

New observations of the jumping spider *Neobrettus tibialis* (Araneae: Salticidae: Spartaeini) in West Bengal, India

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Abstract. New observations on the behaviour of *Neobrettus tibialis* in West Bengal include documentation of brooding behaviour by females, mating by brooding females, and filial oophagy by females. These add to earlier published observations of these spiders (Ahmed et al. 2018). Examination of the microscopic anatomy of both males and females now supports their identification at the species level.

Key words. *Brettus cingulatus*, brooding, brood nest, Chintamani Kar Bird Sanctuary, filial oophagy, Kolkata, mating systems, *Neobrettus nagalisagus*, *Neobrettus phui*, oophagous parasitoid

Field observations of *Neobrettus tibialis* (Prószyński 1978) in West Bengal by the lead author (IB) were documented in a recent publication (Ahmed et al. 2018) that only identified these spiders as *Neobrettus* (sp. 1). Here we identify the species assignment of these spiders, based on structure of the male pedipalp and female epigynum, and document additional observations in the vicinity of the Chintamani Kar Bird Sanctuary southeast of Kolkata, West Bengal, India (Figure 1).

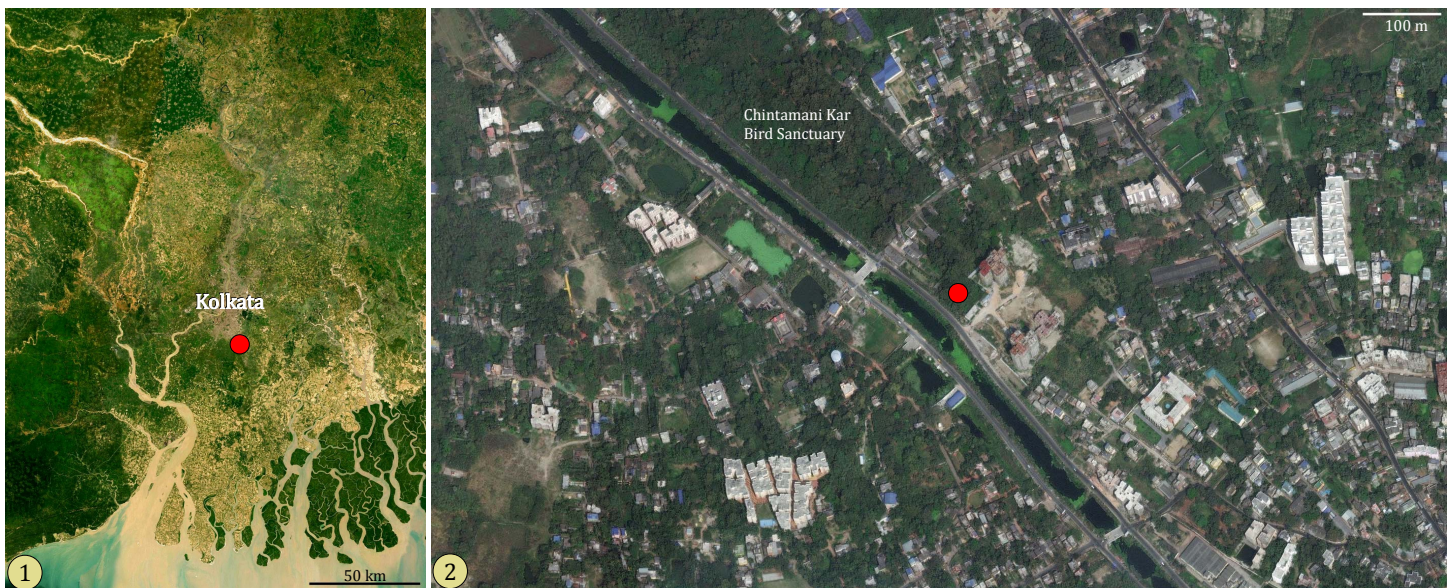


Figure 1. Locality (red circles) where *Neobrettus tibialis* was observed by the lead author (IB), southeast of Kolkata in the vicinity of the Chintamani Kar Bird Sanctuary (N22.4273°, E88.4029°). **1**, Relationship of study site to Kolkata in West Bengal. **2**, Detailed aerial view of study site. Background images courtesy of USGS Landsat Project.

Methods. Live spider images were captured with either a Nikon D850 or Nikon D500, an attached Nikon SB 5000 or SB 910 Speedlight flash, and (for macro photography) a Nikon 105mm f/2.8 macro lens with a Raynox DCR 150 or a Raynox DCR 250 magnifying filter was used. Specimens were preserved in 70% alcohol and later examined and photographed under a Leica M205A stereozoom microscope equipped with a DFC500 HD camera using version 3.8 of the Leica Application Suite (LAS).

Identification. One male and one female specimen from Narendrapur in West Bengal, India (N22.4275°, E88.4042°, coll. 10 NOV 2018 by Indranil Banerjee) were identified as *Neobrettus tibialis* (Prószyński 1978) by comparison with illustrations published by Prószyński (1978) and Wanless (1984). These specimens (Figures 2-3, Table 1) were deposited in the Arachnida Section, National Zoological Collections, Zoological Survey of India, Kolkata (NZC-ZSI).

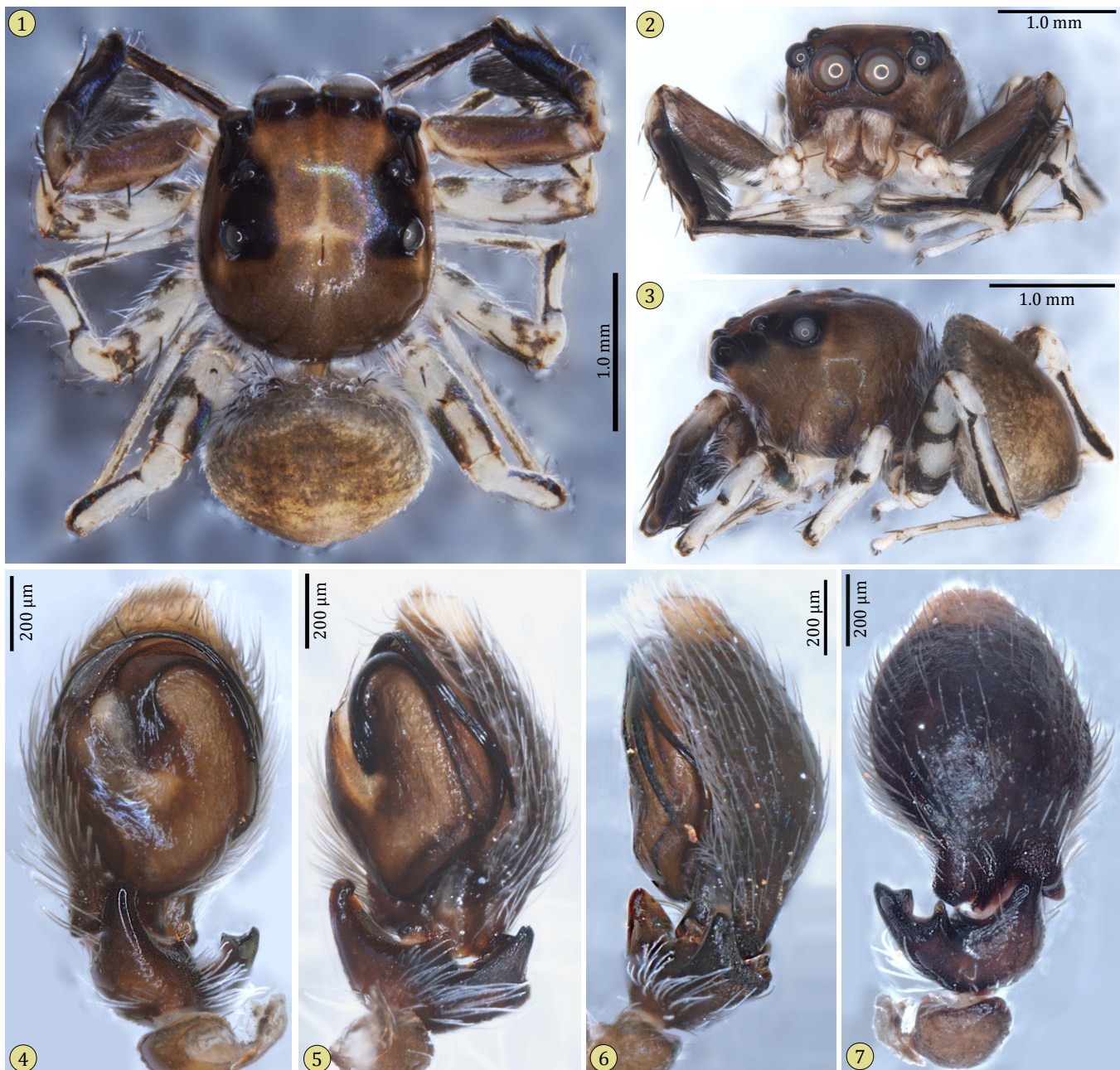


Figure 2. Male *Neobrettus tibialis* in alcohol. 1-3, Dorsal, anterior and left lateral views of specimen with pedipalps removed. 4-7, Ventral (4), ventrolateral (5), lateral (6), and dorsal (7) views of right pedipalp (mirror images).

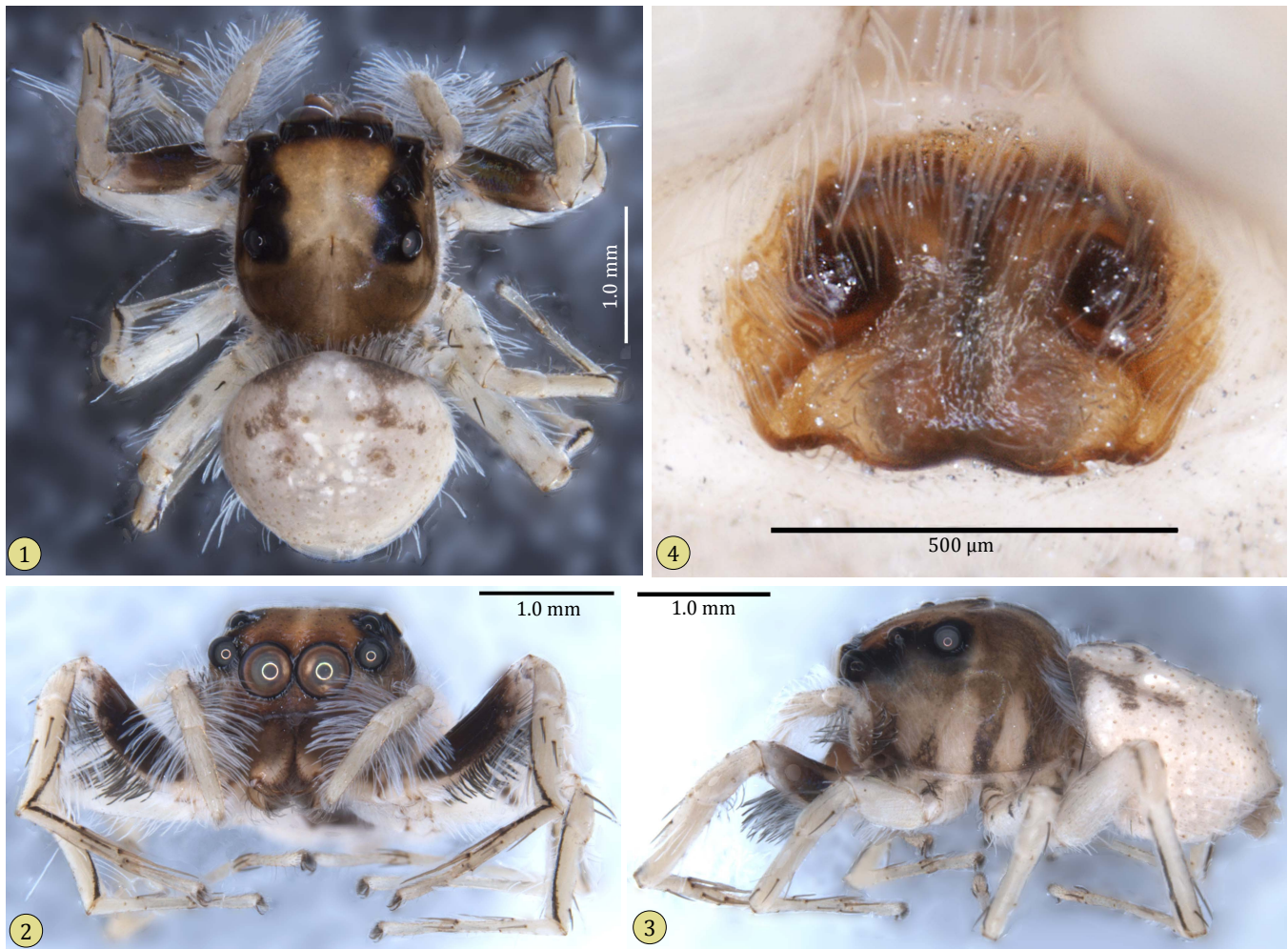


Figure 3. Female *Neobrettus tibialis* in alcohol. **1-3**, Dorsal, anterior and left lateral views of specimen. **4**, Ventral view of epigynum (anterior toward top of page).

Table 1. Morphometry for the male and female specimens of *Neobrettus tibialis*.

measurements in mm		male				female			
		length	width	height	diameter	length	width	height	diameter
body		3.18				3.60			
carapace		1.66	1.50			1.70	1.48		
abdomen		1.66	1.42			1.90	1.70		
clypeus				0.11				0.12	
anterior eye row	AER		1.27				1.28		
posterior eye row	PER		1.28				1.30		
eye field	EF	0.88				0.93			
anterior medial eye	AME				0.41				0.42
anterior lateral eye	ALE				0.22				0.23
posterior medial eye	PME				0.14				0.14
posterior lateral eye	PLE				0.19				0.21

Presently six species, all from the Orient, are assigned to the genus *Neobrettus* Wanless 1984 (Ahmed et al. 2018; WSC 2019). Based on published descriptions we suspect that both *N. nangalisagus* Barrion 2001 and *N. phui* Žabka 1985 are synonyms of the widely distributed *N. tibialis* (Prószyński 1978), but detailed examination of the type specimens for all three species, as well as more extensive field collections to document geographic variation, will be needed to establish their relationship.

Habitat. The occurrence of small and cryptically-coloured *Neobrettus tibialis*, as well as *N. nangalisagus* which may represent the same species, on dried banana leaves has been reported previously (Murphy & Murphy 2000; Barrion 2001; Ahmed et al. 2018). *N. tibialis* were found throughout most of the year on banana plants and surrounding vegetation (Figure 4). Egg sacs were observed mostly on the curled inner sides of the dry banana leaves. During the rainy season females lay their eggs on the underside of banana leaves. Males were observed in their greatest number during the dry summer season (March-May) and were very active at this time. During the last 32 months of field observation, mating was observed only once, during the month of April.



Figure 4. Habitat of *Neobrettus tibialis* in the vicinity of the Chintamani Kar Bird Sanctuary southeast of Kolkata, West Bengal. **1**, The lead author (IB) searching for *N. tibialis* beneath banana leaves **2**, Banana plant and other mixed tropical vegetation. **3**, Site of brooding female *N. tibialis* on dry margin of banana leaf (inset rectangle). **4**, Detail of inset from (3) showing brooding female at the center.

Brooding by female. Females attending broods of varying age are documented in Figure 5. As in the related spartaeine *Brettus cingulatus* Thorell 1895 (Abhijith & Hill 2019), newly deposited eggs were covered with silk bearing many flecks of undetermined composition (Figure 5:1). After the young hatched (as instar 1, Figure 5:2) these flecks were no longer present. As instar 1 spiderlings developed in the brood nest, dark pigmentation of their eyes and cuticle became more visible. After these molted to instar 2 they were covered with long bristles or setae and looked like miniature versions of the adult female.



Figure 5. Female *Neobrettus tibialis* with their broods. **1**, Female tending recently deposited eggs covered with flecked silk. **2**, Female with emergent instar 1 spiderlings, showing little pigmentation. **3**, Female tending instar 1 spiderlings with more eye pigmentation. **4-5**, Females with older instar 1 spiderlings. **6-7**, Females with mixed instar 1 and 2 spiderlings.

Feeding and filial oophagy (Figures 6-8). Male and female *Neobrettus tibialis* were observed feeding on nematoceran and other small insects, caterpillars (Lepidoptera), and the spiderlings of other species. The *filial oophagy* of brooding *Neobrettus* females has been reported previously (Barrion 2001; Ahmed et al. 2018). The possibility that females might also prey on oophagous parasitoids (Figure 7:4-5) is of particular interest. A video recording (Figure 8:4-9) captured one female lifting the silk fabric that covered her brood, apparently feeding on the associated flecks of unknown composition.

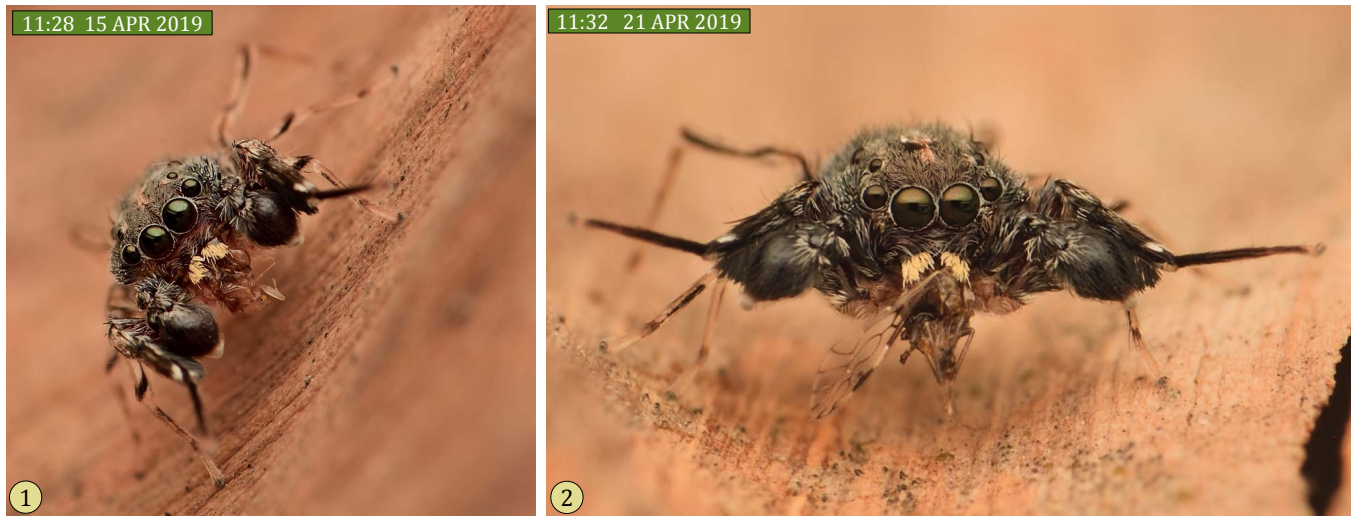


Figure 6. Two adult male *Neobrettus tibialis* feeding on small flying insects. Both males and females extended and waved both pedipalps and legs I as they fed.

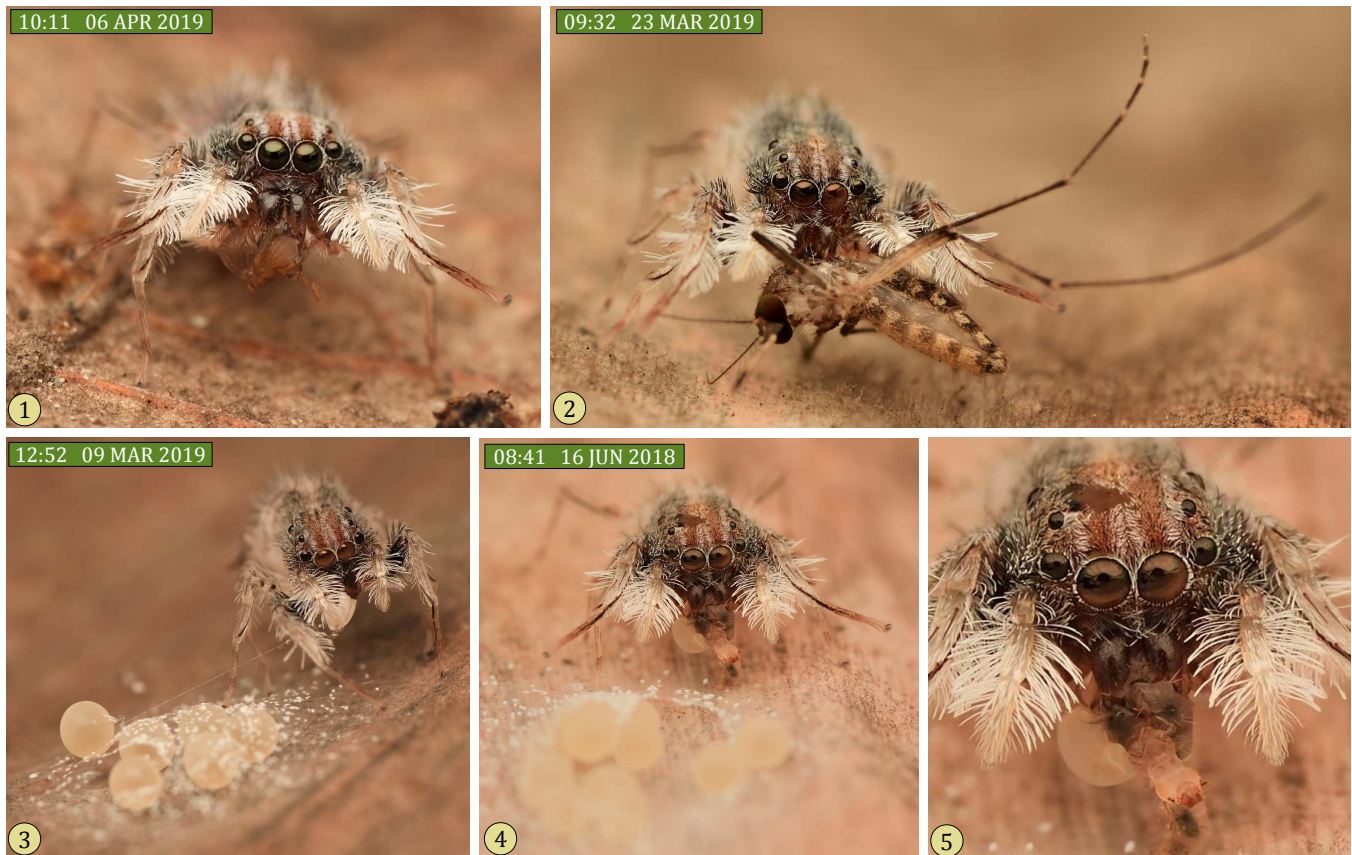


Figure 7. Feeding adult male *Neobrettus tibialis*. **1**, Feeding on small insect. **2**, Feeding on nematoceran. **3**, Filial oophagy. **4**, Oophagy combined with feeding on an insect larva. This might represent capture of an oophagous parasitoid that would otherwise compete for the female's supply of eggs. **5**, Detail from (4),



Figure 8. Selected video frames (25 fps) showing the filial oophagy of female *Neobrettus tibialis*. **1-3**, Both males and females waved their pedipalps and extended legs I as they fed. **4-9**, In this sequence the female used her chelicerae to pull up the silk fabric covering her eggs and appeared to feed on the associated flecks. **10-11**, Sequential frames showing egg before (10, arrow) and after (11) its removal from the brood nest. **12-17**, Sequential frames showing symmetrical lateral movement of the pedipalps as a female fed on one of her eggs.

Mating. Perhaps because of a bias toward the study of temperate or seasonal species, it is widely thought that salticid males mate and then depart well in advance of female brooding. For example, Jackson (1979) reported that approximately one month elapsed between mating and oviposition by the North American dendryphantine *Phidippus johnsoni*. Mating systems in tropical species may be quite different. Here (Figure 9) we document mating between a male and a female attending her newly hatched brood. In this case the male was observed approaching the female as she sat on her brood nest, and mating lasted for at least 6 minutes. This behaviour has been reported previously for the related spartaeine *Brettus cingulatus* (Abhijith & Hill 2019).

Like the flecks associated with the silk covering of the brood nest, eggshell fragments (visible in Figure 9) disappear soon after hatching. It is possible that these, like the flecked silk, provide some nutrition for either the female or her brood.



Figure 9. Mating *Neobrettus tibialis* pair. The female was tending her brood of newly hatched spiderlings when the male approached.

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