# *Maratus tiddalik,* a new peacock spider in the *flavus* group from Western Australia (Araneae: Salticidae: Euophryini)

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**Summary:** A new peacock spider, *Maratus tiddalik*, is described from Cape Naturaliste in Western Australia. This spider is closely related to *M. boranup*. The biogeography and scope of the *Maratus flavus* group is also reviewed.

Keywords: biogeography, courtship, Dreaming story, Leeuwin-Naturaliste National Park

Here we describe one new species in the genus *Maratus* Karsch 1878 from Western Australia (*M. tiddalik* sp. nov.; Figure 1), placed in the *flavus* group with the closely related *M. boranup* Otto & Hill 2018. This brings the total number of confirmed species in the genus to 86, of which 6 (*M. boranup*, *M. felinus* Schubert 2019, *M. flavus* Otto & Hill 2018, *M. suae* Schubert 2020, *M. tessellatus* Otto & Hill 2016, and *M. tiddalik* sp. nov.) are now placed in the *flavus* group, all endemic to coastal areas in the southwestern corner of Australia (Otto & Hill 2019a, 2019b, Schubert 2020). See Schubert (2020) for a discussion of the tentative nature of subgeneric clades within *Maratus*.



**Figure 1.** *Maratus tiddalik* was found in a protected area of coastal vegetation near the northern end of Cape Naturaliste in Western Australia (arrows). **2**, Detail of Cape Naturaliste, at the northern end of the Leeuwin-Naturaliste Ridge (USGS/Landsat).

# Maratus tiddalik, new species

*Type specimens*. The holotype male ( $\circ$  #1), two paratype males ( $\circ$  #2-3), and one paratype female ( $\circ$  #1) were collected at Cape Naturaliste, Leeuwin-Naturaliste National Park, Western Australia (Figure 1; S 33.537378°, E 115.008443°, 15-16 SEP 2020, coll. R. Walker). All types will be deposited in the Western Australian Museum, Perth.

*Etymology*. The species group name (*tiddalik*, noun in apposition) is a reference to the abstract image of a frog on the dorsal opisthosoma of the adult male (Figure 2). The popular tale of *Tiddalik the Frog* originated as an Aboriginal Dreaming (Dreamtime) story with the people of South Gippsland, Victoria (Wikipedia 2020).



**Figure 2.** As shown here, the distinctive pattern of scales on the dorsal opisthosoma of the adult male *Maratus tiddalik* can be seen as the abstract image of a frog (anterior opisthosoma at the bottom).

*Diagnosis. Maratus tiddalik* is most closely related to *M. boranup*, found some 70 km to the south on the coastal (west) side of the Leeuwin-Naturaliste ridge (Figures 3:1-3, 24). As with that species, the detailed structures of the genitalia are much like those of other *Maratus* in the *flavus*, *linnaei*, *mungaich* and *vespa* groups from Western Australia. In both species legs III are marked with white spots visible from the front, and tufts of long white setae on the sides of the opisthosoma appear to represent a vestige of flaps that may have figured in the display of a common ancestor. Unlike *M. boranup*, the fan of the male *M. tiddalik* is decorated with colourful scales, and the pattern of scales on both the carapace and the dorsal opisthosoma is quite different. Males of both species rely on similar movements of legs III and do not elevate or display their fan (dorsal opisthosomal plate) during courtship. The male *M. boranup* does elevate the fan when mating (Otto & Hill 2018; Figure 2:3), and it is possible that *M. tiddalik* males do the same. This display may play a role in conspecific communication, perhaps as a warning to "keep away." Presently we place both species, with *M. felinus*, *M. flavus*, *M. suae* (close to *M. tesselatus*) and *M. tessellatus*, in the *Maratus flavus* (or *flavus*) group.



**Figure 3.** Comparison of the adult male *Maratus boranup* (1-3) with *Maratus tiddalik* (4-6). **3,** Note elevation of the opisthosoma by the mating male.

*Description of male* (Figures 2, 3:4-6, 4-9). Males (n=3) ranged from 3.8 to 4.2 mm in length. The chelicerae are black, shiny and glabrous. The face and pedipalps are covered with white to light grey setae, with longer setae extending forward toward the midline from the clypeus. The carapace is black, with a cover of light grey scales in the eye region, interrupted by a band of dull red scales extending to the rear behind each anterior eye. Behind the eye region an indistinct middorsal band of white scales may be present. Toward the rear and on the sides the carapace is mostly black and glabrous, and a white marginal band is present. The PME are closer to the PLE than to the ALE.

The dorsal plate of the opisthosoma (fan) bears a distinctive pattern of colourful scales but does not extend all the way to the rear (Figure 2). At the front margin of the fan is a tract of mostly white scales, and behind this an irregular patchwork of mostly light brown scales occupies the anterior part of the fan. To the rear of the fan there is a distinct, middorsal, needle-like tract of light brown scales. The posterior part of the fan is covered with a wide, U-shaped band of white (laterally) to iridescent blue (medially) scales, interrupted by tracts of red-orange scales. There are 4 small spots, or two small spots and a medial bar, in a transverse row and comprised of white scales, toward the rear margin of this band. At the posterior margin of the fan is a black middorsal triangle flanked by a pair of small black spots toward the front, and surrounded on either side by small flaps of iridescent blue scales at the rear of the U-shaped band. Only small lateral flaps, possibly vestigial, are present (Figure 3:6). Behind each lateral flap is a tuft of long white setae. The spinnerets are dark grey and above these a small triangle of white colular setae is

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present. The venter of the opisthosoma is indistinctly banded dark brown and black, with a cover of scattered white to light grey setae (Figure 4). The proximal part of each coxa, the sternum and the labium are grey with scattered light grey setae. Each distal coxa and the ventral side of each femur is light brown and translucent, interrupted by irregular bands of black pigmentation.

Legs I and II are shorter, legs IV longer, and legs III by far the longest. The distal femur to metatarsus of each leg is dark brown to black. Legs I, II and IV have a cover of white to light grey scales and other setae. Legs III are mostly black, with long white setae on each tarsus, and three small but distinct white spots on the front, one at the base of each tibia, the second more distally positioned on the tibia and smaller, and the third at the base of each metatarsus.

The detailed structure of the pedipalp (Figure 9) resembles that of other members of the *flavus*, *mungaich*, and *vespa* groups and does not support identification to species. As in other members of those groups, the larger outer (ventral) apex of the embolus bears a single "tooth" or projection on its ventral margin. In life the femur and patella, and the ventral tibia and tegulum, of each pedipalp is black, and the dorsal (or frontal) side of each tibia and cymbium is brown with a cover of light-grey setae.



**Figure 4.** Ventral views from life of two of the three male types for *Maratus tiddalik*. **5**, Note the small flap (at right) in front of a tuft of long white setae that extend posteroventrally.



Figure 5 (continued on next page). Views from life of the three male types for Maratus tiddalik.



Figure 5 (continued from previous page). Views from life of the three male types for *Maratus tiddalik*.



Figure 6. Detailed views of the three male types for *Maratus tiddalik*, in alcohol.



Figure 7. Dorsal, lateral and ventral views of the three male types for *Maratus tiddalik*, in alcohol.



Figure 8. Detailed frontal (face) views of the three male types for *Maratus tiddalik*, in alcohol.



**Figure 9.** Medial to lateral views of the left pedipalp for each of the three male types for *Maratus tiddalik*, in alcohol (1-5, 6-10, 11-15). **5**, Inset shows a slightly different lateral view of the two apophyses of the embolus at the same scale.

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*Description of female* (Figures 10-12). The paratype female (Q #1) is 5.5 mm in length. The chelicerae and sides of the carapace are light brown and translucent. In life, the distal portion of each paturon may be somewhat orange in colour. The clypeus has a covering of longer off-white setae, extending in a medioventral direction. The eye region has a cover of light orange or tan scales, with a brown stripe extending behind each of the two AME. These stripes may represent the most distinctive feature of the female. To the rear of the eye region there is a dorsomedial tract of off-white scales. The lateral margins of the carapace are glabrous, without a marginal band of scales. The PME are slightly closer to the PLE than to the ALE. Three bands of black pigment can be seen through the translucent sides of the posterior carapace on either side, each extending from the top of the carapace down to the margin.

The opisthosoma is covered with scattered off-white scales and setae. It is similar in colouration to females of a number of other *Maratus* species, dark brown on top, with a lighter brown band on either side, and uniformly light brown below. Spinnerets are grey, and a small, triangular, off-white colular tuft is present above these. From below the coxae, trochanters, proximal femora, sternum, and labium are mostly light brown and glabrous. Two black stripes cross the proximoventral part of each femur.

Legs I and II are shorter, legs III and IV longer. All are light brown and mostly translucent, with a covering of scattered off-white scales and setae. The epigynum (Figure 12:6-7) is typical for *Maratus* and not useful for identification to species. Darker ducts are visible through each of the two large windows (fenestrae), in front of the even larger pair of contiguous posterior spermathecae.



**Figure 10.** (continued on next page). Views from life of the female paratype for *Maratus tiddalik* (Q #1). Note the missing right leg I.



**Figure 10. (continued from previous page).** Views from life of the female paratype for *Maratus tiddalik* ( #1).



**Figure 11.** Ventral views from life of the female paratype for *Maratus tiddalik* (Q #1). Note the stripes of black pigment on the underside of each femur.



**Figure 12.** Views of the female paratype for *Maratus tiddalik* (Q #1), in alcohol. **6-7**, Two ventral views of the epigynum, each in a slightly different focal plane, with the anterior direction toward the top of each image.

*Courtship display* (Figures 13-22). Our study of the courtship of *Maratus tiddalik* is based on video records of spiders placed in a naturalistic setting in the laboratory. Courtship by *M. tiddalik* resembles that of *M. boranup* and relies primarily on movement of the extended legs III and not on display of the fan (dorsal opisthosomal plate). Male *M. tiddalik* raise and wave one or both extended legs III without flexion in what appears to represent advertisement directed at females that may be in vicinity (Figure 14). Courtship display in front of a sighted female (Figures 15-22) involves movement of one or both extended legs III in a manner that follows a regular sequence of extension (A), slight depression (B), lateral rotation of the tarsus (C), lateral rotation of the metatarsus (D), and sudden movement of the body and legs III either to the right or to the left to a new extended position (A).



**Figure 13 (continued on next page).** Display positions of male *Maratus tiddalik*. **1-4,** Single leg display. **5-13,** Two leg display.



**Figure 13 (continued from previous page, continued on next page).** Display positions of male *Maratus tiddalik*. **14-18, 19-20, 21-25,** Three sets of sequential photographs of courtship display.



**Figure 13 (continued from previous page).** Display positions of male *Maratus tiddalik*. **26,** Composite from two photographs to show relative position of female. **27-33, 34-37,** Two sets of sequential photographs of display.

1. 0.00s	2. 0.44s	3. 0.48s 0.04s	4. 0.52s 0.04s
5. 0.88s 0.36s	6. 1.00s	7. 1.16s 0.16s	8. 1.44s 0.28s 14
9. 1.68s 0.24s	10. 1.76s 0.08s	11. 1.92s 0.16s	12. 2.16s 0.24s
13. 2.40s 0.24s 12 0.24s	14. 2.64s 0.24s	15. 3.40s 0.76s	16. 3.56s 0.16s
17. 3.76s 0.20s	18. 4.20s 0.44s	19. 4.48s 0.28s	20. 4.56s 0.08s

**Figure 14.** Sequential video frames (25 fps) showing a fixed single leg III wave by a male *Maratus tiddalik*. Movement and elapsed time (large blue arrow) relative to the previous frame is shown. Each wave was a sudden movement, at a rate of  $\sim 2/s$ . This is thought to represent advertisement when the male is not certain of a female position.



**Figure 15.** Sequential video frames (25 fps) showing a flexible single leg III wave by a male *Maratus tiddalik*. Here the complete cycle of erect leg position (A), slight depression of leg (B), flexion of tarsus (C), flexion of metatarsus (D), and sudden return to erect leg position (A) can be seen.



**Figure 16 (continued on next page).** Sequential video frames (25 fps) showing successive erect leg positions (position A) during the two leg III courtship display of a male *Maratus tiddalik*. Each pair of consecutive frames is superimposed (e.g., frame 1 is superimposed with frame 3 in 16:2, with elapsed time shown in a blue arrow). This highlights the sudden and asymetrical movement of both legs III, simultaneously either to the left or to the right, accompanied by movement of the body of the spider, during this display. In this example these shifts took place at a rate of ~2.4/s.



**Figure 16 (continued from previous page).** Sequential video frames (25 fps) showing successive erect leg positions (position A) during the two leg III courtship display of a male *Maratus tiddalik*.



**Figure 17.** Sequential video frames (25 fps) showing successive positions of the right leg III (positions A-D) during the two leg III courtship display of a male *Maratus tiddalik*. Here only two cycles of rapid leg movement (from 1-5 and from 5-9) are shown. Sequential positions (A-D) correspond to those described in Figure 15.



**Figure 18.** Chart depicting the completion of 12 cycles of leg III movement (positions A-B-C-D-A) during two leg III courtship by a male *Maratus tiddalik*, corresponding to the event shown in Figures 16-17, based on a 25 fps video record. This shows completion of 12 cycles in 5 seconds, or 2.4 cycles/s.



**Figure 19.** Sequential video frames (25 fps) showing vertical bobbing or vibration of the opisthosoma (arrows) during the two leg III courtship display of a male *Maratus tiddalik*. Here 12 cycles are shown over 2.44 seconds, or  $\sim$ 5/s. However this movement was not continuous and active bouts took place at  $\sim$ 12.5/s. Blurring in the down position (e.g., frames 22, 24) corresponded to a much higher rate of vibration (Figure 21).



**Figure 20.** Consecutive video frames (25 fps) showing vertical bobbing or vibration of the opisthosoma (arrows) during the two leg III courtship display of a male *Maratus tiddalik*. Note blurring in the lower position (e.g., frames 2, 4, 7, 10).



**Figure 21.** Chart showing vertical position of the spinnerets during 400 ms of two leg III courtship display by a male *Maratus tiddalik*, based on frame by frame measurement from a 1000 fps video record. With high speed video, movement that appears only as a blurred frame at 25 fps (Figures 19-20) is shown to include rapid vibration at ~134 down/up cycles per second.



Figure 22. Sequential images showing the turn of a female to face a displaying male *Maratus tiddalik*.

During this courtship display the male was seen to make these sudden lateral moves at a rate of ~2.4/s (Figures 16-18). The pedipalps were held in a stationary position and their movement was not part of this display, although they were moved during leg waving without flexion (*advertisement*, Figure 14). At irregular intervals during this display the opisthosoma was rapidly lowered and raised. Bouts of this vibration were observed at a peak rate of ~12.5/s (Figures 19-20), but each time that the opisthosoma was lowered during one of these bouts it was actually vibrated down and up at a much higher rate, ~134 cycles/s (Figure 21).

*Biogeography and habitat* (Figures 23-24). *Maratus tiddalik* was first found (JUN 2020) in a more densely vegetated area under peppermint trees (*Taxandria linearifolia*), about 1 km east of the type locality at Cape Naturaliste (S. Rammohan, pers. comm.). At the nearby type locality, most of our specimens were collected on fleshy, broad-leaved coastal vegetation, most likely *Scaevola crassifolia*; one was found on the ground, on limestone (Figure 23; R. Walker, pers. comm.). *S. crassifolia* is a common coastal dune plant that is thought to disperse by means of floating seeds (Merritt et al. 2014).

Like many of the southwestern *Maratus*, *M. tiddalik* is endemic to a very limited range, separated by as much as 70 km from its nearest relative to the south, *M. boranup* (Figure 24). Like *M. speciosus (O.* Pickard-Cambridge 1874), found in coastal vegetation to the north and south, and both *M. tesselatus* and *M. flavus*, found to the north, these species may be largely restricted to areas of coastal vegetation that have recently become more isolated through human activity. These represent one kind of *island* 

*biogeography*, supporting an unusual variety of unique vegetation in highly disjunct areas (Keating & Trudgen 1986; Keighery & Lyons 2011). Like the Swan Coastal Plain to the east and north of Cape Naturaliste, these fragmented coastal areas are threatened (WWF 2020). Other local jumping spiders with a wider distribution, like *M. karrie* Waldock 2013 and *M. pavonis* (Dunn 1947), are found in inland areas with trees and more extensive areas of contiguous habitat.



**Figure 23.** Views of the type locality for *Maratus tiddalik* at Cape Naturaliste. **4**, Note the broad-leaved coastal vegetation (most likely *Scaevola crassifolia*) and extensive areas of white limestone. Photographs by Ray Walker, used with permission.



**Figure 24.** Distribution of *Maratus* species in the Leeuwin-Cape Naturaliste region, and inland to the east. Like *M. flavus* to the north (Tim's Thicket, not shown), *M. azureus* Schubert 2020 (1), *M. boranup* (2), *M. felinus* (3), *M. madelineae* Waldock 2014 (5), *M. noggerup* Schubert 2020 (6), *M. suae* (9), *M. tessellatus* (10), and *M. tiddalik* (11) have been found in single localities. *M. speciosus* (8) is also found to the north near Perth, restricted to coastal habitats. *M. karrie* (4), *M. pavonis* (7) and *M. vespa* Otto & Hill 2016 (12) are found in inland areas with more contiguous vegetation. Some locality data from iNaturalist (www.inaturalist.org) and the Atlas of Living Australia (ala.org.au) is included here. Image: USGS/Landsat.

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