

***Maratus elephans*, a new member of the *volans* group from New South Wales (Araneae: Salticidae: Euophryinae)**

Jürgen C. Otto¹ and David E. Hill²

¹ 19 Grevillea Avenue, St. Ives, New South Wales 2075, Australia, *email* jurgenotto@optusnet.com.au

² 213 Wild Horse Creek Drive, Simpsonville, SC 29680-6513, USA, *email* platycryptus@yahoo.com

Key words: courtship, euophryine, jumping spider, *Maratus*, *Maratus pardus*, *Maratus volans*, peacock spider, salticid

Abstract: A new peacock spider, *Maratus elephans*, is described from two males and one female recently collected in New South Wales. Physical characters, courtship display, and distribution of the three known members of the *volans* group (*M. elephans*, *M. pardus*, and *M. volans*) are compared.

We previously described one new species of peacock spider from Western Australia (*Maratus pardus* Otto & Hill 2014) that we grouped with the well-known *Maratus volans* (O. Pickard-Cambridge 1874) in the *volans* group within the genus *Maratus* Karsch 1878. We also described the female *M. volans* for the first time (Otto & Hill 2014). Recently the senior author examined specimens in the Australian Museum, Sydney, collected at two locations near Tamworth, New South Wales in 2001 that we can now identify as an additional species in this group. Here we describe this new species from individuals subsequently collected by Stuart Harris at one of these locations. To this we add a general description of display by males and females, and a review of the *volans* group.

***Maratus elephans*, new species**

Type specimens. One holotype male (♂ #1), one paratype male (♂ #2), and one paratype female (♀ #1) were collected at Andersons Flat near Chaffey Dam in New South Wales (S 31°21'26", E 151°09'04", 2 OCT 2013, on leaf litter and in a gully, coll. S. Harris). All types will be deposited in the Australian Museum, Sydney. Two other male individuals in the collection of the Australian Museum that we can identify as *M. elephans* are: 1) Andersons Flat near Chaffey Dam (KS.80920, Crown Reserve, 8 km S of Woolomin, S 31°21'29", E 151°08'40", trap open 15 NOV - 6 DEC 2001, coll. L. Wilkie & H. Smith) and 2) north of Tamworth (KS.80921, pass SE of Attunga State Forest, back road, S 30°58'33", E 150°55'48", trap open 16 NOV - 7 DEC 2001, coll. G. Carter).

Etymology. The species group name (*elephans*, Latin, m., nom., from the Ancient Greek ἐλέφας, noun in apposition to the genus name, English translation *elephant*) refers to the similarity of the pattern on the extended opisthosomal fan of adult males of this species to the head of an elephant as seen from the front.

Diagnosis. Male *M. elephans* are easily recognised by their characteristic colouration and opisthosomal scale pattern. The only species of *Maratus* in eastern Australia that has equally large flaps fringed with long setae is *M. volans*. *M. elephans* differs from it by having bright red to red-orange instead of bright yellow bands on the opisthosoma and broken instead of solid red stripes crossing the eye region behind each anterior eye (Figure 15). Female *M. elephans* are most reliably identified by their association with

males, as they are quite similar to other *Maratus* females, including female *M. volans*. Based on our examination of a single specimen, they may lack the flecks of dark pigmentation visible through the lateral sides of the carapace as well as spots of dark pigment associated with the legs of female *M. volans*.

Description of male (Figures 1-4). The holotype and paratype male specimens are 4.46 and 4.74 mm in length, respectively, not including the spinnerets.



Figure 1. Views of the holotype and paratype male *Maratus elephants* with flaps of the fan wrapped around the sides of the opisthosoma. The three patches of white scales behind the posterior eye row are similar to those of *M. volans*, but the red scales in the eye region of *M. elephants* are interrupted from front to rear, on a background of grey scales.

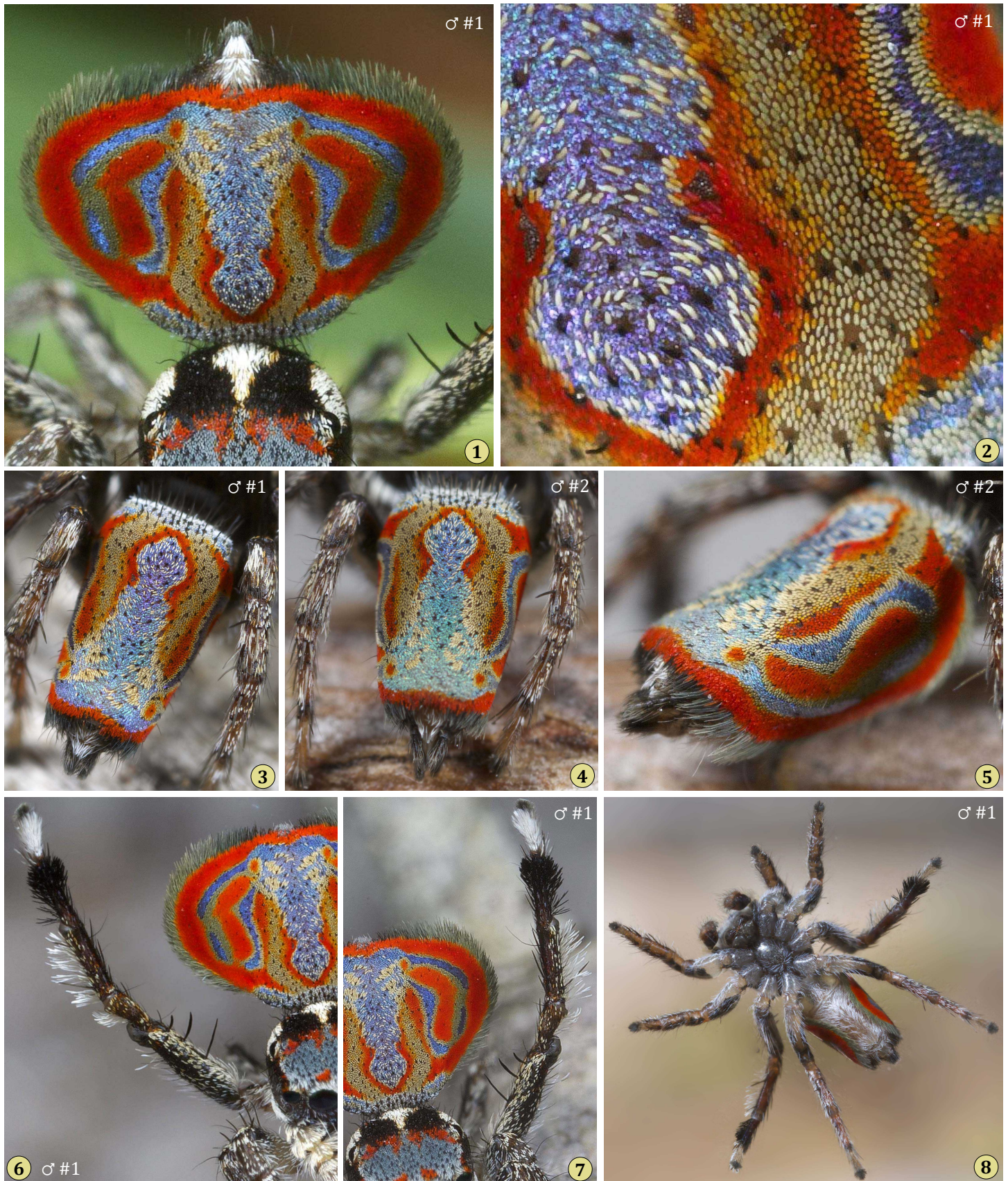


Figure 2. Detailed views of adult male *Maratus elephans*. **1**, Expanded fan during display to female. **2**, Detail of complex scale pattern from (1). **3-4**, Dorsal view of the folded fan of the two male types. **5**, Lateral view of the folded fan. **6-7**, Anterior views of extended leg III during display. **8**, Ventral view.



Figure 3. Adult male *Maratus elephans* types (1-4, 5-7) in ethanol. Translucent grey to brown coxae and other proximal leg segments appear solid white in preserved specimens.

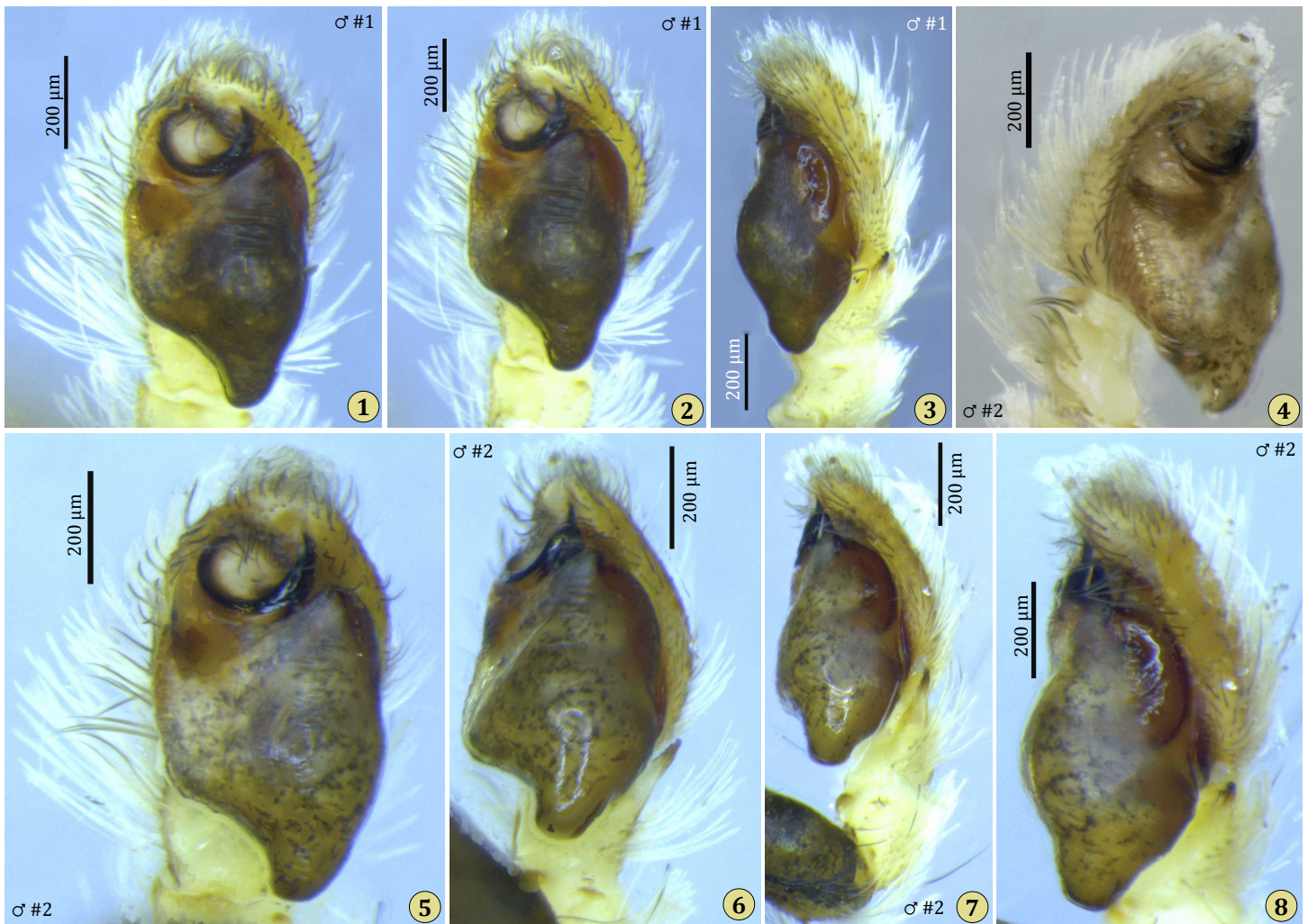


Figure 4. Views of the left pedipalp of the male *Maratus elephans* types, in ethanol. In lateral views (3, 7-8) separation between the inner and outer apices of the embolus, characteristic for *Maratus*, can be seen clearly.

The carapace is black in life, fading to brown in ethanol. The clypeus is brown, with scattered white setae projecting medioventrally. The chelicerae are black and glabrous. The anterior eyes are bordered with white to grey scales. The eye region is densely covered with grey scales, interrupted with eight patches of red scales, with one small patch extended to the rear from the dorsolateral corner of each ALE, one patch forming an arc around each PLE, and two, one anterior and one posterior, behind each AME. The grey scale cover of the eye region is also punctuated with many small black spots. The rest of the carapace is mostly black and glabrous (or brown in ethanol) with a prominent white marginal band on either side, a diamond-shaped median thoracic tract comprised of white scales, and a separate patch of white scales behind each PLE. The PME are closer to the PLE than to the ALE.

The fan (dorsal plate of the opisthosoma) bears large flaps that can be expanded during display, encircled by a dense fringe of long, tan or light-brown setae. Isolated long black setae extend anteriorly from this plate to touch the posterior carapace. The pattern of dense scales that cover the fan is complex, resembling the head of an elephant as seen from the front (Figure 2:1). This pattern, on a background of purple to blue to blue-green iridescent scales, is surrounded by two wide lateral bands of brightly coloured red to red-orange scales on the flaps. Of these two bands, the lateral band extends to the marginal fringe, and the medial band is bent at an angle, surrounded by tan scales that separate it from the background cover of iridescent scales. There is a more complex middorsal figure comprised of mixed iridescent (background) scales and scattered tan scales, and bounded on either side by a third band

comprised of both red to red-orange and tan or light-brown scale fields. Mostly on the dorsal part of the fan, the scale pattern is interrupted with many small dark spots where scales are absent, and each of these spots surrounds a single, short black seta that projects outward from the fan. To the rear a patch of bright white scales runs from the rear margin of the fan to a white triangle of bright white scales associated with the colulus just above the brown to grey spinnerets. The underside of the opisthosoma is covered with white setae. In life, the coxae, sternum, labium, and endites are translucent grey with some white setae but mostly glabrous. In ethanol, these appear as solid white. The trochanters and proximal parts of femora I, II and IV are light brown and translucent on the underside.

Legs I and II are about the same length, much shorter than legs III and IV. Legs III are by far the longest. Legs I, II and IV are not distinctly banded, but are brown with areas of darker pigment and many scattered white to ivory setae that create a 'speckled' or 'salt and pepper' effect. Legs III bear many white to ivory scales on the femora, patellae, and tibia, but are generally dark brown to black (Figure 2:6-7). Dorsal, black macrosetae are present on each femur, but those of femur III are larger and prominent during display. There is a small fringe of white setae under each patella III, and a more prominent fringe of longer white setae under each tibia III. Long black setae cover all sides of each metatarsus III, and these are very dense ('bottlebrush') distally. Each tarsus III is covered with bright white setae that extend over the grey footpads of the pretarsus.

Each pedipalp is light-coloured except for the dark tegulum on the underside. Dorsally, each pedipalp is covered with many long ivory-coloured setae; this cover is interrupted by glabrous areas associated with the distal part of each segment proximal to the cymbium, making the segmentation clearly visible (Figure 1:1). Detailed ventral structures of the pedipalp (rings of the embolus, tegulum, and more heavily sclerotized structures) are similar to those of other *Maratus*, including *M. pardus* and *M. volans* (Otto & Hill 2014). The two apices of the embolus are heavy and can be readily distinguished in a lateral view (Figure 4).

Description of female (Figures 5-6). The female paratype is 4.66 mm in length, not including the spinnerets. In all respects, female *M. elephants* closely resemble female *M. volans* (Otto & Hill 2014). Chelicerae are light-brown, translucent and glabrous. The clypeus is light-brown, translucent, with scattered white setae. White to ivory or light-brown scales surround the eyes and are moderately dense to scattered in the eye region, just below the lateral eyes, and across the dorsal carapace behind the posterior eye row, forming no distinct pattern. Otherwise, the carapace is dorsally dark, but light brown, translucent, and glabrous on the sides and to the rear, with no marginal band. The sides of the carapace are particularly clear, with no flecks of dark pigment visible through the cuticle. The PME are slightly closer to the PLE than to the ALE.

The dorsal opisthosoma is dark brown with scattered white to ivory or brown scales. This dark brown area is surrounded on each side, and on the underside, by light brown cuticle covered with scattered white setae. Scattered dark brown spots are also present on each side of the opisthosoma. In life, leg segments, sternum, and endites are all brown and translucent ventrally. The coxae, sternum, and endites are glabrous. The labium is darker brown. All of these translucent structures appear as solid white in ethanol. Legs I and II are shorter than legs III and IV and nearly equal in length, and leg III is the longest. All legs and the pedipalps are uniformly light brown and translucent, with scattered white to ivory or black to brown setae (white to ivory on the pedipalps), but no banding.

The epigynum (Figure 6:4-5) is similar to that of other *Maratus*, with prominent fossae and a pair of large posterior spermathecae. Darker, more sclerotized ducts are visible in the posterior half of the fossae, and these are darkest toward the posterolateral margin of each fossa.



Figure 5. Views of the living female paratype for *Maratus elephans*. These closely resemble the females of *M. volans*, but unlike that species lack spots of dark pigment on the legs and flecks of dark pigment visible through the sides of the carapace. Like female *M. volans*, the appearance of female *M. elephans* may be associated with cryptic mimicry of leaf scars (Otto & Hill 2014, Figure 20), suggesting a similar microhabitat preference.

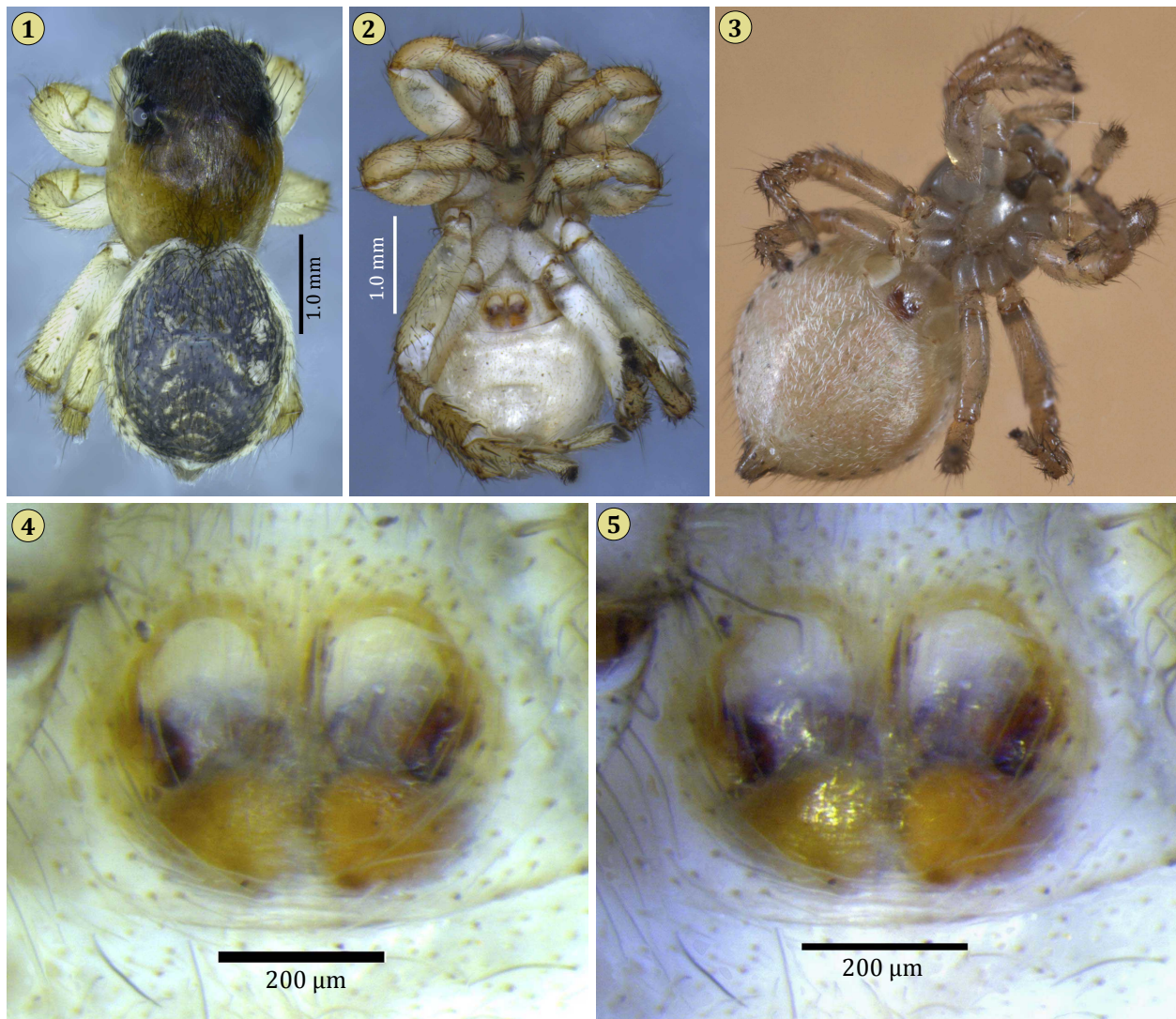


Figure 6. Female paratype of *Maratus elephans*. **1-2**, Dorsal and ventral views in ethanol. **3**, Ventral view of living spider. **4-5**, Two ventral views of the epigynum.

Courtship display by males (Figures 7-11). As in the related *M. pardus* and *M. volans* (Girard *et al.* 2011, Otto & Hill 2014), the fan dance of *M. elephans* can be described as rapid, bilaterally symmetric lateral waving of the extended legs III (between vertical and horizontal positions) in association with rapid lateral waving of the elevated and extended fan. In all three species, the length of each up-down cycle of leg movement is close to the length of each left-right cycle of fan movement. For *M. pardus* and *M. volans*, these cycles occur at a frequency of ~4-6 cycles/s. In *M. pardus*, cycle rates of 10 cycles/s have also been observed for leg waving in the absence of fan movement. Video records for *M. elephans* reveal similar movement, including lowering of the pedipalps as the legs are lowered, at 3.5-8 cycles/s, (Figures 10-11). In *M. volans*, legs III are waved behind the fan, whereas these are waved in front of the fan in *M. pardus*. In *M. elephans*, however, one leg III is often waved in front of the fan as the other is waved behind the fan. It appears that the leading leg III is the one held in front of the fan as a male steps to one side or the other during this display.

For comparison, during the fan dance of both *M. pavonis* (no flaps) and *M. splendens* (with flaps), the fan is often waved at about twice the frequency (7-8 cycles/s) as the extended legs III (3/s), and the fan is also frequently waved in the absence of leg movement (Hill & Otto 2011). *M. speciosus* males (no flaps but with long fringes) only wave the fan (~8 cycles/s) with legs III held in a lower position (Hill & Otto 2014).

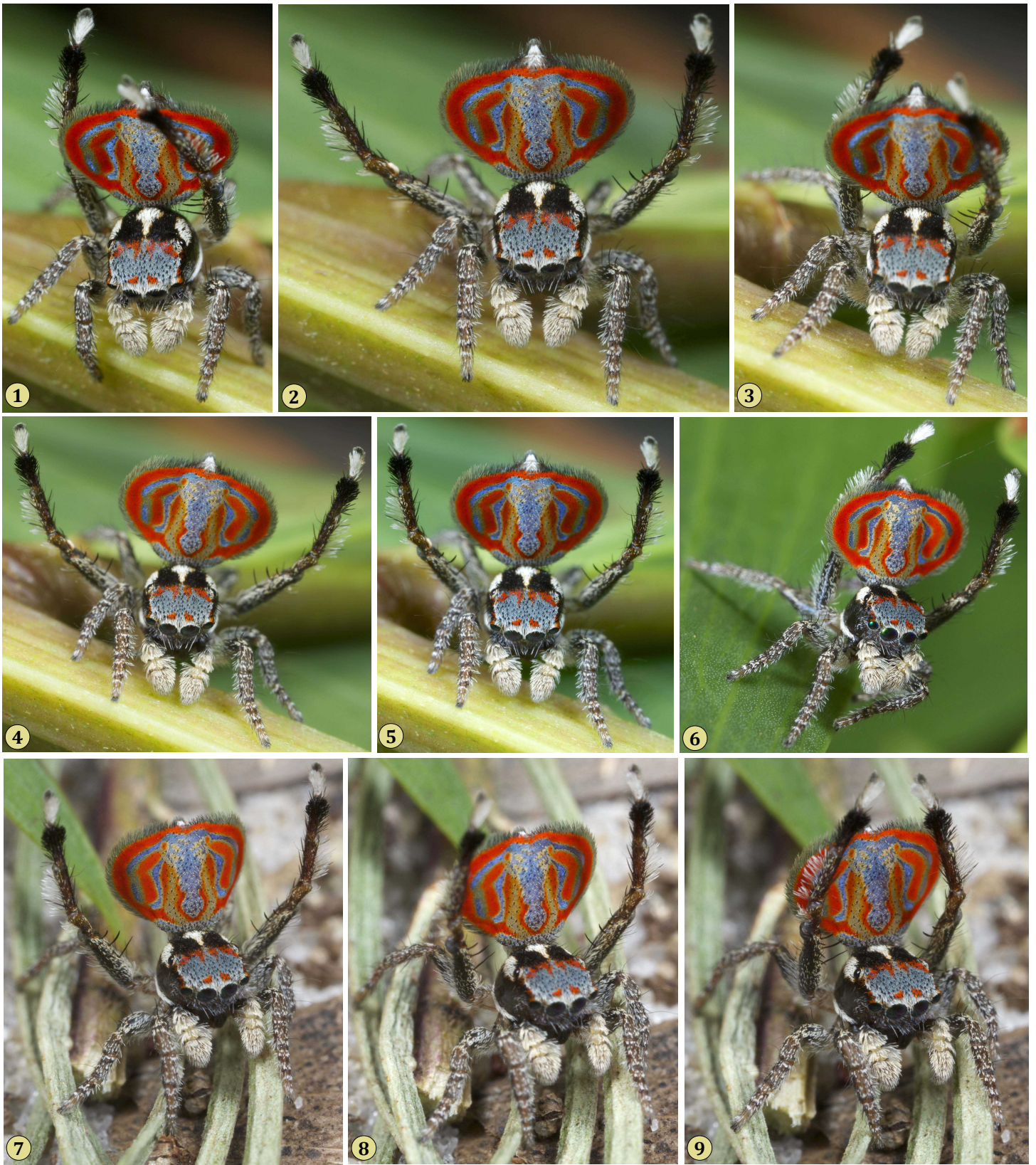


Figure 7. Positions assumed during the fan dance by a male (σ #1) *Maratus elephans* facing a female. **1, 3, 6,** Note the position of the elevated leg RIII behind the fan, and the elevated leg LIII in front of the fan when both legs were raised to a near-vertical position. **4,** Fan tilted or waved to one side. **9,** Sometimes both legs were raised in front of the fan.

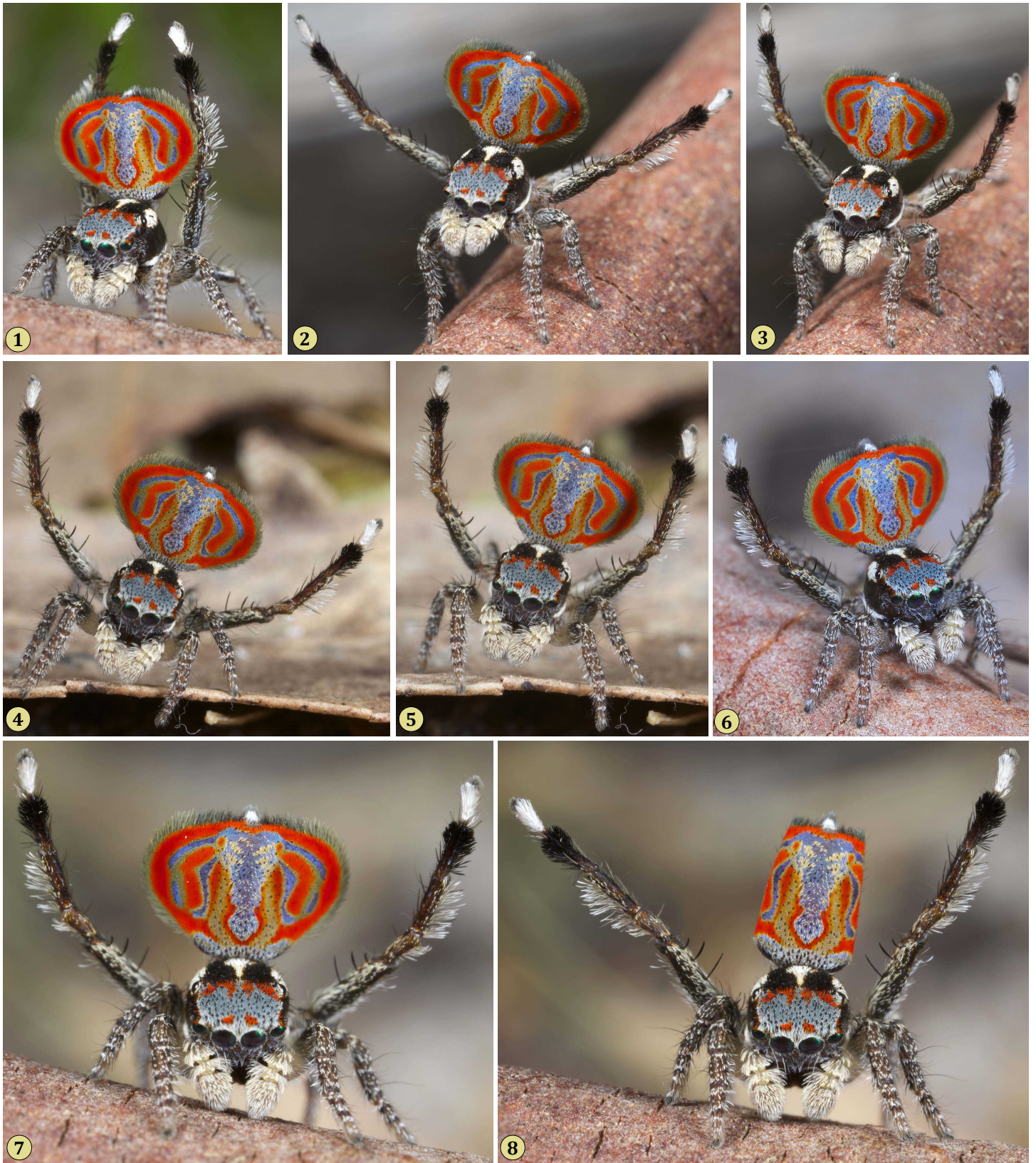


Figure 8. Positions assumed during the fan dance by a male (σ #1) *Maratus elephans* facing a female. **1**, The fringe of white scales beneath the tibia adds to the apparent width of the fan when raised to a near-vertical position. **8**, The fan is normally fully erect and expanded during the fan dance, but may be partially folded near the beginning or end of this display.

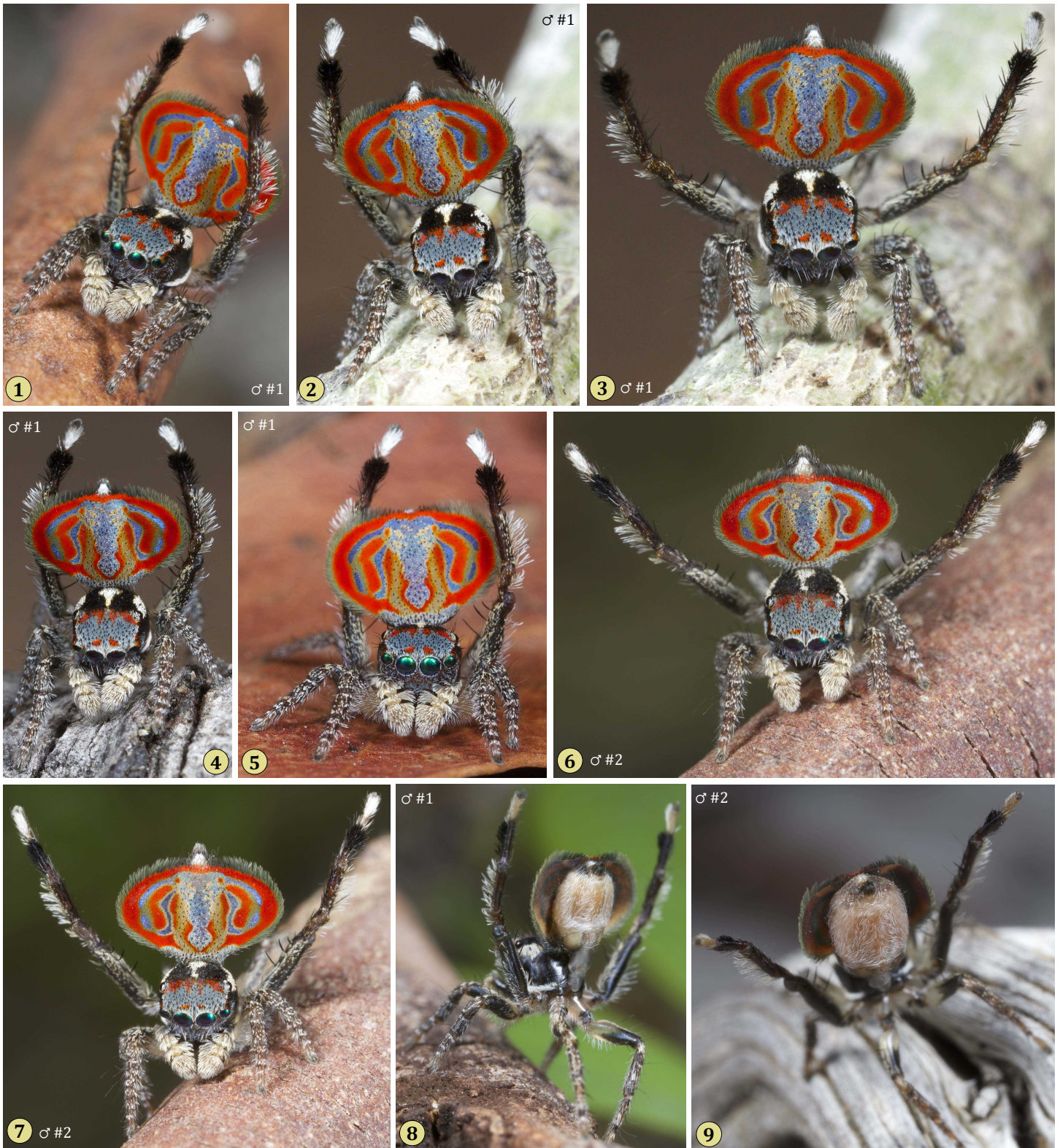


Figure 9. Positions assumed during the fan dance by male (♂ #1, 2) *Maratus elephans* facing a female. **2**, Here both elevated legs III were held behind the fan. More often one leg III was held in front of the fan, and one behind the fan, in this position (1, 4, 5). **8-9**, Rear views.

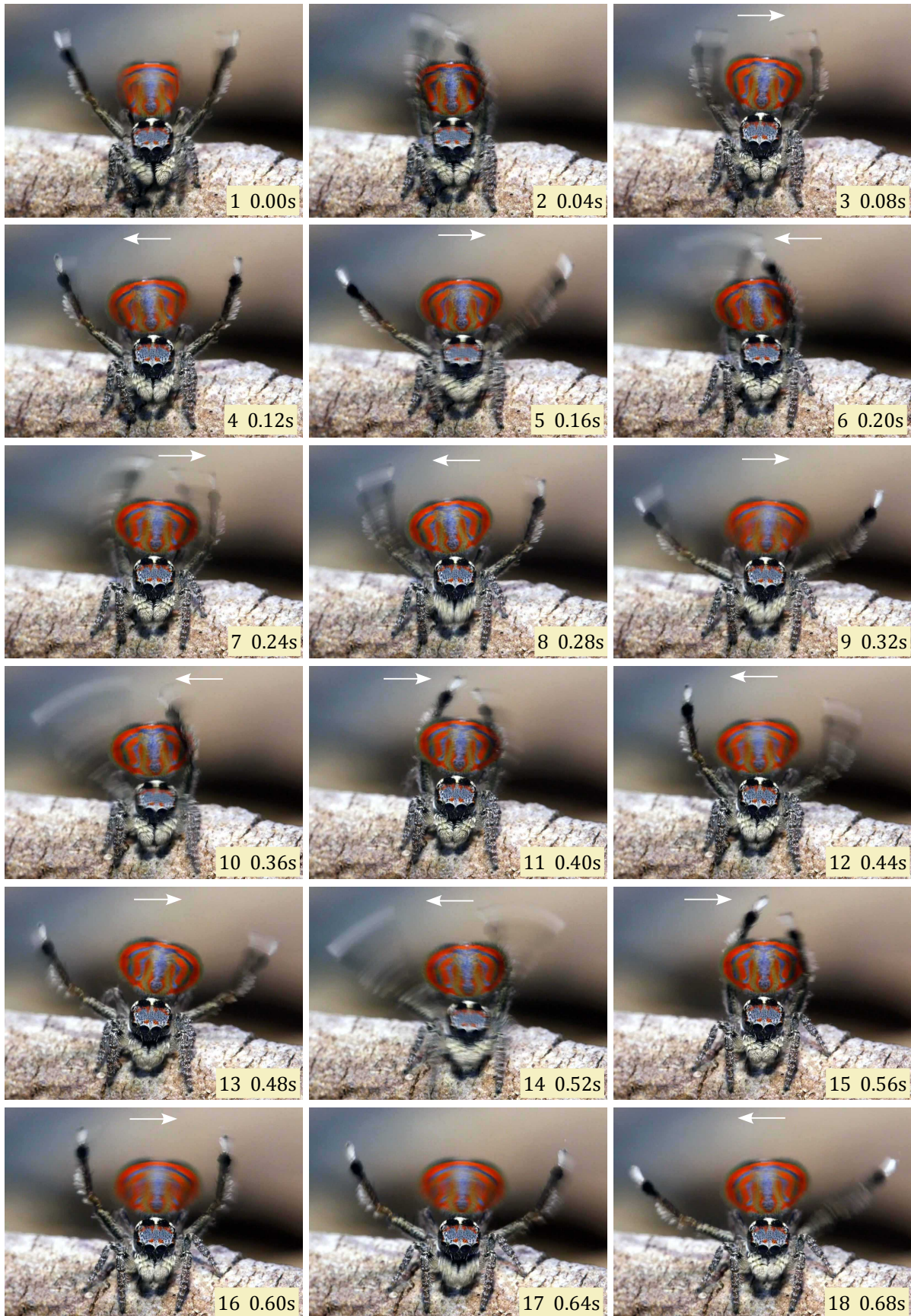


Figure 10 (continued on next page). Sequential video frames (25FPS, exposure 20 msec/frame) showing continuous movement during the fan dance of a male *Maratus elephants*. Arrows indicate the direction of movement of the fan relative to its position in the previous frame.



Figure 10 (continued from previous page). Complete cycles of display (legs III lowered and raised as fan is waved) are represented by frames 20-23, 23-28, and 28-33 (rate of 5-8 cycles/s). Elevation of legs III (e.g., blurred movement in frame 27) is relatively fast and continuous, but lowering may be interrupted.

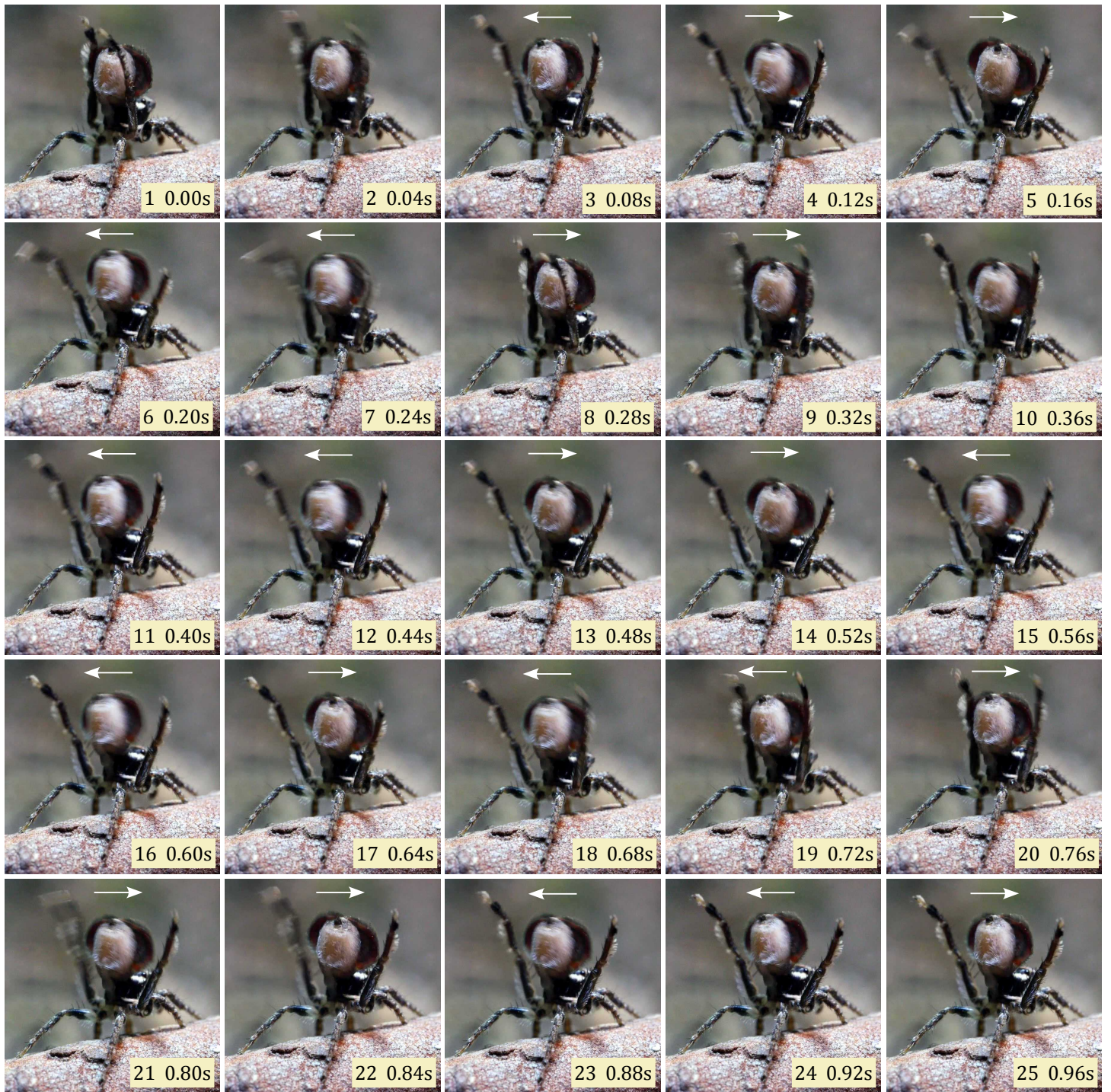


Figure 11. Sequential video frames (25FPS, exposure 20 msec/frame) showing continuous movement during the fan dance of a male *Maratus elephans* viewed from the rear. In this sequence cycles were slower (about 2-3 cycles/s, frames 8-19), and legs III were not moved continuously, and were not lowered to the extent as shown in Figure 10. Arrows indicate the direction of movement of the fan relative to its position in the previous frame.

During their final approach to the female, males raised and held legs III in an elevated position as they waved the retracted but partly elevated fan from side to side, with the pedipalps held to each side to expose the chelicerae (Figures 12-13).

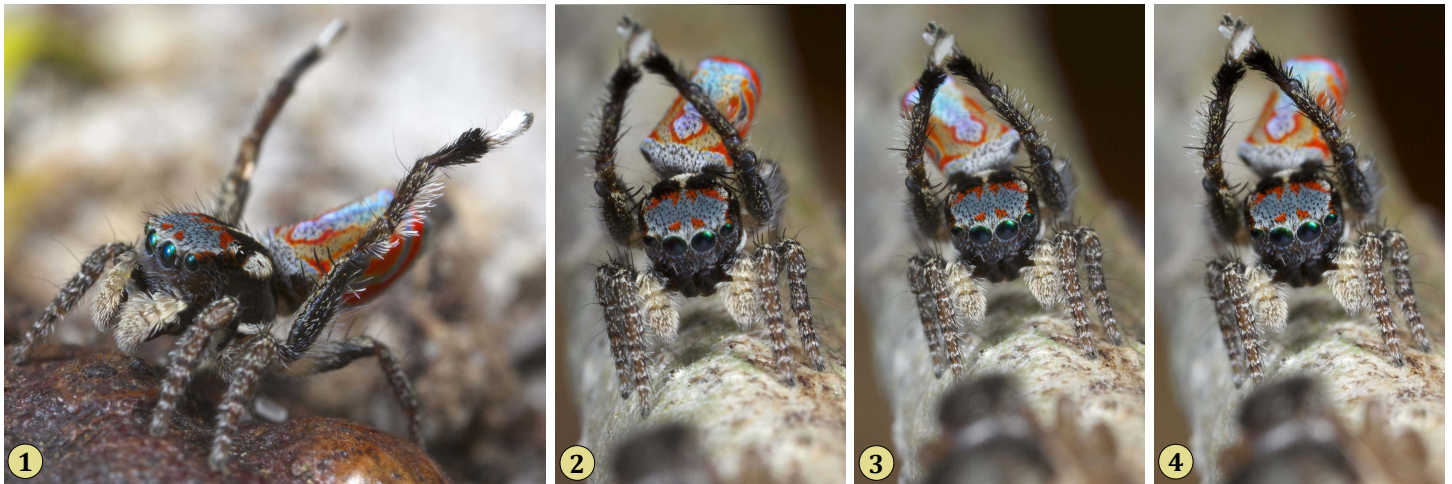


Figure 12. Views of a male *Maratus elephans* approaching a female. **1**, With legs III erect but flexed to the rear at the tibiometatarsal joint. **2-4**, Three sequential views of a male with erect legs III crossed in front of a female (blurred in the foreground). Note the movement of the partly elevated but retracted fan from side to side.

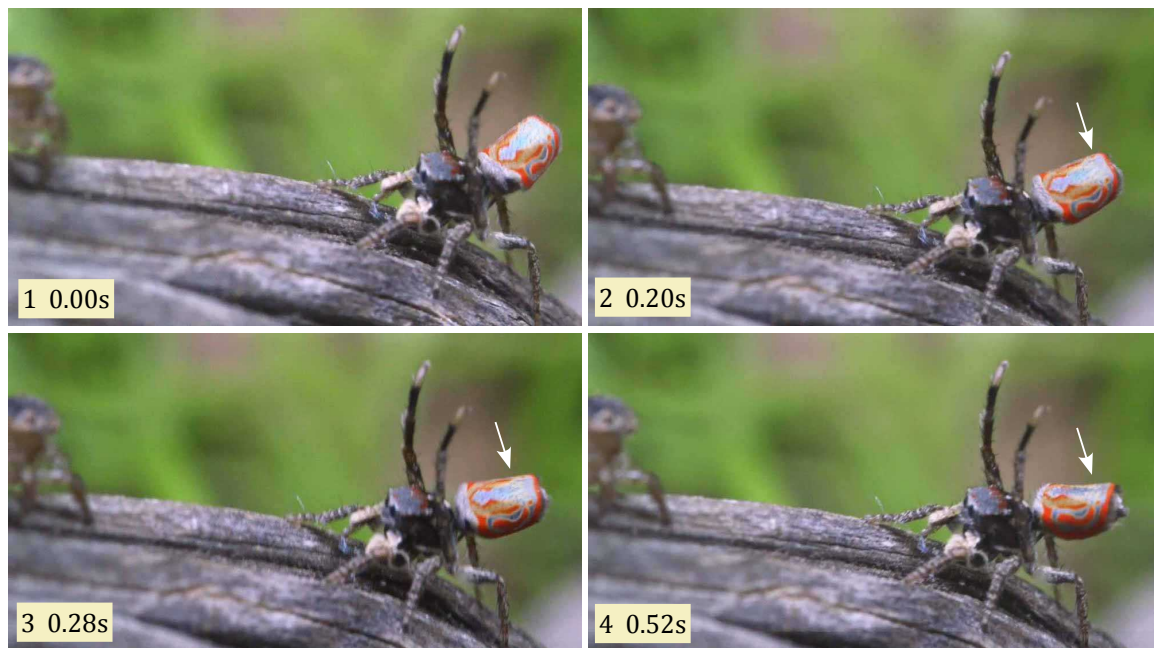


Figure 13. Sequential but not consecutive frames (25FPS, exposure 20 msec/frame) from a video depicting the approach of a male *Maratus elephans* to a female (at left). The extended and elevated legs III were flexed slightly to the rear, and the opisthosoma was slowly waved from side to side. Arrows indicate movement of the opisthosoma relative to its position in the previous frame.

Display by females. We previously described display by female *M. pardus* and *M. volans* in front of males (Otto & Hill 2014, Figures 36-39). Here we document a similar display by a female *M. elephans* (Figure 14). These displays, which are similar to the male fan dance with respect to the extension of legs III and waving of the elevated opisthosoma, appear to warn the male, or to advertise the fact that the female is not willing to mate.

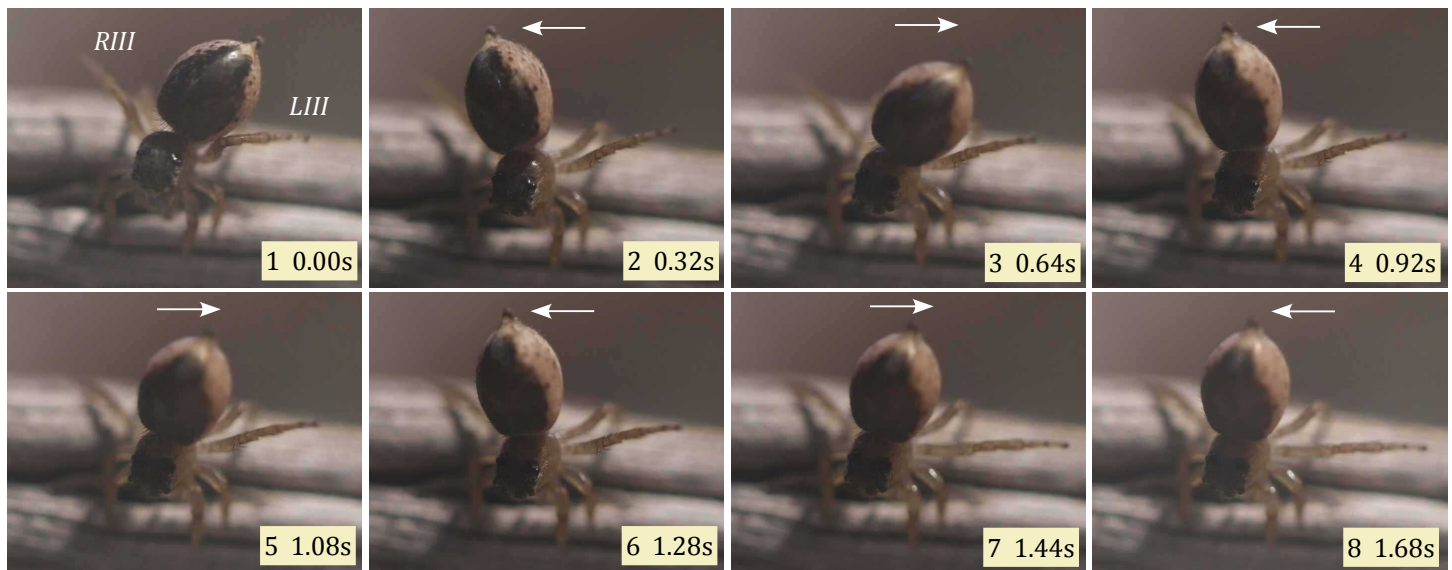


Figure 14. Sequential but not consecutive video frames (25FPS, exposure 20 msec/frame) showing elevation and extension of legs III and waving of the opisthosoma by a female *Maratus elephans* in the vicinity of a male. Arrows indicate the direction of movement of the fan relative to its position in the previous frame.

The *volans* group within the genus *Maratus*

The three members of the *volans* group share a number of characteristics that, collectively, separate them from the other known *Maratus* (Table 1). *M. elephans*, *M. pardus*, and *M. volans* are readily identified by the unique appearance of males (Figure 15).

Table 1. Expression of important male characters that collectively identify members of the *volans* group. Not all of these characters are unique to that group.

shared character	<i>M. elephans</i>	<i>M. pardus</i>	<i>M. volans</i>
red stripe crosses eye region behind each anterior eye	interrupted	absent	present
white middorsal patch and white dorsolateral patch on either side behind posterior eye row	present	white middorsal patch with light brown scales on either side	present
fan wide (elliptical to superelliptical*) with flaps	elliptical	superelliptical and larger	superelliptical and larger
fan background (between bands) densely covered with iridescent purple to blue to blue-green scales	present	present	present
bright marginal bands on each flap	three bands comprised of bright red and light-brown scales	two light orange bands tipped with red-orange	three bright yellow bands tipped with red-orange
complex dorsal opisthosomal figure comprised of pigmented scale fields separated by iridescent background scales between flaps	present ('elephant')	present ('spots')	present ('three stripes')
dense fringe of long setae surround the expanded fan	black at the rear, light-brown around the circumference, and absent near the front	white toward the rear, light-orange and white toward the front	very light-blue at the rear to longer and white to bright yellow-orange at the front
fringe of white setae under tibia III	present	present	present
black bottlebrush of metatarsus III	present	present	present
white setae cover tarsus III	present	present	present
legs I, II, IV with many white setae but banding of segments is not distinct	present	present	present
fan dance with symmetrical leg III waving accompanied by fully extended fan waving at about the same frequency	present (often one leg III in front and one leg III behind fan)	present (legs III in front of fan)	present (legs III behind fan)

*A superelliptical shape, or superellipse, is intermediate between an ellipse and a rectangle.



Figure 15. Displaying males of the three species associated with the *volans* group of the genus *Maratus*. 1-3, *M. elephans* from Andersons Flat near Chaffey Dam, NSW. 4-6, Three different *M. pardus* from Cape Le Grand National Park, WA. 7-9, Three different *M. volans* from Ku-ring-gai Chase National Park, NSW. The position of legs III relative to the fan varies in the three species from (2) one leg in front and one behind in *M. elephans*, to (5) both legs in front in *M. pardus*, to (8) both legs behind in *M. volans*. All three species are vividly and distinctly coloured.

Unlike the well-known *Maratus volans*, *M. elephans* and *M. pardus* are presently known from only a few localities (Figure 16). In part this difference may be due to the presence of *M. volans* in park lands near major coastal metropolitan areas (Brisbane, Sydney, and Melbourne) where they are more often encountered, photographed and collected.

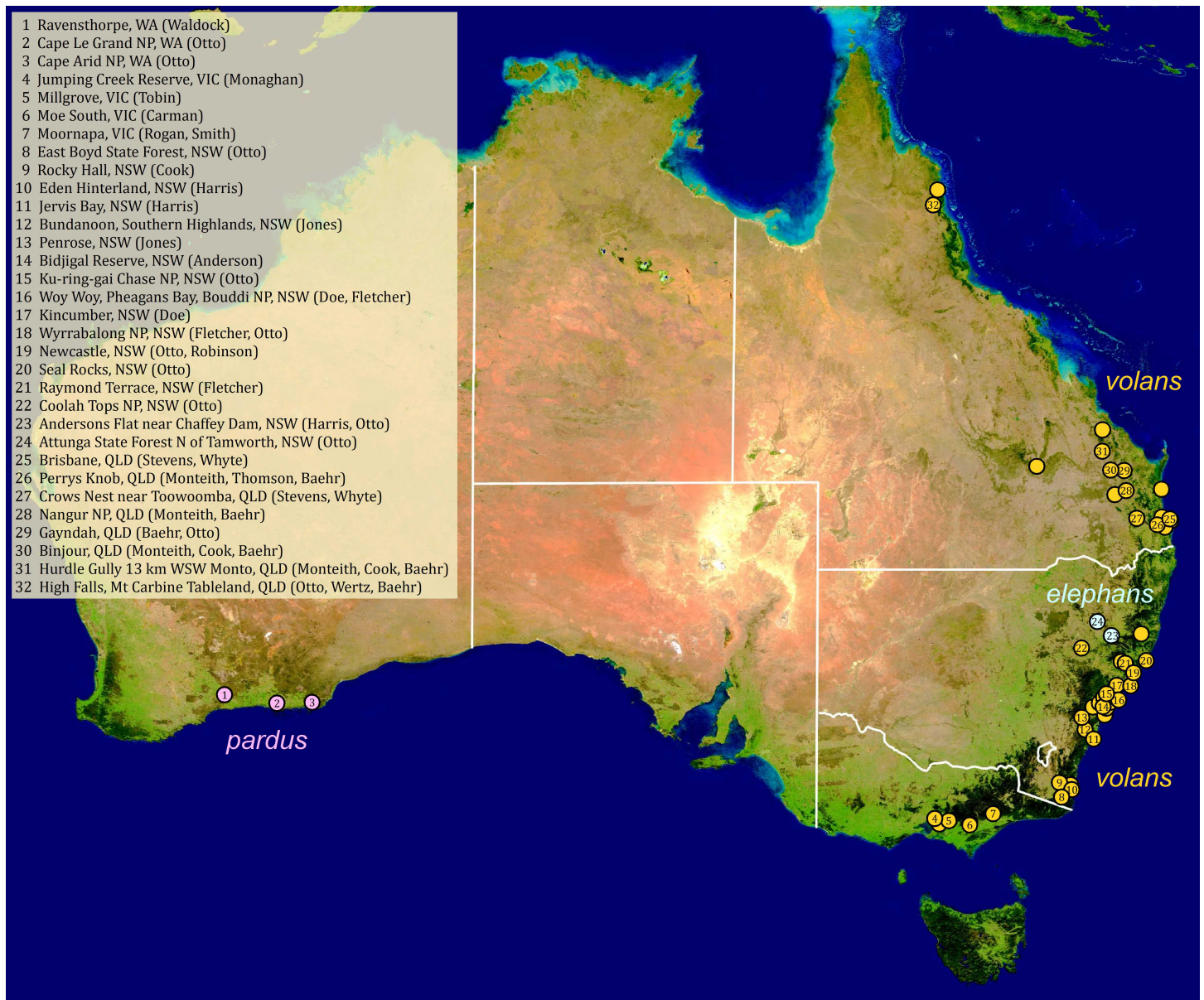


Figure 16. Known localities for the three members of the *volans* group (*M. elephans*, *M. pardus* and *M. volans*). Numbered localities are associated with records that have been verified from photographs (many posted on FLICKR™), by the examination of specimens, or listed in previous publications. For each listed locality, the respective collector and/or photographer and/or examiner is given. Unverified records of *M. volans* from the *Atlas of Living Australia* (http://bie.ala.org.au/species/Maratus_volans) are not numbered, and some of these posted records (e.g., west of Melbourne, or Tasmania) are not shown here as they are now known to represent other species.

Acknowledgments

We thank Stuart Harris for his collection of *Maratus elephans*, Barbara Baehr of the Queensland Museum for identification of specimens, Chaffey Dam storage custodian Nick Burr from State Water for providing access to the site where *M. elephans* was collected, and Graham Milledge from the Australian Museum for providing access to preserved specimens of *M. elephans*. All photographs presented here are copyright © J. C. Otto.

References

- Girard, M. B., M. M. Kasumovic and D. O. Elias. 2011.** Multi-modal courtship in the peacock spider, *Maratus volans* (O.P.-Cambridge, 1874). PLoS ONE 6 (9): e25390: 1–10. (doi:10.1371/journal.pone.0025390)
- Hill, D. E. and J. C. Otto. 2011.** Visual display by male *Maratus pavonis* (Dunn 1947) and *Maratus splendens* (Rainbow 1896) (Araneae: Salticidae: Euophryinae). Peckhamia 89.1: 1-41.
- Hill, D. E. and J. C. Otto. 2014.** Visual display by the male Coastal Peacock Spider [Araneae: Salticidae: Euophryinae: *Maratus speciosus* (O. Pickard-Cambridge 1874)]. Peckhamia 119.1: 1-18.
- Karsch, F. 1878.** Diagnoses Attoidarum aliquot novarum Novae Hollandiae collectionis Musei zoologici Berolinensis [Descriptions of several new salticids from Australia in the collection of the Berlin Museum]. Mittheilungen des Münchener Entomologischen Vereins 2 (1): 22-32.
- Otto, J. C. and D. E. Hill. 2014.** Description of a new peacock spider from Cape Le Grand, Western Australia, with observations on display by males and females and comparative notes on the related *Maratus volans* (Araneae: Salticidae: Euophryinae: *Maratus*). Peckhamia 114.1: 1-38.
- Pickard-Cambridge, O. 1874.** On some new genera and species of Araneida. The Annals and Magazine of Natural History. Series 4, volume 14, Issue Number 81, Paper 24: 169–183, plate XVII.