

## First record of the genus *Neobrettus* Wanless 1984 from India, with some natural history notes (Araneae: Salticidae: Spartaeina)

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**Abstract:** *Neobrettus* is reported for the first time from India, with field observations in West Bengal of nesting and oophagy by nesting females of an unidentified species (*N. cf. tibialis*). The distribution of *Neobrettus* species in South and Southeast Asia, the relationship of *Neobrettus* to other members of the Spartaeina, and the role of oophagy in this genus are also discussed.

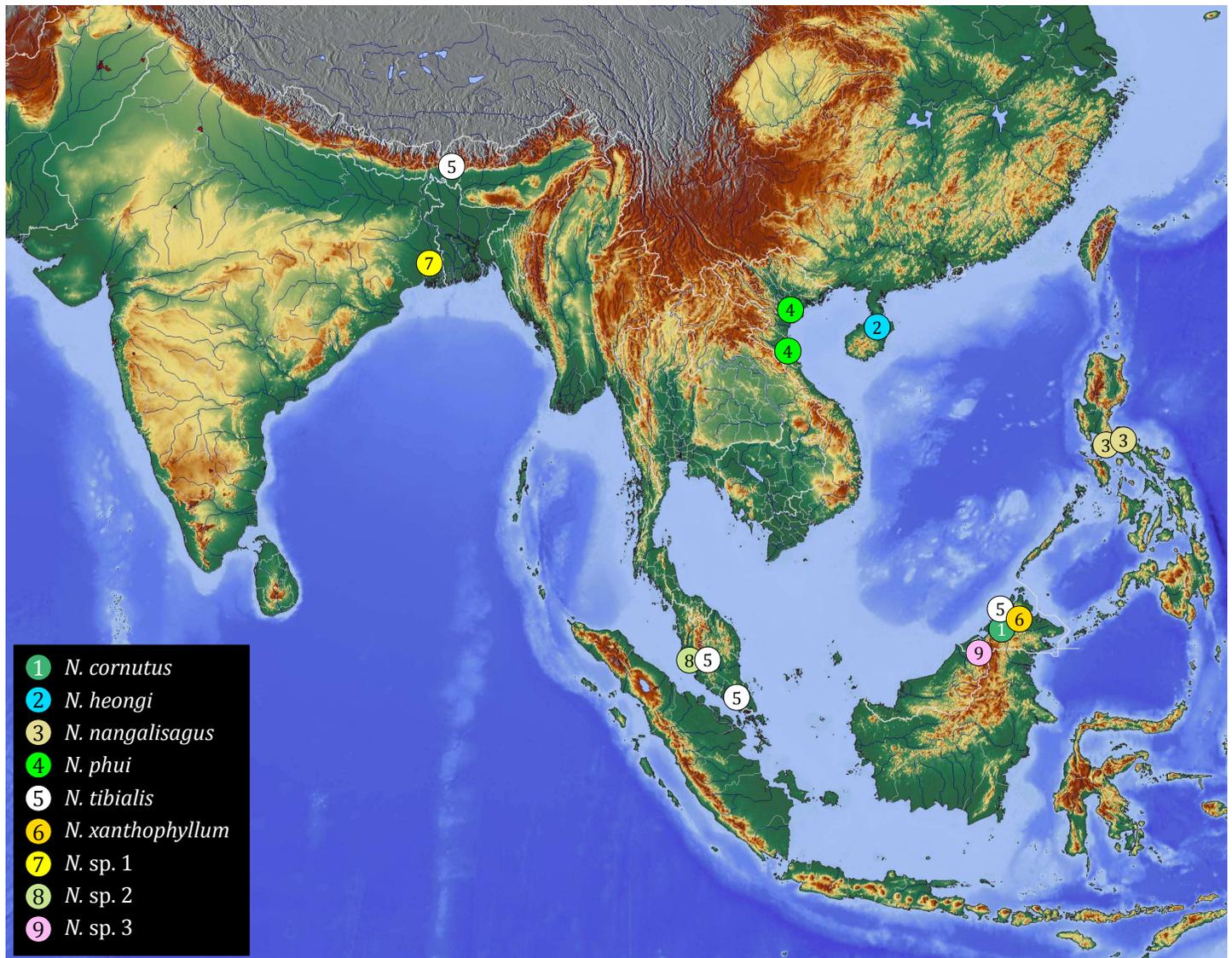
**Key words:** *Brettus cingulatus*, *Myrmaplatys plateleoides*, *Neobrettus tibialis*, oophagy, South Asia, Southeast Asia, West Bengal

### Introduction

The genus *Neobrettus* Wanless 1984 currently includes six described species of small spartaeine salticids distributed across South and Southeast Asia (Table 1; Figure 1; WSC 2018). Largely overlooked in their natural environment, most likely as a result of their small size and cryptic coloration, the natural history of these spiders, including their behaviour and distribution, has received little study.

**Table 1.** Localities in South and Southeast Asia where *Neobrettus* species have been found. Numbers at left correspond to labels on the distribution map (Figure 1).

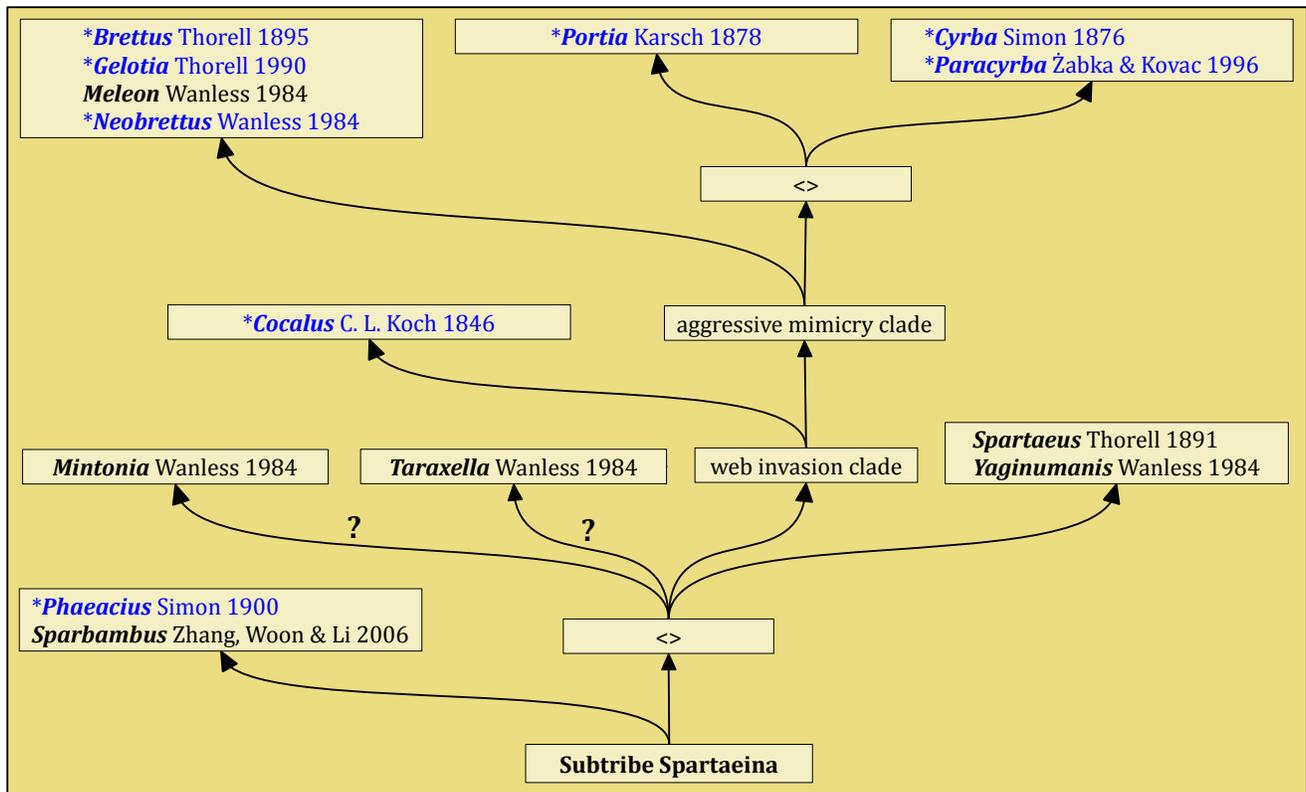
species	locality	references
1. <i>Neobrettus cornutus</i> Deeleman-Reinhold & Floren 2003	Mt. Kinabalu N. P. at Poring Hot Springs, Sabah, Malaysia	Deeleman-Reinhold & Floren 2003
2. <i>Neobrettus heongi</i> Barrion & Barrion-Dupo 2013	Dapo village, Dapo town, Hainan Island, China	Barrion et al. 2013
3. <i>Neobrettus nangalisagus</i> Barrion 2001	Dolores Sta. Lucia area, Mt. Banahaw, Quezon Province, Luzon Island, Philippines	Barrion 2001
	Caliraya, Laguna Province, Philippines	Barrion 2001
4. <i>Neobrettus phui</i> Żabka 1985	Bac Thai, Phu Long, Nong Thinh, Vietnam	Żabka 1985
	Cuc Phuong, Ninh Binh Province, Vietnam	Żabka 1985
5. <i>Neobrettus tibialis</i> (Prószyński 1978)	Phuntsholing, Bhutan	Prószyński 1978; Wanless 1984
	Genting, about 30 miles NE of Kuala Lumpur, Malaysia	Wanless 1984; Su et al. 2007
	Layang-Layang, Johor, Malaysia	Wanless 1984
6. <i>Neobrettus xanthophyllum</i> Deeleman-Reinhold & Floren 2003	Mt. Kinabalu N. P. at Poring Hot Springs, Sabah, Malaysia	Deeleman-Reinhold & Floren 2003
7. <i>Neobrettus</i> sp. 1	West Bengal (22.33°N, 88.43°E)	this study
8. <i>Neobrettus</i> sp. 2	Near Genting, Henry Barlow's Land, Selangor, Malaysia (3.355°N 101.793°E) (♂ specimen SGM05-3375, ♀ specimen SGM05-3370)	Maddison 2015b
9. <i>Neobrettus</i> sp. 3	Botanical Trail, Gunung Mulu National Park, Sarawak, Malaysia (4.038°N, 114.814°E) (♂ specimen SWK12-1336)	Maddison 2015b
	Headquarters area, Gunung Mulu National Park, Sarawak, Malaysia (4.042°N, 114.814°E) (♀ specimen SWK12-1040)	Maddison 2015b



**Figure 1.** Distribution of *Neobrettus* species in South and Southeast Asia. **7**, New record of *Neobrettus* from West Bengal (this paper). **8**, See Figure 4. **9**, See Figures 5 and 6. See Table 1 for more details. The background relief map is in the public domain (CC0), courtesy of maps-for-free (<https://maps-for-free.com>).

One unidentified species photographed recently by Maddison (2015b) in Malaysia (locality 8 in Figure 1; Figure 4) resembles the widely distributed *N. tibialis* and may in fact be that species, the type species for the genus *Neobrettus*. The unidentified *Neobrettus* from West Bengal (locality 7 in Figure 1) that we document here also closely resembles a photograph of the *N. tibialis* published by Prószyński (2016).

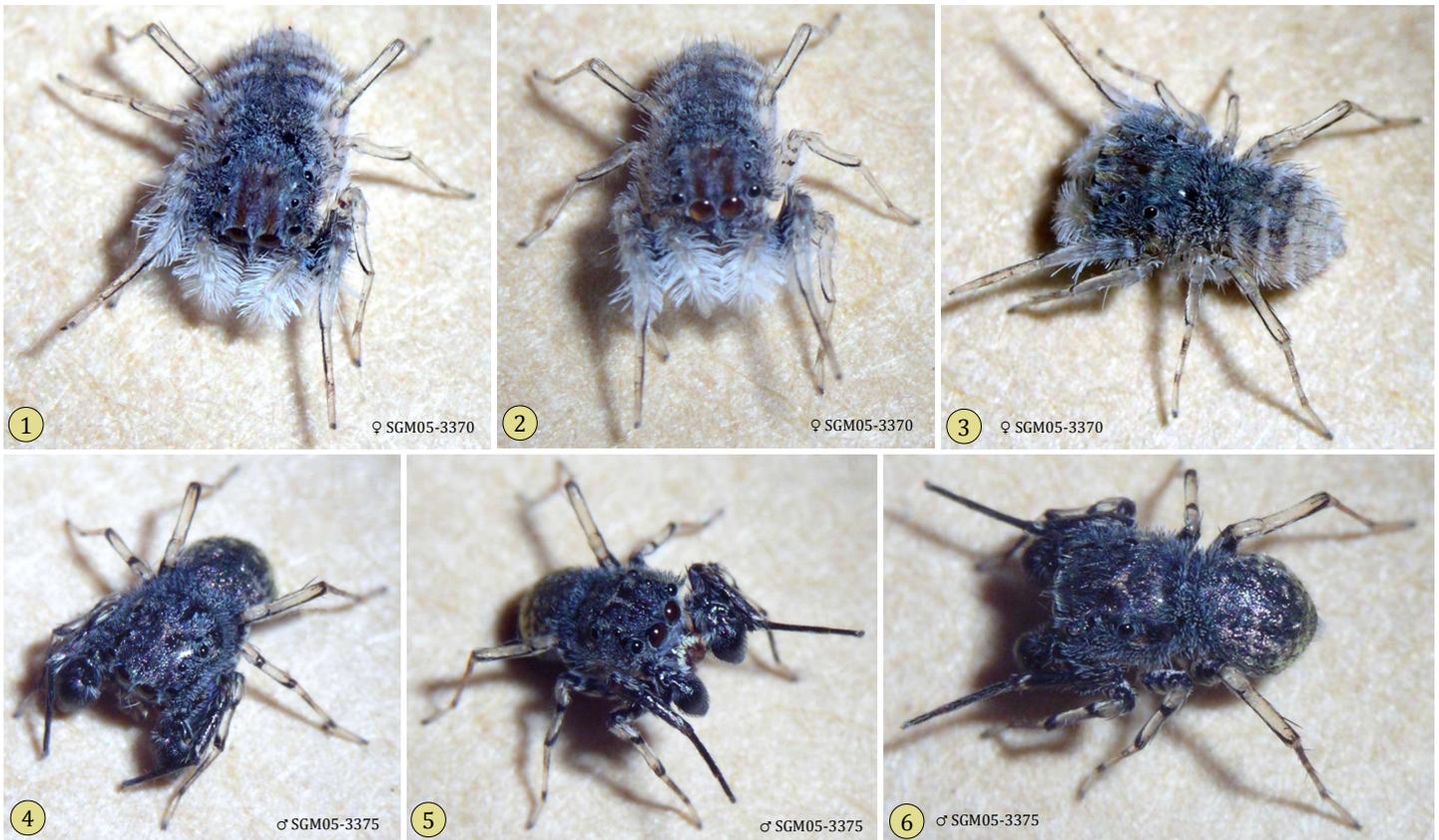
Maddison recently (2015a) reduced Wanless' (1984) subfamily Spartaeinae to the rank of subtribe, the Spartaeina. DNA sequencing of species within the Spartaeina strongly supports the hypothesis that *Neobrettus* is closely related to *Brettus*, and more distantly related to *Portia* (Figure 2; Su et al. 2007; Maddison et al. 2014). As shown in Figures 2-3, many genera within the Spartaeina are known to incorporate small tufts of densely woven silk into the outer layers of their egg sac (Jackson 1990a, 1990b; Žabka & Kovac 1996; Ahmed et al. 2017; this paper), and this may be considered to be a symplesiomorphic character of the group. This DNA sequencing of spartaeine species was based in part on *N. tibialis*, but also on an unidentified female specimen from Sarawak (SWK12-1040), a long-legged *Neobrettus* that resembles *N. cornutus* (locality 9 in Figure 1; Figures 5-6; Maddison et al. 2014).



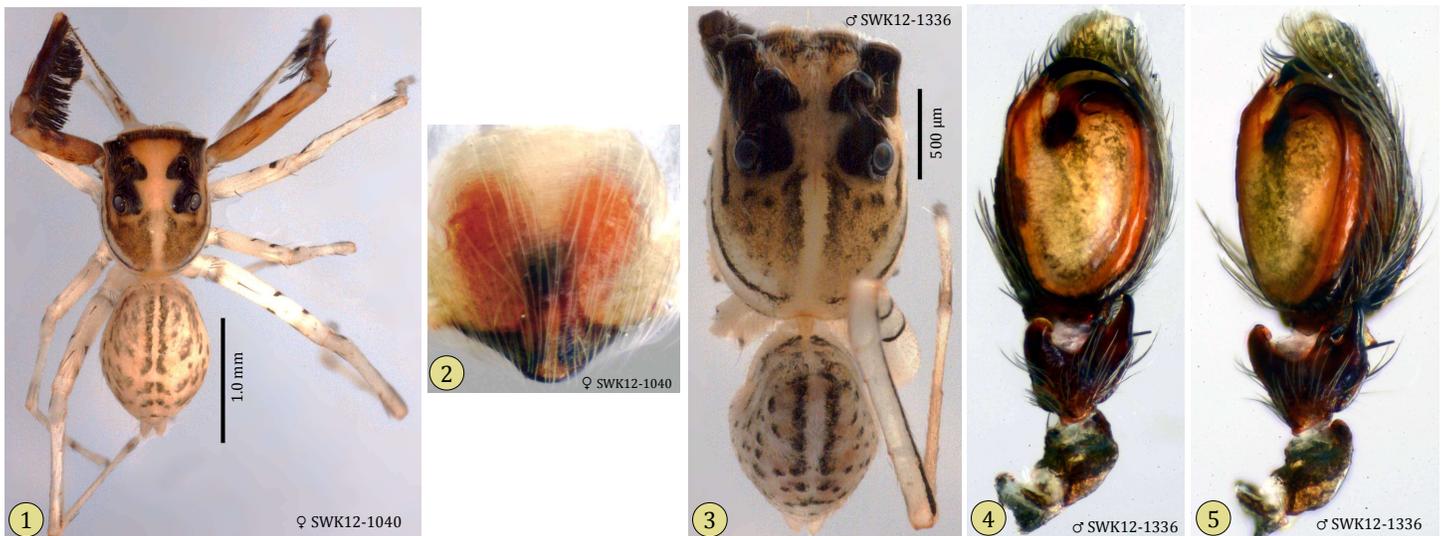
**Figure 2.** Hypothetical phylogeny of the Spartaeina after Su et al. (2007) and Maddison et al. (2014, Figure 14). Maddison et al. compared DNA sequences from all of the genera shown here. Su et al. compared DNA sequences from most of these genera, including a *Neobrettus tibialis* from the Genting Highlands of Malaysia, and came up with a similar phylogeny; the *web invasion clade* and *aggressive mimicry clade* were identified in their work. Genera known to incorporate small tufts of dense silk into the outer layer of their egg sac are marked with an asterisk (Jackson 1990a, 1990b; Žabka & Kovac 1996; Ahmed et al. 2017; this paper for *Neobrettus*). The relationship of *Taraxella* and *Mintonia* to the other genera shown here has little support.



**Figure 3.** Nesting female *Brettus cingulatus* Thorell 1895 from West Bengal (22.33°N, 88.43°E). Like other Spartaeina, the female *Brettus* incorporates dense tufts of silk into the outer layers of her egg sac. *Brettus* is a close relative of *Neobrettus*. See Ahmed et al. (2017) and Patil & Uniyal (2018) for other records of this species in South and Southeast Asia.



**Figure 4.** Unidentified *Neobrettus* species from the vicinity of Genting, Malaysia (locality 8 in Table 1 and Figure 1). This species closely resembles *N. tibialis* and may be that species, known to occur in the same area. 1-3, Adult female. 4-6, Adult male. Photographs (Maddison 2015b) © 2015 W. Maddison, used under a [Creative Commons Attribution \(CC BY\) 3.0 license](https://creativecommons.org/licenses/by/3.0/).



**Figure 5.** Unidentified *Neobrettus* species from Sarawak (locality 9 in table 1 and Figure 1). This long-legged species resembles *N. cornutus*. In addition to *N. tibialis*, this female (1-2) was used as a representative of *Neobrettus* for DNA sequencing (Maddison et al. 2014). 1, Dorsal view of female specimen. 2, Ventral view of epigynum. 3, Dorsal view of male specimen. 4-5, Ventral (4) and retrolateral (5) views of left pedipalp of male showing large tibial apophyses. This female and male are also shown in Figure 6. All photographs © 2015 W. Maddison, used under a [Creative Commons Attribution \(CC BY\) 3.0 license](https://creativecommons.org/licenses/by/3.0/) (Maddison 2015b).



**Figure 6.** Unidentified *Neobrettus* species from Sarawak (locality 9 in table 1 and Figure 1). **1-7**, Views of female. **8-12**, Views of male. Maddison (2012) described the impressive brushes of tibia I and constant up and down movement of legs I by this species. Although their function is not known, similar features can be found in a number of unrelated salticids. One of the authors (DEH) observed this kind of decoration and movement in an undescribed *Tutelina* from the southeastern United States in which the fringed tibia resembled the head of an ant or some other insect when observed from the side. All photographs © 2015 W. Maddison, used under a [Creative Commons Attribution \(CC BY\) 3.0 license](https://creativecommons.org/licenses/by/3.0/) (Maddison 2015b).

Here we report the genus *Neobrettus* from India for the first time, from West Bengal. Given the distribution of the related genus *Brettus* (Ahmed et al. 2017; Figure 3), and the wide distribution of banana production (Kumar et al. 2013) along with their tendency to live on dried banana leaves (Murphy & Murphy 2000, p. 324; Barrion 2001), it is reasonable to expect that *Neobrettus* will be found to have a much wider distribution across subtropical to tropical India in the future.

### Field observations in West Bengal

This account is based on field observations and photography of an unidentified *Neobrettus* species living in a fruit orchard in West Bengal (22.33°N, 88.43°E; locality 7 in Table 1 and Figure 1), by one of the authors (IB). Field observations began in the early morning (08:17) on 8 February, 2017, and continued intermittently for about one year thereafter. This fruit orchard contained mostly perennial fruiting trees to include mango and plantain. *Neobrettus* were observed to shelter, hunt and breed on the broad, dried leaves of banana plants, which they apparently prefer as a microhabitat.

*Identification* (Figure 7). Identification was based on the unique appearance of these small salticids (body length 2.5-3.5 mm). Consistent with published descriptions and illustrations of *N. tibialis* these small spiders were compact with a squat and distinctly fuzzy appearance and a stiff ventral fringe of hair on the tibia of the first leg that distinguished them from all other spartaeines (Wanless 1984; Murphy & Murphy 2000; Deeleman-Reinhold & Floren 2003; Prószyński 2016). Males were darker in colouration, ranging from dark brown to black, with small yellow to pale white spots dotting the opisthosoma. Females were a lighter shade of brown with contrasting pale white bands encircling the opisthosoma. The ratio of male to female spiders was found to be widely disparate, with approximately one male observed for every twenty females sighted.

*Egg sac construction* (Figure 8). Courtship and mating were not observed, but a total of approximately 22 egg sacs were observed. Each female produced a cluster of 12-17 eggs which were laid on a thin layer of silk spun on the surface of a leaf. After it was deposited each egg was coated with a fine layer of silk. This process was repeated for each egg in turn, after which the entire cluster of eggs was covered with a thin layer of silk bearing the many small, white, embedded tufts of dense silk characteristic of the *Spartaeina* (Jackson 1990a, 1990b; Kovac & Zabka, 1996; Figure 2). Once the egg sac was completed, female *Neobrettus* perched on top of it, often making clockwise and counter-clockwise turns in place, or turning to face the egg cluster below them.

*Oophagy by nesting females* (Figure 9). Brooding females were not observed to leave their egg sac or to pursue prey during the several weeks that it took for their eggs to hatch and their spiderlings to emerge, but they were occasionally observed feeding on 1-2 of their own eggs. Females that fed in this manner did not repair their own damaged egg sac, but they continued to guard their remaining eggs for the duration of their incubation. As evidenced by the normal appearance of the eggs that were eaten, and the successful hatching of the remaining eggs, we can assume that these females were feeding on fertilised or viable eggs.

In one instance a female was observed raiding the egg sac of a conspecific *Neobrettus* that was absent for reasons unknown. This female climbed over the egg sac, broke the protective silk layer covering the eggs and immediately fed on one egg before carrying a second egg away, leaving the all the other eggs exposed to the elements. On another occasion a female *Neobrettus* was observed stalking the egg sac of a *Brettus* sp. containing about 30 eggs. This raid was soon abandoned after the female *Brettus* in attendance, not sitting on her egg sac, moved closer to that egg sac.



**Figure 7.** *Neobrettus* sp. observed in West Bengal. **1-3**, Adult females. Note the thick off-white fringes of the pedipalps and tibiae I, and the long bristles projecting from the opisthosoma. **4-6**, Adult males. Note the brush of long black setae under each tibia I and the group of off-white scales at the base of each paturon. **7**, Penultimate male.



**Figure 8.** Female *Neobrettus* sp. tending their clutches on the surface of banana leaves in West Bengal.



**Figure 9.** Oophagy by female *Neobrettus* sp. in West Bengal. **1-8**, Brooding females feeding on their own eggs. **9**, Female feeding on an egg away from the egg sac. **10**, Female feeding on an egg that she has carried away from an opened egg sac.

*Life cycle* (Figure 10). Spiderlings were observed moulting for the first time approximately two weeks after hatching and they dispersed soon after this. This *Neobrettus* species probably mates during late winter, and females with egg sacs were observed until late May, just before the onset of the monsoon season.



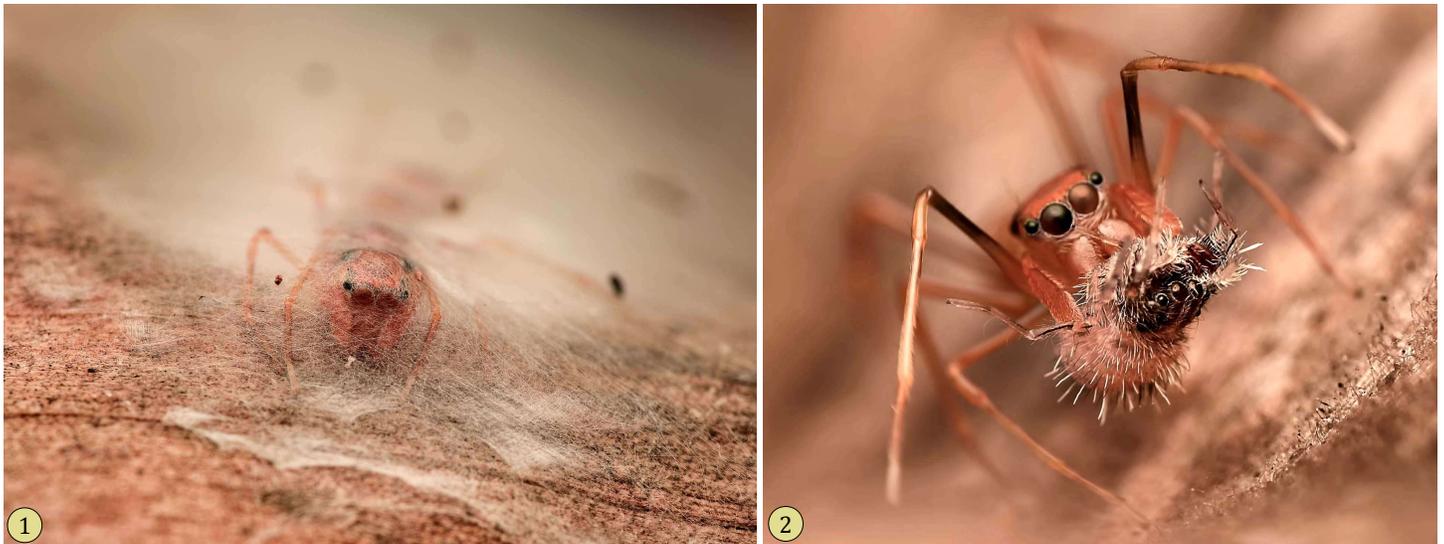
**Figure 10.** Female *Neobrettus* sp. and their offspring in West Bengal. **1**, Female tending first instar or larval offspring after hatching. **2-3**, Two females tending first instar offspring as their eyes (note dark pigment) developed. Stripes across the eye region of adult females varied in definition and coloration (from brown to dull red). **4**, Second instars ready to emerge after their molt.

*Predatory behaviour of Neobrettus* (Figure 11). Adult *Neobrettus* were observed preying on small insects, including whiteflies, plant hoppers and male mosquitoes that gathered to feed on plant juices. Su et al. (2007) placed *Neobrettus* in a clade within the Spartaeina (Figure 2) that engaged in *web invasion* (invasion of the webs of other spiders to prey upon them, with *glue immunity*, the ability to walk on sticky webs), and within this clade a subclade that also engaged in *aggressive mimicry* (luring a web spider to a vulnerable position by plucking its silk lines). Other than the oophagy described above, we did not observe this behaviour.



**Figure 11.** Adult female *Neobrettus* feeding on a captured insect.

*Predation on Neobrettus* (Figure 12). A myrmarachnine salticid, most likely *Myrmaplata* (*Myrmarachne*) *plateleoides* O. Pickard-Cambridge 1869, was observed as it darted out of its silk retreat to capture an approaching *Neobrettus*.



**Figure 12.** Myrmarachnine salticids at the study site in West Bengal. 1, Female in shelter (egg sac or resting sac). 2, Female, most likely a *Myrmaplata* (*Myrmarachne*) *plateleoides* O. Pickard-Cambridge 1869, feeding on a captured female *Neobrettus*.

### Discussion.

Several writers (Murphy & Murphy 2000; Deeleman-Reinhold & Floren 2003) have suggested that *Neobrettus* are either colonial or gregarious. We have not recorded any related social behaviour other than an attraction to the eggs of conspecifics that would support the idea that these spiders aggregate, and this may simply be the result of their ability to survive at a relatively high population density in some

areas. Their tendency to inhabit the surface of dried banana leaves has been documented previously (Murphy & Murphy 2000, p. 324; Barrion 2001). With their many bristles, at least in the female, they might mimic *small patches of grey mould*, or a *particular unsavoury caterpillar* (Murphy & Murphy 2000).

It is unusual for a female arthropod to feed on her own fertilised eggs, particularly as she is guarding them. Filial egg cannibalism has been recorded in other arthropods that invest in maternal or paternal care (e.g. the earwig *Forficula auricularia*, Koch & Meunier 2014, and the assassin bug *Rhinocoris tristis*, Thomas & Manica 2003), but often the eggs that are eaten have not been fertilised. One of the authors (DEH) has, however, watched a female jumping spider, *Habronattus coecatus* (Hentz 1846), feed on her entire clutch of five eggs in captivity. All of these eggs were laid some time after this female had mated, and they looked quite normal when compared to infertile eggs that tend to collapse into a mass. The pursuit of the eggs of conspecifics or other salticids, as well as their small size, suggests that oophagy contributes significantly to the diet of *Neobrettus* when they are not tending their own egg sac. The spartaeine *Portia labiata* (Thorell 1887) also feeds on the eggs of other spiders, but in the laboratory the female *P. labiata* generally discriminated between her own egg sac and those of conspecifics, readily consuming conspecific eggs but seldom her own, even when this egg sac had been moved to a foreign web. *Portia* have not been observed feeding on their own eggs in nature (Clark & Jackson 1994).

Barrion (2001) also observed *Neobrettus* females, in this case *N. nangalisacus* in the Philippines, feeding on their own eggs. Although we do not know all of the factors that might contribute to this behaviour, including population density, it may be a general characteristic of the genus. If this is the case, then we would expect that the advantage associated with the use of her own eggs as a predictable, safe food reserve by a female would compensate for the associated loss of fecundity.

One more comment: For some reason Wanless (1984) specified that the genus name *Neobrettus* that he applied to these *small, squat hairy spiders* was of the feminine gender. Since that time, however, this genus has been associated with at least one species name with a masculine ending (*cornutus*). Given the *-us* ending of *Neobrettus*, and the fact that Wanless derived this name from *Brettus*, it seems preferable to continue to treat this genus name as if it were masculine.

### Acknowledgements

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