

## Wasp-like movement by the jumping spider *Myrmarachne dishani* in Sri Lanka (Araneae: Salticidae: Astioda: Myrmarachnini)

David Edwin Hill<sup>1</sup>

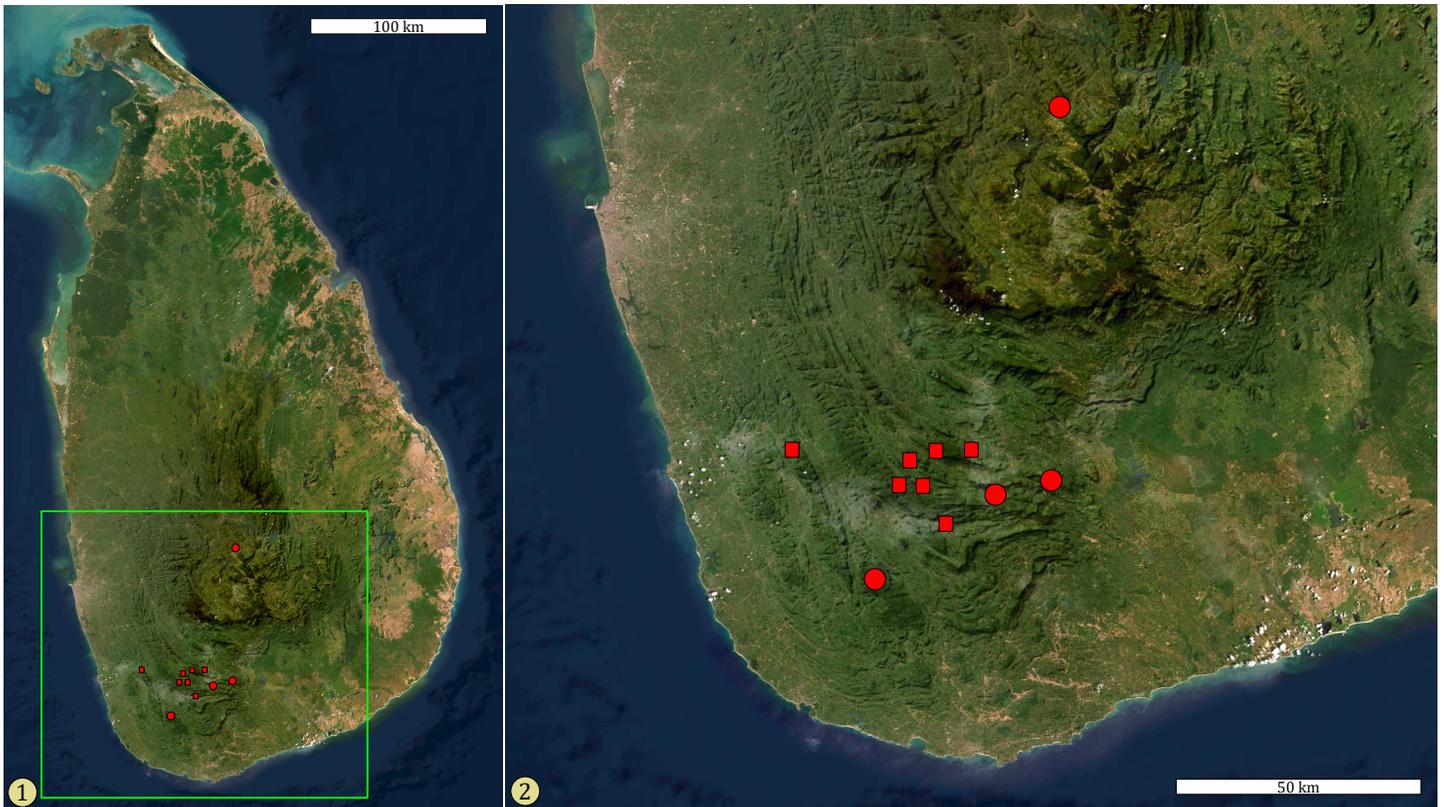
<sup>1</sup> 213 Wild Horse Creek Drive, Simpsonville, South Carolina 29680, USA, *email* platycriptus@yahoo.com

The myrmarachnine jumping spider *Myrmarachne* (*Myrmage*) *dishani* was described by Benjamin (2015) from several specimens previously collected in the Morningside section of the Sinharaja Forest Reserve in southern Sri Lanka. Benjamin also examined specimens from several other localities, and more recently this species has also been observed by a series of *iNaturalist* photographers. All localities where this distinctive spider has been found are less than 100 km from the type locality (Figures 1, 2). It is thought to be endemic to that area, a region of primary tropical rainforest and high endemism that, with the Western Ghats of India, has been designated as a *biodiversity hotspot* (CEPF 2008).

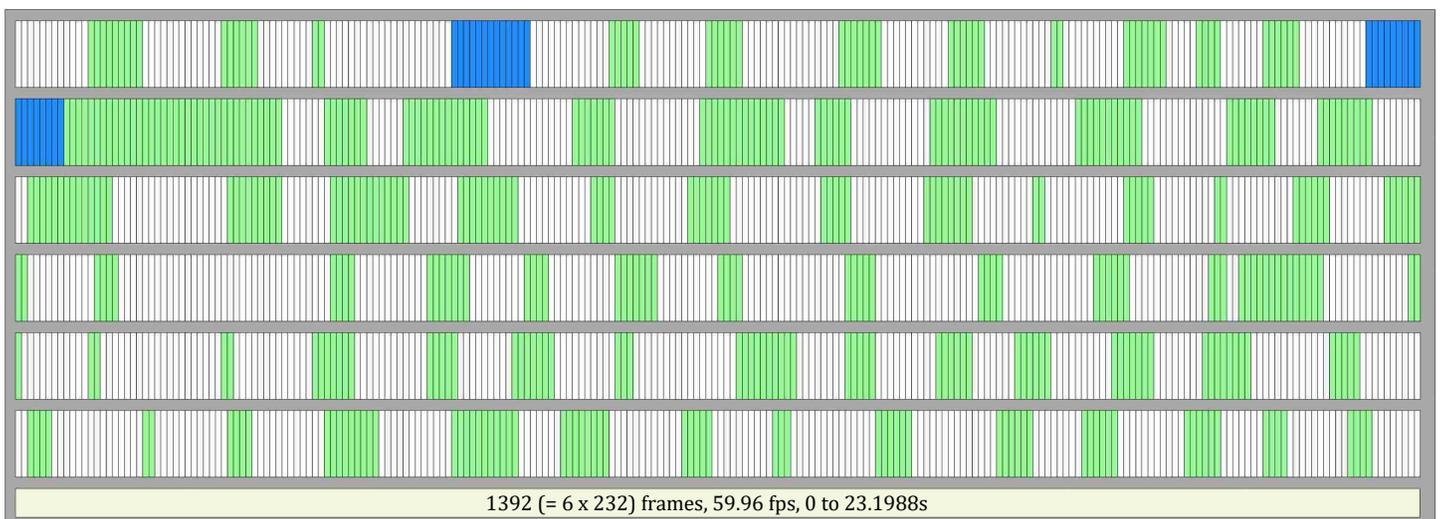


**Figure 1.** Adult ♂ *Myrmarachne dishani* in Sri Lanka. **1**, Holding prey (iNaturalist observation 269736198, © Pasindu Dilshan Abegunawaradhana, CC BY-NC 4.0). **2**, Lateral view (iNaturalist observation 152807660, © Tharindu Ranasinghe, CC BY-NC 4.0). Note the highly reflective dorsal opisthosoma. The elongated chelicerae of these males are laterally compressed and distally expanded. In many other *Myrmarachne* the chelicerae are dorsoventrally compressed, and grooved on the upper surface. Unlike most members of this genus, which appear to be ant mimics, *M. dishani* are marked with stripes or bands of bright setae, and each metatarsus + tarsus of legs I is bright white. Including the chelicerae, these males are about 8.25 mm in length.

I have recently been able to study the movement of an adult male *M. dishani* in Sri Lanka through the examination of frames from a low resolution 59.96 fps video clip. At normal playback speed, this shows the spider running continuously on a series of low growing leaves and stems. However frame-by-frame analysis of this video clip reveals something quite different: This spider was actually changing its position intermittently (~3 Hz), and for about 2/3 of the time it was not stepping or turning at all (Figure 3).



**Figure 2.** Known distribution of *Myrmarachne dishani* in southwestern Sri Lanka (detail of inset at right). Records published by Benjamin (2015) are shown as larger circles; squares represent additional records posted on the *iNaturalist* site. Most of these spiders have been found between Ratnapura and Galle, near the Sinharaja Forest Reserve. The type locality is in the Morningside section of Eastern Sinharaja. The male photographed for this study of movement corresponds to *iNaturalist* observation 229429298. Maps ©OpenStreetMap.



**Figure 3.** Frame-by-frame analysis of movement by a ♂ *Myrmarachne dishani*. Each space represents one frame of a 1392 frame video clip, recorded at 59.96 fps. The entire sequence, from left to right and top to bottom, is shown here. Each horizontal record represents ~4s. During white intervals ( $n=75$ , median length 0.183s, average length 0.196s), this spider remained in place and did not turn or step. During green intervals ( $n=72$ , median length 0.100s, average length 0.109s), the spider turned or stepped. Approximately  $\frac{2}{3}$  (0.63) of the time this spider was not turning, stepping, ore engaged in a jumping sequence, but it continued to bob its opisthosoma and wave legs I up and down. During blue intervals this spider was preparing to jump and then jumped. This spider moved intermittently at an average rate of  $\sim 3.2$  Hz, or more than 3 times per second.

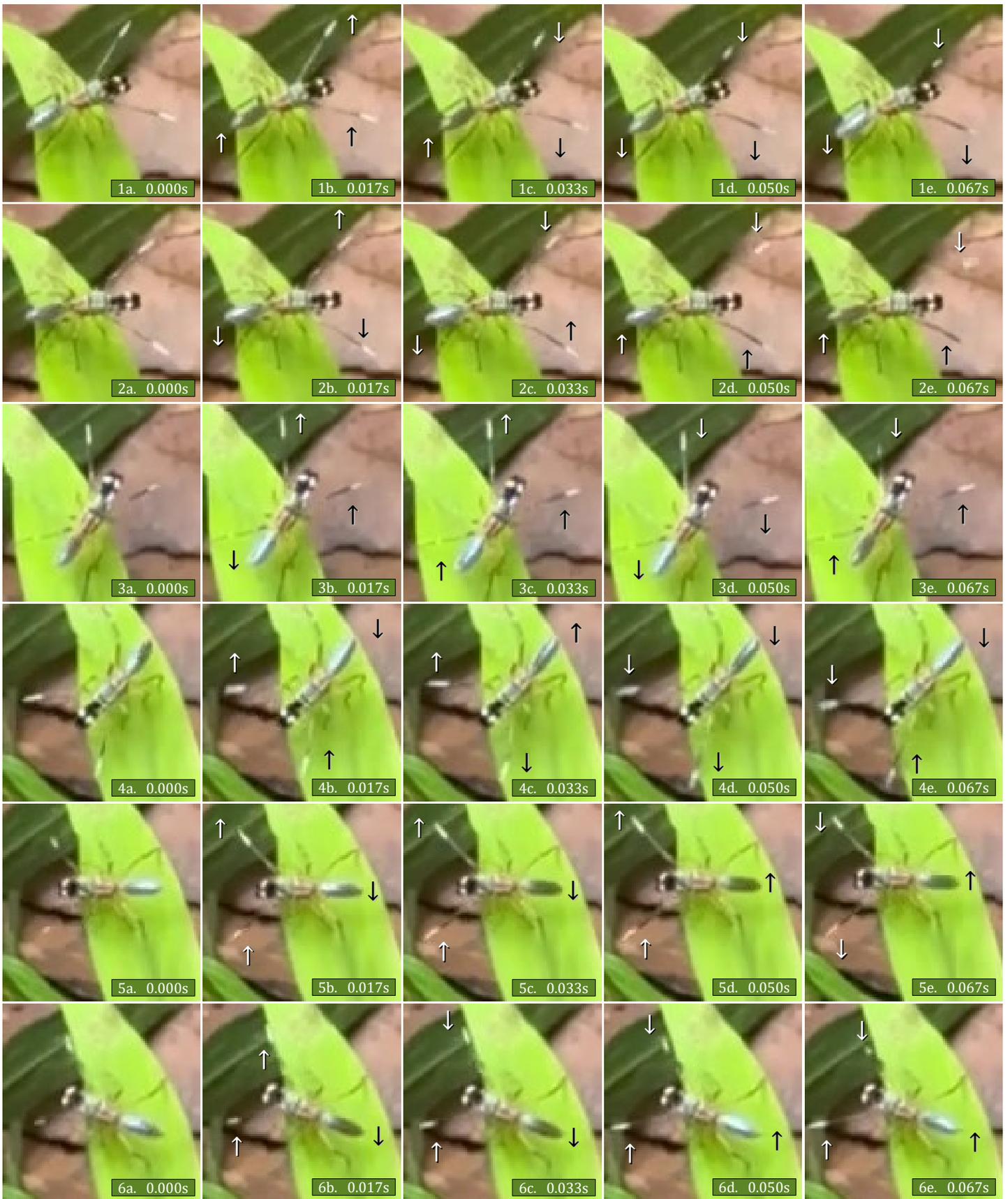
Shamble et al. (2017) described what they called *locomotor mimicry* in *Myrmarachne formicaria*, a Palaearctic species that has now been introduced to North America. They recorded *overall movement* of these spiders with 120 fps video, and considered segments in which they moved at less than 4 mm/s to be *stationary episodes*, which averaged 0.083s in duration, accompanied by *in phase* (bilaterally symmetric) rearing of legs I. Their study focused on the winding paths of these spiders in an arena, and thus cannot be compared with our observations of movement by *M. dishani* in a more complicated natural setting.

One of the two jumps that were recorded in this video clip is shown in Figure 4. The male *M. dishani* flexed its hind legs (legs IV) and then jumped directly to a nearby branch at a distance of 4.7 cm. The take-off velocity of this jump was at least 40 cm/s. This was somewhat slower than the take-off velocity measured for jumps by the salticid *Phidippus* for jumps to positions, which tend to be slower than predatory jumps (Hill 2020). However this velocity was sufficient to place the spider directly on top of the branch that it faced. Some accounts (e.g., Jackson 1986) have suggested that *Myrmarachne* species do not jump like other salticids, but this is clearly not the case for *M. dishani*. Hashimoto et al. (2020) more recently reported that ant-like *Myrmarachne* species could not jump as far as other jumping spiders.



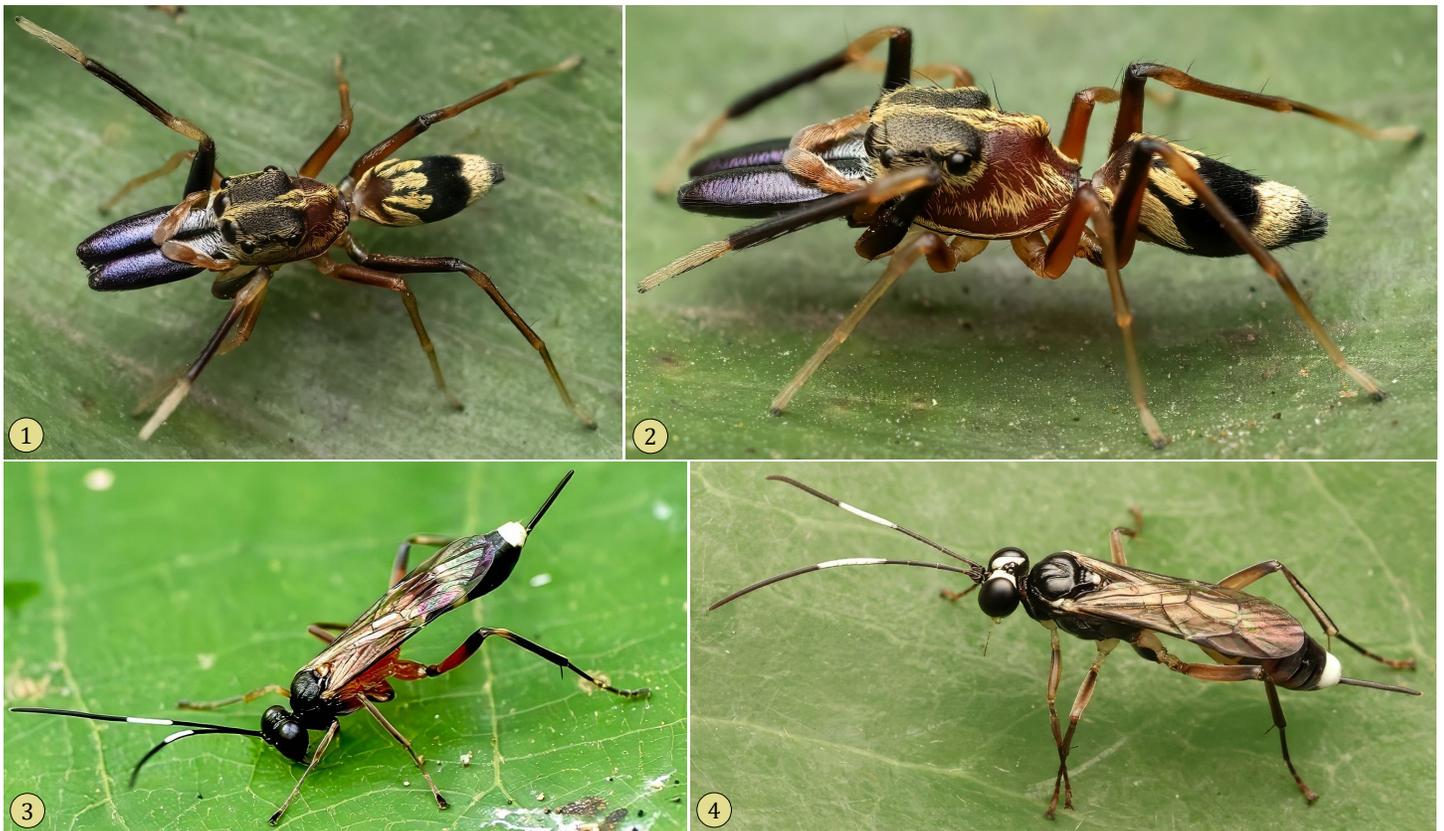
**Figure 4.** Jump by a ♂ *Myrmarachne dishani*. Note the starting position for this jump at left, with legs IV flexed. This is a typical position for jumping spiders with longer legs IV, and provides mostly forward propulsion toward a target as these legs are extended. The arrow shows the blurred image of this spider at the center point (in both space and time) for this jump. The linear scale was determined by comparison with the known width of a cell phone that appeared in early frames of this sequence, and the resultant estimate of the length of this spider, including chelicerae, was 8.25 mm as shown in the blue scale bar at lower left.

Waving (up and down) of the extended legs I and up-down bobbing of the opisthosoma were both observed by comparison of sequential frames during a total of 16 different sequences in which this spider did not turn or step, but remained in one position (corresponding to white intervals in Figure 3; see Figure 5). These sequences covered a total of 3.434s. A total of 35 up-down-up or down-up-down cycles of opisthosomal bobbing were counted in this period, averaging 10.19 Hz. Leg I waves (also up-down-up or down-up-down cycles) took place at a slower rate, averaging 5.46 Hz for each leg. The two legs I only moved in the same direction 47% of the time, indicating that they were moved asynchronously.



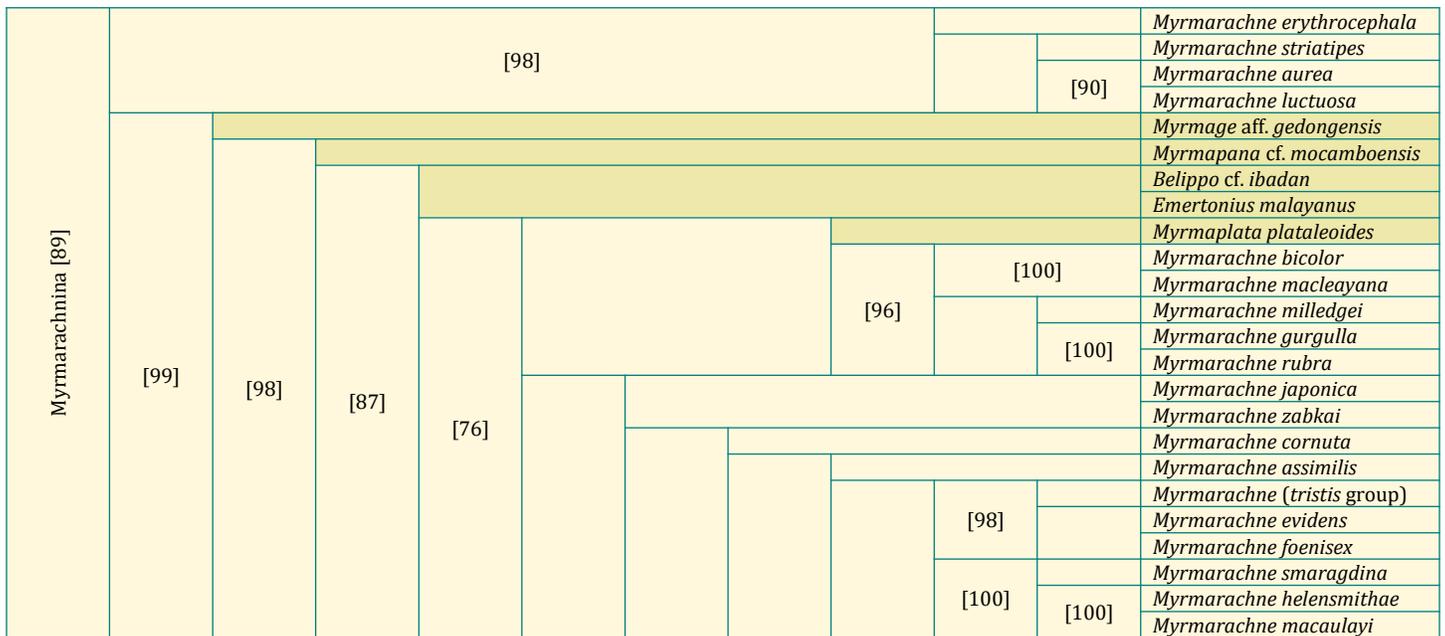
**Figure 5.** Six series (1-6) of consecutive frames showing how up or down direction of movement was determined by comparison of consecutive frames. Each arrow indicates movement of either a leg I or the opisthosoma relative to the previous frame. In some cases this direction could only be determined by comparison of a larger series of frames.

Most *Myrmarachne* species are relatively uniform in coloration, in many cases closely mimicking the ants with which they associate. *M. dishani*, much like the distantly related *M. exasperans* (Figures 6.1-6.2), have a distinctive pattern of scales on the carapace. The frequency of rapid bobbing of the opisthosoma by both species is 10-11 Hz, near the rate measured for movement of the wings and antennae by cryptine wasps (Hymenoptera: Ichneumonidae: Cryptini: *Goryphus*; Figures 6.3-6.4) that have been observed in the same microhabitat (Hurni-Cranston & Hill 2019). The reflective opisthosoma of *M. dishani* resembles the moving wings of these wasps, and the banding of the carapace and chelicerae may also resemble the white bands or markings of some *Goryphus* species. In addition, both *M. dishani* and *M. exasperans* wave a light-colored metatarsus+tarsus I, similar to the white segment on each antenna of *Goryphus*. Thus we hypothesize that *M. dishani*, like *M. exasperans*, is a mimic of these small wasps. This may represent a form of Batesian mimicry, protecting *M. dishani* from attacks by larger wasps that specialize on spider prey (Hurni-Cranston & Hill 2019).



**Figure 6.** 1-2, Adult ♂ *Myrmarachne exasperans*, Bali (*iNaturalist* observation 257573277, © Lawrence Hylton, CC BY 4.0). Males of this species, unlike *M. dishani* (but like the type for the genus *Myrmarachne*, *M. melanocephala* MacLeay 1839), has dorsoventrally compressed chelicerae. 3, ♀ *Goryphus* cf. *basilaris* Holmgren 1868, Shenzhen, Guangdong (*iNaturalist* observation 166978418, © rainyang, CC BY-NC 4.0). 4, ♀ *Goryphus* cf. *basilaris*, Okinawa (*iNaturalist* observation 301017374, © Fabian A. Boetzel, CC BY-NC 4.0).

**Note on nomenclature.** Several years ago Prószyński (2016), based on the structure of the epigynum, proposed a division of the large genus *Myrmarachne* MacLeay 1839 into a series of smaller genera. There is no requirement that one follow this division although some agencies, to include the *World Spider Catalog* and *iNaturalist*, have chosen to do so. Even if this division were based on a valid phylogeny (see Figure 7), it does not assist us in the identification of these spiders and merely adds to the instability of names previously published (as does the exercise of *genus splitting* in general). At some point the phylogeny of myrmarachnines may be sufficiently known to justify the introduction of new genus group names, but that time may only come after the discovery and study of many new species.



**Figure 7.** Hypothetical phylogeny of *Myrmarachne sensu lato* (Myrmarachnina), after Maddison & Szűts (2019). Numbers correspond to bootstrap percentages for each hypothetical clade, shown for values of 75 or greater. Four of the genera created or resurrected by Prószyński (2016; *Emertonius*, *Myrmage*, *Myrmapana*, *Myrmaplata*) are nested at four different levels within this collection of *Myrmarachne* species. Thus the genus *Myrmarachne* would be polyphyletic if these generic names were used. The type species for the genus (*Myrmarachne melanocephala* MacLeay 1839) was not included in this study.

## Acknowledgments

I thank Marco Chan for sending me the video clip of *Myrmarachne dishani* used in this study, as well as for his useful comments on the text. I also thank *iNaturalist* and its many contributors for making their many records of these spiders available to a wide audience. Permission levels for photographs that appear here are [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/) and [CC BY-NC 4.0](https://creativecommons.org/licenses/by-nc/4.0/).

## References

- Benjamin 2015.** Suresh P. Benjamin. Model mimics: antlike jumping spiders of the genus *Myrmarachne* from Sri Lanka. *Journal of Natural History* 49 (43-44): 2609-2666.
- CEPF 2008.** Critical Ecosystem Partnership Fund. DEC 2008. CEPF Fact Sheet: Western Ghats & Sri Lanka Hotspot. *Online at* <https://www.cepf.net/resources/other/western-ghats-and-sri-lanka-fact-sheet>
- Hashimoto et al. 2020.** Yoshiaki Hashimoto, Tomoji Endo, Takeshi Yamasaki, Fujio Hyodo, Takao Itioka. Constraints on the jumping and prey-capture abilities of ant-mimicking spiders (Salticidae, Salticinae, Myrmarachne). *Scientific Reports* 10 (18279): 1-11.
- Hill 2010.** David Edwin Hill. 3 NOV 2010. Targeted jumps by salticid spiders (Araneae: Salticidae: *Phidippus*). *Peckhamia* 84.1: 1-35.
- Hurni-Cranston & Hill 2019.** Tiziano Hurni-Cranston, David E. Hill. 20 APR 2019. Notes on the jumping spider *Myrmarachne exasperans* (Araneae: Salticidae: Astioidea: Myrmarachnini) in Bali, a possible mimic of parasitoid wasps (Hymenoptera: Ichneumonidae: Cryptini: *Goryphus*). *Peckhamia* 176.2: 1-28.
- Jackson 1986.** R. R. Jackson. The biology of ant-like jumping spiders (Araneae, Salticidae): prey and predatory behaviour of *Myrmarachne* with particular attention to *M. lupata* from Queensland. *Zoological Journal of the Linnean Society* 88: 179-190.
- MacLeay 1839.** W. S. MacLeay. On some new forms of Arachnida. *Annals of Natural History* 2 (7): 1-14, pl. 1-2.
- Maddison & Szűts 2019.** Wayne P. Maddison, Tamás Szűts. 7 MAY 2019. Myrmarachnine jumping spiders of the new subtribe Levieina from Papua New Guinea (Araneae, Salticidae, Myrmarachnini). *ZooKeys* 842: 85-112.
- Prószyński 2016.** Jerzy Prószyński. 26 MAY 2016. Delimitation and description of 19 new genera, a subgenus and a species of Salticidae (Araneae) of the world. *Ecologica Montenegrina* 7: 4-32.
- Shamble et al. 2017.** Paul S. Shamble, Ron R. Hoy, Itai Cohen, Tsevi Beatus. Walking like an ant: a quantitative and experimental approach to understanding locomotor mimicry in the jumping spider *Myrmarachne formicaria*. *Proceedings of the Royal Society B* 284 (20170308): 1-10.