm) (ZRC 2010.0175), upstream and waterfall of Muong Phang stream, Muong Phang, Dien Bien Province, Vietnam, 21°27.000′N 103°10.548′E, 1070 m asl, coll. D.C.J. Yeo & A.D. Tran, 28 July 2004. *Indochinamon datii* Dang, Hoang & Do, 2024: paratypes, 1 male (53.4 × 39.6 mm), 1 female (43.7 × 33.2 mm) (ZRC 2024.0014), mainstream, Bản Cỏi village, Xuân Sơn National Park, Tân Sơn district, Phú Thọ province, Vietnam, 21.140°N 104.942°E, coll. Cuong Do, 18 March 2023; others, 2 males (81.0 × 59.3 mm, 66.3 × 49.2 mm) (ZRC 2023.0622), small trail in karst forest, Bản Cỏi village, Xuân Sơn National Park, Tân Sơn district, Phú Thọ province, coll. V.T. Ngo, 7 June 2011, 22:00 hours. *Indochinamon jinpingense* (Dai, 1995): 1 male (64.0 × 47.0 mm) (ZRC 1998.266), Sin Ho District, Lai Chau Province, northern Vietnam, coll. V.D. Nguyen, November 1997. *Indochinamon kimboiense* (Dang, 1975): 2 males (71.8 × 56.6 mm, 71.5 × 56.8 mm), 2 females (63.0 × 49.5 mm, 52.8 × 41.1 mm) (ZRC 2010.0165), Kim Boi area, Hoa Binh Province, Vietnam, purchased from villagers, 14 & 15 Apr. 2007; 1 male (58.8 × 45.3 mm), 2 females (69.4 × 53.6, 49.9 × 37.4 mm) (ZRC 2010.0166), stream in Cuc Phuong National Park, about 6 km from main gate, Ninh Binh Province, northern Vietnam, 20°18′N 105°38′E, coll. D.C.J. Yeo, H.H. Ng & X.Q. Nguyen, 16 September 1997. *Indochinamon lanae* Ng & Ngo, 2023: Holotype, male (39.0 × 30.0 mm) (ZRC 2022.0049), small stream, branch of Ba Che River, Don Dat commune, Ba Che Town, Quang Ninh Province, northeastern Vietnam, 21°13′4.50″N 107°16′26.05″E, coll. V.T. Ngo, 15 March 2022; paratype: juvenile female (16.8 × 13.5 mm) (ZRC 2022.0050), same data as holotype. *Indochinamon lui* Naruse, Chia & Zhou, 2018: holotype, male (43.0 × 32.9 mm) (NCU MCP 2013.0010), Mang Huai Town, Yun County, Yunnan Province, China, coll. Lu Yong Feng, 24 February 2004. *Indochinamon parpidum* Naruse, Chia & Zhou, 2018: holotype, male (47.1 × 36.5 mm) (NCU MCP 2013.0015), Niujie Town, Shiping County, Yunnan Province, China, coll. Li Hai Chun, 23 February 2004. *Indochinamon signum* Ng & Ngo, 2023: holotype, male (36.9 × 29.3 mm) (ZRC 2022.0051), Don Dat commune, Ba Che Town, Quang Ninh Province, northeastern Vietnam, coll. local people through V.T. Ngo, 14 March 2011; paratypes: male (31.0 × 25.4 mm), 1 subadult female (28.4 × 22.6 mm) (ZRC 2022.0052), same data as holotype. *Indochinamon tujiense* Naruse, Chia & Zhou, 2018: holotype, male (45.3 × 33.2 mm) (NCU MCP 2013.0005), Tujie Town, Nanhua County, Yunnan Province, China, coll. He Yong Gang, 23 February 2004. *Indochinamon villosum* (Yeo & Ng, 1998): holotype, male (44.8 × 34.3 mm) (ZRC 1998.276), tributary of Nam Tha River, about 800 m asl, Luang Nam Tha Province, northern Laos, coll. H. Morioka, 13 November 1997.

Indochinamon laevimarginatum, new species
(Figs. 1–4)

Material examined. Holotype: male (57.2 × 41.3 mm) (ZRC 2023.0602), Xuân Sơn National Park, Tân Sơn District, Phú Thọ province, northern Vietnam, coll. V.T. Ngo, around 1900 hours, 7 June 2011. Paratype: 1 female (46.2 × 34.7 mm) (ZRC 2023.0603), same data as holotype.

Diagnosis. Carapace (Figs. 1A, B, 4A) transversely subovate, wider than long, CW/CL ratio 1.33–1.38; dorsal surface gently convex, relatively smooth except few granules around branchial region; epigastric and postorbital crista pronounced, smooth; postorbital cristae gently sloping posterolaterally; epibranchial tooth poorly defined, almost indiscernible or as a small smooth nodule, weakly separated from external orbital tooth; external orbital tooth broad, low, lateral margin straight or weakly concave, distinctly longer than mesial margin; anterolateral margins cristate, relatively smooth,

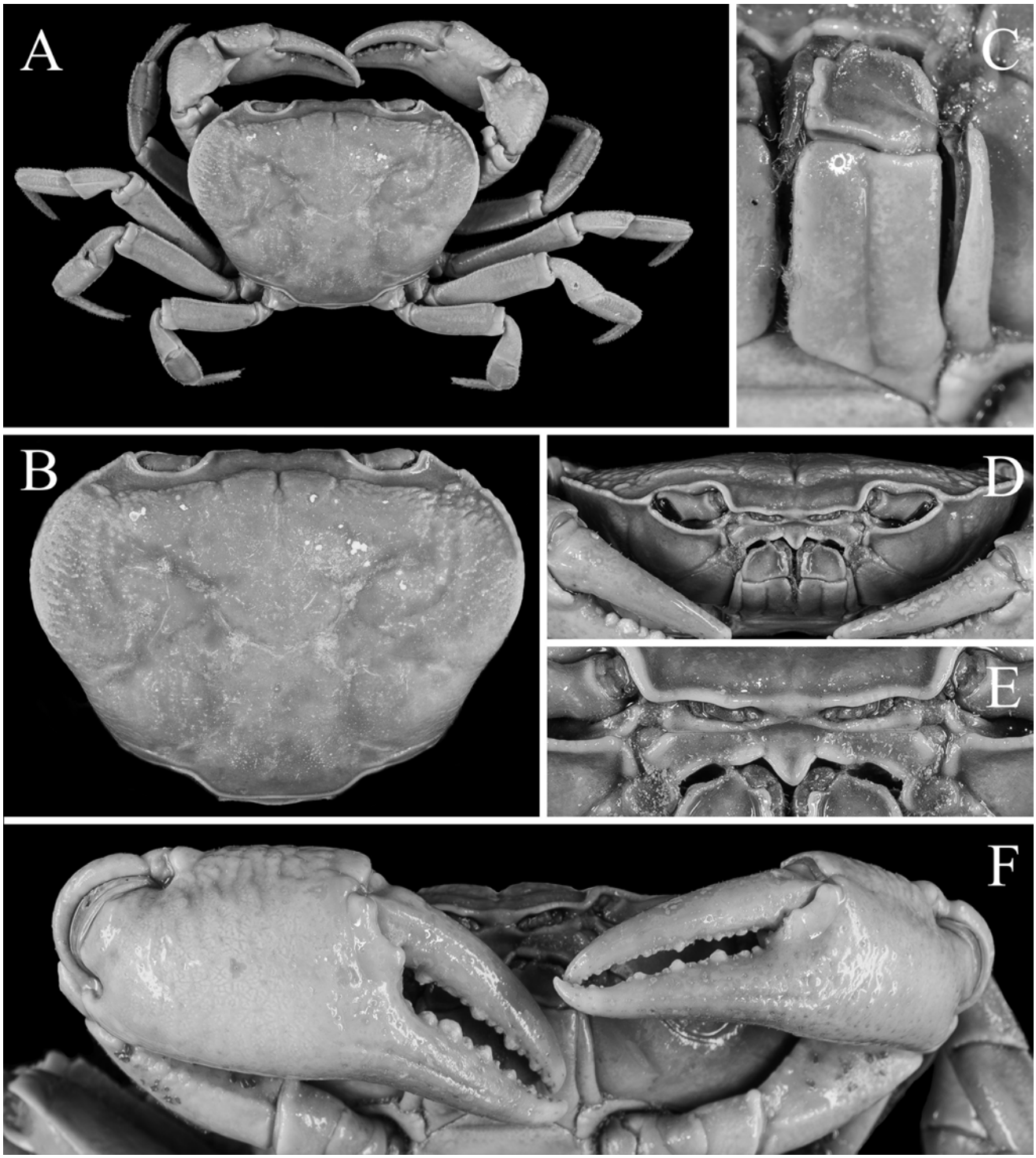

Fig. 1. *Indochinamon laevimarginatum*, new species, holotype, male (57.2 × 41.3 mm) (ZRC 2023.0602). A, dorsal view; B, carapace dorsal view; C, left third maxilliped; D, carapace frontal view; E, antennae, antennules and epistome; F, chelipeds.

appearing very weakly serrated; posterolateral margin strongly converges towards posterior carapace margin. Frontal region (Fig. 1D) smooth, with gently sinuous margin; epistomal median lobe (Fig. 1E) well-developed, narrowly triangular; suborbital and pterygostomial regions (Fig. 1D) smooth, subhepatic region sometimes with some low rugae. Ambulatory legs and dactylus (Fig. 1A) not elongate, third walking leg length ca. 0.96 times CW, relatively stout, merus margins smooth. Male thoracic sternum with s3/4 (Fig. 2A) barely discernible; male pleon (Fig. 2B) broadly triangular; telson narrowly triangular, lateral margins concave. G1 (Fig. 3A–D) relatively short, stout; subterminal article relatively straight, basal part broad, tapering strongly to distal part; distal part of lateral margin without distinct cleft; terminal article short, 0.38 times length of subterminal article, almost straight, strongly directed outwards by bending of distal subterminal article, ca. 70°, gently tapering throughout to broad tip, with numerous long stiff setae on dorsal surfaces, and with very low dorsal flap only visible in dorsal view. Vulva (Fig. 4C) large, occupying about half of sternite 6, impinges on sternite 5, directed mesial-ventrally, with low vulvar cover on outer margin.

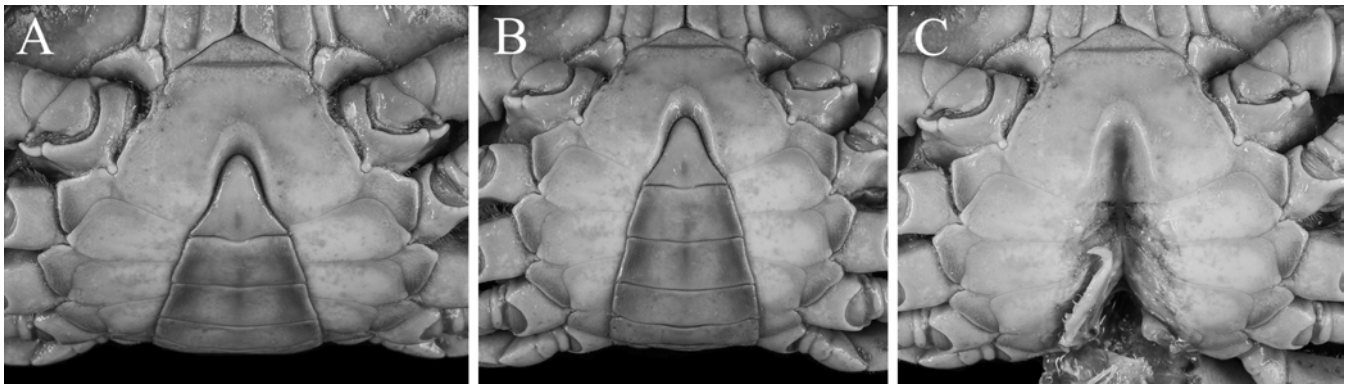

Fig. 2. *Indochinamon laevimarginatum*, new species, holotype, male (57.2 × 41.3 mm) (ZRC 2023.0602). A, anterior half of thoracic sternum; B, posterior half of thoracic sternum and pleon; C, sternopleonal cavity.

Etymology. The name is derived from the Latin 'laevigatus' for smooth and 'marginatum' for margin, alluding to the relatively smooth anterolateral margin of the carapace. This is in contrast to the typically serrated and sharp condition in most *Indochinamon* species.

Live colouration. In life, the dorsal surfaces of the carapace, ambulatory legs, and outer surfaces of the chelipeds are dark brown, with a tinge of green; while the ventral surfaces are largely pale off-white with lateral edges purple and the tips of the fingers are orangish-red (Ngo V. T., pers. obs.).

Remarks. *Indochinamon laevimarginatum*, new species, belongs to a group of *Indochinamon* with a distinctly bent G1 terminal article. Members of this group include *I. boshanense* Dai & Chen, 1985, *I. dangi* Naruse, Nguyen & Yeo, 2011, *I. flexum* (Dai, Song, Li & Liang, 1980), *I. jianchuanense* (Dai & Chen, 1985), *I. lanae* Ng & Ngo, 2023, *I. lipkei* (Ng & Naiyanetr, 1993), *I. lui* Naruse, Chia & Zhou, 2018, *I. menglaense* (Dai, 1995), *I. tujiense* Naruse, Chia & Zhou, 2018, and *I. parpidum* Naruse, Chia & Zhou, 2018.

Among the species of *Indochinamon* listed above, the G1 of *I. laevimarginatum*, new species, most closely resembles *I. lipkei* from Chiang Rai province, northwestern Thailand. The two species differ from all the aforementioned species by the degree at which the G1 terminal article is bent outwardly as well as the general shape of the terminal article. The two species possesses a G1 terminal article that is obliquely bent at approximately 70° from the vertical axis (Fig. 3A, B; Ng & Naiyanetr, 1993: fig. 47B, C). This immediately separates it from *I. jianchuanense* and *I. parpidum*, where the G1 terminal article is less strongly bent outwards, directed about 60° and 45° from the vertical axis respectively (Naruse et al., 2018: figs. 6I, 9A), and from *I. boshanense*, *I. dangi*, *I. flexum*, and *I. lanae*, where the G1 terminal article is even more strongly bent outwards at 80–90° from the vertical axis (Dai, 1999: fig. 97; Naruse et al., 2011: fig. 9D, E; Naruse et al., 2018: fig. 6H; Ng & Ngo, 2023: fig. 11A). Furthermore, the general shape of the G1 terminal article of *I. laevimarginatum*, new species, and *I. lipkei* also differ from the other species mentioned, in its straight conical shape (Fig. 3A, B; Ng & Naiyanetr, 1993: fig. 47B, C). The G1 in *I. flexum* and *I. lanae*, is distinctly curving (Dai, 1999: fig. 97; Ng & Ngo, 2023: fig. 11A), while in *I. boshanense*, *I. dangi*, *I. jianchuanense*, *I. lui*, *I. menglaense*, *I. tujiense*, the G1 terminal article is subconical in shape, abruptly tapering distally, with a broad bulge at the proximal margin, and in *I. menglaense* and *I. tujiense*, there is also a circular hump along the outer margin at the distal end (Naruse et al., 2011: fig. 9D, E; Naruse et al., 2018: figs. 6H–J, 13B, 17B).

Between *I. laevimarginatum*, new species, and its closest congener, *I. lipkei*, the former can be distinguished from the latter by the following differences: overall smoother carapace dorsal surfaces, with relatively fewer granules (Figs. 1A, B, 4A) (versus carapace dorsal surfaces more strongly rugose and granulose in *I. lipkei*; cf. Ng & Naiyanetr, 1993: fig. 12A); anterolateral margins smooth, or appears very weakly serrated (Figs. 1A, B, 4A) (versus anterolateral margins lined with sharp granules, appearing distinctly serrated in *I. lipkei*; cf. Ng & Naiyanetr, 1993: fig. 12A); external orbital tooth relatively broader and lower (Figs. 1A, B, 4A) (versus external orbital tooth relatively narrower, projected out more prominently in *I. lipkei*; cf. Ng & Naiyanetr, 1993: fig. 12A); male telson lateral margins strongly concave (Fig. 2A) (versus male telson lateral margins very gently concave in *I. lipkei*; cf. Ng & Naiyanetr, 1993: fig. 12C); G1 subterminal article very broad proximally, tapering uniformly distally (Fig. 3A, B) (versus G1 subterminal article tapers weakly proximally, with abrupt narrowing distal outer edge, appearing as distinct concavity in *I. lipkei*; cf. Ng & Naiyanetr, 1993: fig. 47B, C); G1 terminal article appears shorter relative to subterminal article, length 0.38 times subterminal article (Fig. 3A, B) (versus G1 terminal article appears longer relative to subterminal article, length 0.41 times length of subterminal article in *I. lipkei*; cf. Ng & Naiyanetr, 1993: fig. 47B, C); and the G1 terminal article dorsal flap low but visible from dorsal view (Fig. 3D) (versus G1 terminal article without any visible dorsal flap in *I. lipkei*; cf. Ng & Naiyanetr, 1993: fig. 47D, E). Geographically, *I. laevimarginatum*, new species, is some 500 kilometres north of the type locality of *I. lipkei* in Chiang Rai province, northwestern Thailand.

Distribution. *Indochinamon laevimarginatum*, new species, is so far only known from the type locality within Xuân Sơn National Park, Phú Thọ province in northern Vietnam.

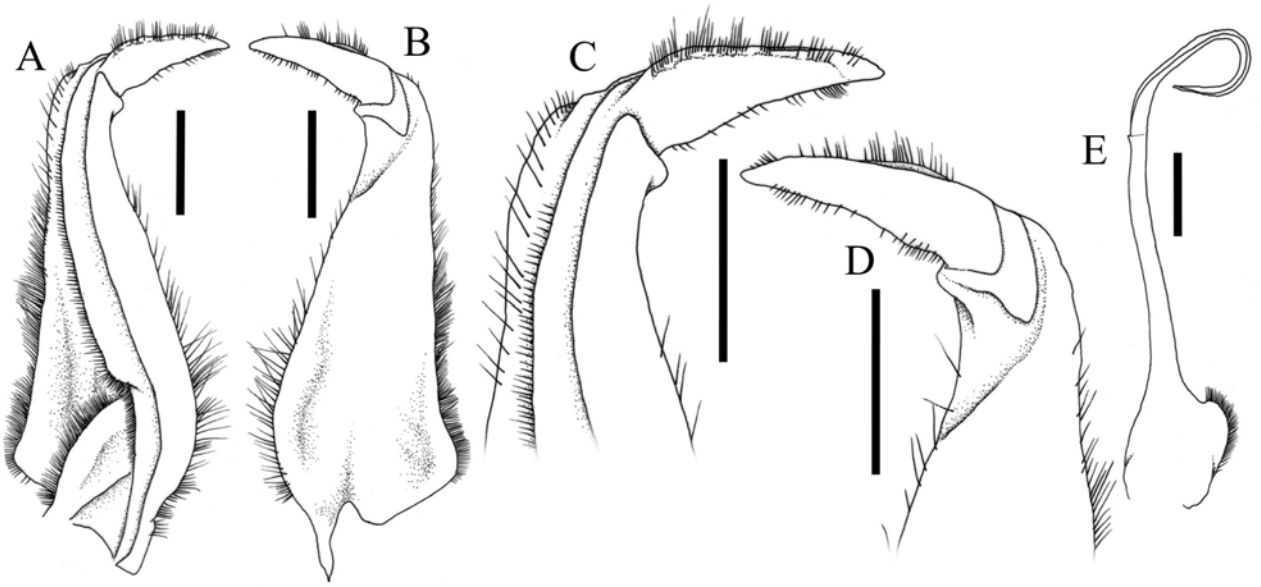

Fig. 3. *Indochinamon laevimarginatum*, new species, holotype, male (57.2 × 41.3 mm) (ZRC 2023.0602). A, left G1 (ventral view); B, left G1 (dorsal view); C, distal part of left G1 (ventral view); D, distal part of left G1 (dorsal view); E, left G2. Scale bar = 2 mm.

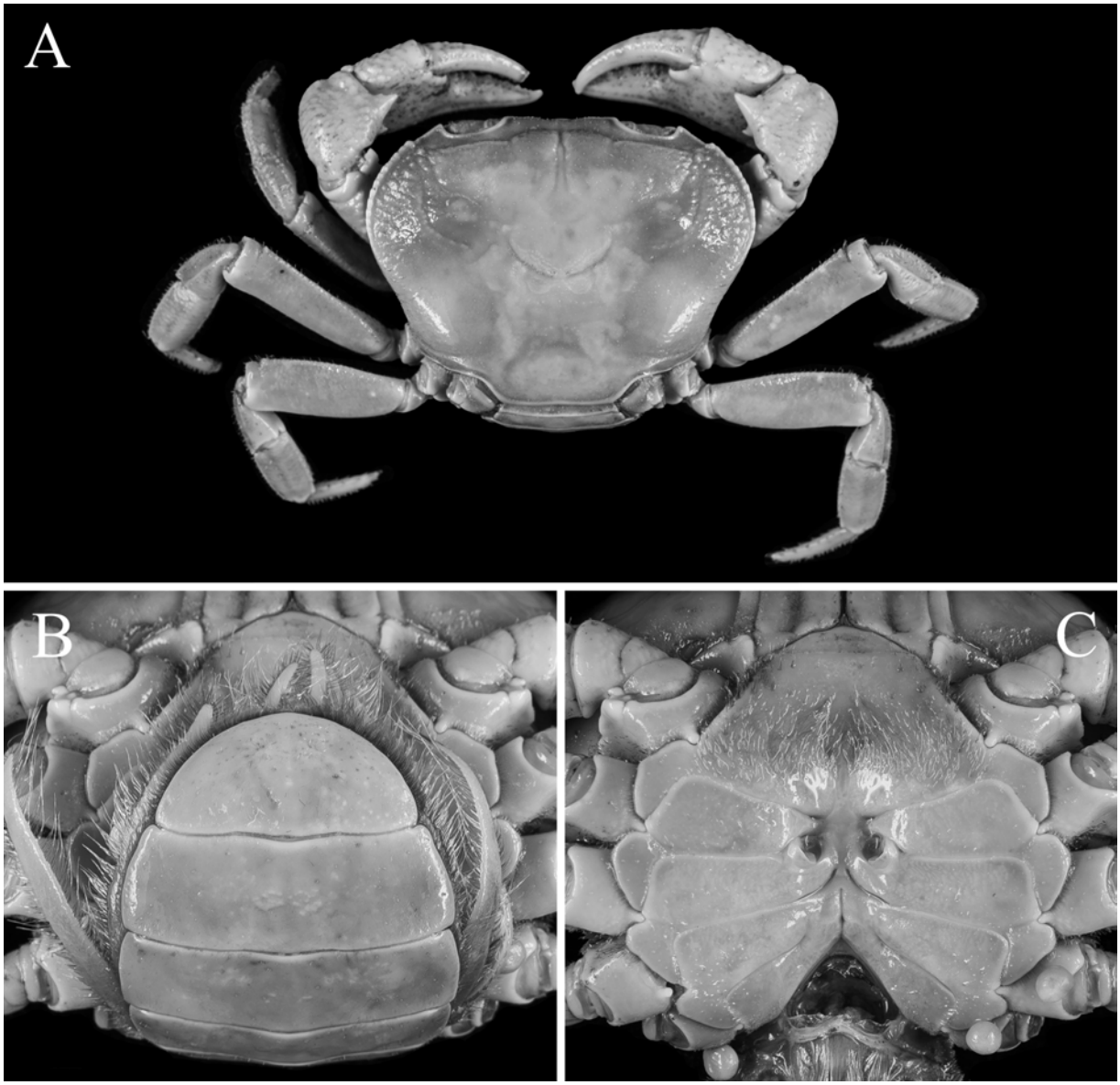

Fig. 4. *Indochinamon laevimarginatum*, new species, paratype, female (46.2 × 34.7 mm) (ZRC 2023.0603). A, dorsal view; B, pleon; C, sternopleonal cavity and vulvae.

***Indochinamon olivaceum*, new species**
(Figs. 5–8)

Material examined. Holotype: male (52.6 × 39.5 mm) (ZRC 2023.0604), small streams in karst forest, Mèo Vạc district, Hà Giang province, northern Vietnam, 23°08′N 105°24′E, 1300 m asl, coll. H'Mong ethnic people at night, 13 May 2022.

Diagnosis. Carapace (Fig. 5A, B) transversely ovate, slightly wider than long, CW/CL ratio 1.33; dorsal surface gently convex, gently rugose and granulose especially around branchial region and regions behind postorbital cristae; epigastric and postorbital crista pronounced, uneven; postorbital cristae gently sloping posterolaterally; epibranchial tooth well defined, appearing as a small blunt

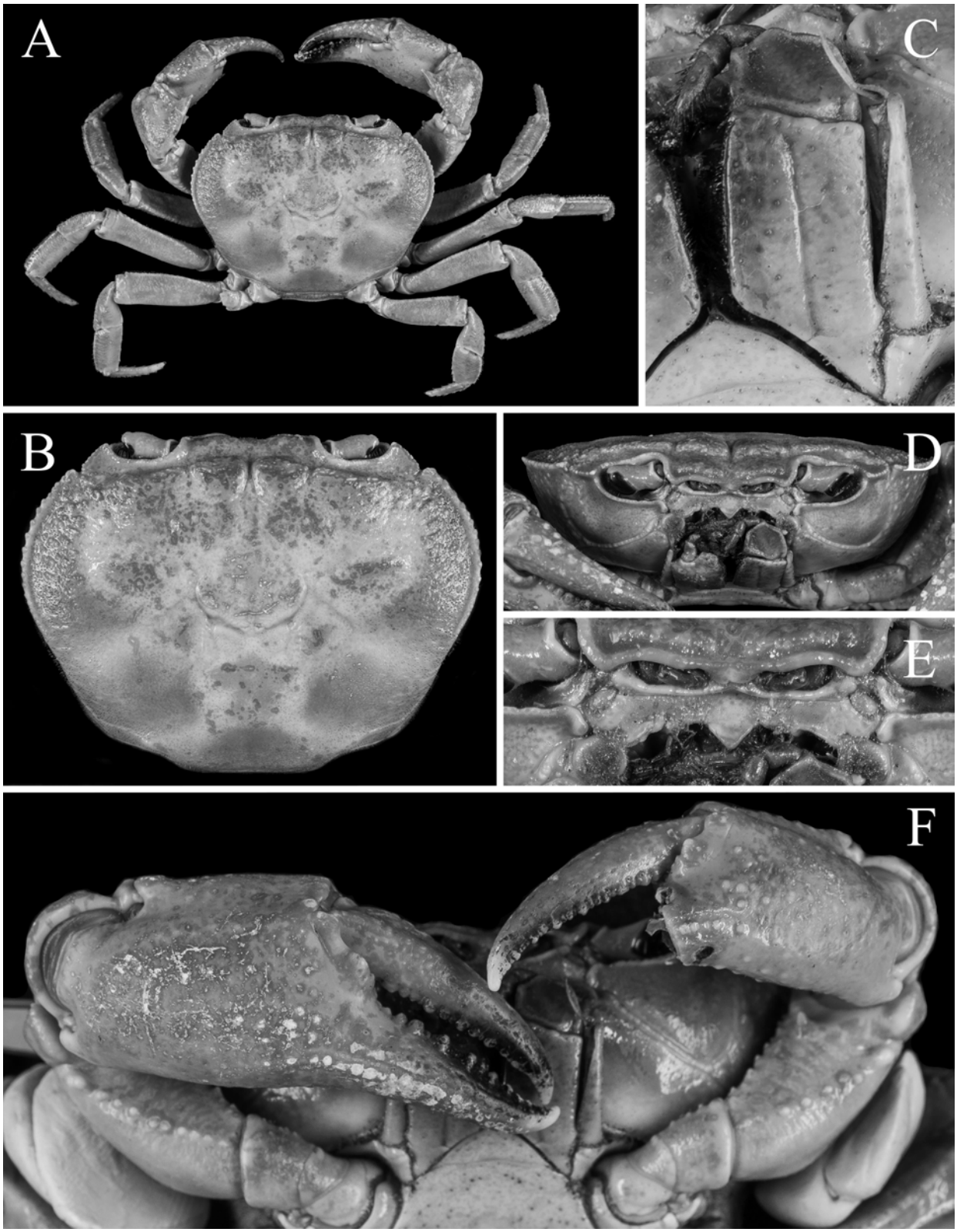

Fig. 5. *Indochinamon olivaceum*, new species, holotype, male (52.6 × 39.5 mm) (ZRC 2023.0604). A, dorsal view; B, carapace dorsal view; C, left third maxilliped; D, carapace frontal view; E, antennae, antennules and epistome; F, chelipeds.

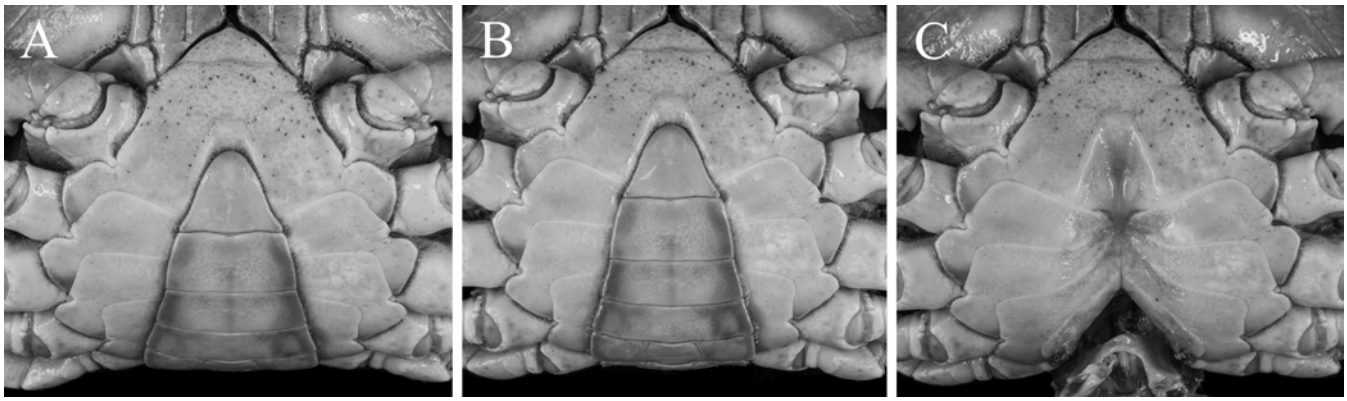

Fig. 6. *Indochinamon olivaceum*, new species, holotype, male (52.6 × 39.5 mm) (ZRC 2023.0604). A, anterior half of thoracic sternum and telson; B, posterior half of thoracic sternum and pleon; C, sternopleonal cavity.

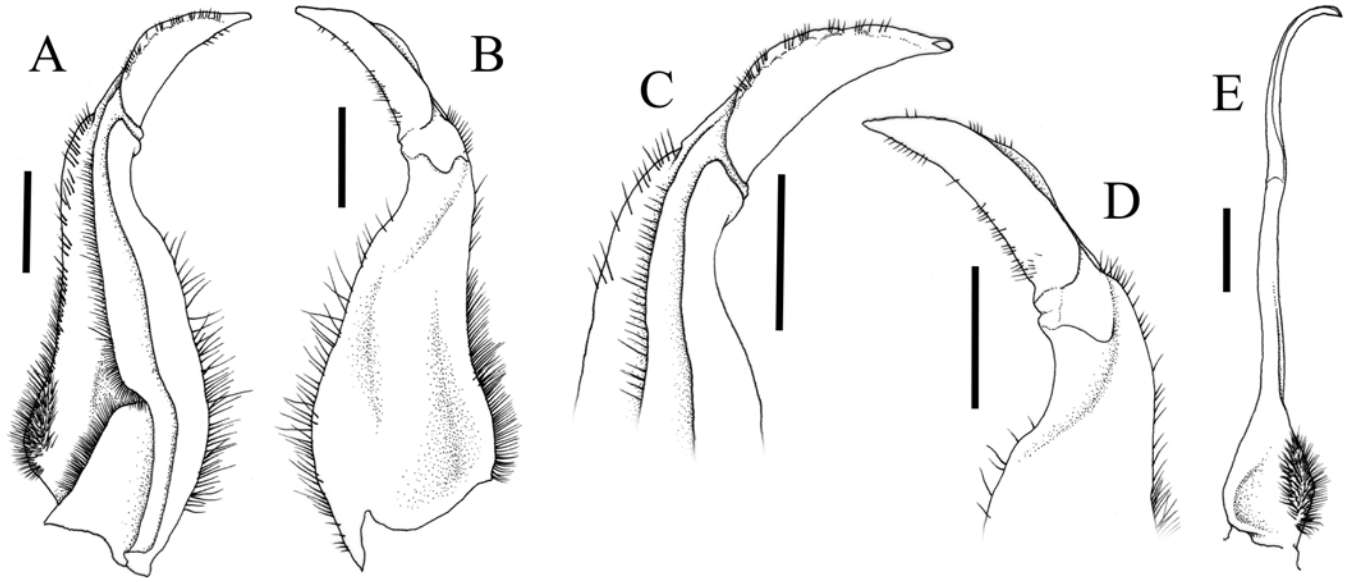

Fig. 7. *Indochinamon olivaceum*, new species, holotype, male (52.6 × 39.5 mm) (ZRC 2023.0604). A, left G1 (ventral view); B, left G1 (dorsal view); C, distal part of left G1 (ventral view); D, distal part of left G1 (dorsal view); E, left G2. Scale bar = 2 mm.

protuberance, clearly separated from external orbital tooth by V-shaped cleft; external orbital tooth broad, lateral margin convex, longer than mesial margin; anterolateral margins cristate, lined with small sharp granules, appearing gently serrated; posterolateral margin strongly converges towards posterior carapace margin. Frontal region (Fig. 5D) gently rugose, with sinuous margin; epistomal median lobe (Fig. 5E) well-developed, broadly triangular; suborbital and pterygostomial regions (Fig. 5C) smooth, subhepatic region gently rugose. Ambulatory legs and dactylus (Fig. 5A) not elongate, relatively stout, third walking leg length proportional to CW, merus margins smooth. Male thoracic sternum with s3/4 (Fig. 6A) barely discernible; male pleon (Fig. 6B) triangular; telson broadly triangular, lateral margins weakly concave. G1 (Fig. 7A–D) relatively short, stout, sinuous, distal part of lateral margin of subterminal article with distinct cleft; terminal article long, 0.41 times length of subterminal article, gently curving, bent outwards, ca. 45°, not tapering throughout, strongly tapers at distal third portion to a sharp tip, with numerous short stiff setae on dorsal surfaces, and with low, relatively long dorsal flap only visible in dorsal view.

Etymology. The name is derived from the Latin ‘olivae’ for olive, alluding to the colouration of the species in life.

Live colouration. In life, the dorsal surfaces of the carapace, ambulatory legs, and dorsal surfaces of the chelipeds are olive green; while the ventral surfaces largely pale off-white with lateral edges purple; with the outer surface of the chelipeds purplish-green and the finger tips orange (Fig. 8)

Remarks. *Indochinamon olivaceum*, new species, shares many affinities with *I. frontatum* Shi, Pan & Sun, 2023. Both species are noteworthy among congeners for possessing a more ovate carapace that is less transverse anteriorly and for their unique G1 morphology—it has a relatively long conical terminal article that is gently bent outwards and curving, with a low but distinct dorsal flap (Figs. 5A, 7A, B; Shi et al., 2023: figs. 2A, 5A). This contrasts to most *Indochinamon* species which typically have a carapace that is much more transverse anteriorly, particularly around the branchial areas (e.g., *I. kimboiense*, *I. bavi*, *I. villosum*, *I. cua*, *I. phongnha*; cf. Yeo & Ng, 1998: fig. 7A, D; Naruse et al., 2011: figs. 1A, 4A, 7A).

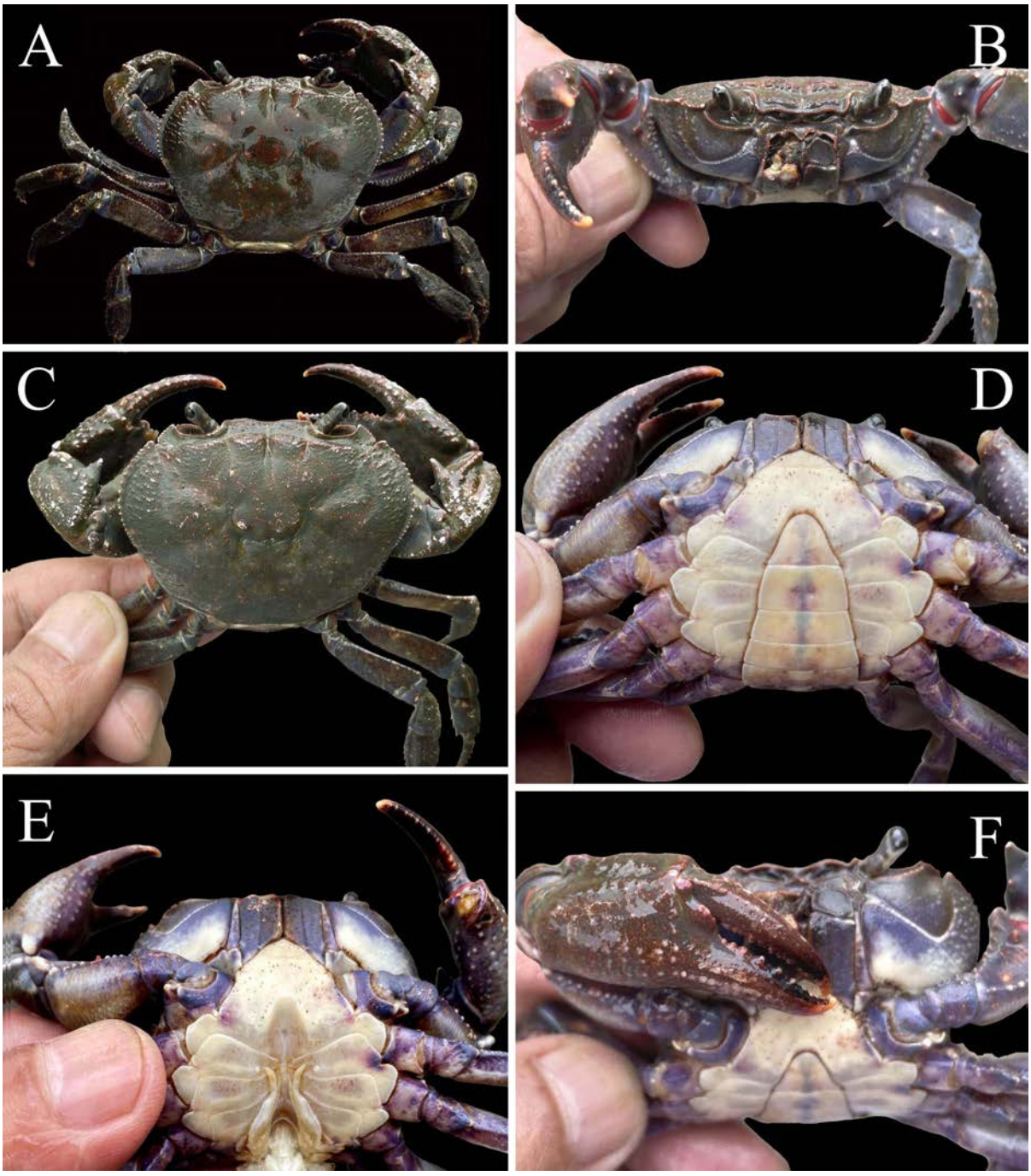

Fig. 8. *Indochinamon olivaceum*, new species, live colouration. Holotype, male (52.6 × 39.5 mm) (ZRC 2023.0604). A, C, dorsal view; B, frontal view; D, ventral view; E, thoracic sternites and sternopleonal cavity; F, right cheliped lateral view.

Indochinamon olivaceum, new species, can be differentiated from *I. frontatum* by the following differences: well-produced epistomal median lobe (Fig. 5E) (versus epistomal median lobe lower, appearing broader in *I. frontatum*; cf. Shi et al., 2023: fig. 2B); frontal cristae just posterior to frontal margin, and anterior to epigastric cristae, clearly separated into two, appearing as two lobes (Fig. 5D) (versus frontal cristae anterior to epigastric cristae not separated into two lobes in *I. frontatum*; cf. Shi et al., 2023: fig. 2B); fingers of chela more slender, relatively longer (Fig. 5F) (versus fingers of chela relatively more stout, shorter in *I. frontatum*; cf. Shi et al., 2023: fig. 3B, C); G1 subterminal article broader proximally, tapering less strongly proximally before tapering strongly distally (Fig. 7A, B) (versus G1 subterminal article less broad, tapering relatively evenly distally in *I. frontatum*; cf. Shi et al., 2023: fig. 6A, B); and the G1 terminal article more strongly bent outwards, about 40° from the vertical axis, less strongly hooked distally, with a dorsal flap that is proximal to median in position (Fig. 7C, D) (versus G1 terminal article that is directed more vertically, about 30° from the vertical axis, more strongly hooked distally, with a dorsal flap that is more median to distal in position in *I. frontatum*; cf. Shi et al., 2023: fig. 6A, B).

Distribution. *Indochinamon olivaceum*, new species, is currently known only from the type locality in Mèo Vạc district, Hà Giang province, in northern Vietnam.

***Indochinamon granulatum*, new species**
(Figs. 9–13)

Material examined. Holotype: male (61.3 × 45.8 mm) (ZRC 2023.0605), limestone stream, Tả Lủng Commune, Mèo Vạc district, Hà Giang province, northern Vietnam, 23°09′N 105°22′E, 1,400 m asl, coll. H'Mong ethnic people at night, 13 May 2022. Paratype: 1 female (57.0 × 43.8 mm) (ZRC 2023.0606), same data as holotype.

Diagnosis. Carapace (Figs. 9A, B, 12A) transversely subovate, wider than long, especially pronounced anteriorly, CW/CL ratio 1.30–1.33; dorsal surface almost flat, branchial regions and regions behind postorbital cristae with numerous large distinct granules; epigastric and postorbital crista pronounced, uneven; postorbital cristae appearing concave when viewed dorsally; epibranchial tooth well defined, appearing as a sharp protuberance, clearly separated from external orbital tooth by V-shaped cleft; external orbital

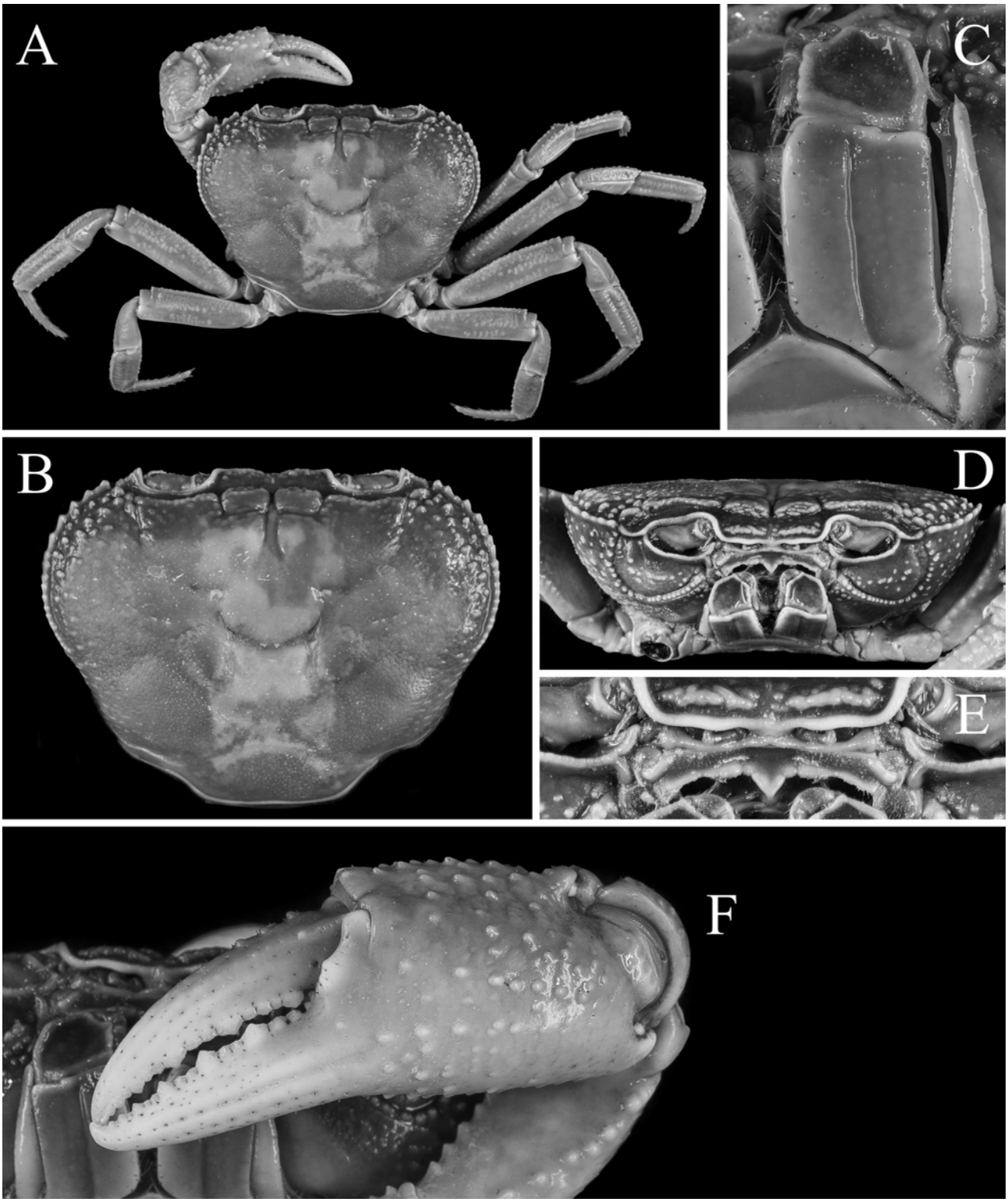

Fig. 9. *Indochinamon granulatum*, new species, holotype, male (61.3 × 45.8 mm) (ZRC 2023.0605). A, dorsal view; B, carapace dorsal view; C, left third maxilliped; D, carapace frontal view; E, antennae, antennules and epistome; F, left cheliped (right cheliped missing).

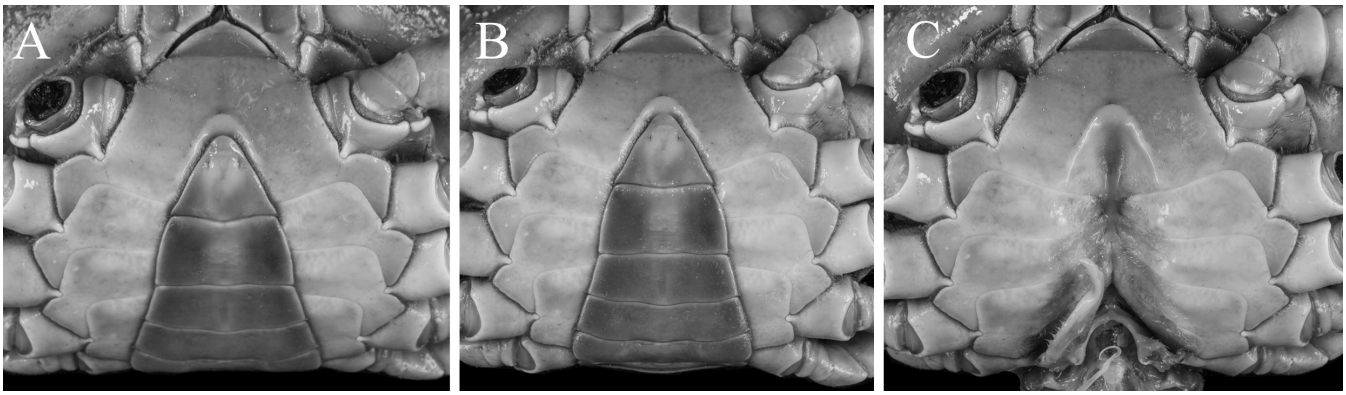

Fig. 10. *Indochinamon granulatum*, new species, holotype, male (61.3 × 45.8 mm) (ZRC 2023.0605). A, anterior half of thoracic sternum and telson; B, posterior half of thoracic sternum and pleon; C, sternopleonal cavity.

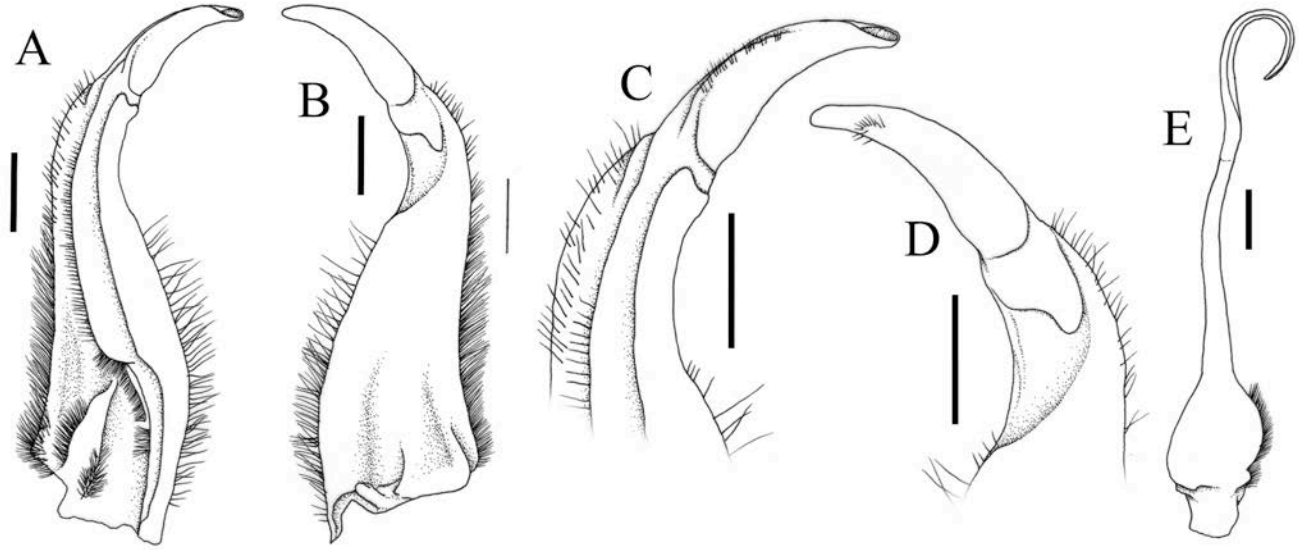

Fig. 11. *Indochinamon granulatum*, new species, holotype, male (61.3 × 45.8 mm) (ZRC 2023.0605). A, left G1 (ventral view); B, left G1 (dorsal view); C, distal part of left G1 (ventral view); D, distal part of left G1 (dorsal view); E, left G2. Scale bar = 2 mm.

tooth low, broad, sharp, lateral margin straight, longer than mesial margin; anterolateral margins cristate, lined with sharp granules, appearing serrated; posterolateral margin strongly converges towards posterior carapace margin. Frontal region (Fig. 9D) rugose, with distinct post frontal rugosity, with gently sinuous margin; epistomal median lobe (Fig. 9E) well-developed, broadly triangular, sharp; suborbital, subhepatic, pterygostomial regions granulose. Third maxilliped (Fig. 9C) ischium relatively elongate, length to width ratio 1.56; exopod with relatively short flagellum, reaches half width of merus. Ambulatory legs and dactylus (Fig. 9A) relatively elongate, third walking leg length ca. 1.14 times CW, merus margins gently serrated. Male thoracic sternum with s3/4 (Fig. 10A) shallow but discernible; male pleon (Fig. 10B) triangular; telson broadly triangular, lateral margins straight. G1 (Fig. 11A–D) relatively slender, sinuous; basal part of subterminal article broad, tapering gently distally; distal part of lateral margin of subterminal article with shallow but distinct cleft, terminal article long, 0.37 times length of subterminal article, curving downwards, bent outwards, ca. 45°, tapering gently to a broad blunt end, no dorsal fold visible. Vulva (Fig. 12C) large, occupying about half of sternite 6 length, impinges strongly on sternite 5, directed anterio-mesially, with well-produced vulvar cover on outer margin.

Etymology. The name alludes to the unusually large and conspicuous granules and rugosity scattered around the male holotype's carapace dorsal, frontal surfaces, and on the chela.

Live colouration. In life, the dorsal surfaces of the carapace, ambulatory legs, and outer surfaces of the chelipeds are reddish brown; while the ventral surfaces are largely pale off-white with the lateral edges orangish; tips of fingers white (Fig. 13).

Remarks. *Indochinamon granulatum*, new species, is markedly different from congeners with regards to its external morphology to most congeners in terms of its relatively longer ambulatory legs, that in most species, are typically short and stout. In all other aspects, the new species agrees well to the current diagnostic traits of *Indochinamon* sensu lato. Other *Indochinamon* species with longer ambulatory legs include *I. chuahuong* Do, Nguyen & Le, 2016 and *I. falx*, new species; though the ambulatory legs of these two species are still distinctly more elongated than those of *I. granulatum*, new species.

Indochinamon granulatum, new species, can be differentiated from *I. chuahuong* and *I. falx*, new species, by the following

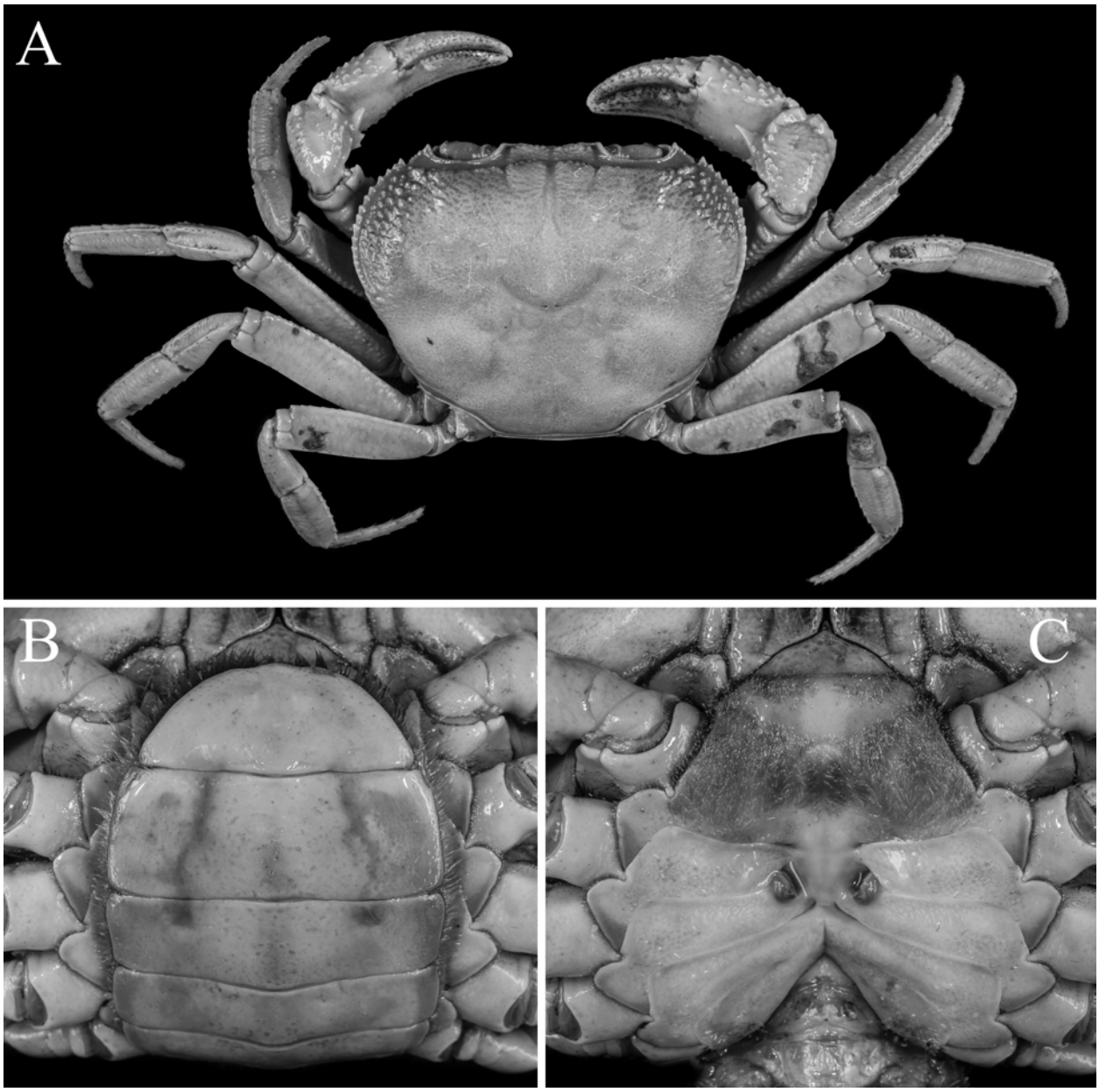

Fig. 12. *Indochinamon granulatum*, new species, paratype, female (57.0 × 43.8 mm) (ZRC 2023.0606). A, dorsal view; B, pleon; C, sternopleonal cavity and vulvae.

differences: relatively shorter legs, third walking leg length ca. 1.14 times CW (Fig. 9A) (versus ambulatory legs comparatively longer, appearing even more elongated, third walking leg length ca. 1.28–1.38 times CW in *I. chuahuong* (cf. Do et al., 2016: fig. 2A), and *I. falx*, new species; Fig. 24A); carapace anterolateral margins line with large granules, appearing coarsely serrated (Fig. 9B) (versus carapace anterolateral margins lined with smaller granules in *I. falx*, new species (cf. Fig. 25B) while in *I. chuahuong*, is lined with very pronounced teeth-like granules, appearing more spinate; cf. Do et al., 2016: fig. 2A); carapace posterolateral margins subparallel, with a distinct waist-like appearance, particularly pronounced for male (Fig. 9B) (versus carapace posterolateral margins converges more strongly posteriorly, without waist-like margins, in both males and females, in *I. chuahuong*; cf. Do et al., 2016: fig. 2A, and *I. falx*, new species; Fig. 25B); G1 subterminal article broader, stouter (Fig. 11A, B) (versus G1 subterminal article more slender in *I. chuahuong*; cf. Do et al., 2016: fig. 4A, C, and *I. falx*, new species; Fig. 27A, B); and the G1 terminal article curving strongly, relatively broad and elongate, width to length ratio 0.29 (Fig. 11C, D) (versus G1 terminal article proportionately more slender, curving more strongly and more elongated, width to length ratio ca. 0.19 in *I. falx*, new species; Fig. 27C, D, while in *I. chuahuong*, is curving less strongly, slightly broader, width to length ratio ca. 0.32, and relatively shorter; cf. Do et al., 2016: fig. 4B, C).

Indochinamon granulatum, new species, also shares some affinities with *I. malipoense* Zhang, Pan, Hao & Sun, 2020, in terms of the G1 morphology; both species possessing a gently curving G1 terminal article with no dorsal flap visible (Fig. 11; Zhang et al., 2020: fig. 8B, C, F). Nevertheless, *Indochinamon granulatum*, new species, can be differentiated from *I. malipoense* by the following differences: frontal margin straight when viewed frontally (Fig. 9D) (versus

Fig. 13. *Indochinamon granulatum*, new species, live colouration. Holotype, male (61.3 × 45.8 mm) (ZRC 2023.0605). A, dorsal view; B, frontal view; C, ventral view; D, thoracic sternites and sternopleonal cavity.

frontal margin appearing convex when viewed frontally in *I. malipoense*; cf. Zhang et al., 2020: fig. 7B); carapace posterolateral margin strongly converges towards sub-parallel "waist-like" posterior carapace margin, especially pronounced in mature males (Fig. 9B) (versus carapace posterolateral margin strongly converging posteriorly, without any "waist-like" carapace margin in both mature individual of *I. malipoense*; cf. Zhang et al., 2020: fig. 7A); ambulatory legs relatively more elongate (Fig. 9A) (versus ambulatory leg comparatively less elongated in *I. malipoense*; cf. Zhang et al., 2020: fig. 7A); third maxilliped ischium more elongate, length to width ratio 1.56 (versus third maxilliped ischium less elongate, length to width ratio 1.30 in *I. malipoense*; cf. Zhang et al., 2020: fig. 8A) male thoracic sternum with incomplete s3/4, lateral edges more well-defined (Fig. 10A) (versus male thoracic sternum with complete s3/4 in *I. malipoense*; cf. Zhang et al., 2020: fig. 7C); male pleon telson more narrowly triangular (Fig. 10A) (versus telson more broadly triangular in *I. malipoense*; cf. Zhang et al., 2020: fig. 7C); male G1 subterminal article with cleft beginning more distally, distal portion more slender and more strongly curving outwards (Fig. 11B) (versus G1 subterminal article with cleft beginning more anteriorly, distal portion broader and less strongly curving outwards in *I. malipoense*; cf. Zhang et al., 2020: fig. 8C); and the G1 terminal article proportionately longer, ca. 0.37 times length of subterminal article, more strongly bent and curving outwards, ca. 45° (Fig. 11B, D) (versus G1 terminal article proportionately shorter, ca. 0.31 times length of subterminal article, less strongly bent and curving outwards, ca 30° from vertical axis in *I. malipoense*; cf. Zhang et al., 2020: fig. 8C).

Distribution. *Indochinamon granulatum*, new species, is currently known only from the type locality; Mèo Vạc district, Hà Giang province, in northern Vietnam.

***Indochinamon scimitar*, new species**

(Figs. 14–18)

Material examined. Holotype: male (52.6 × 40.4 mm) (ZRC 2023.0607), small stream flowing in karst mountains, Cao Bình commune, Hòa An district, Cao Bằng province, northern Vietnam, 22°44′N 106°10′E, 250 m asl, coll. V.T. Ngo, 4 June 2022. Paratypes: 1 female (40.0 × 31.0 mm)

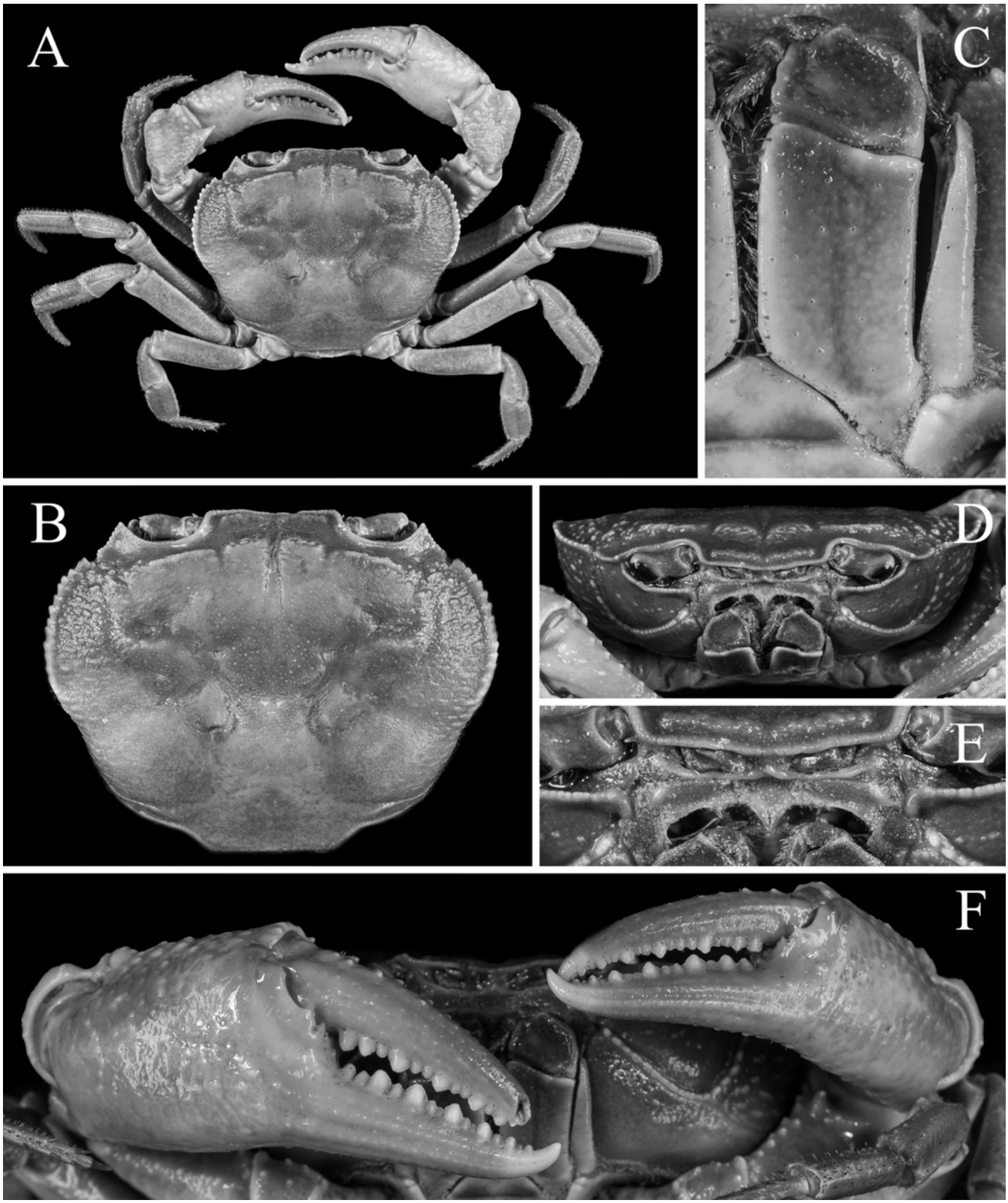

Fig. 14. *Indochinamon scimitar*, new species, holotype, male (52.6 × 40.4 mm) (ZRC 2023.0607). A, dorsal view; B, carapace dorsal view; C, left third maxilliped; D, carapace frontal view; E, antennae, antennules and epistome; F, chelipeds.

(ZRC 2023.0608), 1 male (50.2 × 39.0 mm), 1 female (40.0 × 30.5 mm) (ZVNU), same data as holotype.

Diagnosis. Carapace (Figs. 14A, B, 17A) transversely subrectangular, slightly wider than long, CW/CL ratio 1.28–1.31; dorsal surface almost flat, branchial regions and regions behind postorbital cristae rugose; epigastric and postorbital crista pronounced, uneven; postorbital cristae distinctly sloping posterolaterally; epibranchial tooth well defined, appearing as a sharp protuberance, clearly separated from external orbital tooth by distinct V-shaped cleft; external orbital tooth large, broad, sharp, lateral margin

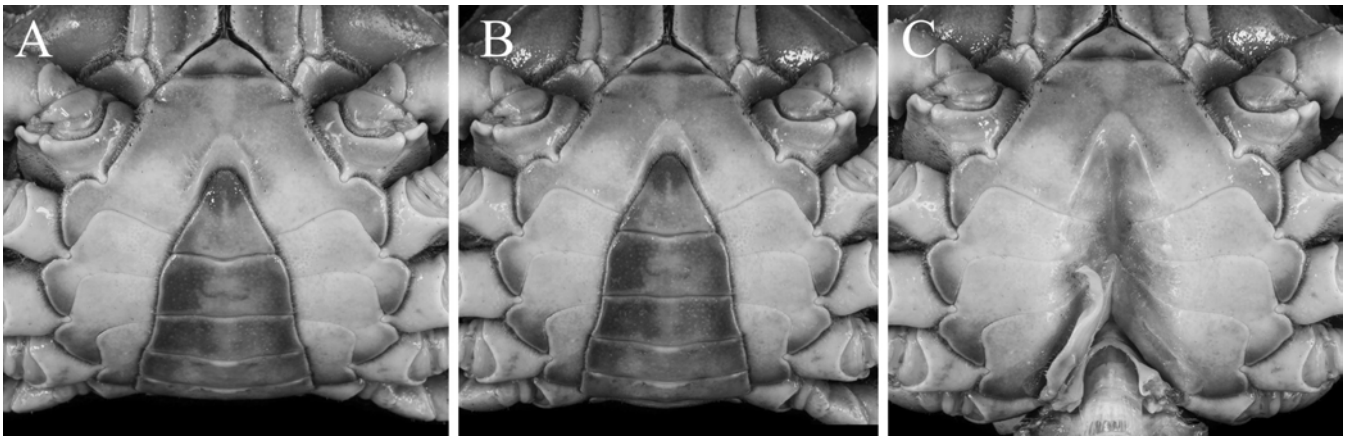

Fig. 15. *Indochinamon scimitar*, new species, holotype, male (52.6 × 40.4 mm) (ZRC 2023.0607). A, anterior half of thoracic sternum and telson; B, posterior half of thoracic sternum and pleon; C, sternopleonal cavity.

straight or weakly concave, longer than mesial margin; anterolateral margins cristate, lined with small sharp granules, appearing serrated; posterolateral margin strongly converges towards sub-parallel 'waist-like' posterior carapace margin, especially pronounced in mature males. Frontal region (Fig. 14D) rugose, with uneven post frontal rugosity, with gently sinuous margin; epistomal median lobe (Fig. 14E) well-developed, triangular, sharp; suborbital region with few granules, subhepatic region rugose, pterygostomial regions smooth or faintly granulose. Third maxilliped (Fig. 14C) exopod with well-developed flagellum, reaches width of merus. Ambulatory legs and dactylus (Fig. 14A) not elongate, relatively stout, third walking leg length ca. 1.01 times CW, merus margins gently serrated. Male thoracic sternum with s3/4 (Fig. 15A) barely discernible, edges more well defined, subparallel to front before curving down strongly to edge of sternopleonal cavity; male pleon (Fig. 15B) triangular; telson triangular, lateral margins straight. G1 (Fig. 16A–D) relatively stout, short, sinuous; basal part of subterminal article broad, tapering gently distally; distal part of lateral margin of subterminal article tapers strongly with distinct cleft; terminal article long, 0.46 times length of subterminal article, curving downwards, bent outwards, ca. 45°, not tapering throughout except distal ⅔, where it tapers strongly to a rounded tip, with a small, low dorsal fold visible in dorsal view. Vulva (Fig. 17C) large, occupying slightly more than half of sternite 6 width, impinges strongly on sternite 5, directed mesially, with well-produced vulvar cover on outer margin.

Etymology. The name alludes to the G1 terminal article resembling the short convex blade of a scimitar. Name used as a noun in apposition.

Live colouration. In life, the dorsal surfaces of the carapace, ambulatory legs and dorsal surfaces of the chelipeds are dark brownish-green; ventral surfaces largely pale off-white with lateral edges purple. The outer surfaces of the chelipeds are brownish-green while the finger tips are orangish-white (Fig. 18).

Remarks. *Indochinamon scimitar*, new species, is most likely to be confused with two other Vietnamese species; *I. dangi* Naruse, Nguyen & Yeo, 2011, and *I. phongnha* Naruse, Nguyen & Yeo, 2011, when considering its external morphology. The aforementioned species are all characterised by their relatively subquadrate, less transverse carapace with a distinct sub-parallel 'waist-like' posterior carapace margin (Fig. 14A; Naruse et al., 2011: figs. 7A, 10A). *Indochinamon scimitar*, new species, can nonetheless be immediately separated from them by its relatively shallower cervical, H-shaped median groove, and by its distinctive G1 terminal article that is proportionately longer, about 0.46 times the length of subterminal article that is bent outwards about 45°, gently curving and not visibly tapering throughout, only tapering strongly (Figs. 14A, 16C, D). This contrasts with the very deep and strong cervical, H-shaped median groove and a G1 terminal article that is shorter, about 0.31–0.34 times length of subterminal article that is tapering throughout and relatively straight, which furthermore in *I. dangi*, is strongly bent outwards at almost 90° (Naruse et al., 2011: figs. 7A, 9A, B, D, E, 10A).

In terms of G1 morphology, *I. scimitar*, new species, closely resembles another Vietnamese species, *I. cua* (Yeo & Ng, 1998), in its broad and stout G1 subterminal article and proportionately long terminal article, about 0.4 times length of subterminal article (Fig. 16A, B; cf. Yeo & Ng, 1998: fig. 4B, C, E, G). The two species can easily be separated by the following differences: s3/4 strong, more prominent towards the lateral edges, appearing convex anteriorly (Fig. 15A) (versus s3/4 faint, appearing straight in *I. cua*); G1 subterminal article with relatively weaker, smoother cleft on distal outer margin (Fig. 16A, B) (versus G1 subterminal article with strong cleft on distal outer margin, appearing angular in *I. cua*; cf. Yeo & Ng, 1998: fig. 4B, C); and the G1 terminal article gently curving throughout, with a weakly produced dorsal flap visible in dorsal view (Fig. 16C, D) (versus G1 terminal article straight, with no visible dorsal flap visible in dorsal view in *I. cua*; cf. Yeo & Ng, 1998: fig. 4E, G).

Distribution. *Indochinamon scimitar*, new species, is currently only known from its type locality, Cao Bình commune, Hòa An district, Cao Bằng province, in northern Vietnam.

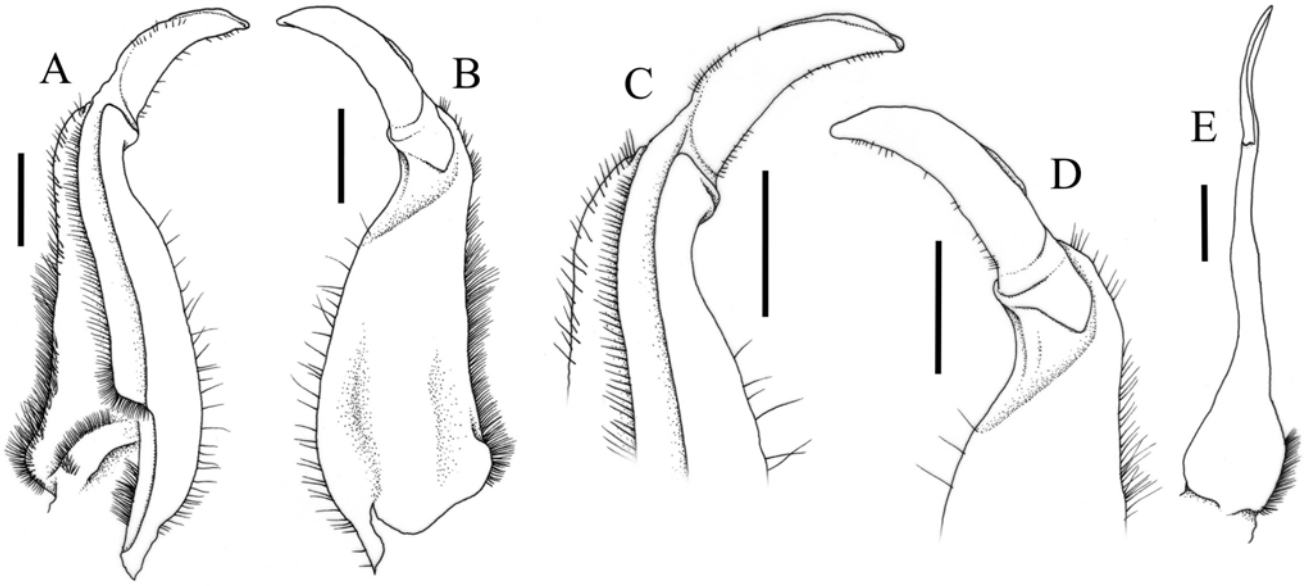

Fig. 16. *Indochinamon scimitar*, new species, holotype, male (52.6 × 40.4 mm) (ZRC 2023.0607). A, left G1 (ventral view); B, left G1 (dorsal view); C, distal part of left G1 (ventral view); D, distal part of left G1 (dorsal view); E, left G2. Scale bar = 2 mm.

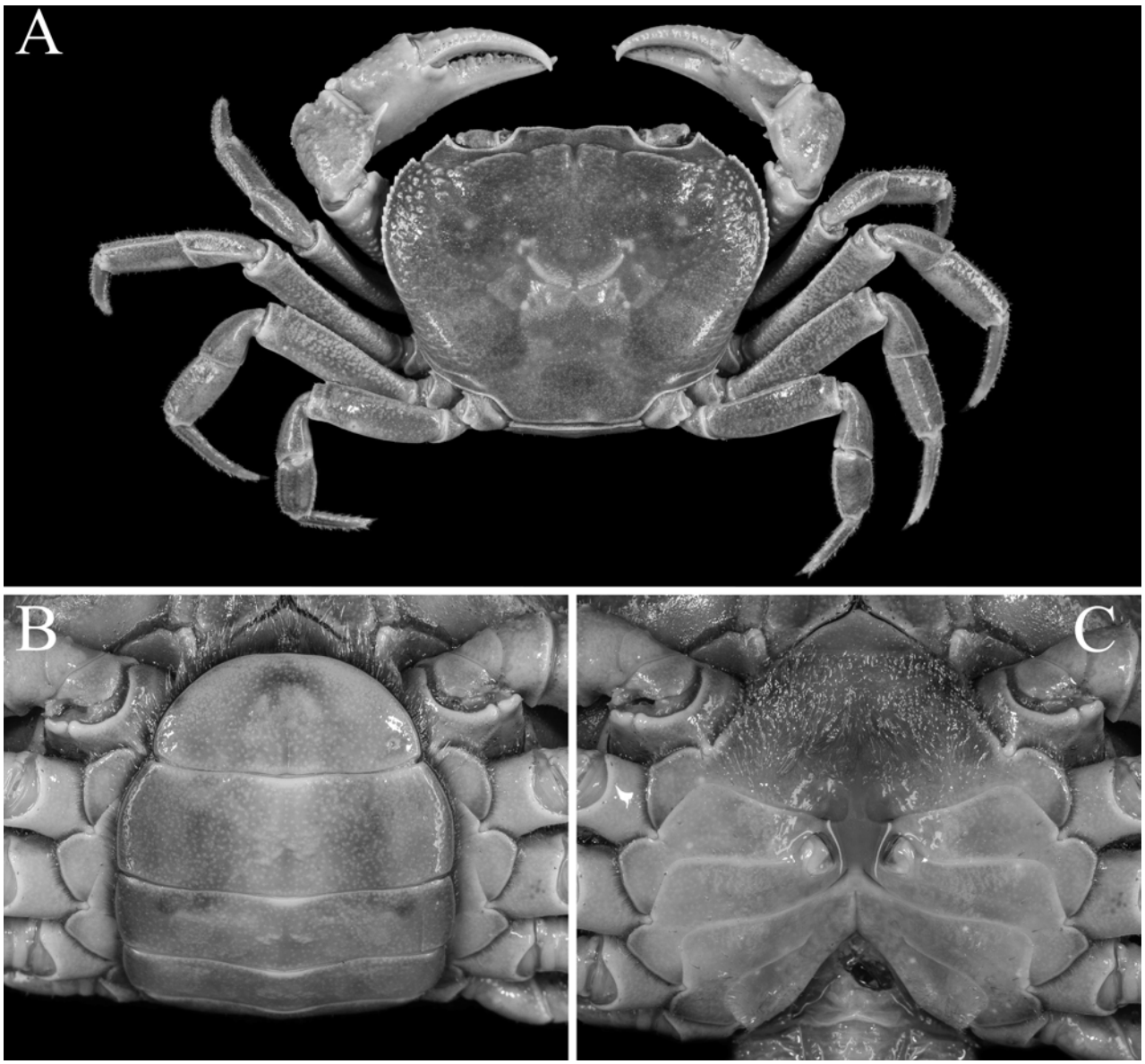

Fig. 17. *Indochinamon scimitar*, new species, paratype, female (40.0 × 31.0 mm) (ZRC 2023.0608). A, dorsal view; B, pleon; C, sternopleonal cavity and vulvae.

Fig. 18. *Indochinamon scimitar*, new species, live colouration, holotype, male (52.6 × 40.4 mm) (ZRC 2023.0607). A, dorsal view; B, frontal view; C, ventral view; D, thoracic sternites and sternopleonal cavity.

Indochinamon erythreum, new species
(Figs. 19–22)

Material examined. Holotype: male (64.3 × 48.2 mm) (ZRC 2023.0609), small rivulet in karst forest, Xuân Sơn National Park, Tân Sơn District, Phú Thọ province, northern Vietnam, coll. V.T. Ngo, around 2000 hours, 5 June 2011. Paratype: 1 male (62.4 × 46.8 mm) (ZVNU), same data as holotype.

Diagnosis. Carapace (Fig. 19A, B) transversely subovate, wider than long, CW/CL ratio 1.33; dorsal surface gently convex, branchial regions and regions behind postorbital cristae rugose and granulose; epigastric and postorbital crista pronounced, rugose; postorbital cristae distinctly gently sloping posterolaterally; epibranchial tooth weakly developed appearing as a sharp protuberance, separated from external orbital tooth by shallow V-shaped cleft; external orbital tooth large, broad, lateral margin straight or weakly concave, longer than mesial margin; anterolateral margins sub-cristate, lined with small sharp granules, appearing serrated; posterolateral margin strongly converges towards posterior carapace margin. Frontal region (Fig. 19D) rugose, with well-developed post frontal rugosity, with sinuous margin; epistomal median lobe (Fig. 19E) well-developed, broadly triangular; suborbital region weakly granulose, subhepatic region rugose, pterygostomial regions largely smooth with few granules at margins. Third maxilliped (Fig. 19C) exopod with well-developed flagellum, reaches width of merus. Ambulatory legs and dactylus (Fig. 19A) not elongate, third walking leg length ca. 1.05 times CW, merus margins gently serrated. Male thoracic sternum with s3/4 (Fig. 20A) not discernible except for grooves demarcating sutures at lateral edges; male pleon (Fig. 20B) narrowly triangular; telson broadly triangular, lateral margins straight. G1 (Fig. 21A–D) relatively slender, gently sinuous; basal part of subterminal article tapering gently distally; distal part of lateral margin of subterminal article without distinct cleft; terminal article long, slender, 0.40 times length of subterminal article, weakly curving downwards, gently bent outwards, ca. 35°, gently tapering throughout except distal ⅔, where it tapers more strongly to a blunt tip, with a small, low dorsal fold visible in both ventral and dorsal view.

Etymology. The name is derived from the Greek word ‘erythros’ for red, alluding to its reddish colour in life.

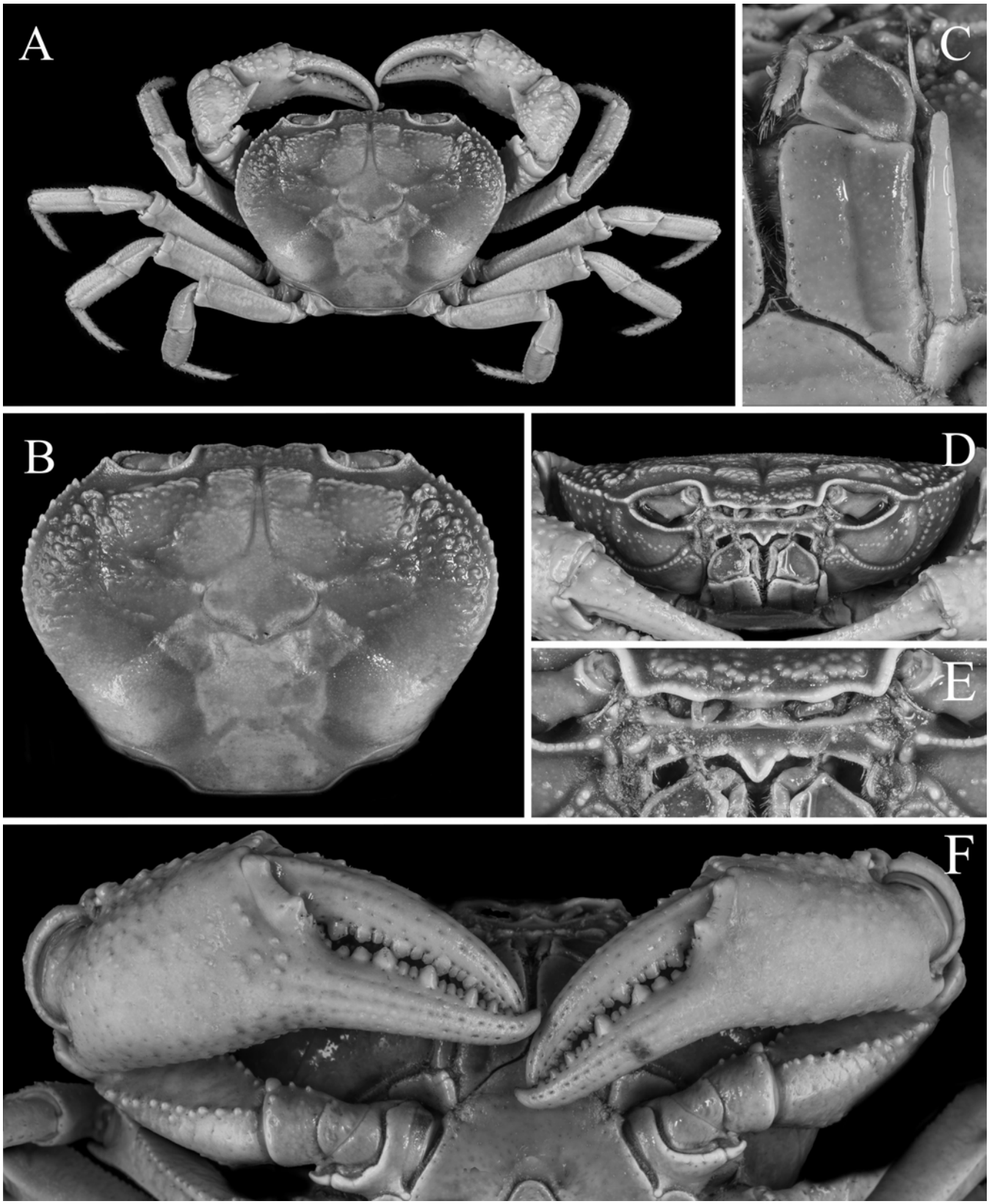

Fig. 19. *Indochinamon erythreum*, new species, holotype, male (64.3 × 48.2 mm) (ZRC 2023.0609). A, dorsal view; B, carapace dorsal view; C, left third maxilliped; D, carapace frontal view; E, antennae, antennules and epistome; F, chelipeds.

Live colouration. In life, the dorsal surfaces of the carapace, ambulatory legs and outer surfaces of the chelipeds are dark to blood red; while the ventral surfaces are largely pale off-white with the lateral edges magenta (Fig. 22).

Remarks. *Indochinamon erythreum*, new species, is morphologically closest to *I. signum* Ng & Ngo, 2023, described from Quảng Ninh province, northern Vietnam. Both species share a very similar G1 morphology and overall reddish colouration in life. Nevertheless, *I. erythreum*, new

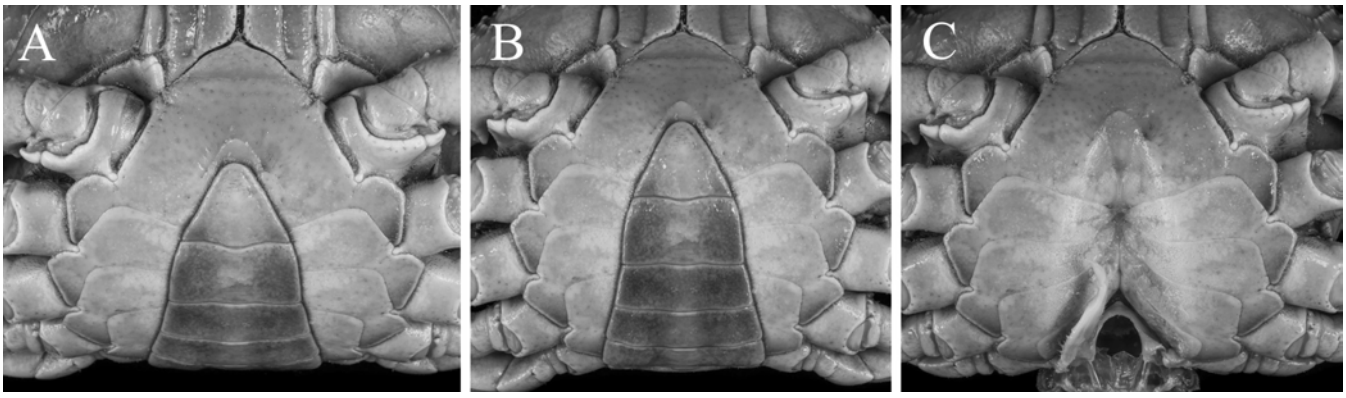

Fig. 20. *Indochinamon erythreum*, new species, holotype, male (64.3 × 48.2 mm) (ZRC 2023.0609). A, anterior half of thoracic sternum and telson; B, posterior half of thoracic sternum and pleon; C, sternopleonal cavity.

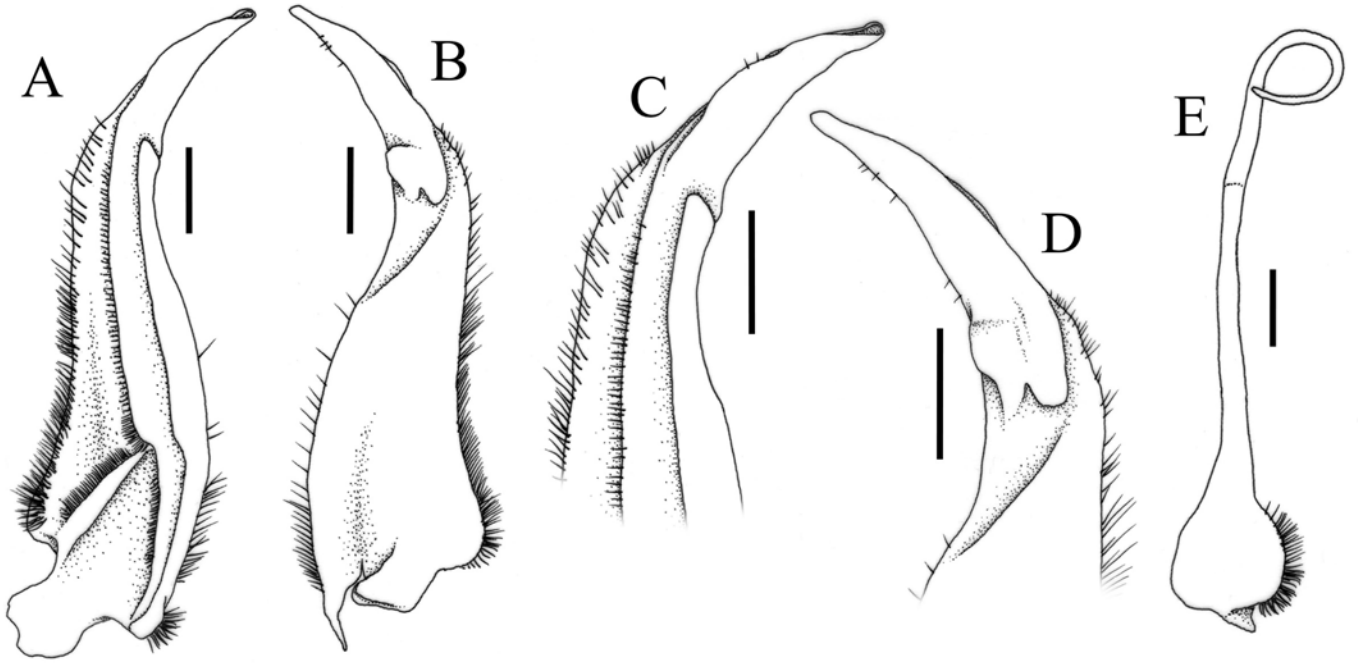

Fig. 21. *Indochinamon erythreum*, new species, holotype, male (64.3 × 48.2 mm) (ZRC 2023.0609). A, left G1 (ventral view); B, left G1 (dorsal view); C, distal part of left G1 (ventral view); D, distal part of left G1 (dorsal view); E, left G2. Scale bar = 2 mm.

species, can be reliably differentiated from *I. signum* by the following suite of differences: carapace appearing more transverse, wider, width to length ratio 1.33 (Fig. 19A) (versus carapace appears less transverse, more subquadrate, width to length ratio 1.26 in *I. signum*; cf. Ng & Ngo, 2023: fig. 9B); postorbital cristae sloping more strongly posterolaterally, appearing granulose (Fig. 19A) (versus postorbital cristae slopes less strongly posterolaterally, lateral edges appearing subparallel to frontal margin in *I. signum*; cf. Ng & Ngo, 2023: fig. 9B); external orbital tooth broader, with concave lateral margins (Fig. 19A) (versus external orbital tooth more acute, with straight to slightly convex lateral margins in *I. signum*; cf. Ng & Ngo, 2023: fig. 9B); frontal margin distinctly sinuous, lateral edges appearing projected (Fig. 19D) (versus frontal margin smooth and appearing convex in relation to ventral plane when viewed frontally in *I. signum*; cf. Ng & Ngo, 2023: fig. 9C); s3/4 almost indiscernible, with very weak grooves demarcating suture at lateral edges (Fig. 20A) (versus s3/4 more distinct, well defined and nearly complete in *I. signum*; cf. Ng & Ngo, 2023: fig. 9F), male pleonal somite 6 more elongated antero-posteriorly, width to length ratio 1.75 (Fig. 20B) (versus male pleonal somite 6 less elongated antero-posteriorly, width to length ratio 1.99 in *I. signum*; cf. Ng & Ngo, 2023: fig. 9E); G1 subterminal article appearing broader proximally, with a slightly longer distal neck-like region (Fig. 21B) (versus G1 subterminal article more slender overall with a shorter distal neck-like region in *I. signum*; cf. Ng & Ngo, 2023: fig. 10F, G); and the G1 terminal article dorsal flap shorter, only visible from proximal third to median point of the lateral margin (Fig. 21D) (versus G1 terminal article dorsal flap much longer, visible from proximal point to distal three quarter point of the lateral margin in *I. signum*; cf. Ng & Ngo, 2023: fig. 11G).

Indochinamon erythreum, new species, occurs in the same general area as the recently described *I. datii* Dang, Do & Pham, 2024, from Xuan Son National Park. Nonetheless, the new species can easily be differentiated from the latter

by the following differences: epigastric cristae prominently anterior to postorbital cristae (Fig. 19A) (versus epigastric cristae slightly anterior or appears to be relatively in line with the postorbital cristae in *I. datii*; cf. Dang et al., 2024: figs. 1A, 4); postorbital cristae distinctly sloping posterolaterally (Fig. 19A) (versus postorbital cristae subparallel to frontal and supraorbital margin in *I. datii*; cf. Dang et al., 2024: figs. 1A, 4); frontal margin distinctly sinuous, lateral edge distinctly produced as broad angle (Fig. 19D) (versus frontal margin straight or very gently sinuous, lateral edges not produced in *I. datii*; cf. Dang et al., 2024: fig. 1B); s3/4 shallow but complete (Fig. 20A) (versus s3/4 not discernible or only as very minute clefts on lateral edges in *I. datii*; cf. Dang et al., 2024: fig. 1C); G1 subterminal article distal neck-like constriction longer (Fig. 21B) (versus G1 subterminal article distal neck-like constriction short, not obvious in *I. datii*; cf. Dang et al., 2024: fig. 2G); and the G1 terminal article relatively more slender and longer, tapers uniformly throughout (Fig. 21C, D) (versus G1 terminal article relatively broader, shorter, margins appearing to be subparallel in proximal half before tapering abruptly, appearing like a cleft on the outer margin, tapering gently thereafter in *I. datii*; cf. Dang et al., 2024: fig. 2G).

Distribution. *Indochinamon erythreum,* new species, is currently only known from its type locality, within Xuân Sơn National Park, Tân Sơn District, Phú Thọ province, in northern Vietnam.

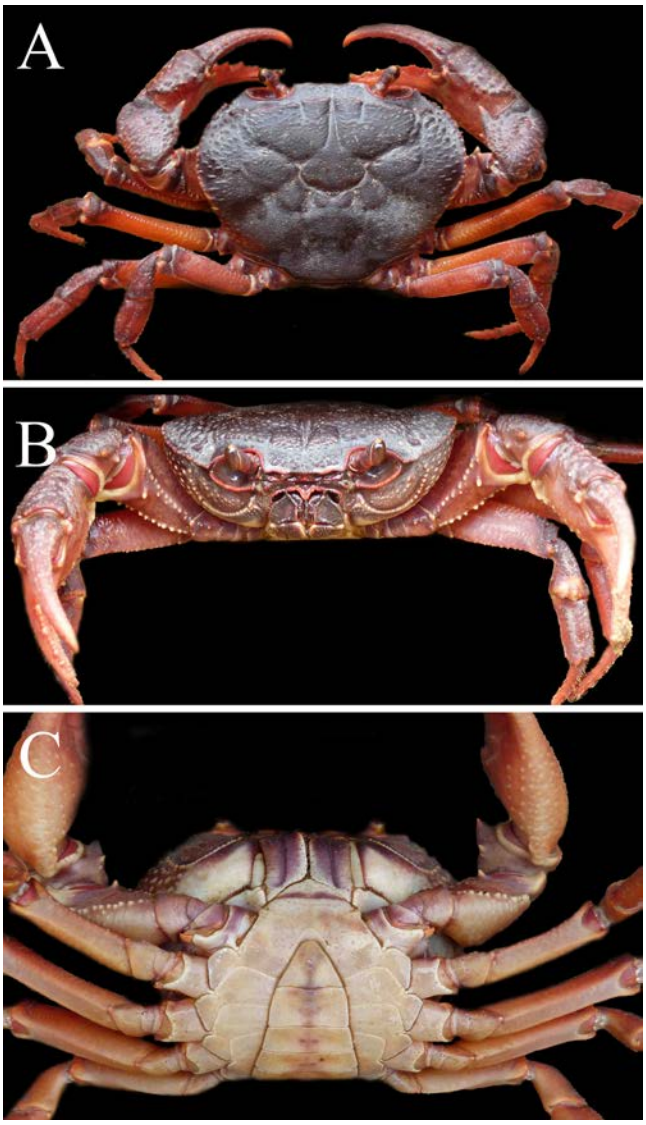

Fig. 22. *Indochinamon erythreum*, new species, live colouration, holotype, male (64.3 × 48.2 mm) (ZRC 2023.0609). A, dorsal view; B, frontal view; C, ventral view.

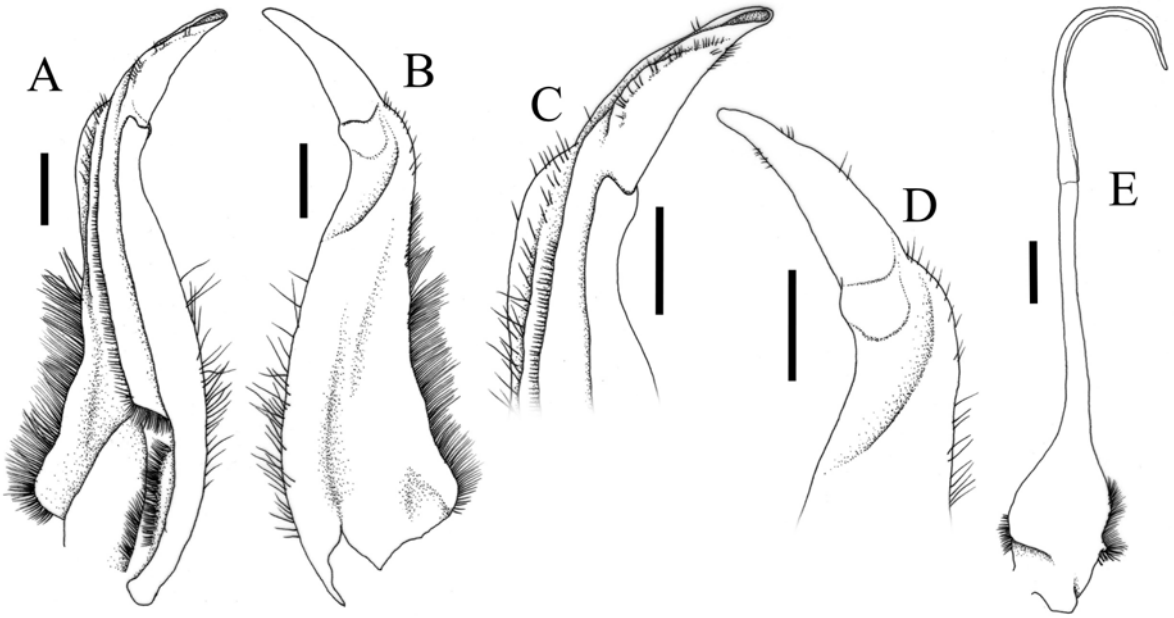

Fig. 23. *Indochinamon datii*, Dang, Do & Pham, 2024, male (81.0 × 59.3 mm) (ZRC 2023.0622). A, left G1 (ventral view); B, left G1 (dorsal view); C, distal part of left G1 (ventral view); D, distal part of left G1 (dorsal view); E, left G2. Scale bar = 2 mm.

***Indochinamon falx*, new species**
(Figs. 24–26, 32A–D)

Material examined. Holotype: male (64.0 × 50.0 mm) (ZRC 2023.0610), purchased from local villagers, Phù Lưu Commune, Hàm Yên district, Tuyên Quang province, northern Vietnam, coll. V.T. Ngo, 15 May 2022.

Diagnosis. Carapace (Fig. 24A, B) transversely subquadrate, slightly wider than long, CW/CL ratio 1.28; dorsal surface

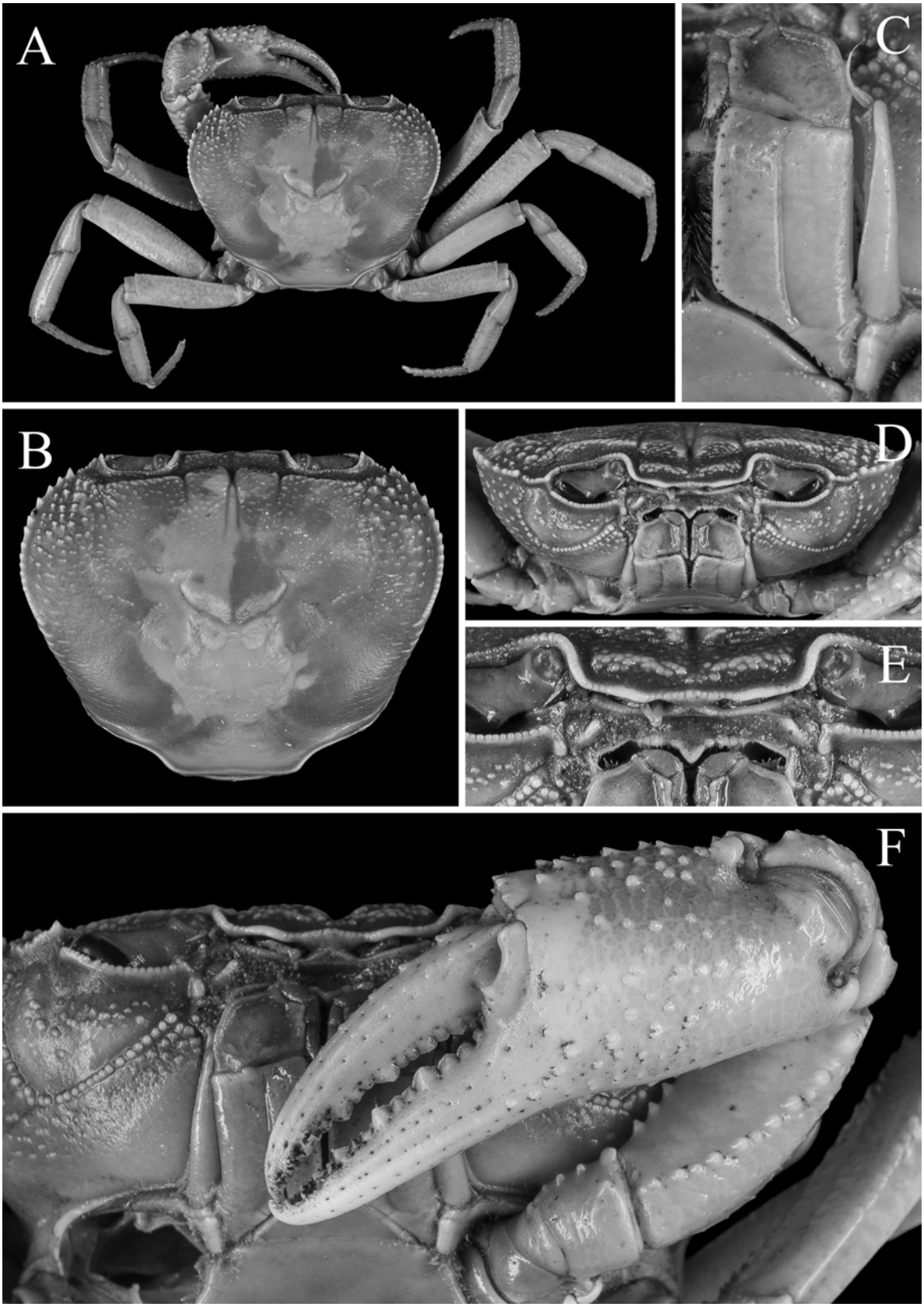

Fig. 24. *Indochinamon falx*, new species, holotype, male (64.0 × 50.0 mm) (ZRC 2023.0610). A, dorsal view; B, carapace dorsal view; C, left third maxilliped; D, carapace frontal view; E, antennae, antennules and epistome; F, left cheliped (right cheliped missing).

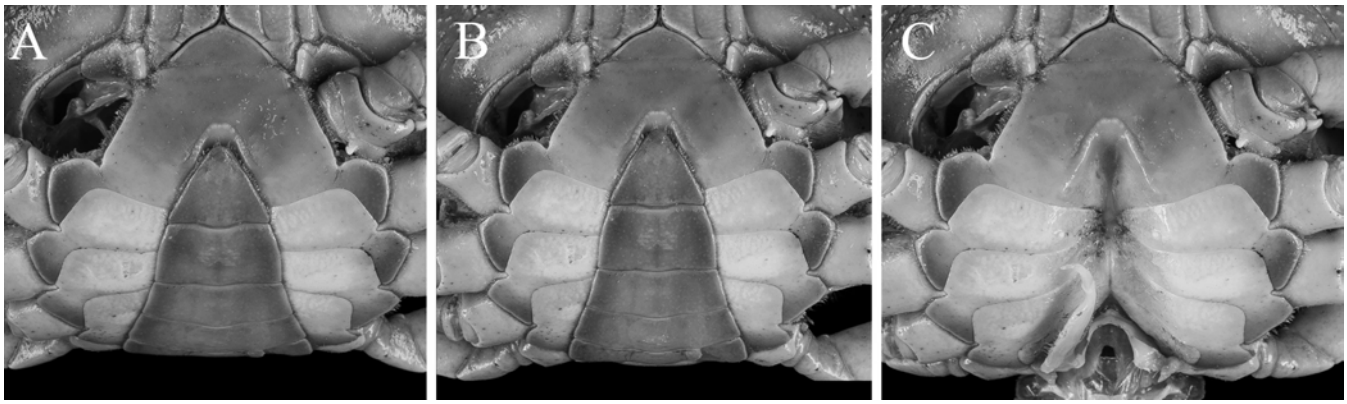

Fig. 25. *Indochinamon falx*, new species, holotype, male (64.0 × 50.0 mm) (ZRC 2023.0610). A, anterior half of thoracic sternum and telson; B, posterior half of thoracic sternum and pleon; C, sternopleonal cavity.

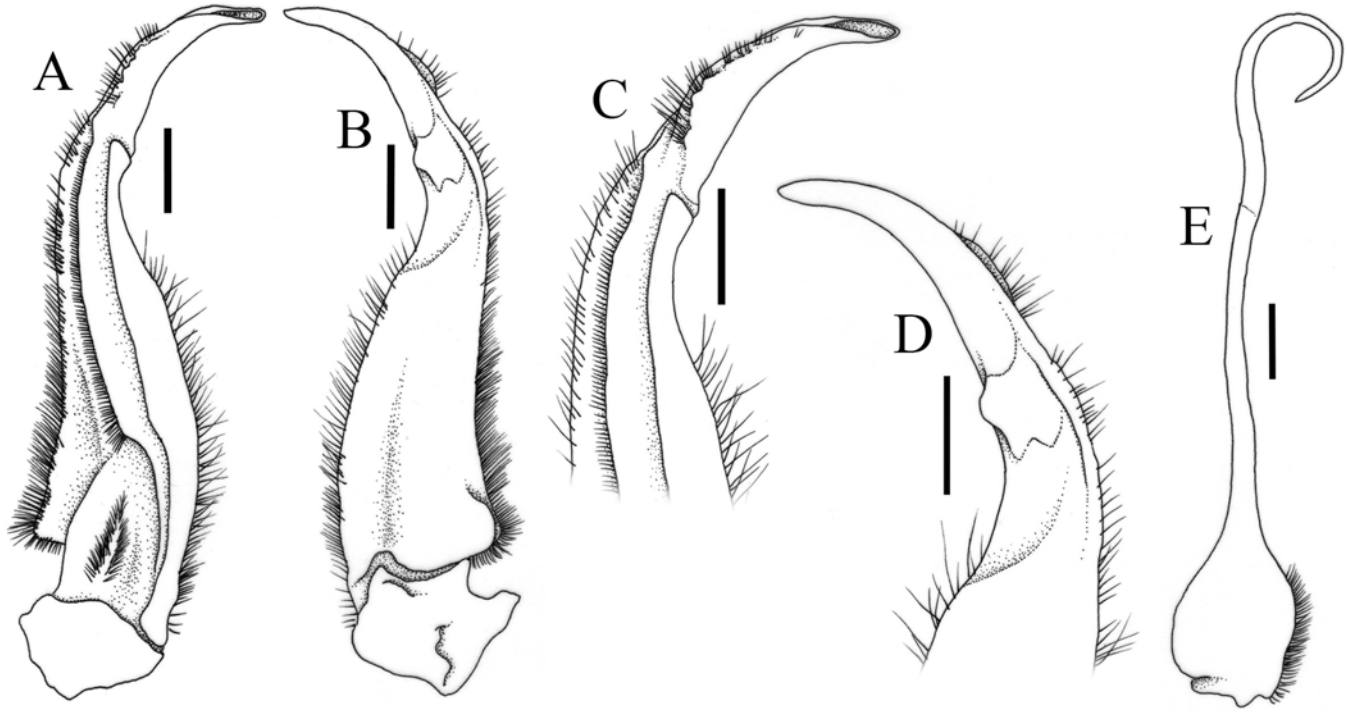

Fig. 26. *Indochinamon falx*, new species, holotype, male (64.0 × 50.0 mm) (ZRC 2023.0610). A, left G1 (ventral view); B, left G1 (dorsal view); C, distal part of left G1 (ventral view); D, distal part of left G1 (dorsal view); E, left G2. Scale bar = 2 mm.

convex, branchial regions granulose and regions behind postorbital cristae rugose; epigastric and postorbital crista pronounced, rugose; postorbital cristae very gently sloping posterolaterally; epibranchial tooth relatively well-developed appearing as a sharp tooth/protuberance, separated from external orbital tooth by shallow V-shaped cleft; external orbital tooth large, broad, lateral margin weakly concave, serrated, longer than mesial margin; anterolateral margins cristate, lined with sharp granules, appearing serrated; posterolateral margin strongly converges towards posterior carapace margin. Frontal region (Fig. 24D) rugose, with well-developed post frontal rugosity, with convex margin when viewed frontally; epistomal median lobe (Fig. 24E) well-developed, broadly triangular; suborbital and pterygostomial region weakly granulose, subhepatic region rugose. Third maxilliped (Fig. 24C) exopod with relatively short flagellum, reaches half-width of merus. Ambulatory legs and dactylus (Fig. 24A) distinctly elongate, third walking leg length ca. 1.38 times CW, merus margins gently serrated. Male thoracic sternum with s3/4 (Fig. 25A) not discernible; male pleon (Fig. 25B) narrowly triangular; telson broadly triangular, lateral margins straight. G1 (Fig. 26A–D) relatively slender, sinuous; basal part of subterminal article tapering gently distally; distal part of lateral margin of subterminal article with shallow cleft; terminal article long, very slender, 0.46 times length of subterminal article, bent outwards, ca. 40°, but strongly curving downwards, tip perpendicular to vertical axis, gently tapering throughout to a blunt tip, with a barely discernable dorsal fold visible in dorsal view.

Etymology. The name is derived from the Latin ‘falx’ meaning sickle, alluding to the unique and distinctive sickle shaped G1 terminal article. Name used as noun in apposition.

Live colouration. In life, the dorsal surfaces of the carapace are greyish blue; ambulatory legs and chelipeds with coxa, merus, and carpus purple. The ventral surfaces are largely pale off-white. The surface of the chela is purplish-brown,

and the finger tips are white. The ocular peduncle, orbits, regions around the epistome, and merus of the third maxilliped are purple (Ngo V. T. pers. obs.).

Remarks. *Indochinamon falx*, new species, has several unusual morphological traits that sets it apart from its congeners. In particular, *I. falx*, new species, possesses relatively elongated ambulatory legs and is most similar to *I. chuahuong* Do, Nguyen & Le, 2016, and to a lesser extent, *I. granulatum*, new species. The similarities and differences with the latter species have been elaborated in the remarks for the latter new species (see earlier). *Indochinamon falx*, new species, is differentiated from *I. chuahuong* by overall external carapace and G1 differences; carapace less transverse, more subquadrate, carapace width to length ratio 1.28 (Fig. 24A) (versus carapace distinctly more transverse, appearing subovate, carapace width to length ratio 1.36–1.40 in *I. chuahuong*; cf. Do et al., 2016: fig. 2A, B); carapace dorsal surface appearing more convex when viewed frontally (Fig. 24D) (versus carapace dorsal surface flat or appears weakly concave due to weakly inflated branchial regions when viewed frontally in *I. chuahuong*; cf. Do et al., 2016: fig. 2C); external orbital tooth lateral margins lined with small, rounded granules (Fig. 24B) (versus external orbital tooth lateral margins with pronounced sharp protuberances, appearing serrated in *I. chuahuong*; cf. Do et al., 2016: fig. 2B); male thoracic sternites 3 and 4 completely fused, with no trace of s3/4 (Fig. 25A) (versus male thoracic sternites 3 and 4 completely fused but with prominent depression at lateral edges demarcating s3/4 in *I. chuahuong*; cf. Do et al., 2016: fig. 3A); and the G1 terminal article more slender, elongated, width to length ratio 0.19, more strongly curving and bent outwards, tip almost perpendicular to vertical axis (Fig. 26C, D) (versus G1 terminal article broader, stouter, width to length ratio 0.32, less strongly curving and bent outwards, tip projected about 40° from vertical axis in *I. chuahuong*; cf. Do et al., 2016: fig. 4A).

In terms of G1 morphology, *I. falx*, new species, also resembles *I. hamyenense*, new species. Both species have a very slender G1 terminal article that curves outwards, making it unique from its congeners which possesses a G1 terminal article that is typically broader in appearance. Nonetheless, the two new species are easily distinguished morphologically (see remarks for *I. hamyenense*, new species, below).

Distribution. *Indochinamon falx*, new species, is currently known only from its type locality in Hàm Yên district, Tuyên Quang province, in northern Vietnam.

Indochinamon hamyenense, new species
(Figs. 27–31, 32E–H)

Material examined. Holotype: male (71.7 × 55.8 mm) (ZRC 2023.0611), limestone stream, Phù Lưu Commune, Hàm Yên district, Tuyên Quang province, northern Vietnam, 22°10′N, 105°04′E, elevation 300 m asl, coll. V.T. Ngo, 15 May 2022. Paratype: 1 female (65.6 × 50.9 mm) (ZRC 2023.0612), same data as holotype.

Diagnosis. Carapace (Figs. 27A, B, 30A) transversely subovate, slightly wider than long, CW/CL ratio 1.28–1.29; dorsal surface relatively flat, branchial and regions behind postorbital cristae strongly granulose; epigastric and postorbital crista pronounced, strongly rugose; postorbital cristae gently sloping posterolaterally; epibranchial tooth appearing as sharp granule, separated from external orbital tooth by shallow V-shaped cleft; external orbital tooth large, broad, lateral margin weakly concave, serrated, longer than mesial margin; anterolateral margins cristate, lined with sharp granules, appearing serrated; posterolateral margin strongly converges towards subparallel 'waist-like' posterior carapace margin. Frontal region (Fig. 27D) rugose, with well-developed post frontal rugosity, with convex margin when viewed frontally; epistomal median lobe (Fig. 27E) well-developed, broadly triangular; suborbital, subhepatic and pterygostomial region strongly granulose. Third maxilliped (Fig. 27C) exopod with well-developed flagellum, almost reaches width of merus. Ambulatory legs and dactylus (Fig. 27A) not elongate, stout, third walking leg length ca. 1.01 times CW, merus margins serrated. Male thoracic sternum with s3/4 (Fig. 28A) discernible, complete; male pleon (Fig. 28B) narrowly triangular; telson broadly triangular, lateral margins weakly convex. G1 (Fig. 29A–D) relatively stout, sinuous; basal part of subterminal article broad, tapering gently distally; distal part of lateral margin of subterminal article tapers strongly with distinct cleft; terminal article long, very slender, 0.45 times length of subterminal article, gently curving downwards, bent outwards, ca. 45°, gently tapering throughout to a blunt tip, with a barely discernable dorsal fold visible in dorsal view. Vulva (Fig. 30C) large, occupying slightly more than half of sternite 6, appearing recessed, impinges strongly on sternite 5, directed anterio-mesially, with very low concave vulvar cover on outer margin.

Etymology. This new species name is named after the province of its type locality, Hàm Yên district in Tuyên Quang province, northern Vietnam. Name used as noun in apposition.

Live colouration. In life, the dorsal surfaces of the carapace are pale with slight tinge of steel blue; ambulatory legs and chelipeds with coxa, merus, carpus purplish brown. The ventral surfaces largely pale off-white. Chela surfaces largely yellow, with finger tips white. The ocular peduncle, orbits, regions around the epistome and merus of third maxillipeds are purple (Fig. 31).

Remarks. *Indochinamon hamyenense*, new species, superficially resembles *I. kimboiense* (Dang, 1975), with regards to its external morphology. Both species possess a carapace that is very transverse, particularly around the branchial region and anterolateral margin, before converging posteriorly with a waist-like lateral carapace margin (Fig. 27B; cf. Naruse, Nguyen & Yeo, 2011: fig. 1A). Furthermore, the carapace of both species also possesses a very dense concentration of large granules and rugosities, particularly around the branchial region, and areas behind the postorbital and epigastric cristae (Fig. 27B; cf. Naruse, Nguyen & Yeo, 2011: fig. 1A). *Indochinamon hamyenense*,

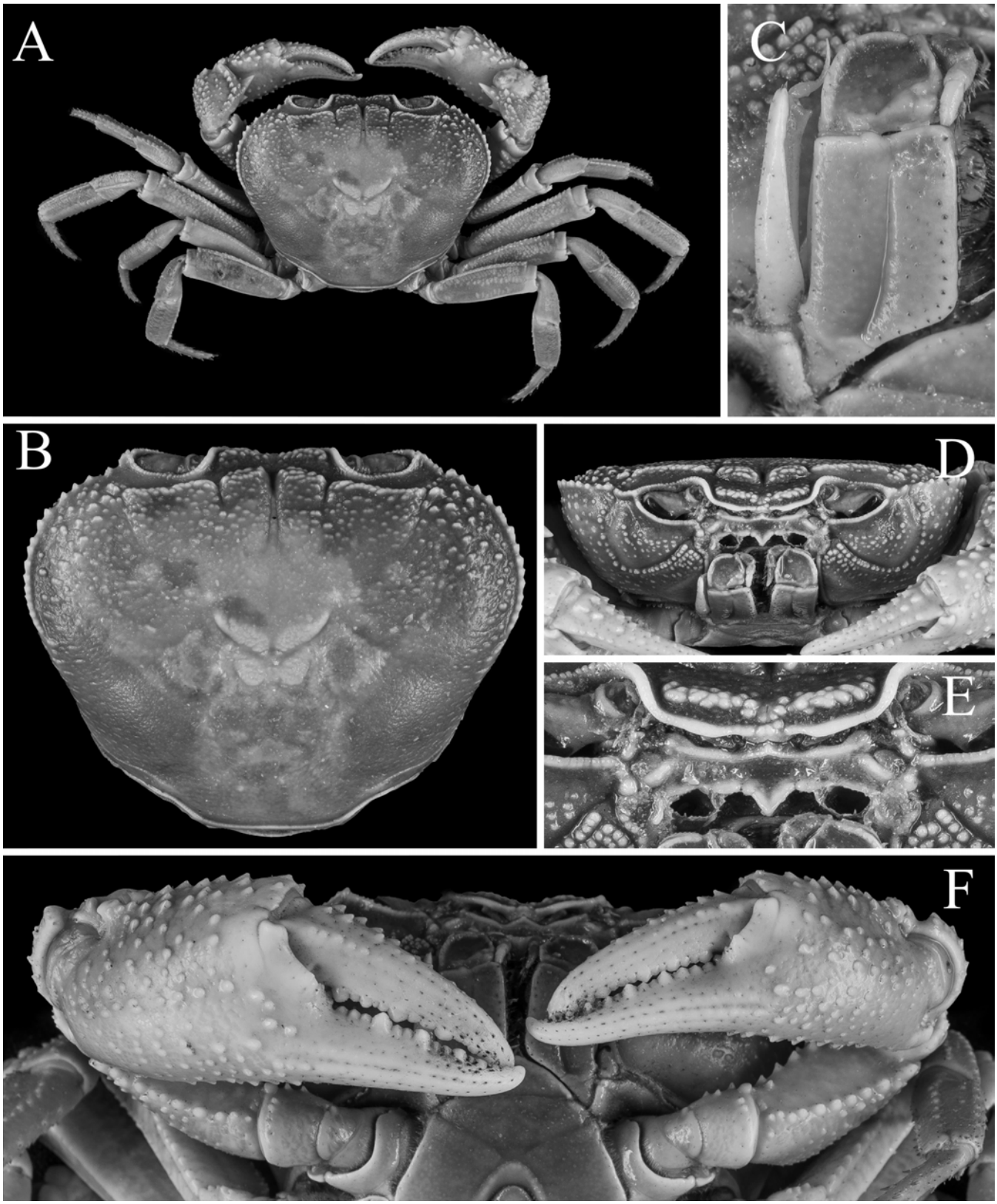

Fig. 27. *Indochinamon hamyenense*, new species, holotype, male (71.7 × 55.8 mm) (ZRC 2023.0611). A, dorsal view; B, carapace dorsal view; C, right third maxilliped; D, carapace frontal view; E, antennae, antennules and epistome; F, chelipeds.

new species, however, differs from *I. kimboiense* in the following characters: suborbital margins concave when viewed frontally (Fig. 27D) (versus suborbital margins very weakly concave, appearing more sinuous and straight in *I. kimboiense*; cf. Naruse et al., 2011: fig. 2A); s3/4 groove distinct (Fig. 28B) (versus s3/4 indiscernible or very faint depression demarcating suture in *I. kimboiense*; cf. Naruse et al., 2011: fig. 1B); male pleon telson, broadly triangular, with gently convex lateral margins (Fig. 28B) (versus male pleon telson narrowly triangular, with distinctly concave lateral margins in *I. kimboiense*; cf. Naruse et al., 2011: fig. 1B); G1 subterminal article with a longer distal neck-like

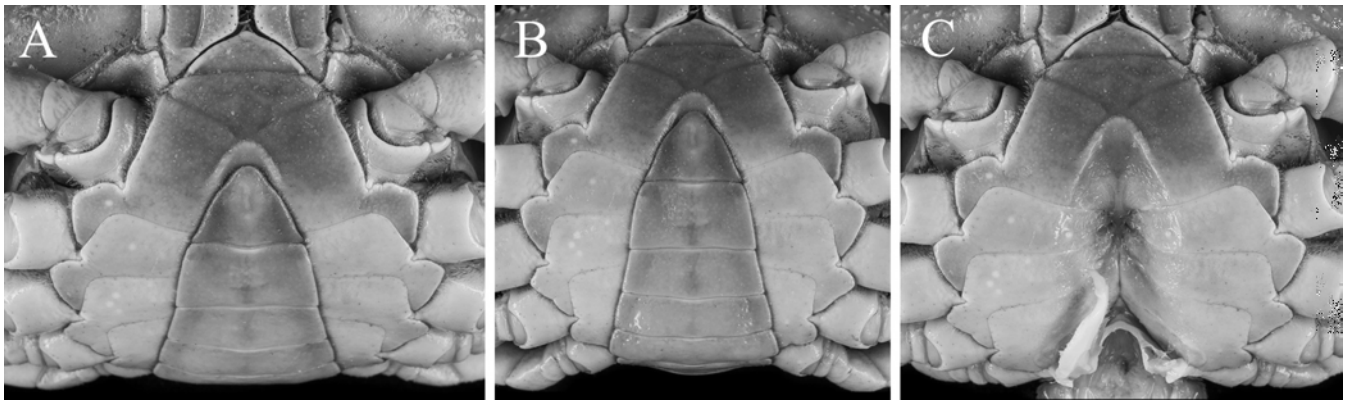

Fig. 28. *Indochinamon hamyenense*, new species, holotype, male (71.7 × 55.8 mm) (ZRC 2023.0611). A, anterior half of thoracic sternum and telson; B, posterior half of thoracic sternum and pleon; C, sternopleonal cavity.

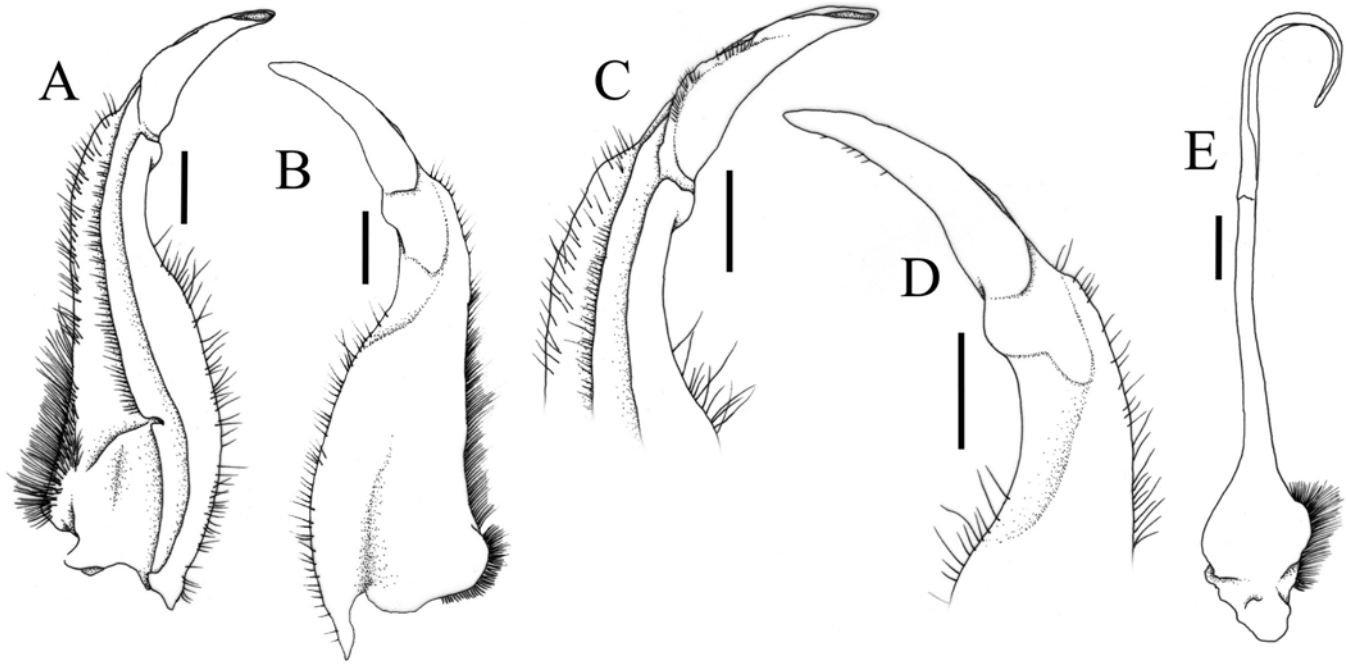

Fig. 29. *Indochinamon hamyenense*, new species, holotype, male (71.7 × 55.8 mm) (ZRC 2023.0611). A, left G1 (ventral view); B, left G1 (dorsal view); C, distal part of left G1 (ventral view); D, distal part of left G1 (dorsal view); E, left G2. Scale bar = 2 mm.

portion (Fig. 29A, B) (versus G1 subterminal article distal neck-like portion short and stout in *I. kimboiense*; cf. Naruse et al., 2011: fig. 3B); and the G1 terminal article distinctly curving and bent outwards, ca. 60° from vertical axis, with low and short dorsal flap that is only visible at proximal part (Fig. 29C, D) (versus G1 terminal article relatively straight, more gently bent outwards, ca. 40° from vertical axis, with low and long dorsal flap, that is visible and extends for almost the entire dorsal margin in *I. kimboiense*; cf. Naruse et al., 2011: fig. 3B).

The holotype and paratype of *I. hamyenense*, new species, were also collected close to the holotype of another new species, *I. falx*. The two species also share some similarities in their G1 morphology, mentioned in the earlier remarks for *I. falx*, new species. Nonetheless, the specimens of the two species possess a suite of differences that cannot be explained other than in treating them as separate taxa. *Indochinamon hamyenense*, new species, differs from *I. falx*, new species, by the following suite of differences: carapace dorsal surface appears flat when viewed frontally (Fig. 27D) (versus carapace dorsal surface appears convex when viewed frontally in *I. falx*, new species; Fig. 24D); carapace posterolateral margin converges less strongly with subparallel margins, with a 'waist-like' appearance (Fig. 27B) (versus carapace posterolateral margin converges more strongly towards carapace posterior, without a distinct 'waist-like' appearance in *I. falx*, new species; Fig. 24B); ambulatory legs short, stout, third walking leg length ca. 1.01 times of CW (Fig. 27A) (versus ambulatory legs distinctly elongated, slender, third walking leg length ca. 1.38 times of CW in *I. falx*, new species; Fig. 24A); s3/4 complete (Fig. 28A) (versus s3/4 indistinct in *I. falx*, new species; Fig. 25A); G1 subterminal article relatively broader (Figs. 29A, B, 32F) (versus G1 subterminal article slender in *I. falx*, new species; Figs. 26A, B, 32B); and the G1 terminal article broader, width ca. 0.27 times length, more strongly bent outwards basally, ca. 45° from vertical axis, but less

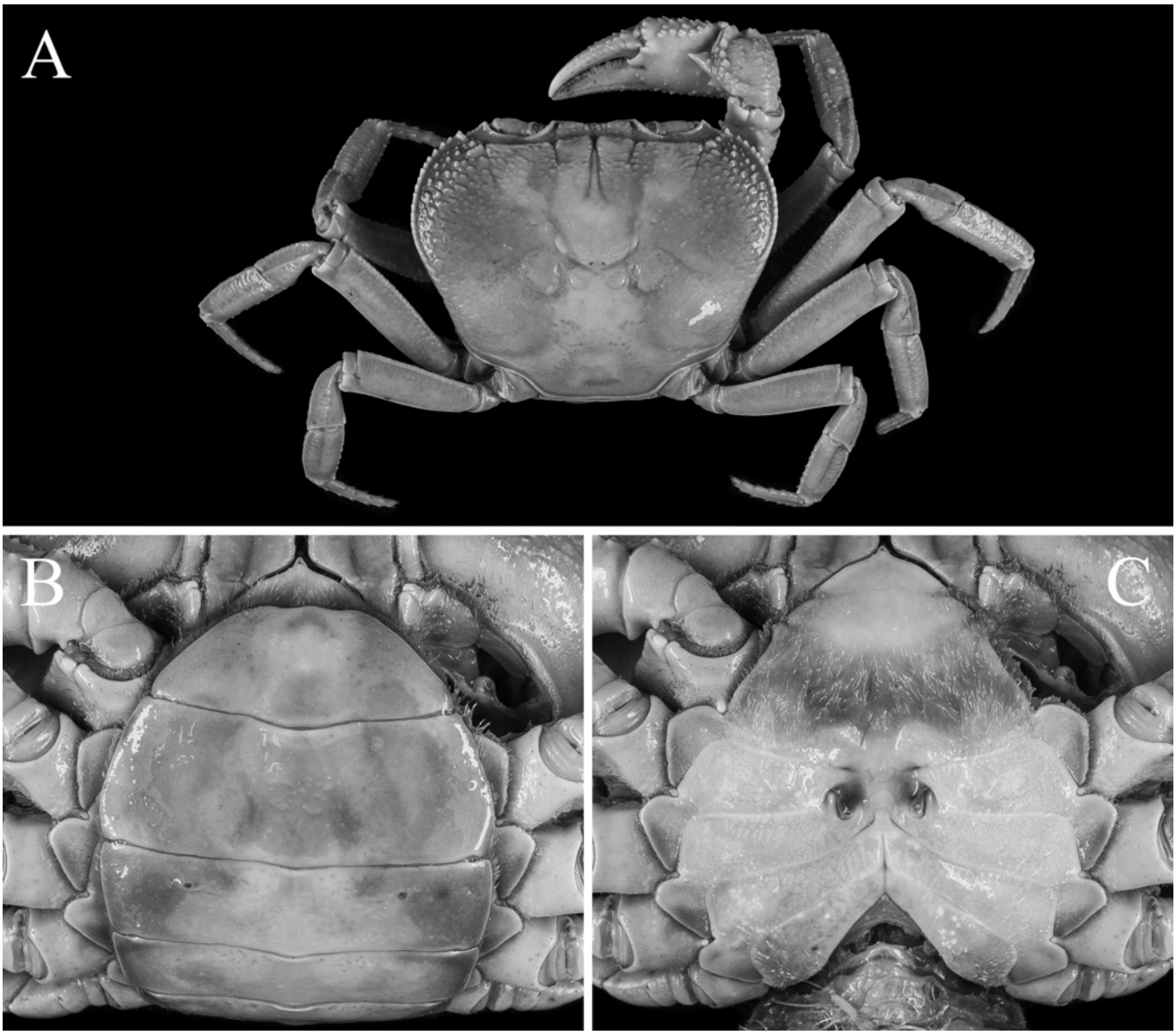

Fig. 30. *Indochinamon hamyenense*, new species, paratype, female (65.6 × 50.9 mm) (ZRC 2023.0612). A, dorsal view; B, pleon; C, sternopleonal cavity and vulvae.

strongly curving downwards, with the tip terminating ca. 70° from vertical axis (Figs. 29D, 32H) (versus G1 terminal article much more slender, width ca. 0.19 times length, less strongly bent outwards basally, ca. 40° from vertical axis, but strongly curving downwards, with tip terminating perpendicular to vertical axis in *I. falx*, new species; Figs. 26D, 32D).

Distribution. *Indochinamon hamyenense*, new species, is currently only known from its type locality in Hàm Yên district, Tuyên Quang province, in northern Vietnam.

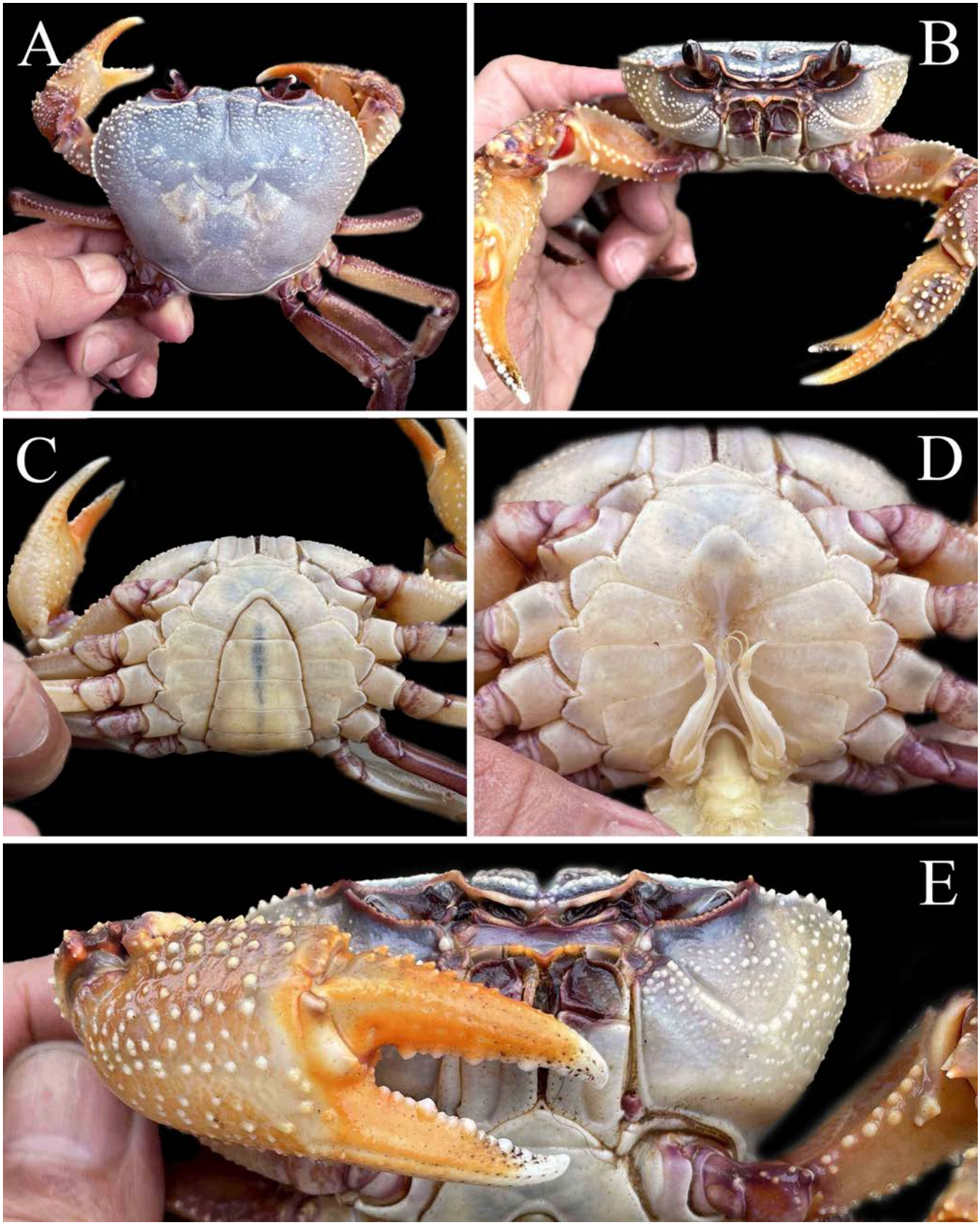

Fig. 31. *Indochinamon hamyenense*, new species, live colouration, holotype, male (71.7 × 55.8 mm) (ZRC 2023.0611). A, dorsal view; B, frontal view; C, ventral view; D, thoracic sternites and sternopleonal cavity; E, right cheliped.

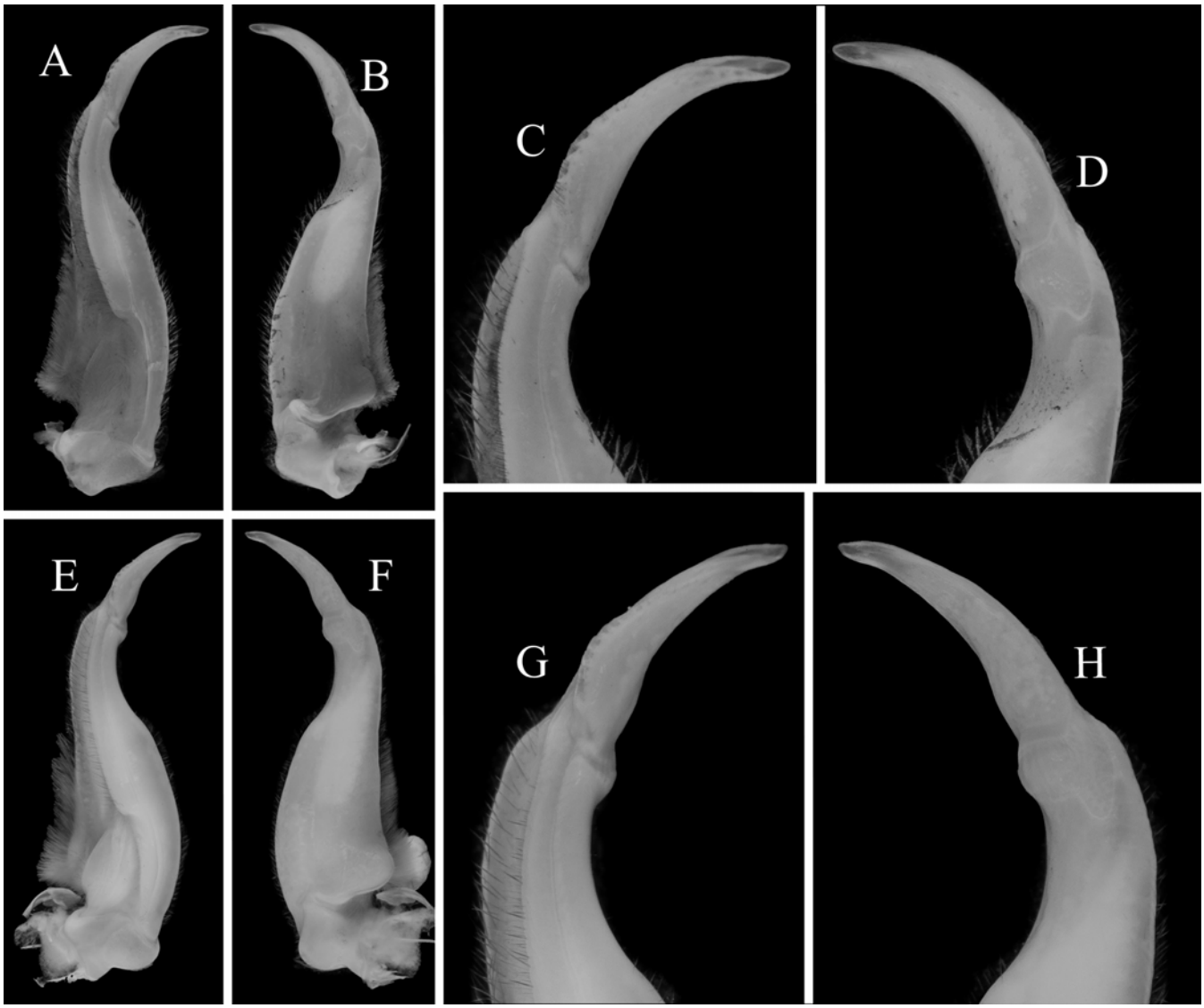

Fig. 32. Left G1. A–D, *Indochinamon falx*, new species, holotype, male (64.0 × 50.0 mm) (ZRC 2023.0610); E–H, *Indochinamon hamyenense*, new species, holotype, male (71.7 × 55.8 mm) (ZRC 2023.0612). A, E, left G1 (ventral view); B, F, left G1 (dorsal view); C, G, distal part of left G1 (ventral view); D, H, distal part of left G1 (dorsal view).

***Indochinamon lacertosum*, new species**
(Figs. 33–36)

Material examined. Holotype: male (77.2 × 60.5 mm) (ZRC 2023.0613), beneath limestone boulder, An Toàn Khu area, Phú Đình Commune, Định Hóa distinct, Thái Nguyên province, northern Vietnam, 21°45N, 105°31E, elevation 500 m asl, coll. V. T. Ngo, 26 June 2022.

Diagnosis. Carapace (Fig. 33A, B) transversely subovate, wider than long, CW/CL ratio 1.28; dorsal surface almost flat, branchial regions and regions behind postorbital, epigastric cristae strongly rugose and granulose; epigastric and postorbital crista pronounced, rugose; postorbital cristae gently sloping posterolaterally; epibranchial tooth relatively well-developed appearing as a pronounced, sharp tooth, separated from external orbital tooth by broad V-shaped cleft; external orbital tooth large, broad, lateral margin straight, serrated, slightly longer than mesial margin; anterolateral margins cristate, prominently lined with sharp granules, appearing serrated; posterolateral margin strongly converges towards posterior carapace margin. Suborbital margins almost straight when viewed frontally (Fig. 33D); frontal region rugose, with well-developed post frontal rugosity, with sinuous margin when viewed frontally; epistomal median lobe (Fig. 33E) well-developed, broadly triangular; suborbital and pterygostomial region granulose, subhepatic region rugose. Third maxilliped (Fig. 33C) exopod with relatively short flagellum, reaches half-width of merus. Ambulatory legs and dactylus (Fig. 33A) robust, stout, third walking leg length 1.13 times CW, merus margins gently serrated. Male thoracic sternum with s3/4 (Fig. 34A) prominent, complete; male pleon (Fig. 34B) narrowly triangular; somite 6 lateral margin convex; telson broadly triangular, lateral margins straight. G1 (Fig. 35A–D) relatively broad, stout, sinuous; basal part of subterminal article very broad, margins subparallel, appearing subrectangular, before tapering abruptly in a step-like cleft, appearing thereafter as a broad, long, neck-like section; terminal article long and broad, 0.43 times length of subterminal article, bent outwards, ca. 40°, gently curving

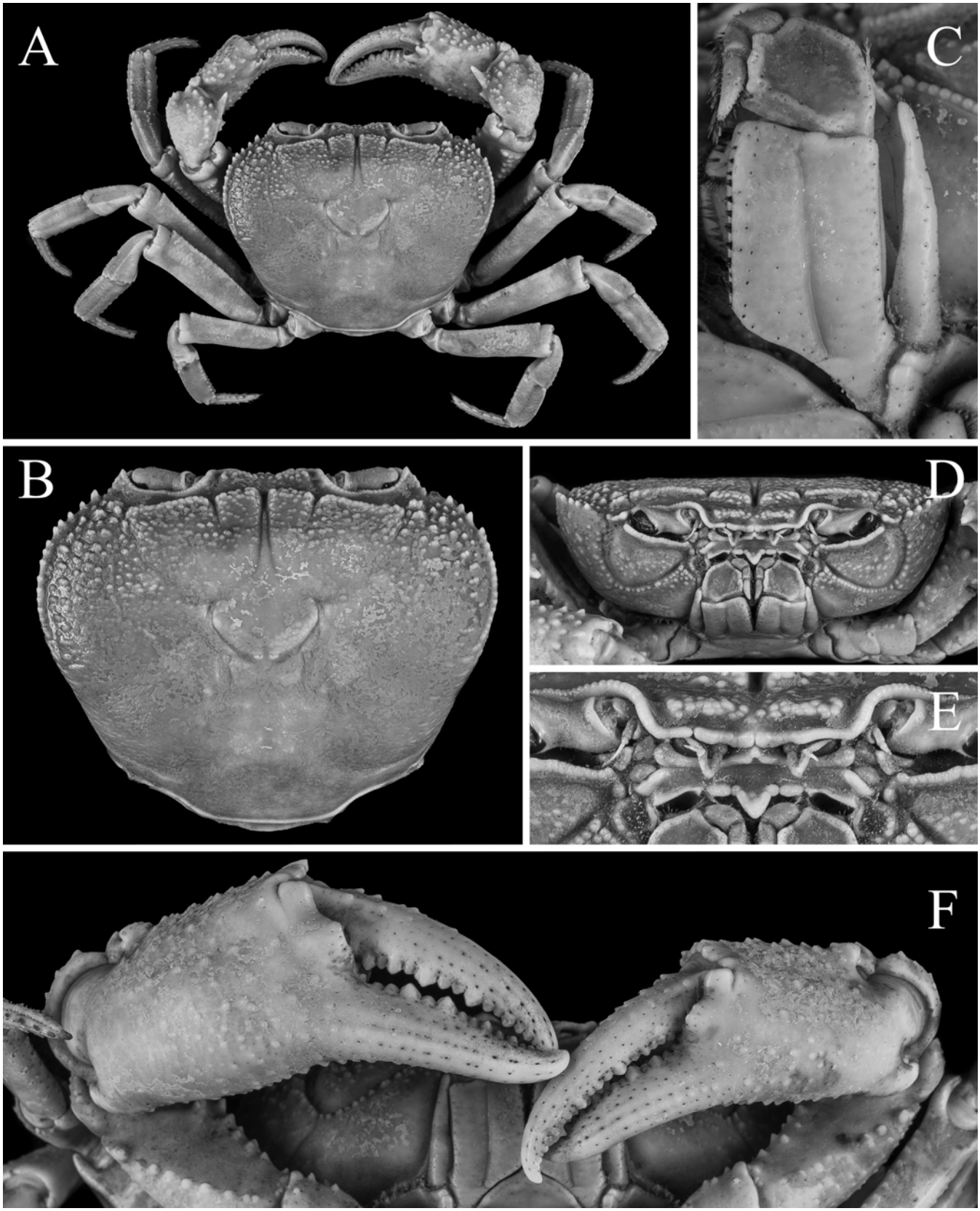

Fig. 33. *Indochinamon lacertosum*, new species, holotype, male (77.2 × 60.5 mm) (ZRC 2023.0613). A, dorsal view; B, carapace dorsal view; C, right third maxilliped; D, carapace frontal view; E, antennae, antennules and epistome; F, chelipeds.

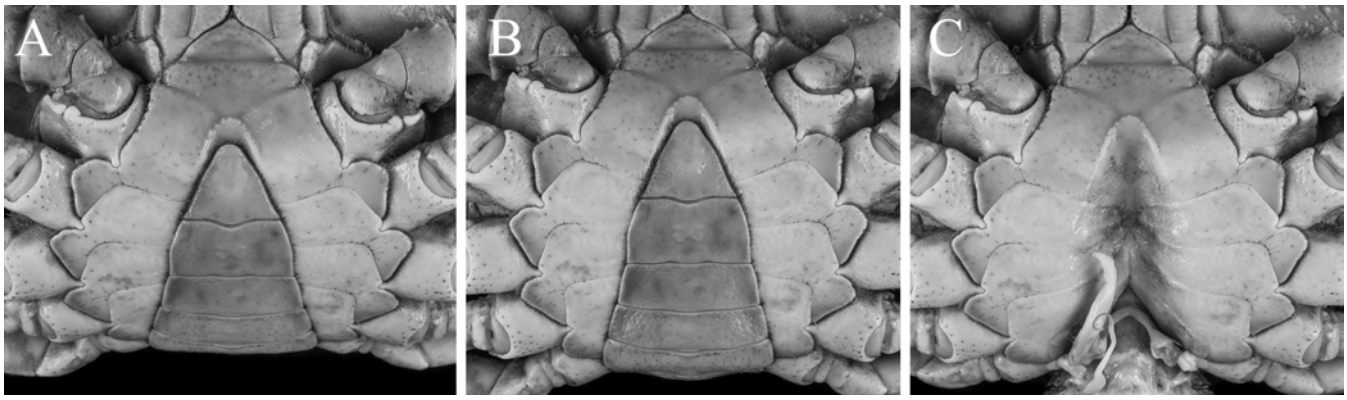

Fig. 34. *Indochinamon lacertosum*, new species, holotype, male (77.2 × 60.5 mm) (ZRC 2023.0613). A, anterior half of thoracic sternum and telson; B, posterior half of thoracic sternum and pleon; C, sternopleonal cavity.

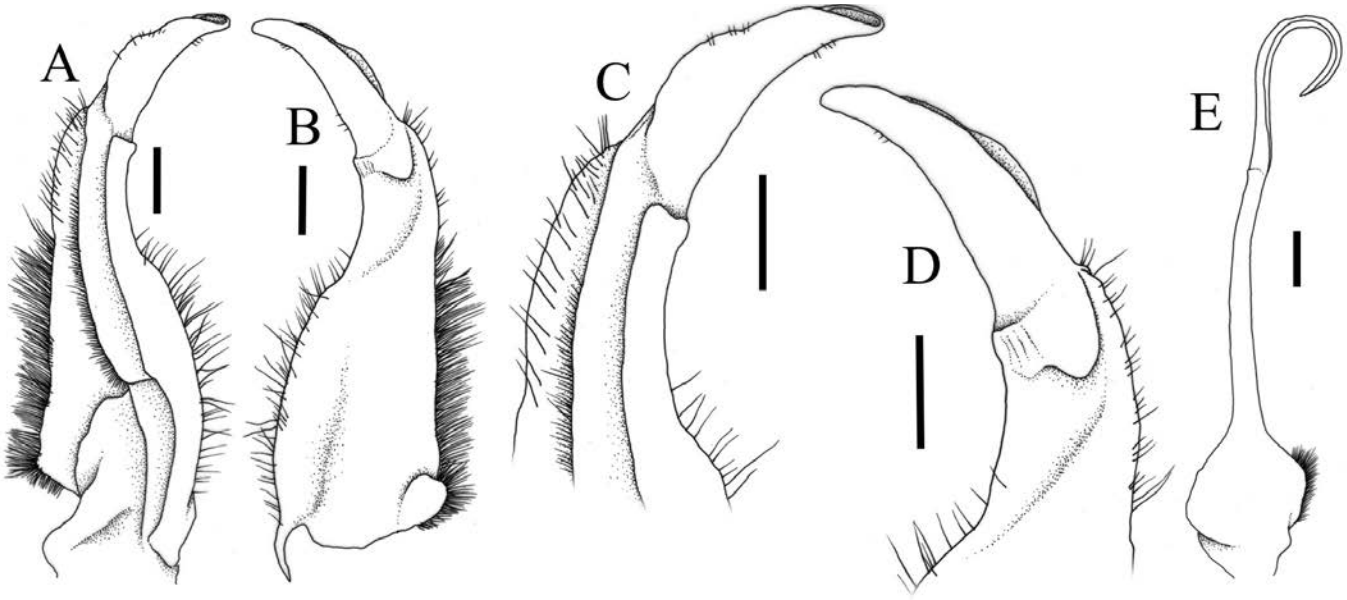

Fig. 35. *Indochinamon lacertosum*, new species, holotype, male (77.2 × 60.5 mm) (ZRC 2023.0613). A, left G1 (ventral view); B, left G1 (dorsal view); C, distal part of left G1 (ventral view); D, distal part of left G1 (dorsal view); E, left G2. Scale bar = 2 mm.

throughout, gently tapering throughout to a broad blunt tip, with a dorsal fold visible in dorsal view from proximal ¼ to distal ¾ part of terminal article.

Etymology. The new species named is derived directly from the Latin word 'lacertosus', meaning robust, for the large robust appearance of the overall G1.

Live colouration. In life, the dorsal surfaces of the carapace, ambulatory legs and chelipeds are light yellow. The ventral surfaces largely white (Fig. 36).

Remarks. *Indochinamon lacertosum*, new species, possesses a suborbital margin that is almost straight and a very distinctive male gonopod that sets it apart from most congeners: it has a G1 with a subterminal article that is distinctively subrectangular basally, before tapering sharply as a cleft, with a relatively long but broad neck-like distal part (Fig. 35B). This character allies it most closely with *I. hamyenense*, new species. Most other *Indochinamon* species typically possess a G1 subterminal article with either no clear 'neck-like' distal part, or appear much shorter in comparison (cf. Naruse et al., 2011: figs. 3B, E, 9B, E; Naruse et al., 2018: figs. 4C, 9C, 13C, 17C; Ng & Win Mar, 2018: fig. 4B; Ng & Ngo, 2023: fig. 10B, G). Other *Indochinamon* species with this character, albeit less prominently, include the two new species, *I. thienkense* and *I. angustum*. Differences between *I. lacertosum*, new species, and these two new species will be elaborated in the remarks of the latter two species (see later).

With regards to *I. hamyenense*, new species, *I. lacertosum*, new species, can be easily distinguished in that the carapace posterolateral margins converge uniformly and strongly, without a 'waist-like' margin (Fig. 33A) (versus carapace posterolateral margin with 'waist-like' margin, due to more transverse branchial region in *I. hamyenense*, new species; Fig. 27A); suborbital margin almost straight when viewed frontally (Fig. 33D) (versus suborbital margin distinctly concave in *I. hamyenense*, new species; Fig. 27D); frontal margin sinuous when viewed frontally (Fig. 33E) (versus frontal margin distinctly concave in *I. hamyenense*, new species; Fig. 27E); external orbital tooth more well produced, appearing more acute (Fig. 33B) (versus external orbital tooth

Fig. 36. *Indochinamon lacertosum*, new species, live colouration. Holotype, male (77.2 × 60.5 mm) (ZRC 2023.0613). A, dorsal view; B, frontal view; C, ventral view.

less well produced, appearing more obtuse in *I. hamyenense*, new species; Fig. 27B); male pleonal somite 6 lateral margin distinctly convex (Fig. 34B) (versus somite 6 lateral margin almost straight or very weakly convex in *I. hamyenense*, new species; Fig. 28B); G1 subterminal article basal part subrectangular, margins subparallel, before cleft-like strong tapering (Fig. 35B) (versus G1 subterminal article basal part more trapezoidal, margins gently tapering distally, abrupt distal taper less pronounced appearing more as a rounded cleft in *I. hamyenense*, new species; Fig. 29B); and the G1 terminal article appears more robust and stout, with a more well produced dorsal flap that extends from proximal ¼ to distal ¾ part (Fig. 35D) (versus G1 terminal article comparatively more slender, with a weakly produced dorsal flap, extending only from proximal origin to proximal ⅓ part in *I. hamyenense*, new species; Fig. 29D).

Distribution. *Indochinamon lacertosum*, new species, is known only from its type locality in Định Hóa distinct, Thái Nguyên province, in northern Vietnam.

Indochinamon thienkense, new species
(Figs. 37–41)

Material examined. Holotype: male (64.3 × 49.9 mm) (ZRC 2023.0614) limestone stream, Tam Đảo National Park, Thiện Kế commune, Sơn Dương district, Tuyên Quang province northern Vietnam, 400 m asl, coll. V.T. Ngo, 12 May 2022. Paratypes: 1 male (64.4 × 50.5 mm) (ZVNU), 1 female (55.7 × 43.8 mm) (ZRC 2023.0615), same data as holotype.

Diagnosis. Carapace (Figs. 37A, B, 40A) transversely subovate, wider than long, CW/CL ratio 1.27–1.29; dorsal surface almost flat, branchial regions and regions behind postorbital, epigastric cristae granulose; epigastric and postorbital crista pronounced, rugose; postorbital cristae gently sloping posterolaterally; epibranchial tooth relatively well-developed appearing as a pronounced, broad tooth, separated from external orbital tooth by narrow V-shaped cleft; external orbital tooth large, broad, lateral margin straight, serrated, equal in length to mesial margin; anterolateral margins cristate, prominently lined with sharp granules, appearing serrated; posterolateral margin strongly converges towards posterior carapace margin. Suborbital margins concave when viewed frontally (Fig. 37D); frontal region rugose, with well-developed post frontal rugosity, margin almost straight when viewed frontally; epistomal median lobe (Fig. 37E) well-developed, triangular; suborbital, subhepatic and pterygostomial region granulose. Third maxilliped (Fig. 37C) exopod with relatively short flagellum, reaches half-width of merus. Ambulatory legs and dactylus (Fig. 37A) not prominently elongated, third walking leg length ca. 1.09 times CW, merus margins gently serrated. Male thoracic sternum with s3/4 (Fig. 38A) indiscernible except for very weak grooves at lateral edges; male pleon (Fig. 38B) narrowly triangular; somite 6 lateral margin very weakly convex; telson broadly triangular, lateral margins straight. G1 (Fig. 39A–D) relatively broad, stout, sinuous; basal part of subterminal article very broad, tapering distally, appearing trapezoidal, before more abrupt taper in a cleft, appearing thereafter as a broad, neck-like section; terminal article long and broad, 0.45 times length of subterminal article, bent outwards, ca. 45°, curving downwards, tip almost perpendicular to vertical axis, gently tapering throughout to a narrow but blunt tip, with a low dorsal fold visible in dorsal view from proximal ¼ to distal ¾ part of terminal

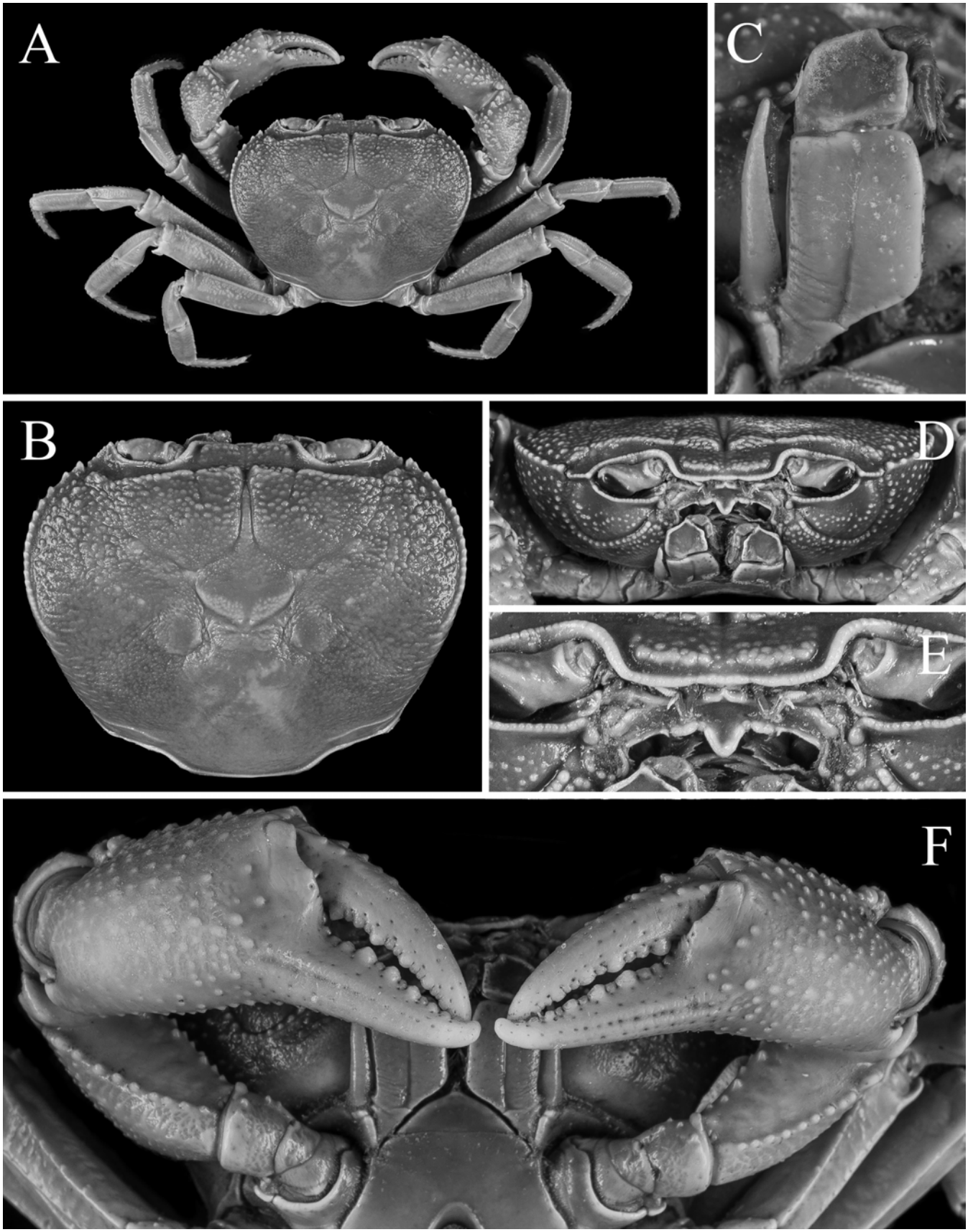

Fig. 37. *Indochinamon thienkense*, new species, holotype, male (64.3 × 49.9 mm) (ZRC 2023.0614). A, dorsal view; B, carapace dorsal view; C, right third maxilliped; D, carapace frontal view; E, antennae, antennules and epistome; F, chelipeds.

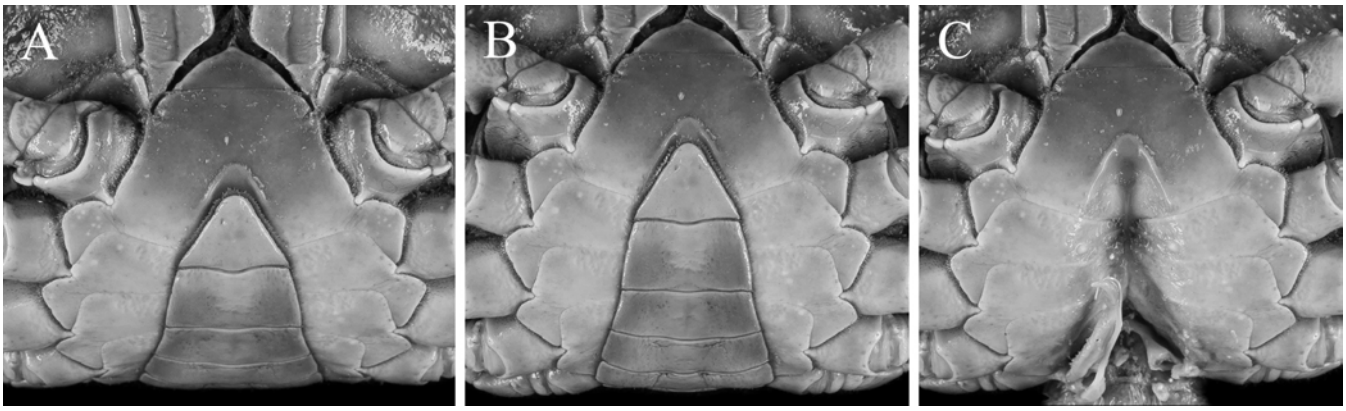

Fig. 38. *Indochinamon thienkense*, new species, holotype, male (64.3 × 49.9 mm) (ZRC 2023.0614). A, anterior half of thoracic sternum and telson; B, posterior half of thoracic sternum and pleon; C, sternopleonal cavity.

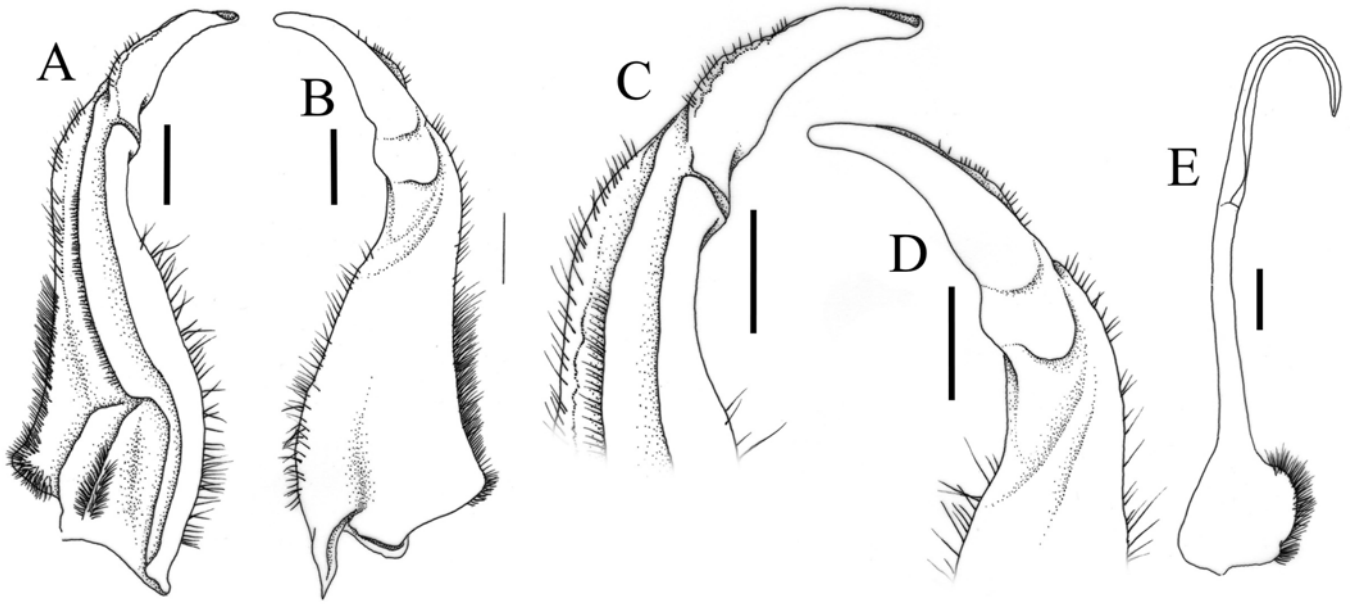

Fig. 39. *Indochinamon thienkense*, new species, holotype, male (64.3 × 49.9 mm) (ZRC 2023.0614). A, left G1 (ventral view); B, left G1 (dorsal view); C, distal part of left G1 (ventral view); D, distal part of left G1 (dorsal view); E, left G2. Scale bar = 2 mm.

article. Vulva (Fig. 40C) large, occupying about half of sternite 6, appearing recessed, impinges onto half of sternite 5, directed anterio-mesially, with prominent vulvar cover on outer margin.

Etymology. This new species name is named after its type locality, Thiện Kế commune, northern Vietnam.

Live colouration. In life, the dorsal surface of the carapace is greenish brown, with orange orbital, frontal and anterolateral margins. Ambulatory legs and chelipeds are orangish-brown. The ventral surfaces are largely dirty-yellow, and the outer surfaces of the chelipeds orange, with the finger tips white (Fig. 41).

Remarks. As mentioned in the earlier remarks for *Indochinamon lacertosum*, new species, *I. thienkense*, new species, is most closely allied with three other new species *I. hamyenense*, *I. lacertosum*, and *I. angustum*. These three new species share a similar G1 morphology that set them apart from other congeners, in which the subterminal article of the G1 possesses a distinct cleft on the outer margin, with a relatively long 'neck-like' distal part, and the terminal article being relatively long, bent outwards ca. 40–45° and curving to varying degrees, but never straight (Figs. 29, 35, 39, 44)

Nevertheless, *I. thienkense*, new species, can be distinguished from the three aforementioned new species by the following differences: carapace posterolateral margins without 'waist-like' appearance (Fig. 37A) (versus carapace posterolateral margins with distinct 'waist-like' appearance in *I. hamyenense*, new species; Fig. 27A); suborbital margin gently concave when viewed frontally (Fig. 37D) (versus suborbital margin almost straight in *I. lacertosum*, new species; Fig. 35D); frontal margin relatively straight when viewed frontally (Fig. 37E) (versus frontal margin sinuous in *I. lacertosum*, new species (Fig. 33E), gently sinuous in *I. angustum*, new species (Fig. 42E), while in *I. hamyenense*, new species, is concave when viewed frontally; Fig. 27E); s3/4 only with shallow grooves at lateral margins demarcating suture (Fig. 38A) (versus s3/4 complete in *I. lacertosum*, new species (Fig. 34A) and *I. hamyenense*, new species;

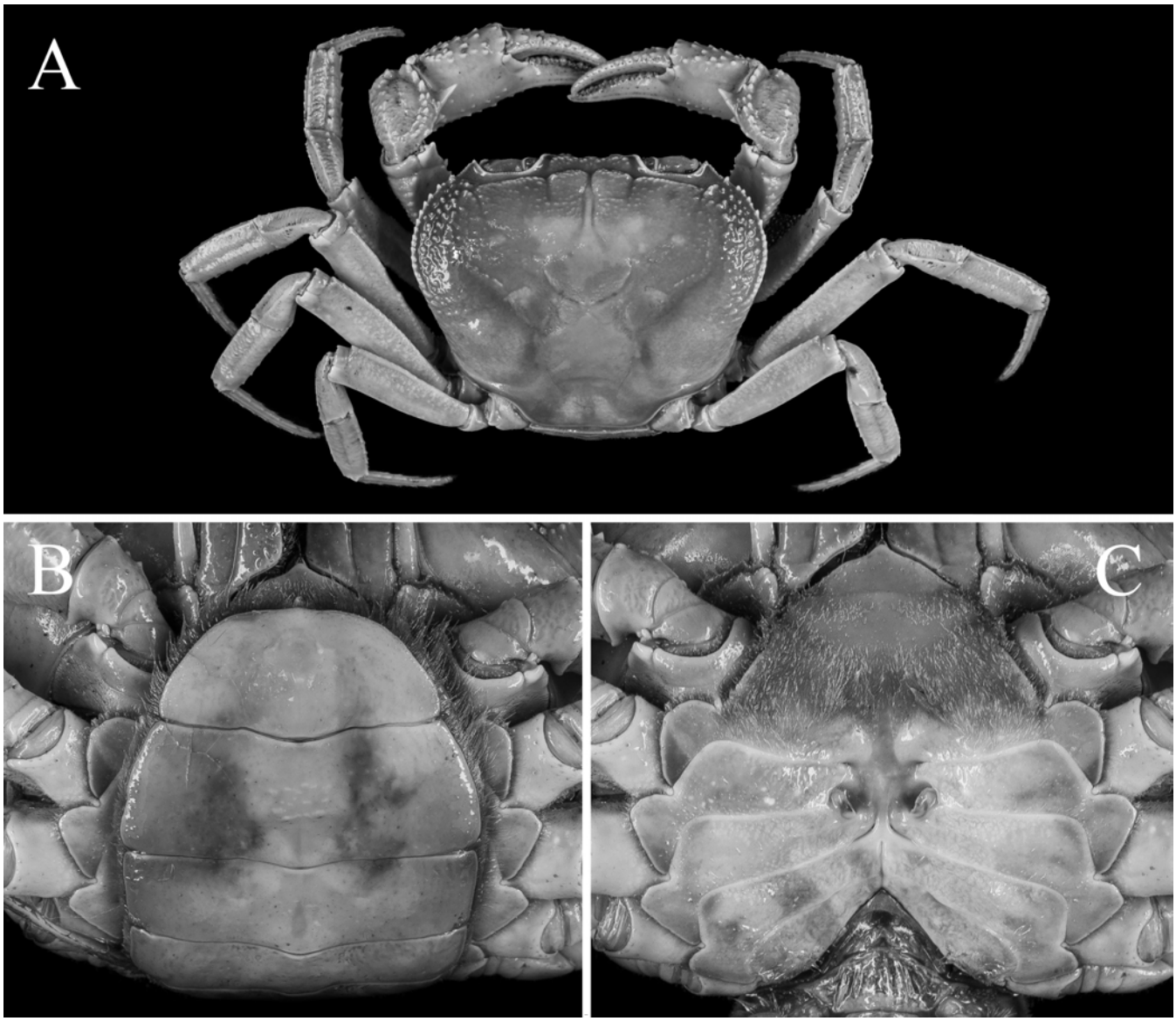

Fig. 40. *Indochinamon thienkense*, new species, paratype, female (55.7 × 43.8 mm) (ZRC 2023.0615). A, dorsal view; B, pleon; C, sternopleonal cavity and vulvae.

Fig. 28); male pleonal somite 6 lateral margins relatively straight or very weakly convex (Fig. 38B) (versus somite 6 lateral margins convex in *I. hamyenense*, species; Figs. 28B, *I. lacertosum*, new species; Fig. 34B, and *I. angustum*, new species; Fig. 43B); and the G1 subterminal article broad, basal part tapers more strongly (Fig. 39A, B) (versus G1 subterminal article basal part taper less strongly, appearing more subrectangular in *I. lacertosum*, new species; Fig. 35A, B, and trapezoidal in *I. hamyenense*, new species; Fig. 29A, B, while in *I. angustum*, new species, the overall G1 subterminal article is much more slender, tapering less strongly; Fig. 44A, B). Additionally, the four species also exhibit very clear differences in the form of the G1 terminal article. In *I. thienkense*, new species, it is relatively slender, curving strongly, with blunt tip terminating perpendicular to vertical axis (Fig. 39D), while in *I. hamyenense*, new species, it is more slender with a more acuminate tip (Fig. 29D). The G1 terminal article is even more broad and stout in *I. lacertosum*, new species (Fig. 35D) and *I. angustum*, new species (Fig. 44D). Furthermore, the G1 terminal article of *I. thienkense*, new species, also possesses a low, long dorsal flap that extends from proximal ¼ to distal ¾ part of terminal article (Fig. 39D), that in *I. hamyenense*, new species, and *I. angustum*, new species, is much shorter, only extending from proximal origin to proximal ⅓–½ of terminal article (Figs. 29D, 44D).

Distribution. *Indochinamon thienkense*, new species, is currently only known from its type locality in Thiện Kế commune, Sơn Dương district, Tuyên Quang province in northern Vietnam.

Fig. 41. *Indochinamon thienkense*, new species, live colouration, holotype, male (64.3 × 49.9 mm) (ZRC 2023.0614). A, dorsal view; B, frontal view; C, right cheliped; D, ventral view; E, thoracic sternites and sternopleonal cavity.

Indochinamon angustum, new species
(Figs. 42–45)

Material examined. Holotype: male (68.0 × 53.0 mm) (ZRC 2023.0616), Phù Lưu Commune, Hàm Yên district, Tuyên Quang province, northern Vietnam, purchased from local villagers by V.T. Ngo, 15 May 2022.

Diagnosis. Carapace (Fig. 42A, B) transversely subovate, wider than long, CW/CL 1.28; dorsal surface almost flat, branchial regions and regions behind postorbital, epigastric cristae rugose and granulose; epigastric and postorbital crista pronounced, rugose; postorbital cristae gently sloping posterolaterally; epibranchial tooth relatively well-developed appearing as a pronounced, sharp tooth, separated from external orbital tooth by broad V-shaped cleft; external orbital tooth large, broad, lateral margin straight, serrated, lateral margins longer than mesial margin; anterolateral margins cristate, prominently lined with sharp granules, appearing serrated; posterolateral margin strongly converges towards posterior carapace margin. Suborbital margins gently concave when viewed frontally (Fig. 42D); frontal region rugose, with well-developed post frontal rugosity, margin gently sinuous when viewed frontally; epistomal median lobe (Fig. 42E) well-developed, triangular; suborbital, subhepatic and pterygostomial region granulose. Third maxilliped (Fig. 42C) exopod with relatively short flagellum, reaches half-width of merus. Ambulatory legs and dactylus (Fig. 42A) not prominently elongated, third walking leg length ca. 1.01 times CW, merus margins gently serrated. Male thoracic sternum with s3/4 (Fig. 43A) indiscernible except for very weak grooves at lateral edges; male pleon (Fig. 43B) narrowly triangular; somite 6 lateral margin convex; telson broadly triangular, lateral margins straight. G1 (Fig. 44A–D) relatively slender; basal part of subterminal article slender, weakly tapering distally, appearing subrectangular,

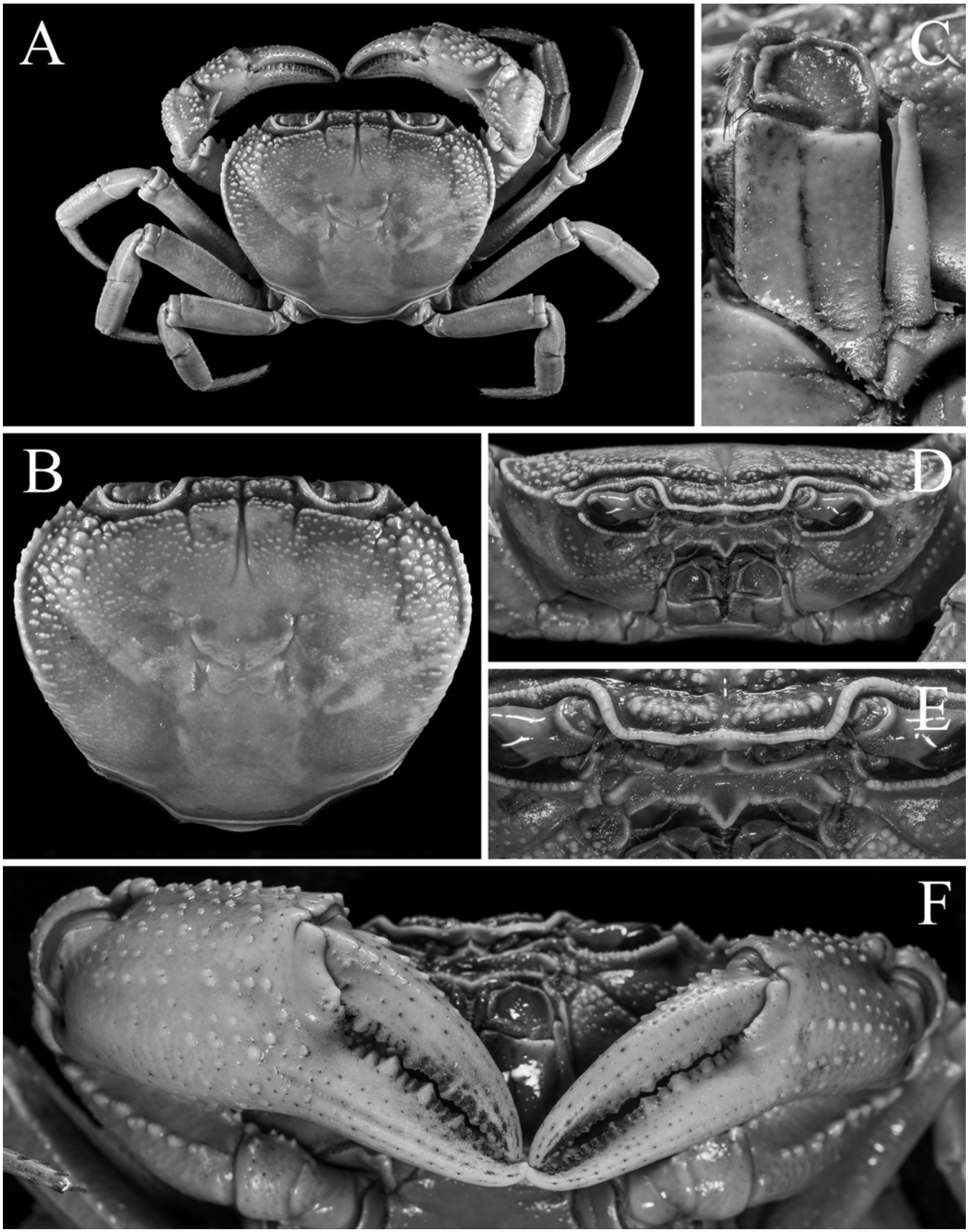

Fig. 42. *Indochinamon angustum*, new species, holotype, male (68.0 × 53.0 mm) (ZRC 2023.0616). A, dorsal view; B, carapace dorsal view; C, right third maxilliped; D, carapace frontal view; E, antennae, antennules and epistome; F, chelipeds.

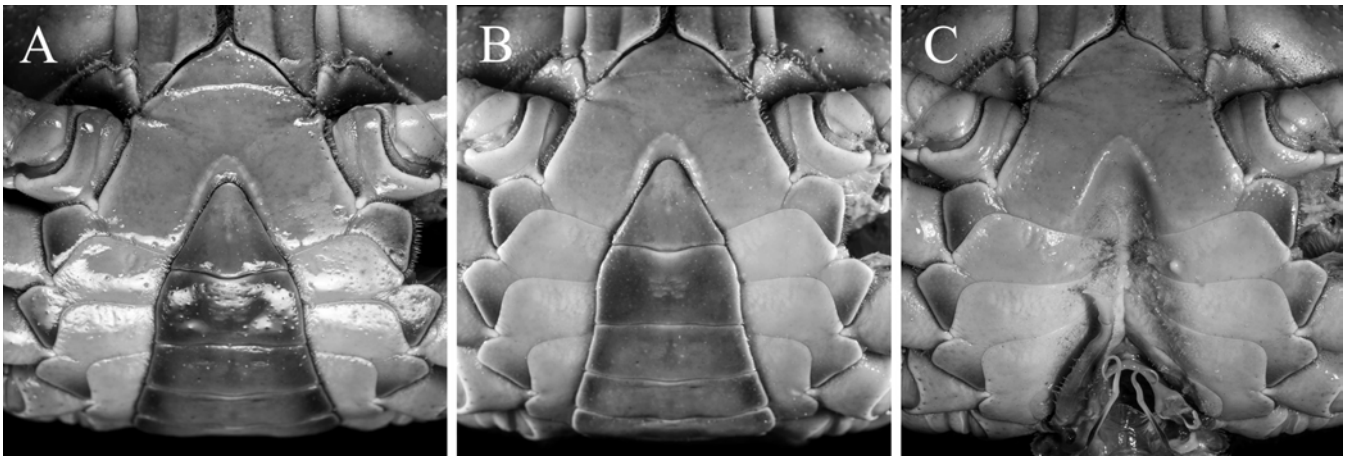

Fig. 43. *Indochinamon angustum*, new species, holotype, male (68.0 × 53.0 mm) (ZRC 2023.0616). A, anterior half of thoracic sternum and telson; B, posterior half of thoracic sternum and pleon; C, sternopleonal cavity.

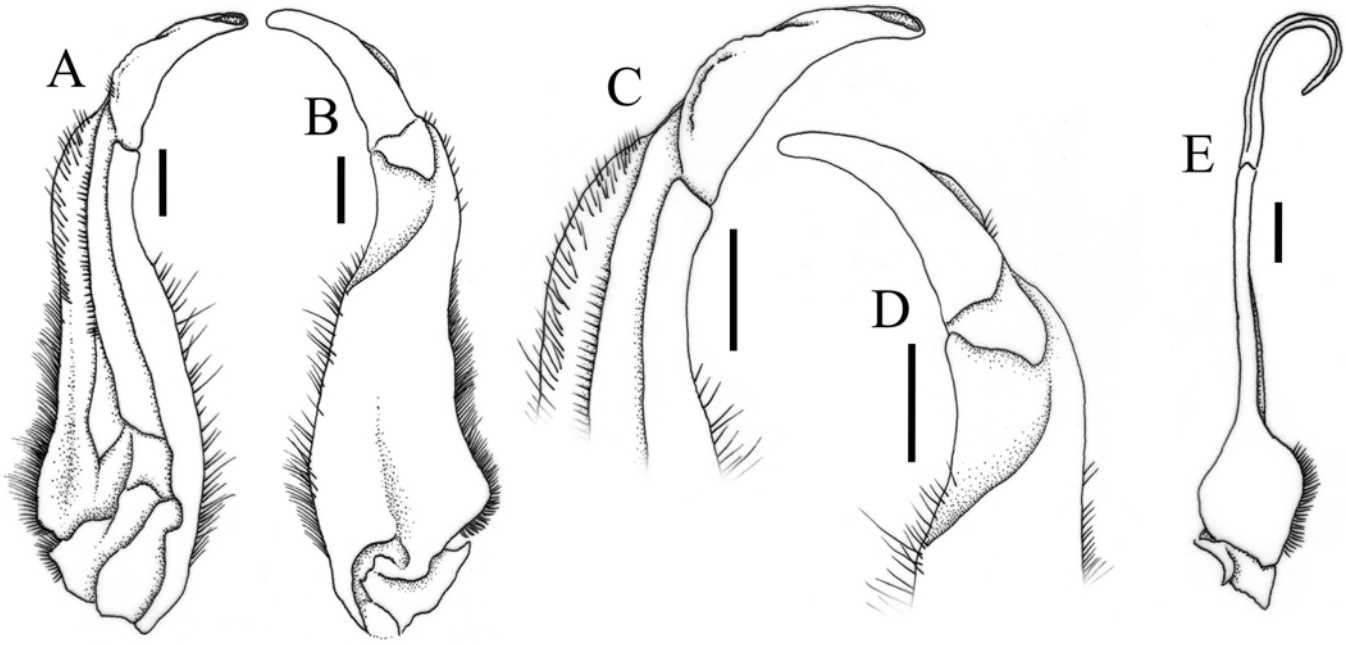

Fig. 44. *Indochinamon angustum*, new species, holotype, male (68.0 × 53.0 mm) (ZRC 2023.0616). A, left G1 (ventral view); B, left G1 (dorsal view); C, distal part of left G1 (ventral view); D, distal part of left G1 (dorsal view); E, left G2. Scale bar = 2 mm.

before tapering in a cleft, appearing thereafter as a broad, neck-like section; terminal article long and broad, 0.42 times length of subterminal article, bent outwards, ca. 45°, curving downwards, tip almost perpendicular to vertical axis, gently tapering throughout to a narrow but blunt tip, with a low dorsal fold visible in dorsal view from near proximal origin to ½ part of terminal article.

Etymology. The species name is derived from the Latin word 'angustus', meaning narrow, alluding to its relatively slender G1 subterminal article.

Live colouration. In life, the dorsal surfaces of the carapace are pale white with very slight blue hue; ambulatory legs and dorsal surfaces of chelipeds as well as the coxa, meri, carpi being purple. The ventral surfaces largely pale off-white. Cheliped, ambulatory leg ventral surfaces largely light purplish brown, finger tips yellowish white (Fig. 45).

Remarks. Differences between *Indochinamon angustum*, new species, and *I. thienkense*, new species, have been elaborated in the remarks section for the latter. With regards to the diagnostic G1 of this new species, it is most similar to that of *I. lacertosum*, new species, with regards to its broad, curving terminal article (Figs. 35D, 44D). *Indochinamon angustum*, new species, can however, be easily distinguished from *I. lacertosum*, new species, by its concave suborbital margin, incomplete s3/4, more slender G1 subterminal article and by its shorter G1 terminal article dorsal flap that only extends from near proximal origin to about median position (Figs. 42D, 43A, 44A, B, D); which contrasts with the straight suborbital margin, complete s3/4, more broad G1 subterminal article and a longer G1 terminal dorsal flap that extends from proximal ¼ to distal ¾ position of the terminal article in *I. lacertosum*, new species (Figs. 33D, 34A, 35A, B, D).

Fig. 45. *Indochinamon angustum*, new species, live colouration, holotype, male (68.0 × 53.0 mm) (ZRC 2023.0616). A, dorsal view; B, frontal view; C, ventral view; D, thoracic sternites and sternopleonal cavity.

Distribution. *Indochinamon angustum*, new species, is currently only known from its type locality in Hàm Yên district, Tuyên Quang province, in northern Vietnam.

Indochinamon septentrionum, new species
(Figs. 46–50)

Material examined. Holotype: male (76.1 × 59.5 mm) (ZRC 2023.0617), An Toàn Khu area, Phú Đình Commune, Định Hóa distinct, Thái Nguyên province, northern Vietnam, 21°45′N 105°31′E, 500 m asl, coll. local people, 26 June 2022. Paratypes: 1 male (73.1 × 57.3 mm) (ZVNU), 1 female (78.2 × 59.7 mm) (ZRC 2023.0618), same data as holotype.

Diagnosis. Carapace (Figs. 46A, B, 49A) transversely subovate, wider than long, CW/CL 1.28–1.30; dorsal surface almost flat, branchial regions and regions behind postorbital, epigastric cristae rugose; epigastric and postorbital crista pronounced, rugose; postorbital cristae gently sloping posterolaterally; epibranchial tooth relatively well-developed appearing as a pronounced, sharp tooth, separated from external orbital tooth by V-shaped cleft; external orbital tooth large, broad, lateral margin straight, serrated, lateral margins longer than mesial margin; anterolateral margins cristate, prominently lined with sharp granules, appearing serrated; posterolateral margin strongly converges towards posterior carapace margin. Frontal region (Fig. 46D) rugose, with well-developed post frontal rugosity, margin gently sinuous when viewed frontally; suborbital, subhepatic and pterygostomial region granulose; epistomal median lobe (Fig. 46E) well-developed, triangular. Third maxilliped (Fig. 46C) exopod with relatively short flagellum, reaches half-width of merus. Ambulatory legs and dactylus (Fig. 46A) not prominently elongated, third walking leg length proportionate to CW, merus margins gently serrated. Male thoracic sternum with s3/4 (Fig. 47A) indiscernible except or with very weak grooves at lateral edges; male pleon (Fig. 47B) narrowly triangular; somite 6 lateral margin convex; telson broadly triangular, lateral margins straight. G1 (Fig. 48A–D) relatively broad, sinuous; basal part of subterminal article very broad, tapering smoothly distally, without a distinct cleft or ‘neck-like’ part; terminal article long and relatively slender, 0.42 times length of subterminal article, bent outwards, ca. 40°, gently curving downwards

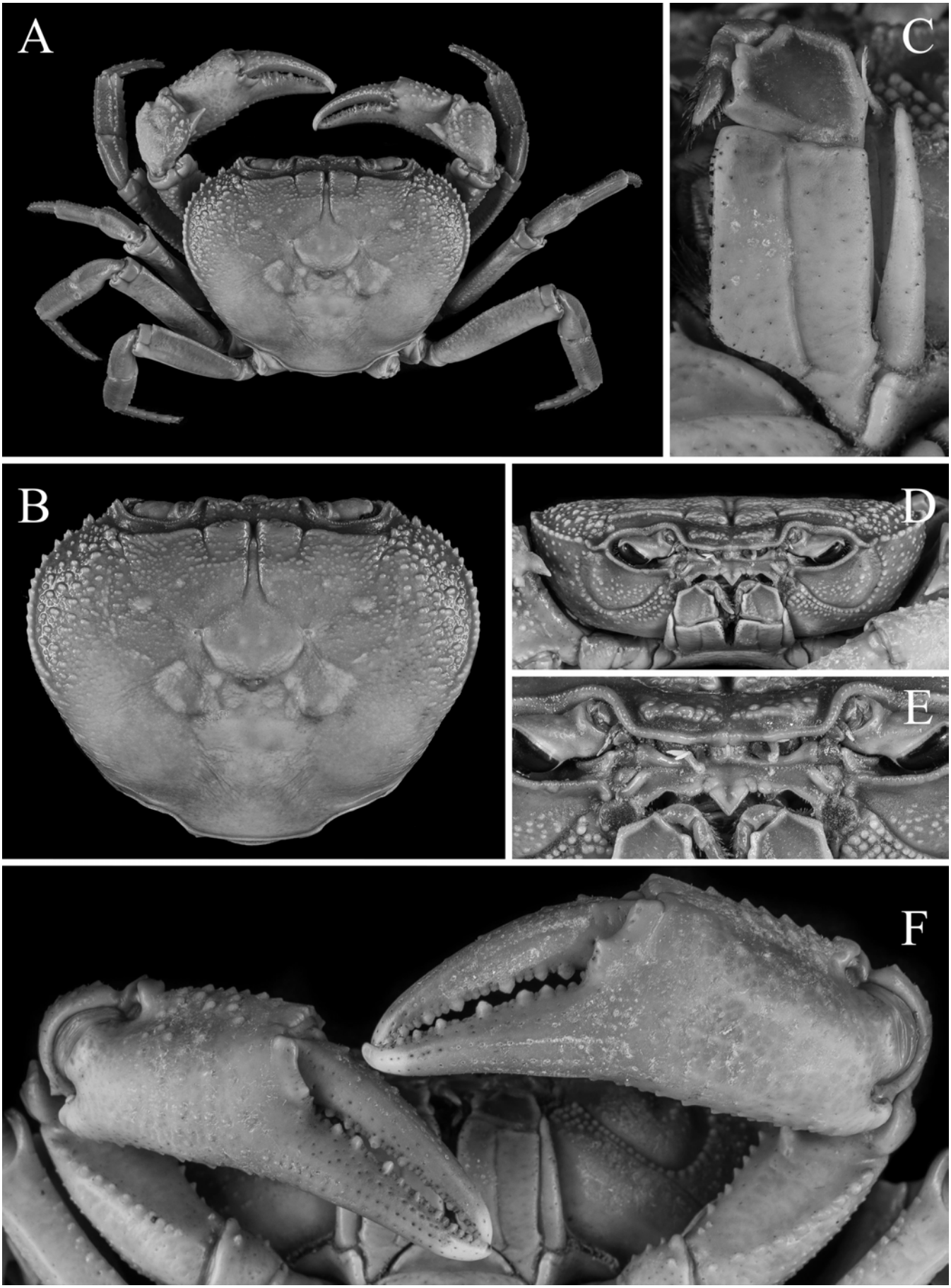

Fig. 46. *Indochinamon septentrionum*, new species, holotype, male (76.1 × 59.5 mm) (ZRC 2023.0617). A, dorsal view; B, carapace dorsal view; C, right third maxilliped; D, carapace frontal view; E, antennae, antennules and epistome; F, chelipeds.

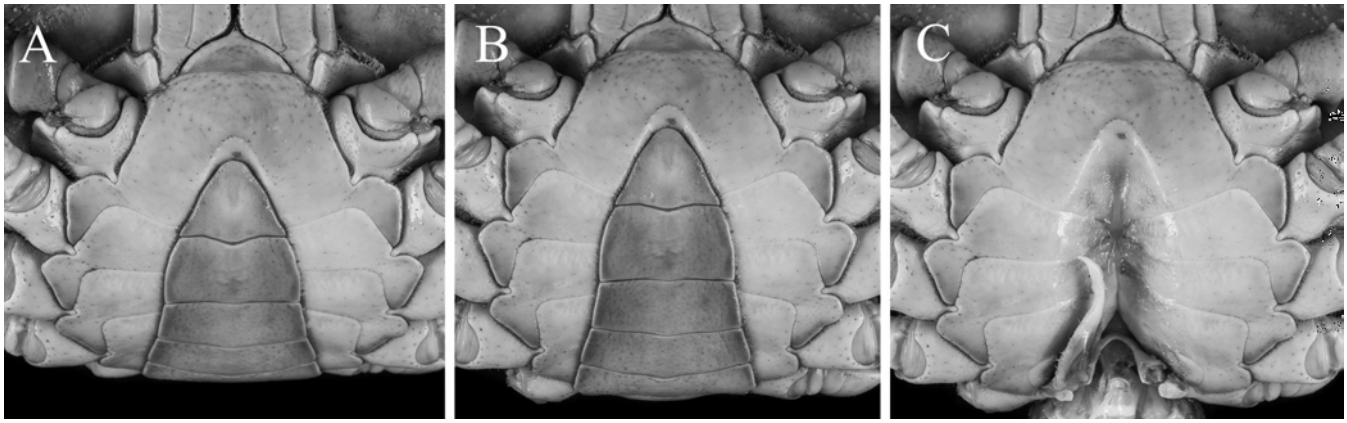

Fig. 47. *Indochinamon septentrionum*, new species, holotype, male (76.1 × 59.5 mm) (ZRC 2023.0617). A, anterior half of thoracic sternum and telson; B, posterior half of thoracic sternum and pleon; C, sternopleonal cavity.

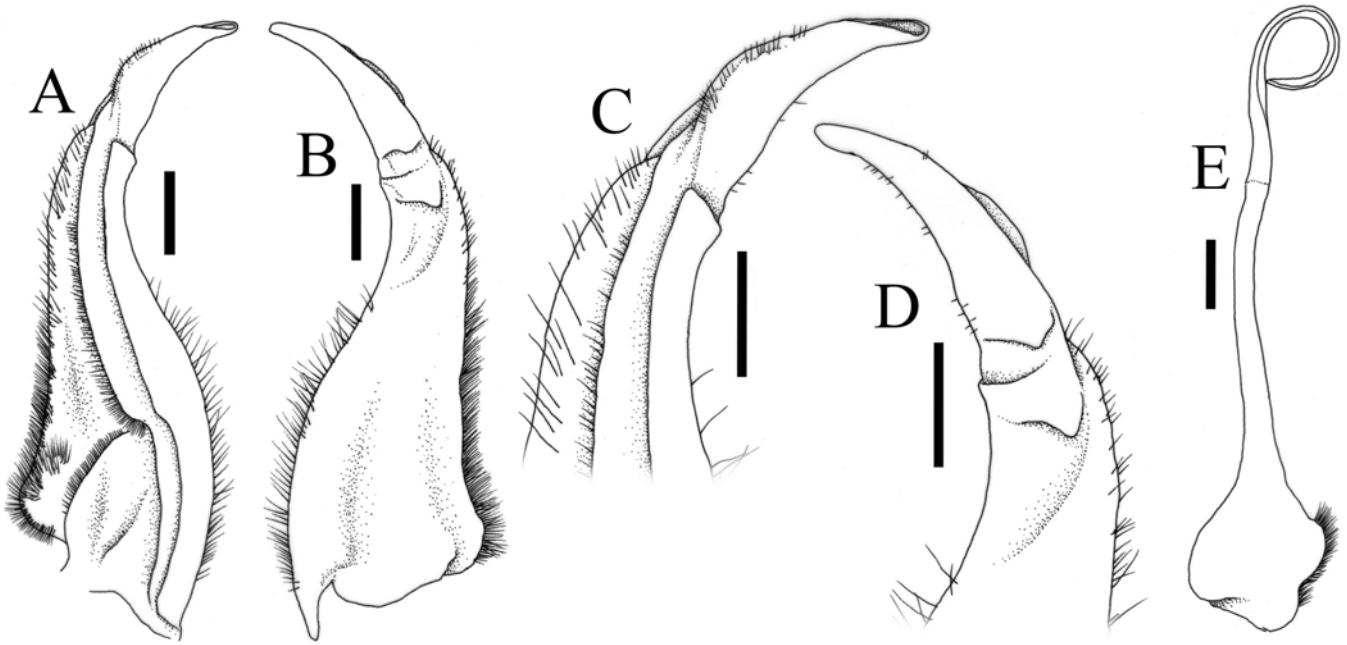

Fig. 48. *Indochinamon septentrionum*, new species, holotype, male (76.1 × 59.5 mm) (ZRC 2023.0617). A, left G1 (ventral view); B, left G1 (dorsal view); C, distal part of left G1 (ventral view); D, distal part of left G1 (dorsal view); E, left G2. Scale bar = 2 mm.

throughout, gently tapering throughout to a narrow but blunt tip, with a low and short dorsal fold only visible in dorsal view from proximal ¼ to median part of terminal article. Vulva (Fig. 49C) large, occupying more than half of sternite 6, appearing greatly recessed, impinges strongly on sternite 5, directed anterio-mesially, with prominent vulvar cover on outer margin.

Etymology. The new species is named after the Latin word 'septentriones' for north, alluding to its distribution in northern Vietnam.

Live colouration. In life, the dorsal surface of the carapace is yellow to grey with tinge of purple. Dorsal surfaces of ambulatory legs, chelipeds and frontal regions are dirty yellow to greyish purple. The ventral surfaces largely off-white. Tips of fingers white (Fig. 50).

Remarks. *Indochinamon septentrionum*, new species, shares most similarities with *I. yensonense*, new species, with regards to the overall external and G1 morphology. The two species can be differentiated by the following differences: overall carapace most transverse around median part (Fig. 46B) (versus carapace most transverse anteriorly, about anterior third *I. yensonense*, new species; Fig. 51B); G1 subterminal article broader basally, more sinuous (Fig. 48B) (versus G1 subterminal article narrow basally, less sinuous in *I. yensonense*, new species, Fig. 53B); and the G1 terminal article shorter, ca. 0.42 times length of subterminal article, curving less strongly, tip projecting about 60° from vertical axis, dorsal flap extends only from proximal ¼ to median part (Fig. 48D) (versus G1 terminal article longer, ca. 0.45 times length of subterminal article, curving more strongly with tip almost perpendicular to vertical axis, dorsal flap extends longer, from proximal origin to distal ¾ part in *I. yensonense*, new species; Fig. 53D).

Distribution. *Indochinamon septentrionum*, new species, is currently only known from its type locality in Định Hóa distinct, Thái Nguyên province, in northern Vietnam.

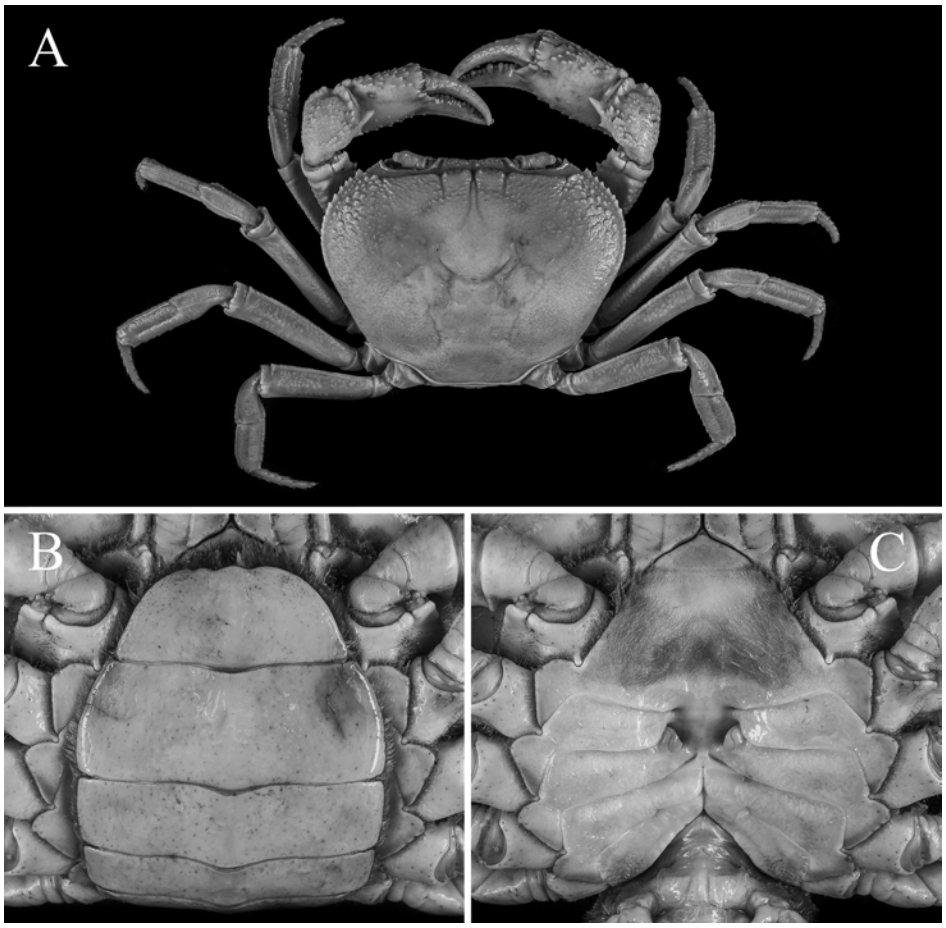

Fig. 49. *Indochinamon septentrionum*, new species, paratype, female (78.2 × 59.7 mm) (ZRC 2023.0618). A, dorsal view; B, pleon; C, sternopleonal cavity and vulvae.

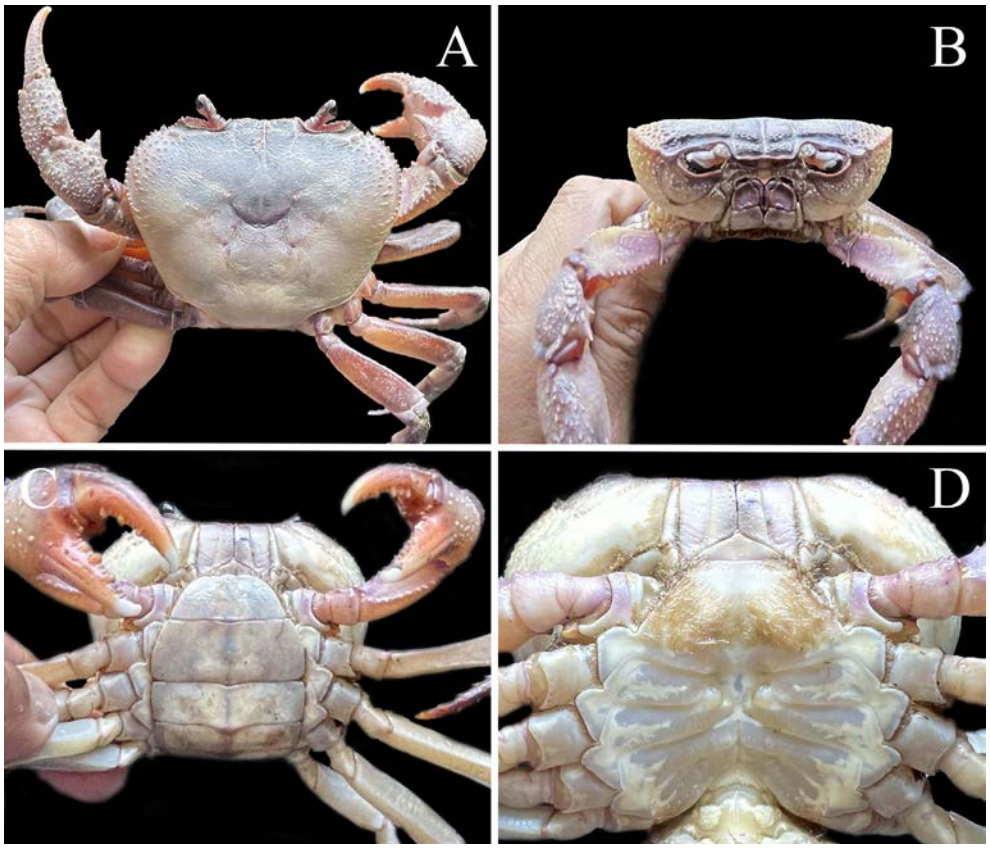

Fig. 50. *Indochinamon septentrionum*, new species, live colouration. A, paratype, male (73.1 × 57.3 mm) (ZCFS); B–D, paratype, female (78.2 × 59.7 mm) (ZRC 2023.0618). A, dorsal view; B, frontal view; C, ventral view; D, sternopleonal cavity and vulvae.

***Indochinamon yensonense*, new species**
(Figs. 51–55)

Material examined. Holotype: male (70.5 × 55.1 mm) (ZRC 2023.0619) Thái Bình commune, Yên Sơn district, Tuyên Quang province northern Vietnam, 200 m asl, coll. V.T. Ngo, 13 May 2022. Paratypes: 1 male (74.4 × 59.3 mm) (ZVNU), 1 female (79.3 × 60.2 mm) (ZRC 2023.0620), same data as holotype.

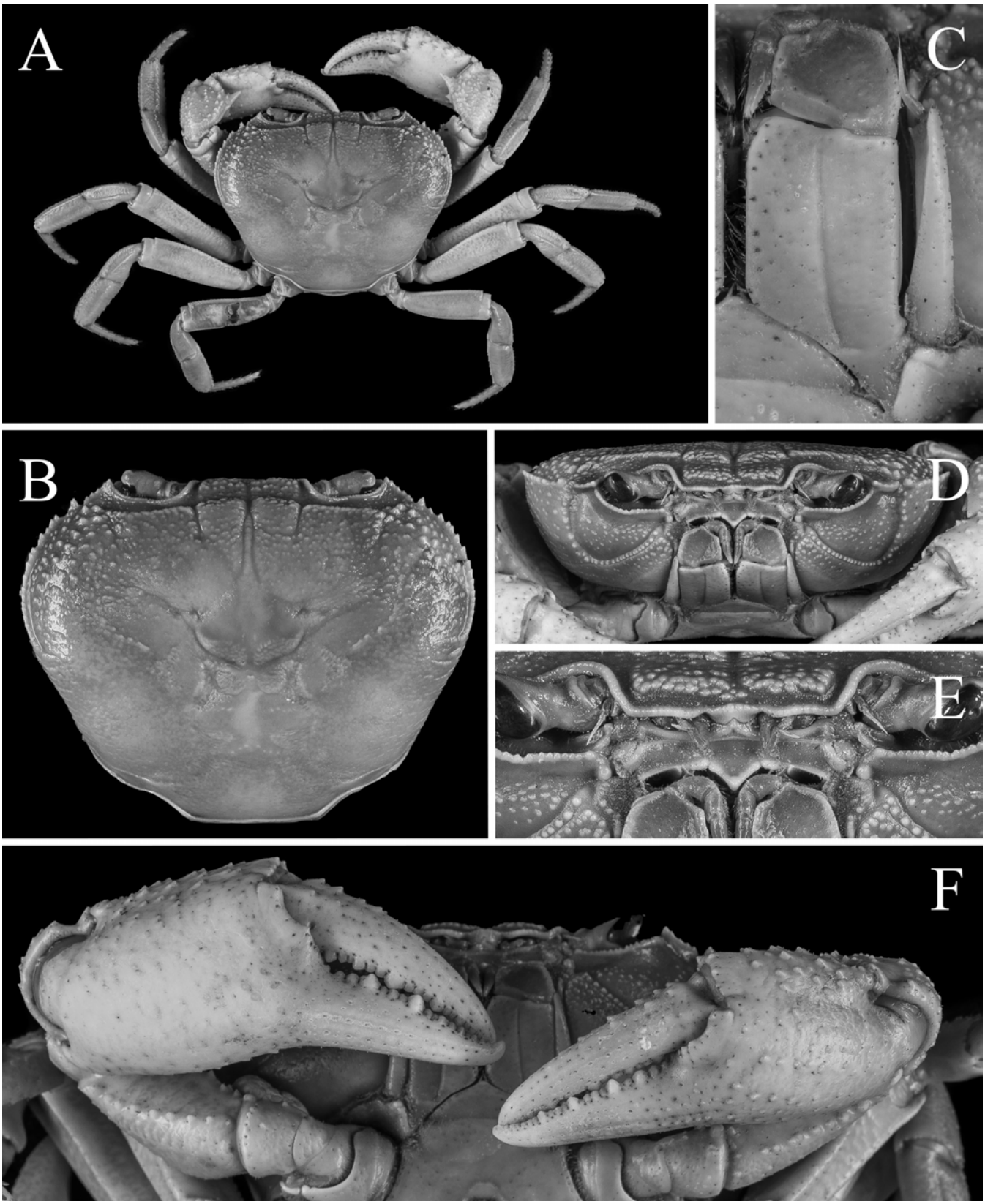

Fig. 51. *Indochinamon yensonense*, new species, holotype, male (70.5 × 55.1 mm) (ZRC 2023.0619). A, dorsal view; B, carapace dorsal view; C, right third maxilliped; D, carapace frontal view; E, antennae, antennules and epistome; F, chelipeds.

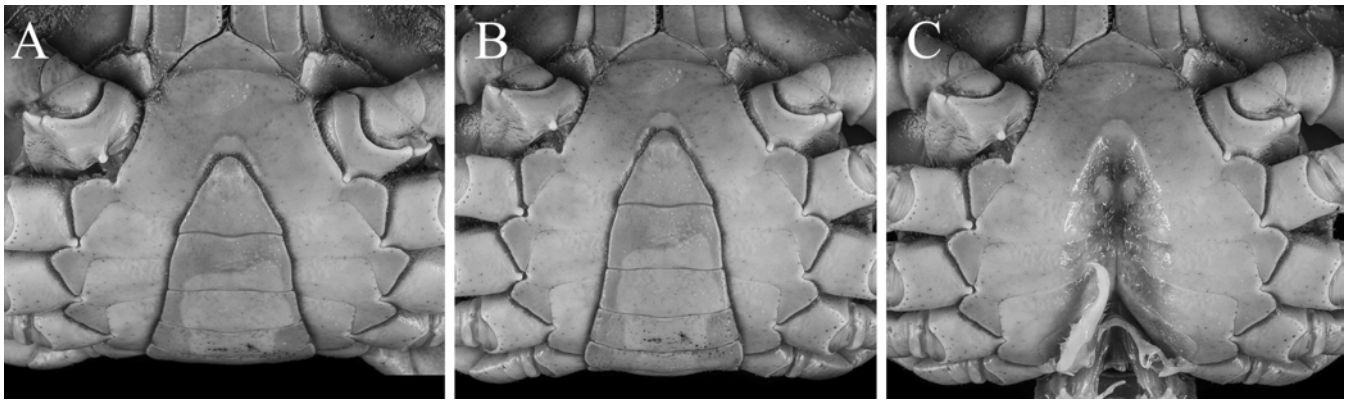

Fig. 52. *Indochinamon yensonense*, new species, holotype, male (70.5 × 55.1 mm) (ZRC 2023.0619). A, anterior half of thoracic sternum and telson; B, posterior half of thoracic sternum and pleon; C, sternopleonal cavity.

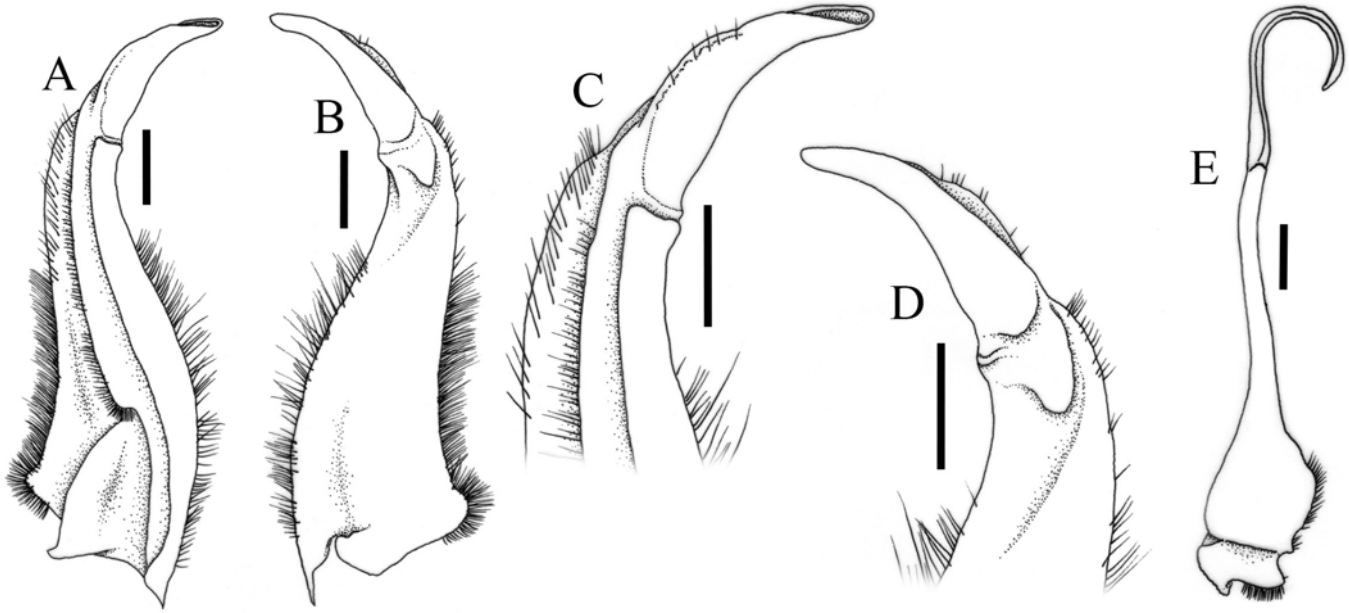

Fig. 53. *Indochinamon yensonense*, new species, holotype, male (70.5 × 55.1 mm) (ZRC 2023.0619). A, left G1 (ventral view); B, left G1 (dorsal view); C, distal part of left G1 (ventral view); D, distal part of left G1 (dorsal view); E, left G2. Scale bar = 2 mm.

Diagnosis. Carapace (Figs. 51A, B, 54A) transversely subovate, wider than long, CW/CL 1.25–1.32; dorsal surface almost flat, branchial regions and regions behind postorbital, epigastric cristae rugose and granulose; epigastric and postorbital crista pronounced, rugose; postorbital cristae very gently sloping posterolaterally, almost subparallel to frontal margin; epibranchial tooth relatively well-developed appearing as a pronounced, sharp granulation, separated from external orbital tooth by broad V-shaped cleft; external orbital tooth large, broad, lateral margin straight to concave, serrated, lateral margins slightly longer than mesial margin; anterolateral margins cristate, prominently lined with sharp granules, appearing serrated; posterolateral margin strongly converges towards posterior carapace margin. Frontal region (Fig. 51D) rugose, with well-developed post frontal rugosity, margin gently sinuous when viewed frontally; suborbital, subhepatic and pterygostomial region granulose; epistomal median lobe (Fig. 51E) well-developed, broadly triangular. Third maxilliped (Fig. 51C) exopod with relatively short flagellum, reaches half-width of merus. Ambulatory legs (Fig. 51A) not prominently elongated, dactylus slightly elongated, third walking leg length ca. 1.08 times CW, merus margins gently serrated. Male thoracic sternum with s3/4 (Fig. 52A) indiscernible except for very weak grooves at lateral edges; male pleon (Fig. 52B) narrowly triangular; somite 6 lateral margin very weakly convex; telson broadly triangular, lateral margins gently sinuous. G1 (Fig. 53A–D) relatively slender; basal part of subterminal article slender, tapering distally, without cleft on outer margin nor 'neck-like' section; terminal article long and relatively slender, 0.45 times length of subterminal article, bent outwards, ca. 45°, curving downwards, tip almost perpendicular to vertical axis, gently tapering throughout to a narrow but blunt tip, with a low dorsal fold visible in dorsal view from near proximal origin to distal ⅓ part of terminal article. Vulva (Fig. 54C) large, occupying about half of sternite 6, appearing greatly recessed, impinges strongly on sternite 5, directed anterio-mesially, with low vulvar cover on outer margin.

Etymology. The new species is named after its type locality, Yên Sơn district, northern Vietnam.

Live colouration. Two colour morphs are known: a grey/purple morph and a yellow morph. The grey/purple morph

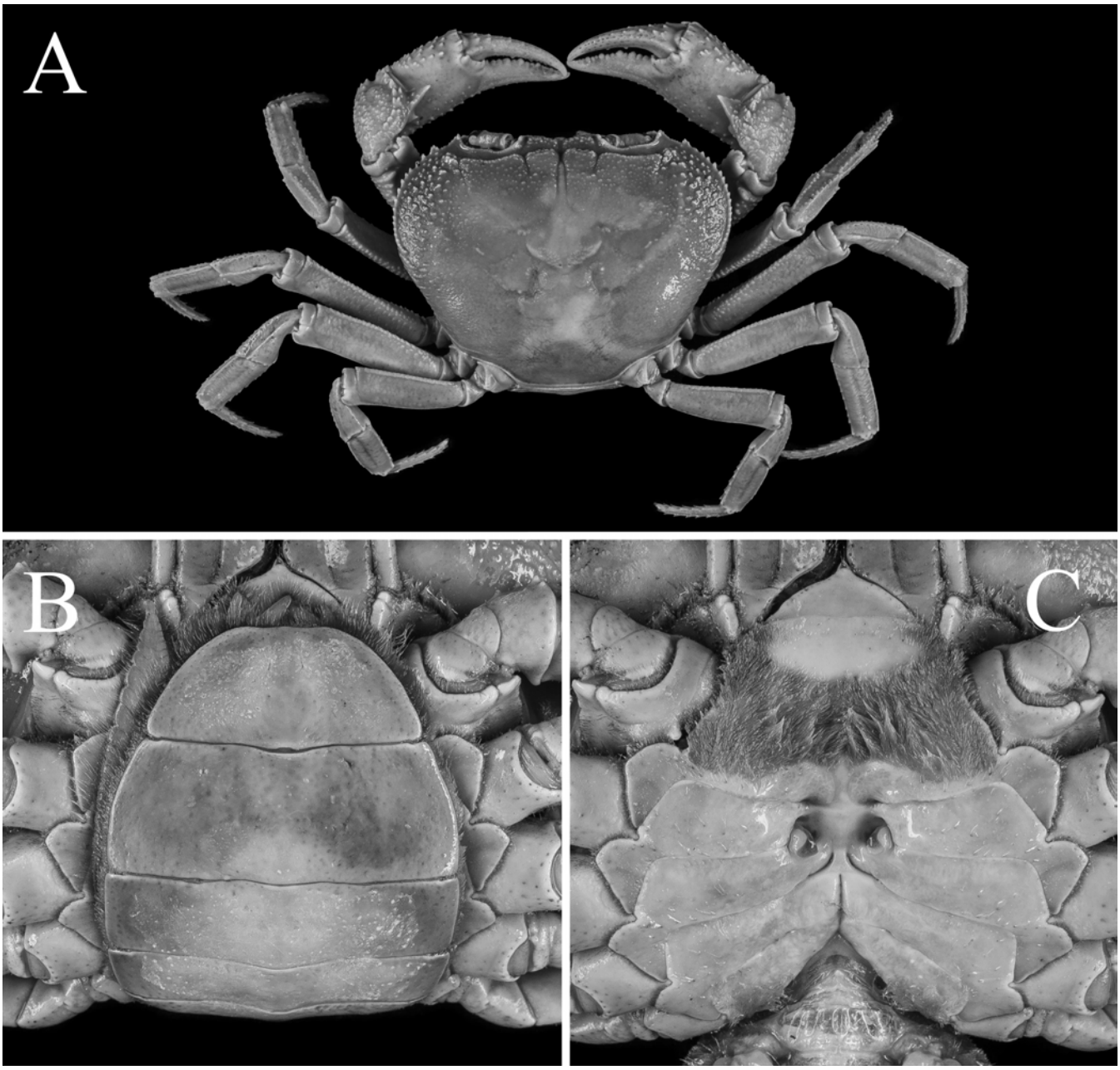

Fig. 54. *Indochinamon yensonense*, new species, paratype, female (79.3 × 60.2 mm) (ZRC 2023.0620). A, dorsal view; B, pleon; C, sternopleonal cavity and vulvae.

is characterised by grey carapace dorsal surface, with the dorsal surfaces of the ambulatory and cheliped coxa, meri, carpi, purple, the ventral surfaces are largely pale off-white, the lateral surfaces of the cheliped largely purple, and the fingers are orange with white tips (Fig. 55A–D). The yellow morph is characterised by an overall uniform yellow on the dorsal surfaces, while the ventral surfaces are off-white (Fig. 55E–H).

Remarks. Besides bearing similarities to *Indochinamon septentrionum*, new species (see earlier), *I. yensonense*, new species, also resembles *I. malipoense* Zhang, Pan, Hao & Sun, 2020, especially in terms of its overall carapace morphology, where the postorbital and frontal region appears very narrow from dorsal view (Fig. 51A; Zhang et al., 2020: fig. 7A). The two species are also similar in their G1 morphology where the subterminal article is relatively slender and without a cleft on outer margin, while the terminal article is relatively slender and curving outwards (Fig. 53A–D; Zhang et al., 2020: figs. 7A, 8C). Regardless, the two species can still be separated by the following differences: carapace appears more transverse anteriorly, around anterior third of carapace (Figs. 51B, 54A) (versus carapace appears most transverse more posteriorly, around median portion in *I. malipoense*; cf. Zhang et al., 2020: fig. 7A); frontal margin appears gently sinuous when viewed frontally (Fig. 51E) (versus frontal margin appears concave when viewed frontally in *I. malipoense*; cf. Zhang et al., 2020: fig. 7B); epistomal median lobe low, broadly triangular (Fig. 51E) (versus epistomal median lobe more projected, appearing more acutely triangular in *I. malipoense*; cf. Zhang et al., 2020: fig. 7B); s3/4 with very weak grooves demarcating suture on lateral edges (Fig. 52A) (versus s3/4

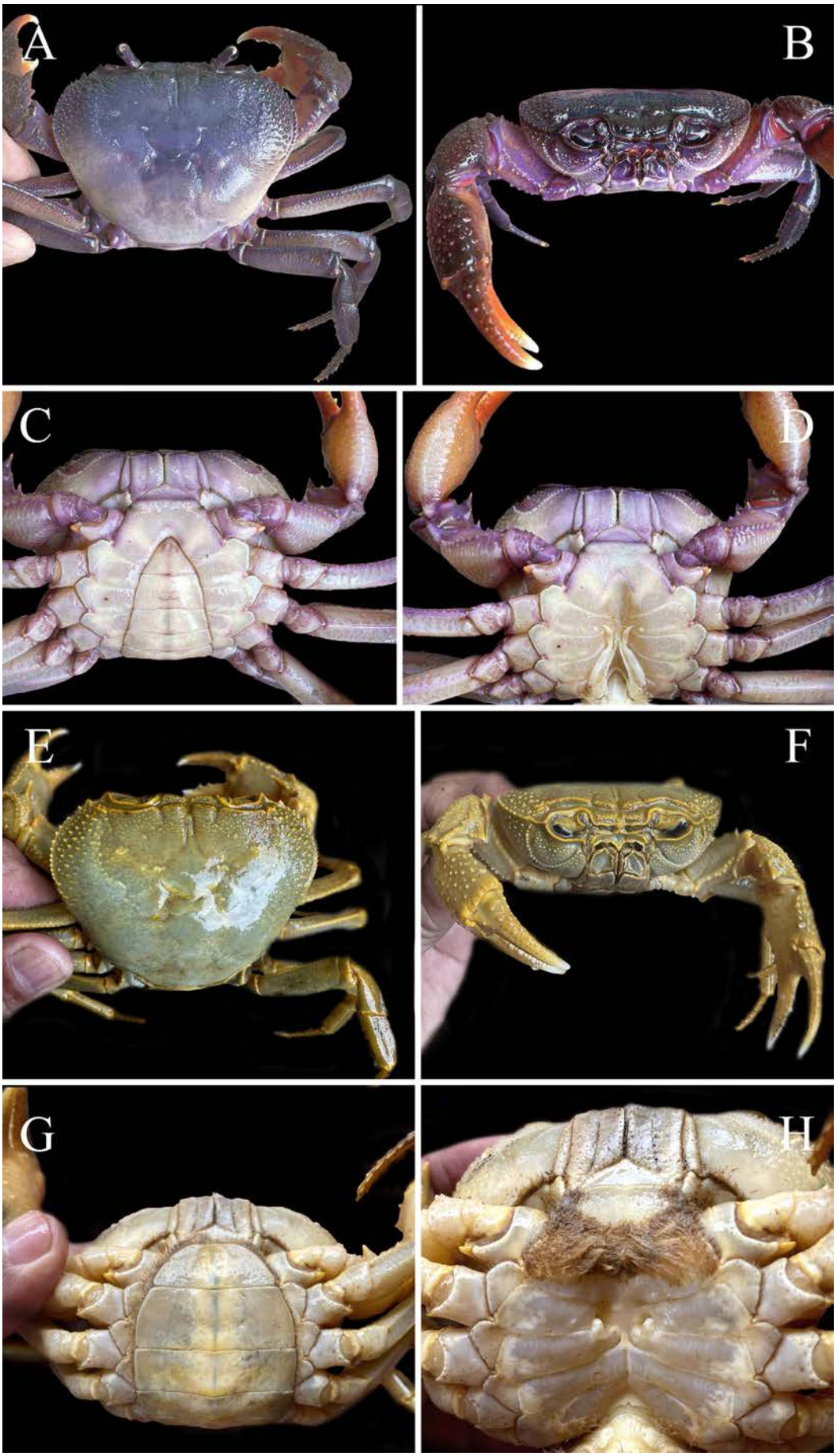

Fig. 55. *Indochinamon yensonense*, new species, live colouration. A–D, paratype, male (74.4 × 59.3 mm) (ZCFS); E–G, paratype, female (79.3 × 60.2 mm) (ZRC 2023.0620). A, E, dorsal view; B, F, frontal view; C, G, ventral view; D, thoracic sternites and sternopleonal cavity; H, sternopleonal cavity and vulvae.

complete in *I. malipoense*; cf. Zhang et al. 2020: fig. 7C); male pleonal somite 6 lateral margin very weakly convex (Fig. 52B) (versus somite 6 lateral margins distinctly convex in *I. malipoense*; cf. Zhang et al., 2020: fig. 7C); G1 subterminal article more sinuous (Fig. 53A, B) (versus G1 subterminal article less sinuous in *I. malipoense*; cf. Zhang et al., 2020: fig. 8C); and the G1 terminal article relatively longer, ca. 0.45 times subterminal article length, more strongly bent outwards, ca. 45° relative to vertical axis, with tip almost perpendicular to vertical axis, with a discernible dorsal flap (Fig. 53D) (versus G1 terminal article relatively shorter, ca. 0.31 times subterminal article length, less strongly bent outwards, ca. 35° relative to vertical axis, with tip projected about 70° from vertical axis, with no discernible dorsal flap in *I. malipoense*; cf. Zhang et al., 2020: fig. 8C).

Despite the somewhat distinct colours of the two morphs, they are morphologically identical and were all collected in the same area.

Distribution. *Indochinamon yensonense*, new species, is currently only known from its type locality in Định Hóa distinct, Thái Nguyên province, in northern Vietnam.

DISCUSSION

Prior to this study, the number of *Indochinamon* species found in Vietnam was 13 (see Dang et al., 2024). The surprising discovery of 12 new species of *Indochinamon* has resulted in a twofold increase in the total species count of the genus to 25, certainly confirming the view that the freshwater crab diversity in Vietnam is still in the discovery phase. Similar to past accounts of *Indochinamon* species, most species described in this study have an aquatic lifestyle, being typically found under rocks and boulders within streams with clean water, often in or near karst landscapes. There were, however, also other species; notably those with longer ambulatory legs (e.g., *I. granulatum*, new species) that possess a semi-aquatic lifestyle, inhabiting both within streams and on the moist forest floor of the karst forest.

Given that most *Indochinamon* species are stream and river dwellers, with the drainages facilitating dispersal and gene flow, it is somewhat surprising the diversity is so high. This high degree of endemism appears to be similar to that observed with terrestrial species where rivers and mountains effectively serve as geographic barriers which promote the formation of new species by vicariance (Ng et al., 2023). That being said, the geography of northern Vietnam is very rugged and complex, with numerous independent drainages isolated by high mountains and geological formations, with many areas being karst landscapes. As such, we cannot discount vicariance taking place even for primarily aquatic species. Several distinct new species (*I. falx*, *I. hamyenense* and *I. angustum*; and *I. lacertosum* with *I. septentrionum*) were collected in close proximity, which, while unusual, is not unique (*Insulamon* spp. in Freitag, 2012; *Nanhaipotamon* spp. in Huang et al., 2012, 2021). How this has come about is not known, and we perhaps also cannot ignore anthropogenic causes. As it is now, the ecology and evolutionary history of the freshwater crabs in the region is still poorly understood, and more work will need to be undertaken to better understand the fauna composition and ecology in the area especially in light of the widespread habitat destruction of karst landscapes in the region.

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