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New records of spiders (Arachnida: Araneae) from the Sundarban Biosphere Reserve, India

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Abstract
The Bay of Bengal is engulfing Sundarban Biosphere Reserve day by day, facing extinction. The area abodes so many economically important flora and fauna and most of them are unexplored. Spiders are one of the such fauna that having biological, medicinal, pesticide values along with economic. They exhibit the ability to both lower and stabilize pest population making them excellent biological pest management candidates. Their silk now a day is used to make a diverse range of items like bullet proof clothing, parachutes, surgical threads, artificial tendons, biodegradable bottles. Venom is now being used as pesticides. Its active protein component is also used as drugs that prevent atrial fibrillation during cardiac failure. They are also used in Homeopathic medicines (viz. Aranea Diadema, Latrodectus Mactans, Latrodectus Hasselti, Tarentula Hispania, Lycosa Tarentula etc.) where tinctures are prepared by putting the living spiders into absolute alcohol.

Keywords: Spiders, new record, Sundarbans, India

1. Introduction
Sundarban Biosphere Reserve, a UNESCO World Heritage Site spreads over India and Bangladesh containing the largest mangrove belt of World. The Indian counterpart is bounded by the Ichamati-Raimangal River in the east, Hugli River in the west, Bay of Bengal in the south and the imaginary Dampier - I Hodges line drawn (during the years 1829-1830) in the north [1].

Contributions of Taxonomists [2-9] enriched the spider fauna of this unique mangrove ecosystem. In addition, scientific worker [10] published a pictorial handbook on the spider fauna of Sundarbans, which dealt with 115 species of spiders under 37 genera belonging to 13 families.

While surveying the different areas of Sundarbans under the insect pollinator project funded by MOEFCC, the authors collected several spider specimens and thus resulted new records of nine species from the Sundarban Biosphere Reserve including a new record from West Bengal.

2. Material and Methods
The study was conducted from May, 2014 to March, 2016 at different islands *viz*. Jharkhali, Kultali, Bakkhali, Bali, Gosaba, Satjelia and Sagar Island of the Indian counterpart of Sundarbans (Fig. 1). The specimens were collected either by hand or by beating or by sweeping net from the different areas and preserved temporarily in 70% alcohol as [11]. The examples were identified by consulting following literatures [2-6, 10] and then photographed with the help of Stereo Zoom Binocular Microscopes, model Leica EZ4 HD. Specimens examined are deposited in the "National Zoological Collections of Zoological Survey of India, Western Ghat Regional Centre Calicut" (ZSIK).

Abbreviations used here are CD = copulatory duct, FD = fertilization duct, RTA = retrolateral apophysis and VTA = ventrolateral apophysis.

3. Results
Previously a total of 115 species of spiders under 37 genera belonging to 13 families were reported from the Indian part of Sundarban Biosphere Reserve by [10]. Present communication reports 09 species of 08 genera belonging to 07 families of spider for the first time from the Sundarban Biosphere Reserve, India. All the species are listed below.

Class Arachnida
Order Araneae
Family Araneidae

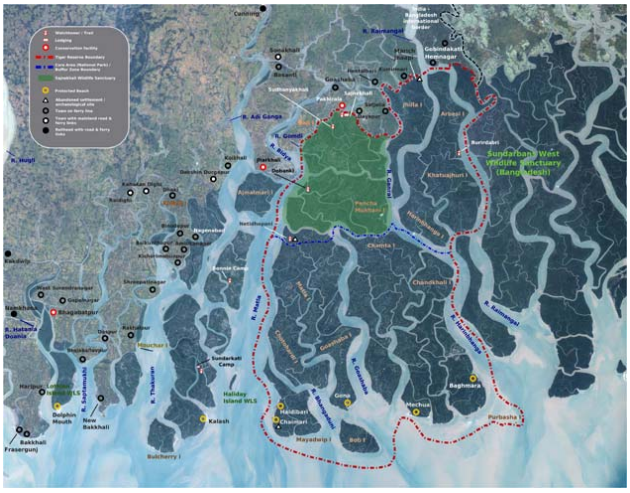

Fig 1: Different islands of Sundarbans.

1. *Araneus panchganiensis* Tikader & Bal
(Fig. 2)
Araneus pachganiensis Tikader & Bal, Rec. Zool. Surv. India, Occ. Pap., 24: 48 (1981).

Fig 2: *Araneus panchganiensis* Tikader & Bal, dorsal view, general habitus.

Diagnosis: Cephalothorax and legs yellowish, abdomen brownish yellow. Sternum heart-shaped, pointed behind, clothed with pubescence and hair, a broad yellowish patch in the middle. Legs long and strong, yellowish with distinct transverse bands, femora of all legs having with two dark brown transverse bands. Abdominal dorsum provided with two very conspicuous shoulder humps and dark brown patches forming a folium. Six pairs of sigilla arranged mid longitudinally on the dorsum. Epigyne with very strong triangular scape, a distinct dorsal depression, a pair of pointed horn-like projections at the copulatory openings. CD long, coiled. Spermatheca oval. FD shorter, converging.

Materials examined: 3 exs. ♀, India: West Bengal: Sundarban, Jharkhali, 30.iii.2016, coll. B. Mitra and party.

Distribution: India: Maharashtra, West Bengal [3, 12-14].

Family Lycosidae

2. *Lycosa phipsoni* Pocock
(Fig. 3)
Lycosa phipsoni Pocock, J. Bombay Nat. Hist. Soc. **12:** 751 (1899).

Fig 3: *Lycosa phipsoni* Pocock, dorsal view, general habitus.

Diagnosis: Abdominal dorsum with few brown mark and four pairs of sigilla. Venter with a broad, longitudinal, black patch extending from epigastric furrow to the base of spinnerets. *Epigynum* not so much sclerotized, a highly sclerotized margin near furrow, a guide pocket in each lateral side; tubular CD arising anteriorly and curved; spermatheca sac-like, longer than wide, looking banana like; FD posterior to spermatheca and converging.

Materials examined: 1 ex. ♀, India: West Bengal: Sundarban, Bali island, 26.v.2014, coll. B. Mitra and party.

Distribution: India: Assam, Maharashtra, Orissa, West Bengal; Bhutan, China, Nepal, Taiwan [4, 12-13, 15].

3. *Pardosa pusiola* (Thorell)
(Fig. 4)
Lycosa pusiola Thorell, Bih. Kong. Sven. Veten. Akad. Hand, 24(2): 65 (1891).
Pardosa pusiola (Thorell); Simon, Mitt. Nat. Mus. Hamburg, 22: 70 (1905).

Fig 4: *Lycosa pusiola* Thorell, dorsal view, general habitus.

Diagnosis: Centre of thoracic region provided with conspicuous fovea, along the border few long hairs. Two conspicuous dark brown, longitudinal bands extend from the third row of eyes to the base of cephalothorax. Abdominal mid-longitudinal area with a pale stripe. Epigynum with a 'I'-like median septum and two horn like hoods anteriorly alongside the guide pockets; CD arising from the guide pocket, curved; spermatheca nearly oval; FD short, upwardly directed above the spermatheca.

Materials examined: 1 ex. ♂, India: West Bengal: Sundarban, Bakkhali, Fressarganj, 18. vi. 2015, coll. B. Mitra and party.

Distribution: India: West Bengal; Bangladesh, Bhutan, China, Indonesia, Myanmar, Nepal, Sri Lanka [4, 12-13, 15].

Family Oxyopidae

4. *Oxyopes chittriae* Tikader
(Fig. 5)
Oxyopes chittriae Tikader, Proc. Ind. Acad. Sc., 62(B): 140-144.

Fig 5: *Oxyopes chittriae* Tikader, dorsal view, general habitus.

Diagnosis: Cephalothorax and legs brownish-green, abdomen brown. Abdomen mid-dorsally with a conspicuous longitudinal, deep-brown broad stripe, extending from base to end and this deep brown stripe surrounded by chalk-white patches. Epigynum 'W'-like with a pocket anteromedially, where CDs open. CD very long, coiled more than thrice. Spermatheca nearly triangular. FD short, thin and backwardly and inwardly directed.

Materials examined: 1 ex. ♀, India: West Bengal: Sundarban, Jharkhali, 31.iii.2016, coll. B. Mitra and party.

Distribution: India: Gujarat, Maharashtra, West Bengal (new record) [12-13, 16-17].

Family Saltisidae

5. *Carrhotus viduus* (C. L. Koch)
(Fig. 6)
Plexippus viduus C. L. Koch, Die Arachniden, **104**: 1166 (1846).
Carrhotus viduus (C. L. Koch); Thorell, Bih. Kong. Sven. Veten. Akad. Hand, 24 (2): 142 (1891).

Fig 6: *Carrhotus viduus* (C. L. Koch), dorsal view, general habitus.

Diagnosis: Cephalothorax of both sexes jet black with two broad, parallel bonds of white hairs, extending from lower end of ocular quadrangle to the tip of abdomen. Abdomen also jet black. CD tubular, anteriorly directed and curved. Spermatheca bilobed. FD thin, anteriorly directed and curved towards CD. Male palpal embolus conical apically in the middle of bulbus. Bulbus posteriorly produced over the tibia. RTA produced with a blunt tip. VTA weakly produced.

Materials examined: 1 ex. ♂, India: West Bengal: Sundarban, Kultali, 24.iv.2016, coll. B. Mitra and party.

Distribution: India: Assam, Kerala, West Bengal; Bintan Island, China, Indonesia, Malacca, Malaysia, Myanmar, Nepal, Penang Island, Singapore, Sri Lanka, Sumbawa [12-13, 18].

Family Sparassidae

6. *Olio tener* (Thorell)
(Fig. 7)
Sparassus tener Thorell, Bih. Kong. Sven. Veten. Akad. Hand, 24(2): 80 (1891).
Olios tener (Thorell); Gravely, Rec. Ind. Mus. Calcutta, 33: 244(1931).

Fig 7: *Olios tener* (Thorell), dorsal view, general habitus.

Diagnosis: Cephalothorax and legs pale yellowish in colour, abdomen pale yellowish. Chelicera moderate, yellowish, armed with 2 and 5 teeth on outer and inner margins of fang furrow respectively. Abdomen oval, dorsum provided with 2 pairs of sigilla and a light greyish marking. Epigynum with distinct lateral lobes, plate like median piece in between these, extending from anterior end to the posterior end, subdivided at the posterior end. CD very short and anterior to spermatheca. Spermatheca nearly 'N' like. FD .

Materials examined: 1 ex. ♀, India: West Bengal: Sundarban, Henry island, 16.vi.2015, coll. B. Mitra and party.

Distribution: India: Bihar, Karnataka, Maharashtra, Tamil Nadu, West Bengal; Myanmar, Pakistan [12-13, 19].

Family Tetragnathidae

7. *Tetragnatha hasselti* Thorell
(Fig. 8)
Tetragnatha hasselti Thorell, Ann. Mus. Civ. Stor. Nat. Genova, 28: 217 (1890).

Fig 8: *Tetragnatha hasselti* Thorell, dorsal view, general habitus.

Diagnosis: Chelicerae orange yellow, long, strong, nearly 2 times longer than cephalothorax, promargin and retromargin with 6 and 5 teeth respectively, promarginal guide tooth longest, apophysis situated near apex, very small, beside retromargin basally with 3 denticles; fangs brownish, long, linear, nearly as long as chelicerae, strongly curved, with 2 cusps. Paracymbium of male palp bluntly rounded at tip, conductor long, as long as embolus.

Materials examined: 1 ex. ♂, India: West Bengal: Sundarban, Bali island, 26.v.2014, coll. B. Mitra and party.

Distribution: India: Assam, West Bengal; Bangladesh, Celebes, China, Indonesia, Myanmar, Thailand [13, 20].

8. *Tetragnatha mandibulata* Walckenaer
(Fig. 9)
Tetragnatha mandibulata Walckenaer, Hist. Nat. Insects. Aptères. Paris, 2: 211(1849).

Fig 9: *Tetragnatha mandibulata* Walckenaer, dorsal view, general habitus.

Diagnosis: Cheliceral promargin and retromargin with 14 and 16 teeth respectively; readily distinguishable from others by the forwardly' directed first ventral tooth in female and by the large triangular first dorsal tooth in male; first three ventral teeth in female very large and followed without any long interval by several smaller' ones. The armature of the fang not very strong. Abdomen broadest anteriorly and moderately narrowed posteriorly, terminating in a round tip, slightly extending beyond spinnerets. The subapical spine in male acuminate and simply pointed.

Materials examined: 5 exs. ♀, India: West Bengal: Sundarban, Bali island, 01.v.2016, coll. B. Mitra and party.

Distribution: India: Assam, Karnataka, Kerala, Orissa, Tamil Nadu, West Bengal; Australia, Bangladesh to Philippines, West Africa [6, 12-13].

Family Thomisidae

9. *Thomisus andamanensis* Tikader
(Fig. 10)
Thomisus andamanensis Tikader, Zool. Surv. India, 1: 39 (1980).

Fig 10: *Thomisus andamanensis* Tikader, dorsal view, general habitus.

Diagnosis: Cephalothorax and legs brownish green, abdomen chalk-white. Legs long and stout, I and II-longer than III and IV Tibiae and metatarsi of I provided with two and four pairs of ventral spines respectively. Epigynum with two almost oval copulatory openings; copulatory ducts converging as V-shaped; spermathecae kidney shaped; fertilization ducts thick, long and tubular.

Materials examined: 1 ex. ♀, India: West Bengal: Sundarban, Bakkhali, Laxmipur, 16.vi.2015, coll. B. Mitra and party.

Distribution: India: Andaman Island, Kerala, West Bengal [2, 12-13, 20].

4. Discussion

The reserve is made up of 54 small islands and is crisscrossed by seven main rivers and innumerable of the Ganges. All the rivers have a southward course towards the sea. The eco-geography of this area is totally dependent on the tidal effect of two flow tides and two ebb tides occurring within 24 hours with a tidal range of 3–5 m and up to 8 m [21-22] in normal spring tide, inundating the whole of area in varying depths. The delta is densely covered by mangrove forests, and is one of the largest reserves for the Royal Bengal tiger. The Sundarban mudflats [22] are found at the estuary and on the deltaic islands where low velocity of river and tidal current occurs. The flats are exposed in low tides and submerged in high tides. Due to the geographical topography with hostile terrain criss-crossness of rivers and their tributaries, long international border with Bangladesh, exploration of fauna is difficult. Though the spider count is 124 (including nine new records), it may be increased if fully exploration possible. The coastal active delta of Sundarban at the mouth of Bay of Bengal in Bangladesh, having a complex geomorphologic and hydrological character with climatic hazards, has a vast area of mangrove forests with a variety of flora and diverse fauna in a unique ecosystem. The natural environment and coastal ecosystem of this Biosphere Reserve and World Heritage Site is under threat of physical disaster due to unscientific and excessive human interferences. Conservation and environmental management plan for safeguarding this unique coastal ecology and ecosystem is urgently required.

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