

## Ant associations of the jumping spider *Carrhotus viduus* in Karnataka, India (Araneae: Salticidae: Salticini)

David E. Hill<sup>2</sup>, Abhijith A. P. C.<sup>2</sup>, Sanath R. M.<sup>3</sup> and Harshith J. V.<sup>4</sup>

<sup>1</sup> 213 Wild Horse Creek Drive, Simpsonville SC 29680, USA, *email* platycryptus@yahoo.com

<sup>2</sup> Indraprastha Organic Farm, Kalalwadi Village, Udboor Post, Mysuru-570008, Karnataka, India, *email* abhiapc@gmail.com

<sup>3</sup> Sri Krishna Kripa House, Manila village, Nayarmoole post, Bantwala Taluk, Dakshina Kannada 574243, India, *email* sanath.rm89@gmail.com

<sup>4</sup> House no: 17/5/180, Seminary 2nd Cross, Jeppu, Valencia, Mangalore 575002, India, *email* hjv1986@gmail.com

Eight jumping spiders of the genus *Carrhotus* Thorell 1891 have been reported from India (Table 1; Logunov 2021; WSC 2021; Metzner 2021). Of these, the most widely-distributed is the type species, *C. viduus* (C. L. Koch 1846).

**Table 1.** *Carrhotus* species reported from India.

species	distribution	notes
<i>C. andhra</i> Caleb 2020 (in Caleb, Bera & Acharya 2020)	Paderu, Visakhapatnam, Andhra Pradesh	
<i>C. assam</i> Caleb 2020 (in Caleb, Bera & Acharya 2020)	Assam and Nepal	atypical pedipalp for the genus
<i>C. erus</i> Jastrzębski 1999	Himalayan foothills of India and Nepal	
<i>C. sannio</i> (Thorell 1877)	northeastern India, Réunion, Sulawesi	DNA study (Maddison et al. 2017) supports placement of genus in tribe Salticini (Maddison 2015)
<i>C. silanthi</i> Caleb 2020 (in Caleb, Bera & Acharya 2020)	Madras Christian College, Tambaram, Chennai	atypical pedipalp for the genus
<i>C. spiridonovi</i> Logunov 2021	Banigosha-Daspalla, Odisha	only male known, resembles <i>C. andhra</i>
<i>C. tristis</i> Thorell 1895	Myanmar and Kolkata, India	atypical pedipalp for the genus
<i>C. viduus</i> (C. L. Koch 1846)	south and southeast Asia including Indonesia	type species for genus

Based on photographic records of *C. viduus* in Karnataka, we document the frequent association of this species with ants (Figures 1-11). Most of these photographs were taken at the Indraprastha Organic Farm, Kalalwadi Village, Karnataka of the second author.

We have no reason to believe that this association represents any form of ant-mimicry or specialization on ants as prey. This association appears, rather, to represent the ability of *C. viduus* to survive in the presence of ants, and as a result to be able to utilize the many species of Hemiptera (in particular Auchenorrhyncha and Sternorrhyncha) that are tended by those ants, as prey. In addition the presence of ants may provide some protection to these spiders from other predators. Here we use the definition of *Hemiptera* and associated clades published by Johnson et al. (2018) in their recent study of hemipteroid phylogeny.



**Figure 1.** *Carrhotus viduus* with prey. **1-2**, Female feeding on an aphid (Hemiptera: Aphidoidea). **3-4**, Male feeding on a treehopper (Hemiptera: Membracoidea). **5**, Immature feeding on a mosquito (Diptera: Culicidae). Photo credits: 1-2, Harshith J. V.; 3-4, Sanath R. M.; 5, Abhijith A. P. C.



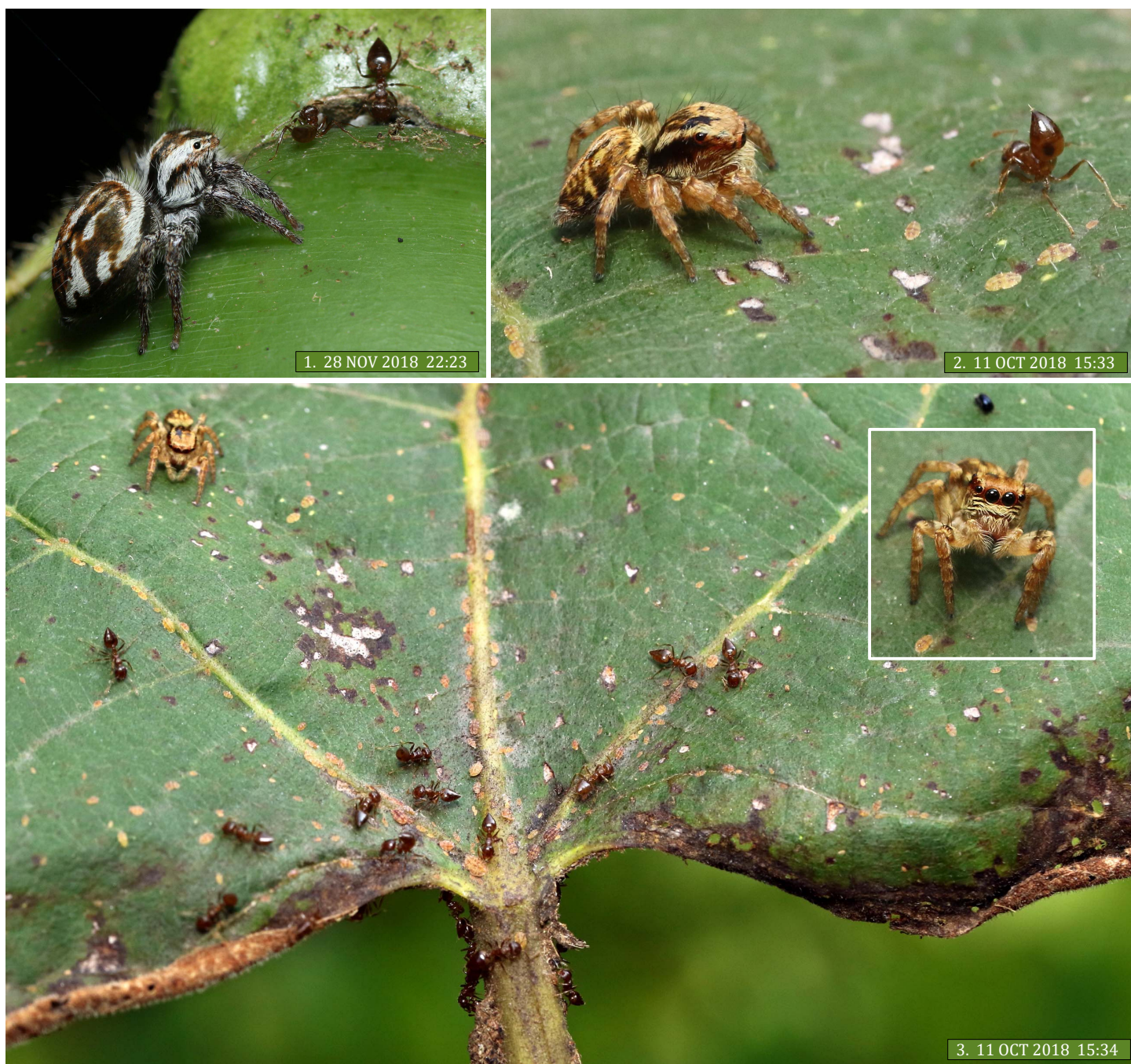
**Figure 2.** *Carrhotus viduus* nest near scale insects (Hemiptera: Coccoidea) tended by ants. **1**, Note the position of the nest (arrow) below a group of scale insects tended by ants. **2**, Detail showing spider within the nest, near a scale insect (right, center). Photographs by Sanath R. M.





**Figure 3.** *Carrhotus viduus* shelter near a group of ants tending a colony of treehoppers (Hemiptera: Membracoidea). 1-2, Two views of female at nest (right) watching the ants. 3, Female at nest. 4, Ants tending treehoppers of various ages. Photographs by Abhijith A. P. C.





**Figure 4.** *Carrhotus viduus* watching active *Crematogaster* ants as they tend to a colony of small scale insects (Hemiptera: Coccoidea). **1**, Adult female *Carrhotus*. **2-3**, Immature *Carrhotus* (detailed view in inset). Photographs by Abhijith A. P. C.





**Figure 5.** Association of *Carrhotus viduus* with an active colony of Green Tree Ants (*Oecophylla smaragdina*). **1**, Immature *C. viduus* at upper left, near ant nest at upper right. **2-3**, Two views of a *C. viduus* shelter (upper right) near Green Tree Ants. **4**, Another *C. viduus* shelter (upper left) near Green Tree ants. Photographs by Abhijith A. P. C.





**Figure 6.** *Carrhotus viduus* near Green Tree Ants as they tend a colony of scale insects (Hemiptera: Coccoidea). **1**, Ants with scale insects. **2**, Immature *C. viduus* feeding on a scale insect while watching Green Tree Ants as they tend to their scale insects. **3**, Female *C. viduus* watching a Green Tree Ant that has assumed a threatening posture. Photographs by Abhijith A. P. C.





**Figure 7.** Male *Carrhotus viduus* near Green Tree Ants. **1**, Note the position of this male below the ants (arrow). **2**, Male watching active group of Green Tree Ants. **3**, Dorsal view of male. **4-5**, Two views of male in shelter. Photographs by Abhijith A. P. C.





**Figure 8.** *Carrhotus viduus* near Green Tree Ants as they tend aphids (Hemiptera: Aphidoidea) on *Capsicum*. Photographs by Abhijith A. P. C.





**Figure 9.** Nests of *Carrhotus viduus* near a colony of Green Tree Ants. **1-3**, Three views of *Carrhotus* nest containing pre-emergent second instar *C. viduus*. **4**, Tape measure (20 inch extension) to indicate scale (nest shown by arrow at lower left). **5**, *Carrhotus* (arrow) and nest (C) near Green Tree Ants (upper right). Note the nearby *Myrmarmachne plataleoides* (O. Pickard Cambridge 1869) nests (M). *M. plataleoides* is a well-known mimic of the Green Tree Ant. **6**, Detail from (5), showing a male *M. plataleoides* tending to a female in her shelter (M, lower right). Photographs by Abhijith A. P. C.





**Figure 10.** Adult female *Carrhotus viduus* near Green Tree Ants. **1**, Watching a column of ants at a distance. **2**, Constructing a shelter. **3**, Lateral view. Photographs by Abhijith A. P. C.





**Figure 11.** Various prey of *Carrhotus viduus*. **1**, Immature feeding on a spider (*Tetragnatha*). **2-5**, Feeding on whiteflies (Hemiptera: Aleyrodoidea). Note the presence of a small, tending ant (3-4). **6**, Immature feeding on a female *Myrmarachne plataleoides*. **7-8**, Female feeding on an adult male *M. plataleoides*. Photo credits: 1-6, Abhijith A. P. C.; 7-8, M. Vijay.



Mezőf et al. (2020) reported that the European *Carrhotus xanthogramma* (Latreille 1819) fed on a wide variety of arthropod prey, of varying size, to include not only Hemiptera but also some ants and spiders. This generally agrees with our own observations of *C. viduus*, although we have not seen these spiders feeding on any of the ants that they associate with. Predation on the ant-mimic *Myrmarachne plataleoides* (Figure 11:6-8), in the absence of predation on the Green Tree Ant (*Oecophylla smaragdina*), suggests that these *Carrhotus* may readily observe the difference between the two. The frequent observation of nearby ants by *C. viduus* (Figures 3:2, 4, 6:2-3, 7:2, 8:1, 10:1) is notable, as this spider appears to seek out the associates of these ants as prey, but successfully avoids the ants.

## Acknowledgements

We thank M. Vijay, RMNH Mysore for permission to include his photographs in this paper.

## References

- Caleb, J. T. D., C. Bera and S. Acharya. 2020.** New species and synonymies in the genus *Carrhotus* Thorell, 1891 from India (Aranei: Salticidae: Salticini). *Arthropoda Selecta* 29 (1): 51-66.
- Jastrzębski, P. 1999.** Salticidae from the Himalaya: The genus *Carrhotus* Thorell 1891 (Araneae, Salticidae). *Senckenbergiana Biologica* 79: 1-9.
- Johnson, K. P., C. H. Dietrich, F. Friedrich, R. G. Beutel, B. Wipfler, R. S. Peters, J. M. Allen, M. Petersen, A. Donath, K. K. O. Walden, A. M. Kozlov, L. Podsiadlowski, C. Mayer, K. Meusemann, A. Vasilikopoulos, R. M. Waterhouse, S. L. Cameron, C. Weirauch, D. R. Swanson, D. M. Percy, N. B. Hardy, Irene Terry, S. Liu, Xin Zhou, B. Misoff, H. M. Robertson and K. Yoshizawa. 2018.** Phylogenomics and the evolution of hemipteroid insects. *Proceedings of the National Academy of Sciences, USA* 115 (50): 12775-12780.
- Koch, C. L. 1846.** Die Arachniden. J. L. Lotzbeck, Nürnberg, Dreizehnter Band: 1-234, pl. 433-468, figs. 1078-1271; Vierzehnter Band: 1-88, pl. 467-480, figs. 1272-1342.
- Latreille, P. A. 1819.** [Articles sur les araignées]. In: Nouveau dictionnaire d'histoire naturelle, appliquée aux arts, à l'agriculture, à l'économie rurale et domestique, à la médecine, etc. Nouvelle Édition. Deterville, Paris, Tome 30-36.
- Logunov, D. V. 2021.** New species and records of the jumping spiders from India and Nepal (Aranei: Salticidae). *Arthropoda Selecta* 30 (3): 351-361.
- Maddison, W. P. 2015.** A phylogenetic classification of jumping spiders. *Journal of Arachnology* 43: 231-292.
- Maddison, W. P., S. C. Evans, C. A. Hamilton, J. E. Bond, A. R. Lemmon and E. M. Lemmon. 2017.** A genome-wide phylogeny of jumping spiders (Araneae, Salticidae), using anchored hybrid enrichment. *ZooKeys* 695: 89-101.
- Metzner, H. 2021.** Jumping spiders (Arachnida: Araneae: Salticidae) of the world, *online at: <http://www.jumping-spiders.com/>*, accessed on 5 OCT 2021.
- Mezőf, L., G. Markó, C. Nagy, D. Korányi and V. Markó. 2020.** Beyond polyphagy and opportunism: natural prey of hunting spiders in the canopy of apple trees. *PeerJ* 8:e9334 DOI 10.7717/peerj.9334 (pp. 1-38)
- Pickard-Cambridge, O. 1869.** Descriptions and sketches of some new species of Araneida, with characters of a new genus. *Annals and Magazine of Natural History* (4) 3: 52-74.
- Thorell, T. 1877.** Studi sui Ragni Malesi e Papuani. I. Ragni di Selebes raccolti nel 1874 dal Dott. O. Beccari. *Annali del Museo Civico di Storia Naturale di Genova* 10: 341-637.
- Thorell, T. 1891.** Spindlar från Nikobarerna och andra delar af södra Asien. *Kongliga Svenska Vetenskaps-Akademiens Handlingar* 24 (2): 1-149.
- Thorell, T. 1895.** Descriptive catalogue of the spiders of Burma, based upon the collection made by Eugene W. Oates and preserved in the British Museum. London: 1-406.
- WSC. 2021.** World Spider Catalog. Version 22.5. Natural History Museum Bern, *online at <http://wsc.nmbe.ch>*, accessed on 5 OCT 2021. doi: 10.24436/2