PECKHAMIA 114.1, 2 May 2014, 1—38 ISSN 2161—8526 (print)
urn:lsid:zoobank.org:pub:0A957A76-AA36-48F6-AFC6-5DFC29280AFF (registered 30 APR 2014) ISSN 1944—8120 (online)

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*)

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KEY WORDS: euophryine, jumping spider, *Maratus pardus*, salticid, *volans* group

ABSTRACT: A new species of *Maratus*, *M. pardus*, is described from Cape Le Grand National Park in Western Australia. This spider shares a number of characters with *M. volans* (O. Pickard-Cambridge 1874), and both are assigned to a new clade (the *volans* group) within the genus *Maratus*. The female *M. volans* and general features of display by males and females of both species are also described.

Recently David Knowles from Perth In Western Australia informed us of a new and distinctly spotted peacock spider ('Orangeblotch Aqua Peacock Salspider') which he found and photographed in mid-October 1994 at Cape Le Grand in Western Australia, on sandy rises covered with sparse swamp heath and sedges. One of us (J. C. Otto) traveled to that location in October of 2013 and collected live individuals which are here described. This description raises the number of species that we can confidently assign to the genus *Maratus* to 28. An additional 16 species still assigned to this genus are questionable (Otto & Hill 2014), but many more remain unnamed. Because of a number of morphological and behavioural characters shared with *M. volans* (O. Pickard-Cambridge 1874), this new species is assigned with *M. volans* to a new clade, the *volans* group, within the genus *Maratus*.

Maratus pardus, new species

Type specimens. The holotype male (♂ #1), 11 paratype males (♂ #2-12), and 13 paratype females (♀ #1-13) were collected at Cape Le Grand National Park in Western Australia (33.96698°S, 122.252268°E, 4-22 OCT 2013, Jürgen Otto coll.). All will be deposited in the Western Australian Museum. Also examined were three males (♂ #14-16) and one female (♀ #14) that were lost or released, and one male (♂ #13) that has been retained for DNA extraction, a process that is likely to be destructive.

Etymology. The species group name (*pardus*, Latin, m., from the Ancient Greek *πάρδος*, noun in apposition to the genus name, English translation *leopard*) is a reference to the presence of many leopard-like spots on the dorsal opisthosomal fan of males, and to the cat-like behaviour of salticid spiders in general.

Diagnosis. Males have a distinct pattern of large spots (scales) on the dorsal opisthosomal fan that cannot be confused with any other. Males most resemble the well-known *Maratus volans*. Shared characters include bands of bright yellow scales on the opisthosomal flaps, the presence of a long fringe around the entire margin of the fan, the placement of scales and setae on all legs including legs III, the structure and position of the uniformly-coloured pedipalps, and courtship display. The dorsal markings displayed by some *M. pardus* females can be used to distinguish this species from other *Maratus*, but the variability of these markings, even in a single population, is significant. Some females have few markings, making identification difficult. Female *M. pardus* differ from those of *M. volans* (described below) with respect to the glabrous lateral sides of the prosoma and the dark opisthosoma of female *M. volans*. The male pedipalp of *M. pardus* is similar to that of other *Maratus*, especially *M. volans*, and of little use in the identification of this species. The same applies to the structural details of the female epigynum, at least those details that are visible externally, such as the relative size of the fossae or the width of the septum. Both male pedipalp and female epigynum exhibit considerable intraspecific variation further diminishing their usefulness for species identification.

Description of male (Figures 1-9). The male holotype and ten male paratype specimens (N=11) range from 4.10-4.58 mm in body length not including the spinnerets, and from 4.21-4.67 mm including the spinnerets. The carapace is black, dark brown in preserved specimens. The chelicerae are black, of average size for the genus. White scales border the lower half of the anterior eyes, and below these longer white setae, directed ventro-medially from both sides, cover the clypeus. The eye region is covered with uniform, dense brown to red-brown scales, and brown to red-brown scales border the top half of the anterior eyes. A more sparse cover of long brown to red-brown scales or setae extends down laterally from the eye region on either side, replaced near the marginal band with long white scales. This cover of long brown to red-brown scales also extends to the rear of the carapace, behind the PLE row, where it is interrupted by a broad median band of bright white scales. On either side of the carapace there is a wide marginal band comprised of a dense cover of long, bright white scales or setae. At the rear margin, the carapace is glabrous and bears a triangular notch that allows free movement of the pedicel (Figure 9). The PME are closer to the PLE than to the ALE.

The opisthosoma bears a prominent dorsal plate with extensible flaps that, when not used in display, are wrapped around the lateral sides to meet or to overlap at the venter. At the anterior of this plate scattered long, white, erect setae project toward the carapace. The fully expanded plate (Figures 4-5) is strongly fringed laterally and to the rear with long white setae, and at the front with yellow setae. The distinctive markings of this plate readily identify the male *M. pardus*. On a field or background of uniform light blue to blue-green iridescent scales, the center of this plate is covered with about 14-18 spots or blotches of bright to dark red-orange or orange pigmented scales, mostly bordered by light yellow pigmented scales. As shown in Figures 4-5, details of this pattern vary and this allows individual spiders to be readily identified. In some males the spots are darker, and loss or shrinkage of the orange scales may also render the affected blotches dark blue, black, or purple, as the dark colour of the underlying cuticle becomes more dominant (Figures 4:4, 5:2, 5:3). The appearance of this pattern is also greatly affected by immersion in ethanol with most scales, in particular white ones, becoming significant duller. However, this effect is reversed when the specimen is subsequently air dried (Figure 6:5). There is a small triangular tuft of white setae above the anal tubercle as in other *Maratus*, and the spinnerets are of usual length and black. The ventral opisthosoma (Figure 1:7) is dark brown with a cover of long white to tan setae, and the underside of the lateral flaps is dark brown to black, with only a few scattered white setae. The sternum, labium, and endites are dark brown to black in living spiders, light brown in preserved specimens. As viewed from below, the coxae and proximal segments of the legs are brown and translucent, or white in preserved specimens.

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 similar in appearance, dark brown in life with irregular bands of white scales or setae. In preserved specimens, these are mottled with bands of darker pigment along their length, against a white background. Legs III (Figure 2:2-3) are brown to red-brown, distinctively marked with a brush of white setae beneath the distal tibia and a dense bottlebrush of long black setae on all sides of the metatarsus, contrasting with the bright white setae of the tarsus. Tenent setae of the footpads are grey.

The pedipalps are normally held with their distal ends pointed ventrally, frequently moved up and down in unison in this position. Each pedipalp is densely covered dorsally with uniform, long, bright white setae. The ventral structures of the pedipalp (Figure 7) are typical for the genus, virtually identical in details with *M. volans* (Figure 8), with the apex of the embolus divided into inner and outer parts. There is a small tooth or projection near the apex of the outer ring of the embolus. The width and shape of the proximal extension of the tegulum varies greatly (Figure 7:2, 7, 9) and is of little use for identification.

Figure 1. Views of living holotype (1-7, ♂ #1) and paratype (8-9) male *Maratus pardus*. **1-2,** Anterior views showing the bright white setae of the pedipalps and the irregularly ringed black/white legs I and II. **3,** Antero-lateral view of prosoma, showing position of PME slightly closer to PLE than to ALE. **4,** Display with the darker legs III extended and opisthosoma elevated with fringed flaps of fan fully extended. **5,** Postero-lateral view with lateral flaps folded. **6,** Detail of posterior opisthosoma with fringed flaps folded. A small tuft of white setae extends to the rear above the black spinnerets. **7,** Rear view of display showing hyperextension of the pedicel and scattered long white setae beneath the lateral flaps. **8-9,** Two other males with folded opisthosomal flaps.

Figure 2. Living male *M. pardus*. **2-3.** Anterior views of legs III, much longer than the other legs. These legs are dark with generally brown to red-brown setation, with a prominent brush of white setae under the distal tibia, a prominent *bottlebrush* of long black setae covering the metatarsus on all sides, and long white setae covering the tarsus. **9,** Ventral view of the opisthosoma showing folded flaps.

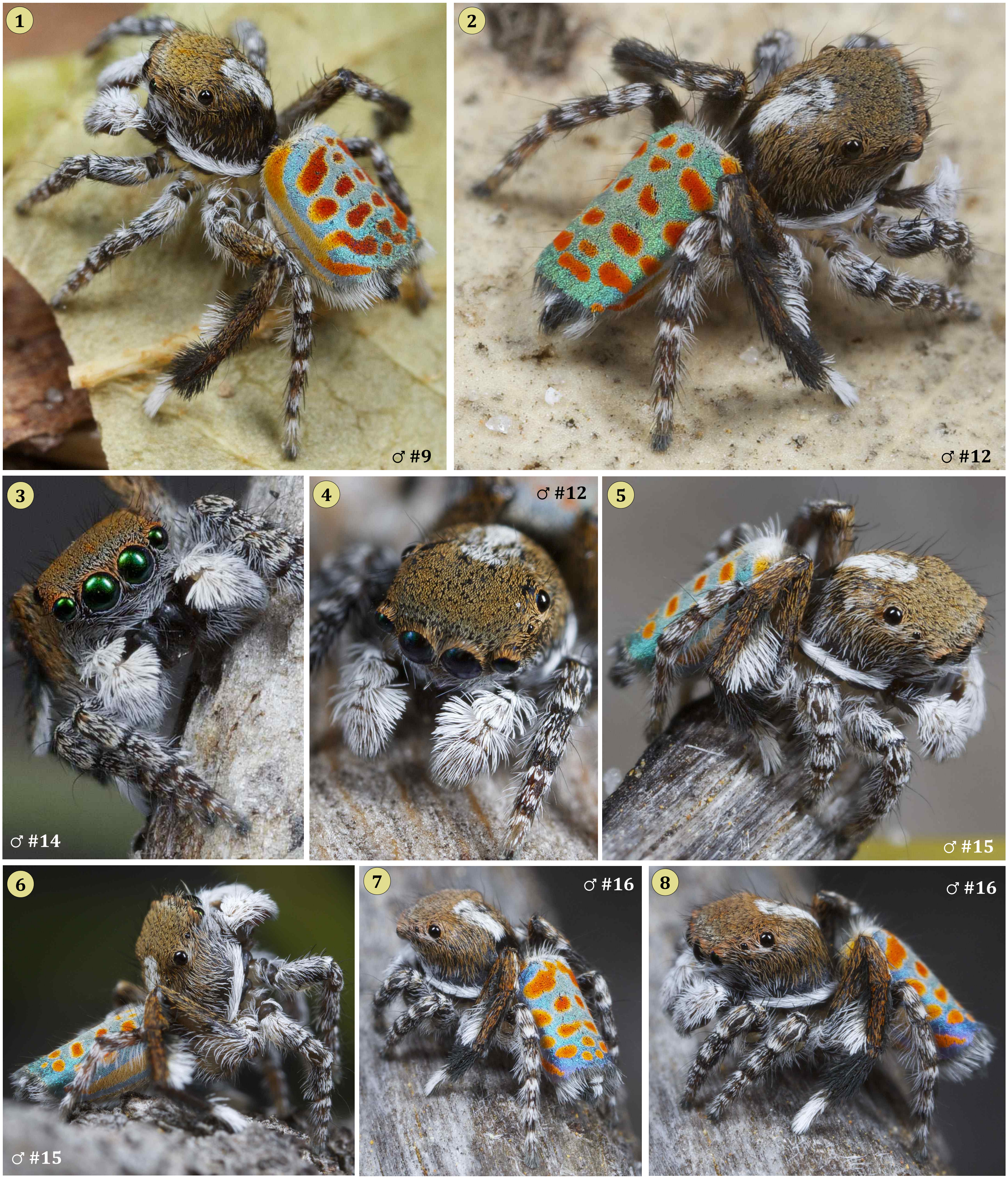

Figure 3. Living male *M. pardus*. **3,** The black chelicerae, partly exposed in this view, are normally concealed behind the bright white pedipalps. **4,** Brown to red-brown scales cover the eye region and border the upper half of the anterior eyes.

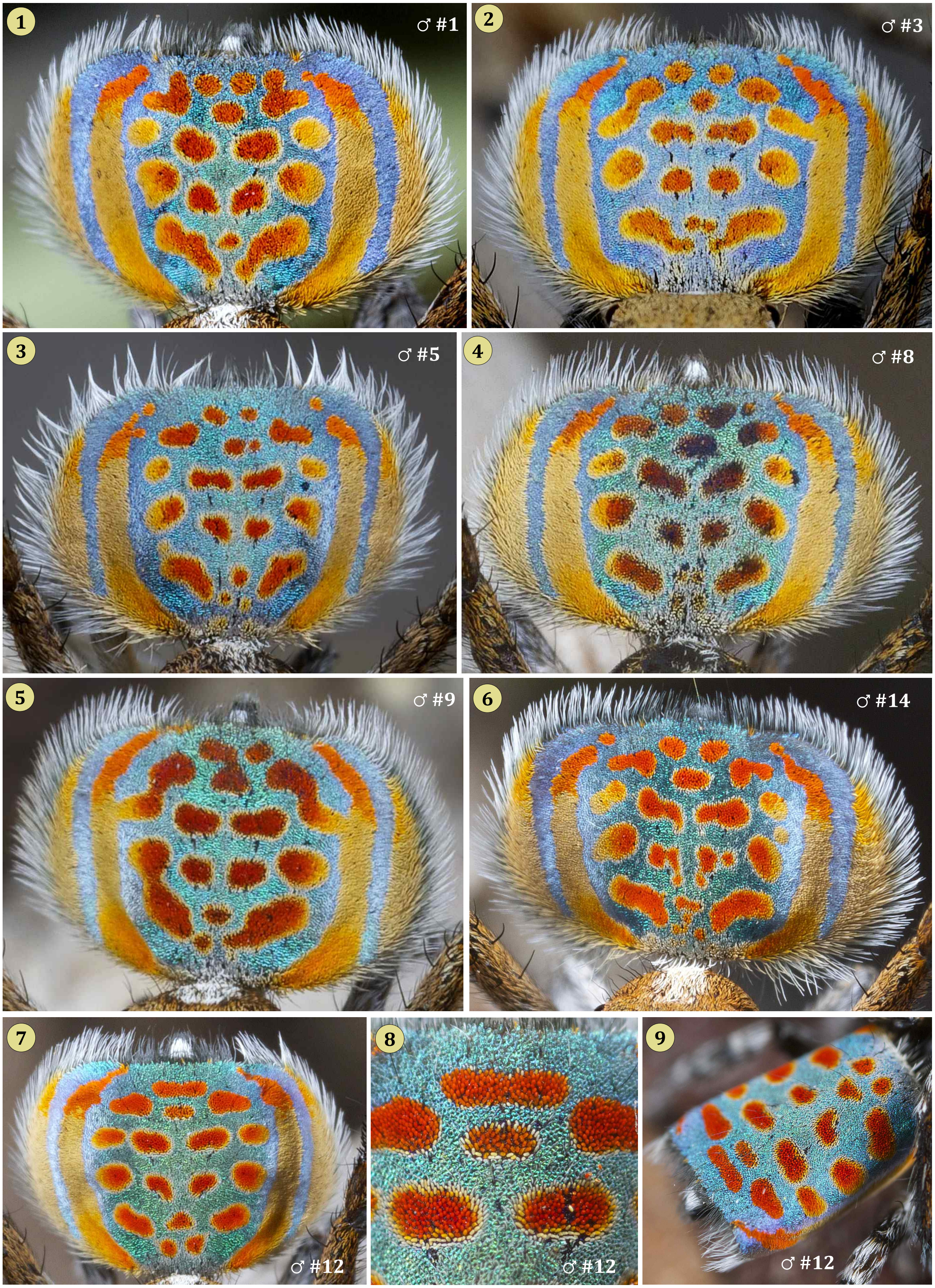

Figure 4. Fan of living holotype (1) and other (2-9) male *M. pardus*. **8,** Detail of posterior spots from (7). **9,** Fan with folded flaps. Note variations in the size and placement of the spots, comprised of pigmented scales. Two prominent bands of generally yellow (pale yellow to orange or red-orange) scales cover much of the dorsal surface of each lateral flap. The iridescent background scales are light blue to blue-green in colour, varying according to the direction of illumination and the direction of the observer.

Figure 5. Extended fan of three other male *M. pardus* showing variation in the appearance of spots. In (1), the spots are fairly uniform in colouration. In (2) the central spots are darker, with those along the median dark purple. The dark areas in (3) appear to be the result of loss of scales rather than pigmentation. The fan shown in Figure 4:4 also has darker spots toward the center, as well as dark areas that appear to represent the loss of scales.

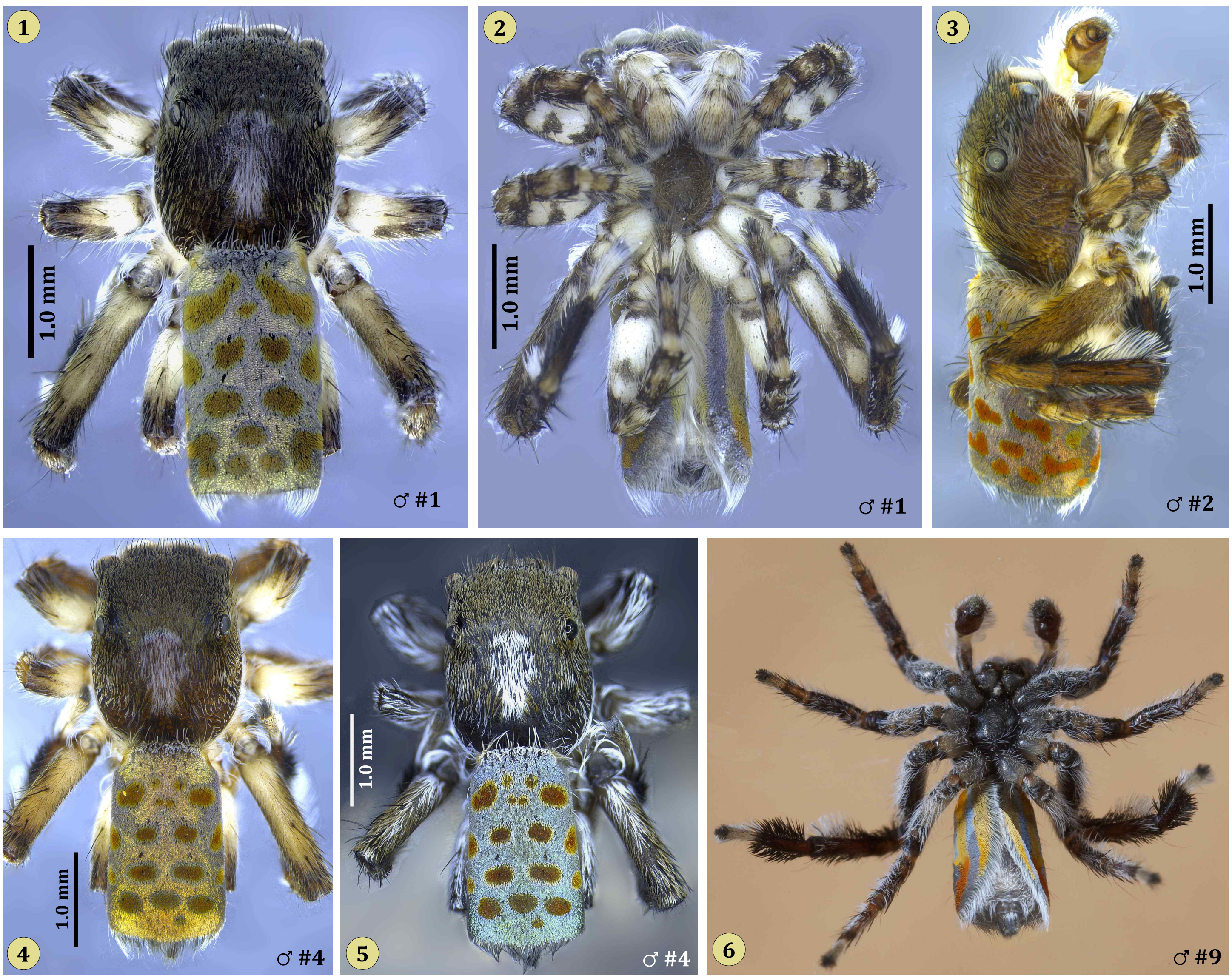

Figure 6. Holotype (1-2) and paratype (3-6) male *M. pardus*. Note how the translucent cuticle of the coxae and other parts of the legs appears bright white in specimens preserved in ethanol (1-2), but much darker in the living animal (6). One paratype male is shown in ethanol (4) and after drying (5). The bright white scales of the postero-median band of the carapace was much easier to see when the specimen was dried. In addition, the iridescent scales of the fan were much closer to their living appearance in the dried specimen.

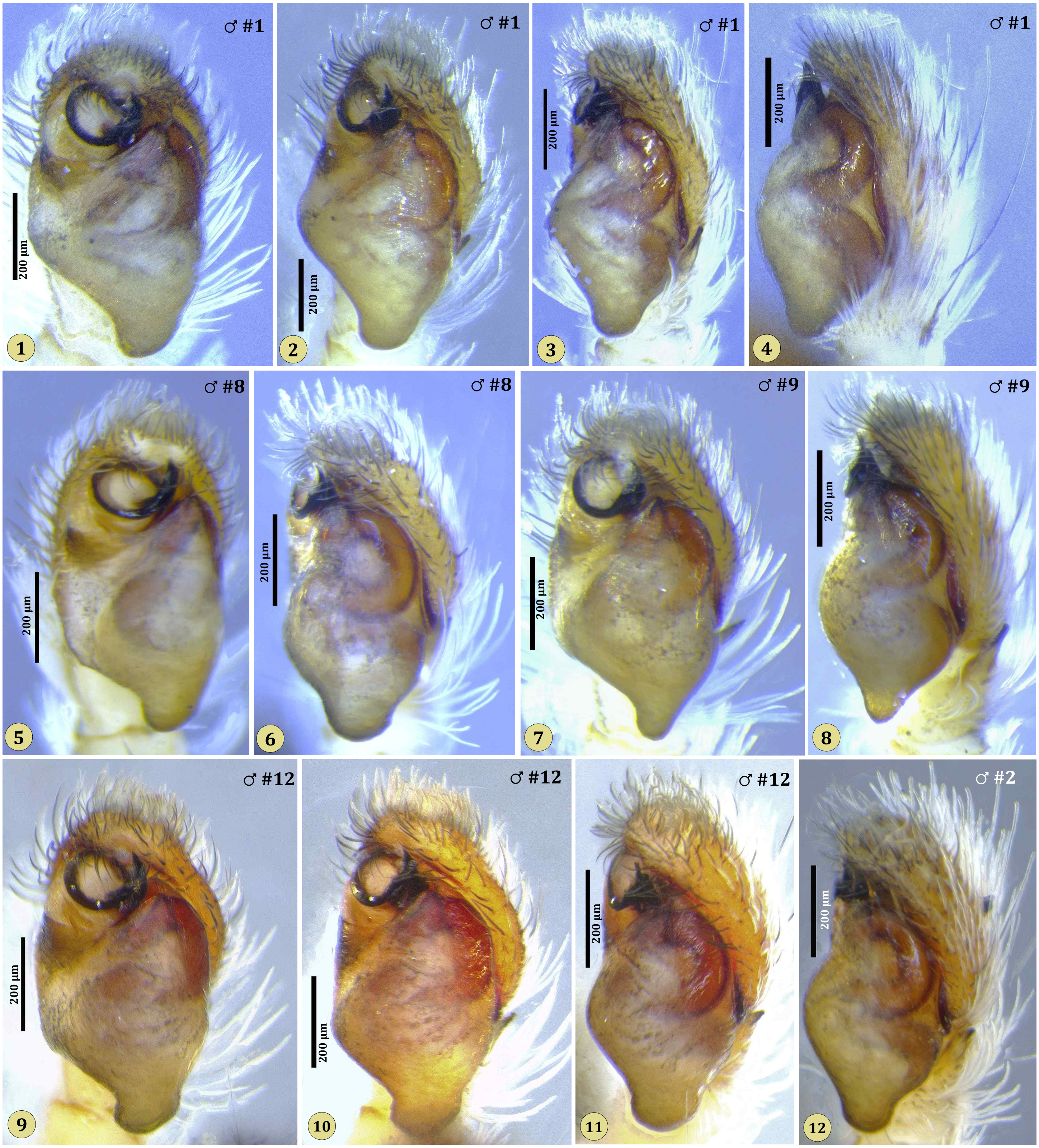

Figure 7. Ventral to posterior (lateral in normal position) views of the left pedipalp of holotype (1-4) and four paratype (5-12) male *M. pardus*. These are similar to those of other *Maratus*, and *M. volans* in particular (Figure 8). The distal embolus is heavy, divided into and outer and inner apex. There is a prominent distal projection of the tegulum just to the right of (or lateral to) the distal embolus in these views. The RTA bears small teeth along its distal margin, difficult to see. Note the difference in shape of the proximal projection of the tegulum between male #9 (7) and male #12 (10).

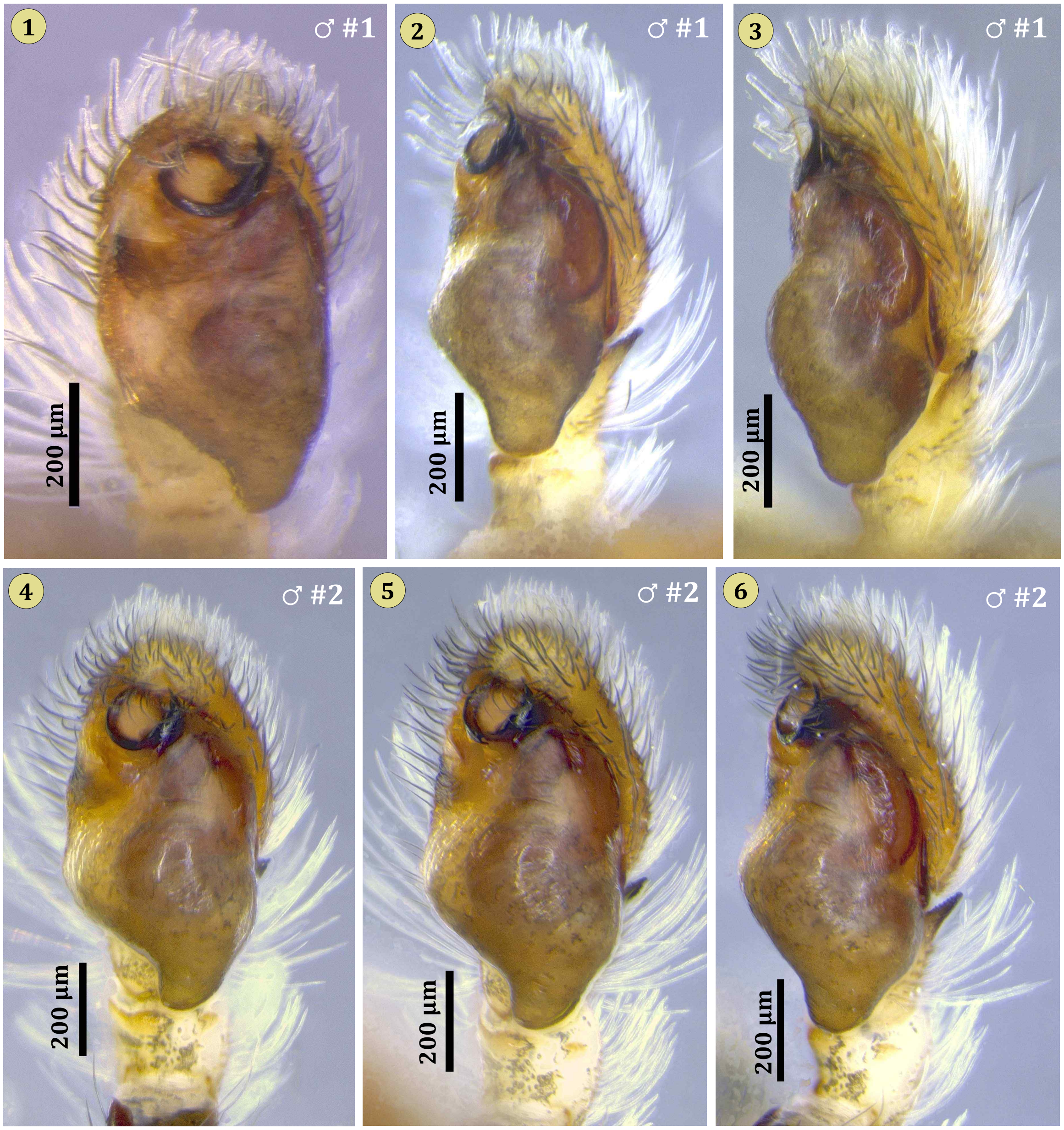

Figure 8. Ventral to posterior (lateral in normal position) views of the left pedipalp of two different male *M. volans* (O. Pickard-Cambridge 1874) from Ku-ring-gai Chase National Park near Sydney. These are virtually indistinguishable from the pedipalps of *M. pardus*, even in details of shape and sclerotization. Shared characters include the shape of the embolus, including the small tooth-like projection near the heavy apex, the presence of both inner and outer apices, lateral sclerite near the RTA where the tegulum meets the cymbium, medial sclerotization of the tegulum proximal to the embolus, and presence of a distinct distal projection of the tegulum lateral to the apex of the embolus. Shape and sclerotization of the tip of the RTA is also the same in both species. In addition, the dense setation of the upper side of the pedipalp is much the same, and pedipalps are held in the same position toward the front, in both species.

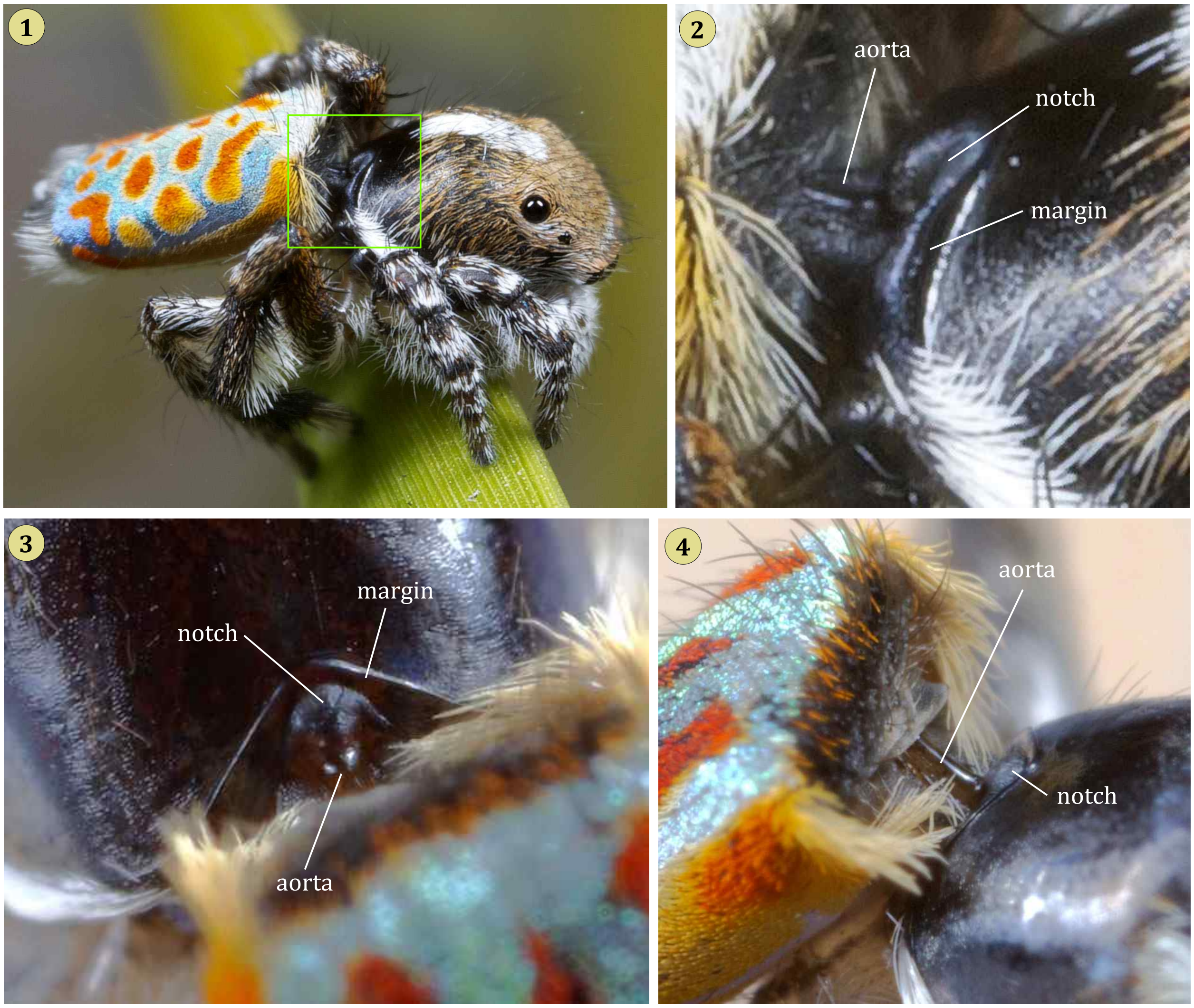

Figure 9. Relationship of the pedicel to the posterior notch of the carapace. **1-2,** Lateral view of holotype male *M. pardus* (♂ #1), showing detail (2). 3-4, Detailed postero-dorsal (3) and lateral (4) views of the pedicel of *M. volans* (Ku-ring-gai Chase National Park), for comparison. Other salticids also have a posterior notch in the carapace that facilitates movement of the opisthosoma, but this has rarely been figured. In each species, the triangular *notch* is bordered by a thick cuticular *margin*, narrower at the median. The anterior aorta, bringing hemolymph directly from the heart to the prosoma, occupies a dorsal position in the pedicel and it is covered with cuticle (*aorta*) that must serve to prevent its collapse during movement of the pedicel.

Description of female (Figures 10-13). Female paratype specimens (N=7) range from 4.32-5.44 mm in body length not including the spinnerets, and from 4.38-5.82 mm including the spinnerets. The carapace and chelicerae are brown. Beneath the front eye row long white setae project dorso-medially from each side, as in the males. Beneath these setae the clypeus is glabrous and dark brown. The eye region is densely covered with white setae anteriorly, often interrupted by an acute median projection of the dark posterior eye region that is sparsely covered with white setae. The sides of the carapace are sparsely covered with white setae, but there is no marginal band as in the male. As in the male, the carapace has a broad median band of white setae on the thoracic slope behind the PLE row, often cross-shaped and distinctive for the species. The PME are slightly closer to the PLE than to the ALE.

The dorsal opisthosoma is dark with variable black, brown, or white markings comprised of pigmented setae. There is a tract of 4-6 more-or-less distinct, lighter-coloured spots on either side, in a row parallel to the midline, and longer white to light-brown scales are most dense on the lateral margins of the opisthosoma. There is a small triangular tuft of white setae above the anal tubercle as in other *Maratus*, and the spinnerets are dark brown to black. Beneath, the opisthosoma is brown, uniformly covered with white to light-brown setae. The sternum is dark brown and relatively glabrous, lighter brown in preserved specimens. Beneath, the coxae, labium, and endites are light-brown and somewhat translucent, or white in preserved specimens.

Figure 10. Six different female *Maratus pardus*. There is a broad white median band behind the PLE on the carapace. Although there is much variation in pattern and colour contrast, there are generally two long rows of dorsal spots on the dorsal opisthosoma, bracketed on each side by a wider marginal bands of light-coloured setae. Note that the clypeus, beneath a fringe of long white setate beneath the anterior eyes, is almost completely glabrous (8). Although there are some white scales along the lateral margins of the carapace, there is no distinct marginal band here as is found in males.

Figure 11. Five other female *Maratus pardus*. The pattern of white scales on top of the carapace distinguishes most females of this species from other *Maratus*. The median band behind the PLE row is often shaped like a cross (4), and usually an acute median projection of the dark posterior half of the eye region interrupts the white scale cover of the anterior half of the eye region (5). However, some females (7-12) have less distinct markings with less contrast.

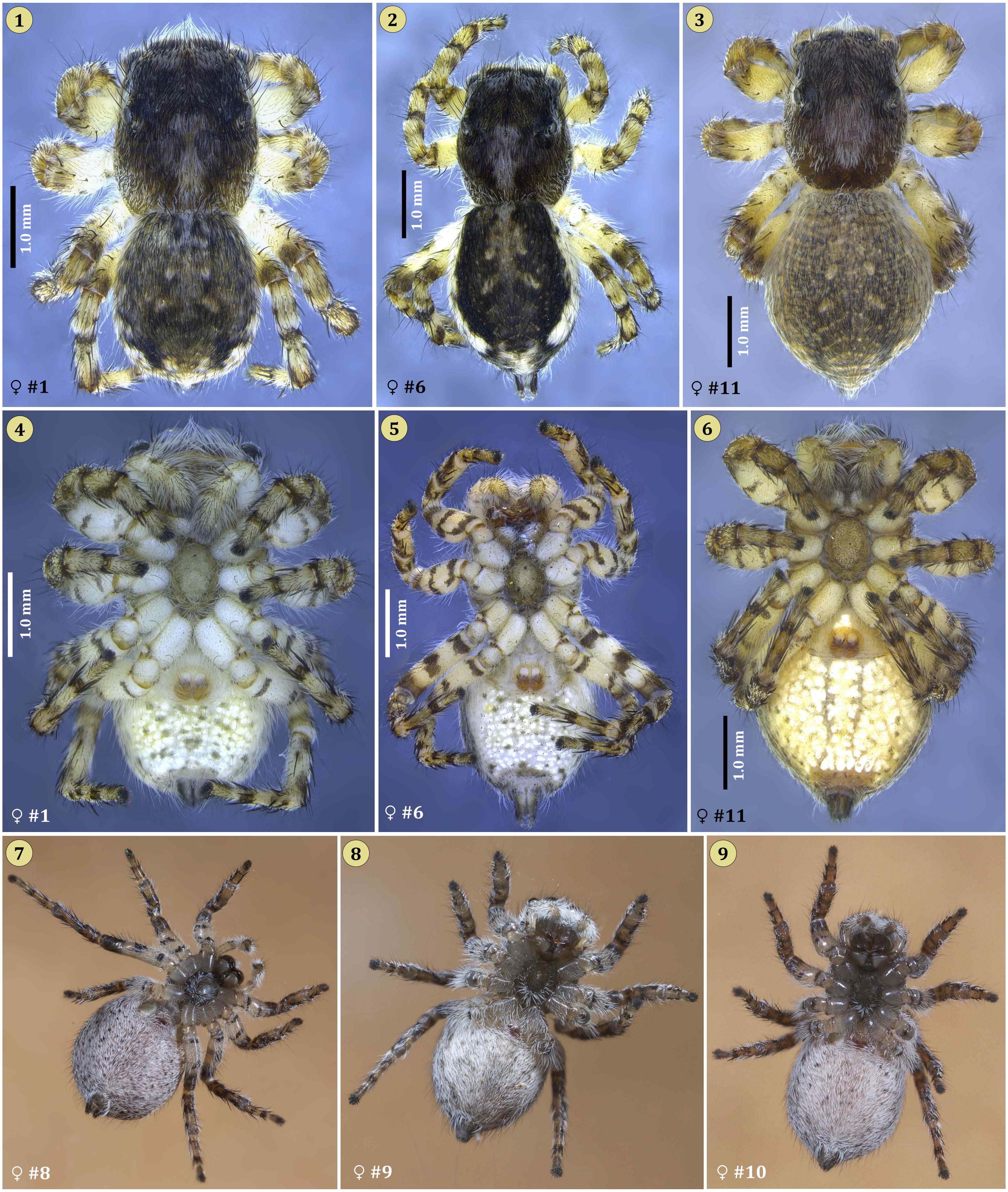

Figure 12. Three paratype specimens of female *M. pardus* in alcohol (1-6), and ventral views of three other living paratype female *M. pardus* (7-9). Although the darker leg bands can still be seen in preserved specimens, the light-brown to brown pigments of the living spiders are lost. Many of the white setae can barely be seen and the wide median band of white scales on the carapace is subdued when submerged in ethanol. This effect is reversible and drying of the spiders brings back the original brightness of these scales.

Legs I and II are about the same length, much shorter than legs III and IV. Legs III are longer than legs IV. All legs are light brown and translucent from the coxae to the proximal femora, and darker brown distal to this. They all have an indistinct banding comprised of an alternation of dark areas with light-brown to white scales on each segment. This is similar to the colour pattern of legs I, II and IV of the males. Pedipalps are light-brown, covered with long white setae.

The epigynum (Figure 13) is similar to that of other *Maratus*, with fossae generally smaller than the posterior spermathecae. The relative width of the septum between the fossae varies.

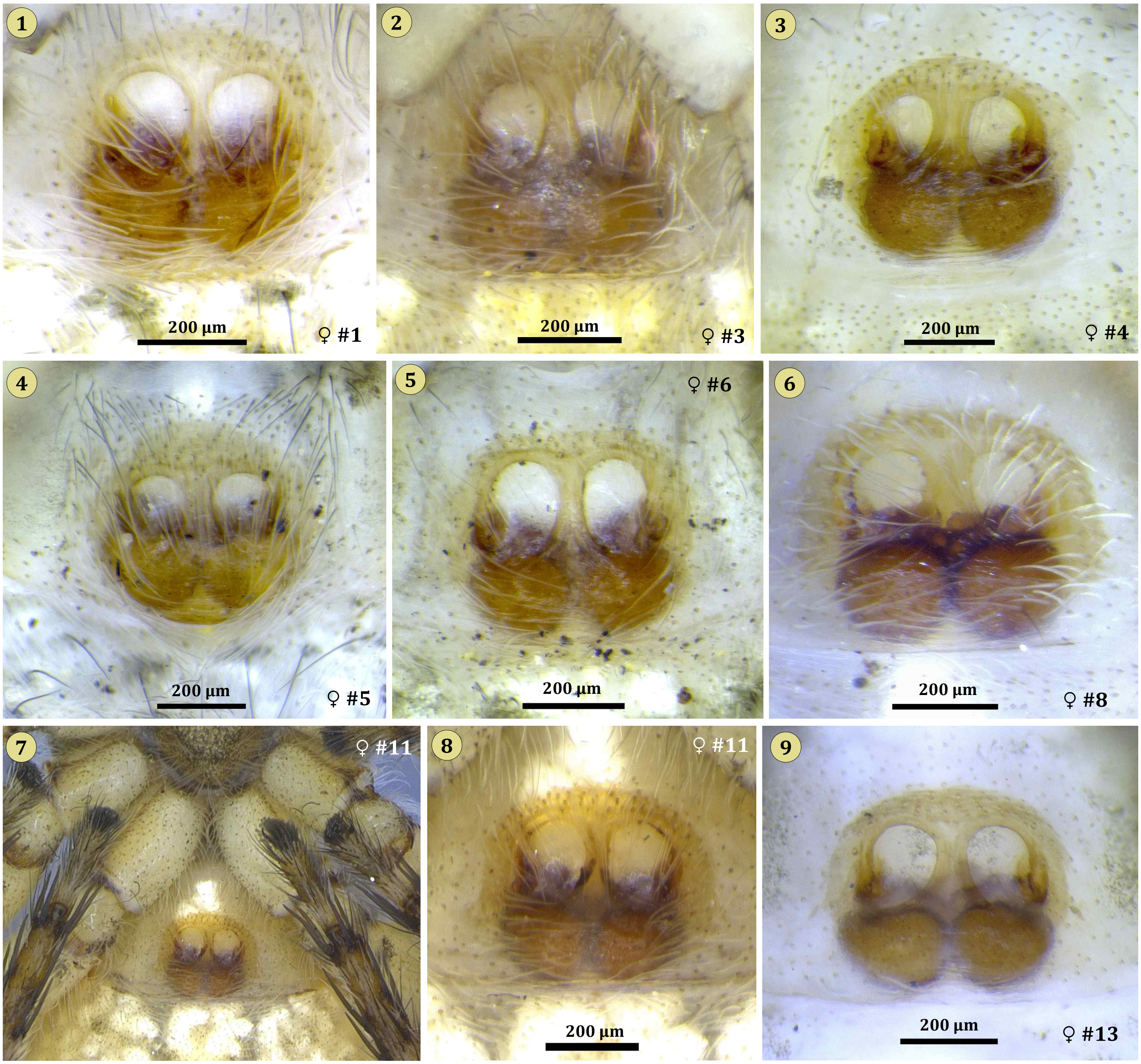

Figure 13. Ventral view of the epigynum of eight different female paratype *M. pardus* (anterior toward the top). The posterior spermathecae are generally larger than the fossae, but in one example shown here (5) they are of similar size and the fossae are more eliptical. The visibility and shape of the dark cuticle associated with internal ducts varies.

Habitat and distribution. All of the types for *Maratus pardus* were collected in subcoastal swampland at Cape Le Grand National Park (Figures 14-15). Most were found on slightly elevated sandy ridges that flank an unused and overgrown vehicular track on either side and are the result of grading during the maintenance of this track. But some were found on small plants in lower areas. Waldock (2007) previously illustrated a male (*Maratus* sp. nov.) from the vicinity of Ravensthorpe.

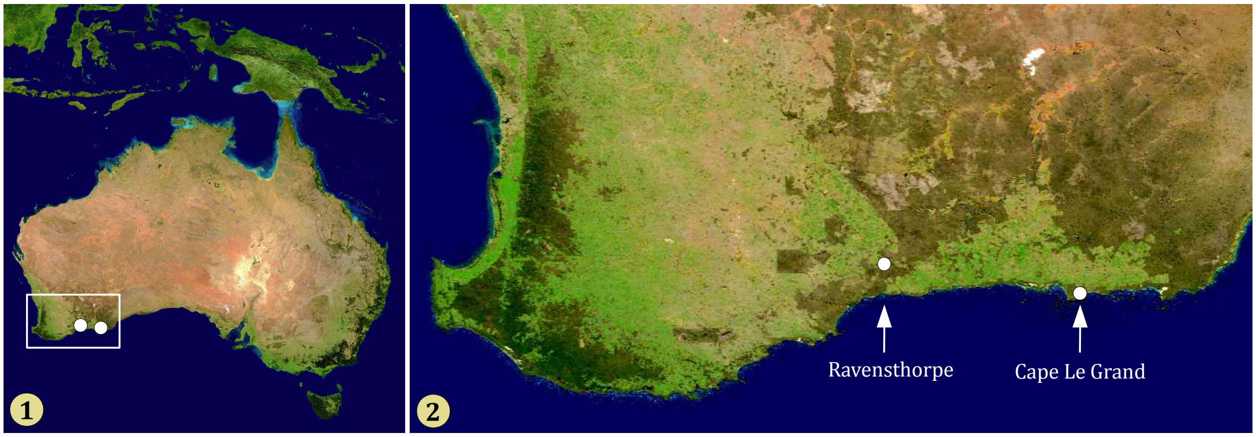

Figure 14. *Maratus pardus* is known from two localities near the southern coast of Western Australia: Cape Le Grand (type locality) and near Ravensthorpe (Waldock 2007). Satellite maps courtesy of NASA Visible Earth (Land and shallow water bathymetry).

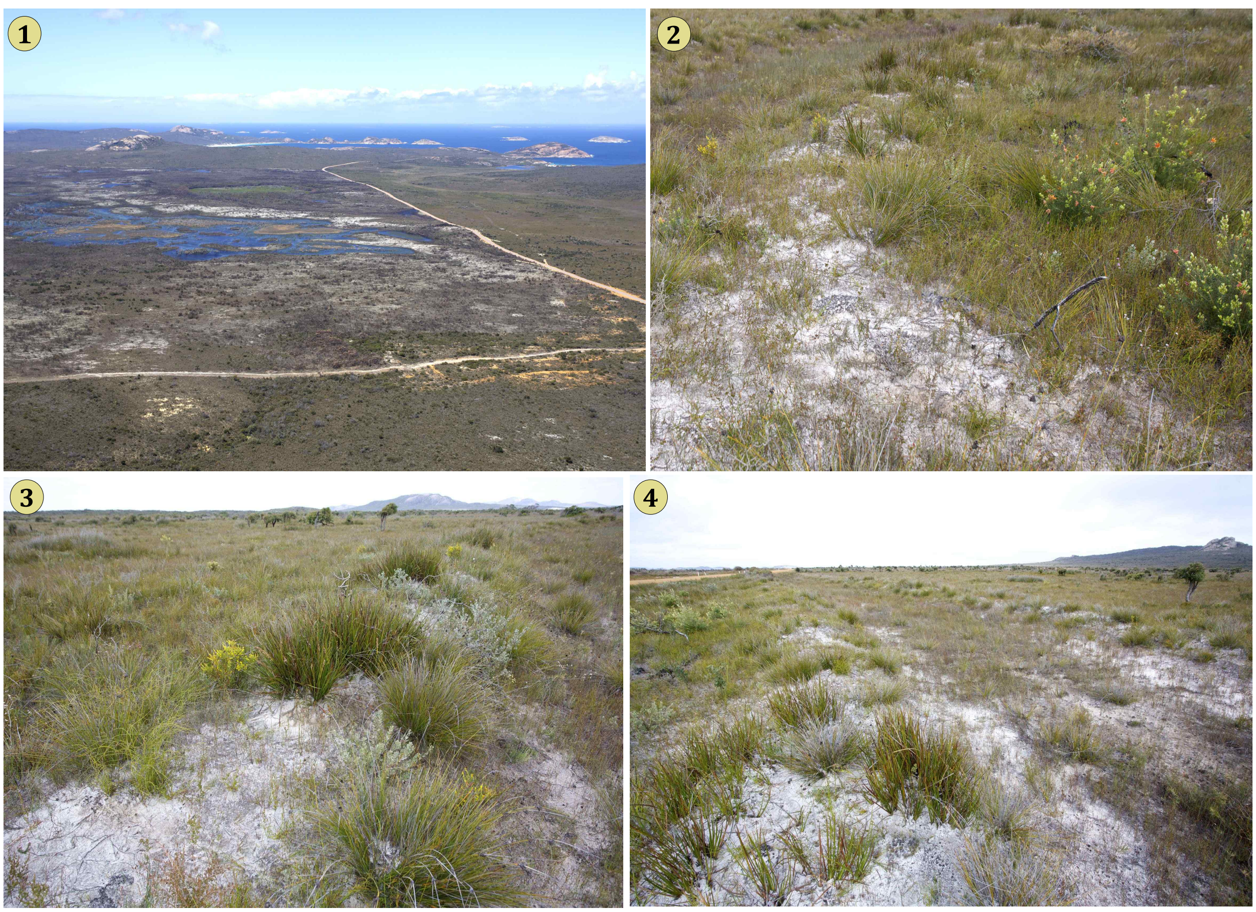

Figure 15. Habitat of *Maratus pardus* at Cape Le Grand National Park. **1,** Distant view from Frenchman Peak showing unpaved road and wetlands near the coast close to where *M. pardus* was collected. Standing water in this area (center, to the left of the road) is visible because the overlying vegetation has been recently burnt. Before this picture was taken there was an unusual amount of rainfall, and this area may not usually be as wet. However, the numerous frogs that were sighted during the collection of the spiders indicate that the area is a generally swampy. **2-4,** Near views of slightly elevated sandy ridges near the road where *M. pardus* was found. The largest shrub in the distance (3, 4 at upper right) is *Nuytsia floribunda* ("Christmas Tree").

♀ ***Maratus volans*** **(O. Pickard-Cambridge 1874)**

Salticus volans O. Pickard-Cambridge 1874
Maratus amoenus Karsch 1878; Żabka 1987
Saitis volans : Simon 1901; Ridewood 1913; Butler 1933; Dunn 1947
Maratus volans : Żabka 1991; Hill 2009; Otto & Hill 2011; Girard *et al.* 2011

Specimens examined. All female *Maratus volans* described here were collected or photographed in Ku-ring-gai Chase National Park near Sydney. Three of these (#1-3) were observed mating with *M. volans* males and the remainder were found in the vicinity of *M. volans* males. Specimens 6-9 were preserved and are presently in the collection of J. C. Otto.

Description of female (Figures 16-20). Three female specimens ranged from 4.15-6.32 mm in body length not including the spinnerets, and from 4.32-6.56 mm including the spinnerets. The carapace is dark brown on top, but glabrous and translucent, light-brown on the sides and beneath the eyes in front. Beneath the front eye row a relatively sparse group of long white setae project dorso-medially from each side. The chelicerae are brown, darker than the clypeus. The eye region is moderately covered with ivory-white to brown setae, and similar setae, including some red-brown setae, surround the eyes on either side. There is no marginal band as in the male. There is no band of setae on the glabrous thoracic slope behind the eye region. The PME are slightly closer to the PLE than to the ALE.

Like the carapace behind the eye region, the dorsal opisthosoma is very dark brown, almost black. Broad tracts of white to ivory-white setae on very light brown cuticle surround this central dark area of the dorsal opisthosoma. In some individuals an indistinct pattern of scattered ivory-white setae can be observed in this central dark area. There is a small triangular tuft of white setae above the anal tubercle as in other *Maratus*, and the spinnerets are brown. Beneath, the opisthosoma is very light brown, uniformly covered with scattered, short white setae. Several rows of small, brown spots may also be present. From beneath, the sternum, coxae, labium, and endites are uniformly light brown, translucent, and glabrous, the same colour as the sides of the carapace. In preserved specimens these appear white.

Legs I and II are about the same length, much shorter than legs III and IV. Legs III are longer than legs IV. All legs are uniformly light brown or darker brown (in some individuals) and translucent from the coxae to the proximal femora. All legs are ringed or blotched with areas of dark pigment, but this varies between individuals. Pedipalps are light-brown, covered with long white setae.

The epigynum (Figure 19), as viewed from below and externally, is similar to that of other *Maratus*, with fossae generally, but not always, smaller than the posterior spermathecae. As with female *M. pardus*, the relative width of the septum between the fossae varies. There are no obvious external characters of the epigynum, including details of the darkly sclerotized internal ducts that are visible through the cuticle, that can be used to separate *M. volans* from *M. pardus*.

Maratus volans females can often be found in litter, on dry, dead, fallen twigs. We suspect that they may mimic leaf scars on these dry twigs (Figure 20) and that selective pressure for crypsis, with requirements varying according to microhabitat, has driven the divergence in general appearance between *M. volans* and *M. pardus*. The female of *M. volans* is similar to other *Maratus* that we have described from eastern Australia, most notably *M. plumosus*, *M. calcitrans* and *M. digitatus* (Otto & Hill 2012a, 2013). *M. plumosus* can be distinguished from *M. volans* by the presence of a narrow brown band laterally on the opisthosoma, and the female of *M. calcitrans* has a denser scattering of white setae on the opisthosoma and legs. The female of *M. digitatus*, however, seems to lack any distinguishing feature and separation from *M. volans* may need to rely on males in the vicinity.

Figure 16. Three different female *M. volans*. Note variation in overall darkness of the cuticle. The second female (3-4) is particularly dark.

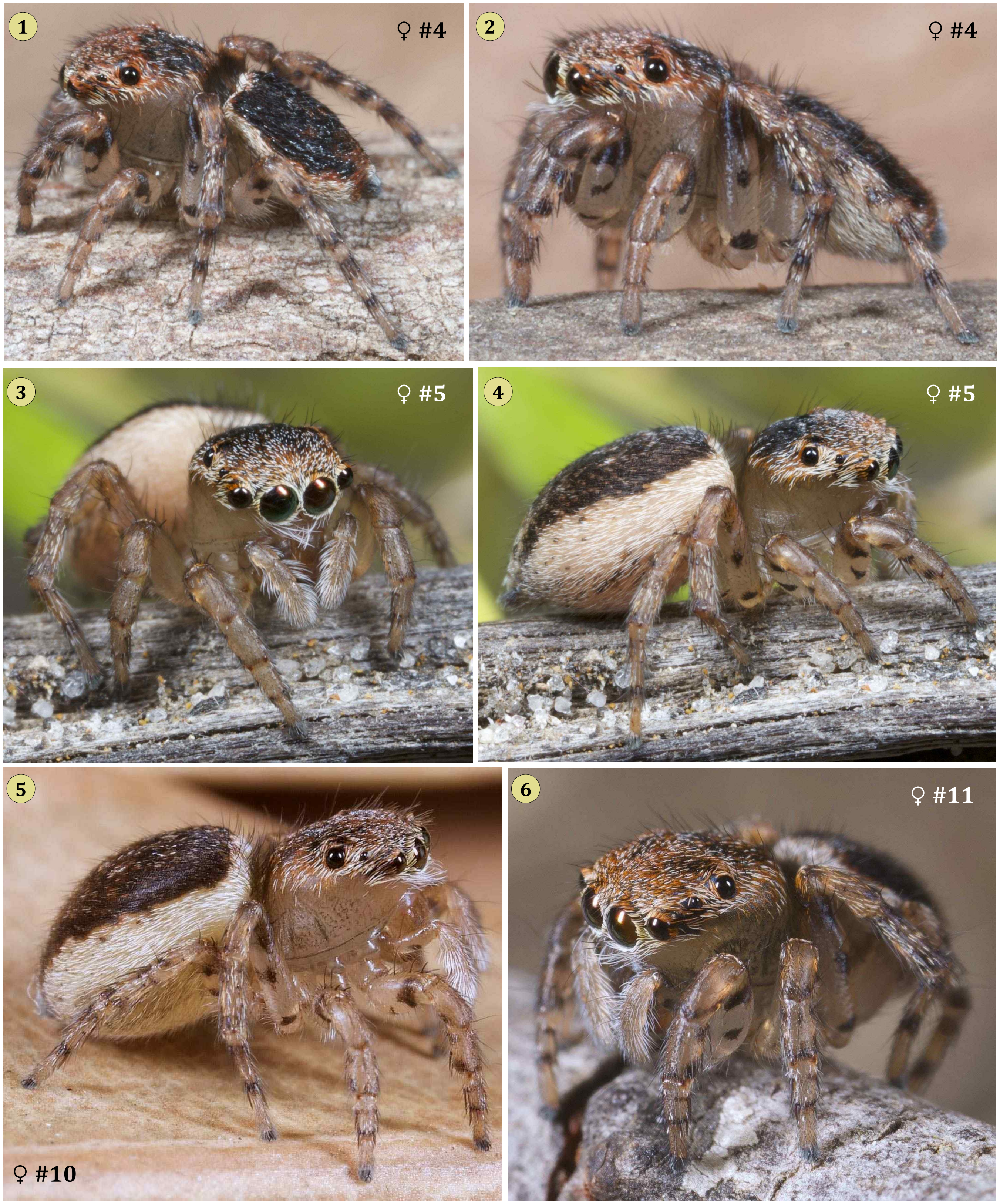

Figure 17. Four more female *M. volans*.

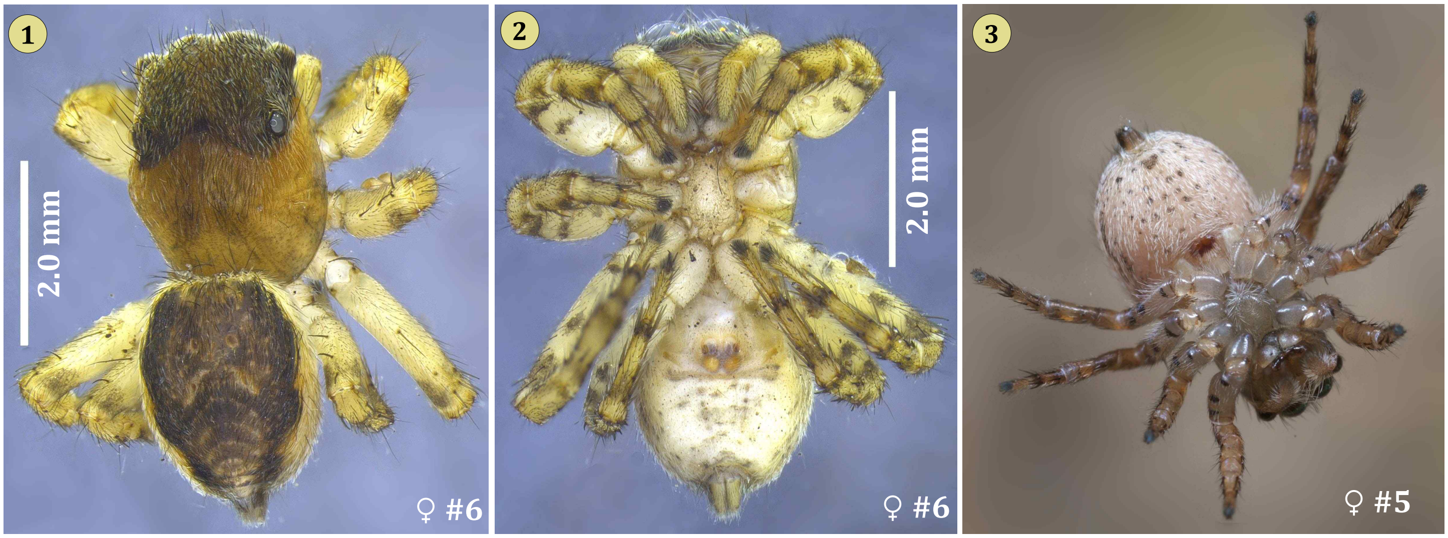

Figure 18. Female *M. volans*. **1-2,** Specimen in ethanol. **3,** Underside of a living female.

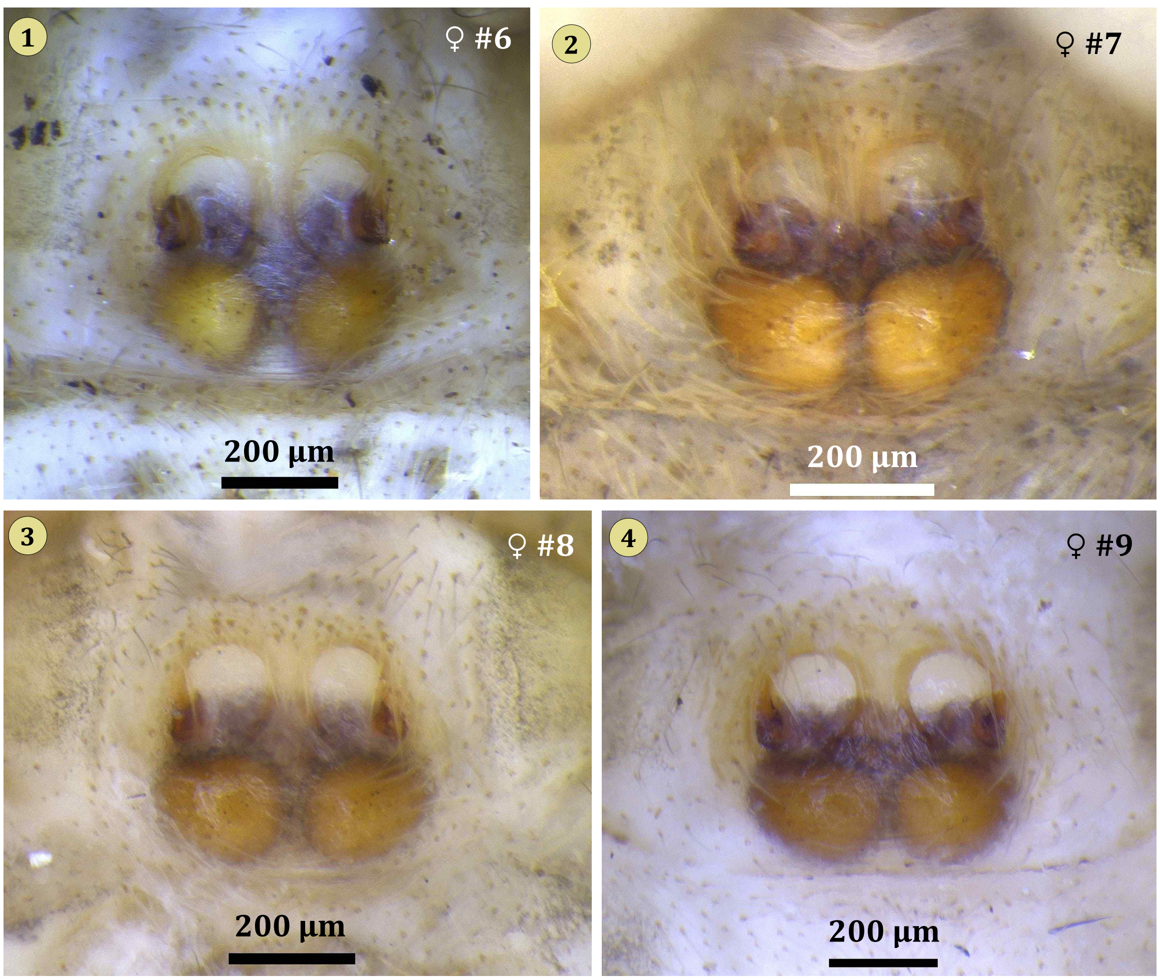

Figure 19. External, ventral view of the epigynum of four different female *M. volans*. As in *M. pardus*, a considerable part of the fossae is occupied by darkly sclerotized internal ducts. Note the relatively small spermathecae in (1), and the wider septum between the fossae in (4).

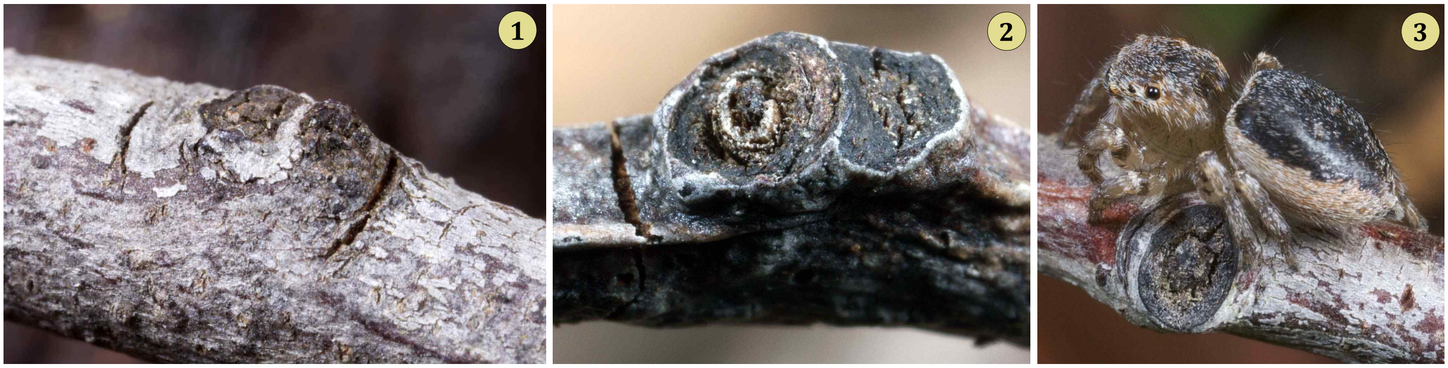

Figure 20. Comparison of leaf scars on a stem (1-2) to a female *M. volans* (3). One of us (J. C. Otto) confused one of these leaf scars (1) with a female when hunting for *M. volans*. We suspect that the appearance of female *M. volans* is associated with cryptic mimicry of these leaf scars. This *M. volans* (and all *M. volans* in subsequent figures) was captured in Ku-ring-gai Chase National Park.

Immature stages of *M. pardus* and *M. volans*

Here we describe several of the immature stages or instars of *M. pardus* and *M. volans*. Other instars of *M. pardus* may be described at a later date. The convention that we follow is to label hatchling spiders as first instars (*i1*, Figure 21:3). After considerable development in the brood sac, these moult to the second instar (*i2*, Figure 22), a fully functional stage that is fully equipped to live on its own. The setation of second instars in these species suggests the appearance of the adult female for each of the two species, respectively. The second instar of *M. pardus* bears many long white setae and the cuticle is otherwise light-brown and translucent. In contrast, the second instar of *M. volans*, except for the appendages, is dark brown with only a few scattered setae on the dorsal opisthosoma, and the legs may already have a ring of dark pigment along the distal margin of each segment. At this stage the sides of the carapace is glabrous in both species. By the time that they reach the penultimate stage male *M. volans* are distinctively patterned, but lack many adult features including the opisthosomal fan, the prominent white marginal band of the carapace, and the specialization of legs III for display (Figure 23). Immature or penultimate female *M. volans* resemble the adults, but their pedipalps are colourless and not light-brown, and they have a distinct pattern of ivory to red-brown setae on the dorsal opisthosoma (Figure 24).

Our observations (Figure 21) suggest a *brood size* (= count of emergent second instars), of about 6-7, commensurate with the small size of adult female *M. volans*. Martyn Robinson (Australian Museum) observed from 6-13 eggs per clutch from four different female *M. volans*, and two of these females had 3 consecutive broods (pers. comm.). Thus the fertility rate of *M. volans* may be as high as 10-15 (= count of emergent or second instar offspring per female per season).

Figure 21. Two different female *M. volans* in their brood sac. **1,** Female with with 7 eggs. **2,** A different female with 6 eggs laid in December. These hatched after about 2 weeks. **3,** First instars from the 6 eggs shown in (2). About 2 weeks after hatching, all emerged from the brood sac as second instars (Figure 22:4-7), and the female died several days later without feeding.

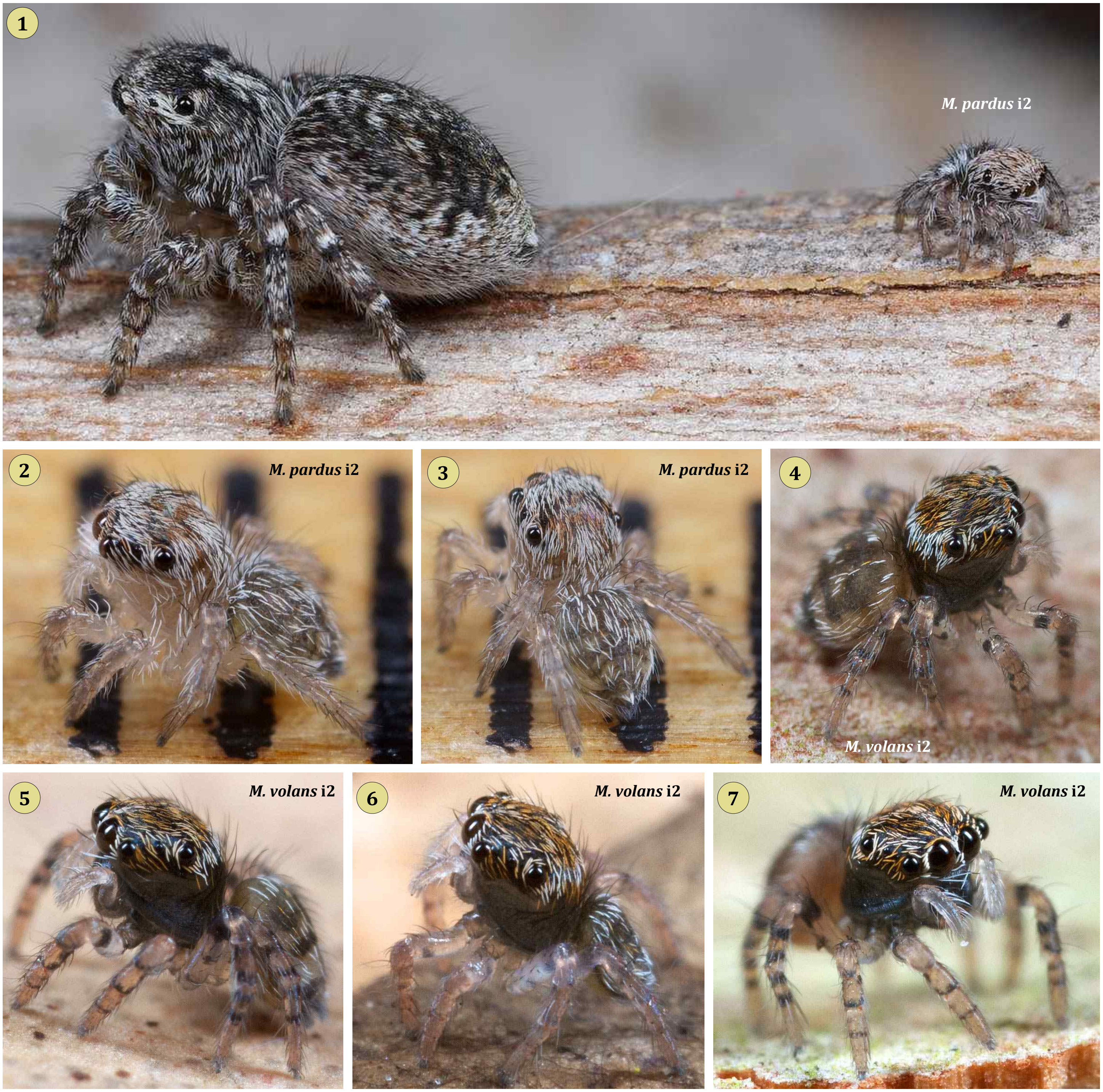

Figure 22. Second instar spiderlings of *M. pardus* and *M. volans*. **1,** The colouration of the second instar spiderling of *M. pardus* is similar to that of the adult female, about four times its length. **2-3,** The pattern of long white setae on the carapace of the second instar *M. pardus* suggests the presence of a longitudinal median band of white setae behind the PLE row as found in the adult female. As in *M. volans*, the sides of the carapace are relatively (but not completely) glabrous, and there are some red-brown scales in the eye region. **5-7,** The second instar *M. volans* are quite dark by comparison, with relatively few setae on the dorsal opisthosoma. They already have a suggestion of alternating longitudinal bands of red-brown or white setae in the eye region, a pattern that becomes prominent in the adult male of this species.

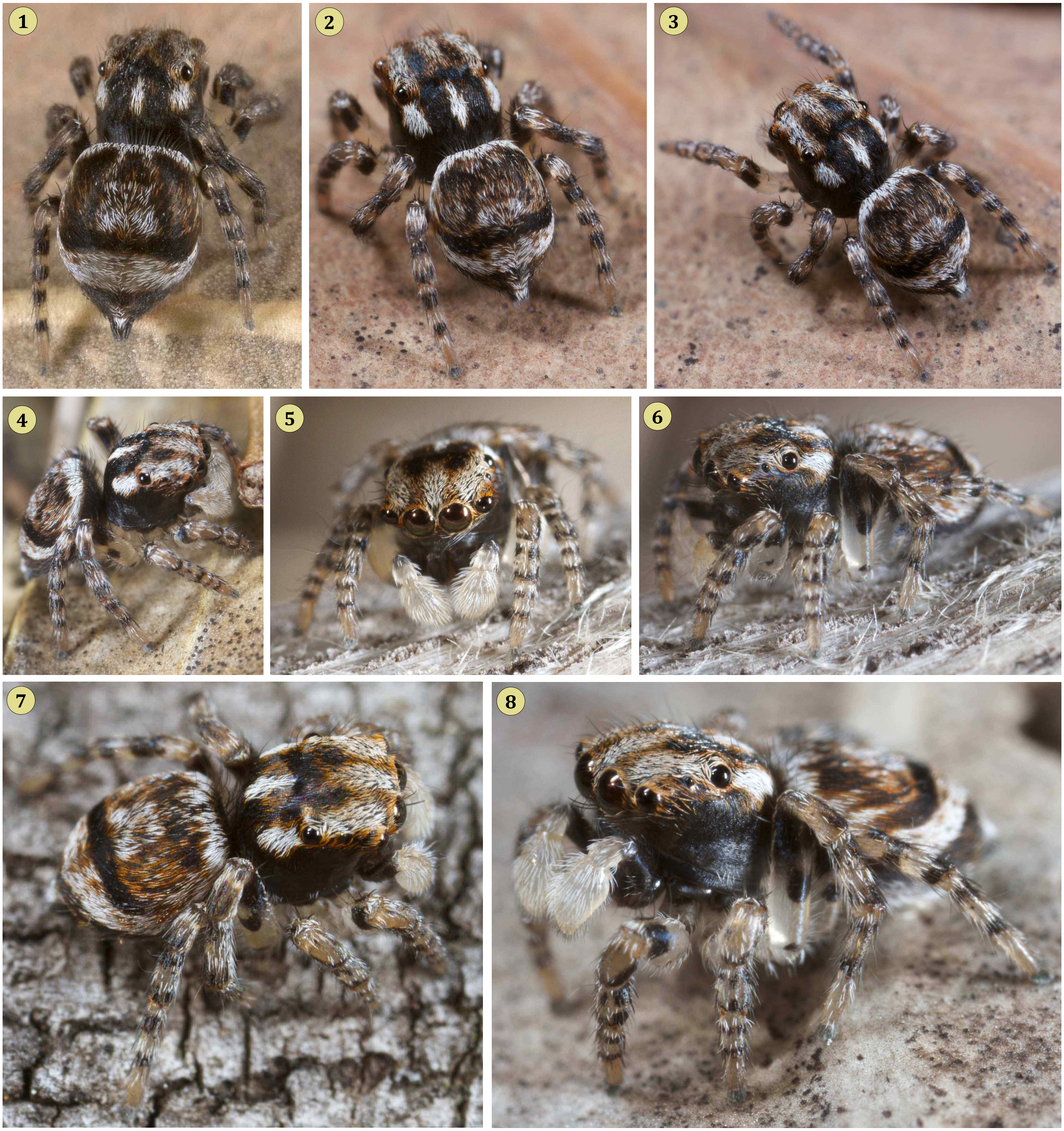

Figure 23. Three different (1, 2-4, 5-8) penultimate male *M. volans*. As in adult females, the colouration of legs III is similar to that of the other legs at this stage. The dorsal carapace already bears the same pattern of longitudinal bands that one observes in the adult. One more moult will bring out the display colours of legs III, the dorsal opisthosomal plate (including flaps), the prominent white marginal bands of the carapace, and the brightly coloured scale cover of the adult. The penultimate male *M. volans* has distinctive, bold markings that permit its identification, but subdued colouration.

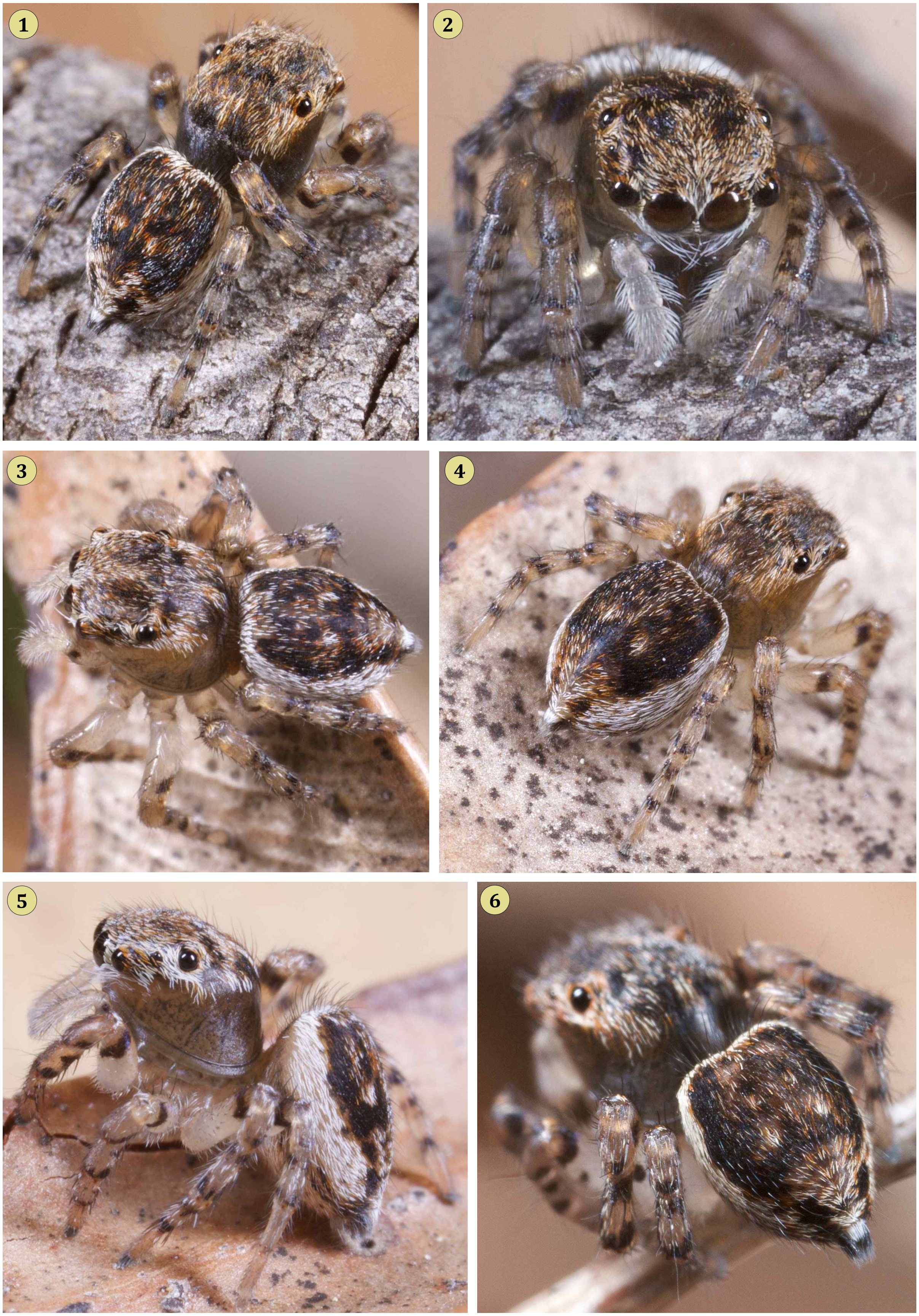

Figure 24. Six different immature and possibly penultimate female *M. volans*. These have a distinct pattern of lighter (ivory to red-brown) scales on the dorsal opisthosoma that we have not seen on adult females. The pedipalps of immature females are also colourless, unlike the light-brown pedipalps of adults.

Behaviour of *M. pardus* and *M. volans*

The male fan dance. The general appearance and courtship display of male *M. pardus* and *M. volans* have many similarities, and it is for this reason that we group both in a clade that we call the '*volans* group' of the genus *Maratus*. Similarities in appearance include the shape and size of the expanded fan, the presence of several wide bands of yellow to red-orange scales on the flaps of this fan, the length and colouration of the fringe that surrounds the fan, and the background of light blue to blue-green iridescent scales of the fan. The colouration and setation of all legs, including the specially modified legs III, is almost identical in the two species, although the white fringe beneath the distal tibiae of *M. volans* is less distinct. Both have a median band of white scales on the carapace behind the PLE, white lateral marginal bands on the carapace, and a medio-ventrally oriented fringe of long white setae beneath the anterior eye row. In both species the pedipalps are covered with uniform, long white setae, and are held with their distal segments facing down and forward, usually in front of the chelicerae. The major difference in the appearance of the two species lies in the theme of multiple bright red to red-orange lines extending from just behind the anterior eye row to the fan of male *M. volans*, as compared to the uniform colouration of the eye region and the pronounced spots rather than stripes on the fan of *M. pardus* (Figures 25-31).

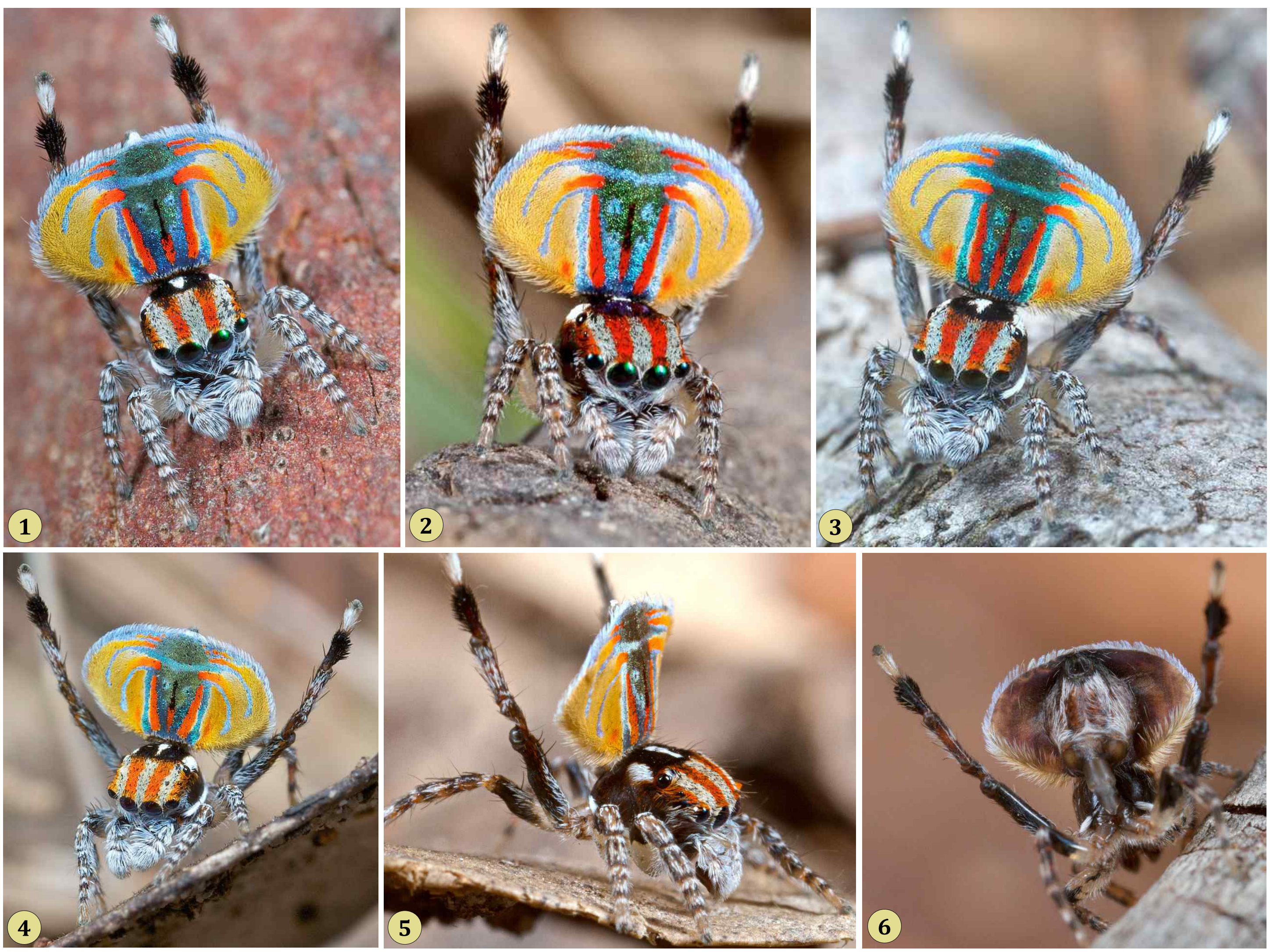

Figure 25. Six different adult male *Maratus volans* from Ku-ring-gai Chase National Park displaying to a female. When the extended legs III are brought together, they remain behind the extended fan.

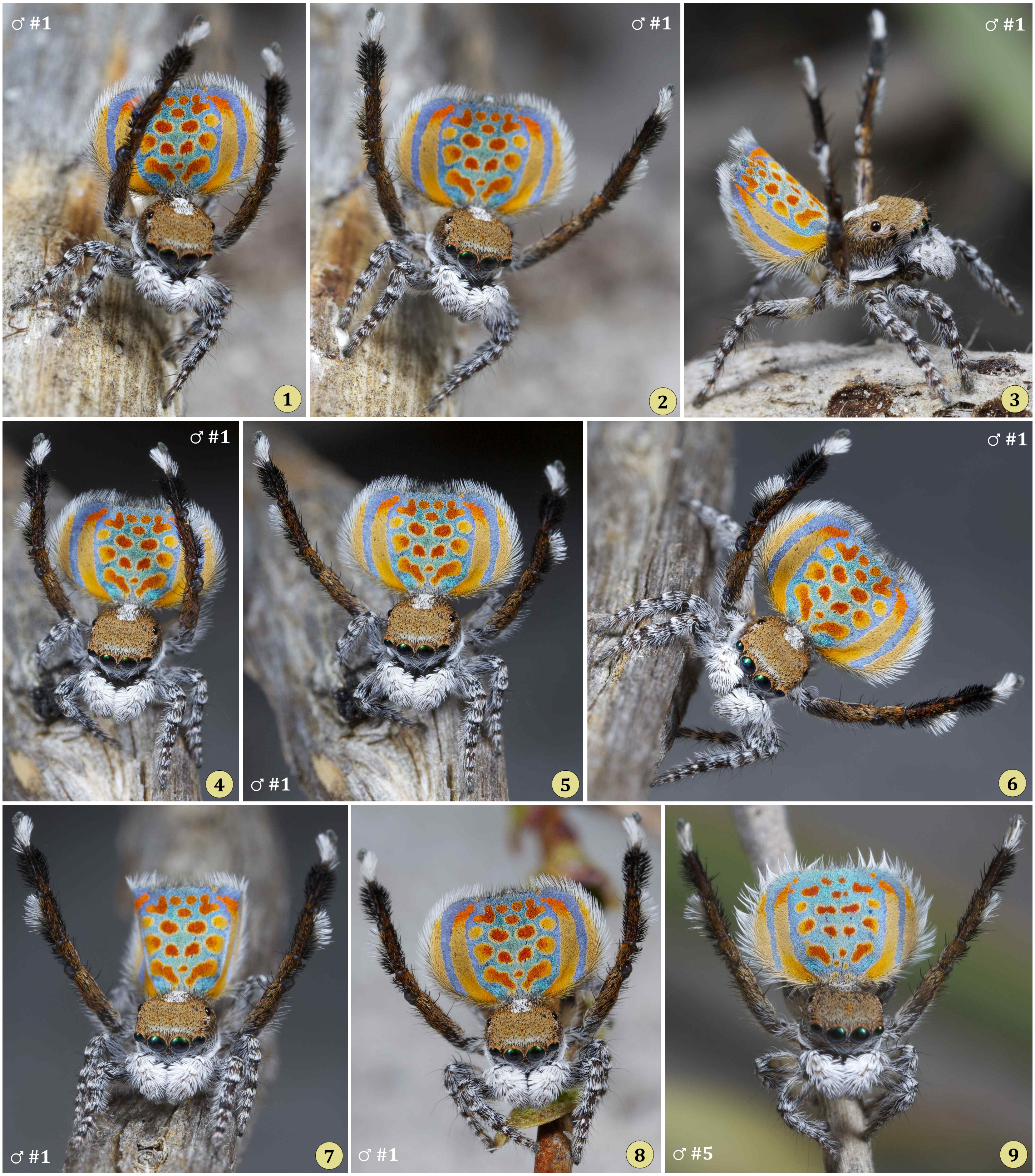

Figure 26. Views of f*an dance* by holotype (1-8) and a paratype male (9) *M. pardus* in front of a female *M. pardus*. The pedipalps are held together in front of the chelicerae during this display, and may be moved up and down. Rapid movement of extended legs III is generally bilateral. These legs are moved in a plane to the front of the extended fan, often in front of the fan (1, 3, 4). The extended fan is also rotated from side to side.

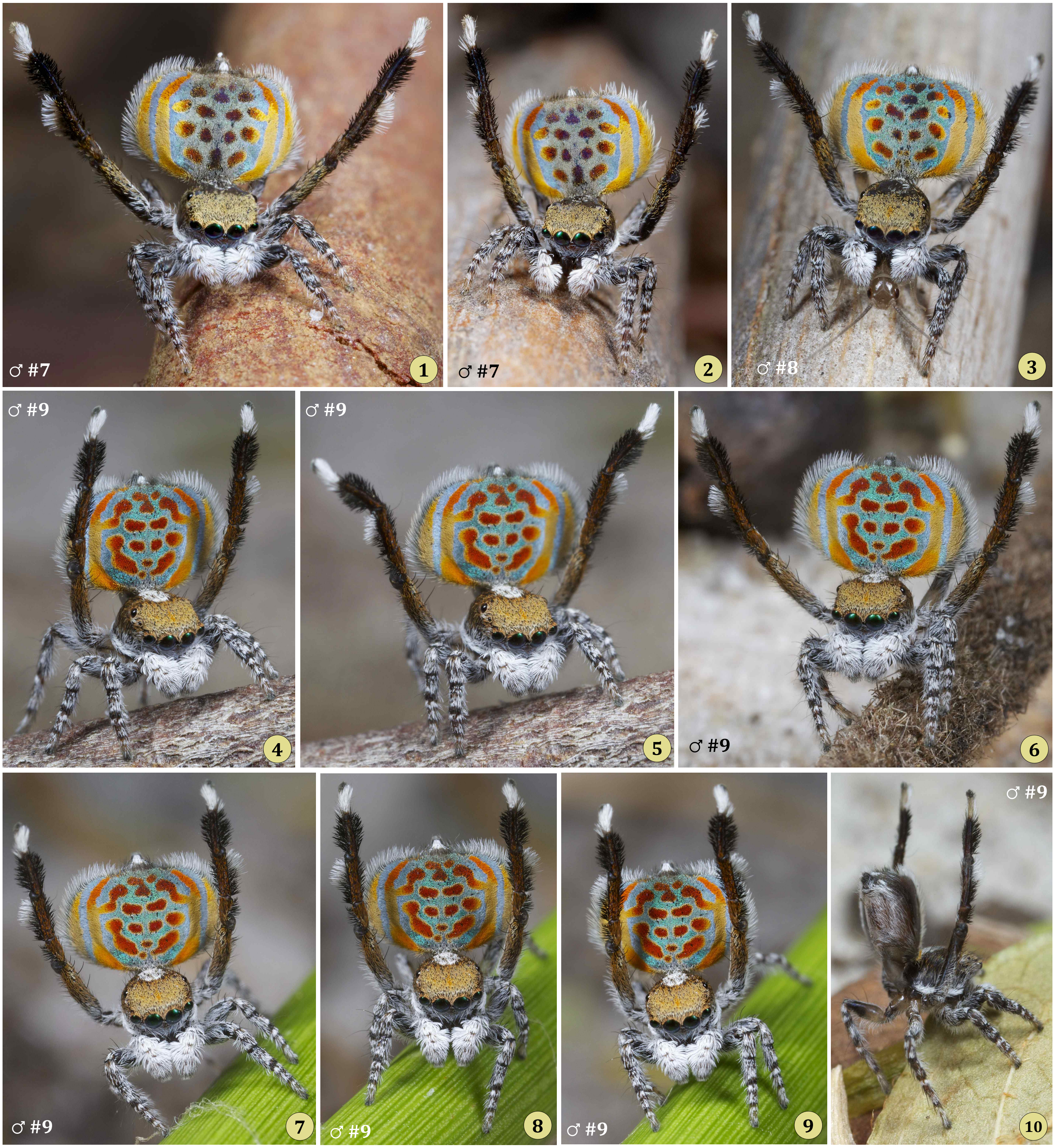

Figure 27. Views of the fan dance of three different male *M. pardus* as they display to females. Note flexion at the tibio-metatarsal joint of legs III in (5). **10,** Postero-lateral view showing thin flap, flattened opisthosoma, and extended pedicel during this display.

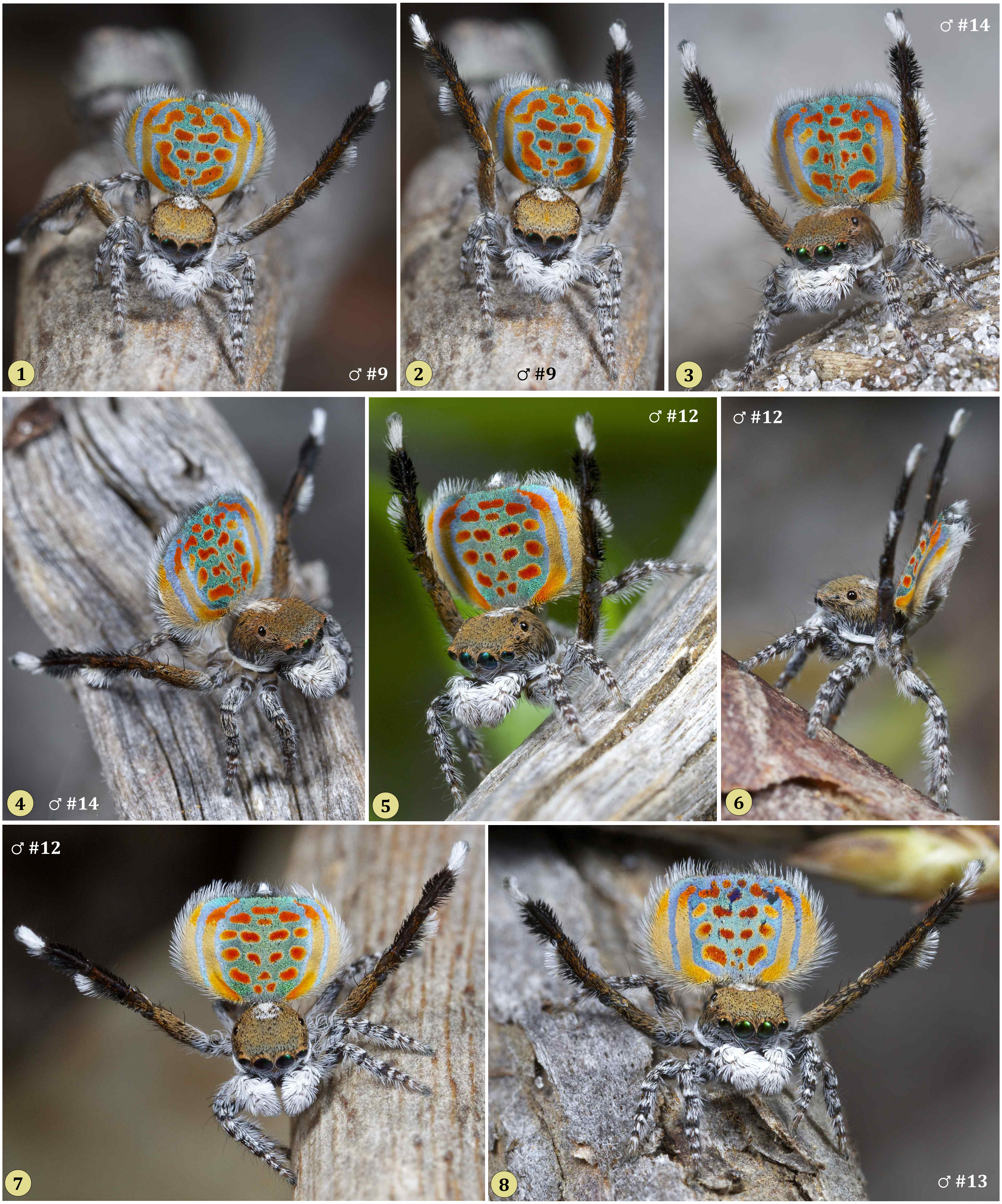

Figure 28. Views of the fan dance of four different male *M. pardus* as they displayed to females. **6,** Lateral view of male in an elevated position.

The courtship display of male *Maratus volans* has been studied in more detail that that of any other members of the genus, and includes both vibratory and visual components (Hill 2009, Girard *et al.* 2011, Otto & Hill 2011, Otto 2011). We have observed all of the components of the visual display of *M. volans* in *M. pardus*, and the two species are quite similar in all of these (Figures 29-31). This includes intermittent bilateral pedipalp flicker, opisthosomal bobbing, leg III wave, fan dance, fan flapping, and pre-mount display (Girard *et al.* 2011: Table 1). During this fan dance, males of both species would frequently step from side to side if permitted by the underlying surface. During its fan dance *M. volans* moves its fully extended legs III *to the rear of* the extended fan (Girard *et al*. 2011: 2-5 cycles/s; Figure 29). A male *M. pardus* moved legs III at a similar rate (~5 cycles/s) *in front of* the extended fan during this display (Figure 30). In a second sequence of display (Figure 31), the same male moved legs III at a higher rate (~10 cycles/s), and this was accompanied by more vibration at the tibio-metatarsal joint, a visual effect enhanced by the greater development of the fringe of long white setae on the distal tibiae III of *M. pardus*. Thus there appear to be at least two different modes of display during the fan dance of *M. pardus*: one mode that emphasized bold movement of the fan, legs III, and pedipalps (Figure 30), and a second mode with an emphasis on more rapid movement or vibration with less displacement, including very rapid movement at the tibio-metatarsal joint of legs III (Figure 31). We previously observed similar displays in *M. pavonis* (Dunn 1947) and *M. splendens* (Rainbow 1896), but those species also engaged in prolonged *semaphore* signalling without the fan, and they also moved their extended legs III apart more slowly or 'deliberately' during the fan dance (Hill & Otto 2011).

The third leg wave of males (Figures 32-35). Use of legs III to signal conspecifics appears to be common to most if not all '*Saitis* group' euophryines (Hill 2009). Unilateral leg III signals may appear in the courtship display of males, but they have generally been observed when conspecifics are at a greater distance (Hill & Otto 2011). They may thus represent a more general form of advertisement aimed at provoking a response from females that may be watching, but are not yet visible to the male due their cryptic nature and their tendency to remain relatively motionless. The males of *M. pardus*, when employing such unilateral leg III signals, often turned around and gazed into a different direction seemingly looking for a response. In some instances unilateral and alternating signaling with leg III was also observed at a closer distance during the approach to a specific female.

Both *M. pardus* and *M. volans* rapidly raise and then gradually lower a laterally extended third leg during this display. *M. volans* males raise and then lower a leg III almost continuously over the span of several seconds during this display (Figure 32), whereas leg III is intermittently jerked (or vibrated) down-then-up as it is lowered by male *M. pardus* (Figures 33-34). The cycle rate of these intermittent movements by *M. pardus* is ~2-4/s.

Display with elevated opisthosoma and legs III by females. Like female *M. volans* (Figure 36), female *M. pardus* occasionally responded to approaching males by signalling with their legs III. Usually both legs were stretched out and moved, but sometimes one leg was engaged in the display more than the other (Figures 37-39). This was generally accompanied by elevation and movement of the opisthosoma from side to side as the female slowly walked away from a courting male, sometimes interrupted by more rapid and abrupt dashes. It is interesting to note that females behaving in this way generally did not engage in any direct eye contact with the males and by exposing their opisthosoma they concealed their eyes from the gaze of the male. Males usually responded by interrupting their courtship display and folding away their fans. This is similar to the behaviour of females of other species of *Maratus* that we have studied (Otto & Hill 2012a, 2012b, 2013, 2014). Since such female displays never directly preceded mating in any species, and they often followed an attack on the courting male, we assume that this is either a warning to the male or a sign that the female is not willing or ready to mate. A video depicting the displays of *M. pardus*, including the fan dance and single leg wave of males, and the display of females, can be viewed online (Otto 2014).

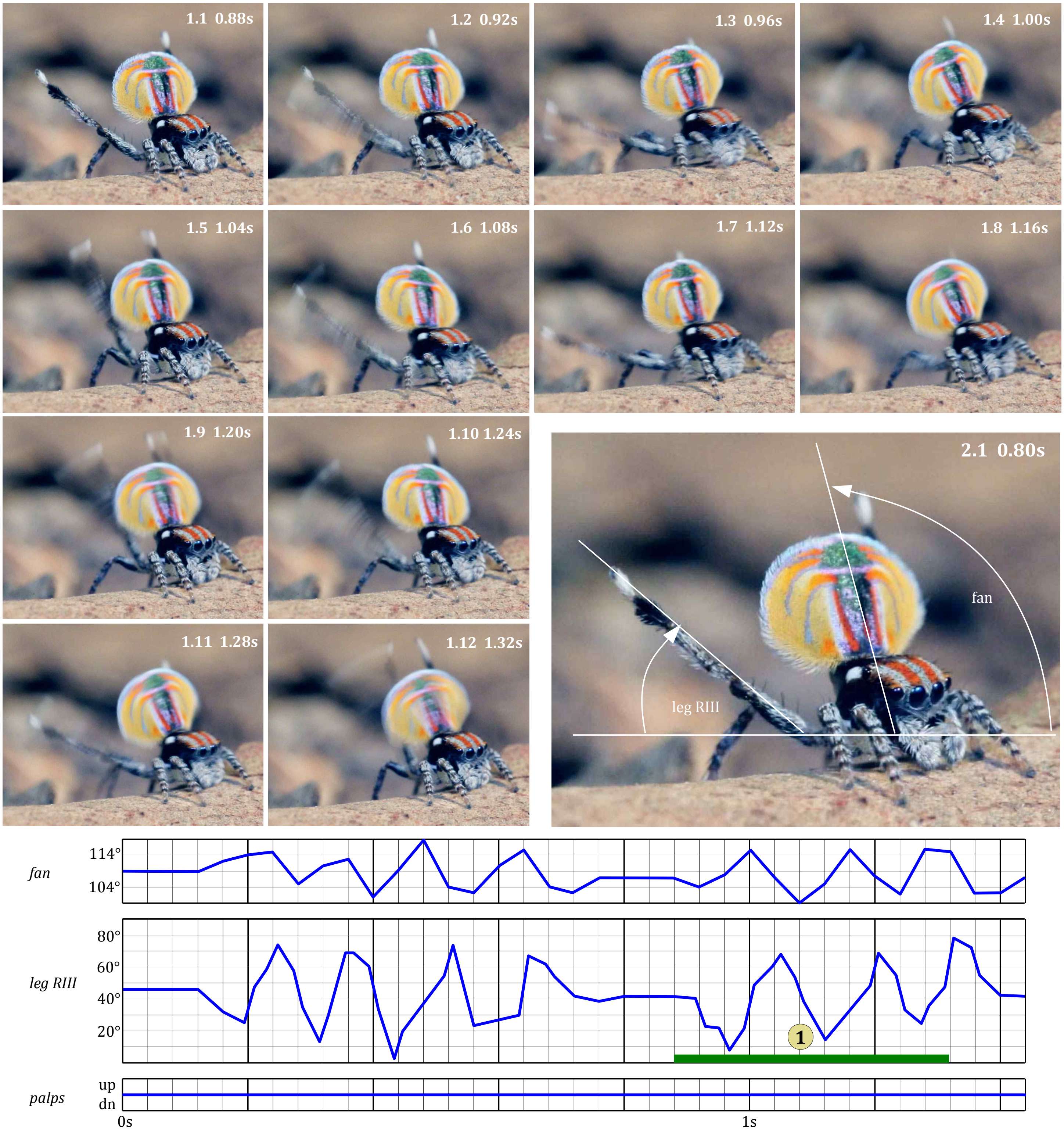

Figure 29. Analysis of a brief sequence from the fan dance of a male *M. volans* from Ku-ring-gai Chase National Park, based on a 25fps video clip. The sequence of frames shown above (1.1-1.12) spans the time interval marked with a horizontal green line (1) in the chart. The frame rate limited our resolution movement during this display. Both extremes of blurred movement in a frame were recorded in this chart. Components of movement were measured in each frame as shown in 2.1: position of the median axis of the fan, and elevation of the right third leg (RIII), both relative to the horizontal. Because of the oblique orientation of this spider relative to the camera, these measurements should not be taken as absolute elevations, but were nonetheless useful to record timing and relative position during movement. The left third leg was generally out of view, but usually close to the elevation of the right leg during this display. Observed cycles of movement during this display (~4/s, maximum rate ~6/s) agree with those reported by Girard *et al.* (2011). Note the rapid movement of the third legs *behind* the fan in this species. Lateral movement of the fan was almost in sync with leg movement, but pedipalps were not moved.

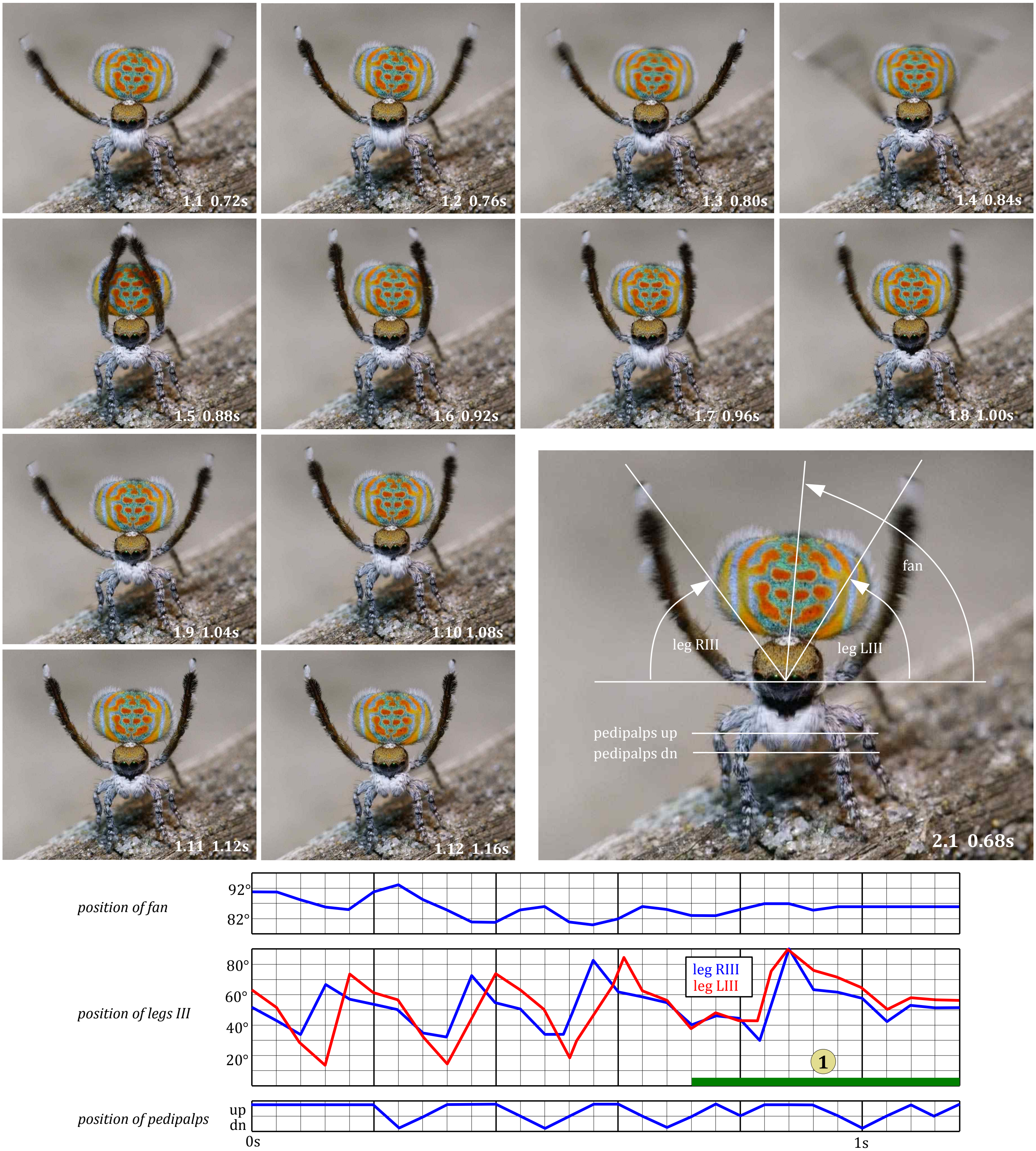

Figure 30. Analysis of a brief sequence from the fan dance of a male *M. pardus* based on a 25fps video clip. As in the previous figure, the position of a representative sequence of frames (1-1.12) is marked by a horizontal green line (1) in the chart, and the basis for measurement of position from each frame is shown in (2.1), here based on elevation of positions relative to a horizontal line drawn through the centers of the AME. In this example the elevation of both third legs was measured. Legs III were raised and lowered together, but movement of the left leg tended to precede that of the right leg. Lateral movement of the fan was loosely synchronized with leg movement, as was the up and down movement of both pedipalps. Cycle rate compared with that of *M. volans*, ~5/s.

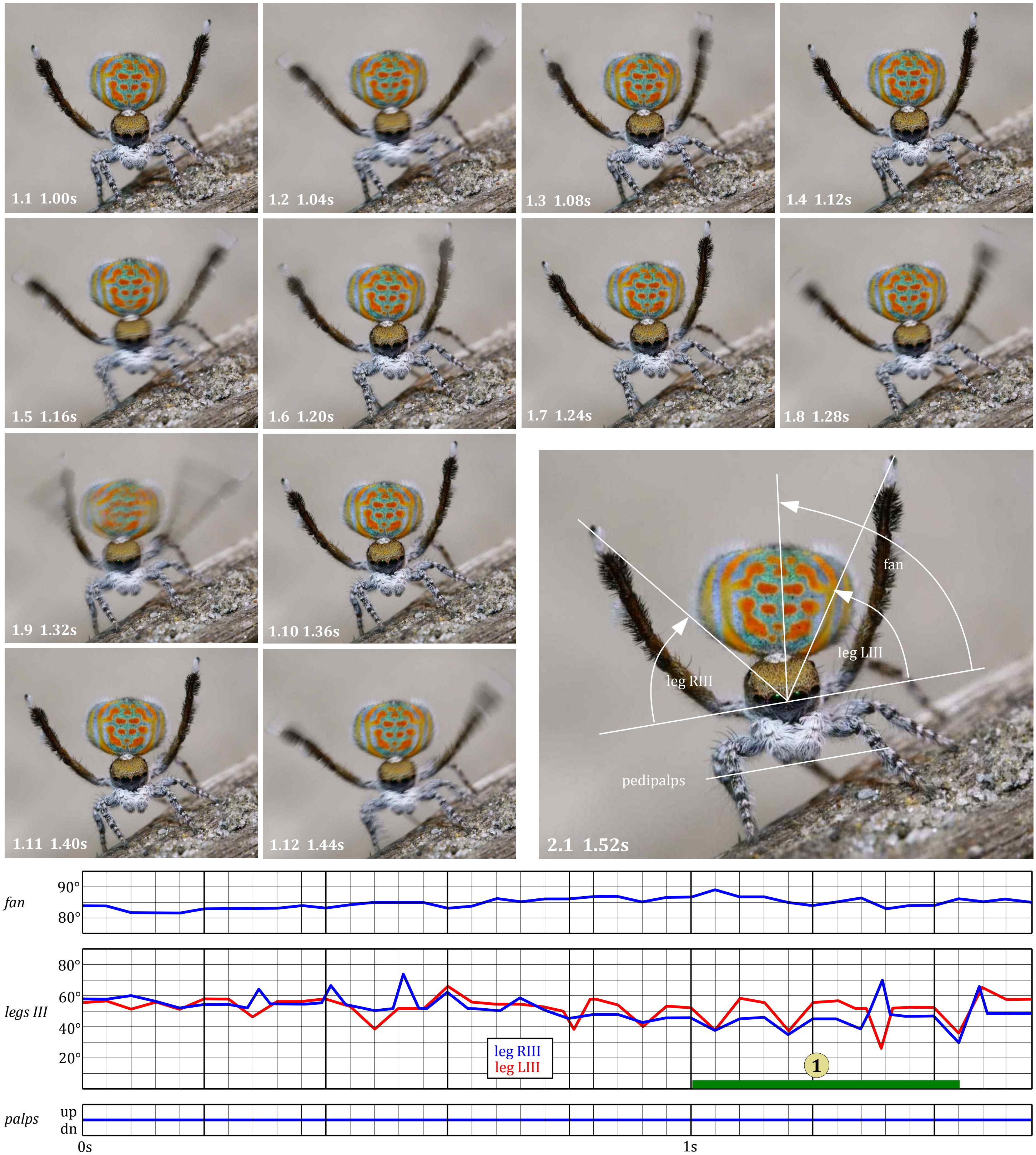

Figure 31. Analysis of a second sequence of frames (25fps) during the display of the male *M. pardus* shown in Figure 29. As in the previous figures, the temporal position of a representative sequence of frames is indicated on the chart (1). Conventions for the measurement of position (2.1) were the same as those used for Figure 29, based on a horizontal line drawn through the centers of the AME. As in the previous example, cycles of leg movement were roughly synchronous (or bilateral), but displacement was much less during each cycle. Cycle speed was also twice as fast (~10/s). Movement or vibration of the fan took place but was much less marked, and pedipalps were held in place. In addition, there was a much greater tendency to vibrate the metatarsi of the third legs (1.2, 1.3, 1.5, 1.6, 1.8, 1.12) than in the previous example.

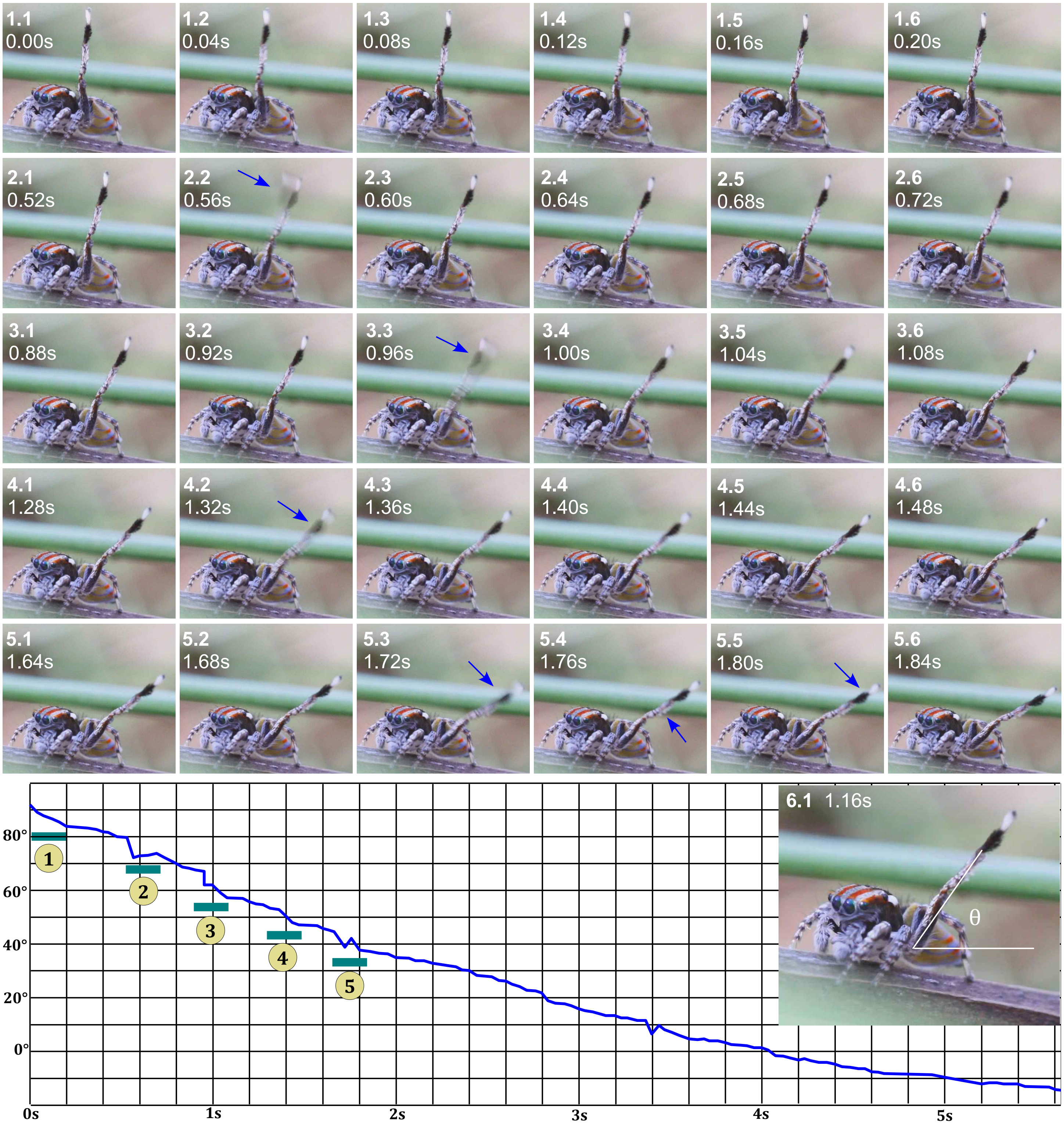

Figure 32. Analysis of a single leg wave by a male *M. volans* from Ku-ring-gai Chase National Park. Five sequences (1-5), marked in the chart, are illustrated with separate frames above. The convention for measuring the position of leg LIII as its elevation relative to a horizontal line is shown in 6.1. Again, because of perspective, this does not provide an accurate measure of leg elevation, but it does provide a good indicator of the timing and relative position of this leg. As shown here, the downward movement of this leg by *M. volans* is quite continuous over many seconds. Faster movement of leg LIII is indicated with arrows in respective frames.

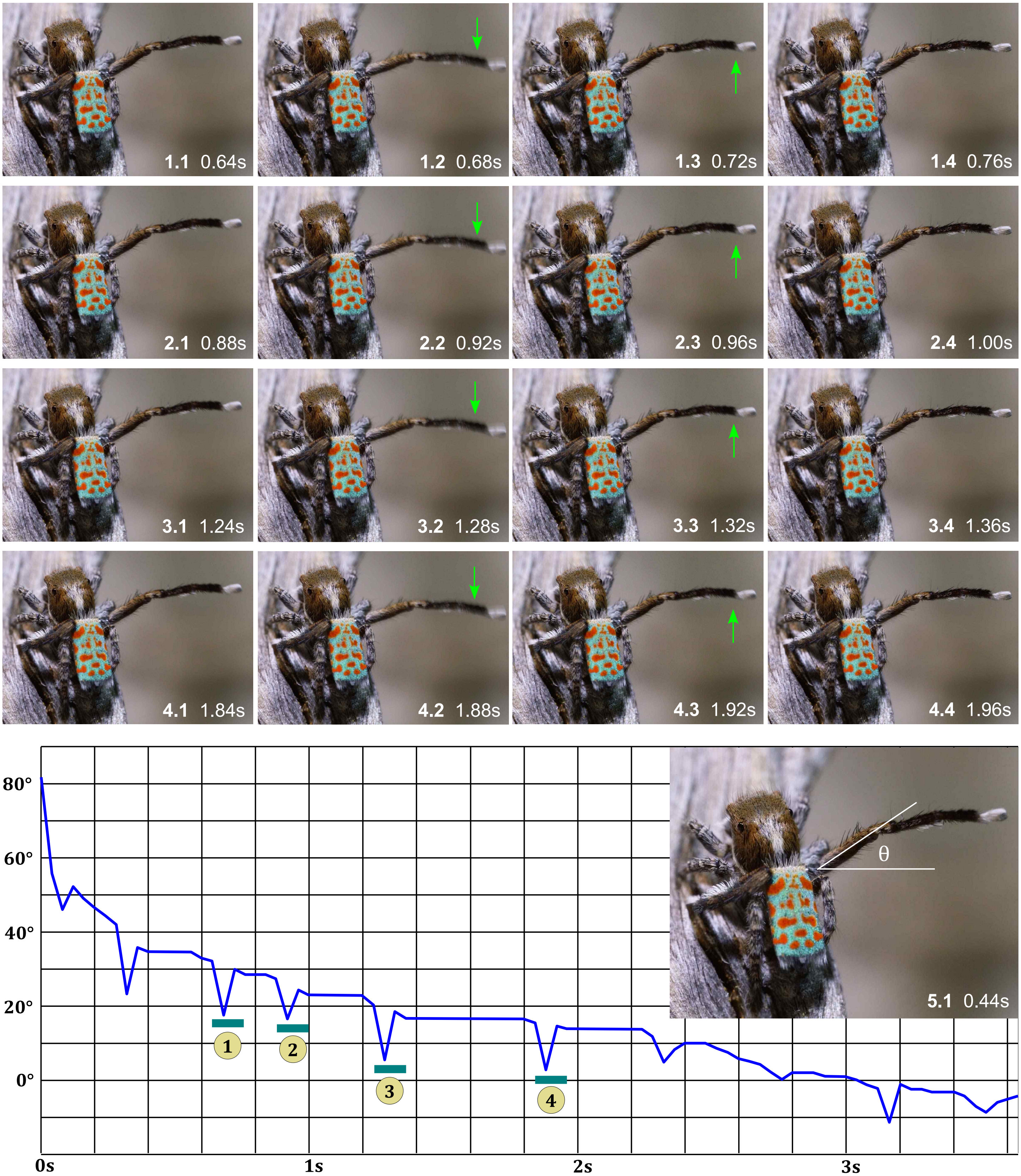

Figure 33. Analysis of a single leg wave by a male *M. pardus*. Four sequences (1-4), marked in the chart, are illustrated above, and the convention for measurement of leg RIII position from frames (as the elevation of the femur) is shown in (5.1). In *M. pardus*, leg III was also moved downward over several seconds during this display, but downward movement was frequently interupted by a rapid down-then-up vibration of the leg. Arrows indicate movement relative to the previous frame in this sequence.

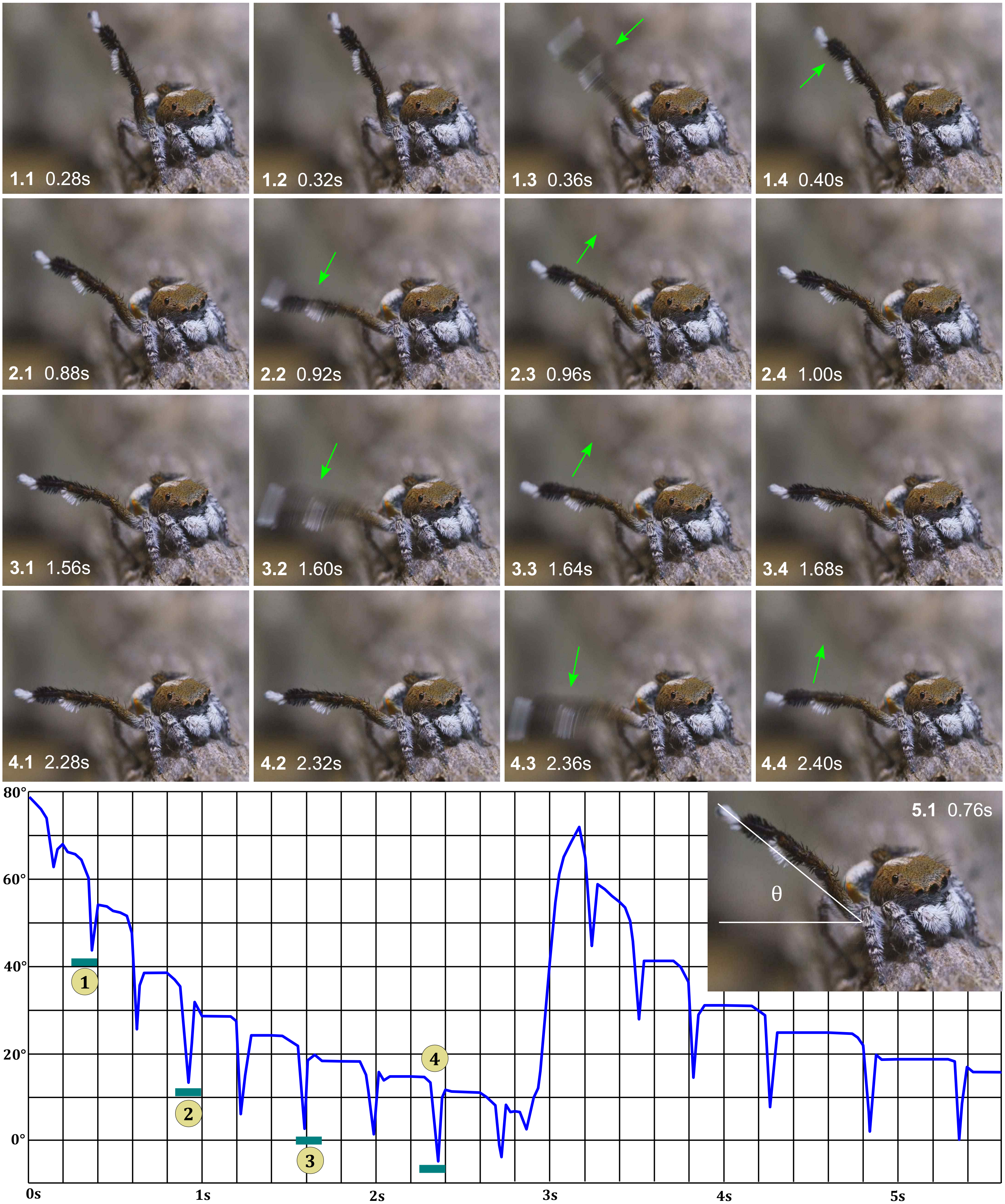

Figure 34. Analysis of a single leg wave by a male *M. pardus*. Here elevation of the entire leg RIII (5.1) was measured to record movement. Interrupted downward movement over 3s was followed by rapid elevation of leg RIII, then by a second sequence of interrupted downward movement. Each arrow indicates movement of leg RIII relative to its position in the previous frame.

Figure 35. Two different male *M. pardus* displaying with an extended leg III.

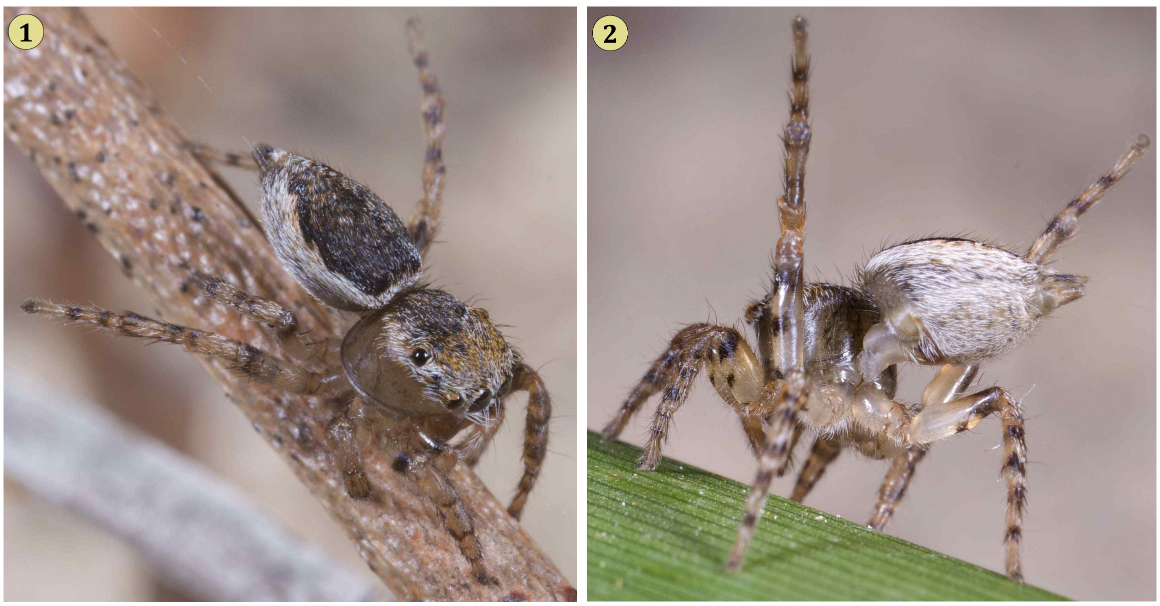

Figure 36. Display by female *M. volans* from Ku-ring-gai Chase National Park, showing extension of legs III and elevation of opisthosoma.

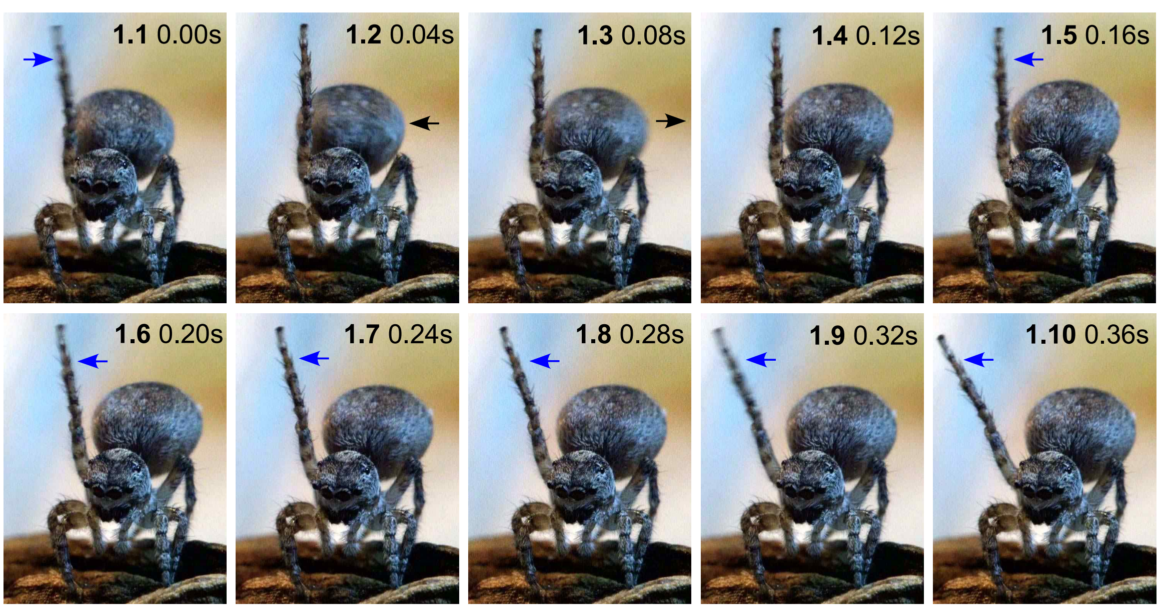

Figure 37. Sequence of frames (1.1-1.10, 25fps) showing lateral movement of extended leg RIII and limited movement of elevated opisthosoma (arrows) by a female *M. pardus*.

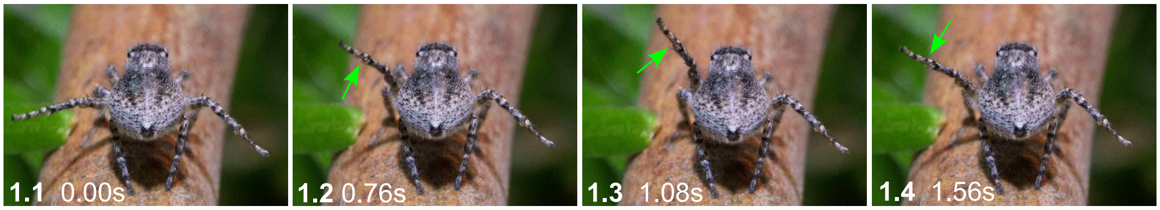

Figure 38. Selected (not sequential) frames (25fps) from a sequence showing elevation of opisthosoma and single leg wave of a female *M. pardus*.

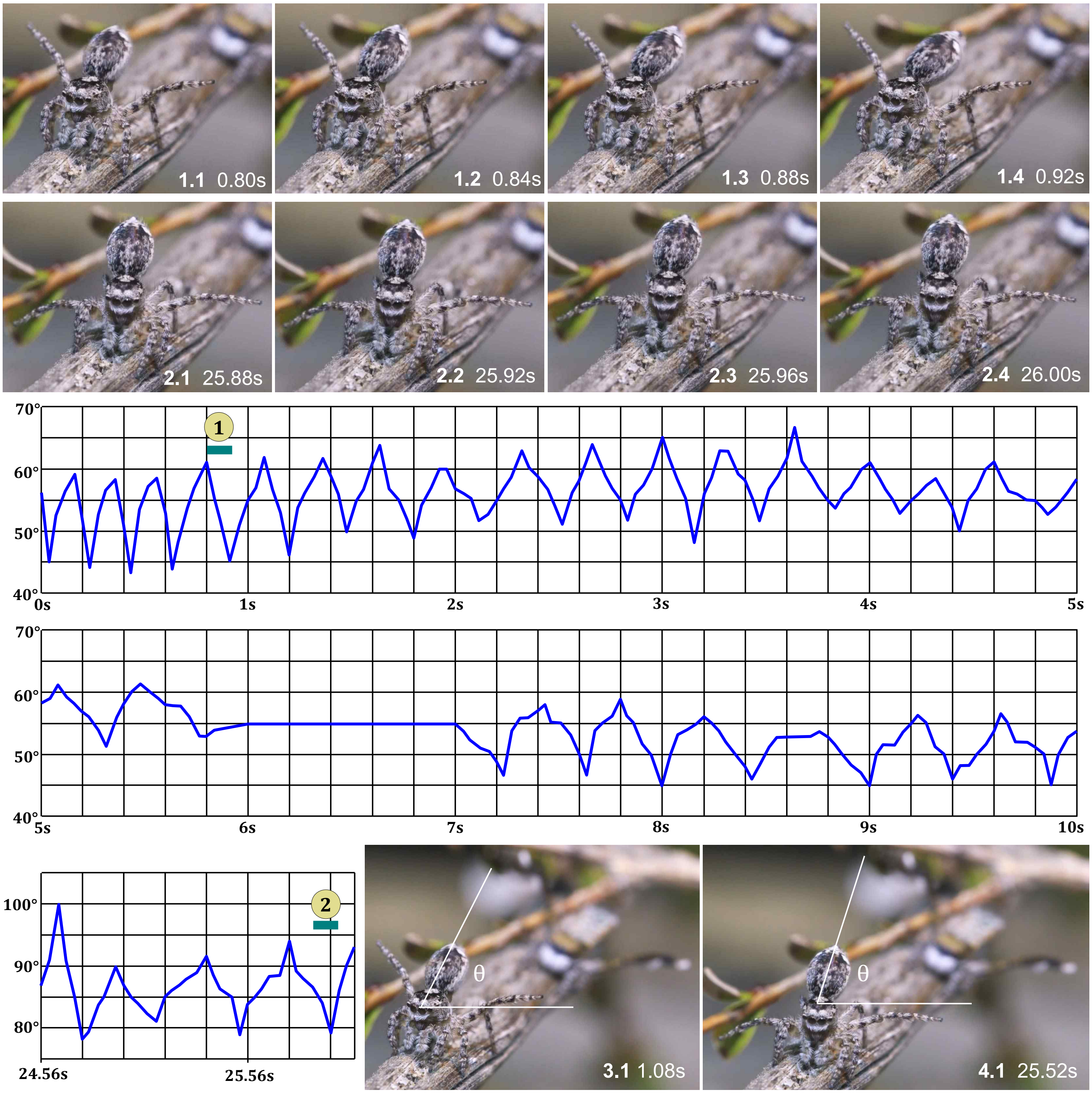

Figure 39. Video sequence (25fps) showing lateral wave of the elevated opisthosoma (rate ~2-4/s) by a female *M. pardus* that has turned away from a courting male (visible in 3.1 and 4.1). Because this spider changed position, the convention for measuring position during the first 10s of the sequence (3.1) differed from that used during the last short sequence (4.1).

Mating. A mating pair of *Maratus pardus* is shown in Figure 40. As in other *Maratus*, but unlike other salticids that have been observed, the pedicel of the female is so flexible that the opisthosoma can be rotated by about 180° during the mating process.

Figure 40. Three views of a mating pair of *M. pardus* (♂ #9, ♀ #10), showing the ability of the female to rotate her opisthosoma by about 180°.

Predation. A female *Maratus volans* is capable of capturing and feeding on relatively large orthopteran prey (Figure 41). We have previously documented the ability of an adult female *M. linnaei* Waldock 2008 to capture and feed on a large ant (Otto & Hill 2011, Figure 12).

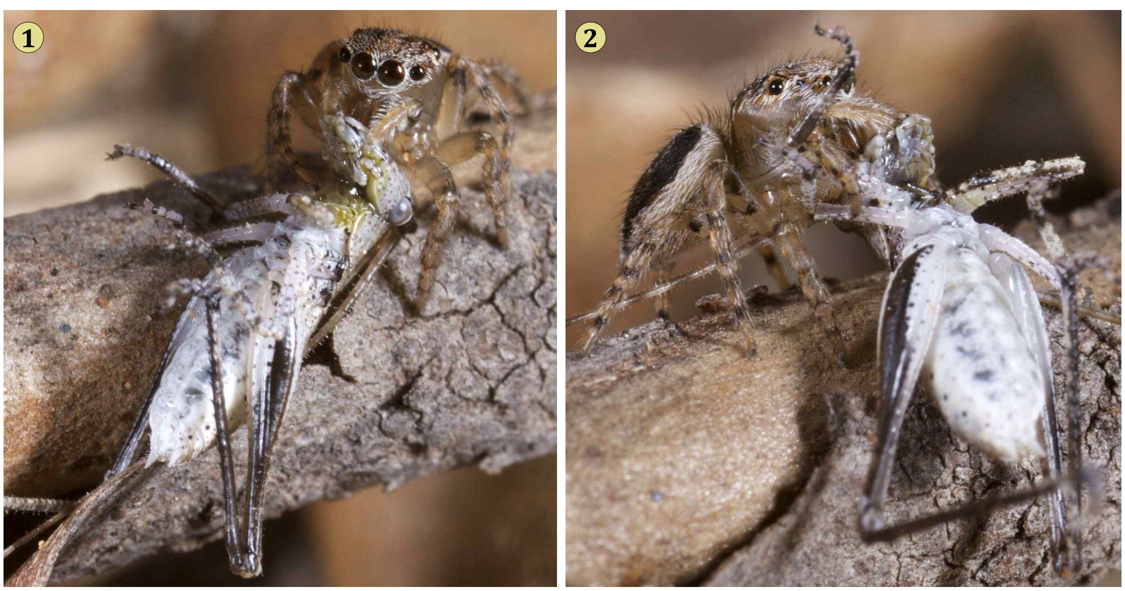

Figure 41. Adult female *M. volans* from Ku-ring-Gai Chase National Park feeding on a captured orthopteran.

The *volans* group of the genus *Maratus*

Three clades have been named within the genus *Maratus* (Otto & Hill 2014): the *calcitrans* group (3 species), the *mungaich* group (6 species), and the *pavonis group* (3 species). To these we now add the volans group (2 species, *M. volans* and *M. pardus*). We have highlighted many of the similarities between *M. pardus* and *M. volans* here, including the fact that external genitalia of the two are virtually indistinguishable, common elements in the display repertoire, and detailed characters of both legs III and the opisthosomal plate of males. It may be useful to assign more species to this group in the future, but for the present we simply define this as a clade containing both *M. pardus* and *M. volans*, and not containing any of the other clades that have been previously designated in the genus *Maratus*.

Acknowledgments

We thank David Knowles for his assistance in locating this new species, and Martyn Robinson for information related to the brood size of *M. volans*. We also thank G. B. Edwards and David B. Richman for their reviews of our manuscript, the Department of Parks and Wildlife of Western Australia for permission to collect specimens in Cape Le Grand National Park (License number SF008869), and the National Parks and Wildlife Service of New South Wales for permission to collect specimens in Ku-ring-gai Chase National Park (License number SL100390).

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