

Standing display of the Australasian jumping spider *Ohilimia* (Araneae: Salticidae: Euophryini: Papuaphryni)

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The *Diolenius* clade (Zhang & Maddison 2015) includes 10 genera of euophryine jumping spiders (Figure 1). Several of these genera (e.g., the closely related *Diolenius* and *Ohilimia*) have an unusually long trochanter of the first leg, close to the femur of that leg in length (Gardzińska & Patoleta 2010, 2013; Bohne et al. 2011).

Diolenius clade		<i>Chalcolemia</i> Zhang & Maddison 2012	Zhang & Maddison 2012
		<i>Chalcolecta</i> Simon 1884	Gardzińska & Żabka 2005
		<i>Diolenius</i> Thorell 1870	Gardzińska & Żabka 2006; Gardzińska & Patoleta 2013
		<i>Ohilimia</i> Strand 1911	Gardzińska 2006; Gardzińska & Patoleta 2010
		<i>Sobasina</i> Simon 1898	Wanless 1978; Berry et al. 1998
		<i>Efate</i> Berland 1938	Berry et al. 1996
		<i>Paraharmochirus</i> Szombathy 1915	Zhang & Maddison 2012
not sequenced		<i>Furculattus</i> Balogh 1980	Szűts 2003
		<i>Tarodes</i> Pocock 1898	Gardzińska 2015
		<i>Udvardya</i> Prószyński 1992	Gardzińska 2015

Figure 1. Hypothetical phylogeny of the *Diolenius* clade (after Zhang & Maddison 2015). *Diolenius* and *Ohilimia* are closely related, but can be separated by the presence of 5-7 pairs of evenly-spaced spines on the underside of each metatarsus I in *Diolenius*, and only 3 pairs of these spines in *Ohilimia*. In adult males these spines are quite small (Gardzińska 2006). More recent or important references for each genus are shown in the right-hand column.

Ohilimia is a little-known genus with only three named species, all endemic to New Guinea and surrounding areas in tropical Australasia (Figure 2). Almost nothing is known of the ecology, behavior, or natural history of these species, although Davies and Żabka (1989) stated that this was a fly mimic:

Diolenius [*Ohilimia scutellata*], a fly-mimic is found on the leaves of palms, ginger and other plants in north Queensland. The spider moves backwards, its elongate front legs resembling the wings of a fly.

This fly-mimicry was subsequently referenced by Gardzińska (2006) in her revision of *Ohilimia*:

According to Davies and Żabka (1989), species of *Ohilimia* mimic flies in reverse. Their first elongate legs are held in the manner reminiscent of flies' wings and they move backwards.

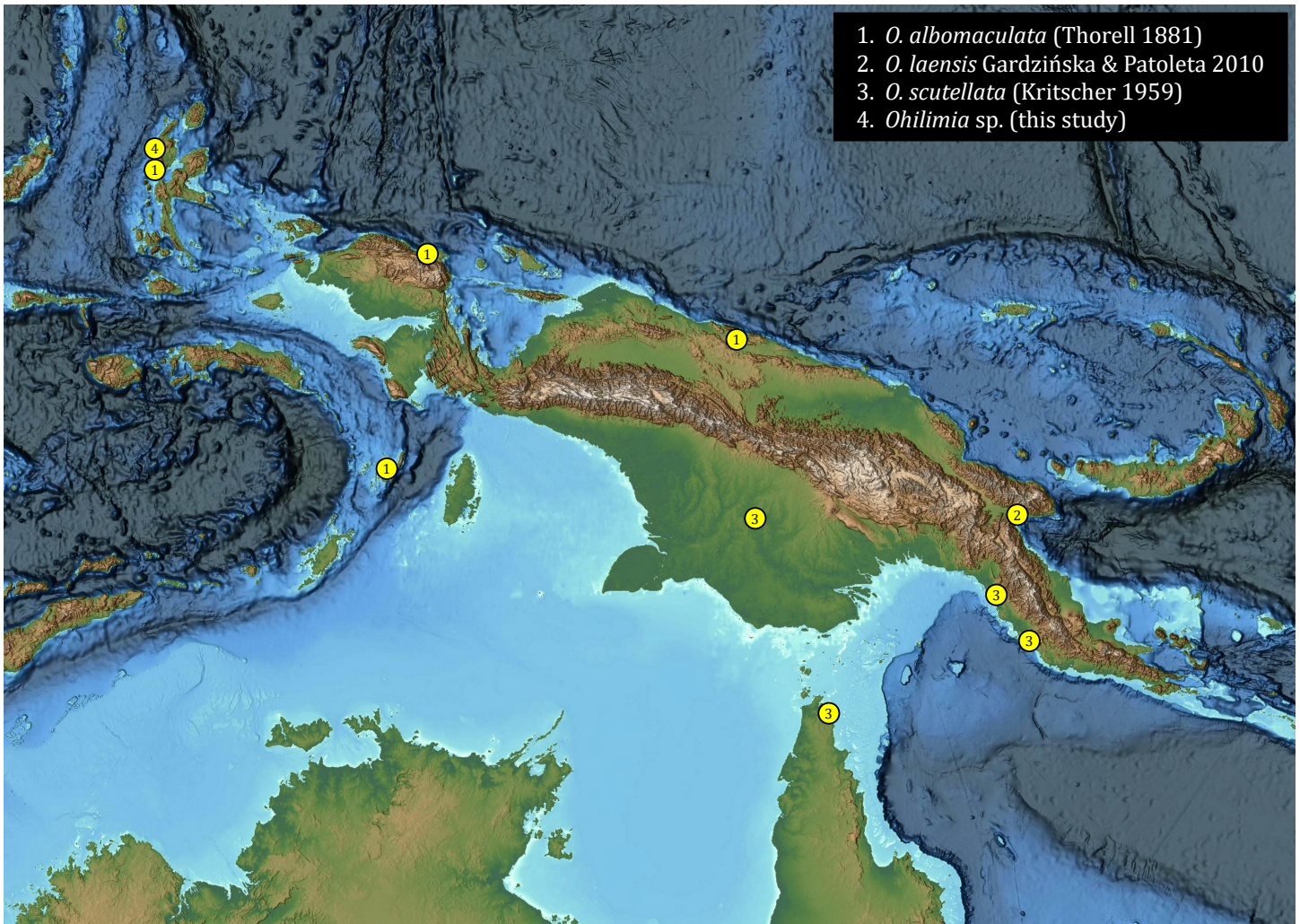


Figure 2. Range of *Ohilimia* in tropical Australasia (Sahul), far to the east of the Wallace line. Localities shown here are based on references cited in Figure 1. Behavior described in this paper was based on observation of a single male photographed at West Halmahera Regency, North Maluku, Indonesia (4). Recently photographs of a male of the same species, from Kota Ternate, a small volcanic island just west of North Maluku, were posted on iNaturalist (Berghöfer 2024).

The predatory function of the long first legs of these spiders has not been described, and here we have no related observations to report. However it seems that, although these spiders can jump, they may rely on raptorial extension of legs I, equipped with powerful tibial spines, to reach forward and grab their prey. In addition no aspect of the courtship behavior of these spiders has been described.

Here, based on a kinematic study of a series of 60 fps video clips recorded by one of the authors (YN) at West Halmahera Regency, North Maluku, Indonesia, we describe the *standing display* of a single male *Ohilimia* (locality 4 in Figure 2; Figures 3.1-3.3). This is not a courtship display, but represents a pattern of movement of the spider when resting at a single position (not stepping), apparently a form of advertisement as it makes the spider more visible to conspecifics, potential prey, and potential predators. Displays of this kind, in particular pedipalp flickering (rapid up and down movement) are frequently observed in other salticids.

Unfortunately published descriptions of *Ohilimia* species do not include field marks or the coloration of living spiders, and we cannot determine whether this represents a male *O. albomaculata*, which has been found in the same area, or a new species. The identity of other *Ohilimia* that have been posted on *iNaturalist* (Figures 3.4-3.6) also cannot be confirmed, for the same reason.



Figure 3. Male *Ohilimia* sp. **1-3**, Adult male from West Halmahera Regency, North Maluku, Indonesia, studied in this paper. **4**, Penultimate male from Cape Tribulation, Queensland (29 JAN 2022). The spines of metatarsus I of this spider are relatively long, like those of females. **5-6**, Adult male from Cairns, Queensland (14 SEP 2024). Like (4), this may be an *O. scutellata*. Photo credits: 1-3, © Yongi Ng; 4, © Maurice Allan, iNaturalist observation 205830858; 5-6, © Bridgette Gower, iNaturalist observation 243239767. Photos 4-6 edited and used under a [CC BY-NC 4.0](https://creativecommons.org/licenses/by-nc/4.0/) license.

The flexibility of the long legs I of both *Diolenius* and *Ohilimia* is remarkable. The trochanter I of these spiders is not a simple ring that provides flexibility at the base of femur I, as it does in most salticids, but represents in effect an additional segment altogether, quite as long as the femur, that gives these spiders a much greater reach (Figure 4.1). During the *standing display*, the full flexibility of these legs is not used, as the combined femur-patella-tibia I remains flexed and rotates as a single unit (Figures 4.2-4.6).

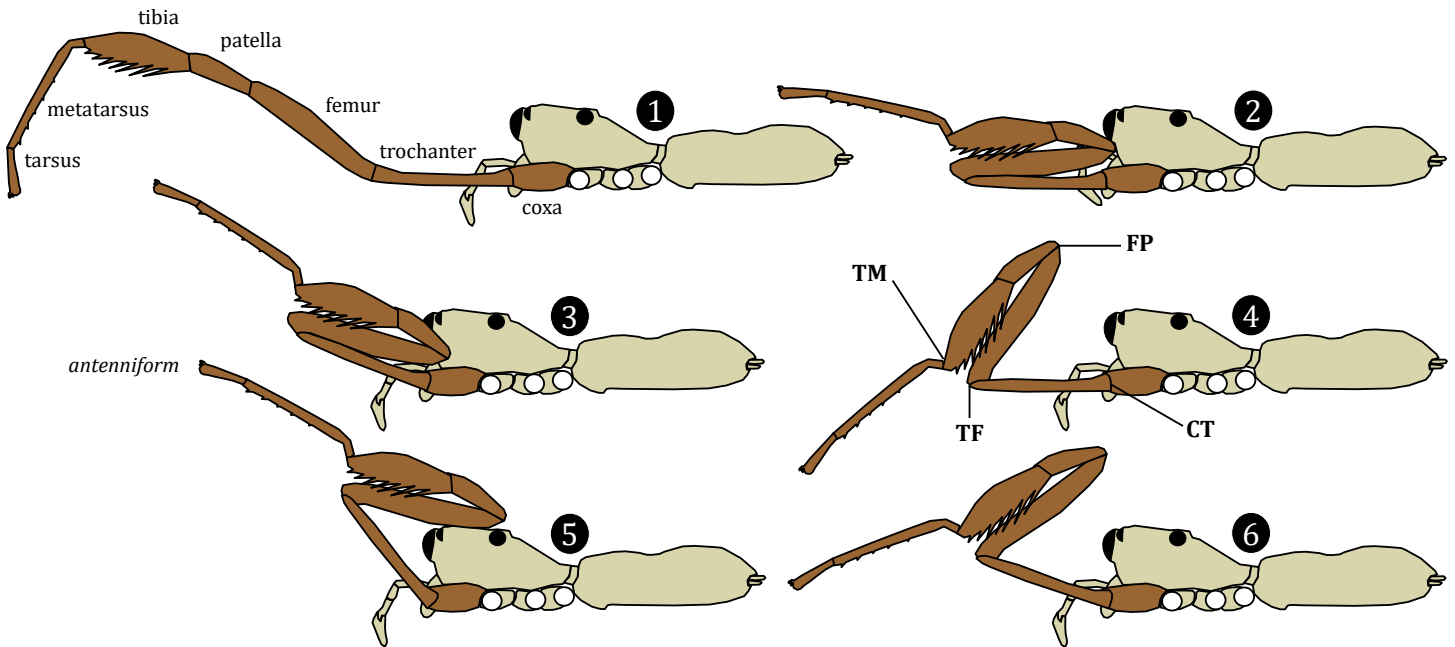


Figure 4. Some of the positions that can be assumed by a *Diolenius* (as shown here) or an *Ohilimia*, as viewed from the side (modified after Bohne et al 2011). **1**, Full extension of all leg segments gives these spiders a very long reach. **2**, Standing display with trochanter in horizontal position. **3**, Standing display with trochanter elevated at the coxa-trochanter joint (CT). **4**, Standing display with the femur extended at the trochanter-femur joint (TF). **5-6**, Standing displays with varying degrees of CT elevation and TF extension. Note that during the standing display, there is little or no rotation at the femur-patella joint (FP), and the femur-patella-tibia I are moved as a unit. During this display some rotation at the tibia-metatarsus I (TM) joint allows the antennaform end of each leg to be brought down to touch the substrate.

During the standing display of the male *Ohilimia* recorded (with 60 fps video) for this study, separation of legs LI and RI varied at some angle in front of the spider. Often, leg I of one side would be lifted as the contralateral leg I was lowered, but, although a general pattern, this alternation was not rigid (Figures 5-6).

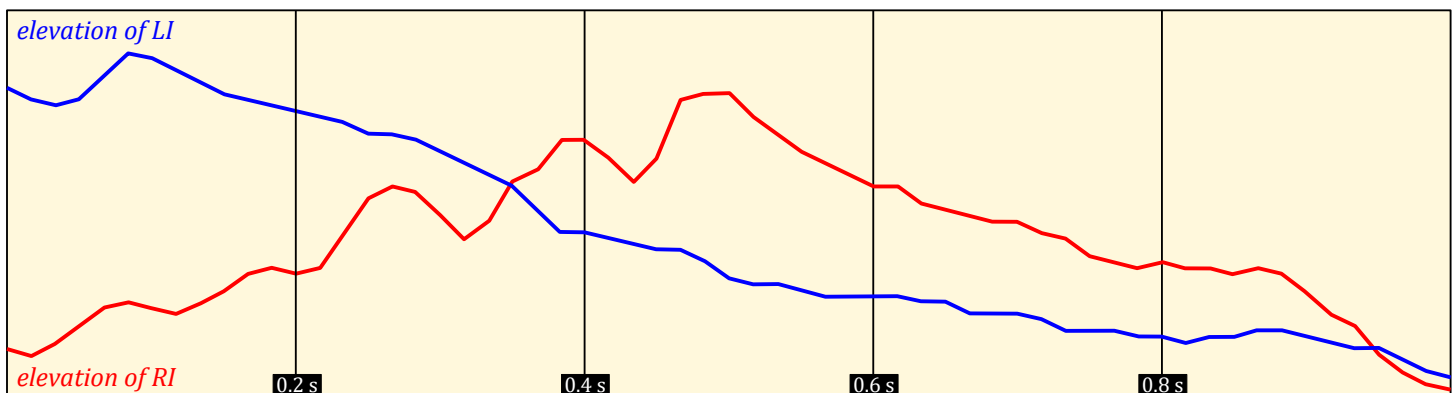


Figure 5. Relative elevation of legs LI and RI during one second of a standing display, corresponding to frames shown in Figure 6, where the measurement is explained. The larger pattern of elevation of RI (up and then down at ~ 1 Hz), due mostly to elevation of the trochanter, was modified by ~ 10 Hz cycles of rotation of the femur at the TF joint (first 0.5 s).

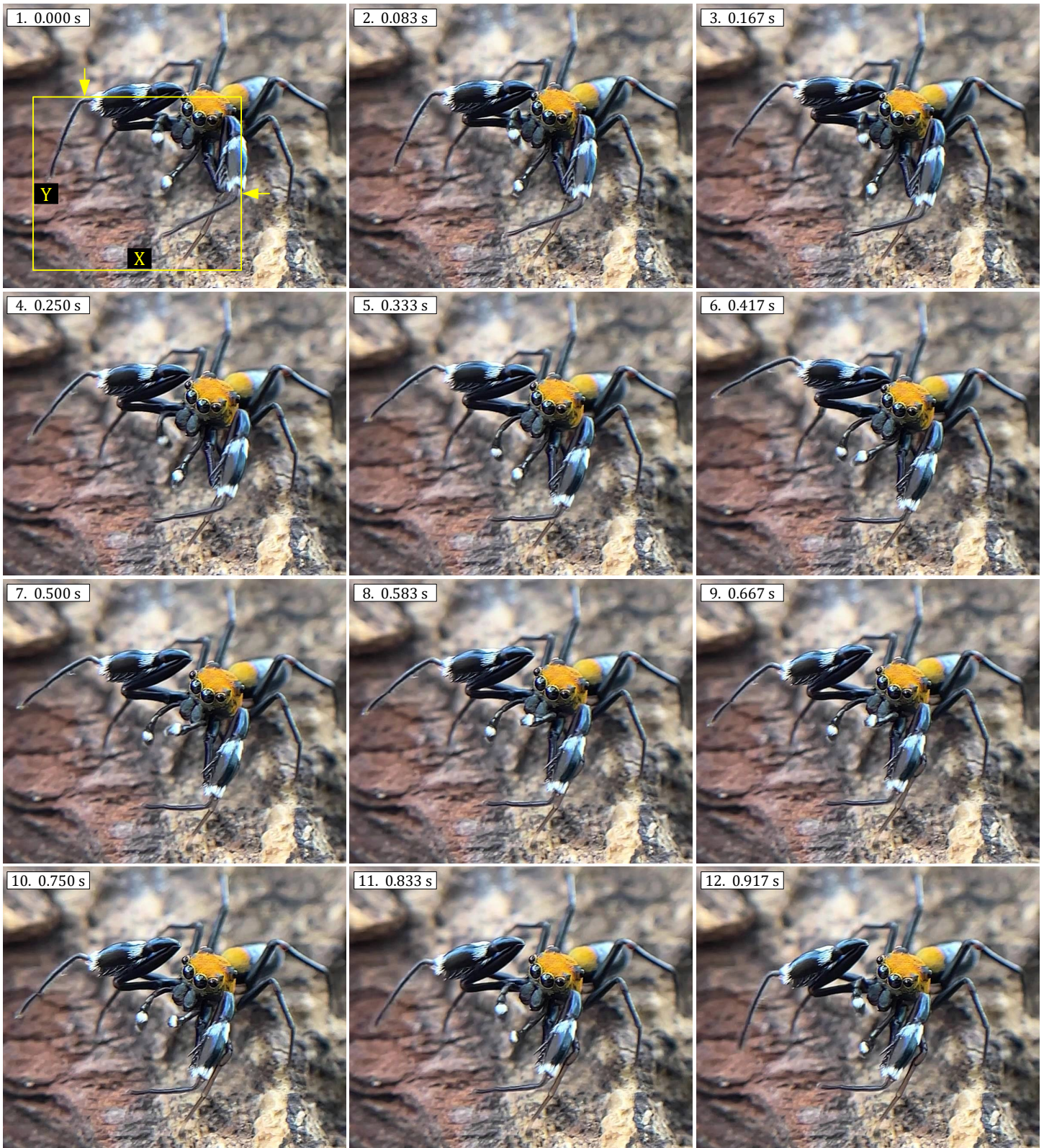


Figure 6. Selected frames from the 60 fps video represented in Figure 5. In frame (1), the measurements used to estimate relative elevation of legs RI (Y) and LI (X) are shown, relative to a rectangle fixed in position at the lower left corner. Note also alternating extension of the pedipalps, each marked with a bright white spot.

The next video clip (2 s, 60 fps) was studied in more detail to determine movement of leg I segments, the pedipalps, and the opisthosoma during a standing display (Figures 7-10).

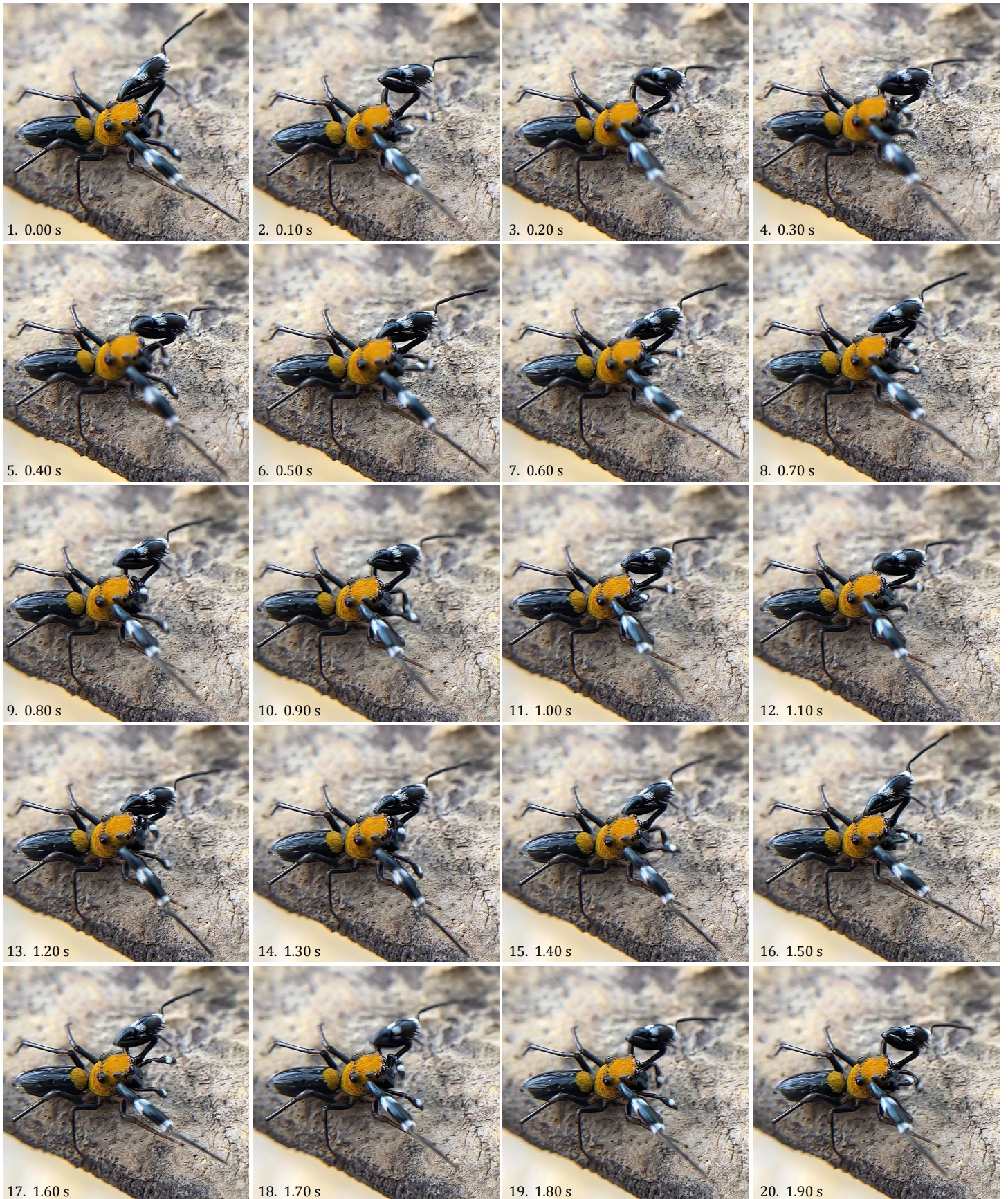


Figure 7. Selected frames (10 fps) from a 60 fps video segment. Note movement of both legs I and both pedipalps during this sequence. Positions used for measurements are shown in Figure 8, and the resulting movements are charted in Figures 9-10.



Figure 8. 1, Detail of frame shown in Figure 7.1. 2, Overlay of measured positions (x, y coordinates) on each frame in the complete 2 s, 60 fps sequence charted in Figures 9-10. Anatomical positions were derived from these positions as follows: angle 2-1, forward inclination of LI; 2, elevation (y) of LI patella base; 3, elevation (y) of opisthosoma; distance 5 (centered on right ALE)-8, length used to estimate elevation of leg RI (distance greater when leg was lower); 6 (centered on white spot), elevation (y) and extension (x) of left pedipalp; 7 (centered on white spot), elevation (y) and extension (x) of right pedipalp; angle 11-10 relative to horizontal, elevation of LI trochanter; interior angle (at position 10) of triangle (2, 10, 11), elevation or extension of LI femur at TF joint. Positions 4 (centered on right PLE) and 9 (landmark) were used to establish frame position, as the video record contained slight changes in direction of the camera.

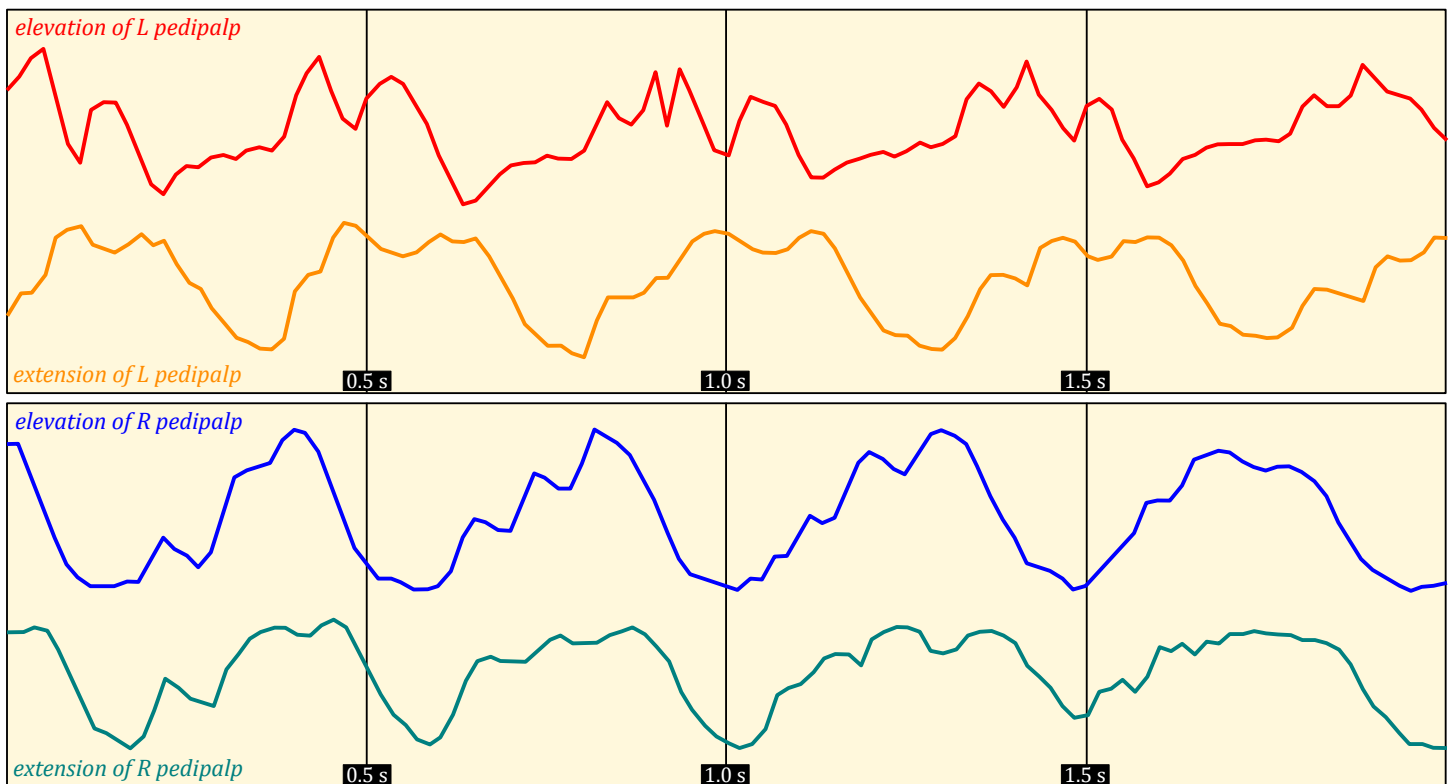


Figure 9. Relative elevation and extension of left and right pedipalps during a 2 s sequence, measured for each frame of a 60 fps sequence. For the right pedipalp (bottom), measured elevation and extension both occurred at the same time at a 2 Hz rate. Synchrony of elevation and extension of the left pedipalp (top) was less evident, but also followed 2 Hz cycles, alternating with the contralateral (right) pedipalp.

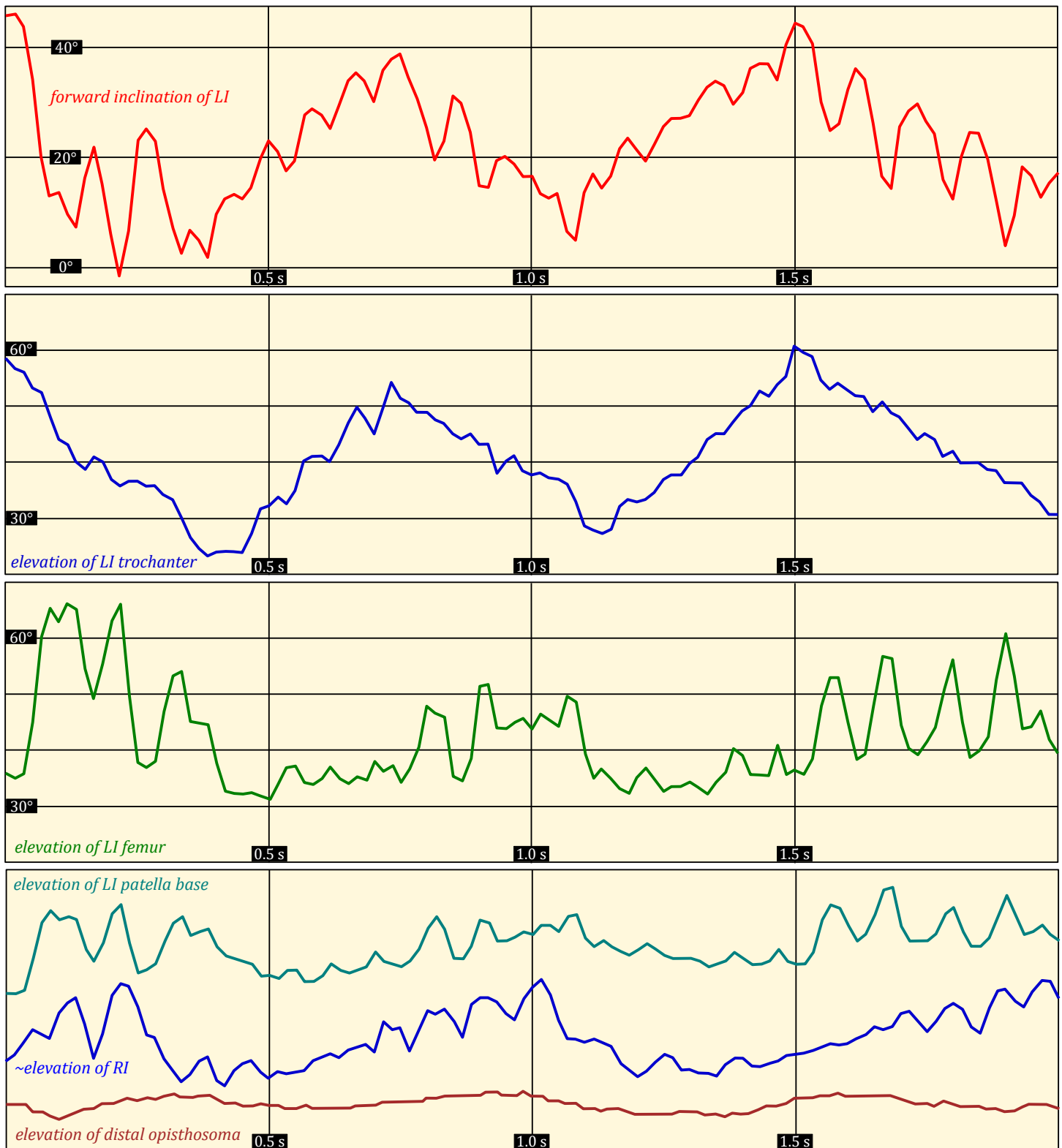


Figure 10. Relative movement of legs I and the opisthosoma during this 2 s sequence. The forward inclination of leg LI (top chart) changed in two cycles, a slower cycle ($\sim 1\text{-}2$ Hz) corresponding to elevation of the LI trochanter (second chart), and a somewhat irregular, faster cycle (~ 10 Hz) corresponding to elevation or extension of the LI femur at the TF joint (third chart). Extension of the LI femur followed elevation of the LI patella base as well as elevation of RI (bottom chart). Slow ($\sim 1\text{-}2$ Hz) and relatively low-amplitude bobbing of the opisthosoma, measured by elevation of the spinnerets (bottom of bottom chart), followed a cycle similar to that of trochanter I elevation, but was not synchronous with that elevation.

These results indicate that the elevation and depression of legs LI and RI can sometimes be "loosely" but not "closely" synchronous, and sometimes alternating, during a standing display. The two major components of movement for each leg I are linked to elevation of the trochanter (at cycles of $\sim 1\text{-}2$ Hz) and elevation of the femur at the TF joint (faster cycles of ~ 10 Hz). Pedipalps are continuously moved, alternately (L/R) elevated and extended, each at a rate of ~ 2 Hz. The opisthosoma may be bobbed over a low amplitude at a rate of $\sim 1\text{-}2$ Hz. In addition, the antenniform terminal segments (metatarsus, tarsus) of each leg I can be rotated at the TM joint to touch the ground when that leg is lowered. These features of the standing display are further illustrated in Figures 11-13.

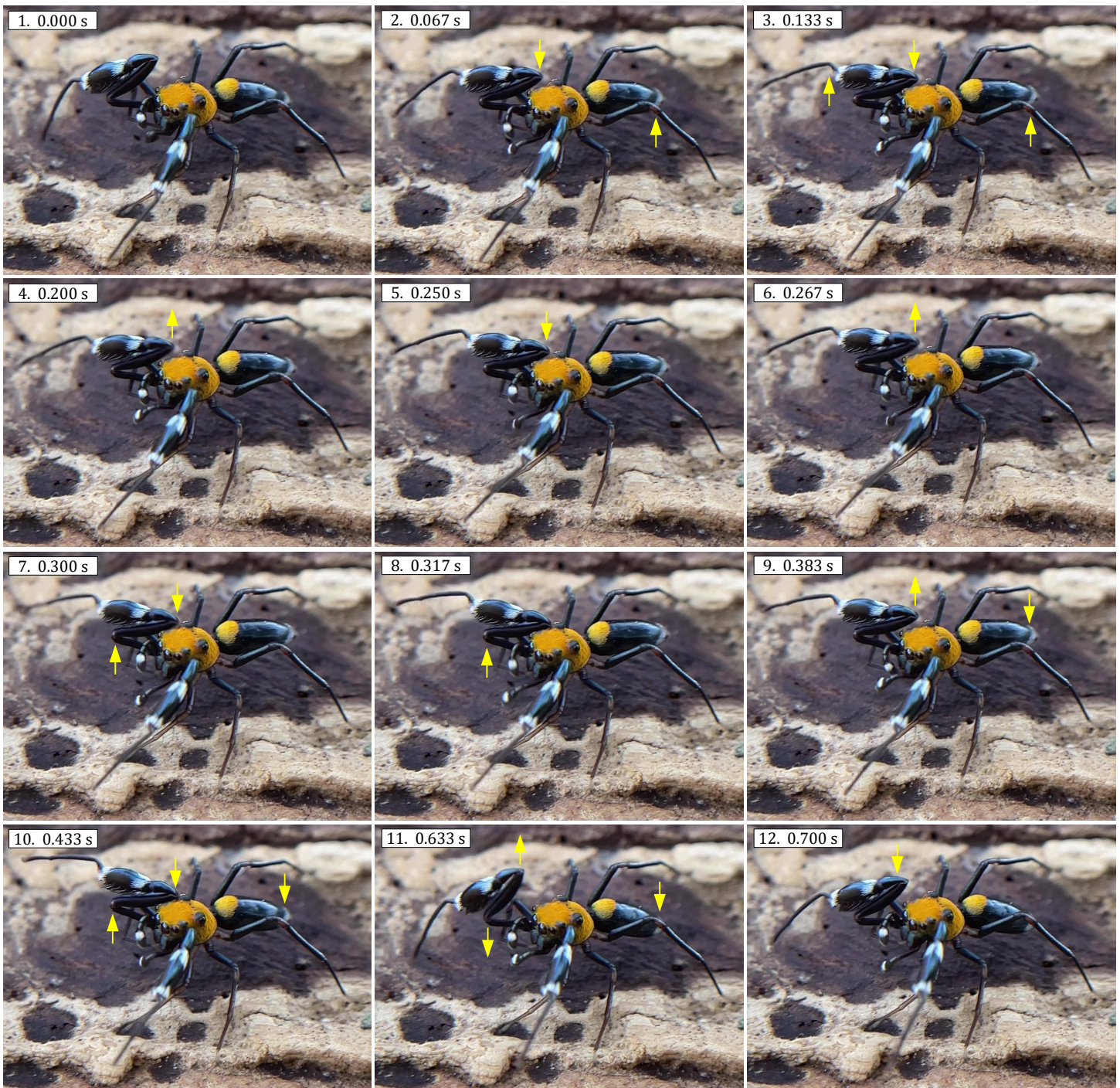


Figure 11. Sequential frames from a different 60 fps video clip showing elevation of trochanter RI (TF joint), extension or elevation of the femur (FP joint), and opisthosomal bobbing. Each arrows indicates movement relative to the previous frame.

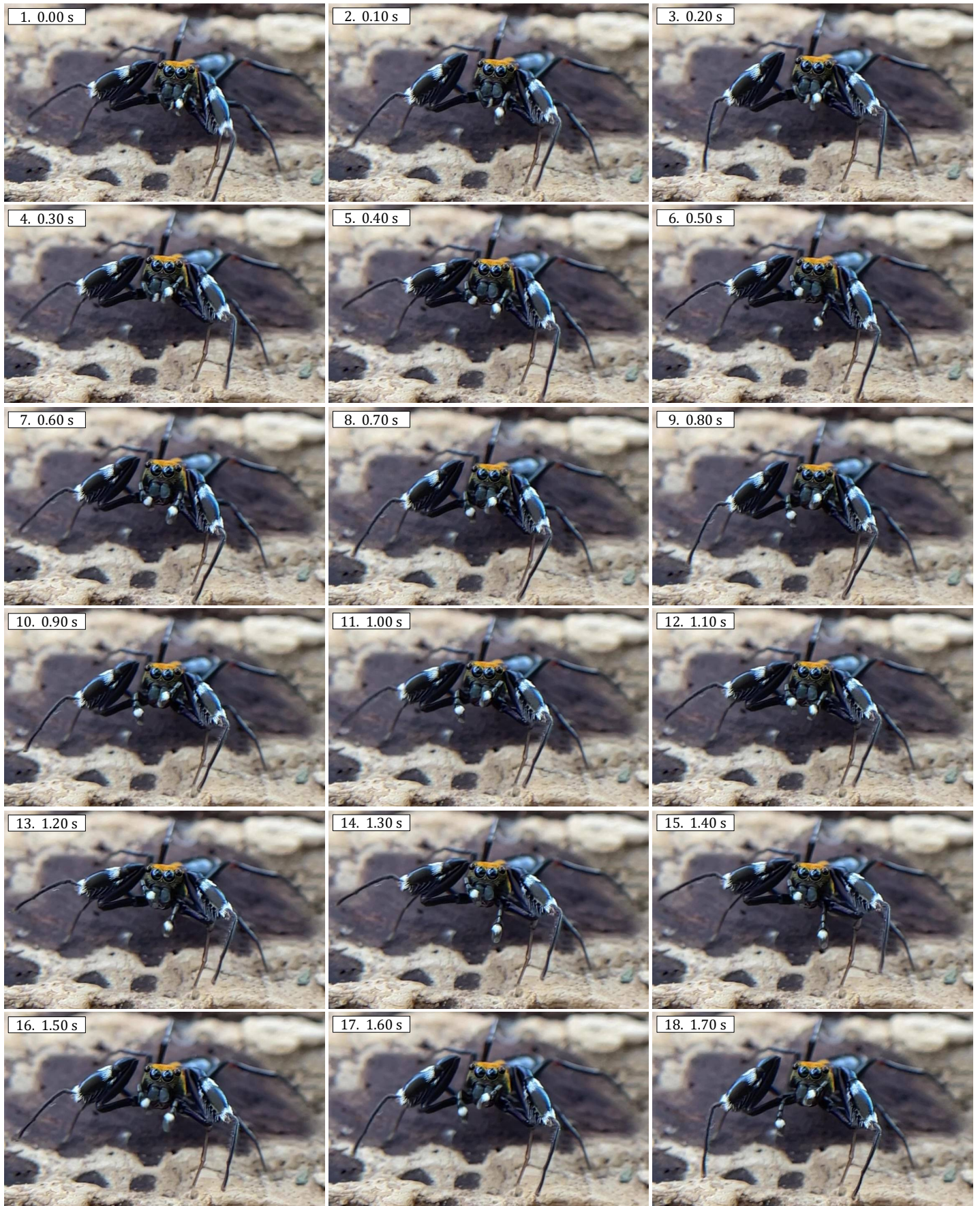


Figure 12. Sequential frames selected from a 60 fps video clip showing a frontal view of a standing display. In this view the alternating L/R extension and elevation of the pedipalps (~ 2 Hz cycles) can be seen clearly.



Figure 13. Sequential frames selected from a 60 fps video clip showing a frontal view of a different standing display. As in Figure 11, the alternating L/R extension and elevation of the pedipalps can be seen clearly. In addition, flexion of the (metatarsus, tarsus) at the TM joint, to touch the substrate, can be seen in frames 2, 5, 8, and 12. This is facilitated by the proximal bend of each proximal metatarsus I.

Role of the standing display. As discussed above, Davies & Žabka (1989) reported that these spiders walked backward to mimic flies. Although it is likely that all salticids can walk backward at times, we did not observe this behavior in *Ohilimia*. Since the acute vision of salticids is based on facing objects of interest, the utility of backward movement by a foraging or hunting spider in the open should be questioned in any case. In addition the utility of moving actively to look like a fly is also something to question, as flies represent the prey of a large variety of animals, including salticids.

We can begin with the likelihood that active movement by these spiders can draw attention to them by visual predators, or even those sensitive primarily to vibration. There is a cost. So, what is the benefit?

Several possibilities should be considered here. First, movement may attract insect prey to the spider. For example flies may be attracted to movement that mimics the movement of flies gathering to scavenge on a food source, or to potential mates. Second, rapid movement when standing or walking may mimic the movement of predatory or parasitoid wasps, thus protecting the spider from its predators to the extent that they avoid these insects. A third possibility is that the spider uses its extended legs I to mimic the head of an actively moving insect, thus diverting the attention of a predator, particularly one that attacks the head of its prey (as do salticids), from the more vulnerable carapace or opisthosoma. A variety of unrelated salticids have wide tibiae I, with antenniform distal leg segments, that together resemble insect heads when observed from the side. Movements by these spiders seem to mimic the movements of an actively foraging insect. Use of both legs I for this purpose, extended in different directions, may improve the effectiveness of this ruse. A fourth possibility is that movement draws the attention of conspecifics, leading them to reveal their presence.

Other displays, and predation. Field observations are needed to establish to role of the elongated legs I in feeding. They appear to represent raptorial appendages, perhaps less effective at exerting force during an attack, but capable of extending the reach of the spider to grasp prey, as an alternative to jumping. In addition we know nothing about the courtship display of these spiders, which may be facilitated by the presence of shorter spines on the underside of each adult male metatarsus I.

Acknowledgements

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References

- Berghöfer 2024.** Johannes Berghöfer. 19 DEC 2024. *online* at <https://www.inaturalist.org/observations/256584583>
- Berry et al. 1996.** James W. Berry, Joseph A. Beatty, Jerzy Prószyński. Salticidae of the Pacific Islands. I. Distributions of twelve genera, with descriptions of eighteen new species. *Journal of Arachnology* 24 (3): 214-253.
- Berry et al. 1998.** James W. Berry, Joseph A. Beatty, Jerzy Prószyński. Salticidae of the Pacific Islands. III. Distribution of seven genera with descriptions of nineteen new species and two new genera. *Journal of Arachnology* 26: 149-189.
- Bohne et al. 2011.** Guido Bohne, David E. Hill, Ryan Kaldari. 23 JAN 2011. Male and female *Diolenius* Thorell 1870 (Araneae: Salticidae) from Pulau Kri, Raja Ampat, West Papua, Indonesia. *Peckhamia* 87.1: 1-6.
- Davies & Żabka 1989.** Valerie Todd Davies, Marek Żabka. 13 NOV 1989. Illustrated keys to the genera of jumping spiders (Araneae: Salticidae) in Australia. *Memoirs of the Queensland Museum* 27 (2): 189-266.
- Gardzińska 2006.** Joanna Gardzińska. A revision of the spider genus *Ohilimia* Strand, 1911 (Araneae: Salticidae). *Annales Zoologici, Warszawa* 56 (2): 375-385.
- Gardzińska 2015.** Joanna Gardzińska. 5 NOV 2015. Revision of *Tarodes* Pocock, 1899 and *Udvardya* Prószyński, 1992 (Araneae: Salticidae), with descriptions of two new species of *Udvardya* from New Guinea. *Zootaxa* 4039 (3): 445-455.
- Gardzińska & Patoleta 2010.** Joanna Gardzińska, Barbara Patoleta. 27 DEC 2010. A new species of *Ohilimia* Strand, 1911 from New Guinea (Araneae: Salticidae). *Genus* 21 (4): 625-629.
- Gardzińska & Patoleta 2013.** Joanna Gardzińska, Barbara Patoleta. 23 MAY 2013. A new species and records of *Diolenius* Thorell, 1870 (Araneae: Salticidae) from New Guinea. *Zootaxa* 3664: 63-68.
- Gardzińska & Żabka 2005.** Joanna Gardzińska, Marek Żabka. A revision of the spider genus *Chalcolecta* Simon, 1884 (Araneae: Salticidae). *Annales Zoologici, Warszawa* 55 (3): 437-448.
- Gardzińska & Żabka 2006.** Joanna Gardzińska, Marek Żabka. A revision of the spider genus *Diolenius* Thorell, 1870 (Araneae: Salticidae). *Annales Zoologici, Warszawa* 56 (2): 387-433.
- Maddison 2015.** Wayne P. Maddison. A phylogenetic classification of jumping spiders (Araneae: Salticidae). *Journal of Arachnology* 43(3): 231-292.
- Szűts 2003.** Tamas Szűts. On remarkable jumping spiders (Araneae: Salticidae) from Papua New Guinea. *Folia Entomologica Hungarica* 64: 41-57.
- Wanless 1978.** F. R. Wanless. 27 APR 1978. A revision of the spider genus *Sobasina* (Araneae: Salticidae). *Bulletin of the British Museum of Natural History (Zoology)* 33: 245-257.
- Zhang & Maddison 2012.** Junxia Zhang, Wayne P. Maddison. New euophryine jumping spiders from Papua New Guinea (Araneae: Salticidae: Euophryinae). *Zootaxa* 3491: 1-74.
- Zhang & Maddison 2015.** Junxia Zhang, Wayne P. Maddison. 27 MAR 2015. Genera of euophryine jumping spiders (Araneae: Salticidae), with a combined molecular-morphological phylogeny. *Zootaxa* 3938(1): 1-147.