

## ***Maratus fimbriatus*, a new peacock spider from the Darling Riverine Plains of New South Wales, with a review of the *Maratus chrysomelas* group (Araneae: Salticidae: Euophryini)**

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**Abstract:** A new species of peacock spider from the Darling Riverine Plains Bioregion in New South Wales, *Maratus fimbriatus*, is described. Although males of this species resemble peacock spiders of the (*Maratus*) *chrysomelas* group with respect to both appearance and display, they display with legs I instead of legs III. The structure of the male pedipalp and the female epigynum suggest that *M. fimbriatus* is not closely related to any previously described *Maratus*.

**Key words:** Australia, courtship, euophryine, jumping spider, *Maratus nigromaculatus*, salticid

Recently one of the authors (Otto) identified an undescribed species of *Maratus* Karsch 1878 in the collection of the Australian Museum and collected live specimens of this species near Nyngan in north-central New South Wales. Apart from their remarkable use of legs I in courtship display, males of this species extend and display a prominent fringe that encircles the dorsal plate (scute) of their opisthosoma. In many respects the appearance of this display resembles that of *M. chrysomelas* (Simon 1909) and *M. nigromaculatus* (Keyserling 1883), both fringed and closely related to each other, but not closely related to this new species. After our description of this new fringed species, we illustrate features of the courtship display of *M. chrysomelas* and *M. nigromaculatus* as the two members of a newly-designated clade, the *chrysomelas* group, within the genus *Maratus*.

### ***Maratus fimbriatus*, new species**

**Type specimens.** The holotype male (♂ #1), one paratype male (♂ #2), and two paratype females (♀ #1-2) were collected near Nyngan, New South Wales (31.68110 °S, 147.41246 °E, 22 SEP 2013, coll. J. Otto). These will be deposited in the Australian Museum, Sydney. Additional specimens (24♂, 5♀) in the collection of the Australian Museum were also examined (Table 1, below).

**Etymology.** The species group name (*fimbriatus*, Latin, m., adjective, English translation *fringed*) refers to the presence of a prominent fringe of long setae encircling the opisthosoma of the adult male.

**Diagnosis.** The decoration of legs I and the opisthosoma of males is unlike that of any other known *Maratus* species. The dorsal opisthosoma is encircled by a prominent fringe, and bears two bold white longitudinal lines in front, with the black, glabrous dorsal plate (scute) exposed to the rear. The inner and outer rings of the embolus of the male pedipalp are fused and shaped like a wheel rim, not typical of *Maratus*, and the posterior spermathecae of the female epigynum are relatively small and joined anteriorly by prominent sclerotized ducts also not seen in most *Maratus*.

*Description of male* (Figures 1-5). Males (N=26) ranged from 3.8 to 4.3 mm in length. This includes the two type males and 24 males in the collection of the Australian Museum (Table 1).

The carapace is dark brown to black in life, fading to a lighter yellow-brown on the sides in preserved specimens. Except for the margins, the carapace, including the clypeus, bears an incomplete and variable covering of off-white setae with more prominent off-white stripes extending to the rear behind the lateral eye row on either side. As in other *Maratus*, one or more stout setae may project forward at the median between the AME. Red-brown setae are scattered along the margins of the eye region. An indistinct middorsal tract of off-white setae may extend to the rear behind the eye region, or it may be lacking. The margins of the carapace, the proximal segments of the pedipalps, and the chelicerae are all dark brown to black and glabrous. The eyes do not have the blue or green colouration found in many other *Maratus*. The ALE are about 4/7 the diameter of the AME, separated from them by less than 1/5 the diameter of an AME. The small PME are nearly equidistant between the ALE and the PLE.

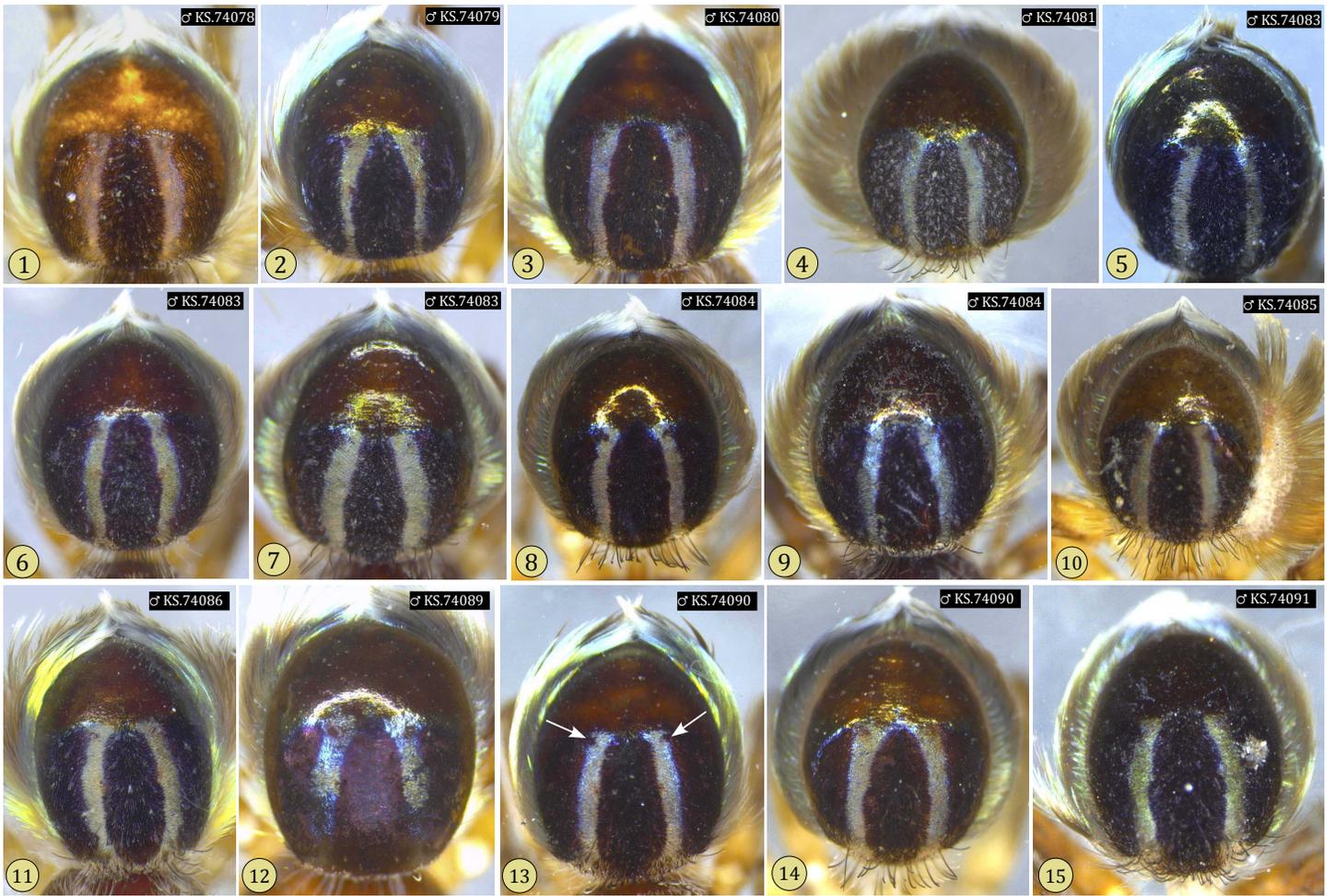
The anterior 2/3 of the dorsal plate of the opisthosoma is covered with a circular area of black scales, interrupted by two longitudinal white stripes (parens) that may converge toward the front or rear of the circular area (Figure 2). Behind this the dorsal plate is exposed, black, glabrous, and very shiny. Laterally the dorsal plate is flanked by a thick fringe of long, curved, bicoloured setae on either side. These appear bright white when folded against the opisthosoma where only the distal part of each seta is exposed, but project a brilliant blue, iridescent colour toward the front when the opisthosoma is flattened and these fringes are extended to expose the coloured, proximal part of each seta (Figure 1:12). From the rear, the proximal portion of each fringing setae is dark brown and not iridescent. The lateral fringes come together at an acute angle (point) toward the rear when retracted. The underside of the opisthosoma is covered with off-white setae but may bear a circular area of brown setae toward the rear, and the brown covers of the book lungs are exposed. The spinnerets are relatively small, brown, and unremarkable. The coxae and trochanters of all legs are dark with a cover of off-white setae. The sternum is dark brown to black with off-white setae around the margins. Like the chelicerae, the labium and proximal segments of the pedipalps including the endites are dark brown to black and glabrous.

Legs I and II are about the same length, much shorter than legs III and IV. Legs III and IV are about the same length. All legs are indistinctly marked and covered with off-white to light-brown setae, with more white on the dorsal femora. Legs I have special markings used in display, however, to include glabrous yellow-brown to brown surfaces of the anterior femora, with all segments distal to the femora dark brown on the underside with few setae.

As viewed from below (Figure 5) the pedipalps resemble those of other *Maratus*. Two rings of the embolus are prominent and appear fused, with no separation evident. The inner or lower ring has a smooth or rounded surface and the outer ring is flattened, with a sharp outer edge. Together, the two fused rings of the embolus have the appearance of a wheel rim. The long, bright white setae of each dorsal tibia and cymbium resembles a 'pom pom', offset by the dark, glabrous proximal segments of each pedipalp. These figure prominently in the male display.



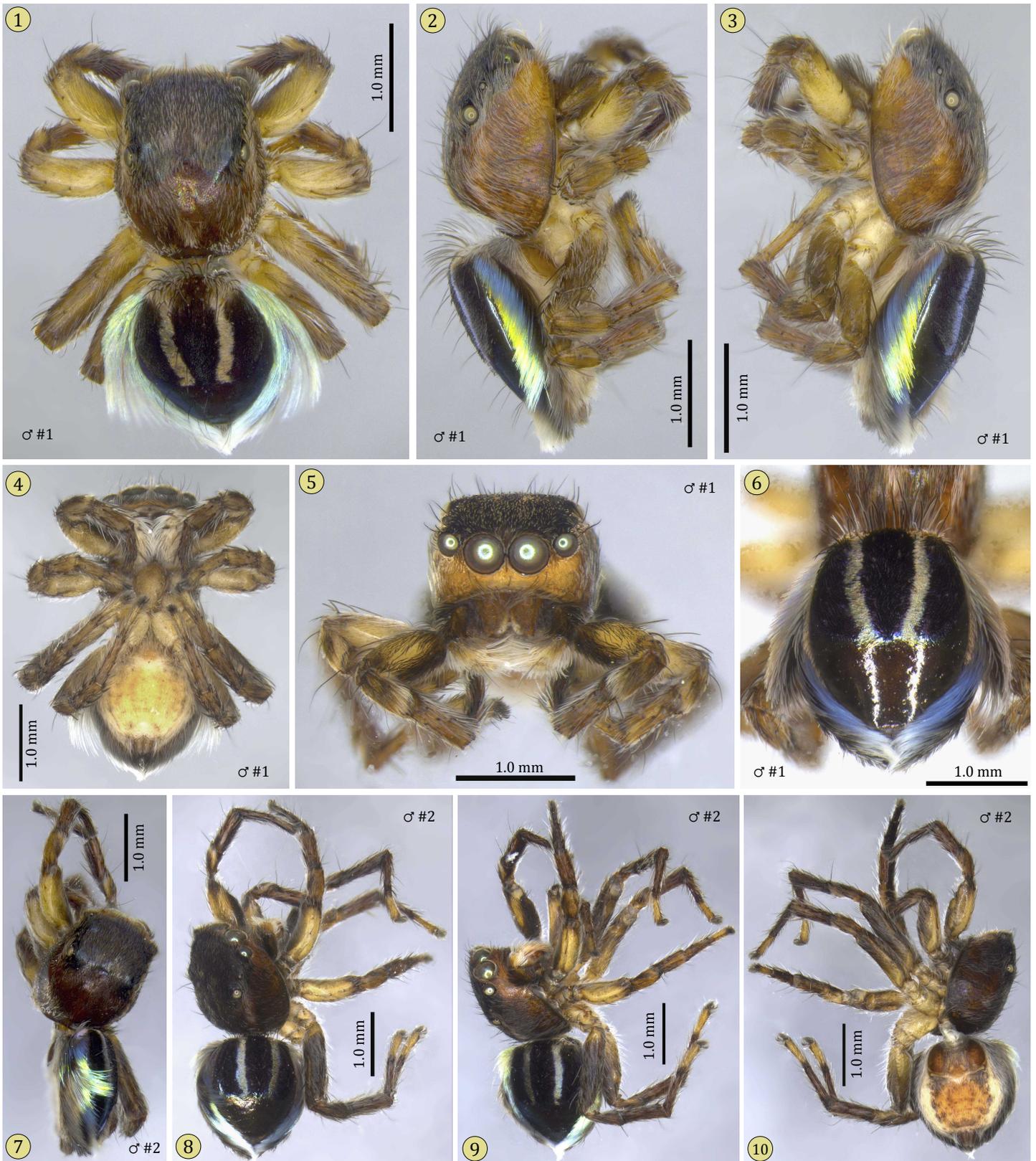
**Figure 1.** Views of holotype (1-6) and paratype (7-12) male *Maratus fimbriatus*. When retracted, the fringes join to form a sharp white tip at the end of the opisthosoma (10). When expanded during courtship display (11, 12), the light blue, iridescent colour of these fringes is revealed to the female.



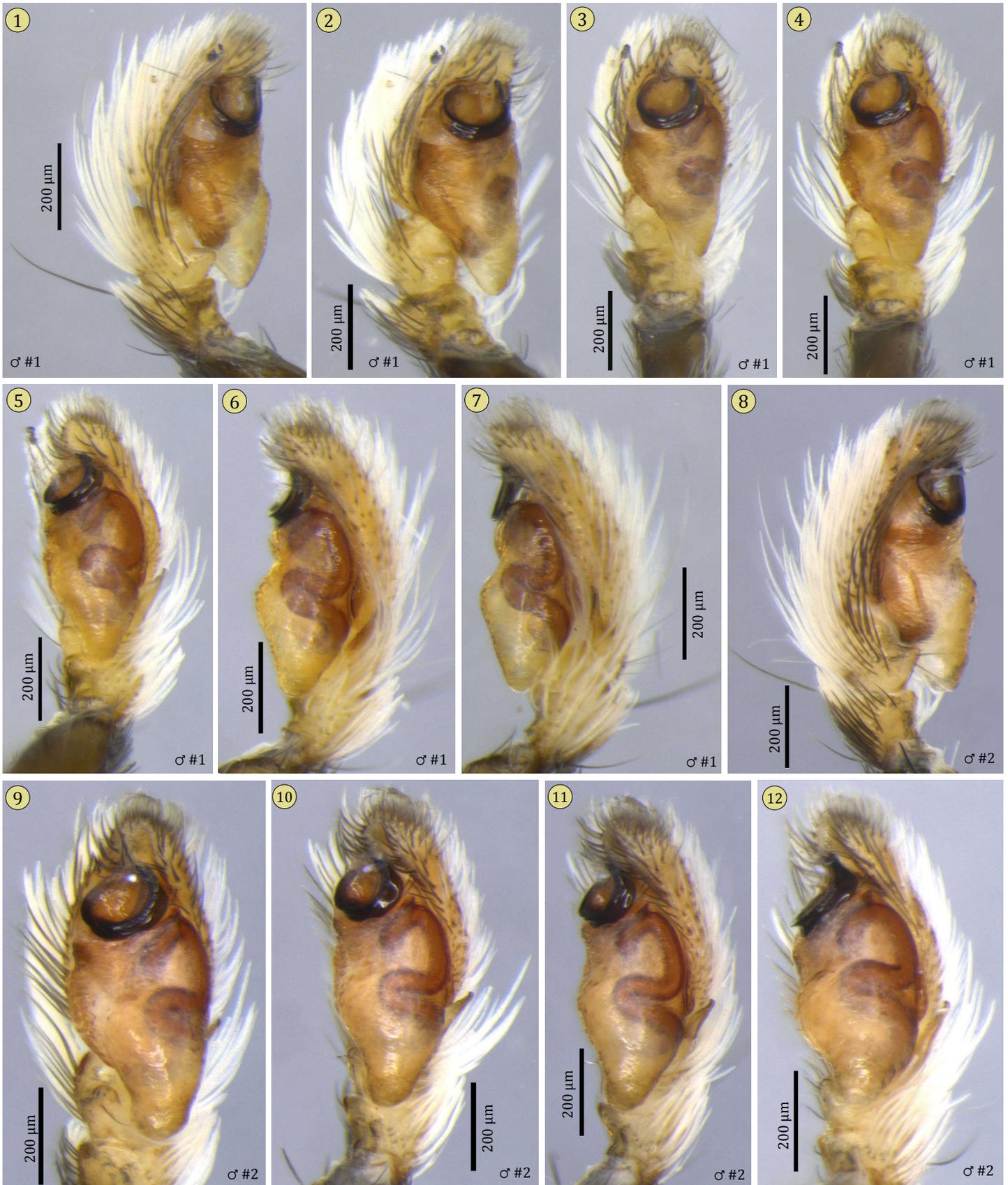
**Figure 2.** Dorsal opisthosoma of 15 male *Maratus fimbriatus* from the collection of the Australian Museum, Sydney. The catalog number of each specimen is shown at the upper right of each photograph (Table 1). The width and distance between the two white stripes varies. In some specimens these stripes converge to either the front (*e.g.*, 11) or the rear (*e.g.*, 14); in other examples (*e.g.*, 1) they are nearly parallel. In most cases (*e.g.*, 13, arrows) a fine posterior-lateral notch interrupts each stripe. This feature may also be observed in the male types (Figure 1).



**Figure 3.** Two views of the underside of a male *Maratus fimbriatus*. From below, the fringes of the opisthosoma are dark. Note the dark, glabrous proximal segments of the pedipalps (1).



**Figure 4.** Male types for *Maratus fimbriatus* (1-6, 7-10) in ethanol. In (6), reflections on the posterior dorsal plate appear to extend the two stripes of the dorsal opisthosoma toward the rear.

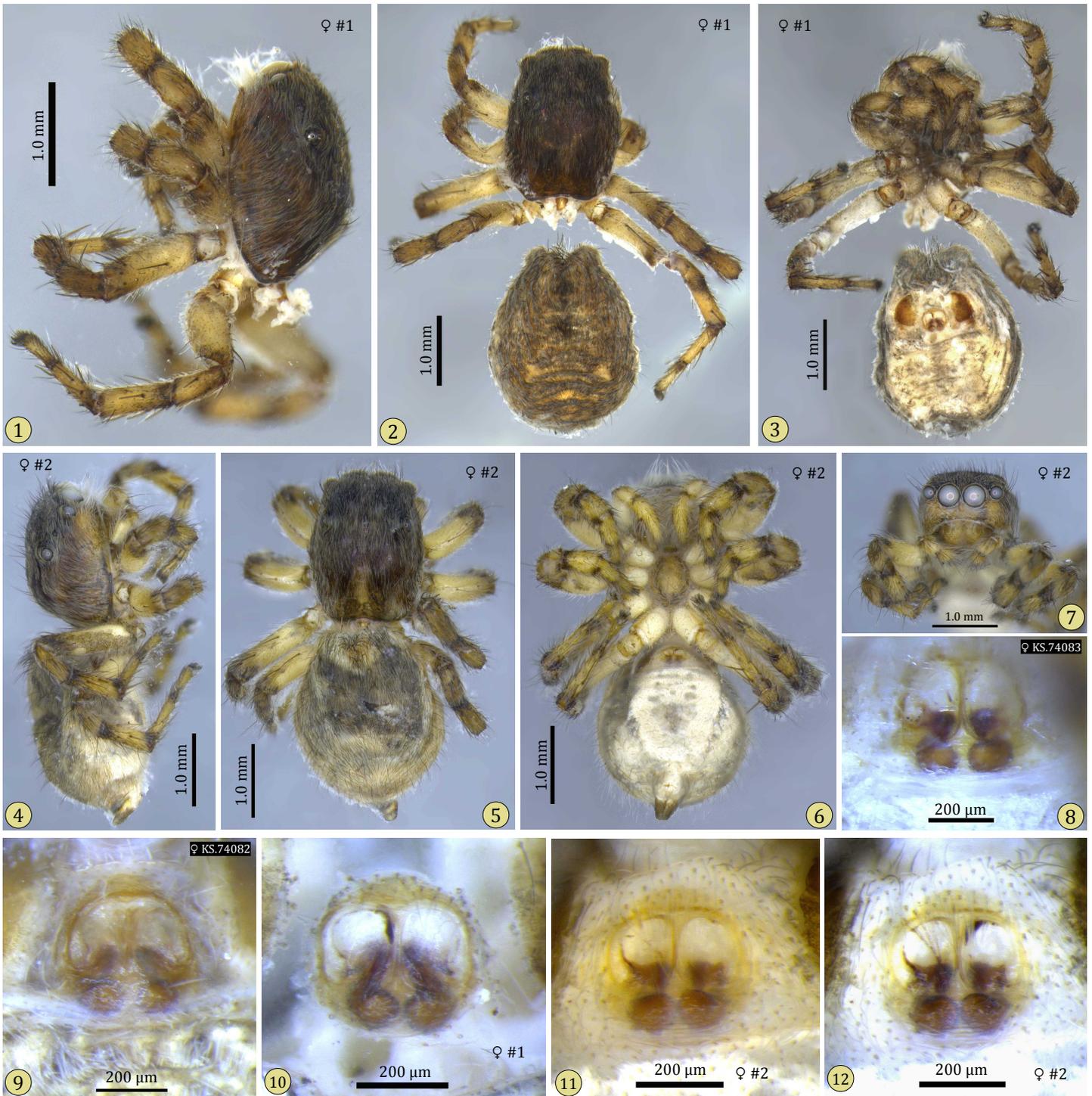


**Figure 5.** Views of the left pedipalp of the two male types (1-7, 8-12) for *Maratus fimbriatus*. In each series the views progress from medial to lateral directions. The inner (lower) and outer rings of the embolus are prominent but fused. The outer ring is flattened with a sharp edge, and the inner ring is rounded in section, giving the embolus the appearance of a wheel rim (6, 12).

**Description of female** (Figures 6-7). The two paratype females and five females from the collection of the Australian Museum (N=7) ranged from 3.6 to 4.9 mm in length.



**Figure 6.** Views of the two female types (1-8, 9-13) for *Maratus fimbriatus*. These have a fairly uniform 'salt and pepper' colouration. On the anterodorsal midline is a black figure in the shape of a two-headed arrow, and behind this on either side is a lighter coloured triangular spot (9). These may assist in the field identification of this species.



**Figure 7.** Views of female *Maratus fimbriatus* in ethanol. The epigynum is figured for two female specimens from the Australian Museum (8, 9), as well as the two paratype females (10-12). The smaller pair of posterior spermathecae in each example is somewhat separate from the large anterior (toward the top as shown here) 'windows' (*fenestrae* or *fossae*) of the epigynum. Prominent ducts of variable sclerotization proceed toward the anterior from these spermathecae.

The body, legs, and pedipalps of females are covered with a 'salt and pepper' pattern of light to dark brown setae with many light or dark brown spots (Figure 6). Many long white setae project anteromedially from the clypeus. As in other *Maratus*, one to several small, stout setae may extend toward the front from the median of the clypeus, just below the AME. The sides of the carapace bear a covering of long off-white setae, but, as in the male, there is no marginal band but instead a broad, brown, glabrous area. The chelicerae are also brown and glabrous. The ALE are about 1/2 the diameter of the AME. The small PME are almost equidistant from the ALE and the PLE.

The anterodorsal midline of the opisthosoma bears a black figure in the shape of a double-headed arrow, and behind this is an off-white or light-brown triangular spot on either side (Figure 6:9). The ventral opisthosoma and ventral femora are covered with off-white setae. The spinnerets are relatively small and brown. The underside of more distal leg segments are more glabrous and brown. The sternum is brown and glabrous but fringed with off-white setae as in the male. Legs I and II are nearly equal in length, much shorter than legs III and IV which are also nearly equal in length.

The paired 'windows' (*fenestrae* or *fossae*) of the epigynum are large as is typical in this group of spiders (Figure 7). The paired posterior spermathecae are prominent but relatively small, somewhat separated from the fenestrae. Prominent ducts of varying degree of sclerotization can be seen anterior to the posterior spermathecae.

*Courtship display* (Figures 8-14). A video of this display is available for viewing online (Otto 2016). With respect to the lateral expansion of the opisthosoma including a wide fringe of encircling setae, and the relative simplicity of the display, the male *Maratus fimbriatus* resembles the two species of the *chrysmelas* group (see below). When males present themselves to females, they raise and flatten their opisthosoma, and expand the opisthosomal fringes. When partly expanded, these fringes extend toward the front. When fully expanded, the fringes form a broad band of iridescent light blue encircling the dorsal plate (Figures 13-14). However, *M. fimbriatus* is unique among the known *Maratus* with respect to its use of legs I rather than legs III when displaying to a female at a distance. Although the use of legs I is common in other Salticidae (*e.g.*, Hill 2014), the only instance in which we have observed the use of these legs in the display of *Maratus* involved the male-male combats or agonistic encounters of *M. vesperilio* (Otto & Hill 2012a). As in other *Maratus*, legs I of *M. fimbriatus* males are relatively short, although they are ornamented and appear dark from the front. In laboratory observations females tended to actively stalk or jump at courting males with their own legs I extended (Figures 8-10). It is possible that this kind of aggressive behaviour by the females is a normal feature of male-female encounters, and that the extended legs I also serve to protect males.



**Figure 8.** Three sequential photographs showing a male *Maratus fimbriatus* moving from side to side and approaching an attentive female (out of focus, at left). This and subsequent videos and photographs of male-female interaction were recorded in the laboratory in a naturalistic setting.

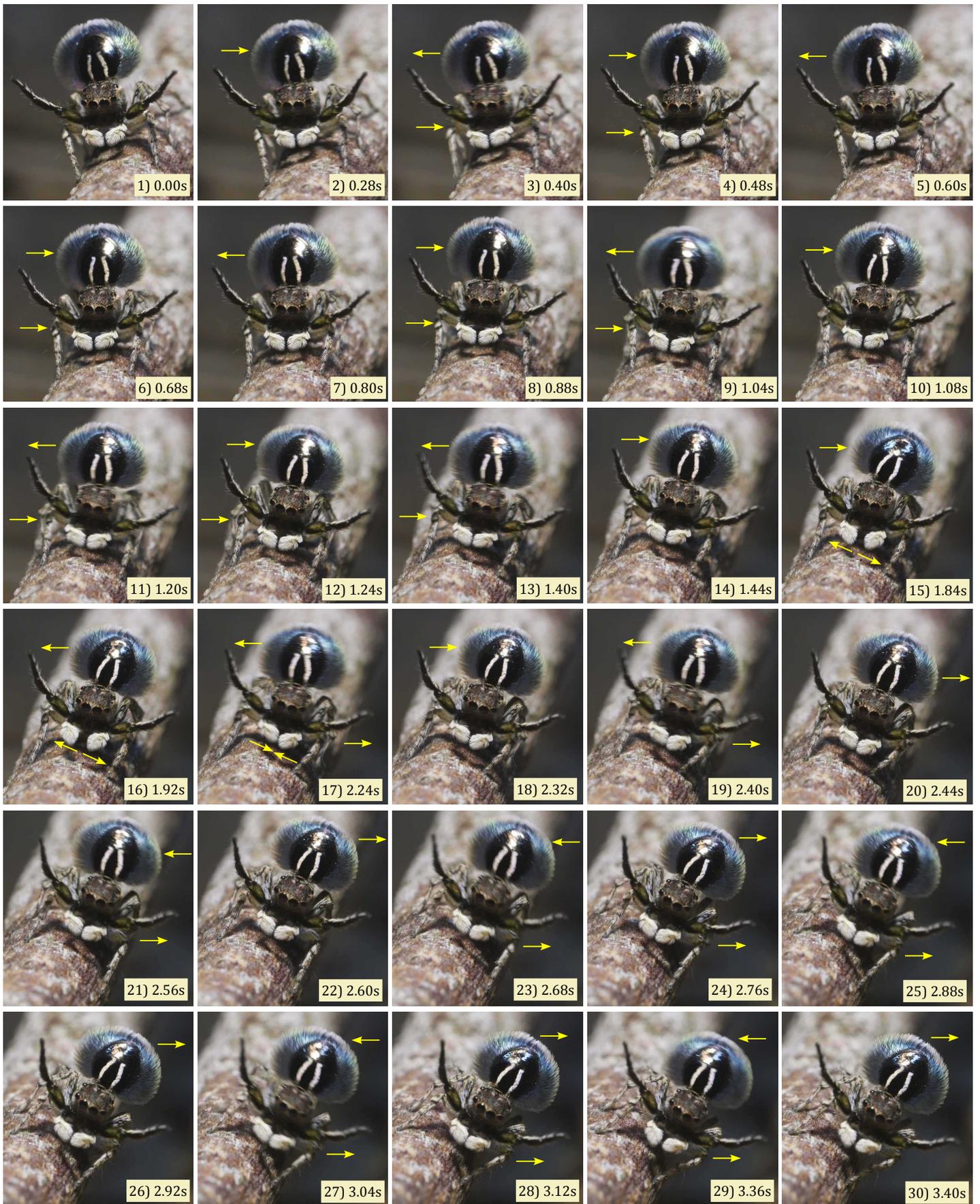


**Figure 9.** Frames from video (25 fps) recordings of male-female interaction in *Maratus fimbriatus*. **1-3**, Sequential frames showing a female raise her legs I during a male approach (2), and then return to a less defensive position as the male backed off (3). Subsequently this female jumped at the male. **4**, This female (at left) also watched and then jumped at the male.



**Figure 10.** Sequential photographs showing a male (upper left) eliciting the attention of a female *Maratus fimbriatus* that subsequently (3) prepared to jump at him.

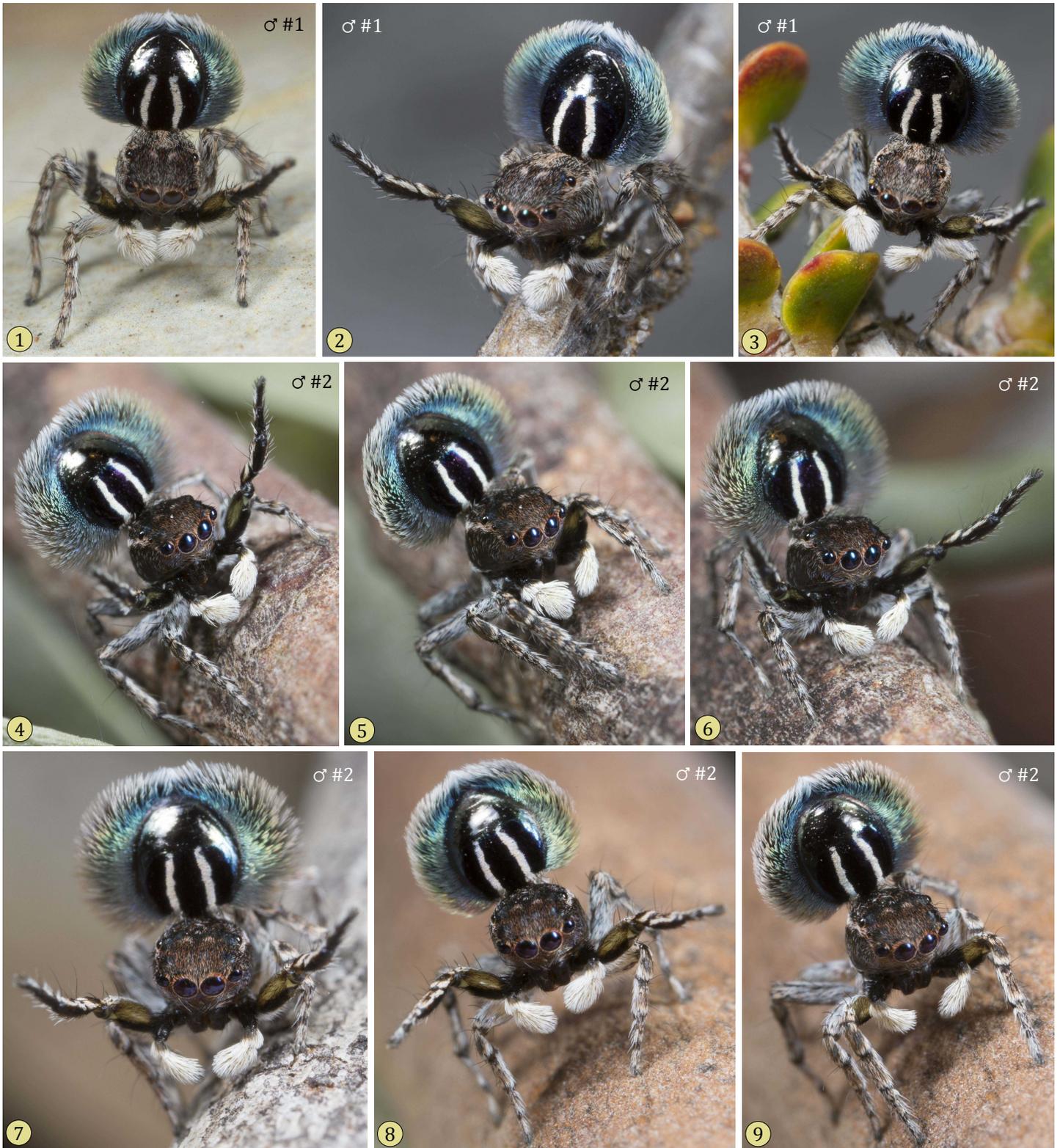
The observed fan dance of male *M. fimbriatus* in front of a female was relatively simple, involving slight side-to-side movement of the fan as the male stepped from side-to-side (Figure 11), with legs I extended and pedipalps raised together in front of the chelicerae. Directly in front of an attentive female, the male stopped stepping and cyclic movement of the fan from side-to-side ( $\sim 2/s$ ) was greater, with limited movement of the pedipalps and legs I (Figure 12).



**Figure 11.** Display by a male *M. fimbriatus* while side-stepping in front of a female (sequential 25 fps video). Arrows indicate direction of stepping, movement of the fan, and (15-17) limited movement of the pedipalps relative to the previous frame.



**Figure 12.** Display by a stationary (not stepping) male *M. fimbriatus* directly in front of a female (sequential 25 fps video). The fan was rotated from side-to-side ( $\sim 2/s$  cycles), and the pedipalps were alternately moved apart and then brought together.



**Figure 13.** Photographs of courtship display by the holotype (1-3) and paratype (4-9) male *Maratus fimbriatus*. 7-8, Note the distinct separation of the 'pom pom' distal pedipalps from the dark, glabrous proximal pedipalps and chelicerae. The anterior surface of femora I is glabrous and light brown or dark olive in colour dorsally.

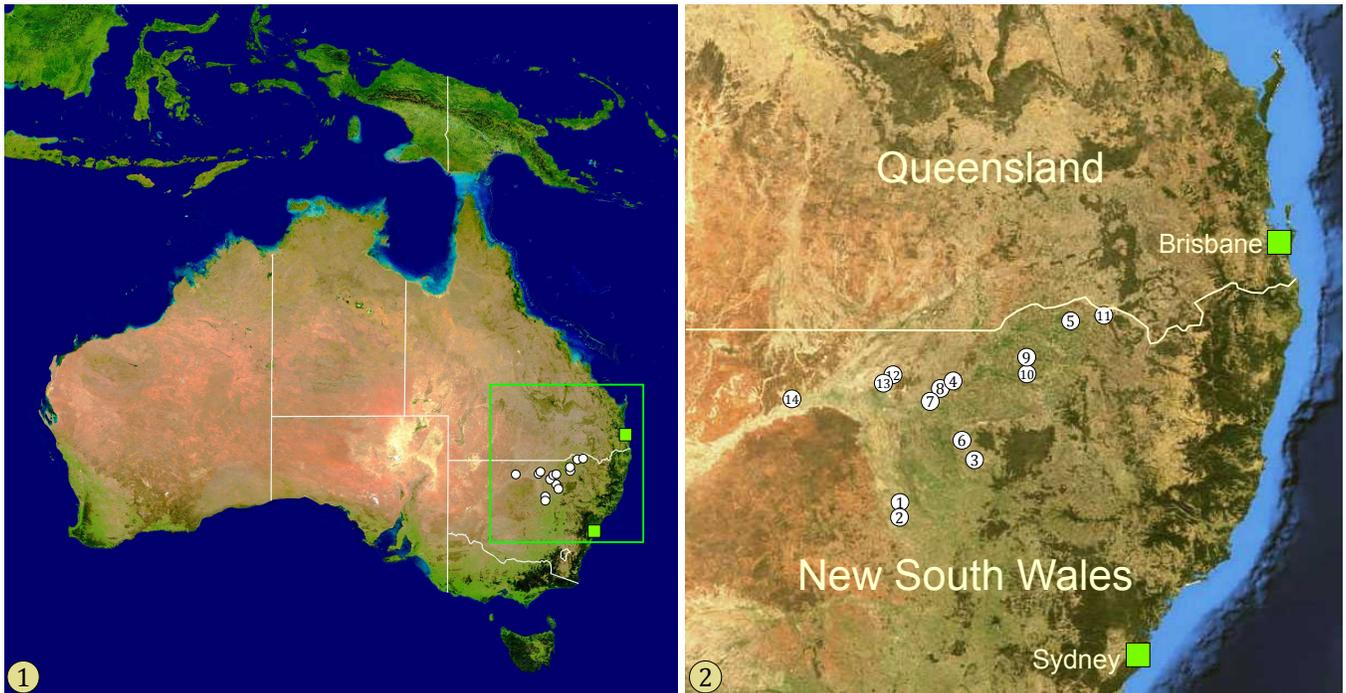


**Figure 14.** More photographs of courtship display by the paratype ( $\sigma$  #2) male *Maratus fimbriatus*. 1-3, From the side, the anterior orientation of the partly extended fringe can be seen clearly. 8-9, In nature, reflections off of the shiny black posterior portion of the dorsal plate may appear as a very bright pair of vertical lines, contributing to the visual effect of the vertical white stripes of the fan.

*Habitat and distribution* (Figures 15-16, Table 1). The types for *Maratus fimbriatus* were collected in an open semi-arid riverine plain woodland near Nyngan. All individuals were found on patches of cracked clay surface (Figure 15:4). Additional specimens from the collection of the Australian Museum that were examined were collected from areas to the north which belong to the same bioregion, commonly referred to as the Darling Riverine Plains (NSW 2016a, 2016b).



**Figure 15.** Views of the type locality near Nyngan, New South Wales, featuring a riverine plain woodland (NSW 2016c).



**Figure 16.** Distribution of *Maratus fimbriatus* in New South Wales. **2**, Detail of inset in (1). See Table 1 for description of numbered localities. Background images courtesy of the NASA Visible Earth project.

**Table 1.** Localities where *Maratus fimbriatus* has been collected. This includes specimens from the collection of the Australian Museum that have been examined, collected as part of a survey of the Darline Riverine Plains Bioregion (map locations 2-14; See Figure 16: 2).

map	catalog number	longitude, latitude	trap interval	specimens	habitat notes
1	<i>type locality</i>	31.68110 S, 147.41246 E	collected live 22 SEP 2013	2♂, 2♀	riverine plain woodland
2	KS.74078	31.68194 S, 147.41194 E	23 NOV-13 DEC 1999	1♂	<i>Acacia pendula</i> patch
3	KS.74079	30.90222 S, 148.54917 E	24 NOV-14 DEC 1999	2♂	<i>Acacia pendula</i> patch
4	KS.74080	29.88083 S, 148.20972 E	26 NOV-16 DEC 1999	2♂, 1♀	native grassland
5	KS.74081	28.89056 S, 149.85833 E	29 NOV-19 DEC 1999	2♂	<i>Acacia pendula</i> patch
6	KS.74082	30.67583 S, 148.45056 E	24 NOV-14 DEC 1999	1♂, 1♀	<i>Acacia pendula</i> patch
7	KS.74083	30.12806 S, 147.94417 E	25 NOV-15 DEC 1999	5♂, 2♀	native grassland
8	KS.74084	29.81944 S, 148.12556 E	26 NOV-16 DEC 1999	2♂, 1♀	<i>Casuarina cristata</i>
9	KS.74085	29.39389 S, 149.44361 E	28 NOV-18 DEC 1999	1♂	native grassland
10	KS.74086	29.65111 S, 149.42306 E	28 NOV-18 DEC 1999	1♂	native grassland
11	KS.74087	28.77167 S, 150.68500 E	29 NOV-19 DEC 1999	1♂	<i>Acacia pendula</i> patch
11	KS.74088	28.77167 S, 150.68500 E	29 NOV-19 DEC 1999	1♂	native grassland
12	KS.74089	29.67417 S, 147.34083 E	25 NOV-15 DEC 1999	1♂	native grassland
13	KS.74090	29.69278 S, 147.33361 E	25 NOV-15 DEC 1999	2♂	<i>Eucalyptus largiflorens</i>
14	KS.74091	30.02694 S, 145.78194 E	27 NOV-19 DEC 1999	2♂	<i>Acacia cambagei</i> patch

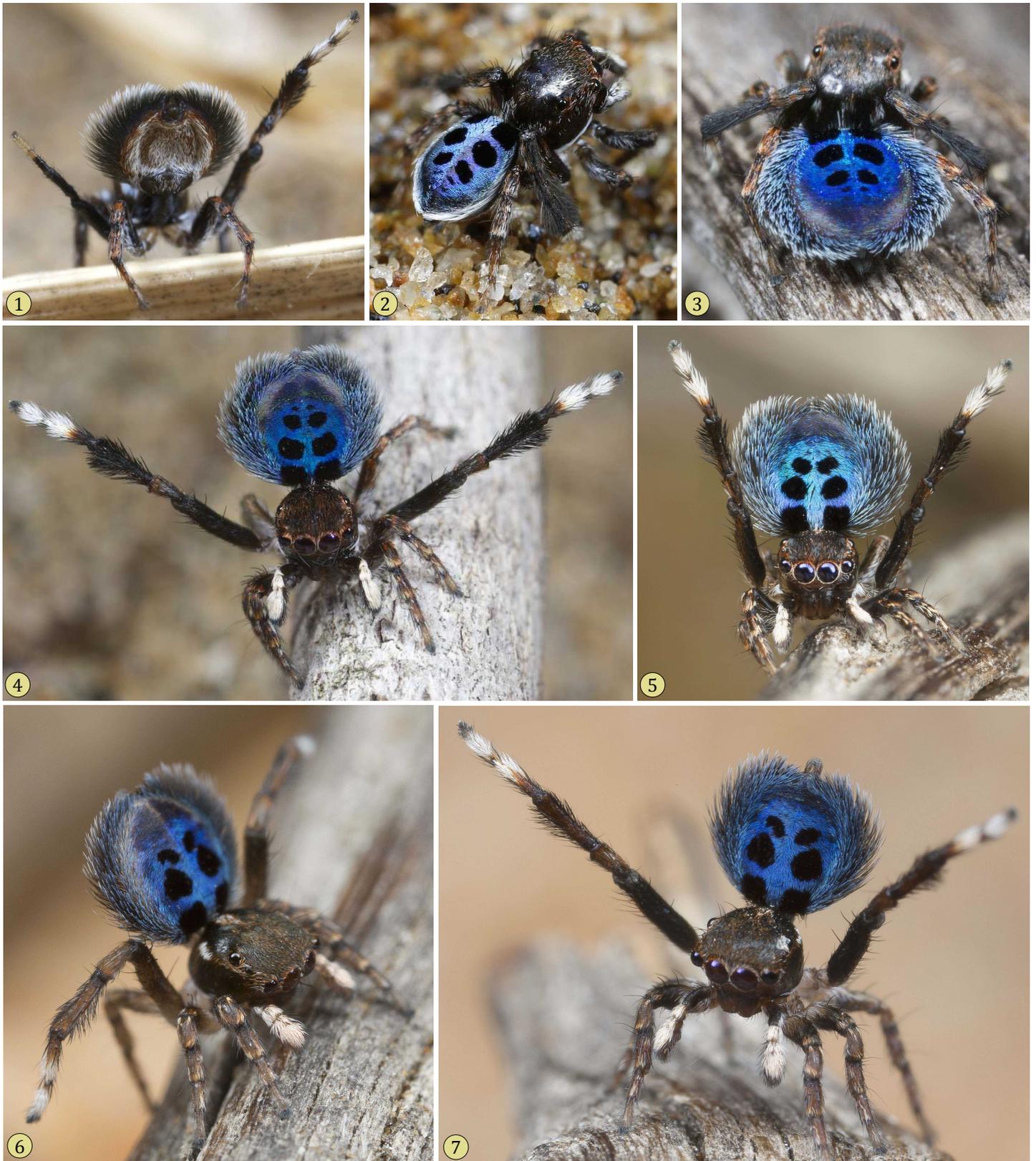
### The *chrysomelas* group of the genus *Maratus*

The *chrysomelas* group is a clade that presently includes two closely related species, *M. chrysomelas* (Simon 1909) and *M. nigromaculatus* (Keyserling 1883). Based on his examination of male pedipalps, Žabka (1987) first recognized this close relationship. *M. chrysomelas* has been more recently redescribed by Waldock (2002), who included the first description of the female, and we have also published photographs of this relatively well-known species (Otto & Hill 2012b, 2012c). *M. chrysomelas* is widely distributed in Australia and is known from many localities where it has been captured, for the most part, in wet pit-fall traps (Waldock 2002). *M. nigromaculatus* is less known and apparently restricted in distribution to coastal areas of Queensland. Curiously, the male specimen of *M. nigromaculatus* examined by Žabka was missing its opisthosoma, the most distinctive feature of this species. The female of *M. nigromaculatus* has not been described. Fortunately, Keyserling (1883) supplied a very good drawing of the male, and we have subsequently identified and documented this species from photographs taken in Wynnum, Brisbane (Otto & Hill 2012b, 2012c).

In addition to similarities in the detailed structure of their pedipalps, male *M. chrysomelas* and *M. nigromaculatus* share many other features (Figures 17-18). The long legs III of both species are very similar, dark brown with bright white setae covering the metatarsi and tarsi. The white setae of the metatarsi III are clearly separated from those of the tarsi III by a dark ring. The pedipalps of both are covered with bright white setae, and are held laterally (and moved little) to expose the dark, glabrous chelicerae during display. Both raise and flatten their opisthosoma and extend fringes of long setae as they display. The dorsal plate of the opisthosoma of both species is covered with bright iridescent scales interrupted by two dark longitudinal bands, mostly continuous in *M. chrysomelas* but appearing as a line of dark spots in *M. nigromaculatus* (hence the name). In Emerald, Queensland, there is a population that appears to represent *M. chrysomelas*, but includes a variety of male forms in which these bands vary from continuous as in typical *M. chrysomelas* to interrupted or spotted as in *M. nigromaculatus* (Figure 19). Since this population is located near the range of *M. nigromaculatus* on the Queensland coast, we suspect that these forms represent gene introgression from that species into a local population of *M. chrysomelas*. Courtship behaviour of the two species is shown in Figures 20-23.



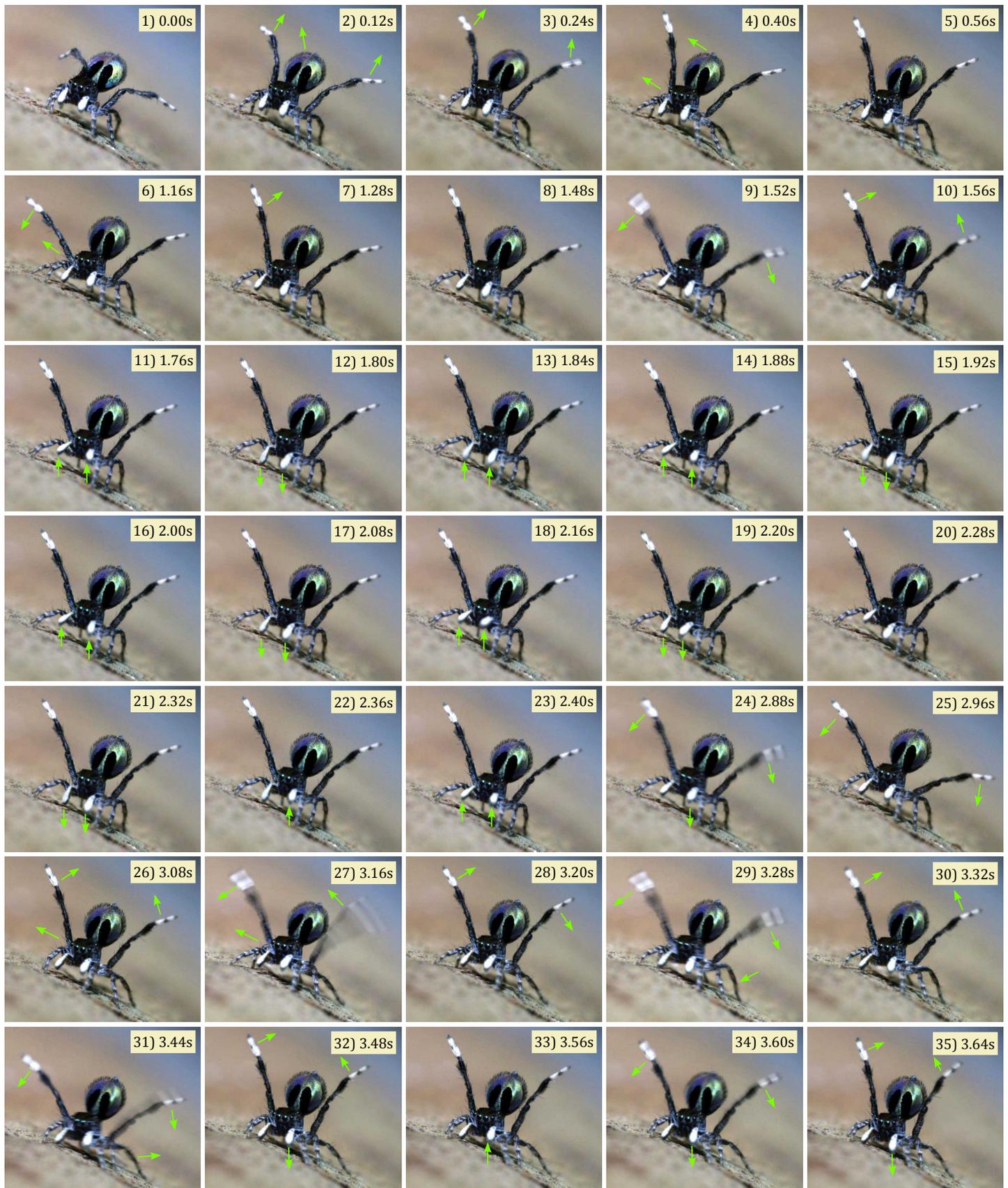
**Figure 17.** Courtship display by two male *Maratus chrysomelas* from Western Australia. The opisthosoma of the male from Cape Le Grand near Esperance (5-7) on the southwestern coast was wider than that of the male from Warwick Open Reserve near Perth (1-4; 31.837 S, 115.8163 E). Note the expansion of the elevated and flattened opisthosoma to reveal a fringe that is much narrower than that of male *M. nigromaculatus* (Figure 18). As in the latter species, the bright white pedipalps were held apart to reveal the dark, glabrous chelicerae during display.



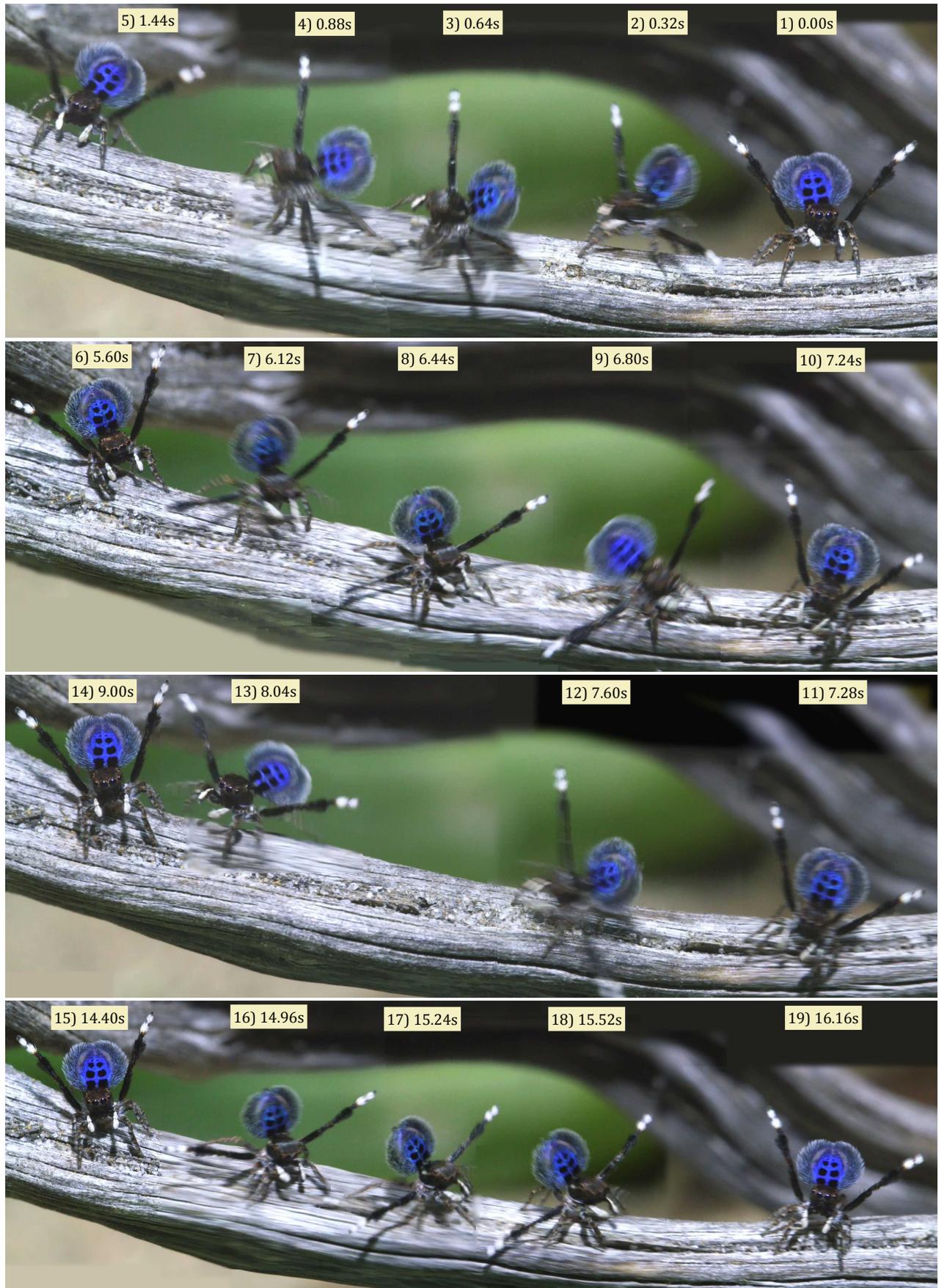
**Figure 18.** Four different male *Maratus nigromaculatus* (1, 2-4, 5, 6-7), recently rediscovered in the vicinity of Brisbane. Keyserling (1883) also described this spider from 'Rockhampton', but no other localities are known. The spiders shown here (and in Figures 21-23) were either collected at Nudgee Beach Reserve in Brisbane, or reared from eggs produced by females collected at that site. This appears to be a coastal species, living amongst grass or pig face plants (*Carpobrotus*) along the borders of estuaries.



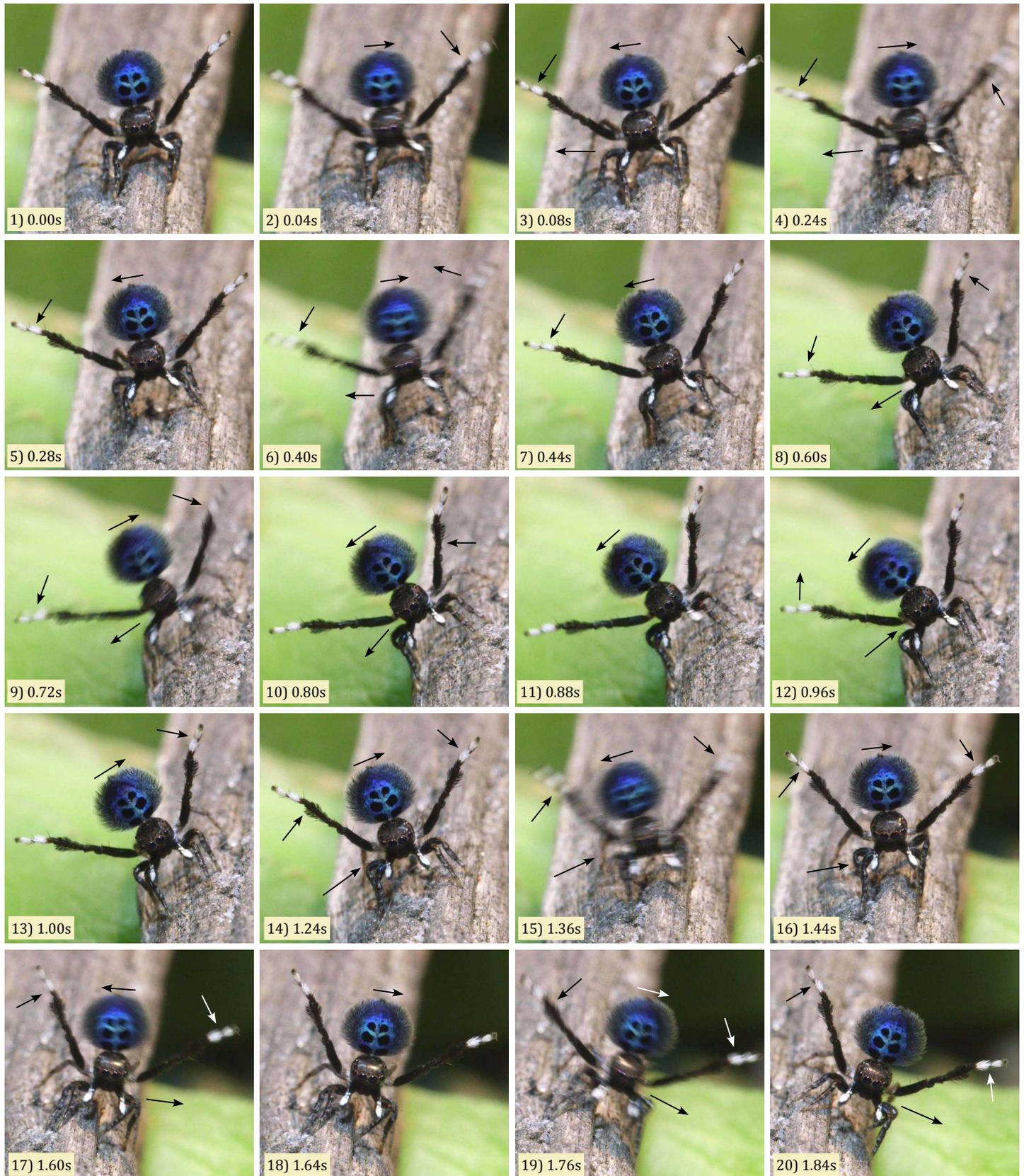
**Figure 19.** Fourteen different male *Maratus* photographed in their natural habitat, a grassy patch in Emerald, Queensland. Several males in this group (1-2) look like typical *M. chrysomelas*, while others exhibit the wider fringes and dark spots or (at the posterior) dashes on the dorsal plate characteristic of *M. nigromaculatus*, or something intermediate between the two species. This may represent gene introgression from that closely-related species into a nearby population of *M. chrysomelas*. Photographs copyright © Laurence Sanders, used with permission.



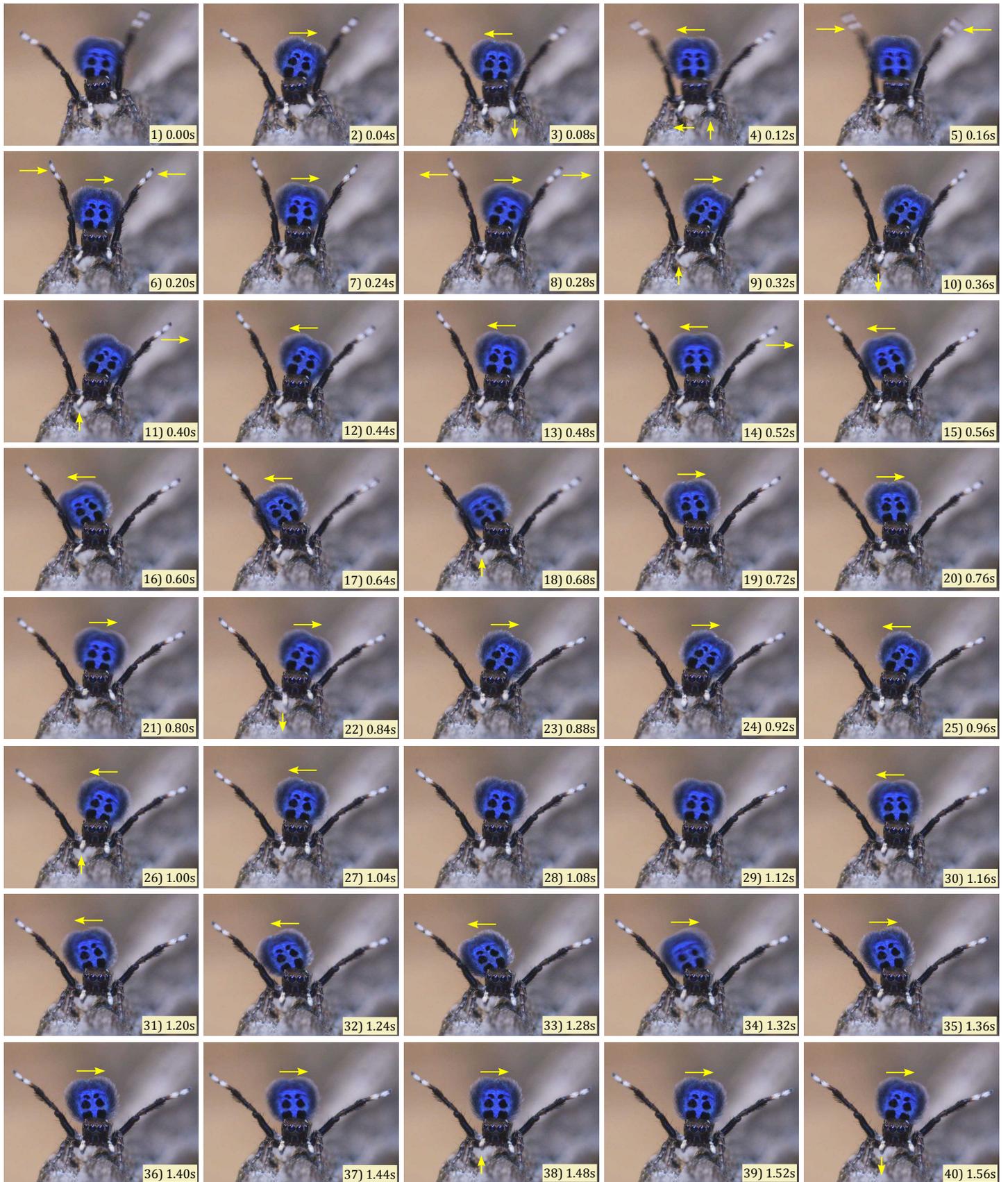
**Figure 20.** Courtship display by a male *M. chrysomelas* from Cape Le Grand near Esperance, WA. Selected, sequential frames from a 25 fps video are shown. Movement of the legs (bilateral waving) and pedipalps (raising and lowering), limited rotation of the elevated fan, and side-stepping are highlighted with arrows. There was little independent movement of the fan.



**Figure 21.** Composite images showing sequential positions (1-19, selected from 25 fps video frames) of a male *M. nigromaculatus* running rapidly from one side to the other of a female that he was facing.



**Figure 22.** Male *M. nigromaculatus* displaying as it stepped from side to side directly in front of a female. This sequence (1-20) includes selected sequential frames from a 25 fps video. Arrows indicate the moderate rotation of the opisthosoma and bilateral waving of legs I that accompanied this rapid stepping movement (also indicated by arrows). As with *M. chrysomelas* (Figure 20), pedipalps were held to the sides of the chelicerae and moved little during this display.



**Figure 23.** Male *M. nigromaculatus* displaying in place directly in front of a female at a distance of  $\sim 1$  cm. Consecutive frames from a 25 fps video are shown. Some bilateral waving of legs I (5-6), and very limited up and down movement of the pedipalps (38) can be seen. The main movement was side-to-side rotation of the elevated and expanded fan cycling at a rate of  $\sim 2/s$ .

Although we have few observations of the display of *M. chrysomelas* (Figure 20), this appears to be similar to that of *M. nigromaculatus*, and relatively simple. In both species the pedipalps are generally separated and held in position to expose the chelicerae. The legs III tend to be held in a fairly constant v-shaped configuration, with some bilateral waving. When moving from side-to-side in front of a female, the fan of both species is also rotated slightly from side-to-side. More significant rotation of the fan of *M. nigromaculatus* has been observed when a male was in a stationary position close to a female (Figure 23). In many respects the simplicity of this display, and the movement of the colourfully fringed fan, resemble the display of male *M. fimbriatus*. The decoration and use of legs III rather than legs I, and continuous separation of the pedipalps during display by males of the *chrysomelas* group is, however, quite different.

### Acknowledgments

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