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SODHIANA, A NEW GENUS OF FRESHWATER CRAB FROM SOUTH ASIA (DECAPODA: BRACHYURA: GECARCINUCIDAE)

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ABSTRACT. — A new genus, *Sodhiana*, is established for three species of gecarcinucid freshwater crabs formerly assigned to *Sartoriana* Bott, 1969. The three species, *Sodhiana blanfordi* (Alcock, 1909), *Sd. afghaniensis* (Pretzmann, 1963), and *Sd. rokitanskyi* (Pretzmann, 1971), superficially resemble *Sartoriana* in gross carapace morphology, some specific carapace characters, and especially in the general form of the male first pleopod. However, they are distinguishable from *Sartoriana* by significant carapace, cheliped, male abdomen, and male first pleopod characters. This paper redefines *Sartoriana* and describes *Sodhiana*, new genus.

KEY WORDS. — Brachyura, Gecarcinucidae, new genus, *Sartoriana*, freshwater crab, South Asia

INTRODUCTION

Sartoriana was established by Bott (1969) for gecarcinucid species with a well developed epibranchial tooth and distinct epigastric and postorbital cristae, and a male first pleopod with a short and straight terminal segment. Bott (1969, 1970) designated *Paratelphusa spinigera* Wood-Mason, 1871, as the type species, and recognised *Paratelphusa* (*Paratelphusa*) *blanfordi* Alcock, 1909, as the only other species in the genus. He, however, synonymised two other species, *Paratelphusa* (*Paratelphusa*) *trilobata* Alcock, 1909, and *Parathelphusa* (*Parathelphusa*) *afghaniensis* Pretzmann, 1963, under *St. spinigera* and *St. blanfordi*, respectively (Bott, 1970). Ng et al. (2008) recognised five species of *Sartoriana,* including the four species mentioned above together with a fifth species described by Pretzmann in 1971, viz., *St. trilobata* (Alcock, 1909), *St. afghaniensis* (Pretzmann, 1963), *St. spinigera* (Wood-Mason, 1871), *St. blanfordi* (Alcock, 1909), and *St. rokitanskyi* (Pretzmann, 1971).

While all five currently recognised *Sartoriana* species superficially possess the general characters that match the broad definition of the genus by Bott (1969, 1970), closer examination of many other aspects of their morphology reveals that they in fact fall into two morphologically distinct groups. One group includes the type species, *St. spinigera* (type locality: vicinity of Calcutta, West Bengal) and *St. trilobata* (Assam), while the other group comprises *St. blanfordi* (type locality: Beluchistan, a region that currently straddles southeastern Iran, southern Afghanistan and western Pakistan), *St. afghaniensis* (type locality: Afghanistan), and *St. rokitanskyi* (type locality: Bandar Abass, Iran). The differences between these groups, some of which have been previously noted in comparisons between *St. blanfordi* and *St. spinigera* (see Alcock, 1909, 1910; Bott, 1970), argue that they are monophyletic groups, which should be recognised as separate genera.

The aim of this paper is to redefine *Sartoriana*, restricting it to the type species, *St. spinigera*, and *St. trilobata*; and establish a new genus, *Sodhiana*, for the other three species, *Sd. blanfordi*, *Sd. afghaniensis*, and *Sd. rokitanskyi*. Detailed taxonomic accounts and re-descriptions of these species will be dealt with later.

The following abbreviations are used: G1 for male first pleopod, G2 for male second pleopod. Measurements are of carapace width and length respectively. Terminology used essentially follows Ng (1988). All measurements are in millimetres. Specimens are deposited in the Natural History Museum (NHM), London, UK; Naturhistorisches Museum Wien, Austria (NHMW); Zoological Reference Collection (ZRC) of the Raffles Museum of Biodiversity Research, National University of Singapore; the Zoological Survey of

India (ZSI), Calcutta, India; and the Zoological Collections of the University of Hormozgan (ZCUH), Bandar Abbas, Iran.

TAXONOMY

GECARCINUCIDAE RATHBUN, 1904

Sartoriana Bott, 1969

Sartoriana Bott, 1969: 361, 1970: 38; Brandis & Sharma, 2005: 18; Ng et al., 2008: 71; De Grave et al., 2009: 32

Type species. — *Paratelphusa spinigera* Wood-Mason, 1871, by original designation.

Diagnosis. — Carapace transverse, high, surfaces smooth; epigastric cristae distinct, well-developed, not confluent with and slightly anterior to postorbital cristae; postorbital cristae distinct, sharp, not reaching anterolateral margin, not confluent with epibranchial tooth; external orbital angle very broad; epibranchial tooth well-developed, acute, situated well posterior to level of postorbital cristae, at widest part of carapace; branchial regions swollen, appearing distinctly convex from frontal view. Ischium of third maxilliped smooth, with well-developed longitudinal median sulcus; exopod with long, well-developed flagellum. Merus of chelipeds with subterminal spine on upper margin; fingers distinctly longer than palm, with pointed tips. Male abdominal cavity reaching imaginary line joining middle part of cheliped bases. Male abdomen T-shaped, with strongly concave lateral margins. G1 terminal segment straight, short, about one-fifth length of subterminal segment, cone-shaped, distinctly separated from subterminal segment; subterminal segment relatively stout, gradually tapering distally. G2 distal segment relatively long.

Remarks. — *Sartoriana* is more precisely defined here for only two species: *St. spinigera* [type species], and *St. trilobata.* Bott (1970) had regarded *S. trilobata* as a junior synonym of *S. spinigera*, but Ng et al. (2008) preferred to recognise it as a distinct species although the reasons behind this decision were not given. Preliminary investigations by the first author based on type material support this action (unpublished data).

Sartoriana (represented by *St. spinigera*) and *Sodhiana*, new genus (represented by *Sd. blanfordi*) are sister groups, forming two distinct clades in the molecular study by Klaus et al. (2010). They can be distinguished morphologically by a suite of carapace, cheliped, male abdomen, and G1 characters (see *Remarks* under *Sodhiana*, new genus). We can be confident of the monophyly of these two genera because several of the diagnostic characters of both groups actually represent apomorphies (e.g., see below).

Next to *Sodhiana*, *Sartoriana* appears to be most closely related to the genus *Barytelphusa* (see Klaus et al., 2010). The following morphological characters, however, clearly separate *Sartoriana* from *Barytelphusa*: carapace epibranchial tooth acute and positioned much further posteriorly (vs. epibranchial tooth triangular and more anteriorly positioned); postorbital cristae not reaching anterolateral margins or confluent with epibranchial teeth (vs. postorbital cristae reaching anterolateral margins and confluent with epibranchial teeth); subterminal spine present on the upper margin of the cheliped merus (vs. subterminal spine absent from cheliped merus); branchial regions distinctly swollen (vs. branchial regions flat); male abdomen distinctly T-shaped (vs. male abdomen narrowly triangular); and overall G1, including terminal and subterminal segments relatively short and stout (vs. G1 including terminal and subterminal segments relatively elongate and slender) (Figs. 1, 3; cf. Bott, 1970; Bahir & Yeo, 2007).

Pretzmann (1971: 474) had regarded *Sartoriana* as a subgenus of *Liotelphusa* when he described the subspecies *blanfordi rokitanskyi*. However, this action has never been followed, with various workers continuing to recognise *Sartoriana* and *Liotelphusa* as separate genera from different subfamilies (Brandis & Sharma, 2005; Ng et al., 2008; De Grave et al., 2009; Klaus et al., 2010). Morphologically, *Sartoriana* species are much larger than *Liotelphusa* species—at least double in size in terms of adult carapace width; and they have a more transverse and convex carapace with an acute, well-developed, and more posteriorly positioned epibranchial tooth (versus squarish and flat carapace with a low or poorly-developed, and anteriorly positioned epibranchial tooth) (present study; cf. Bott, 1970; unpublished data). There is also good molecular evidence that *Sartoriana* is only distantly related to *Liotelphusa* (see Klaus et al., 2010: Fig. 2). All these differences apply to *Sodhiana* as well.

Distribution. — Pakistan, northern India, Bangladesh.

Sodhiana, new genus

Sartoriana Bott, 1970: 38 (part); Ng et al., 2008: 71 (part); Kamrani et al., 2009: 25 [not *Sartoriana* Bott, 1969]

Type species. — *Paratelphusa* (*Paratelphusa*) *blanfordi* by present designation.

Diagnosis. — Carapace broader than long, surfaces smooth; epigastric cristae low, weak, not confluent with and slightly anterior to postorbital cristae; postorbital cristae distinct, sharp, more or less reaching anterolateral margin, confluent with epibranchial tooth; external orbital angle very broad; epibranchial tooth well developed, triangular, situated in line with or slightly posterior to level of postorbital cristae, anterior to widest part of carapace; branchial regions relatively flat, appearing flat to gently convex from frontal view. Ischium of third maxilliped smooth, lacking longitudinal median sulcus; exopod with long, well-developed flagellum. Merus of chelipeds lacking subterminal spine on upper margin; fingers as long as palm, with blunt, spoon-shaped or spatulate fingertips. Male abdominal cavity reaching imaginary line joining middle part of cheliped bases. Male

abdomen triangular, with gently concave lateral margins. G1 slender; terminal segment straight, short, about one-fifth length of subterminal segment, cone-shaped, distinctly separated from subterminal segment; subterminal segment relatively slender, gradually tapering distally. G2 distal segment relatively long.

Etymology. — The genus is named after the late Professor Navjot Sodhi, our dear friend and colleague; one of the great leaders and drivers not only in conservation biology in Asia, but also in the original Biodiversity and Ecology research group in the Department of Biological Sciences. Gender feminine.

Remarks. — The type species of this genus, *Sodhiana blanfordi*, is morphologically similar to *Sartoriana spinigera*, in overall carapace physiognomy and G1 morphology, particularly in the single well-developed epibranchial tooth and distinct epigastric and postorbital cristae, and relatively short and straight G1 terminal segment. Bott (1969, 1970) placed both species in *Sartoriana* on the basis of these characters, while highlighting the following interspecific differences. In fact, some of these differences had been observed 60 years earlier by Alcock (1909, 1910): i) carapace proportionately flatter in *Sd. blanfordi* than in *St. spinigera* (Fig. 1A–D); ii) carapace epibranchial tooth positioned much further anteriorly in *Sd. blanfordi* than in *St. spinigera* (Fig. 1A,B); iii) chelae with spoon-tipped fingers in *Sd. blanfordi* (vs. finger tips pointed in *St. spinigera*) (Fig. 1A,B) (see also Fig. 2B,D,F–H); and iv) no subterminal spine on the upper margin of the cheliped merus in *Sd. blanfordi* (vs. subterminal spine present in *St. spinigera*). While the two species are undoubtedly closely related (Klaus et al., 2010), such high degree of morphological differentiation argues for separating

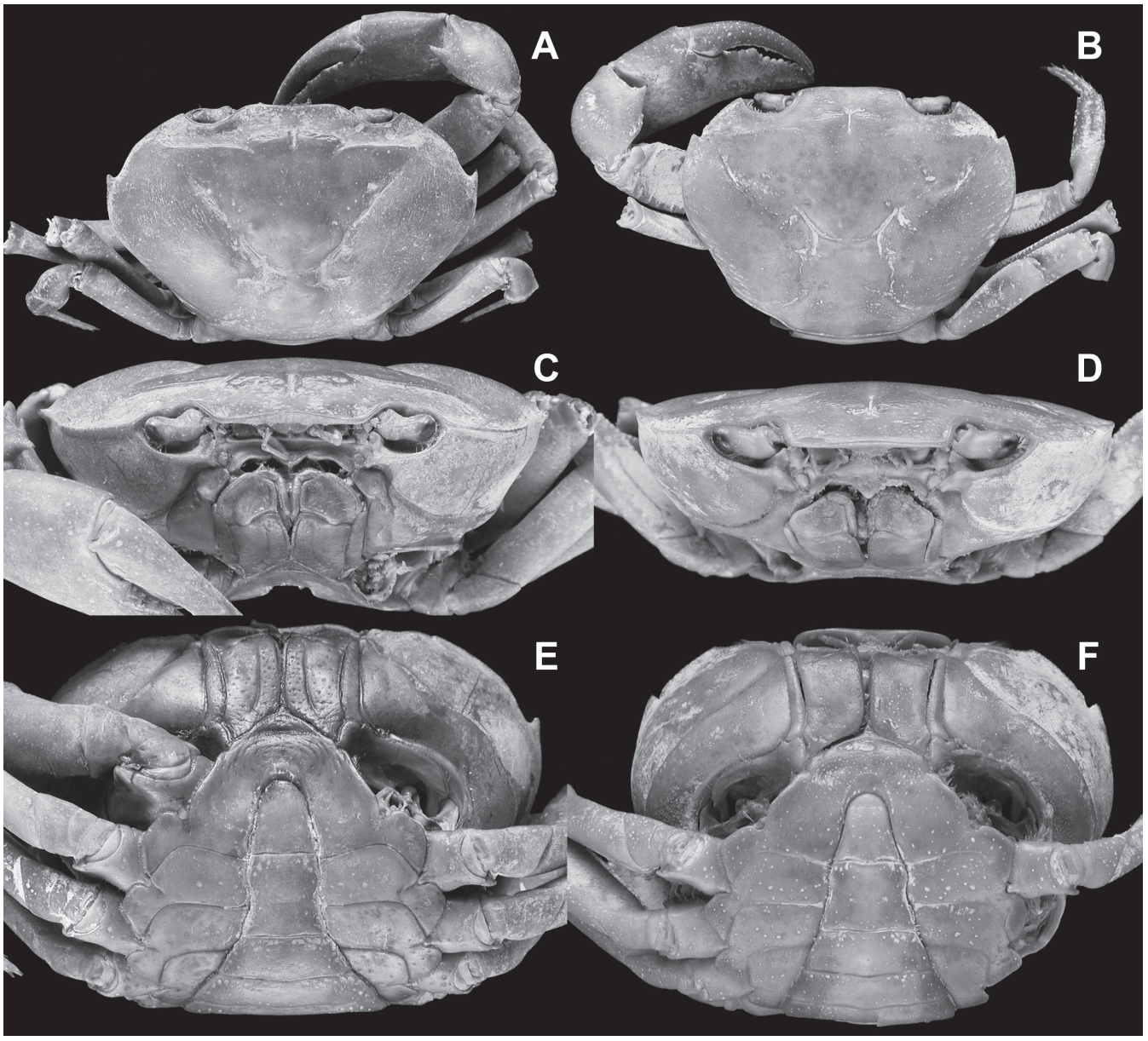

Fig. 1. A, C, E, *Sartoriana spinigera*, (possible syntype) male (59.2 × 41.1 mm) (ZSI 4116/4), B, D, F, *Sodhiana blanfordi*, syntype, male (43.2 × 33.2 mm) (ZSI 4043/4). A, B: dorsal view; C, D: frontal view; E, F: ventral view.

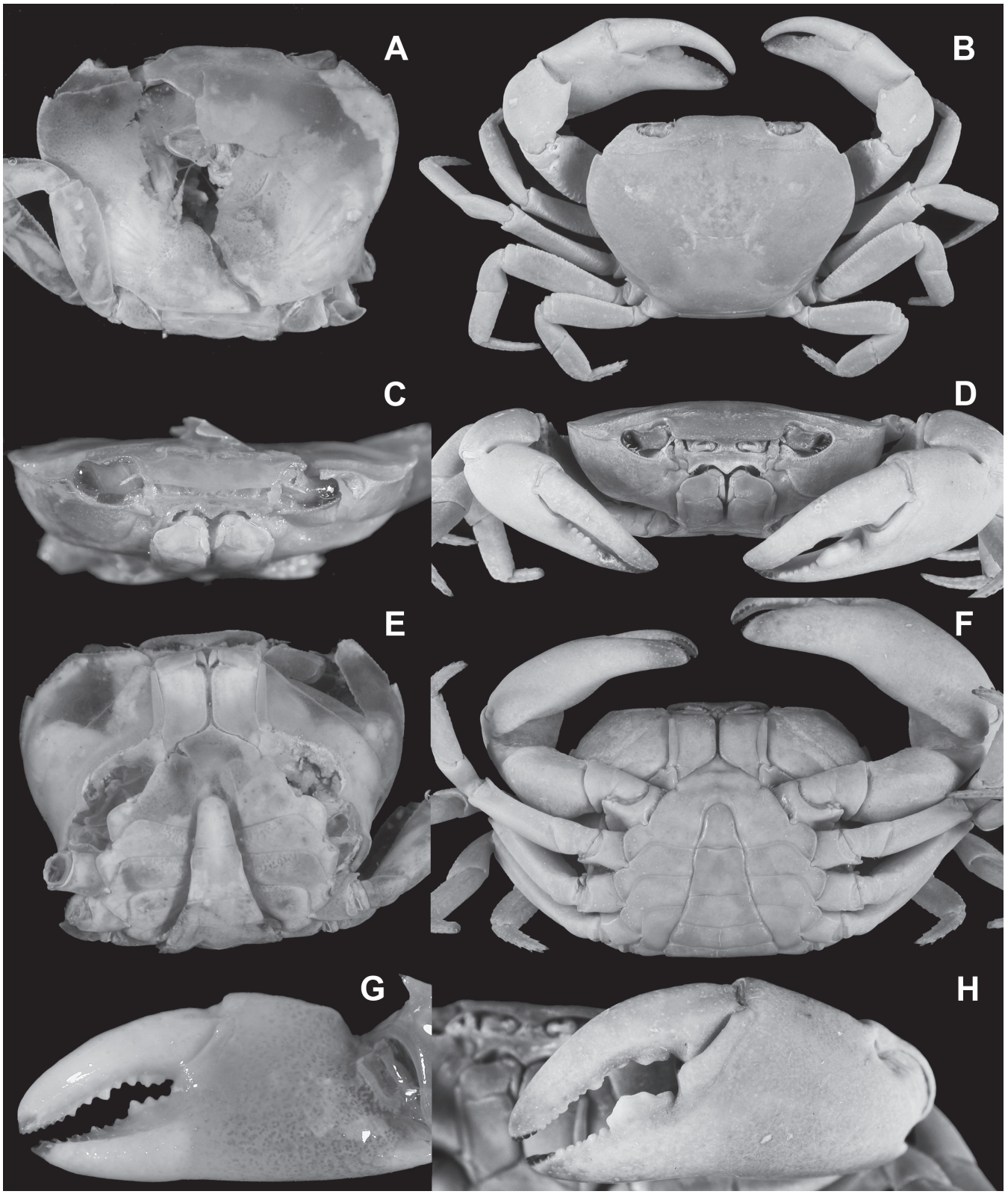

Fig. 2. A, C, E, G, *Sodhiana afghaniensis*, holotype, male (ca. 27.6 × 20.0 mm) (NHMW 3243) (Photographs by: Peter Dworschak), B, D, F, H, *Sodhiana rokitanskyi*, holotype, male (36.8 × 27.8 mm) (NHMW 3784). A, B: dorsal view; C, D: frontal view; E, F: ventral view; G, H: major chela.

them in two genera. Since *St. spinigera* is the type species of *Sartoriana*, this means the establishment of a new genus for *P. blanfordi*, here named *Sodhiana*.

Type and non-type material was examined and many differences in other key morphological characters were found, which provide supporting evidence to separate *Sodhiana* from *Sartoriana* including: carapace relatively less transverse, ca. 1.3 times broader than long (vs. carapace more transverse, ca. 1.4 times broader than long) (Figs. 1A,B, 2A,B); epigastric and postorbital cristae lower and less strongly developed (vs. cristae strongly developed) (Figs. 1A–D, 2A–D); postorbital cristae reaching anterolateral margins and confluent with epibranchial teeth (vs. not reaching anterolateral margin) (Figs. 1A–D, 2A–D); anterolateral margins less strongly convex (versus margins more strongly convex) (Figs. 1A,B, 2A,B); epibranchial tooth triangular (vs. tooth acute) (Figs. 1A,B, 2A,B); branchial regions relatively flat (vs. branchial regions distinctly swollen) (Figs. 1A–D, 2A–D); ischium of the third maxilliped lacking a longitudinal median sulcus (vs. ischium with distinct, well developed longitudinal median sulcus) (Figs. 1C–F, 2C–F); male abdomen triangular (vs. male abdomen distinctly T-shaped) (Figs. 1E,F, 2E,F); and overall G1 and subterminal segment relatively slenderer (vs. overall G1 and subterminal segment relatively stouter) (Fig. 3).

Sodhiana, as presently defined, includes three species: *Sd. blanfordi* [type species]*, Sd. afghaniensis*, and *Sd. rokitanskyi* [Afghanistan]. Bott (1970) had synonymised *Sd. afghaniensis* under *St. blanfordi*, but Ng et al. (2008) restored the species, and also recognised *Liotelphusa* (*Sartoriana*) *blanfordi rokitanskyi* as a valid species of *Sartoriana* although they did not elaborate on their reasons. However, unpublished data from the first author indicate that both species do possess specific diagnostic characters coupled with distinct distributions, which support the action of Ng et al. (2008) in recognising their specific status.

Kamrani et al. (2009), in reporting on *Sd. rokitanskyi* from Iran, commented that "although Pretzmann (1963) regarded *S. afghaniensis* (type locality Rud, Afghanistan) as close to *S. blanfordi*, it is in fact more closely related to *S. spinigera*, sharing a similar carapace physiognomy and the diagnostic spine on the dorsal subdistal part of the cheliped merus". A re-examination of the type material shows otherwise; *St. afghaniensis* is actually morphologically closer to *St. blanfordi*, and both should be referred to *Sodhiana* (unpublished data).

Distribution. — South Asia: Pakistan, Afghanistan, and Iran

COMPARATIVE MATERIAL EXAMINED

Sartoriana spinigera: 1 male (58.8 × 39.7 mm), 1 female (50.0 × 36.9 mm), 1 juv. male (NHM 1889.6.17.39–43) (possible syntypes), Calcutta, India, coll. F. Day, no date; 3 males (largest 59.2 × 41.1 mm), 4 females (largest 52.6 × 36.9 mm), 3 juvs. (ZSI 4116/4) (possible syntypes), Calcutta, coll. J. Wood-Mason, no date; 1 male (24.1 × 17.6 mm), 2 juv. females (ZSI C4402/2), Umiam, East Khasi Hills, Meghalaya, coll. M. R. Rynth, 2 Aug.1976. [The ZSI specimens (collected from Calcutta by Wood-Mason, with no date) as well as the NHM specimens (collected from Calcutta by Day, with no date) are all probably syntypes because in the original description Wood-Mason (1871: 196) wrote: "I found this interesting species exceedingly abundant in the tanks of Calcutta. It has recently been collected by my servant, who accompanied Dr. Day on a trip to the upper waters of the Ganges, at Hardwar and at Roorkee, where it lives in

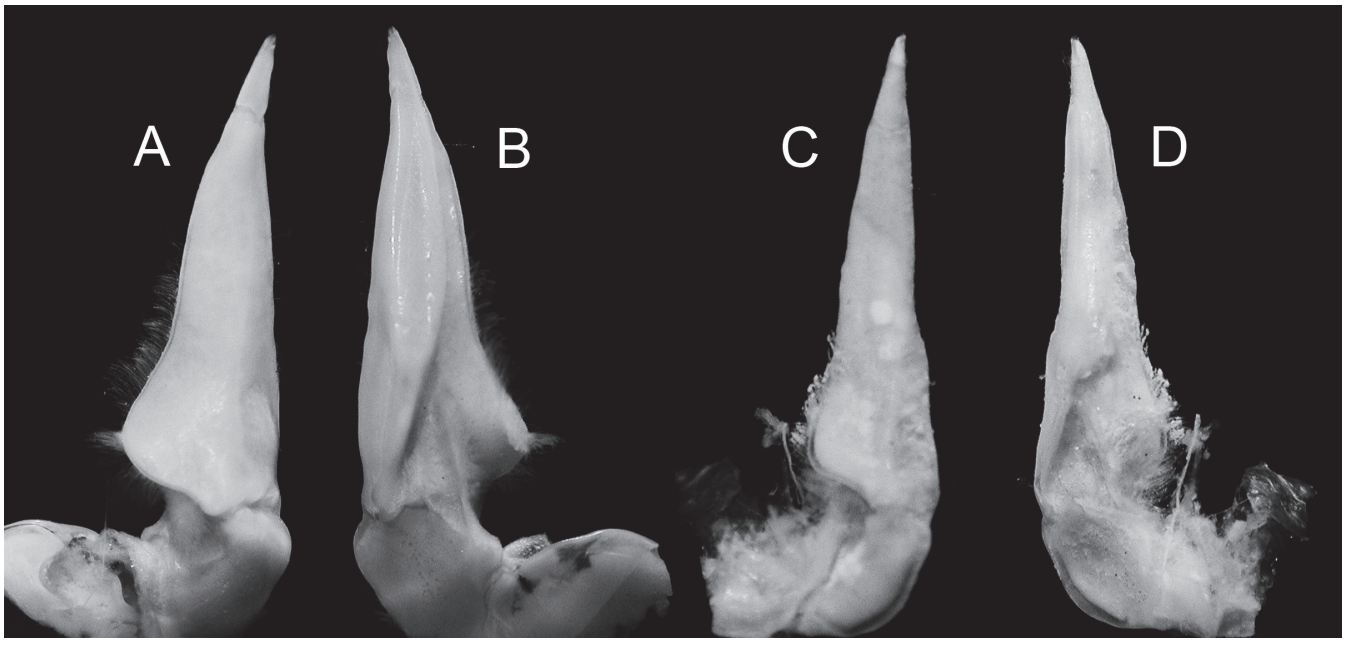

Fig. 3. A, B, *Sartoriana spinigera*, (possible syntype) male (59.2 × 41.1 mm) (ZSI 4116/4), C, D, *Sodhiana blanfordi*, syntype, male (43.2 × 33.2 mm) (ZSI 4043/4). A, C: right G1 dorsal view; C, D: right G1 ventral view.

the river itself and in the contiguous ponds and marshes." Unfortunately, both lots of material have no labels or precise dates of collections that could confirm their type status.]

Sartoriana* cf. *spinigera: 1 male (32.6 × 23.5 mm), 1 female (33.2 × 24.3 mm) (ZRC), jetty Karachi, Pakistan, coll. local collector, no date; 1 male (53.8 × 37.5 mm), 2 females (larger 37.7 × 25.6 mm) (ZRC), probably Mymesingh, north of Dhaka, near Bangladesh University, Bangladesh, coll. unknown, Jun.1996; 1 female (44.2 × 32.0 mm) (ZSI 3131/10), Karachi. coll. Karachi Museum, no date.

Sartoriana trilobata: Syntype, 1 female (34.7 × 24.5 mm) (ZSI 6969/3), Sibsagar, Assam, coll. S. E. Peal, no date.

Sodhiana blanfordi: Syntype, male (46.4 × 35.0 mm) (NHM 1905.10.13.5), Pishin, Baluchistan, presented by ZSI (original cat. no. ZSI 4043/4); syntypes, 4 males (largest 43.2 × 33.2 mm), 5 females (largest 36.9 × 28.8 mm) (ZSI 4043/4), Pishin, Baluchistan, coll. W. T. Blanford, no date; 1 male (41.8 × 31.8 mm), 1 female (37.3 × 28.8 mm) (ZRC), Punjgoor, Beluchistan, Pakistan, coll. Q. Kazmi, 19 Jan.2003; 2 males (larger 37.1 × 28.0 mm) (ZRC), Punjgoor, Beluchistan, Pakistan, coll. Q. Kazmi, 19 Aug.2003.

Sodhiana afghaniensis: Holotype, male (NHMW 3243), Afghanistan – East Perrien, Rud, coll. Gabriel, 1937.

Sodhiana rokitanskyi: Holotype, male (36.8 × 27.8 mm) (NHMW 3784), River Merab near Roodan, Iran, no coll. and date; 2 males (larger 26.2 × 20.0 mm), 7 females (largest 31.2 × 23.5 mm), (ZRC), Geno basin near hot spring, Bandar Abbas, 27°27'25"N, 56°20'28"E southern Iran, coll. E. Kamrani, 7 Nov.2008; 3 males (largest 28.2 × 21.8 mm), 2 females (larger 30.1 × 22.8 mm) (ZRC), 8 males (largest 36.0 × 30.0 mm), 2 females (largest 24.0 × 20.0 mm) (ZCUH), Rudan, near Bandar Abbas, southern Iran, coll. E. Kamrani, 2009.

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