

Euophryine jumping spiders that extend their third legs during courtship (Araneae: Salticidae: Euophryinae: *Maratus*, *Saitis*)²

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Introduction

Some jumping spiders (for example, *Habronattus*, *Saitis*, *Maratus*) have elongated third legs (legs III), apparently an adaptation for life on or near the ground, where these legs can provide a strong vertical component of acceleration during locomotory jumps. Whereas the patellae III of *Habronattus* males are often highly ornamented (Griswold 1987), and can be raised to make them visible to a female in front of a courting male, many, if not all, euophryines placed *properly* into the genera *Saitis* and *Maratus* extend their legs III laterally, either both at the same time, or one at a time, as part of their display. In these spiders, legs I, often prominent in the males of other salticids, are not extended laterally, and do not play a major role in the visual courtship display.

Based on shared characteristics of the male pedipalp and the female epigynum, Prószyński (1976) placed a group of apparently related salticids into the subfamily Euophryinae. Although the members of this subfamily are very widely distributed in both hemispheres, gene sequencing studies have, to date, supported this placement (Table 1, Maddison and Hedin 2003, Maddison *et al* 2008, Maddison 2009). Unlike most of the salticid subfamilies that have been designated, the Euophryinae does not have a singular geographic base for its radiation.

Table 1. Some of the genera included in the diverse and widely distributed salticid subfamily Euophryinae. Genera with support for this placement from comparative studies of gene sequences are highlighted in yellow (Maddison and Hedin 2003, Maddison *et al* 2008, Platnick 2009, Prószyński 2009a).

<i>Amphidraus</i>	Simon	1900	S America
<i>Anasaitis</i>	Bryant	1950	SE US, Caribbean
<i>Asaphobelis</i>	Simon	1902	Brazil
<i>Ascylltus</i>	Karsch	1878	SW Pacific, Queensland
<i>Athamas</i>	O. Pickard-Cambridge	1877	SW Pacific
<i>Bathippus</i>	Thorell	1892	SE Asia, E Indies, Queensland
<i>Belliina</i>	Simon	1902	Venezuela, Trinidad
<i>Bindax</i>	Thorell	1892	Sulawesi, Solomon Is.
<i>Canama</i>	Simon	1903	E. Indies, Queensland
<i>Chalcoscirtus</i>	Bertkau	1880	Eurasia, Nearctic
<i>Chalcotropis</i>	Simon	1902	South Asia, SW Pacific
<i>Chapoda</i>	Peckham & Peckham	1896	Mexico, Central, S America
<i>Chloridusa</i>	Simon	1902	Peru, Brazil
<i>Cobanus</i>	F. Pickard-Cambridge	1900	Mexico, Central, S America
<i>Colyttus</i>	Thorell	1891	SE Asia, E Indies
<i>Commoris</i>	Simon	1902	Caribbean

<i>Coryphasia</i>	Simon	1902	Brazil
<i>Corythalia</i>	C. L. Koch	1851	Caribbean, Central, S America
<i>Cynapes</i>	Simon	1900	Madagascar, Indian Ocean
<i>Cytaea</i>	Keyserling	1882	E Indies, SW Pacific, Australia
<i>Donoessus</i>	Simon	1902	E Indies
<i>Emathis</i>	Simon	1899	E Indies, W Indies
<i>Ergane</i>	L. Koch	1881	Australia to Philippines
<i>Euophrys</i>	C. L. Koch	1834	Eurasia, Africa, Americas
<i>Euryattus</i>	Thorell	1881	S Asia, E Indies, Australia
<i>Habrocestum</i>	Simon	1876	Eurasia, Africa
<i>Hypoblemum</i>	Peckham & Peckham	1886	Australia, New Zealand
<i>Ilargus</i>	Simon	1901	South America
<i>Jotus</i>	L. Koch	1881	Australia, SW Pacific
<i>Klamathia</i>	Peckham & Peckham	1903	South Africa
<i>Lagnus</i>	L. Koch	1879	Fiji
<i>Laufeia</i>	Simon	1889	E to SE Asia
<i>Lepidemathis</i>	Simon	1899	Philippines
<i>Lycidas</i>	Karsch	1878	Australia, China?
<i>Maeota</i>	Simon	1901	Brazil
<i>Maratus</i>	Karsch	1878	Australia
<i>Margaromma</i>	Keyserling	1882	SW Pacific to Australia, Africa?
<i>Mexigonus</i>	Edwards	2002	N America
<i>Mopiopia</i>	Simon	1902	Brazil
<i>Naphrys</i>	Edwards	2002	N America
<i>Neon</i>	Simon	1876	Holarctic, SE Asia, S America
<i>Neonella</i>	Gertsch	1936	Americas including Caribbean
<i>Ocnotelus</i>	Simon	1902	Brazil, Argentina
<i>Omoedus</i>	Thorell	1881	SW Pacific
<i>Pensacola</i>	Peckham & Peckham	1885	Central, S America, Caribbean
<i>Pristobaeus</i>	Simon	1902	Sulawesi
<i>Prostheclina</i>	Keyserling	1882	E Australia
<i>Pseudeuophrys</i>	Dahl	1912	Eurasia
<i>Pystira</i>	Simon	1901	SE Asia, E Indies
<i>Saitis</i>	Simon	1876	Europe to Australia, S America
<i>Semnolius</i>	Simon	1902	Argentina, Brazil
<i>Servaea</i>	Simon	1888	Australia to E Indies
<i>Sidusa</i>	Peckham & Peckham	1895	Central to S America, W Indies
<i>Siloca</i>	Simon	1902	S America to Caribbean
<i>Spilargis</i>	Simon	1902	New Guinea
<i>Stoidis</i>	Simon	1901	Venezuela and Caribbean
<i>Talavera</i>	Peckham & Peckham	1909	Eurasia, one N America
<i>Tariona</i>	Simon	1902	Brazil, Cuba
<i>Thiania</i>	C. L. Koch	1846	Asia to E Indies
<i>Thorelliola</i>	Strand	1942	E Indies, SW Pacific
<i>Thyenula</i>	Simon	1902	Africa
<i>Tylogonus</i>	Simon	1902	Central to S America
<i>Udvardya</i>	Prószyński	1992	New Guinea
<i>Zenodorus</i>	Peckham & Peckham	1885	Australia to SW Pacific

Judging from the relatively small number of euophryines from Africa or Madagascar, it is possible that this group evolved in the late Cretaceous, after the opening of the South Atlantic Ocean separated Africa from the rest of Gondwanaland (South America, Antarctica, and Australia). After an initial radiation across this southern continent, this would have led to the radiation of some euophryine genera out of Australia and

New Guinea into Southeast Asia and the Western Pacific, and to the radiation of *different* euophryine genera out of South America. Evolution of male and female genitalia during this interval would have been very conservative.

If the primary radiation of this group followed the Cretaceous break-up of these southern continents, then they have been extraordinarily successful at dispersal across oceans and continents. The fact that many euophryine genera are found on ocean islands supports this idea. The gene sequences of many more euophryines will have to be studied to work out the detailed phylogeny of the group, and many of the presently recognized generic boundaries will have to be reconsidered during this process.

Even if the structure of their genitalia is relatively conservative, the ornamentation of euophryine males varies greatly. As in other salticid groups, movement of legs I, or movement of the pedipalps, figures prominently in the courtship display of many euophryines, as exemplified by *Anasaitis* and *Naphrys* (Figure 1) (Richman 1982, Hill 2009). The ornamentation of the European species of *Euophrys* (*E. frontalis*, *E. rufibarbis*, *E. sulphurea*, and *E. terrestris*), is limited to facial setae, and legs I, not legs III, also play a major role in their courtship display (Prószyński 2009b).



Figure 1. Adult male *Anasaitis canosa* (Walckenaer 1837) (1), and adult male *Naphrys pulex* (Hentz 1846) (2), both from Greenville County, South Carolina, USA. *A. canosa* extends legs I and rotates its iridescent pedipalps in unison during its courtship display. *N. pulex* also raises and lowers its colorful pedipalps, and extends legs I during courtship (Richman 1982). Legs III are not remarkable, and do not play a major role in the courtship of either species. Photographs by D. E. Hill.³

Within the Euophryinae, the genera *Maratus* and *Saitis*, including relatively small (~4–5 mm in length) but often highly ornamented spiders, are of particular interest with respect to their common use of extended legs III in courtship. *Maratus* were previously placed in *Saitis*, but now almost all of the Australian *Saitis* have been moved to either *Lycidas* or *Maratus* (Žabka 1987). Given the limited variation in pedipalp structure within the Euophryinae, earlier classifications that relied strongly on that structure will most likely give way to new arrangements of the Euophryinae based on a combination of other characters, in the future. Here, I will first look at several representatives of *Saitis*, then *Maratus*.

Spiders of the genus *Saitis* Simon 1876

In many respects, *Saitis*, based upon the type species *S. barbipes*, has been a catch-all genus for a number of different euophryines that have since been transferred to other genera. It is likely that this transfer process will continue. According to Prószyński (2009b), of 53 nominal species of *Saitis* only 14 have

diagnostic drawings of any sort, and only a few of these can be identified as relatives. Species presently associated with *Saitis* are listed in Table 2. Most of these species do not exhibit special modifications of legs III for courtship, and their long-term placement in *Saitis*, based almost entirely on genitalic similarities, may be questionable. *Pseudoeuophrys sengleti* Metzner 1999 has only recently been transferred into the genus *Saitis* (Logunov 2001). The Australian species, similar in many respects to *Maratus*, will be discussed after an examination of that genus.

Table 2. Species that have been associated recently with the genus *Saitis* Simon 1876 (Metzner 2009, Platnick 2009, Prószyński 2009a, 2009c).

<i>annae</i>	Cockerell	1874	Jamaica
<i>ariadneae</i>	Logunov	2001	Crete
<i>auberti</i>	Berland	1938	New Hebrides
<i>barbipes</i>	(Simon)	1868	Mediterranean
<i>berlandi</i>	Roewer	1951	New Hebrides
<i>breviusculus</i>	Simon	1901	Gabon
<i>catulus</i>	Simon	1901	Venezuela
<i>chaperi</i>	Simon	1885	India, Sri Lanka
<i>cupidon</i>	(Simon)	1885	New Caledonia
<i>cyanipes</i>	Simon	1901	Brazil
<i>graeca</i>	Kulczyński	1905	Greece
<i>imitatus</i>	(Simon)	1868	Croatia, Montenegro
<i>insectus</i>	(Hogg)	1896	Central Australia
<i>insulanus</i>	Rainbow	1920	Lord Howe Is
<i>lacustris</i>	Hickman	1944	Central Australia
<i>latifrons</i>	Caporiacco	1928	Libya
<i>leighi</i>	Peckham & Peckham	1903	S Africa
<i>magniceps</i>	(Keyserling)	1882	Queensland
<i>magnus</i>	Caporiacco	1947	Ethiopia
<i>marcusi</i>	Soares & Camargo	1948	Brazil
<i>mundus</i>	Peckham & Peckham	1903	E to S Africa
<i>nanus</i>	Soares & Camargo	1948	Brazil
<i>perplexides</i>	(Strand)	1908	Jamaica
<i>relucens</i>	(Thorell)	1877	Sulawesi
<i>sengleti</i>	(Metzner)	1999	Greece, Crete
<i>signatus</i>	(Keyserling)	1883	
<i>speciosus</i>	(O. P.-Cambridge)	1874	New South Wales
<i>spinus</i>	(Mello-Leitão)	1945	Argentina
<i>splendidus</i>	(Walckenaer)	1837	Timor
<i>taeniatus</i>	Keyserling	1883	Australia
<i>taurica</i>	Kulczyński	1905	Bulgaria to Greece and Turkey
<i>variegatus</i>	Mello-Leitão	1941	Argentina

The Mediterranean *S. barbipes*, the type for *Saitis*, is also the best-known member of this genus. It was first described by Eugène Simon in 1868, and his original French description is presented here, followed by a new English translation. Simon's *Attus barbipes* (pp. 563-564) and *A. scriptus* (pp. 599-600) are both considered to be descriptions of *S. barbipes* (Prószyński 2009a), and both are included here. Simon's original figures (plate II, figures 6 and 9) are also presented, in Figure 2.

Original descriptions, in French (original paragraph structure condensed):

63. ATTUS BARBIPES. Sp. nov.

(Pl. II, fig. 9.)

Long. ♂ ♀ 4 3/4 mill.

Tête grise, bordée de rouge. Thorax noir, gris dans le milieu. Abdomen noirâtre avec une bande médiane fauve. Pattes testacées et courtes, sauf celles de la troisième paire.

♂. La plaque céphalique et le milieu du thorax sont couverts de duvet gris blanc; les parties latérales sont noires et presque glabres; le front, les côtés de la tête et la portion blanche du thorax sont en outre bordés de poils d'un beau rouge. Sous ces poils, le tégument est noir et présente une ligne médiane fauve en arrière. Les yeux de la face sont vert émeraude et entourés de cils rouges. L'abdomen porte une large bande médiane fauve; dans sa partie antérieure cette bande en renferme une autre rougeâtre: en arrière elle est élargie et coupée par trois petites lignes noires, un peu relevées dans le milieu en manière d'accent. Les côtés de cet abdomen sont noirs et garnis de poils roux espacés. Le ventre est blanchâtre. Les pattes-mâchoires sont jaune clair. Les pattes des deux paires antérieures et de la quatrième sont très-courtes, blanchâtres et armées de loin en loin de poils raides et noirs; quelquefois, mais rarement, les antérieures sont annelées de petits cercles noirs. Les pattes de la troisième paire sont singulièrement longues; la cuisse, seule, égale en longueur la totalité d'une patte antérieure, elle est blanchâtre en dessous et rouge en dessus; la jambe, dilatée et comprimée, est entièrement rouge; les deux premiers articles du tarse, qui sont encore plus larges, sont aussi de couleur foncée; le dernier est seul petit et jaunâtre; outre le court duvet vermillon qui couvre les parties rouges de ce membre, la jambe et le tarse sont armés de longs crins raides disposés régulièrement, en dessus et en dessous, comme les barbes d'une plume.

♀. La tête est couverte de poils gris assez espacés; elle est bordée sur les côtés et en arrière de poils jaunes; le thorax est noir et marqué d'une ligne médiane plus blanche. Les yeux de la face sont bronzés. L'abdomen est de teinte testacée; il présente dans le milieu une large bande longitudinale, limitée par deux lignes noires parallèles, fortement festonnées du côté externe; à l'intérieur celle bande est ornée, comme chez le mâle, en avant d'un trait longitudinal, dans le milieu d'un accent transverse, et en arrière de trois petits points noirs; autour des filières est un petit cercle noir. Le ventre, jaune clair, porte en arrière une tache foncée. Les pattes-mâchoires sont d'un jaune diaphane; leur dernier article est un peu élargi. Toutes les pattes sont jaune testacé; celles de la troisième paire dépassent un peu les autres en longueur; les antérieures portent sur la jambe un mince anneau noir et oblique.

FRANCE. Midi (Basses-Alpes, Vaucluse). ITALIE (nord). Le mâle de cette espèce est beaucoup plus rare que la femelle. Elle se trouve sous les pierres dans les parties herbues et humides des montagnes.

92. ATTUS SCRIPTUS. Sp. nov.

(Pl. II, fig. 5.) (fig. 6)

Long. 5 3/4 mill.

Tête noire. Thorax fauve avec deux lignes grises. Abdomen blanc, moucheté de noir, avec une ligne médiane brune suivie de trois accents. Pattes fauves et annelées.

♀. Le corselet ressemble à celui du précédent; la tête est néanmoins plus large; elle porte une tache d'un noir profond et luisant qui forme une ligne droite entre les yeux postérieurs et non une courbe rentrante comme chez frontalès. Le thorax est d'un jaune rougeâtre et présente deux lignes parallèles grises qui se rapprochent en arrière. Les yeux médians antérieurs sont plus convexes. L'abdomen est glabre et blanchâtre; sa portion antérieure est couverte de petits points noirs peu serrés, égaux et équidistants; dans le milieu elle présente une tachette noire longitudinale; sa portion postérieure, dépourvue de mouchetures dans le milieu, est ornée de trois petits accents noirs superposés. Le ventre et le plastron sont jaunâtres. Les pattes-mâchoires sont d'un jaune pâle. Les pattes, également jaunes, portent de loin en loin des anneaux gris peu marqués. D'autres fois l'abdomen est blanchâtre et simplement orné de deux lignes parallèles formées de points noirs; les parties latérales sont irrégulièrement mouchetées; mais le milieu ne présente qu'en arrière quelques petits triangles noirs.

ALPES (Suisse, Vaucluse). ITALIE (Modène). ESPAGNE (Escorial). Le mâle paraît très-rare; la femelle est au contraire fort commune. Les deux individus que j'ai pris à l'Escorial ont le thorax un peu plus étroit.

New English translation:

63. ATTUS BARBIPES sp. nov.

(Pl. II, fig. 9.)

Length ♂ ♀ 4.75 mm

Head grey, bordered with red. Thorax black, gray in the middle. Blackish abdomen with a tawny median band. Legs short and testaceous, except for the third pair.

♂. The optic quadrangle and the middle of the thorax are covered with white grey down; the lateral parts are black and almost hairless; the face, the sides of the head, and the white part of the thorax are also edged with beautiful red hairs. Under these

hairs, the integument is black with a tawny median line toward the rear. The anterior eyes are emerald green, encircled with red eyelashes. The abdomen has a broad, tawny median band; toward the front this band passes through a reddish area. Toward the rear it is enlarged and cut by three small black lines, a bit raised in the middle in the form of an accent. The sides of the abdomen are black and trimmed with scattered, russet hairs. The venter is whitish. The pedipalps are flaxen. Legs I, II, and IV are very short, whitish and bear, here and there, rigid black hairs; infrequently, on the anterior, they are ringed with small black circles. Legs III are particularly long; the femur alone is as long as one of the anterior legs. It is whitish below and red on top; the tibia, widened and flattened, is entirely red; the metatarsus, which is even wider, is also of dark color; the tarsus is alone small and yellowish; in addition to the short bright red down which covers the red areas of this leg, the tibia and metatarsus bear a regular series of long, rigid hairs, above and below, like the barbs of a feather.

♀. The head is covered with rather spaced grey hairs; it is bordered on the sides and behind with yellow hairs; the thorax is black and marked with a very white median line. The eyes of the face are bronzed. The abdomen is slightly testaceous; in the middle is a broad longitudinal band, bounded by two parallel black lines, strongly scalloped laterally; medially this band is adorned, as in the male, by a longitudinal tract in front, in the middle by a transverse accent mark, and in the rear by three small black spots; a small black circle surrounds the spinnerets. The venter, flaxen, bears a dark mark toward the rear. The pedipalps are diaphanous yellow; their last segment is slightly enlarged. All of the legs are testaceous yellow; the third pair exceed the others slightly in length; in front on the patella they bear a slim black, slanting ring.

FRANCE. South of France (Low Alps, Vaucluse). ITALY (north). The male of this species is much rarer than the female. It is found under stones in open, humid prairies or grasslands, in the mountains.

92. *ATTUS SCRIPTUS* sp. nov.

(Pl. II, fig. 6.)

Length 5.75 mm.

Head black. Tawny thorax with two grey lines. Abdomen white, spotted with black, with a brown median line followed by three accents. Legs tawny and ringed.

♀. The body resembles that of the preceding species (*A. frontalis*); the head is however larger; a shiny, deep black line between the posterior eyes is straight and not curved and concave as in *frontalis*. The thorax is ruddy yellow and bears two grey parallel lines which converge toward the rear. The anterior medial eyes are more convex. The abdomen is glabrous and whitish; the anterior portion is covered with small equal and equally spaced, slightly compressed black spots; in the middle it bears a longitudinal black spot; its latter part, devoid of spots in the middle, is adorned with three small stacked black accents. The venter and the sternum are yellowish. The pedipalps are pale yellow. The legs, equally yellow, bear indistinct grey rings here and there. In other specimens the abdomen is whitish and simply adorned with two parallel lines, formed by small black spots; the lateral parts are irregularly spotted, but the middle bears only some small black triangles toward the rear.

ALPS (Switzerland, Vaucluse). ITALY (Modène). SPAIN (Escorial). The male seems very rare; the female is to the contrary very common. Both individuals that I took in Escorial have a slightly narrower thorax.

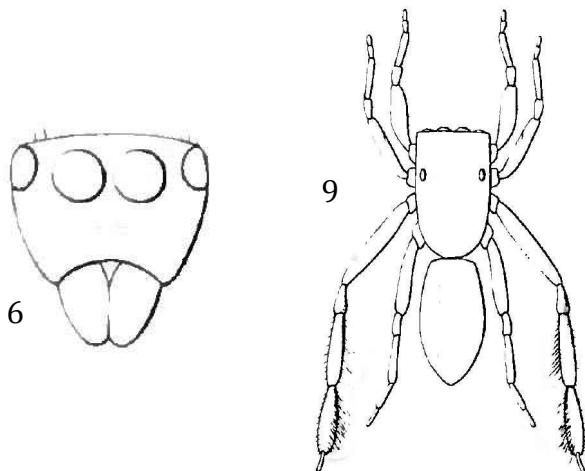


Figure 2. Simon's original (1868) figures of *Attus scriptus* (6) and *Attus barbipes* (9), from plate II (*planche 6 des Annales*). Original captions and English translations (in *italics*) are: Fig. 6. *scriptus*. Face et yeux (*face and eyes*). Fig. 9. *barbipes*. Corcelet et pattes (*body and legs*). Ink bled into the paper as these drawings deteriorated over time, suggesting that the distal segments of legs III were drawn more darkly than this drawing (9) suggests. Note that the original text referred to Fig. 5 instead of Fig. 6, for *A. scriptus*, in error.³

Several other *Saitis* from the Mediterranean region also have highly ornamented legs III (Figure 3). Curiously, the pedipalps of the three species shown here are quite distinctive, almost encompassing the full range of form (ranging from a blunt to a spiral embolus) encountered in the Euophryinae as a group! It may be that this difference facilitated the reproductive isolation of what are otherwise three very similar species with a contiguous, if not overlapping, distribution.

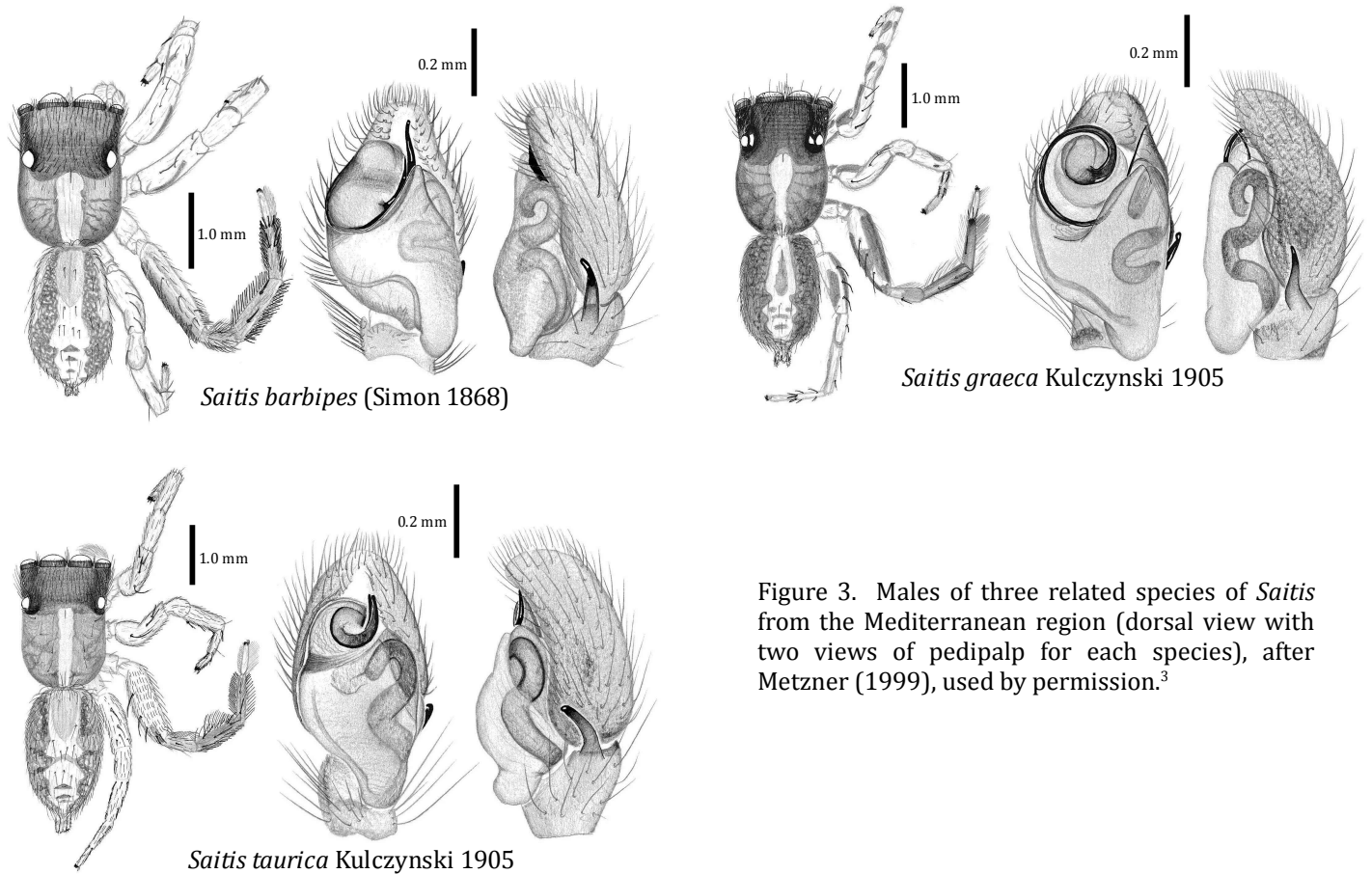


Figure 3. Males of three related species of *Saitis* from the Mediterranean region (dorsal view with two views of pedipalp for each species), after Metzner (1999), used by permission.³

As with other *Saitis* and *Maratus*, female *S. barbipes* tend to be brown and cryptic, almost translucent and in places even quite glabrous. The males, however, are boldly decorated (Figure 4).

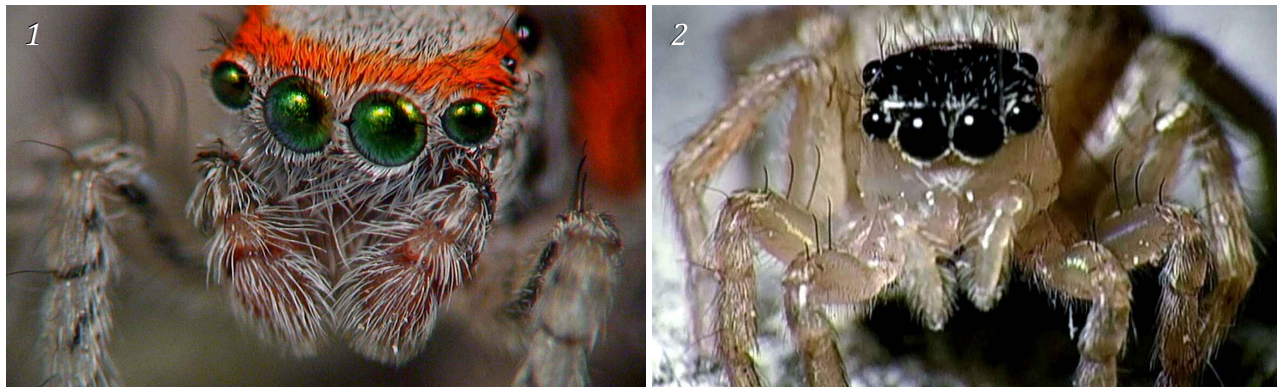


Figure 4. Face views of adult male (1) and adult female (2) *Saitis barbipes*, from the Côte d'Azur, France. The green reflections (structural or interference color) seen in the front eyes of the males can be observed in many other salticids. Photograph (1) courtesy of H. Antoine. Photograph (2) represents a frame from a video produced by H. Antoine (2008), both used by permission.³

The next series of figures (5–8) are stills from a video of the courtship of a male *S. barbipes*, produced by H. Antoine (2008). Frame by frame study of this video has revealed several interesting components of the display repertoire of these salticids that should serve as an introduction to a most interesting subject.

Figure 5 shows how legs III were raised off of the surface and extended to reveal the bright red anterior of the femur, patella, and tibia, most likely at the onset of a display to a sighted female. The white area of the distal tarsus of this leg contrasts with the dark setae of the metatarsus and proximal tarsus, highlighting the extension of the leg. In comparison, the other legs are relatively transparent and quite ordinary in appearance. Monardi (2004) reported that these legs can be extended in unison, or one at a time, and that the frequency of these movements increases as a male comes into contact with the dragline of a female.



Figure 5. Three sequential frames depicting a turn (1–3) to face an object of interest (most likely a sighted female), following by extension and rearing of the colorful legs III of this adult male *S. barbipes*. Here the legs were not fully extended. Note the high contrast between the bright white of the distal tarsus, and the dark setae of the metatarsus and proximal tarsus of this spider. Figures 5–8 from video produced by H. Antoine (2008), used by permission.³

Figure 6 shows this male *S. barbipes* holding legs III in a fairly constant V-shaped angle (near 60°), while rotating this V-shape from side to side. This movement was accompanied by rapid, lateral vibration of the bright white tarsi at the ends of these legs. The extent of this lateral vibration can be seen in the blurred frame (2) of this sequence. According to Monardi (2004), this vibration is audible to a human observer. From this view one can also see the relative continuity of the bright red line extending from the tibia of one leg to the tibia of the other leg III, joined in the middle by a line of bright red scales at the front of the optic quadrangle. In a similar sequence, this spider rotated the V-shape as it stepped slowly from side to side in a crouching stance, but did not vibrate the legs.



Figure 6. Sequence of frames (1–4) depicting side-to-side rotation of a V-shape formed by extended legs III, by a male *S. barbipes*. The legs and, particularly the white distal tarsi, were vibrated rapidly during this display.³

In Figure 7, the male *S. barbipes* is shown moving its extended legs III from a near vertical position to a horizontal position, presumably as it faced a female sighted in the distance. During this movement the legs were not vibrated, and were lowered in a series of small increments.

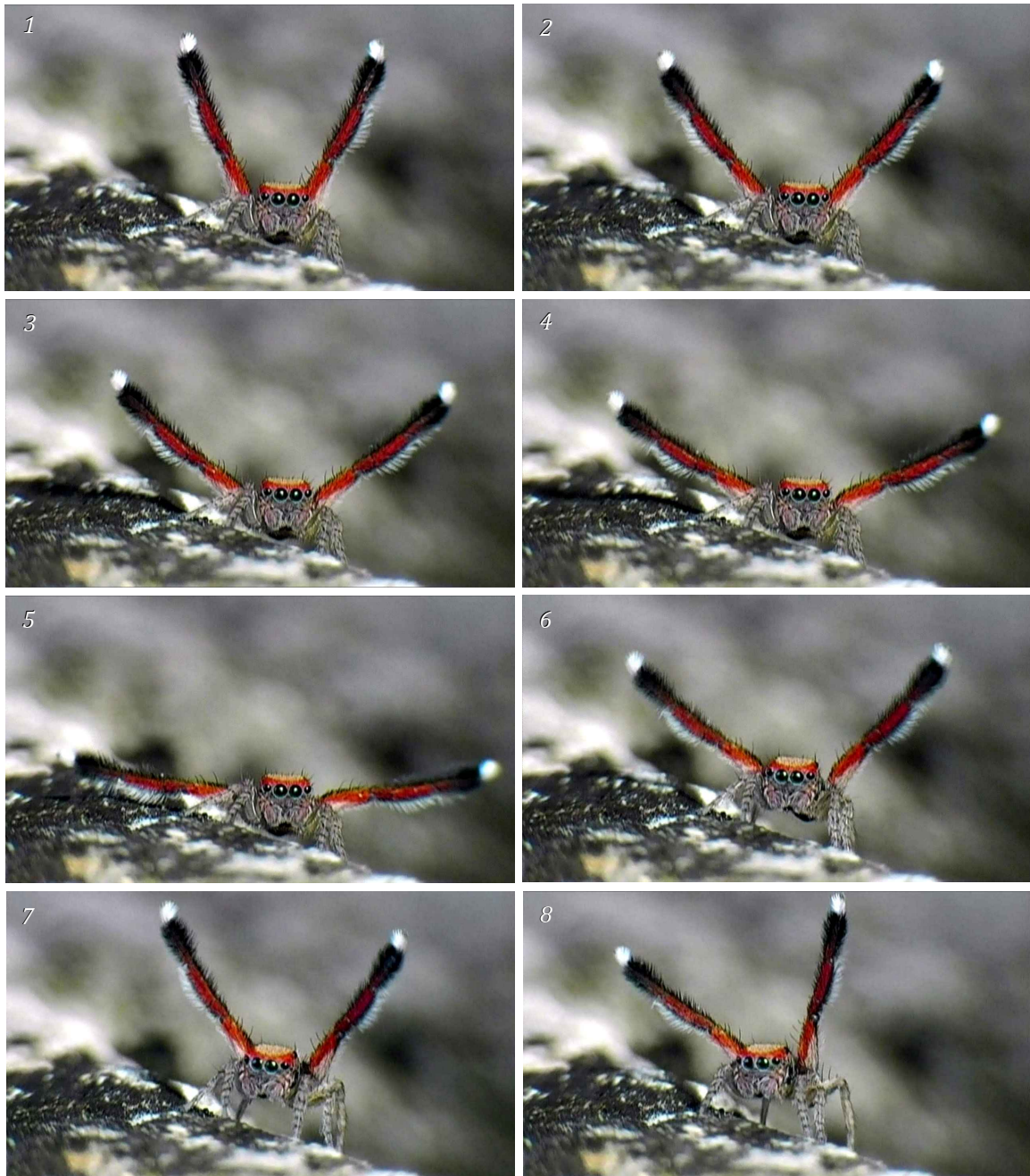


Figure 7. Sequential frames (1–8) depicting successive positions of a male *S. barbipes*, as it moved legs III from a near-vertical to a lower horizontal position, and then raised them again. Movement was not continuous during this sequence, but proceeded in a series of small increments. At the end of this sequence (7–8), the spider began to rotate a fixed V-shape, as shown in Figure 6.³

Thus there were *at least* four different ways that this spider moved its prominent legs III to produce a visual effect. These included extension (Figure 5), rotation of a fixed V-shape from side to side (Figures 6, 7–7, 7–8), vibration of this V-shape (also Figure 6), and the raising or lowering of the extended legs in unison (Figure 7). In addition, this spider also snapped both legs down quickly, in unison, to touch the substrate near a sighted female (not depicted here). During the approach to the front of a female, this spider vibrated its opisthosoma up and down quickly as it touched the female with legs I and II, while

supported on partially flexed legs III (Figure 8). This was similar to vibration behavior recorded previously for *Anasaitis canosa* (Hill 2009).

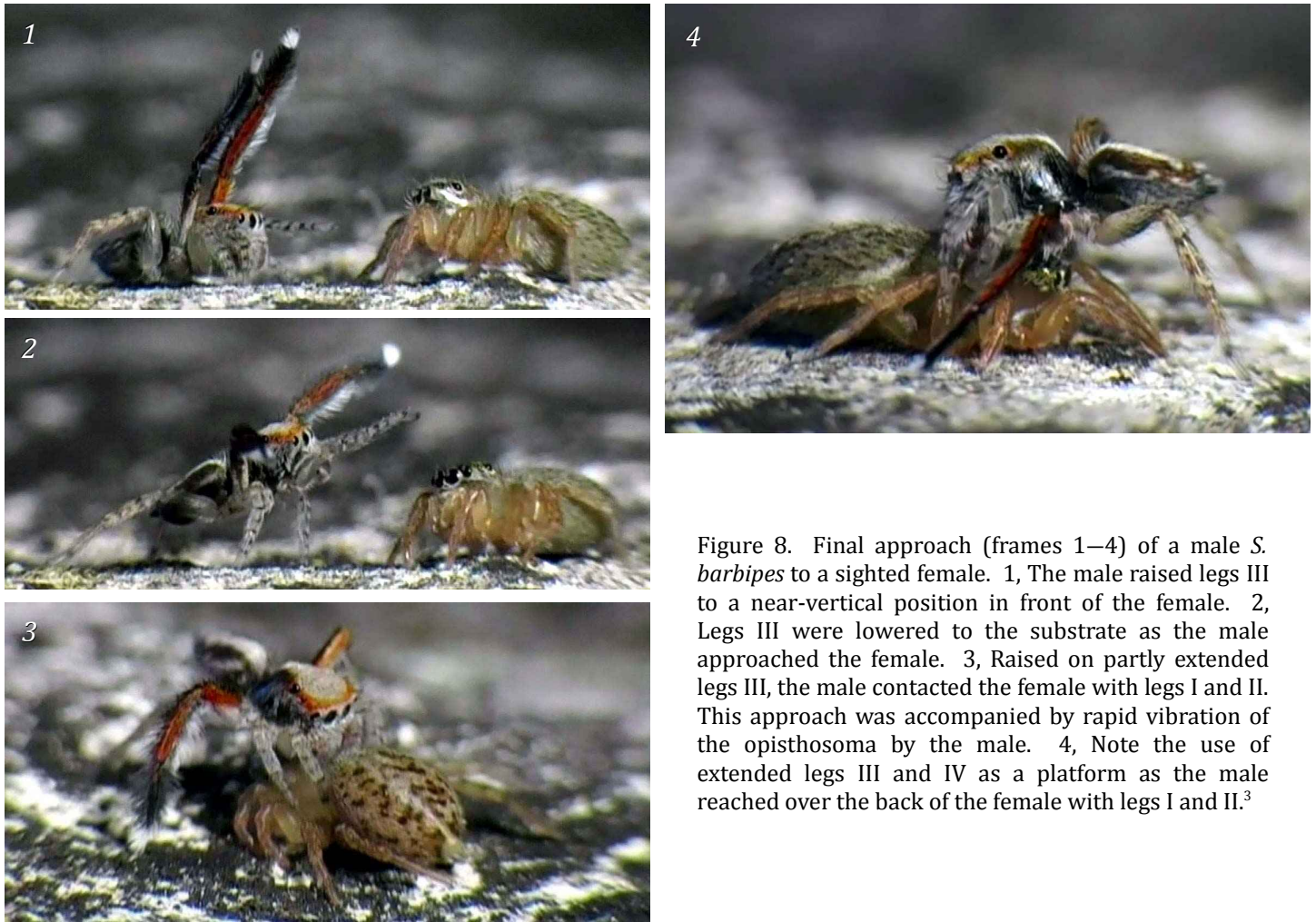


Figure 8. Final approach (frames 1–4) of a male *S. barbipes* to a sighted female. 1, The male raised legs III to a near-vertical position in front of the female. 2, Legs III were lowered to the substrate as the male approached the female. 3, Raised on partly extended legs III, the male contacted the female with legs I and II. This approach was accompanied by rapid vibration of the opisthosoma by the male. 4, Note the use of extended legs III and IV as a platform as the male reached over the back of the female with legs I and II.³

This variety of visual signals raises several questions that cannot be resolved from this brief series of disjunct observations. First, does the male simply try a series of different signals in turn, for effect? Does this follow a progression, or escalation, based on the reaction of a sighted female? Does display associated with detection of a female dragline differ from display directed toward a sighted female? Are different females responsive to different sets of signals?

Spiders of the genus *Maratus* Karsch 1878

Maratus is a distinctive genus of euophryines that appear to be endemic to Australia. To date, seven species of these small (~4 mm) spiders have been named (Table 3), although J. Waldock (2007) has reported that at least 20 species exist. Like *Saitis*, *Maratus* have prominent, elongated legs III that are used by males in their courtship display, but its courtship display is even more remarkable. The dorsal opisthosoma of the male *Maratus* is ornamented with a pattern of brightly-colored scales that can be elevated to the view of courted females, in the manner of a strutting peacock. These animals truly deserve to be called *peacock spiders* (Waldock 1993, 2007, Nieuwenhuys 2008). In many if not all species within this genus, folded lateral flaps associated with the dorsal opisthosoma can also be extended to increase the area of this display, and to complete the pattern.

Table 3. Species presently associated with the genus *Maratus* Karsch 1878 (Platnick 2009, Prószyński 2009a).

<i>amabilis</i>	Karsch	1878	Australia
<i>linnaei</i>	Waldock	2008	Western Australia
<i>mungaich</i>	Waldock	1995	Western Australia
<i>pavonis</i>	(Dunn)	1947	Victoria
<i>rainbowi</i>	(Roewer)	1951	New South Wales
<i>vespertilio</i>	(Simon)	1901	Australia
<i>volans</i>	(O. P.-Cambridge)	1874	Queensland, New South Wales

The best-known *Maratus* is the so-called flying spider, *M. volans*, originally described as *Salticus volans* by O. Pickard-Cambridge (1874, pp. 178-180). For reference, the text of that original description is given here, along with the accompanying figures (Figure 9):

***Salticus (Attus, Sim.) volans*, n. sp.** Plate XVII. fig. 4.

Adult male, length rather above 2 lines.

The *cephalothorax* of this spider is of ordinary form; the thoracic region and sides of the caput are black, with a margin of white hairs; the upper part of the caput between the eyes is banded longitudinally with alternate bands of a soft greyish green and bright scarlet, three of the former to two of the latter; and on the upper part of the thorax are three large spots of white hairs in a transverse row, the lateral spots being considerably the largest: the clypeus, which is retreating, is clothed with numerous fine pale hairs; and the surface of the cephalothorax is furnished with others both pale and dark, and erect.

The *eyes* are in the ordinary position; they form very nearly a square, the fore side being very slightly longer than the hinder one; the small central eye of each lateral row is slightly within the straight line of the other two forming that row, and is also a trifle nearer the hinder than the fore one of these two; the four eyes which form the front row are of a dark shining greenish colour; the two centrals are, like those of most other species of the genus, far the largest; the row is curved, the curve being directed forwards.

The *legs* are moderate in length and strength; their relative length is 3, 4, 2, 1 or 3, 4, 1, 2, the difference between those of the first and second pairs being very slight; they are of a pale yellowish colour, irregularly marked and banded with dark brown, and hairy, numerous short adpressed hairs of a greyish white being mixed with others dark-coloured and erect: the metatarsi of the third pair are furnished with a tuft-like group of bristly black hairs on either side; the tibiae and metatarsi are also furnished with spines.

The *palpi* are short and similar to the legs in colour. The cubital and radial joints are short, the latter being the longest; they are furnished pretty thickly with greyish-white hairs, especially on the inner sides of the radial and on the digital joints; these latter are oval, and of moderate size: the radial joint has a small tapering pointed projection at the extremity of its outer side. The palpal organs appeared to be of very simple structure, and to consist of a largish oval corneous lobe.

The *falces* are small, conical, placed far back behind the frontal margin, and are of a yellowish-brown colour.

The *abdomen* is of an elongated oval form and rather flattened; its upperside is furnished with an epidermis, which is continued laterally on either side to an extent considerably exceeding the width of the abdomen, and of a semioval or elliptical form; the outer portion of this epidermis on either side is capable of being depressed and folded round beneath the abdomen, or elevated and expanded to its full width, after the manner of wings. The whole of the epidermis is densely covered with short scale-like hairs, which give the different tints and hues to the abdomen; the portion which covers the abdomen itself is striped longitudinally for rather more than two thirds of its length alternately with scarlet and greyish green, the latter reflecting brighter green and blue metallic hues; the hinder part is striped transversely, but, except the first of the stripes, not so distinctly, with similar colours; the lateral flaps are of a soft yellowish colour, tinged with olive-green, and each is marked with two somewhat oblique, curved, narrow stripes or lines of greyish green, following nearly the curve of the hinder part of the flap, and thickly fringed with greyish hairs. The underside of the abdomen is of a dull brownish-yellow colour, marked longitudinally, but not very regularly, with dark brown; and the underside of the flap is of a uniform, pale, dull yellowish hue: four small black impressed points form a quadrangular figure near the middle of the upperside of the abdomen; and there are numerous upturned, bristly, black hairs just beneath the fore extremity.

It is difficult to describe adequately the great beauty of the colouring of this spider; but the unique lateral flaps or appendages of the abdomen will serve to distinguish it readily from all other at present known *Saltici*. It is probable, from the great development of these flaps, as above described, that they are sexual; but no doubt the female, when discovered, will have some traces of them more or less developed. Mr. H. H. B. Bradley, of Sydney, New South Wales, to whom I am indebted for examples of this exceedingly interesting and remarkable spider, tells me that he has observed them elevating and depressing the flaps, and also actually using them as wings or supporters to sustain the length of their leaps. That this, as with an analogous appendage in the flying squirrel, should be intended for such sustentation, one could have but little doubt after examining it even in the preserved specimens. It appears to be a very rare spider, Mr. Bradley having been able to procure but three examples (all males in the adult state) during many occasions of special hunting for it. The three examples were all found on one spot near Sydney in the month of October, running and jumping on low plants and flowers.

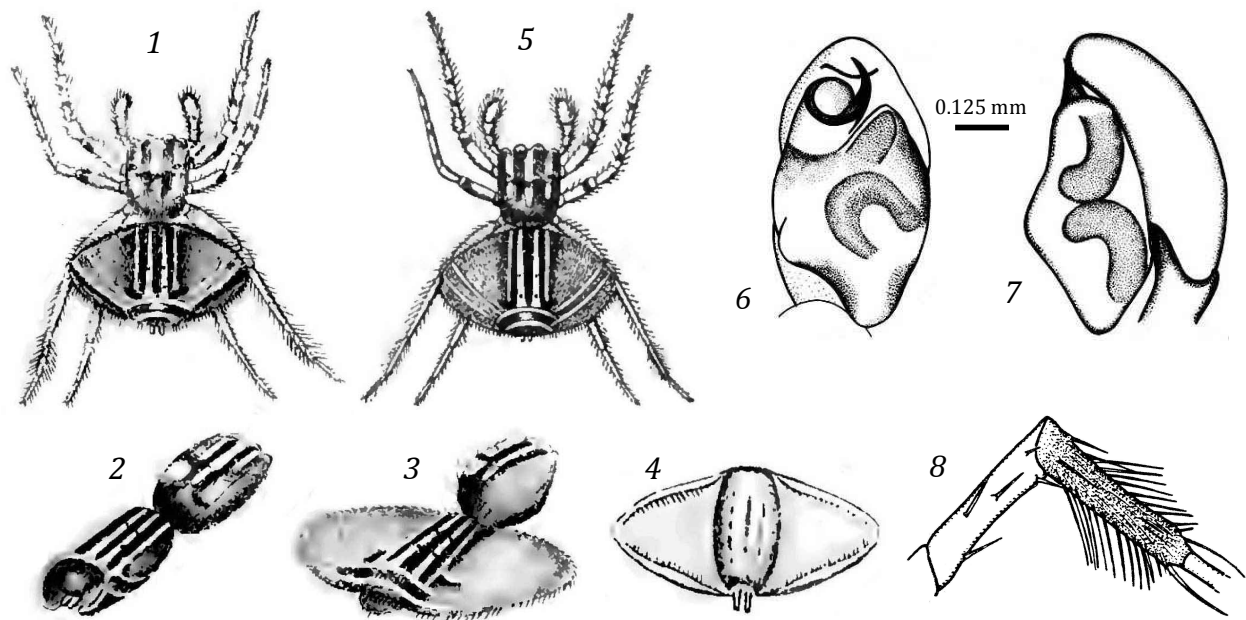


Figure 9. Illustrations of the male type specimen of *Maratus volans*. 1–4, O. Pickard-Cambridge's original (1874) illustrations of *Salticus volans*. The original illustrations of an adult male were in poor condition, but depicted a dorsal view with flaps extended (1), a rear oblique view with the flaps folded (2), a rear oblique view with the flaps extended (3), and a ventral view of the opisthosoma with flaps extended (4). The length of this spider was given as *rather above 2 lines* (more than 4.2 mm). 5, Derived view of (1) published subsequently in a British Museum Guide (Ridewood 1913). Although this copy was in better condition than the original, the artist failed to render the distinctive, elongated setae (*bottle-brush*, 8) associated with the metatarsus of legs III. 6–8, Detailed drawings of O. Pickard-Cambridge's type specimen in the Oxford Museum by Jerzy Prószyński (1984), showing two views of the male pedipalp (6–7), and the bottle-brush on the metatarsus of leg III (8), used by permission.³

As noted by Waldock (2007), O. P.-Cambridge began the myth of the flying spider (hence *volans*) with this description, citing the account of his collector, one H. H. B. Bradley of Sydney, regarding the use of the lateral opisthosomal flaps (*fan*) of *Salticus (Maratus) volans* as wings. O. P.-Cambridge clearly thought that one could scale the dimensions of a flying squirrel linearly, down to those of a small salticid (little more than 4 mm in length at most), and still obtain effective gliding flight. The illusion of wings may have been furthered by the fact that O. P.-Cambridge only examined preserved specimens, for which these flaps could be expanded laterally when the opisthosoma was in a horizontal orientation. This is not to say that the male *Maratus* is not capable of flight, in the manner of either ballistic flight during a jump (Hill 2006), or ballooning flight, although the latter has not been reported for this genus. However, we presently have no evidence that extension of these opisthosomal flaps plays any significant role in the ballistic flight of these spiders (Waldock 2007, 2008). It is unfortunate that a likely myth that began in 1874 has been propagated through a series of popular accounts for 135 years!

When a jumping spider is engaged in ballistic flight after a jump, it accelerates downward in the gravitational field of the Earth. Ordinarily, the acceleration stops when the spider reaches its objective, or when it brakes on the dragline. If a spider jumps from a great height, it can continue to accelerate until it reaches its *terminal velocity*, the point at which the force of air resistance exactly balances the force of gravity. From this point on, the vertical component of velocity is constant. Terminal velocity is a function of air density, spider mass, and spider area subject to air resistance. This comes out to about 5.7 m/s for a large 150 mg *Phidippus*, and about 4.5 m/s (not much different) for a much smaller, 15 mg *Evarcha arcuata*. For most targeted jumps, which involve a take-off velocity of about 0.6–0.9 m/s (Parry and Brown 1959, Hill 2006), the vertical component of air resistance tends to be only a fraction of one percent of the opposing force of gravity, and hence is of little consequence in determining the flight trajectory of these small animals. It is only at a much greater velocity, approaching the terminal velocity, that air resistance becomes an important factor. Thus extension of “wing flaps” (or a *fan*) by a small salticid would have no significant impact on the trajectory of a normal, targeted jump. If these spiders were to free-fall for great distances (say, several meters), then extension of “wing flaps” could reduce their free fall velocity, allowing them to traverse a greater horizontal distance before reaching the ground. A related form of gliding or parachuting flight has been described in several ant species (*Cephalotes*, *Crematogaster*, Dudley et al 2007). However, *Maratus* are thought to live on or near the ground in low bushes.

When not displaying to a female, the adult male *Maratus volans* keeps its colorful *fan* wrapped tightly around the opisthosoma (Figure 10).

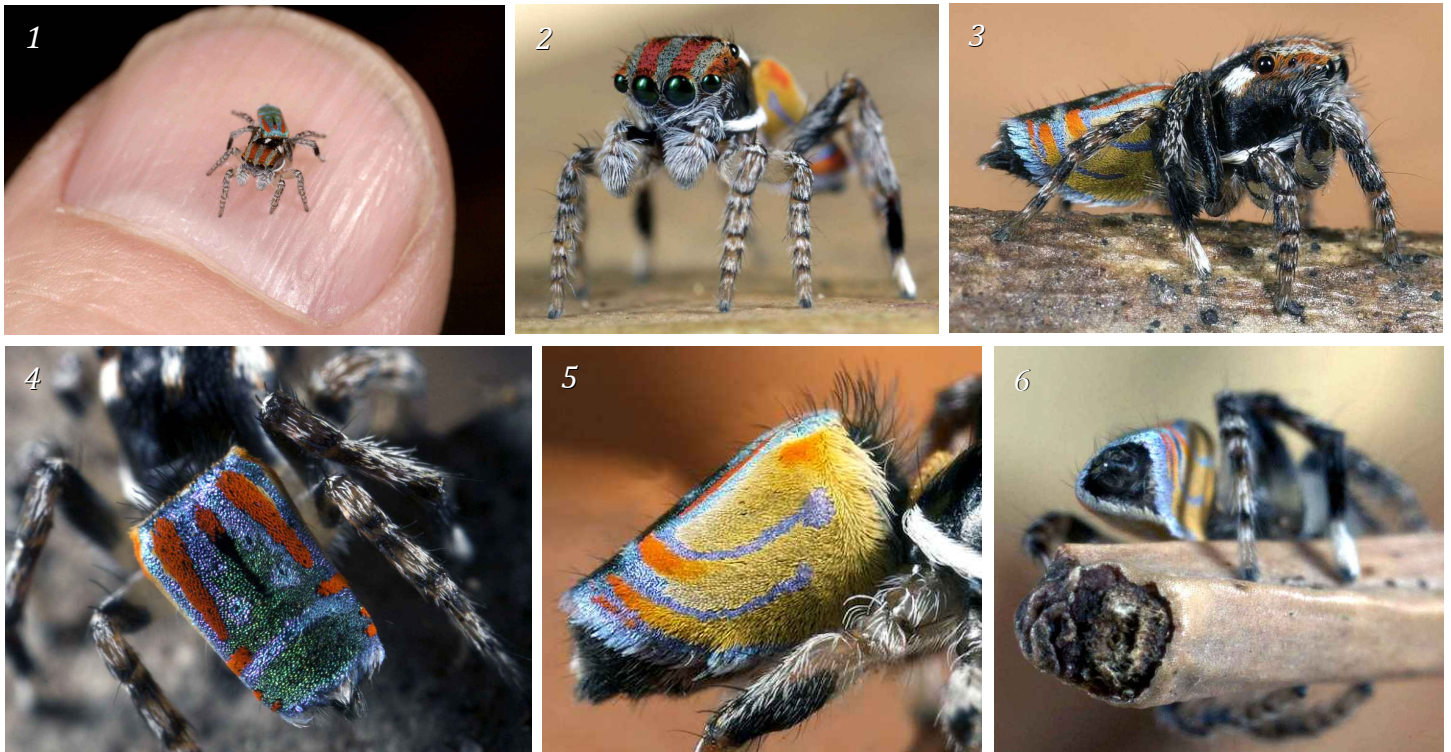


Figure 10. Views of an adult male *Maratus volans* from the vicinity of Sydney, New South Wales, Australia. 1, *M. volans* is little more than 4 mm in length, as shown here. 2, Alert and elevated spider. 3, Lateral view, showing the similarity of this spider's third legs to those of *Saitis barbipes*, with respect to the dark, setose metatarsus and white tarsus. The fringed *fan* is folded tightly around the opisthosoma. 4, Dorsal view of opisthosoma, showing vivid pattern of bright or iridescent scales. 5, Lateral view of opisthosoma, composited from two photographs to improve depth of field. 6, As shown in this posterior view, the lateral margins of the retracted fan meet at the venter. Photographs in this figure and Figures 11–24, 26–29 © Jürgen Otto, used by permission.³

The female *M. volans* is somewhat translucent, and cryptic brown in coloration. The color pattern resembles that of the female *Saitis barbipes* (Figure 11).



Figure 11. Views of adult female *Maratus volans* from the vicinity of Sydney, New South Wales, Australia. As shown in (3), females also have elongated legs III, and these can be extended in a display. The nature of the display shown here is not known.³

Like other salticid males, the male *M. volans* is active and wary. Upon sighting a female, a male can quickly produce a vivid, visual display that includes elevation of the unfurled fan, accompanied by extension and movement of legs III (Figure 12). The courtship display of many male salticids resembles their threat or protective display with respect to the use of legs I, but in these euophryines, the courtship display is distinctly different from a threatening or defensive posture (Figure 13).



Figure 12. Views of adult male *Maratus volans* from the vicinity of Sydney, New South Wales, Australia. 1–2, Two views of a spider peering over the edge of a leaf in a manner common to many salticids, concealing itself from what lies on the other side. 3–4, Spider before and after initiation of its courtship display.³

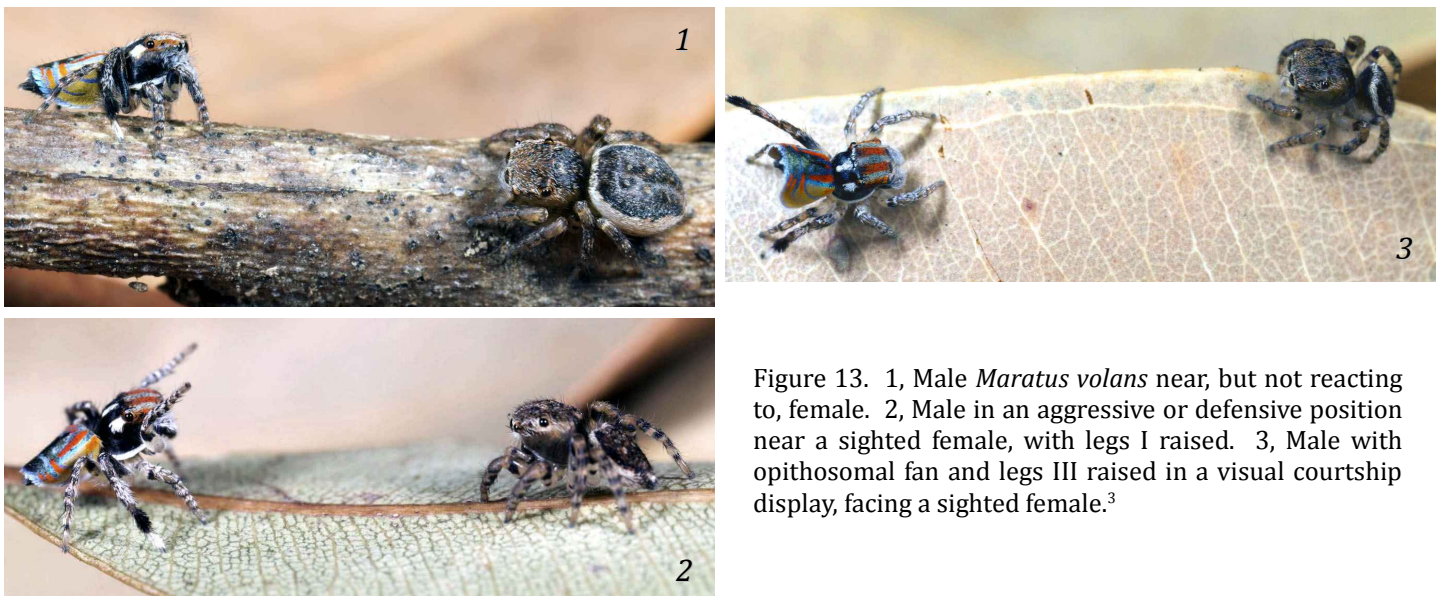


Figure 13. 1, Male *Maratus volans* near, but not reacting to, female. 2, Male in an aggressive or defensive position near a sighted female, with legs I raised. 3, Male with opithosomal fan and legs III raised in a visual courtship display, facing a sighted female.³

Based upon photographic evidence presented in Figure 14, it appears that *Maratus* rely primarily on thrust associated with extension of legs III to initiate their ballistic flight. This differs from the use of legs IV for this purpose in other salticid spiders (Parry and Brown 1959, Hill 2006), and is consistent with the view that these spiders live on or near the ground, where the vertical component of thrust is better served by legs III. As discussed previously, no extension of the opisthosomal fan accompanied initiation of the jumps depicted here.

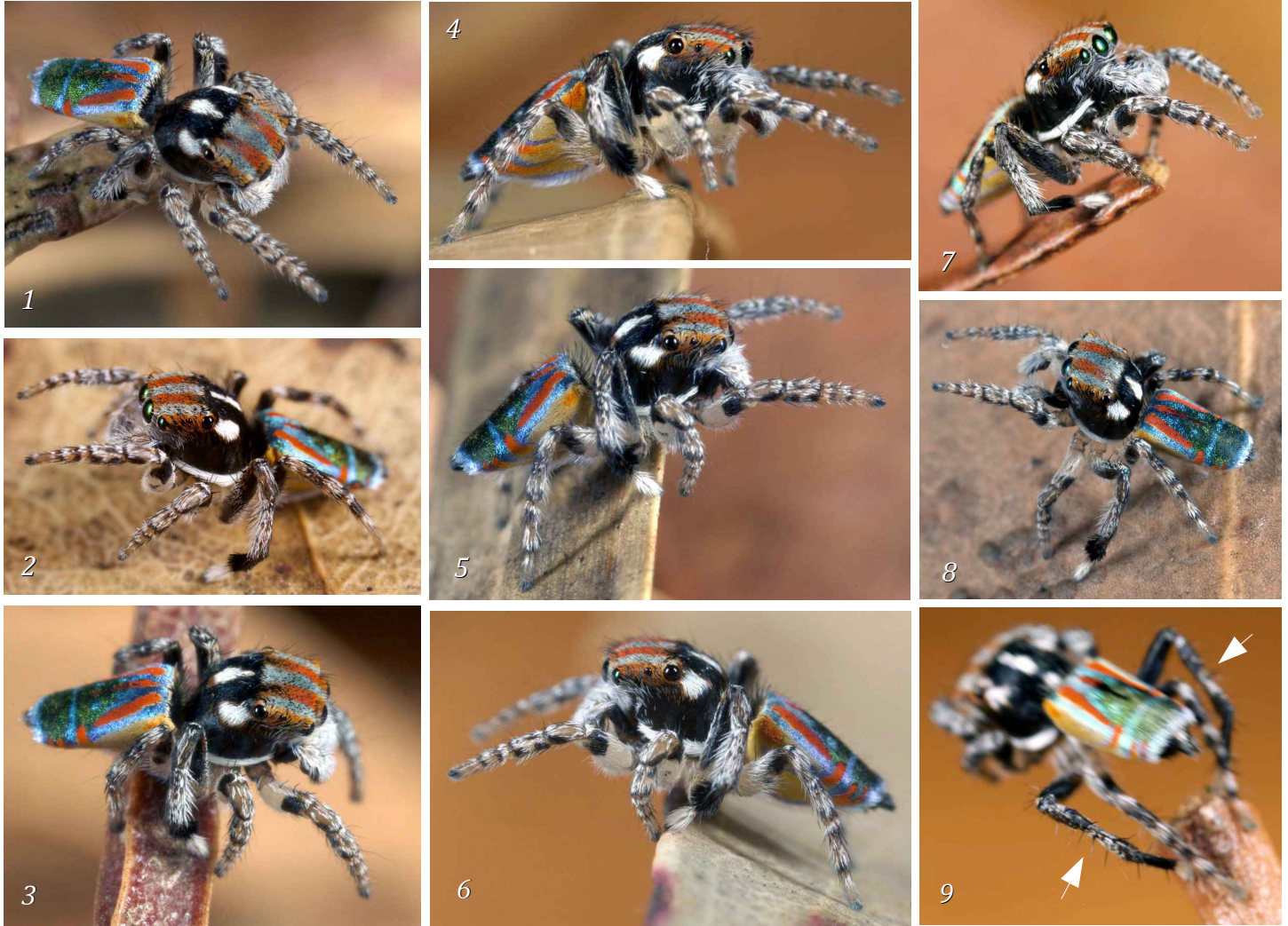


Figure 14. 1–8, Male *Maratus volans* preparing to jump. Except as required to secure a foothold for support (3), legs IV were not flexed against the substrate, as were the elongated legs III. No extension of the opisthosomal fan can be observed here. 9, This photograph captured a spider at the take-off (acceleration phase of jump), as legs III (arrows) were extended. Given their limited flexion prior to the jump, and their limited extension at the take-off, it is likely that the contribution of legs IV to forward acceleration, if any, was much less than that observed for other salticids.³

The first series of photographs of *M. volans* that I reviewed showed a positive correlation between the elevation of the opisthosoma and the lateral expansion of the fan (Figure 15). As a result, I initially thought that these were linked mechanically, much as a sheet of paper rolled from side to side can be extended or flattened by bending it forward slightly, from top to bottom. However, additional photographs (Figure 16) have shown clearly that this mechanical constraint does not exist, and lateral extension of the fan is not an inevitable result of elevation of the prosoma. During the courtship display, this spider can extend and retract its fan freely when the opisthosoma is elevated. This mechanism is most likely linked to hydrostatic (variable internal fluid pressure) inflation of the fan, but the details have yet to be determined.

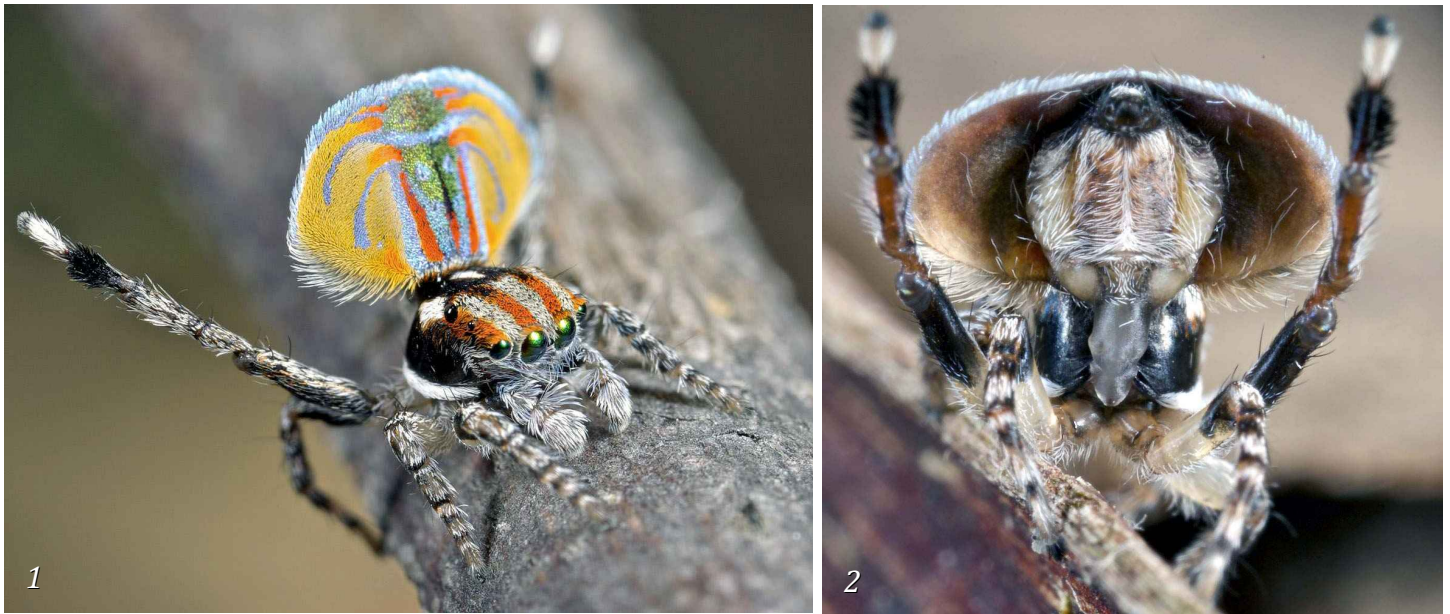


Figure 15. Anterior (1), and posterior (2) views of an adult male *M. volans* with expanded fan. The second view (2) suggests that ventral contraction of the elevated opisthosoma may be associated with inflation of the fan. Note the extended, translucent pedicel at center, flanked (in this view) by the shiny black rear carapace. This view also shows how flexibility at the articulation between the femur and the constricted proximal patella allows legs III to be raised into this extreme position.³

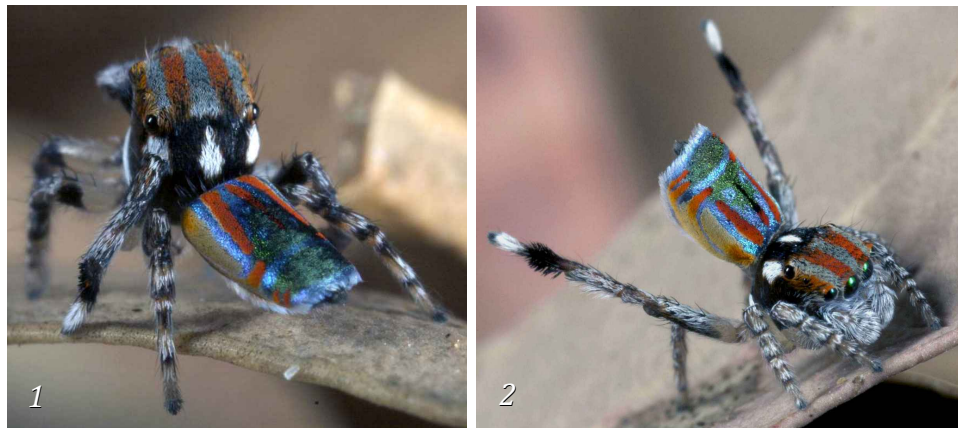


Figure 16. As shown here (1, 2) elevation of the opisthosoma relative to the prosoma does not force expansion of the fan.³

During the course of courtship display, the male *M. volans* can signal to the female with both legs III in unison, held at varying degrees of separation or elevation (Figures 17-20), or with a single leg III (Figure 21). These legs can be raised to a near-vertical position, lowered laterally, or lowered toward the rear. The fan itself can be expanded laterally, or retracted, and the opisthosoma can be raised or lowered, during the display (Figure 22). The opisthosomal fan can also be rotated or turned somewhat to the side, apparently to improve the response of the female to the presentation (Figure 23). Legs III may also be used to display without expansion and elevation of the fan (Figure 24). According to the Jürgen Otto (2009), males were usually observed displaying with extended legs III, without use of their flaps (the fan), when they lost sight of a female. In this situation they *continued to move the third pair of legs from a vertical to a horizontal position, describing a semi-circle, for quite a long time (certainly more than a minute)*. Males were frequently seen to move the fan from side to side in front of females, and they were constantly *on their toes* (e. g., Figures 17.1, 18.1), and stepped sideways, during their display. Observed displays were generally short-lived, *not lasting more than a few seconds*. The greatest observed duration of extension and display of the fan by a male was about 10 seconds. The *females often wagged their abdomen after having seen a male performing his dance*, but mating was not observed as *the dance usually*

ended with the male being frightened away by the female.

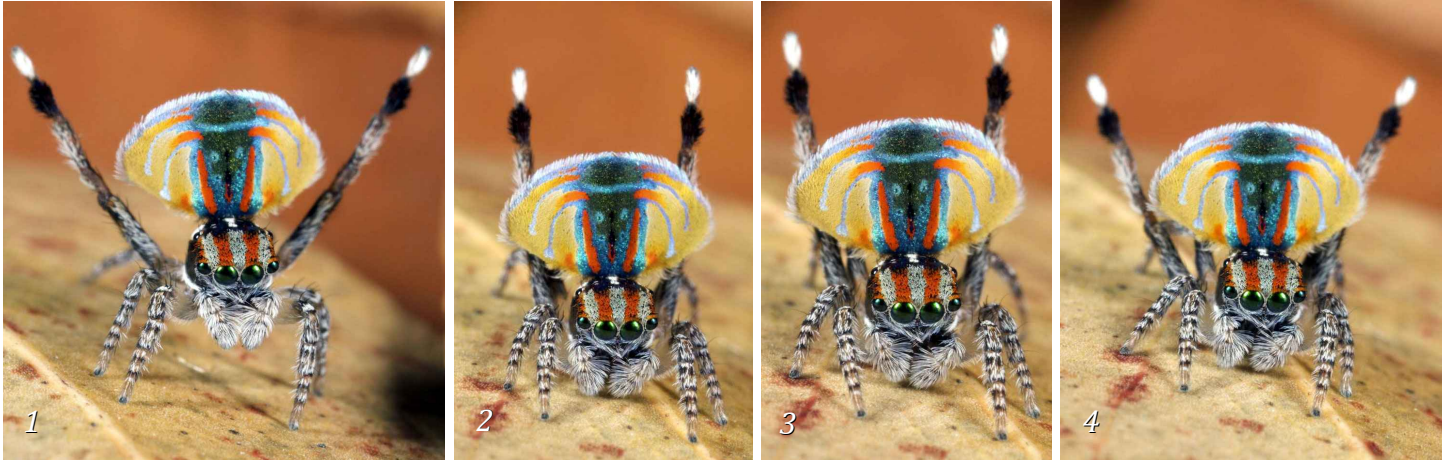


Figure 17. Sequence (1–4) showing legs III moved together, behind the expanded fan. In (4) legs III were lowered to the rear.³

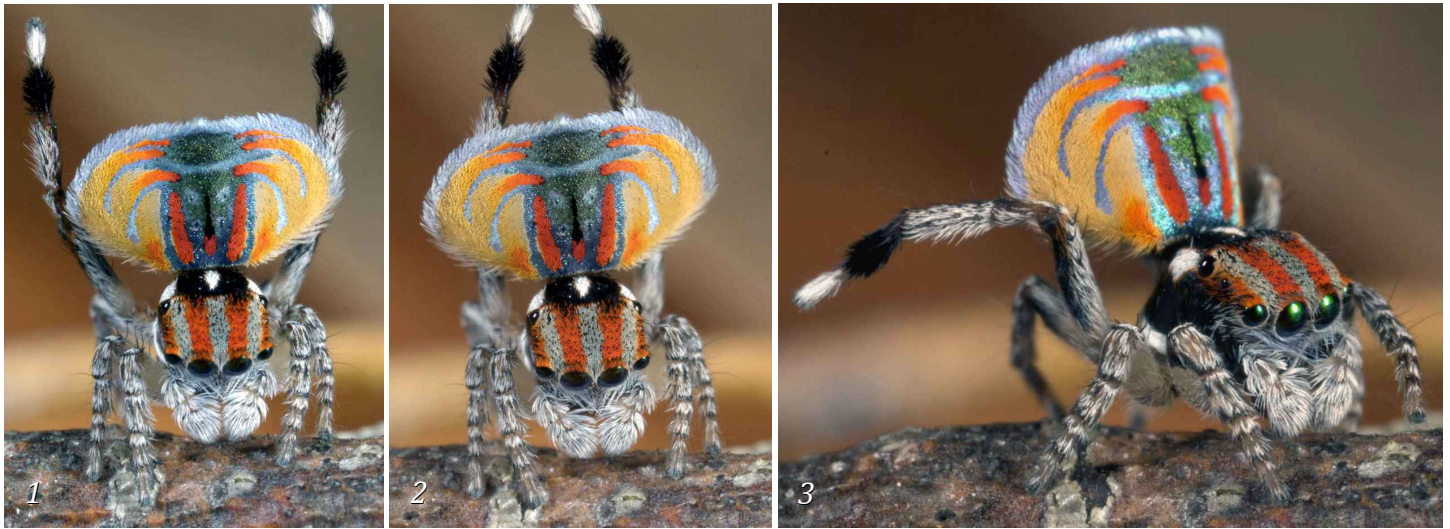


Figure 18. Sequence (1–3), showing legs III moved up to a position above the expanded fan (2), and then lowered (3) as the spider turned.³



Figure 19. Sequence (1–4), as this spider brought vertical legs III together over the expanded fan (4). Note slight movement of the fan from a left (toward right of the spider) tilt (2) to a right tilt (4).³



Figure 20. Sequence (1–2), showing elevation of legs III from a retrograde position, and expansion of the fan, in lateral view.³

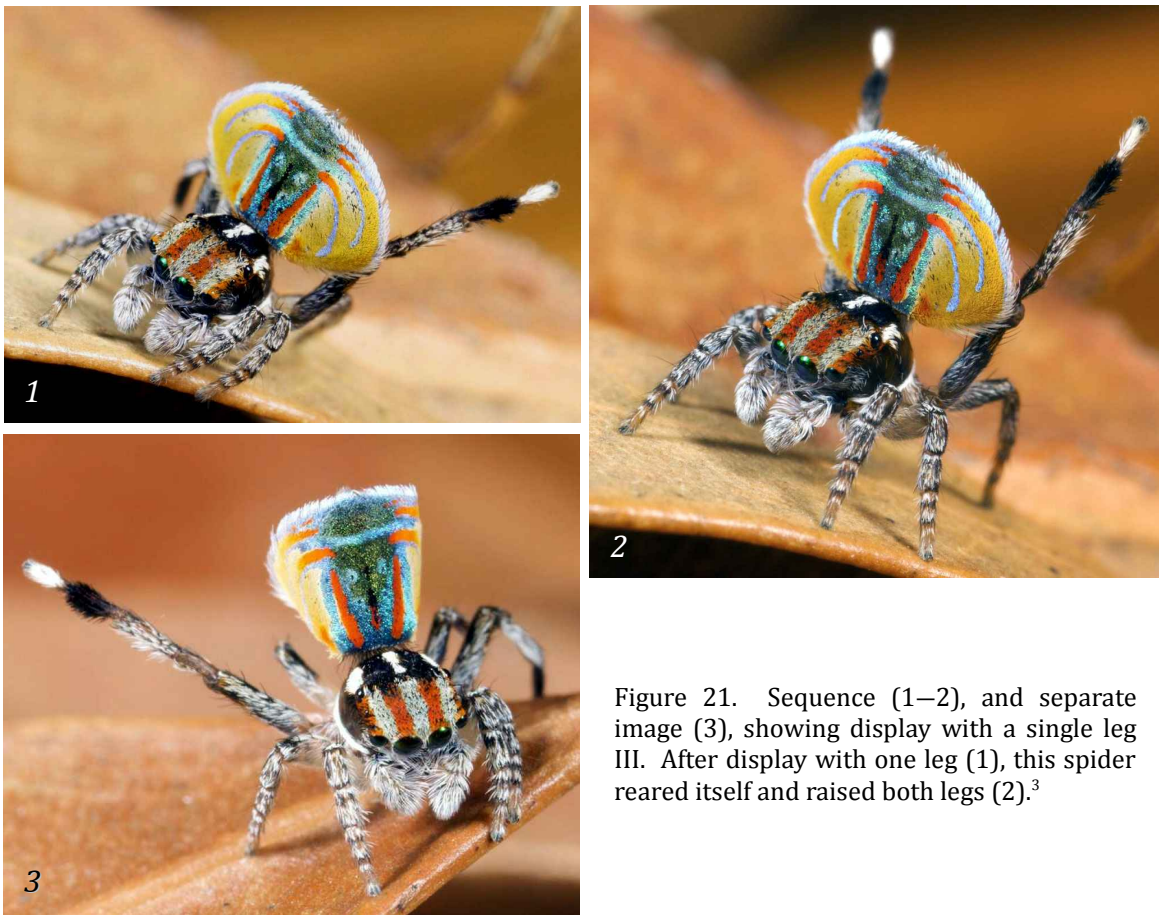


Figure 21. Sequence (1–2), and separate image (3), showing display with a single leg III. After display with one leg (1), this spider reared itself and raised both legs (2).³

This brief and preliminary review of characteristics of the display of *Maratus volans* is based on the examination of sets of sequential photographs, corroborated by the direct observations by the photographer, Jürgen Otto (2009). Further study, including the analysis of video segments, will be needed to demonstrate the full repertoire of these spiders, and to establish the role and effect of each component.

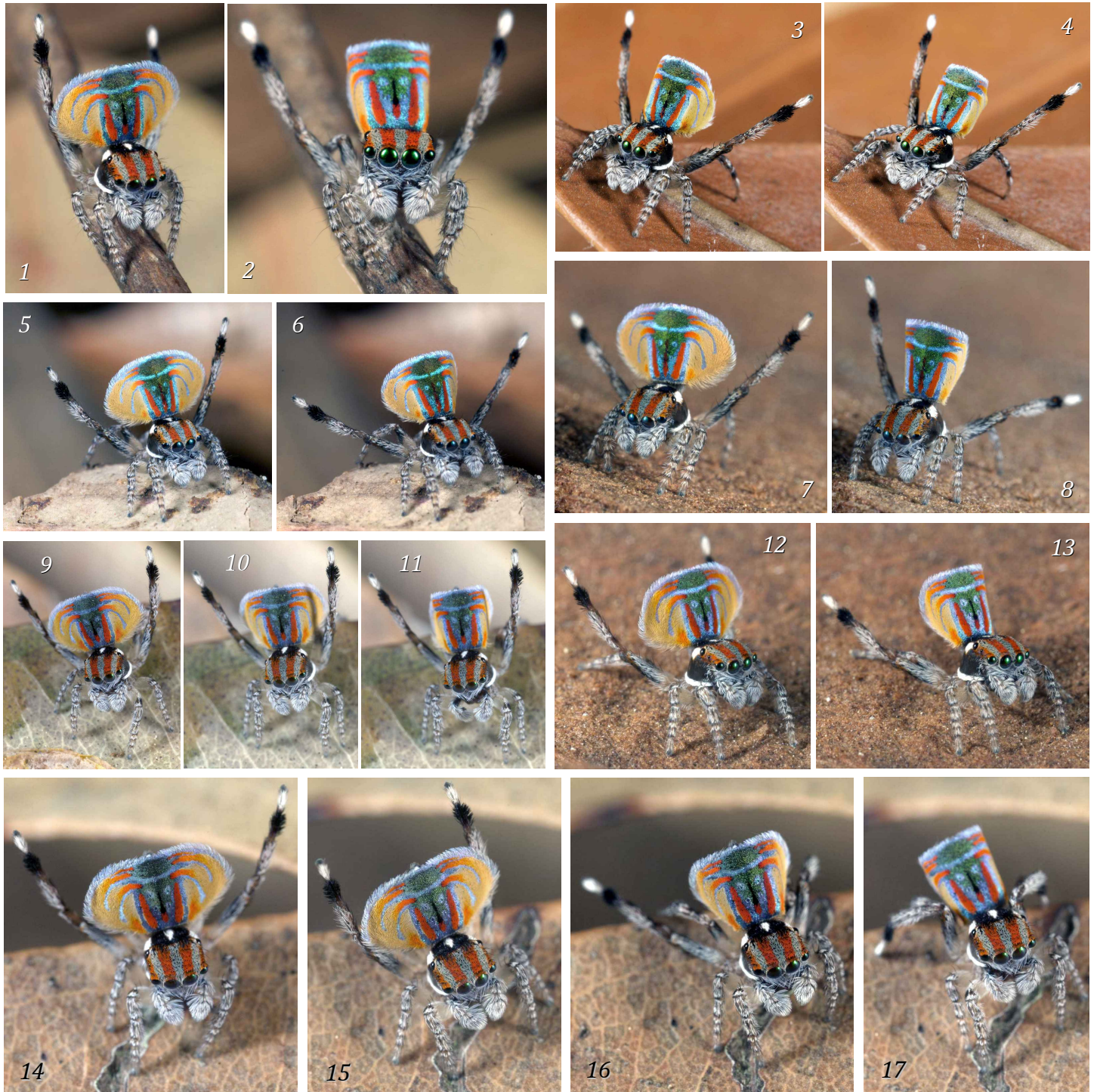


Figure 22. Seven sequences (1–2, 3–4, 5–6, 7–8, 9–11, 12–13, 14–17) showing contraction or folding of the extended fan during courtship display. Note the extreme retrograde position of legs III in (13) and (16).³

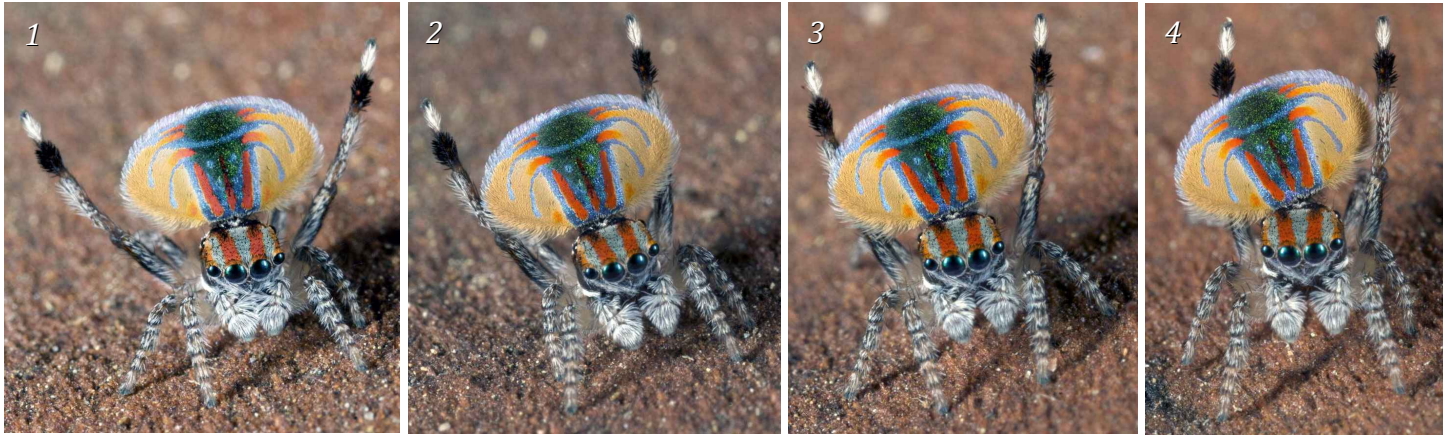


Figure 23. Sequence (1–4) showing ability of a male to rotate the opisthosomal fan to the side (3–4) during courtship display.³



Figure 24. Sequences showing display with legs III (1–2), and display with leg LIII (3–4). without elevation of the opisthosoma or expansion of the fan.³

Other species of *Maratus* have equally remarkable fans. One, *Maratus pavonis* (Dunn 1947) was originally described from Victoria, but is here figured (Figure 25) from Western Australia. This spider has also been reported from the vicinity of Hobart, Tasmania (Zosterops 2008). Legs III of males resemble those of *Saitis barbipes*, with dark red coloration, and the fan has a bright red pattern that forms a bold circular target when expanded, surrounded by iridescent blue-green scales.



Figure 25. Two different (1, 2–3) adult male *Maratus pavonis* from Herdsman Lake near Perth in Western Australia. This species, without the red coloration on legs III, was figured by Waldock (2007). Note the translucence of legs I, II, and IV. Photographs © by Farhan Bokhari, used by permission.³

Waldock (2007) provided several illustrations of the courtship display of male *M. pavonis*, depicting their extended legs III in different positions (elevated, extended to the rear), as well as the elevation of the opisthosoma in association with lateral expansion of the opisthosomal flaps. By this account, males move each leg III in a jerky manner, separately at first, and then in unison, jerking them down stiffly onto the substrate. This would compare with the vigorous tapping observed for a male *Saitis barbipes* in the proximity of a female. The lateral extensions (flaps) of the fan of *M. pavonis* are much smaller than are those of *M. volans*, folding primarily to the sides of the opisthosoma when retracted, and not fully enclosing the venter. During the courtship display of these spiders, the prominent white moustache across the top of the pedipalps may be maintained as the pedipalps are positioned just below the first eye row. Waldock, as part of an ongoing study of *Maratus* courtship, also reported that the males of this species expand and then *vigorously shake* their expanded opisthosoma during the final (3 cm) approach to a female (Waldock 2007, 2008).

As noted previously, Waldock (2007) has suggested that at least 20 species of *Maratus*, most undescribed, exist. Two unidentified spiders that may be associated with this genus in the future were found recently by Jürgen Otto in the vicinity of Sydney, New South Wales, Australia, and are shown here. The first of these (Figures 26–27) has two separate lateral flaps and a posterior *plume* on either side of the opisthosoma, and these flaps can be extended laterally, and even unilaterally, as the opisthosoma is raised during courtship display. The pedipalps of the male are bright white laterally, and ivory brown medially. Like *M. volans*, this spider can also signal by unilaterally raising and extending either one of its legs III, as well as the lateral opisthosomal flaps.



Figure 26. Adult males of an unidentified *Maratus*-like spider from the vicinity of Sydney, New South Wales, Australia. 1–3, front views, showing smooth, light-blue area of anterior femur III (1), and ivory to tan setae of pedipalps, flanked by bright white. 4–5, lateral view of a male, with detail (5). Note presence of two separate lateral flaps surrounding the central pattern of iridescent light blue and red-orange scales. The anterior flap is jet-black, the posterior rounded, olive drab, with an eye pattern. The apex of the opisthosoma has a tuft of bright white scales, and several tufts or *plumes* of dark setae. 6, Detail of a different male, with darker lateral flaps. Photographs in Figures 26–29 © Jürgen Otto, used by permission.³



Figure 27. Additional views of adult males of the species shown in Figure 26, also from the vicinity of Sydney, New South Wales, Australia. 1–12, Males with the opisthosomal flaps or fan in retracted position. Note the relatively light color of the rounded posterior flaps, and the white-tipped apical plumes of one male (12). Some males (*e. g.*, 1, 9) had longer apical plumes. In (4) you can see the clear blue-gray area of the anterior femora III. 13–16, Males signaling by extension of one leg III. Two views of a male with the flaps on the left side of the elevated opisthosoma extended are shown in 15–16. In this case, the flaps were extended in concert with extension of leg III on the same side. These spiders can also extend flaps on both sides of the opisthosoma at the same time.

The second of these spiders (Figures 28–29) has a distinctive plate of bright, iridescent scales on the dorsal opisthosoma that probably figure into its courtship display, but this spider does not appear to have any major lateral flaps or extensions. It may be able to elevate and flatten this normally curved plate in the manner of *M. volans*. As in *Maratus*, legs III of this spider are also prominent. The solid white line at

the top of the raised pedipalps of the male resembles the face of *M. pavonis*.

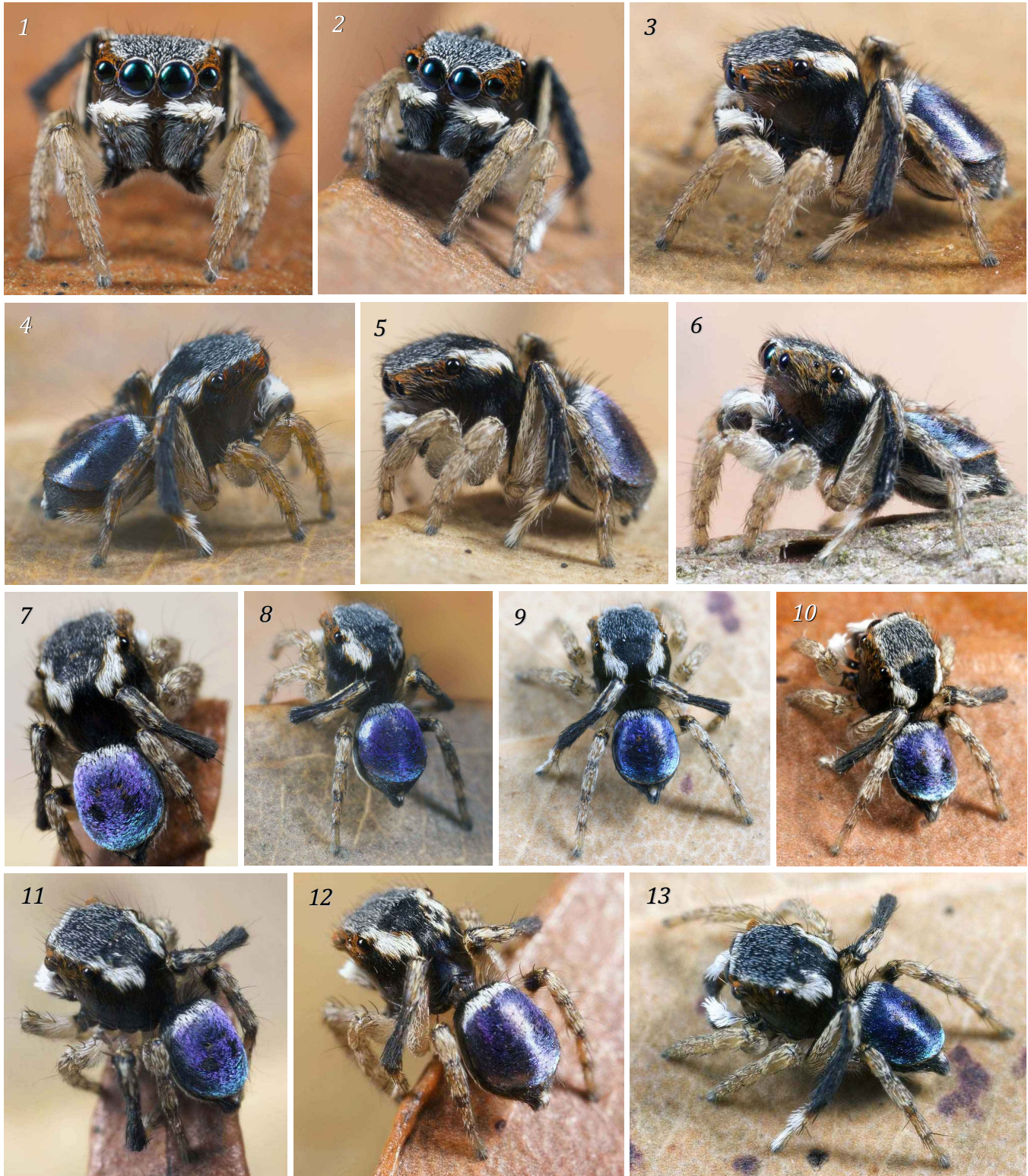


Figure 28. Adult males representing a second unidentified adult male salticid from the vicinity of Sydney, New South Wales, Australia. This spider has a plate of bright blue to purple, iridescent scales on the dorsal opisthosoma. Legs III are also elongated and marked in the pattern of *Maratus*. Note the reddish, dorsal-lateral scales associated with the lateral eyes, and the presence of white setae on the distal portion of the metatarsus, and the tarsus. When the pedipalps are held together (1–2), they produce a bright white horizontal line under the eyes, a feature found in a number of other salticids, including *M. pavonis*. This spider has a broad *fringe* of ventro-lateral white opisthosomal setae (6). The extent to which this spider rears its opisthosoma in the course of courtship display is not known.³

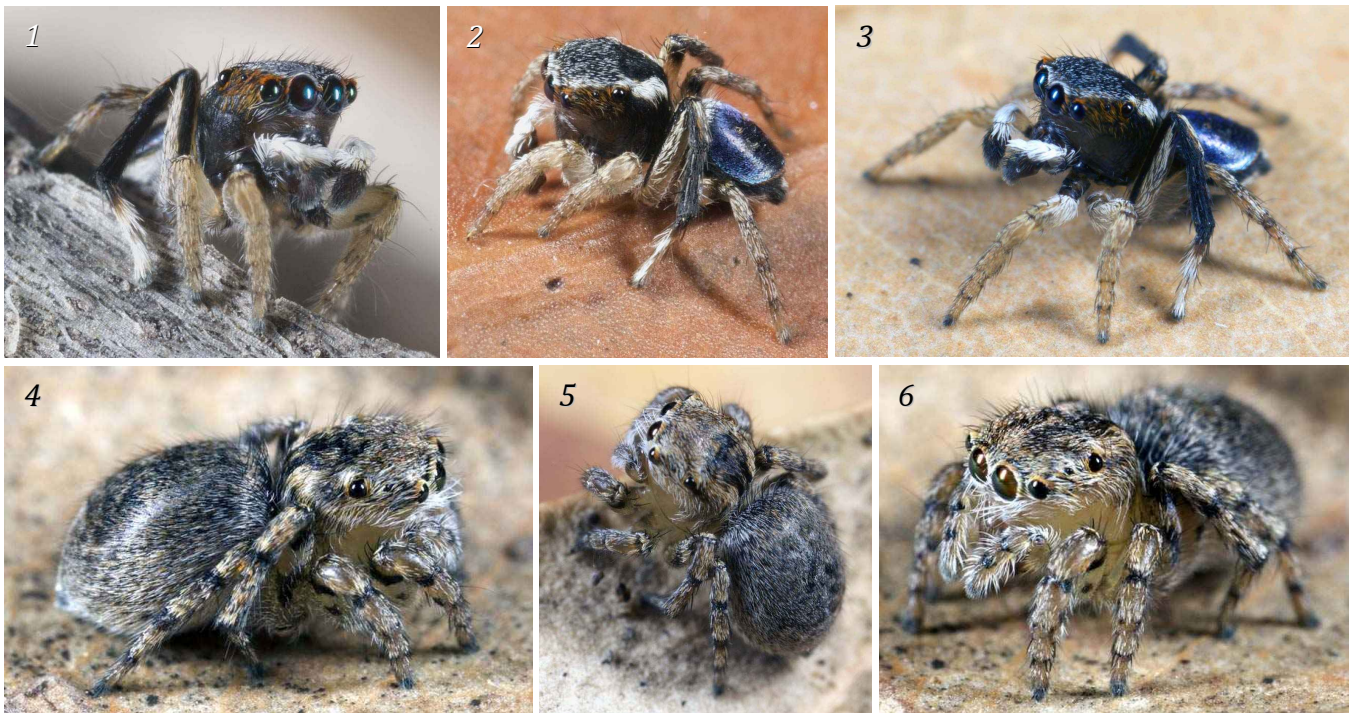


Figure 29. 1–3, Additional views of adult males of the species shown in Figure 28. Note the long, white distal setae and the flexed position of leg RIII in (1). 4–6, Females from the same locality, which may represent the same species.³

At the time that he described *volans*, O. Pickard-Cambridge also described another related *peacock* spider from New South Wales, Australia, *Saitis (Salticus) speciosus*. For reference, this description is given below (Pickard-Cambridge 1874, pp. 180-182), followed by the original figures (Figure 28):

***Salticus (Attus) speciosus*, n. sp.** Plate XVII. fig. 5.

Adult male, length nearly 2 1/2 lines.

The *cephalothorax* of this beautiful species is of ordinary form; its colour is a dark reddish brown, nearly black on the quadrangular area enclosed by the eyes; this space is clothed with short reddish-yellow hairs, mixed with others fewer and longer, both dark-coloured and of a hoary hue, the latter chiefly round the eyes on the anterior portion: the lower part of the sides all round is thinly clothed with fine hoary hairs; and there is a largish, oblong, longitudinal, central patch of white hairs on and behind the occiput; behind each of the eyes of the hinder row is also a small spot of similar hairs.

The *eyes* are mother-of-pearl-like, those of the first row being of a soft green colour, changing to amethyst and bluish grey; they form a quadrangular figure, whose transverse is considerably longer than its longitudinal diameter; the minute eye between the laterals of the first and third rows on each side is intermediate between and in the same straight line with them; the fore lateral eyes are rather less than half the diameter of the fore centrals, being but very slightly (if at all) larger than those of the third or hinder row: the height of the clypeus, which retreats, is less than half the diameter of the fore central eye.

The *legs* are moderate in length and strength; their relative length is apparently 3, 4, 1, 2 (1 and 2 being almost equal); they are of a brownish-yellow colour, paler in parts, and irregularly, but pretty distinctly and boldly, marked and blotched with blackish brown: the tibiae and metatarsi of the hinder pair are strongly fringed on each side with black bristly hairs; other ordinary hairs clothe the rest; all are furnished with a few spines, and have a strong claw-tuft at the extremity of each tarsus.

The *palpi* are short and similar to the legs in colour; they are clothed with long hairs, nearly all of which are white. The radial joint is considerably shorter and less strong than the cubital, and has its outer extremity continued in the form of a rather slender, tapering, sharp-pointed, thorn-like apophysis, equal in length to the joint itself, but not easy to be seen among the long hairs by which it is concealed; the digital joint is oblong-oval, not very large, but somewhat truncated at its fore extremity, and darker-coloured than the rest of the palpus. The palpal organs consist apparently of a large oval lobe, most prominent towards the hinder part.

The *falces* are small, inclined backwards, placed a good way back, beneath the ocular region, and of a dark yellow-brown

colour.

The *abdomen* is of a broad-oval form and flattish, sloping gradually (when seen in profile) from the fore part to the spinners; the upper surface is densely clothed with short adpressed scale-like hairs, among which are a few erect ordinary ones; the lateral margins, quite round to the spinners, appear to project slightly, and are furnished with a rather dense fringe of long, buff and pale yellowish-white, silky hairs; these fringes are very characteristic; and, from their appearance in the six examples that have come under my notice, I suspect that the living spider has power to raise and depress or expand them as a peacock does its train, and that when so expanded they assist to sustain the spider in its leaps. The slightly projecting lateral margins of the upper epidermis appear also to connect this spider with *Salticus volans* (last described); and there is a general similarity in the colouring of the two species: the upperside of the abdomen in the present spider is broadly and transversely banded with alternate and somewhat wavy bands of scarlet maroon and brilliant emerald-green, changing to blue with the different incidences of the light; there are three bands of the scarlet-maroon colour, and four of emerald, the foremost and hindmost bands being of this latter colour; the underside is of a uniform brownish yellow, marked and spotted with dark brown, and clothed with hoary hairs.

Six examples of this interesting and lovely species were received in 1864 from the Swan River, New South Wales.

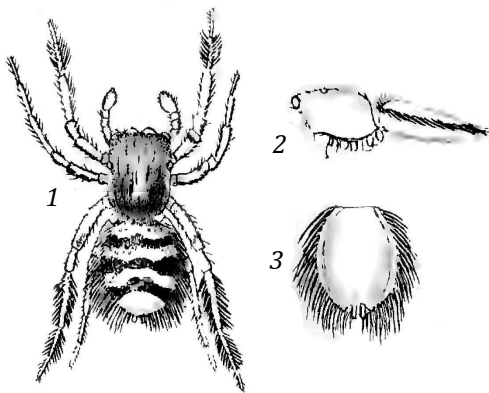


Figure 30. Illustration of *Saitis* (*Salticus* or *Attus*) *speciosus* by O. P.-Cambridge (1874, plate XVII, Fig. 5).³ The original figures have deteriorated through the migration of pigment in the paper, but represent a dorsal view (1), a lateral view (2), and a ventral view of the opisthosoma (3), all of a male. The length of this spider was given as $2\frac{1}{2}$ lines, or about 5.3 mm.

Žabka (1987) redescribed *M. amabilis*, and named a new species within the genus, *M. amoenus*, later recognized as a synonym of *M. volans* when he subsequently (Žabka 1991) transferred the remaining *Maratus* out of the genus *Saitis*. *Maratus* is thus presently viewed as endemic genus with respect to Australia.

It may be that there are no true *Saitis* in Australia, and that spiders like the brilliantly colored *S. speciosus*, and the unidentified species shown in Figures 28–29, really do belong in the euophryine genus *Lycidas*, a group endemic to Australia (Žabka 1987, Waldock 2009). At the same time, these spiders bear distinctive plates (or fans) of scales on the dorsal opisthosoma, and prominent third legs. Neither of these features has been attributed to many *Lycidas*, known primarily from drawings of genitalia that can vary little in the males (as do those of euophryines in general). It is possible that a larger view of the *Maratus* clade will encompass these, and many other Australian endemics, in the future. Recently Waldock (2007) has reported on-going work on revision of this remarkable genus.

Acknowledgments

The primary contributor to this work was Jürgen Otto, who has assembled a large collection of fine macro photographs of *Maratus volans* and related species from the vicinity of Sydney, New South Wales, Australia. There can be no doubt that this is a most impressive collection of photographs, with respect to a spider that can be rightly viewed as one of the most impressive of the Salticidae. With this work he has given us an unsurpassed view of the visual courtship display of these spiders, as well as a great curiosity for future studies. I also thank Hervé Antoine for allowing use of his remarkable and artistic video of the courtship of *Saitis barbipes*, as well as a detailed photograph of this special European spider. I would also like to thank Farhan Bokhari for use of his detailed photographs of *Maratus pavonis* from Western Australia, Dr. Heiko Metzner for the use of his fine drawings of Mediterranean *Saitis*, and Dr. Jerzy Prószyński for use of his drawings of the type specimen of *M. volans*. I thank Marek Žabka for supplying copies of his papers on these Australian spiders, and Julianne Waldock for her review of the identity

of known (or unknown) Australian species.

I am also grateful to Dr. Heiko Metzner, Jürgen Otto, and Dr. Jerzy Prószyński for their critical reviews of the manuscript, and for their respective contributions to the content of the final paper.

References

- Antoine, H. 2008.** La mâle de l'araignée *Saitis barbipes* danse devant sa femelle pour la séduire. Video.
http://www.dailymotion.com/video/x7qmpz_saitis_animals
<http://www.dailymotion.com/rated/user/proscopia/video/x7qmpz>
http://www.clipser.com/watch_video/1132156
- Dudley, R., G. Byrnes, S. P. Yanoviak, B. Borrell, R. M. Brown, and J. A. McGuire. 2007.** Gliding and functional origins of flight: biomechanical novelty or necessity? *Annual Review of Ecology and Evolutionary Systematics* 38: 179-201.
- Dunn, R. A. 1947.** A new salticid spider from Victoria. *Memoires of the National Museum of Victoria* 15: 82-85.
- Griswold, C. E. 1987.** A revision of the jumping spider genus *Habronattus* F. O. P.-Cambridge (Araneae: Salticidae), with phenetic and cladistic analyses. *University of California Publications in Entomology* 107: i-ix, 1-344.
- Hill, D. E. 2006.** Targeted jumps by salticid spiders (Araneae, Salticidae, *Phidippus*). [Peckhamia Epublications](#). 1-28.
- Hill, D. E. 2009.** Courtship and mating behavior of *Anasaitis canosa* jumping spiders in Greenville County, SC, USA. Video.
[Internet Archive 201MB, 32:51.](#)
- Logunov, D. V. 2001.** New and poorly known species of the jumping spiders (Aranei: Salticidae) from Afghanistan, Iran and Crete. *Arthropoda Selecta* 10 (1): 59-66.
- Maddison, W. P. 2009.** Euophryinae. Tree of Life web project. June 21, 2009.
<http://www.tolweb.org/Euophryinae/2855>
- Maddison, W. P., M. R. Bodner and K. M. Needham. 2008.** Salticid spider phylogeny revisited, with the discovery of a large Australasian clade (Araneae: Salticidae). *Zootaxa* 1893: 49-64.
- Maddison, W. P. and M. C. Hedin. 2003.** Jumping spider phylogeny (Araneae: Salticidae). *Invertebrate Systematics* 17: 529-549.
- Metzner, H. 1999.** Die Springspinnen Griechenlands. *Andrias* 14: 1-279. Karlsruhe.
- Metzner, H. 2009.** Worldwide database of jumping spiders (Arachnida, Araneae, Salticidae).
<http://www.jumping-spiders.com/>
- Monardi, Y. 2004.** Courtship dance for *Saitis barbipes*.
http://saitis.club.fr/montardi/salticidae/courtship/courtship_frame.html
- Nieuwenhuys, E. 2008.** Peacock spider, *Maratus volans*.
http://www.xs4all.nl/~ednieuw/australian/salticidae/Peacock_spider_Maratus_volans.htm
- Otto, Jürgen. 2009.** Personal communication.
- Parry, D. A. and R. H. J. Brown. 1959.** The jumping mechanism of salticid spiders. *Journal of Experimental Biology* 36: 654-664.
- Pickard-Cambridge, O. 1874.** On some new genera and species of Araneida. *The Annals and Magazine of Natural History*. Series 4, volume 14, Issue Number 81, Paper 24: 169-183, plate XVII.
- Platnick, N. I. 2009.** Fam. Salticidae. In: *The World Spider Catalog*, Version 9.5. American Museum of Natural History.
<http://research.amnh.org/entomology/spiders/catalog/SALTICIDAE.html>
- Prószyński, J. 1976.** Studium systematyczno-zoogeograficzne nad rodzina Salticidae (Aranei) Regionow Palearktycznego i Nearktycznego. *Wyzsza Szkoła Pedagogiczna w Siedlcach Rozprawy* 6: 1-260.
- Prószyński, J. 1984.** Atlas rysunkow diagnostycznych mniej znanych Salticidae. *Zeszyty Naukowe WSRP, Siedlce*: figs. 1-177.
- Prószyński, J. 2005.** Gen. *Maratus* Karsch, 1878. In: *Catalogue of Salticidae*, version July 2005.
<http://www.salticidae.org/salticid/catalog/maratus.htm>
- Prószyński, J. 2006.** Gen. *Saitis* Simon, 1876. In: *Catalogue of Salticidae*, version April 2006.
<http://www.salticidae.org/salticid/catalog/saitis.htm>
- Prószyński, J. 2009a.** Monograph of Salticidae (Araneae) of the world. Version June 10th, 2009.
<http://www.miiz.waw.pl/salticid/main.htm>
- Prószyński, J. 2009b.** Personal communication.
- Prószyński, J. 2009c.** Global species database of Salticidae (Araneae).
<http://www.gsd-salt.miiz.waw.pl/salticidae.php>
- Richman, D. B. 1982.** Epigamic display in jumping spiders (Araneae, Salticidae) and its use in systematics. *The Journal of Arachnology* 10: 47-67.
- Richman, D. B. 1998.** The courtship of a Kansas population of *Habronattus borealis* (Araneae, Salticidae). *The Journal of Arachnology* 26: 244-246.
- Ridewood, W. G. 1913.** Guide to the exhibition of specimens illustrating the modification of the structure of animals in relation to flight. *British Museum of Natural History, Special Guide* 6: i-viii, 1-80.

- Simon, E. 1868.** Monographie des especes europeenes de la famille des Attides (Attidae Sundewall—Saltigradae Latreille). Annales de la Société entomologique de France 4(8): 11-72, 529-726, plates V-VII.
- Žabka, M. 1987.** Salticidae (Araneae) of Oriental, Australian and Pacific Regions, II. Genera *Lycidas* and *Maratus*. Annales Zoologici 40(11): 451-482.
- Žabka, M. 1991.** Studium taksonomiczno-zoogeograficzne nad Salticidae (Arachnida: Araneae) Australii. Wyższa Szkoła Rolniczo-Pedagogiczna W Siedlcach. Rozprawa Naukowa 32: 1-110.
- Waldock, J. M. 1993.** Peacocks of the spider world. Australian Natural History 24: 10-11.
- Waldock, J. M. 2007.** What's in a name? Or: why *Maratus volans* (Salticidae) cannot fly. Western Australian Museum. http://www.australasian-arachnology.org/download/Maratus_cannot_fly.pdf
- Waldock, J. M. 2008.** Debunking an urban myth: The jumping spider *Maratus* cannot fly. Australasian Arachnological Society. http://www.australasian-arachnology.org/myths/maratus_cannot_fly/
- Waldock, J. A. 2009.** Personal communication.
- Zosterops. 2008.** Flickr photographs (*Maratus pavonis*). <http://www.flickr.com/photos/zosterops/2988075215/>

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