

Two new species of land-dwelling crabs of the genus *Geosesarma* De Man, 1892 (Crustacea: Brachyura: Thoracotremata: Sesarmidae) from Bintan Island, Indonesia

Christoph D. Schubart¹ & Peter K. L. Ng²

Abstract. Specimens of land-dwelling sesarmid crabs from two localities in Bintan Island (Riau Archipelago, Indonesia) belong to two new species of the genus *Geosesarma* De Man, 1892, and are here described. One higher altitude species (*G. raj*, new species) is characterised by bright colours in life, elongated ambulatory legs and the absence of an exopodal flagellum on the third maxillipeds. A lowland species (*G. bintan*, new species) is characterised by duller coloration, proportionately shorter legs, and the presence of an exopodal flagellum on the third maxillipeds. The gonopod structures of both species are also diagnostic. The two new species are compared with their closest congeners from Singapore and Peninsular Malaysia. With these two descriptions, 51 species are now known in *Geosesarma*.

Keywords. Taxonomy, morphology, fresh water, land, crabs, Sesarmidae, Bintan, Indonesia, *Geosesarma*

INTRODUCTION

Bintan is the largest island of the Riau Archipelago, Indonesia (consisting of about 3,200 islands), with a land area of approximately 2,400 square kilometres. The island is being continuously developed for tourism and investment due to its vicinity to Singapore. Although there are some studies on the marine life of Bintan (Low et al., 1995; Winata et al., 2008; Chou et al., 2010), there is almost nothing known about the terrestrial fauna associated with freshwater streams. Only one freshwater decapod species, a hymenosomatid crab, has been described from the island thus far (Ng & Chuang, 1996).

The freshwater ecosystems of Southeast Asia are inhabited by a very diverse fauna of decapod shrimps and crabs (Yeo et al., 2008). Among the crabs, primary freshwater species of the families Gecarcinucidae and Potamidae are normally found in or around brooks and streams (Ng, 1988; Yeo et al., 2008). In addition, the banks of rivers or the moist ground in their vicinity can be inhabited by crabs of the family Sesarmidae, mostly belonging to the genus *Geosesarma* De Man, 1892. This genus currently consists of 49 described species of relatively small, limnic-terrestrial (cf. Schubart et al., 2000) crabs across the Indo-West Pacific (Ng et al., 2008; Naruse & Jaafar, 2009). With the known exceptions of *G. angustifrons* (A. Milne-Edwards, 1869) and *G. hednon*

Ng, Liu & Schubart, 2004 (and probably a few other species like *G. maculatum* (De Man, 1892)) that have small eggs and marine pelagic larvae (Ng, 1988; Ng et al., 2004), these crabs do not need access to the sea. The more typical mode of reproduction is through large and yolky eggs, from which advanced zoeal larvae (Soh, 1969) or juveniles (Ng & Tan, 1995) hatch. In some species, female crabs have been observed carrying the juveniles on their backs for a few days (Ng & Tan, 1995; unpublished observations). This mode of development promotes retention of the offspring in the parental habitat and thus restricts dispersal. A high degree of endemism can, therefore, be expected and observed in *Geosesarma*, and we are probably just beginning to understand and document the diversity within this genus.

In the present study, we report the discovery of two new species of *Geosesarma* from two localities in Bintan. Specimens are deposited in the Muzium Zoologicum Bogoriense (MZB) and the Zoological Reference Collection, Lee Kong Chian Natural History Museum (ex Raffles Museum of Biodiversity Research), National University of Singapore (ZRC). The abbreviation G1 is used for the male first gonopods. All measurements refer to the size of the carapace (in millimetres) as maximum width × length.

TAXONOMY

Geosesarma De Man, 1892

Geosesarma bintan, new species (Figs. 1A, C, 2A, C, 3A, C, E, G–I)

Material examined. Holotype – male (11.2 × 9.8 mm) (MZB Cru 3813), Indonesia: Riau Archipelago, Bintan Island, near swampy lowland freshwater stream, 1°10'0"N, 104°23'0.6"E, coll. T.H.T.

¹Biologie 1, Universität Regensburg, 93040 Regensburg, Germany; Email: christoph.schubart@ur.de (*corresponding author)

²Lee Kong Chian Natural History Museum, National University of Singapore, Kent Ridge, Singapore 119260, Republic of Singapore; Email: peterng@nus.edu.sg

Tan et al., 11 May 1993. Paratype – male (9.7 × 8.5 mm) (ZRC 2014.0284), same locality data as holotype.

Diagnosis. Carapace rectangular, distinctly wider than long, lateral margins gently diverging towards posterior carapace margin (Fig. 1A, C); dorsal surfaces generally smooth, except for rugose anterior regions; H-shaped median depression shallow; postfrontal cristae prominent, margins rounded; exorbital tooth triangular, directed obliquely, with additional low tooth behind it (Figs. 1C, 2A). Exopod of third maxilliped relatively slender, with long flagellum (Fig. 3A). Male chelae with long fingers, scattered granules, rugosities on dorsal and ventral surfaces of palm, as well as on proximal part of dactylus; dorsal margin of dactylus with 5 or 6 low, rounded granules on proximal half (Fig. 2C). Ambulatory legs with relatively broad meri, with sharp subdistal spine on dorsal margin, surface gently rugose; propodus subrectangular (Figs. 1A, 3C). Male abdomen relatively broad; telson semicircular (Fig. 3E). G1 slender; distal chitinous part elongate; spatuliform, subtruncate tip with weak indentation (Fig. 3G–I).

Colour. In life, the specimens were brownish red, with pale yellow chelae.

Etymology. The species is named after the island where it was discovered. The specific epithet, *bintan*, is used as a noun in apposition.

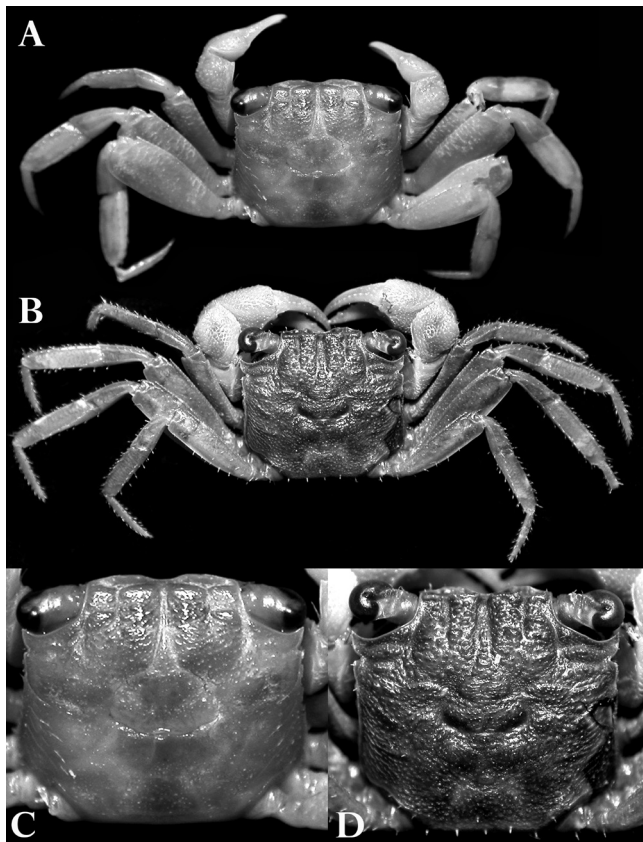


Fig. 1. A, C, *Geosesarma bintan*, new species, holotype, male, 11.2 × 9.8 mm (MZB Cru 3813), Bintan Island; B, D, *Geosesarma raj*, new species, holotype, male, 11.8 × 10.9 mm (MZB Cru 3814, ex ZRC 2007.0676), Bintan Island. A, B, habitus; C, D, dorsal view of carapace.

Remarks. *Geosesarma bintan*, new species, belongs to the same species group as *G. peraccae* (Nobili, 1903) in its carapace being distinctly broader than long, the presence of a flagellum on the exopod of the third maxilliped, the relatively broad meri of the ambulatory legs, and a G1 which is slender and its chitinous tip spatuliform (Ng, 1988). It is perhaps closest to *G. peraccae* and *G. penangense* (Tweedie, 1940) in the general form of its carapace and gonopods. The new species can be separated from *G. peraccae* (type locality: Singapore) by its relatively more slender third maxilliped meri (Fig. 3A) (distinctly broader in *G. peraccae*; cf. Ng, 1988: fig. 56C), relatively longer ambulatory legs (Figs. 1A, 3C) (shorter in *G. peraccae*; cf. Ng, 1988: fig. 56A; Serène, 1968: pl. 1 fig. 2), and relatively shorter G1, with the chitinous part proportionately much shorter (Fig. 3G–I) (proportionately longer with the chitinous part more elongate in *G. peraccae*; cf. Ng, 1988: fig. 56D–F; Serène, 1968: fig. 3, 4). It can be separated from *G. penangense* (type locality: Penang) by its relatively more slender third maxilliped merus (Fig. 3A) (broader in *G. penangense*; cf. Ng, 1988: fig. 58C) and relatively more slender G1, with the chitinous part subtruncate (Fig. 3G–I) (stouter, with the chitinous part gently tapering, in *G. penangense*; cf. Ng, 1988: fig. 58D–F).

The holotype of *G. bintan*, a male, is already mature, with its gonopods fully developed and chitinous, although its chelae are not enlarged, suggesting it can reach larger sizes. The same is known of the allied *G. peraccae* from Singapore, where only very large males have enlarged and brightly coloured chelae (Ng, 1988).

***Geosesarma raj*, new species**

(Figs. 1B, D, 2B, D, 3B, D, F, J–M, 4)

Material examined. Holotype – male (11.8 × 10.9 mm) (MZB Cru 3814, ex ZRC 2007.0676), Indonesia: Riau Archipelago, northern Bintan Island, coll. G. Subaraj, 18 October 2007. Paratypes – 1 female (11.8 × 10.7 mm) (ZRC 2007.0677), Indonesia: Riau Archipelago, Bintan Island, in tree hole, coll. G. Subaraj, 21 October 2007; 1 male (10.0 × 9.7 mm) (ZRC 2007.0675), Indonesia: Riau Archipelago,

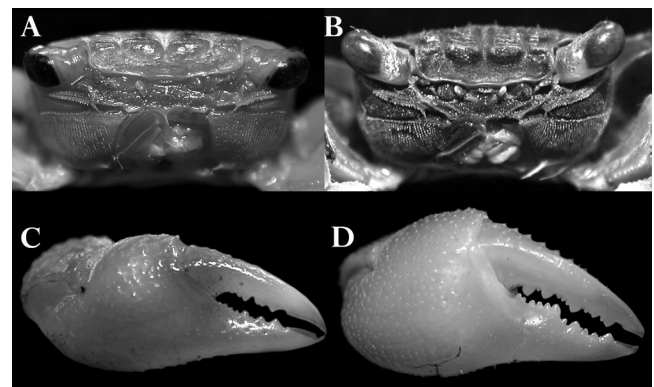


Fig. 2. A, C, *Geosesarma bintan*, new species, holotype, male, 11.2 × 9.8 mm (MZB Cru 3813), Bintan Island; B, D, *Geosesarma raj*, new species, holotype, male, 11.8 × 10.9 mm (MZB Cru 3814, ex ZRC 2007.0676), Bintan Island. A, B, frontal view of carapace; C, D, outer view of right chela.

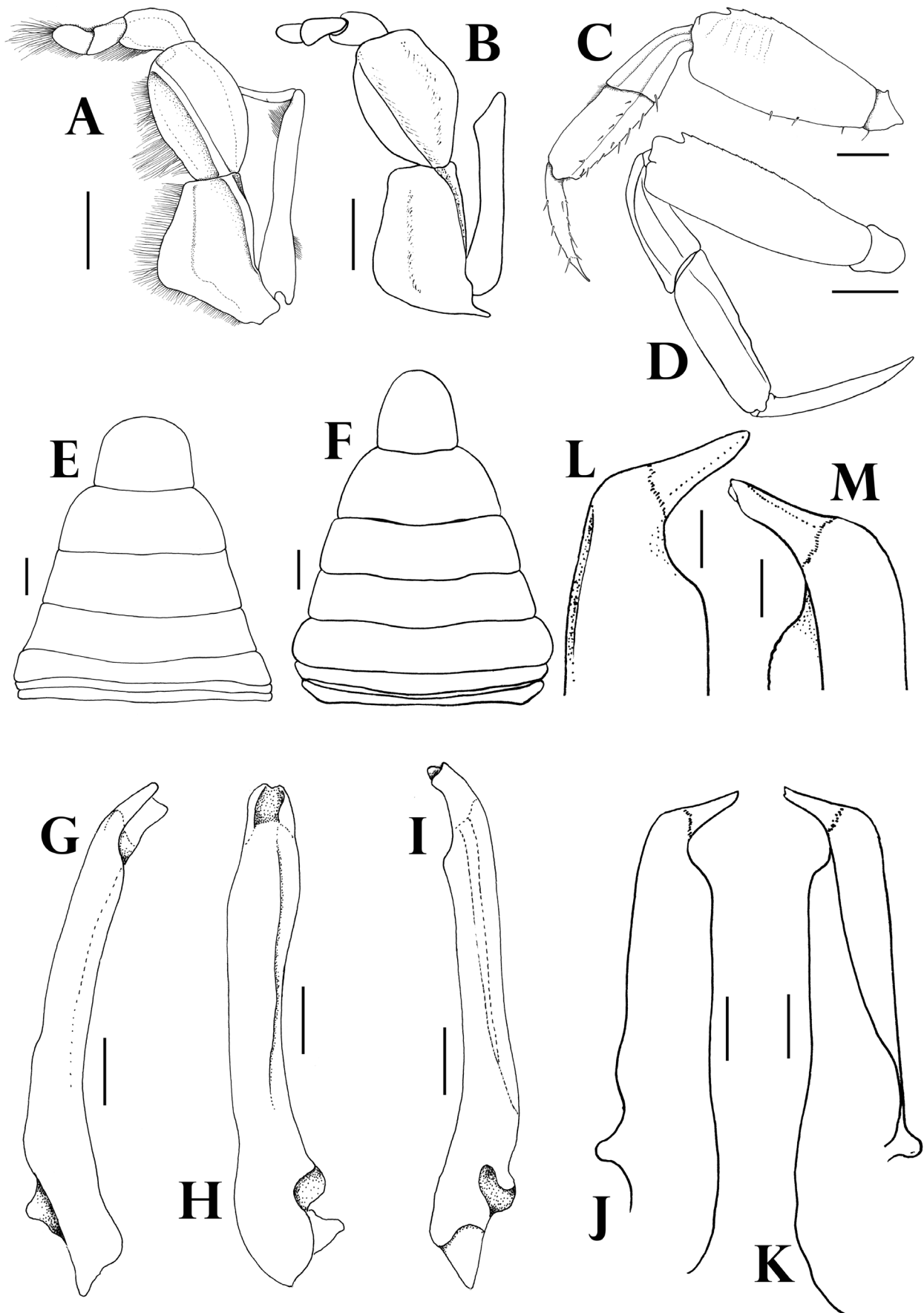


Fig. 3. A, C, E, G-I, *Geosesarma bintan*, new species, holotype, male, 11.2 × 9.8 mm (MZB Cru 3813), Bintan Island; B, D, F, J-M, *Geosesarma raj*, new species, holotype, male, 11.8 × 10.9 mm (MZB Cru 3814, ex ZRC 2007.0676), Bintan Island. A, B, outer view of left third maxilliped; C, D, left fourth ambulatory leg, dorsal view; E, F, male abdomen; G, ventral view of left G1 (denuded); H, lateral view of left G1 (denuded); I, dorsal view of left G1 (denuded); J, ventral view of left G1 (denuded); K, dorsal view of left G1 (denuded); L, M, distal part of left G1 (denuded). Scale bars: A, B, E-I = 1.0 mm; C, D = 2.0 mm; J, K = 0.5 mm; L, M = 0.25 mm.

Bintan Island: Gunong (= Mount) Bintan, above lower waterfalls (attacked by ants), coll. G. Subaraj, 23 June 2007; 1 male (9.4 × 9.0 mm), 2 females (7.3 × 6.8 mm, 6.4 × 6.2 mm) (ZRC 1996.133–135), Gunung Bintan Besar, coll. Y. H. Lee, 19 February 1996.

Diagnosis. Carapace almost squarish, not distinctly wider than long, lateral margins almost parallel (Fig. 1B, D); dorsal surfaces evenly covered with numerous granules and striae; H-shaped median depression deep; postfrontal cristae prominent, margins sharp; exorbital tooth triangular, curving obliquely, with additional low tooth behind it (Figs. 1B, 2B). Exopod of third maxilliped relatively stout, without flagellum (Fig. 3B). Male chelae with long fingers, numerous granules on palm (dorsally and ventrally) and proximal part of dactylus; dorsal margin of dactylus with 8 or 9 sharp granules on proximal two-thirds (Fig. 2D). Ambulatory legs with relatively slender meri, with sharp subdistal spine on dorsal margin, surface almost smooth; propodus elongate (Figs. 1B, 3D). Male abdomen relatively narrow; telson longer than broad, with rounded tip (Fig. 3F). G1 relatively stout, distal chitinous part elongate, tapering; subdistal part broad (Fig. 3J–M).

Colour. The carapace of this species is reddish brown in life, with the chelipeds bright orange (Fig. 4).

Etymology. The species is named after G. Subaraj (“Raj” to all his friends), the collector. The specific epithet, *raj*, is used as a noun in apposition.



Fig. 4. *Geosesarma raj*, new species, holotype, male, 11.8 × 10.9 mm (MZB Cru 3814, ex ZRC 2007.0676), Bintan Island. Colour in life (Photograph by: T. M. Leong).

Remarks. The quadrate carapace, the absence of a flagellum on the exopod of the third maxilliped, and the stout G1, which has a prominent, chitinised, beak-like structure on the distal end with the subdistal part broad, ally *Geosesarma raj*, new species, with species like *G. malayanum* Ng & Lim, 1986, *G. scandens* Ng, 1986, *G. tiomanicum* Ng, 1986, from Peninsular Malaysia, and *G. katibas* Ng, 1995, from Sarawak, East Malaysia.

Geosesarma raj, new species, can be distinguished from *G. scandens* (type locality: Fraser’s Hill) by its relatively longer third maxilliped merus (Fig. 3B) (shorter in *G. scandens*; cf. Ng, 1988: fig. 62C) and the upward-directed (at a more gradual angle) chitinised distal part of the G1 (Fig. 3J–M) (chitinised distal part directed at a steeper angle in *G. scandens*; cf. Ng, 1988: fig. 62D, E). *Geosesarma raj*, new species, can be separated from *G. malayanum* (type locality: Johor) by its more rugose dorsal surfaces of the carapace (Fig. 1B, D) (relatively less rugose in *G. malayanum*; cf. Ng & Lim, 1987: pl. 1; Ng, 1988: fig. 63A); relatively shorter ambulatory legs (Fig. 1B) (longer in *G. malayanum*; cf. Ng & Lim, 1987: pl. 1; Ng, 1988: fig. 63A); and the G1 which is slightly less stout, with the chitinised distal part relatively longer (Fig. 3J–M) (stouter with the chitinised distal part relatively short in *G. malayanum*; cf. Ng & Lim, 1987: fig. 1; Ng, 1988: fig. 63D–G). The new species differs from *G. tiomanicum* (type locality: Pulau Tioman) by its relatively longer third maxilliped merus (Fig. 3B) (relatively shorter merus in *G. tiomanicum*; cf. Ng, 1988: fig. 61C), the tip of the chitinised distal part of the G1 being subtruncate (Fig. 3J–M) (tip sharp; cf. Ng, 1988: fig. 61D, E). From *G. katibas* (type locality: Sarawak), *G. raj*, new species, can be distinguished by its relatively longer third maxilliped merus (Fig. 3B) (shorter in *G. katibas*; cf. Ng, 1995: fig. 11B); the dorsal margin of the dactylus of the male major chela having fewer (8 or 9) and less developed granules (Fig. 2B) (11 distinct granules; cf. Ng, 1995: fig. 11C, D); and the G1 being proportionately longer and less stout (Fig. 3J–M) (relatively shorter and stouter in *G. katibas*; cf. Ng, 1995: fig. 12A–E).

In many other parts of Peninsular Malaysia and Singapore, there is one lowland species living in swampy areas, often in burrows, and another that occurs in higher altitudes, under rocks in fast-flowing streams. In Johor and Singapore, for example, *G. peraccae* occurs in lowland freshwater swamps while *G. nemesis* and *G. malayanum* prefer high-elevation areas with fast-flowing streams (see Ng & Lim, 1987; Ng, 1988, 1990). The same situation appears to be present in Pulau Bintan, with *G. bintan* as the lowland species while *G. raj* occurs in more montane habitats, but not necessarily in streams.

ACKNOWLEDGEMENTS

The authors are grateful to the various collectors who helped obtain the present specimens, especially G. Subaraj, who looked out for crabs for the second author during his work in Bintan. Thanks are also due to Leong Tzi Ming for the colour photographs of *G. raj*. The first author’s work in

Singapore was supported by a postdoctoral appointment from the then Department of Zoology in 1999–2000, and subsequently by a research fellowship from the Lee Kong Chian Natural History Museum, Faculty of Science, National University of Singapore.

LITERATURE CITED

- Chou, LM, Huang D, Tun KPP, Kwik JTB, Tay YC & Seow AL (2010) Temporal changes in reef community structure at Bintan Island (Indonesia) suggest need for integrated management. *Pacific Science*, 64(1): 99–111.
- De Man JG (1892) Carcinological studies in the Leyden Museum, No. 6. *Notes Leyden Museum*, 14(36): 225–264, pls. 7–10.
- Low JKY, Ng PKL & Chou LM (1995) Using obligate symbiont populations as indicators of near-shore coral reef health. In: Watson D, Ong KS & Vigers G (eds.) *ASEAN Criteria and Monitoring: Advances in Marine Environmental Management and Human Health Protection*, Proceedings of the ASEAN-Canada Midterm Technical Review Conference on Marine Science, 24–28 October 1994. EVS Environmental Consultants, Vancouver, and National Science and Technology Board, Singapore. Pp. 246–250.
- Manuel-Santos MR & Yeo DCJ (2007) A new species of *Geosesarma* from Palawan, Philippines (Crustacea: Decapoda: Brachyura: Sesarmidae). *Zootaxa*, 1607: 63–67.
- Milne-Edwards A (1869) Notes sur quelques nouvelles espèces du genre *Sesarma* (Say). *Nouvelle Archives du Muséum d'Histoire Naturelle*, Paris, 5: 25–31.
- Naruse T & Jaafar Z (2009) *Geosesarma aedituens*, a new terrestrial crab (Crustacea: Decapoda: Brachyura: Sesarmidae) from Bali, Indonesia. *Raffles Bulletin of Zoology*, 57(1): 183–187.
- Ng PKL (1986) Preliminary descriptions of 17 new freshwater crabs of the genera *Geosesarma*, *Parathelphusa*, *Johora* and *Stoliczia* (Crustacea: Decapoda: Brachyura) from South East Asia. *Journal of the Singapore National Academy of Science*, 15: 36–44.
- Ng PKL (1988) *The Freshwater Crabs of Peninsular Malaysia and Singapore*. Department of Zoology, National University of Singapore, Shinglee Press, Singapore, i-viii, 1–156 pp., figs. 1–63, 4 pls.
- Ng PKL (1990) The freshwater crabs and prawns of Singapore. In: Chou LM & Ng PKL (eds.) *Essays in Zoology*. Department of Zoology, National University of Singapore. Pp. 189–204.
- Ng PKL (1995) On one new genus and three new species of freshwater crabs (Crustacea: Decapoda: Brachyura: Potamidae and Grapsidae) from Lanjak-Entimau, Sarawak, East Malaysia, Borneo. *Zoologische Mededelingen*, 69(5): 57–72.
- Ng PKL & Chuang CTN (1996) The Hymenosomatidae (Crustacea: Decapoda: Brachyura) of Southeast Asia, with notes on other species. *Raffles Bulletin of Zoology*, Supplement 3: 1–82.
- Ng PKL, Guinot D & Davie P (2008) *Systema Brachyurorum: Part I*. An annotated checklist of extant brachyuran crabs of the world. *Raffles Bulletin of Zoology*, Supplement 17: 1–286.
- Ng PKL & Lim RP (1987) The taxonomy and biology of the nepenthophilous freshwater sesarmine crab, *Geosesarma malayanum* Ng and Lim, 1986 (Crustacea: Decapoda: Brachyura: Grapsidae from Peninsular Malaysia). *Malayan Nature Journal*, 41: 393–402.
- Ng PKL, Liu H-C & Schubart CD (2004) *Geosesarma hednon*, a new species of terrestrial crab (Crustacea: Decapoda: Brachyura: Sesarmidae) from Taiwan and Philippines. *Raffles Bulletin of Zoology*, 52(1): 239–249.
- Ng PKL & Tan CGS (1995) *Geosesarma notophorum* sp. nov. (Decapoda, Brachyura, Grapsidae, Sesarminae), a terrestrial crab from Sumatra, with novel brooding behaviour. *Crustaceana*, 68(3): 390–395.
- Nobili G (1903) *Crustacei di Singapore*. *Bolletino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino*, 18(455): 1–39, 1 pl.
- Schubart CD, Cuesta JA, Diesel R & Felder DL (2000) Molecular phylogeny, taxonomy, and evolution of non-marine lineages within the American grapsoid crabs (Crustacea: Brachyura). *Molecular Phylogenetics and Evolution*, 15(2): 179–190.
- Serène R (1968) Note préliminaire sur de nouvelles espèces de *Sesarma* (Decapoda Brachyura). *Bulletin du Muséum nationale d'Histoire National*, Paris, (2)39(5): 1084–1095, pls. 1, 2.
- Soh CL (1969) Abbreviated development of a non-marine crab, *Sesarma* (*Geosesarma*) *peraccae* (Brachyura: Grapsidae), from Singapore. *Journal of Zoology*, London, 158: 357–370.
- Tweedie MWF (1940) New and interesting Malaysian species of *Sesarma* and *Utica* (Crustacea, Brachyura). *Bulletin of the Raffles Museum*, 16: 88–113, figs. 1–12, pl. XXIV.
- Winata CK, Nadina A & Rofik M (2008) Preliminary study on sea turtles in Bintan Island, Riau Archipelago, Indonesia. *Marine Turtle Newsletter*, 119: 13–14.
- Yeo DCJ, Ng PKL, Cumberlidge N, Magalhães C, Daniels SR & Campos MR (2008) Global diversity of crabs (Crustacea: Decapoda: Brachyura) living in freshwater. In: Balian EV, Lévêque C, Segers H & Martens K (eds.) *Freshwater Animal Diversity Assessment*. *Hydrobiologia*, 575: 275–286.