

The Spider Genus *Toxopsoides* (Araneae: Desidae: Toxopinae): New Records and Species from Australia

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Toxopsoides huttoni Forster and Wilton from New Zealand has not been recorded since its description in a monotypic genus in 1973. Here, the species is recorded from south-eastern Australia. Additional descriptive notes and figures are provided for comparison with three new species of *Toxopsoides* that are described from the same area. *Toxopsoides erici* sp. nov. is from higher altitudes of north-eastern New South Wales and south-eastern Queensland, *T. kathleenae* sp. nov. is from the Sydney Basin and lower areas to the north-east, and *T. macleayi* sp. nov. is from the Blue Mountains to the west of Sydney. Characters are discussed pertaining to the continuing placement of the genus within family Desidae.

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INTRODUCTION

The family Toxopidae was erected by Hickman (1940) for the Tasmanian genus *Toxops* Hickman. Forster (1964) subsequently revised and delimited the family Toxopidae to include *Laestrygones* Urquhart, *Cycloctenus* L. Koch, *Plectophanes* Bryant and *Toxopsiella* Forster. In the course of writing his iconic series on New Zealand Spiders, Forster (1970) reconsidered both the family status and generic composition of the group, placing Toxopinae as a subfamily of Desidae and removing all genera except *Toxops* and *Laestrygones* and the smaller species formerly in *Toxopsiella*, which were transferred to the new genus *Hapona* Forster.

The monotypic genus *Toxopsoides*, with type species *T. huttoni* Forster and Wilton, 1973 was the final genus to be added to the subfamily. Placed at the end of the fourth part of the New Zealand series, Forster and Wilton (1973: 309) wrote: "In general appearance this genus is similar to *Toxops* from Tasmania, but it does not seem to be closely related".

Toxopsoides has turned out to be rather an enigma. The type locality of *Toxopsoides huttoni*, Waitetola in Hawkes Bay, has subsequently proven

to be an incorrect transliteration for Waitetoko, near Lake Taupo (Vink et al. 2011). The type locality remains the only published locality for this species (Vink et al. 2011), although I have not searched for further unidentified New Zealand specimens in collections. Perhaps the observation that the species was presumably a vagrant was true in more ways than apparently intended by Forster and Wilton (1973: 309).

In Australia, to my knowledge there have been no specifically identified records of *Toxopsoides* species, however, the presence of spiders referable to the genus has been recognised for some time, having been figured by Davies (1986: 42, figs 67, 67a) under family Toxopidae. Twenty-four toxopid species from the north-east forests of New South Wales were also listed by Gray and Cassis (1994), most of which were referred to the genus *Toxopsoides* in the Australian Museum databases, although not in the report.

In this paper, I provide the first records for *T. huttoni* since its description. These new records are from south-eastern Australia, where the species appears to be widespread. Three new Australian species are described, all are clearly related to *T. huttoni* in their male and female genitalic morphology:

TOXOPSOIDES IN AUSTRALIA

T. erici sp. nov. from higher altitudes of north-eastern New South Wales and south-eastern Queensland, *T. kathleenae* sp. nov. from the Sydney Basin and lower areas to the north-east, and *T. macleayi* sp. nov. from the Blue Mountains to the west of Sydney.

METHODS

Specimen examinations, measurements and drawings were made using an Olympus SZ16 microscope, fitted with graticule and camera lucida. Photographs in several focal planes (usually 15-40) were taken using a ColorViewI camera mounted on the Olympus SZ16 and layers combined using HeliconFocus software. Plates were composed using Adobe Photoshop. Diagrammatic figures were prepared using Inkscape v.0.45.1. Specimen preparations for scanning electron microscopy were passed through an alcohol series (75–100%), critical point dried and mounted on stubs before coating with gold and viewing using a Zeiss Evo LS15 SEM incorporating a Robinson backscatter detector. Internal details of female genitalia were drawn from an excised epigynum cleared in lactic acid. Eye measurements are taken in dorsal view except MOQL, which is measured from the same plane as the eye bases. Caput width is measured at the posterior edge of posterior lateral eyes.

In this paper I use the term ‘*Toxopsoides* group’ to refer to toxopine relatives of *T. huttoni* that as yet are of unassessed generic status. I use the term ‘*T. huttoni* group’ to refer to species with similar morphology to those treated herein, which are undoubtedly congeneric.

Abbreviations

Specimens with numbers prefixed KS are in the Australian Museum, Sydney, Australia; ANIC denotes the Australian National Insect Collection, Canberra, Australia. Abbreviations are used in reporting some measurements and general text, as follows: AME, anterior median eye(s); ALE, anterior lateral eye(s); EGW, eye group width; MOQAW, median ocular quadrangle anterior width; MOQL, median ocular quadrangle length; MOQPW, median ocular quadrangle posterior width; PME, posterior median eye(s); PLE, posterior lateral eye(s), SEM scanning electron micrograph or microscope.

TAXONOMY

Family Desidae Pocock

Toxopsoides Forster and Wilton, 1973

Toxopsoides Forster and Wilton 1973: 309. Type species *Toxopsoides huttoni* Forster and Wilton by original designation.

Diagnosis

From other Toxopinae genera by double row of trichobothria on metatarsi and tarsi; additionally, from *Toxops* by distinctly narrowed caput in dorsal view and male palp with median apophysis, from *Laestrygones* and *Hapona* by chelicerae with lateral boss, by absence of denticulate ventral abdominal plate present in *Laestrygones*, from *Hapona* by apical insertion of embolus of male palp.

The following combination of non-genital characters quickly separate *Toxopsoides* group species from the Cycloctenidae, Ctenidae and Zoridae—where they are most commonly misplaced in collections: eyes PLE>PME≥AME>ALE; ALE positioned c. half way between AME and PLE; at least 6 pairs of erectable ventral macrosetae on tibia one and two (rather long in females—see Fig. 2b, usually shorter in males, Fig. 2d); paturon with a single anteriorly projecting macroseta from basal third (Figs 1d, 2a); abdomen tapering posteriorly with spinnerets usually visible in dorsal view (Figs 1a, 1c); three claws without claw tufts; abdominal setae not modified, similar in size over whole dorsum.

Description

This description is based on the detailed description (= diagnosis) of Forster and Wilton (1973) with some refinements and additions. Body length up to c. 5.5 mm; laterigrade; ecribellate. Carapace highest at fovea (Fig. 1d); chilum broad, single; paturon with single anteriorly projecting macroseta at c. 1/3 length; eye group occupying most of head width; two rows of four eyes, both strongly recurved; PLE>PME≥AME>ALE; ALE positioned c. half way between AME and PLE; PME separation less than diameter of one eye; posterior eyes with open grate-shaped tapetum (similar to that figured for a borraline stiphidiid by Gray and Smith (2008 fig. 4g). Legs strongly spined, with double row of long spines along ventral surfaces of tibiae and metatarsi of legs 1 and 2; 4123 or 4(12)3 or 4(123); trichobothria long and numerous, in double row on tibiae and tarsi (longest distally); tarsal organ present; superior claws with four teeth, similar; inferior claw with two or three teeth; claw tufts, tenent hairs and scopulae lacking; pretarsus (onychium) present; trochanters shallowly notched (Fig. 2c). Epigynum weakly sclerotised; paired fovea, each with small posteriorly pointing



Figure 1. *Toxopsoides huttoni* Forster and Wilton. a, b, Female (KS.49670): a, habitus, dorsal; b, habitus, ventral; c, male (KS.120530), habitus, dorsal; d, male (KS.45210), carapace profile. Scale bar: d, 0.5 mm.

projection on ventral lip; internally, copulatory ducts initially pass anteroventrally then loop one or more times to receptacula. Colulus undivided; spinnerets with anterior and posterior pairs similar in size; distal segment short. Anal setae long and thick. Male pedipalp without locking tegular/subtegular lobes; with apically arising filiform embolus curving anticlockwise down the prolateral margin, basally

enclosed within membranous tegular outgrowth or envelope (Fig. 4c), which is continuous with sclerotised conductor (Fig. 5a, b); radix absent; median apophysis arising retrolaterally, an elongate, folded plate, rounded distally, with folded edges (Fig. 5d); tibia with retrolateral tibial apophysis and elongate plate. Pedipalp of female with trichobothria on tibia and tarsus; claw smooth.

TOXOPSOIDES IN AUSTRALIA



Figure 2. *Toxopsoides huttoni* Forster and Wilton. a, Female (KS.49670), eyes, frontal; b, c, female (KS.45210), right leg one, prolateral; c, mouthparts and anterior coxae; d, male (KS.120530), right leg one, prolateral. Scale bars b, 0.5 mm, c, 0.5 mm, d, 1.0 mm.

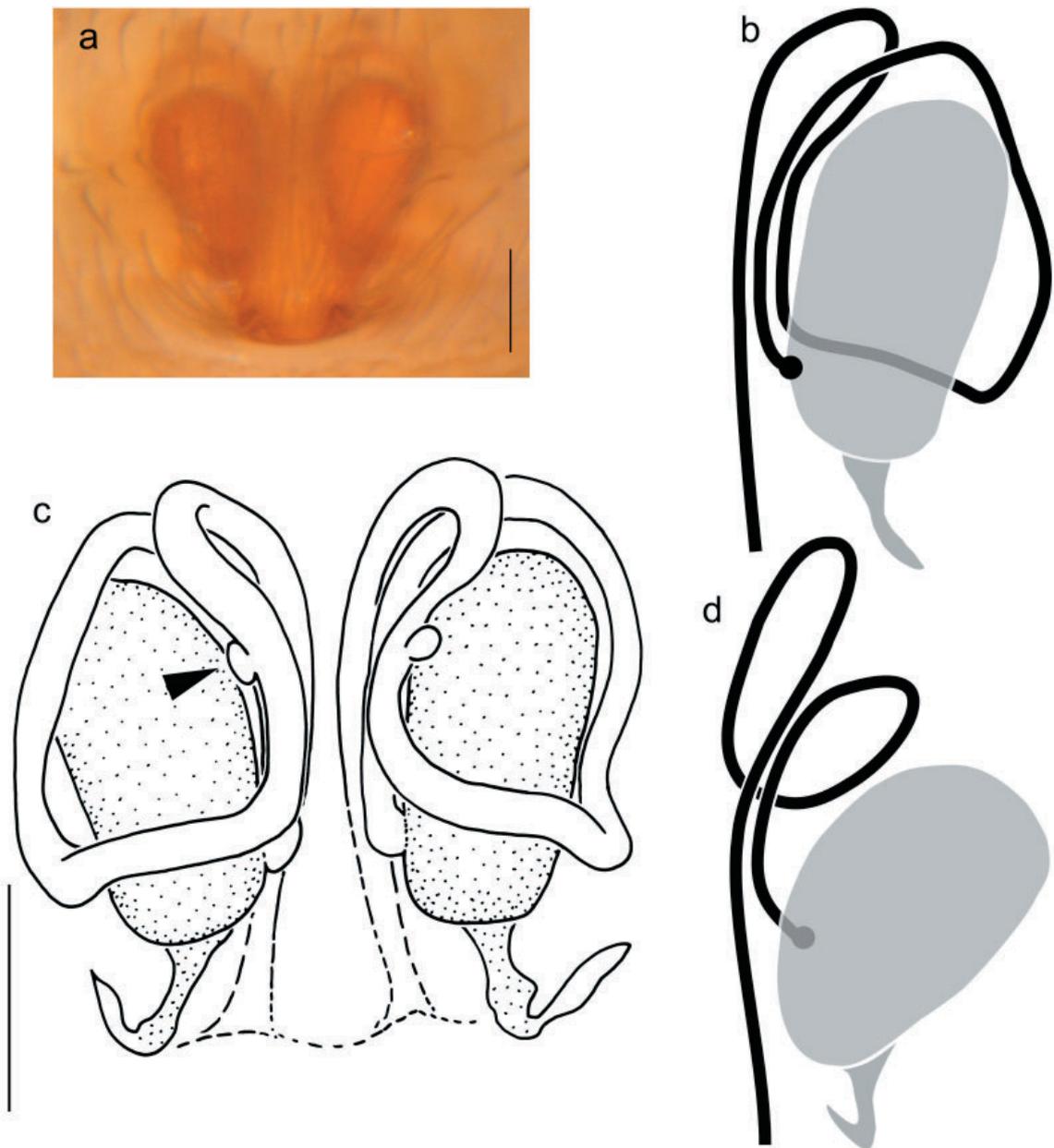


Figure 3a-c. *Toxopsoides huttoni* Forster and Wilton, female genitalia. a, Ventral photograph (KS.45210); b, diagrammatic ventral view of left spermatheca and duct based on Fig. 3c; c, dorsal (internal) cleared (KS.108220), pointer indicates nodule. d, *T. ?huttoni* South Australia, left spermatheca and duct, ventral diagrammatic. Scale bars 0.1 mm.

Comments

Forster and Wilton's figure of the internal genitalia of *T. huttoni* (Forster and Wilton, 1973: fig. 1088) shows a small glandular structure or caecum on each copulatory duct (unlabelled). The present study has confirmed that these were not artefacts and similar structures are found in all species detailed here (pointers in Figs 3c, 14c). Their detailed structure has not been probed.

The male pedipalp of *T. huttoni* group spiders have a general structure as described below for *T. huttoni*. Some other *Toxopsoides* group species lack long convoluted epigynal ducts, have short embolus and differ in other aspects of genitalic morphology; they also differ in behaviour. These species await further analysis as to generic placement.

TOXOPSOIDES IN AUSTRALIA

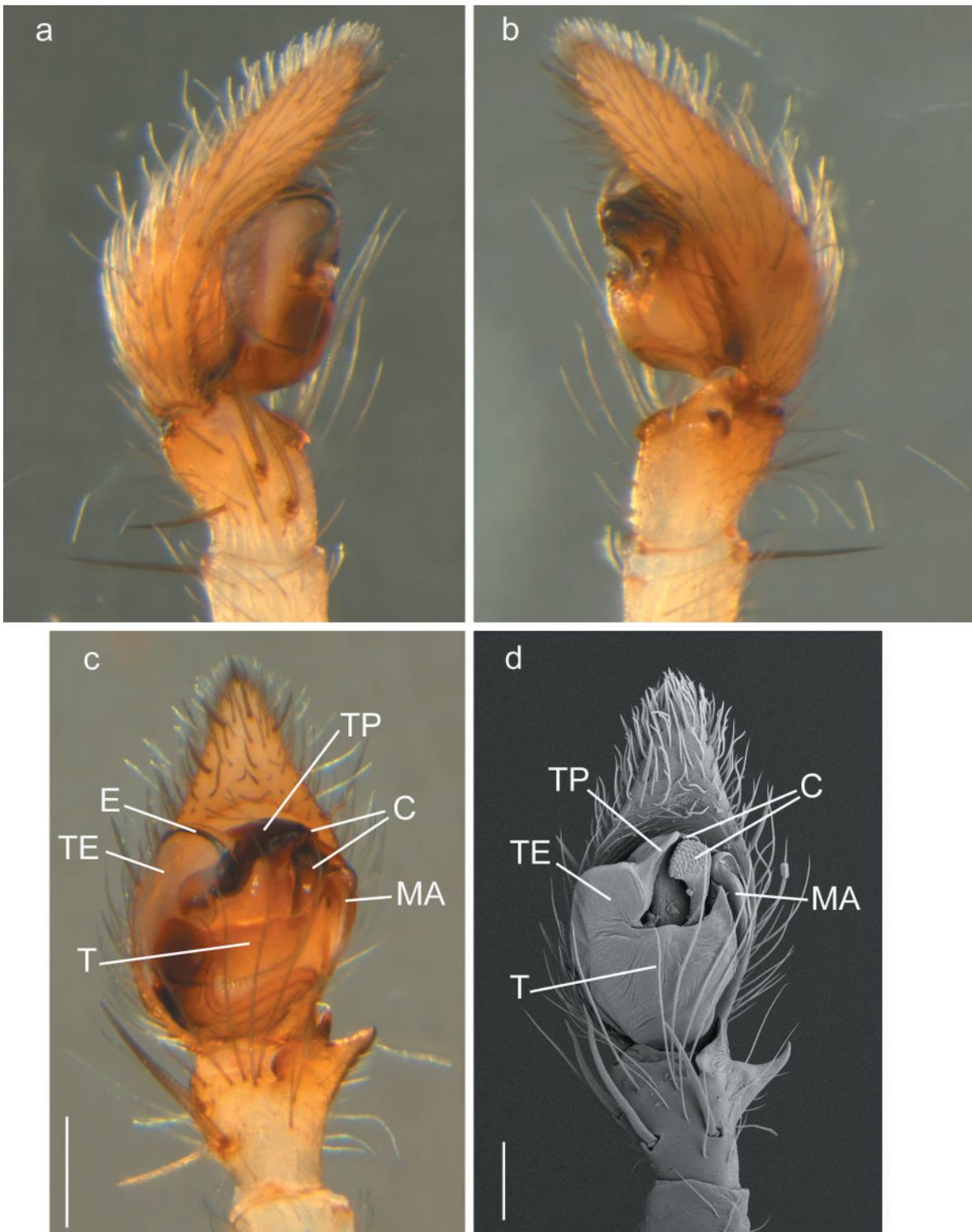


Figure 4. *Toxopsoides huttoni* Forster and Wilton, male pedipalps. a-c, Left pedipalp, prolateral, retro-lateral and ventral (KS.108220, Gulaga NP, NSW); d, ventral (right, image reversed) SEM (KS.45210, Macedon, Vic). Scale bars 0.2 mm. Labels: E, embolus (inside TE); C, conductor; MA, median apophysis; T, tegulum; TE, tegular envelope; TP, tegular envelope process.

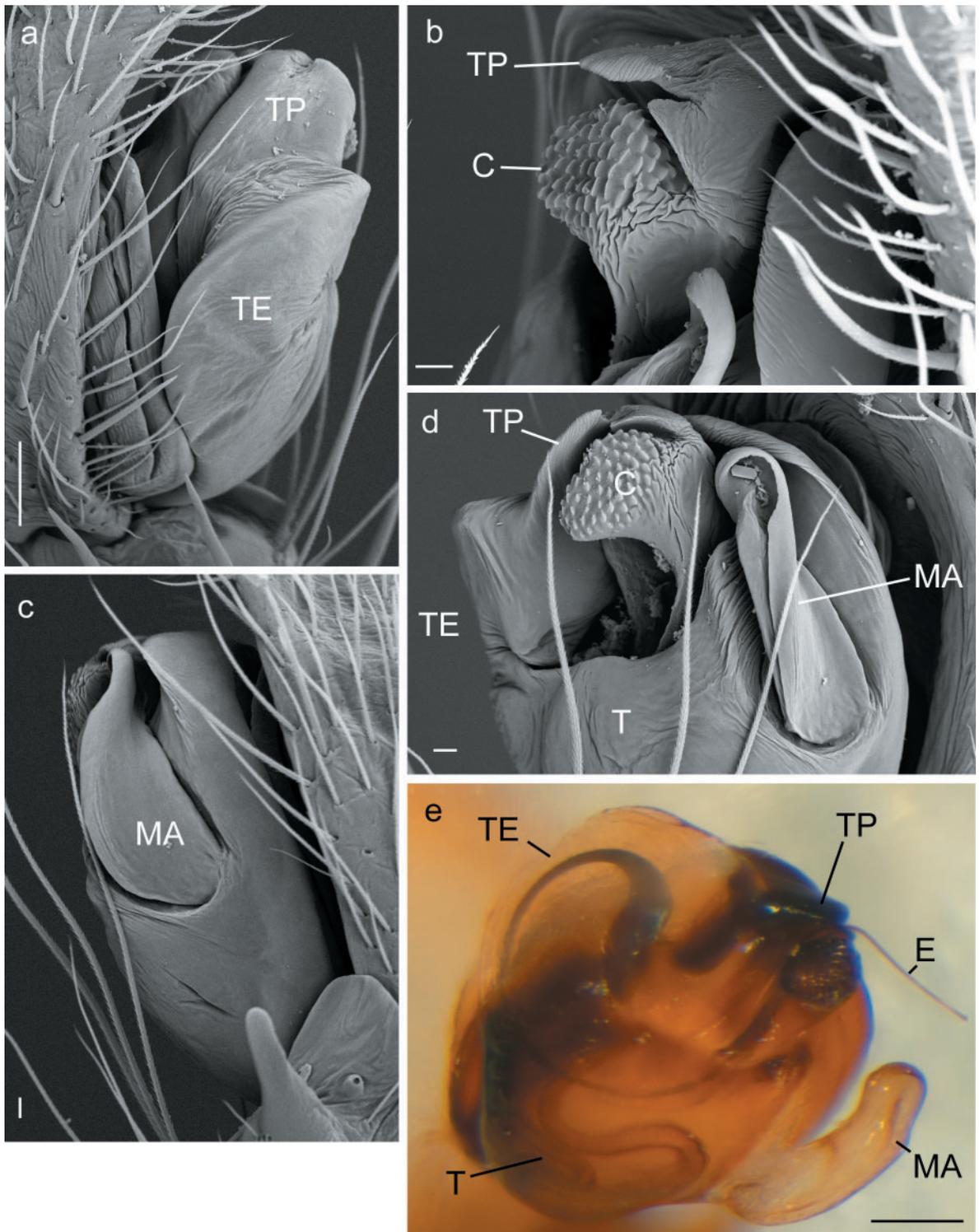


Figure 5. *Toxopsoides huttoni* Forster and Wilton, male pedipalp. a-d, SEM details (KS.45210, right, images reversed): a, prolateral; b, retroapical; c, retrolateral; d, retroventral; e, expanded left bulbus, proapical (KS.120530). Scale bars: a, e, 0.1 mm; b-d, 20 μ m. Labels: E, embolus; C, conductor; MA, median apophysis; T, tegulum; TE, tegular envelope; TP, tegular envelope process.

TOXOPSOIDES IN AUSTRALIA

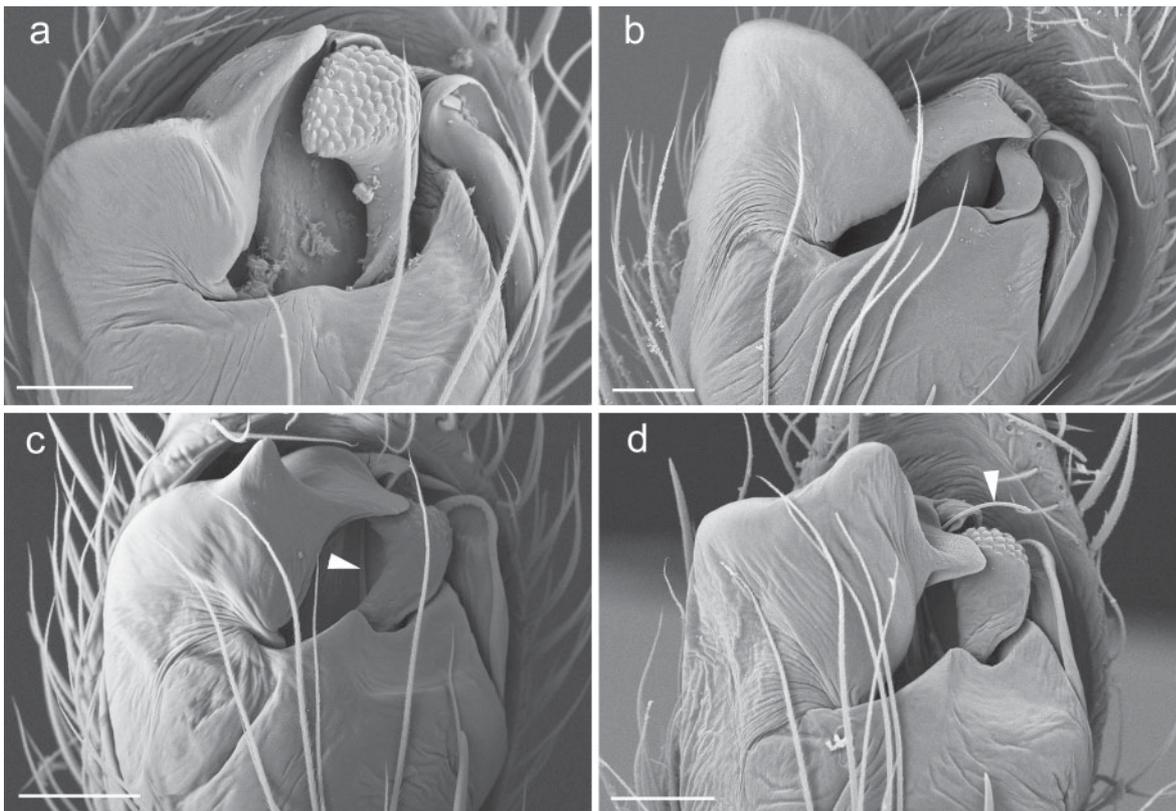


Figure 6. *Toxopsoides* species, male pedipalps, comparison of apical half of left bulbus, ventral. a, *T. huttoni* Forster and Wilton (KS.45210, right, image reversed); b, *T. erici* sp. nov. (KS.103221); c, *T. kathleenae* sp. nov. (KS.118808); d, *T. macleayi* sp. nov. (KS.115589). Scale bars 0.1 mm. Pointers indicate visible embolus.

Included species

Toxopsoides huttoni Forster and Wilton, 1973 (North Island of New Zealand, Victoria to south-east New South Wales, Australia); *T. erici* sp. nov. (Barrington Massif and Great Dividing Range to south-east Queensland, Australia); *T. kathleenae* sp. nov. (Sydney Basin and Hunter region, Australia); *T. macleayi* sp. nov. (Blue Mountains, Australia).

Biology

Toxopsoides huttoni group species are primarily tree trunk dwellers, hiding under loose bark by day and moving out from cover at night. The spiders drop as bark is removed. Specimens have also been found under logs and are occasionally caught in pitfall traps. It is not known where spiders reside at times of the year when trees have shed their loose bark. Adults of *T. erici*, probably the most collected species, have been recorded in every season, *T. huttoni* from January to July, and the other two species have been collected in every season except summer. To some extent this is likely to reflect collector bias, for instance there may be a bias away from the hottest (and therefore most

uncomfortable) seasons, and towards the south later in the year, northwards earlier.

The only definite record of a *Toxopsoides* egg sac of which I am aware (from one of the wider *Toxopsoides* group species) is in the Australian Museum collections. The data indicate that the female was guarding a plano-convex egg sac attached to a surface under a rock overhang (orientation not specified); the egg sac was disguised with sand. I have seen this specimen and the embryos are well developed and close to eclosion. This might suggest some level of parental care in the group. However, despite extensive hand collecting and an attempt to keep spiders in captivity, egg sacs remain unrecorded for any species in the *T. huttoni* group.

***Toxopsoides huttoni* Forster and Wilton, 1973**
(Figs 1-5, 6a, 16)

Toxopsoides huttoni Forster and Wilton 1973:
309, figs 1084-1088

Type Material

Holotype ♀, allotype ♂, New Zealand, North Island, "Hawkes Bay, Waitetola, R. W. Hutton" (as given by Forster and Wilton 1973); label data "Waitetola, 7.V.1966" according to Vink et al. (2011) this locality should be Waitetoko, near Lake Taupo. Otago Museum, not examined.

Diagnosis

Strongly striped leg femora (in both sexes but especially obvious in females Fig. 1a, even old faded specimens) distinguish *T. huttoni* from *T. macleayi* and *T. kathleenae*. Female: from *T. erici* by pear-shaped spermathecae in uncleared ventral view (Fig. 3a), and lacking sinuous ventral loop of copulatory ducts usually visible through the cuticle in *T. erici* (cf. Fig. 3a and Fig. 8a, b). Male: from *T. erici* by more robust ventral conductor with rugose knob-like end (Figs 4c, d, 6a), and embolus base occupying c. 1/2 height of tegular extension (1/3 in *T. erici*); males with faded leg stripes from *T. macleayi* and *T. kathleenae* by lack of anterior prong from tegular extension (cf. Fig. 6a with Figs 6c, d, 12d).

Supplementary description

Forster and Wilton (1973) give a detailed description, which fits most aspects of Australian specimens except as follows. Female. Colour: dorsal pigmentation varies (that recorded by Forster and Wilton was quite dark overall), patterns illustrated (Fig. 1) typical for Australian specimens in alcohol. Eyes (Fig. 2a), in particular anterior eyes, larger than shown by Forster and Wilton (fig. 1086), eyes overall somewhat variable. Sternum slightly longer than wide (Fig. 1b); tip narrowing abruptly between fourth coxae, width similar to length to region of narrowing. Labium wider than long, basal notches present (Fig. 2c). Legs: tarsal organ at 3/4 length of segment on leg four, 5/6 on legs one to three; spination (variable) many specimens with prolateral macroseta on anterior femur. Epigynum. Posteriorly pointing foveal teeth small, blunt. Copulatory ducts, in ventral uncleared view, proximal duct usually not visible except briefly anteriorly (Fig. 3a), with single complete loop dorsally leading directly into spermatheca (Figs 3b, c). Male. Carapace broadens level with posterior eyes, making caput slightly shorter than in female, carapace slightly broader than female. All legs longer than female in proportion to carapace width. Male pedipalp (Figs 4, 5). Basal part of curving, filiform embolus (E) enclosed in translucent tegular envelope (TE). A retrolaterally directed process (TP) arises from anteroretral margin of TE; process extends dorsad, wrapping around towards tegulum and

fusing with conductor (C). Embolus curves behind (or possibly through) ventral tegulum (T), to enter complex of TE and conductor; embolus of expanded palpus exits through a narrow fold (top centre, Fig. 6a). Conductor with rugose knob ventrally (C, Fig. 5d). Cleft between tegulum and tegular process broad and tall (Fig. 6a). Dorsal cymbium with trichobothria and weak terminal scopula (Figs 4a, b).

Measurements of Australian specimens (in mm). Female. Carapace length range, 1.50 to 2.13. (KS.45210): Total length, 5.31; carapace length, 2.13; width, 1.69; height, 0.80; caput width, 0.95; clypeus height, 0.10; abdomen length, 3.35; width, 2.10; labium length, 0.26; width, 0.33; sternum length, 1.05; width (max), 0.93; Eyes: AME, 0.16; PME, 0.19; ALE, 0.14; PLE, 0.21; EGW, 0.83 MOQAW, 0.34; MOQPW, 0.44; MOQL, 0.40. Limbs (femur + (patella-tibia) + metatarsus + tarsus = total): pedipalp, $0.68 + 0.85 + 0.75 = 2.28$; leg I, $1.72 + 2.44 + 1.24 + 0.64 = 6.04$; leg II, $1.76 + 2.12 + 1.36 + 0.64 = 5.88$; leg III, $1.68 + 1.88 + 1.24 + 0.68 = 5.48$; leg IV, $2.00 + 2.48 + 2.00 + 0.84 = 7.32$. Ratio leg I / carapace width: 3.57. Male. Carapace length range, 1.56 to 2.13. (KS.45210): Total length, 4.60; carapace length, 2.10; width, 1.70; height, 0.85; caput width, 1.00; clypeus height, 0.08; abdomen length, 2.55; width, 1.35; labium length, hidden; width, hidden; sternum length, 1.15; width (max), 0.98; Eyes: AME, 0.16; PME, 0.19; ALE, 0.14; PLE, 0.21; EGW, 0.78 MOQAW, 0.35; MOQPW, 0.45; MOQL, 0.40. Limbs (femur + (patella-tibia) + metatarsus + tarsus = total): pedipalp, $0.80 + 0.73 + 0.88 = 2.40$; leg I, $2.28 + 3.08 + 1.80 + 0.80 = 7.96$; leg II, $2.36 + 2.96 + 1.80 + 0.80 = 7.92$; leg III, $2.20 + 2.52 + 1.92 + 0.76 = 7.40$; leg IV, $2.48 + 3.16 + 2.64 + 0.96 = 9.24$. Ratio leg I / carapace width: 4.68.

Comments on description

Some aspects of this description of Australian specimens are at variance with that given by Forster and Wilton. Discrepancies in eye measurements and relative positions may be accounted for by non inclusion of lenses (e.g. apparently omitted in Forster and Wilton fig. 1086). Sclerites of the male pedipalp are here reinterpreted. Forster and Wilton use the term radix for a projection arising near the base of the embolus and (in the generic description) describe the conductor as membranous. Because the figure is not labelled it is not clear what part is intended for either appellation.

The term tegular envelope has been coined based on the observation that the embolus is free to move laterally within the enclosing structure. This is evidenced by inducing expansion of the

TOXOPSOIDES IN AUSTRALIA

pedipalp, which causes rotation of the basal embolus anticlockwise, tightening the radius of curvature and partially expelling the embolus from the conductor groove (Fig. 5e). Fusion of the tegular process with conductor is evidenced by lack of seam under SEM (Fig. 5b) and non separation in an expanded preparation.

Material Examined

Australia. AUSTRALIAN CAPITAL TERRITORY: 1 ♂ (ANIC), Blundells Creek, 3 km E of Picadilly Circus, 35°22'S, 148°50'E, 850 m, Jun 1984, Weir, Lawrence, Johnson. 1 ♂ (ANIC), Wombat Creek, 6 km NE Picadilly Circus, 35°19'S, 148°51'E, 750 m, Jul 1984, Weir, Lawrence, Johnson. NEW SOUTH WALES: 1 ♀ (KS.113028), Coolangubra State Forest, near Waratah Creek, 37°00'30"S, 149°23'32"E, Jan 1984, pitfall trap, G.A. Webb. 1 ♂, 1 ♀ (KS.108220), Gulaga National Park, road to Mt Dromedary, 36°17'13"S, 150°02'24"E, 224 m, 22 May 2009, beat/sweep and hand collecting, G.A. Milledge, H.M. Smith. 1 ♂, 1 ♀ (KS.108153), Meroo National Park, 0.4 km N on Lake Rd, 35°23'52"S, 150°25'02"E, 27 m, 19 May 2009, beat/sweep and hand collecting, G.A. Milledge, H.M. Smith. VICTORIA: 1 ♂ (KS.48877), 7.5 km SE of Woodend, 37°28'S, 144°37'E, 4 Apr 1978, M.R. Gray. 1 ♂, 1 ♀ (KS.45210), 1 ♂, 2 ♀ (KS. 120530), Mt Macedon Forest Park, 37°25'S, 144°38'E, 5 Apr 1978, M.R. Gray, in curled bark. 1 ♂ (KS.118807), Otway Ranges, 1 mile E of Beech Forest, 38°38'S, 143°34'E, 7 Apr 1973, M.R. Gray, on bark. 1 ♂ (KS.105878), Silverband Rd, nr Halls Gap, 37°08'S, 142°31'E, 21 Mar 1974, M.R. Gray. 1 ♀ (KS.49670), Wonderland Rd, Halls Gap, 37°08'S, 142°31'E, 1 May 1973, M.R. Gray. 1 ♂ (KS.105895), Zumsteins, The Grampians, 37°06'S, 142°25'E, 18 Mar 1974, hand collected, M.R. Gray.

Discussed specimens of uncertain status: SOUTH AUSTRALIA: 2 ♂, 1 ♀ (KS.76384), Cleland Conservation Park, 34°58'40"S, 138°41'59"E, 18 Mar 2002, hand, G.A. Milledge and H.M. Smith.

Distribution

New Zealand: North Island, Waitetoko, near Lake Taupo. Australia: South-eastern states and the Australian Capital Territory (Fig. 16). Specimens from South Australia need confirmation (see below).

Comments

The distribution of *T. huttoni* in New Zealand requires further investigation. If the species truly has a limited distribution it could be an accidental introduction from Australia, where it is widespread

in south-eastern states. However, the *T. huttoni* group of species are often poorly represented in collections unless appropriate collecting techniques have been used. Until New Zealand collections have been examined and suitable techniques have been used to search loose bark habitats, it is not possible to draw firm conclusions.

In general males from NSW have the longest embolus for the species, and females have longest ducts (measured by the size of the dorsal loop). In specimens from further south and west, the embolus or ducts become slightly shorter, the examined female from western Victoria approaching the duct configuration of *T. kathleenae*; these specimens are accepted as *T. huttoni*. In South Australia, the two male specimens currently available from the Adelaide area are within the range of variation seen in other areas. However, the single female has the duct loop in a quite different position, as if unwound and stretching anteriorly (Fig. 3d). Conspecificity of males and female requires confirmation and the status of this population awaits assessment.

Toxopsoides erici sp. nov.

(Figs 6b, 7-9, 16)

Type Material

Australia, NEW SOUTH WALES. Holotype ♀ (KS.118803), Barrington Tops Reserve, Polblue Picnic Area, Barrington Trail, 31°56'57"S, 151°26'38"E, 1537 m, 5 Dec 2006, beat, sweep, under bark and logs, G.A. Milledge, H.M. Smith. Paratypes: 1 ♂ (KS.118804), 2 ♂ (KS.98543), data as holotype. 2 ♀ (KS.101478), Coneac State Conservation Area, 31°51'47"S, 151°48'03"E, 1 Jun 2007, H.M. Smith. 1 ♀ (KS.101473), Barrington Tops National Park, Gloucester Tops Rd, 32°02'49"S, 151°37'46"E, 30 May 2007, H.M. Smith. 1 ♂ (KS.98587), Barrington Tops National Park, Gloucester Tops, gate on Kerripit Rd, 32°03'43"S, 151°34'39"E, 1253 m, 6 Dec 2006, beat, sweep, under bark and logs, G.A. Milledge, H.M. Smith.

Etymology

This species is named in memory of my father, Eric Smith who always encouraged my interests in natural history.

Diagnosis

Strongly striped leg femora (in both sexes but especially obvious in females, Fig. 7a) distinguish specimens from *T. macleayi* and *T. kathleenae*. Female: from all other species by elongate spermathecae and distal dorsal loop of copulatory duct (Fig. 8d, pointer);



Figure 7. *Toxopsoides erici* sp. nov. a, Female (KS.101478), habitus, dorsal; b, female (holotype), habitus, ventral; c, male (KS.103286), habitus, dorsal; d, male (KS.118804), ventral sternum and abdomen. Scale bars: 1.0 mm.

a sinuous loop of copulatory duct across spermatheca in ventral view (Figs 8a-c, pointer in 8b) is diagnostic if visible but may be unclear, and is reduced or absent in northern specimens. Male: from *T. macleayi* and *T. kathleenae* by lack of anterior prong from tegular extension (cf. Fig 6b with Figs 6c, d); from *T. huttoni* by finely curved conductor without pronounced knob (Fig. 6b cf. Fig. 6a), and embolus base occupying c. 1/3 height of tegular extension (1/2 in *T. huttoni*).

Description

Generally similar to *T. huttoni* except in genitalia, as follows. Female. Epigynum with posteriorly pointing foveal teeth, similar size to those of *T. kathleenae* (Fig. 11b). Spermathecae long; in ventral view copulatory duct loops sinuously across spermatheca (Figs 8a, b) (southern specimens); ducts pass anteriorly three times connected by broad lateral loop and distal dorsal loop (Figs 8c, d); ventral duct

TOXOPSOIDES IN AUSTRALIA

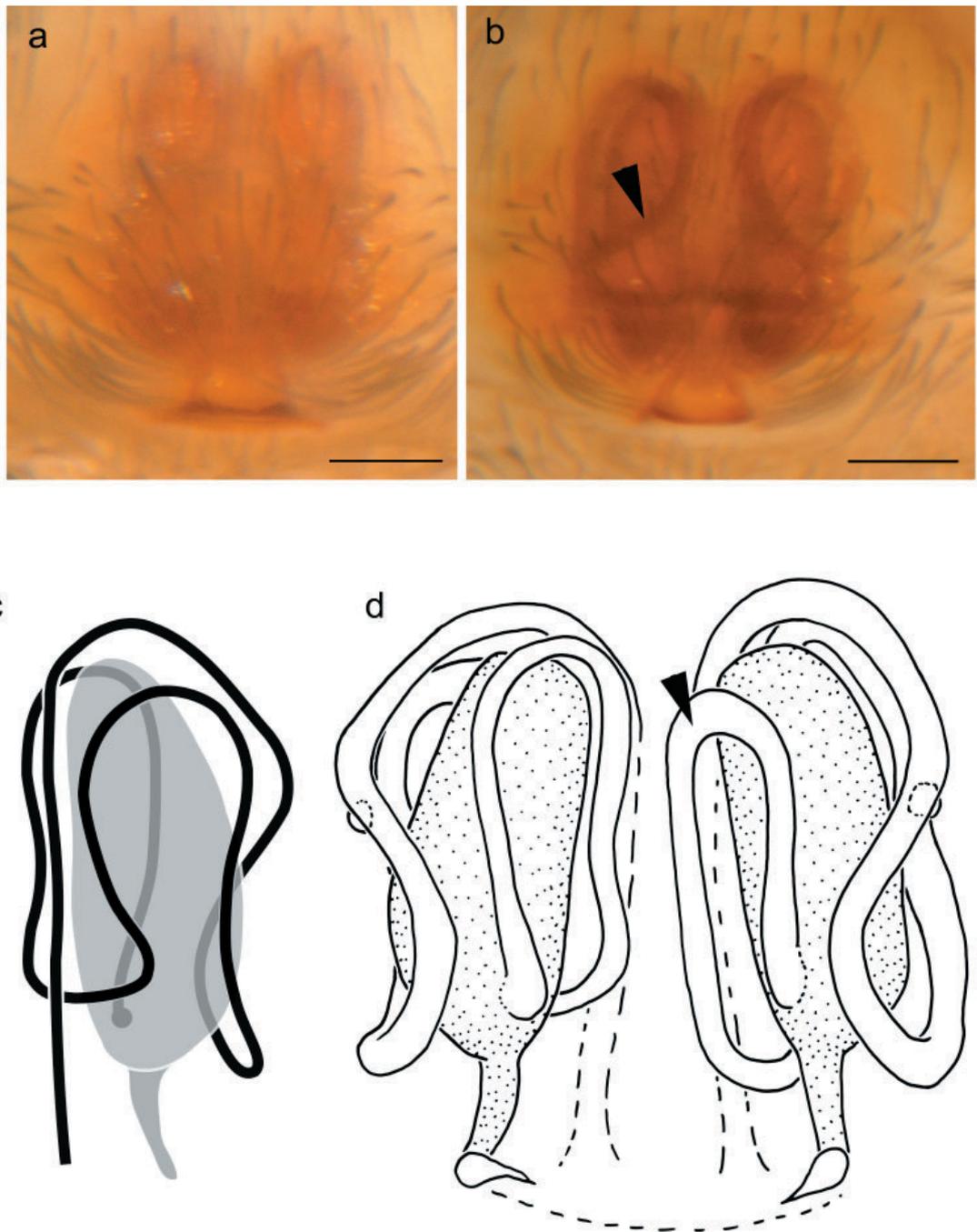


Figure 8. *Toxopsoides erici* sp. nov., female genitalia. a, Ventral photograph (holotype); b, ditto (KS.101472), pointer indicates sinuous ventral duct not present in northern specimens; c, diagrammatic ventral view of left spermatheca and duct based on Fig. 8d; d, dorsal (internal) cleared (KS.101478), pointer to distal dorsal duct loop. Scale bars 0.1 mm.

of northern specimens may lack sinuosity, but distal loop present (pointer, Fig. 8d). Male. Embolus longer than in *T. huttoni*, with correspondingly greater area of tegular envelope (Figs 9a, c), and more elongate path across dorsal tegulum. Conductor slim and sinuous, without enlarged rugose knob (Figs 6b, 9c,

d). Cleft between tegulum and tegular process long and narrow (Fig. 6b).

Measurements (in mm). Female. Carapace length range, 1.70 to 2.40. Specimen KS.118803. Total length, 5.10; carapace length, 2.40; width, 1.95; height, 0.94; caput width, 1.15; clypeus height, 0.10;

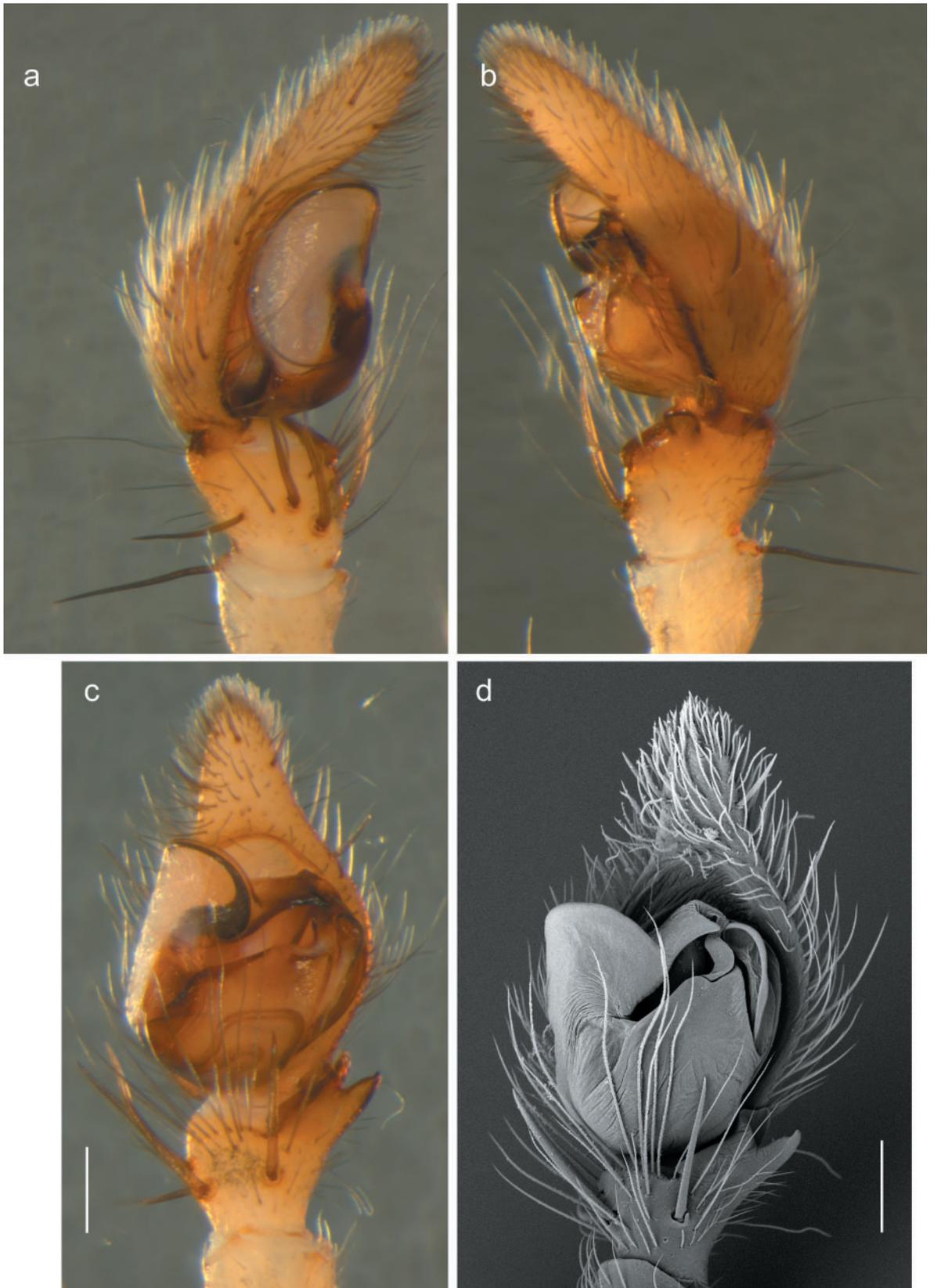


Figure 9. *Toxopsoides erici* sp. nov., male left pedipalps. a-c, Prolateral, retrolateral and ventral (KS.118804); d, ventral SEM (KS.103221). Scale bars 0.2 mm.

TOXOPSOIDES IN AUSTRALIA

abdomen length, 2.90; width, 1.85; labium length, 0.31; width, 0.35; sternum length, 1.25; width (max), 1.10; Eyes: AME, 0.19; PME, 0.23; ALE, 0.13; PLE, 0.24; EGW, 1.00 MOQAW, 0.44; MOQPW, 0.54; MOQL, 0.48. Limbs (femur + (patella-tibia) + metatarsus + tarsus = total): pedipalp, 0.93 + 0.98 + 0.85 = 2.75; leg I, 2.10 + 2.80 + 1.65 + 0.65 = 7.20; leg II, 2.15 + 2.65 + 1.70 + 0.65 = 7.15; leg III, 2.05 + 2.50 + 1.70 + 0.75 = 7.00; leg IV, 2.50 + 3.05 + 2.50 + 0.95 = 9.00. Ratio leg I / carapace width: 3.69. Male. Carapace length range, 1.50 to 2.50. Specimen KS.118804. Total length, 5.19; carapace length, 2.38; width, 2.10; height, 0.80; caput width, 1.05; clypeus height, 0.08; abdomen length, 3.05; width, 1.65; labium length, 0.30; width, 0.36; sternum length, 1.30; width (max), 1.16; Eyes: AME, 0.21; PME, 0.21; ALE, 0.15; PLE, 0.25; EGW, 0.93 MOQAW, 0.44; MOQPW, 0.50; MOQL, 0.49. Limbs (femur + (patella-tibia) + metatarsus + tarsus = total): pedipalp, 0.95 + 0.75 + 1.08 = 2.78; leg I, 2.55 + 3.30 + 1.95 + 0.90 = 8.70; leg II, 2.60 + 3.20 + 2.00 + 0.90 = 8.70; leg III, 2.45 + 2.80 + 2.15 + 0.95 = 8.35; leg IV, 2.80 + 3.40 + 2.85 + 1.15 = 10.20. Ratio leg I / carapace width: 4.14.

Material Examined

Australia, NEW SOUTH WALES. 1 ♀ (KS.101476), Barrington Tops National Park, Gloucester River Campground, 32°03'38"S, 151°41'13"E, 30 May 2007, H.M. Smith. 1 ♀ (KS.104156), Barrington Tops National Park, [as previous], 30 Jan 2008, beat/sweep and hand collecting, G.A. Milledge, A.D. Hegedus. 1 ♀ (KS.101474), Barrington Tops National Park, Gloucester Tops, Antarctic Beech walk, 32°05'19"S, 151°35'43"E, 30 May 2007, H.M. Smith. 1 ♀ (KS.103238), Barrington Tops National Park, Honeysuckle Picnic Area, 31°54'03"S, 151°32'01"E, 1300 m, 18 Mar 2008, night collecting, G.A. Milledge, A.D. Hegedus. 2 ♀ (KS.102237), 1 ♂, 1 ♀ (KS.103289), 1 ♂, 3 ♀ (KS.104160), Barrington Tops Reserve, Barrington Trail, 31°56'37"S, 151°26'53"E, 1350 m, 30 Apr 2008, 19 Mar 2008, 31 Jan 2008, beat, sweep, litter and under bark, G.A. Milledge, A.D. Hegedus. 1 ♂ (KS.103286), Barrington Tops Reserve, Gummi Rd, Manning River crossing, 31°51'41"S, 151°33'07"E, 1109 m, 19 Mar 2008, beat, sweep and under bark, G.A. Milledge, A.D. Hegedus. 1 ♀ (KS.118802), Barrington Tops Reserve, Nth Branch Rd. 0.4 km from Pheasant Ck Rd, 31°52'41"S, 151°29'32"E, 1225 m, 18 Mar 2008, beat/sweep and hand collecting, G.A. Milledge, A.D. Hegedus. 1 ♀ (KS.101692), Barrington Tops State Forest, Cobark Lookout rest area, 31°53'45"S, 151°36'06"E, 25 Sep 2007,

G.A. Milledge. 1 ♀ (KS.101472), Barrington Tops State Forest, Dilgry Circle, Dilgry River crossing, 31°53'20"S, 151°32'19"E, 1189 m, 29 May 2007, H.M. Smith. 4 ♀ (KS.101477), Barrington Tops State Forest, 31°54'01"S, 151°37'49"E, 29 May 2007, H.M. Smith. 1 ♂ (KS.40379), Barrington Tops State Forest, Tugalow Creek, eastern side of Barrington Trail, 31°54'41"S, 151°26'38"E, 1370 m, 4 Feb-9 Apr 1993, pitfall, M.R. Gray, G.A. Cassis. 1 ♂ (KS.115449), Carrai State Forest, 30°54'35"S, 152°16'26"E, 1090 m, 3-8 Dec 1997, sticky trap, E. Tasker. 2 ♀ (KS.101475), Copeland Tops State Forest, near Sleepy Hollow Trail, 31°58'30"S, 151°47'49"E, 28 May 2007, H.M. Smith. 1 ♀ (KS.43759), Mt Allyn nr Barrington Tops, 32°08'S, 151°26'E, Sep 1993, G.S. Hunt, Bark scraped from *Nothofagus* trunks. 1 ♀ (KS.101652), Stewarts Brook State Forest, Polblue Ridge Rd, 0.4 km N of Barrington Tops Forest Rd, 31°56'54"S, 151°23'46"E, 25 Sep 2007, under bark and logs, sclerophyll. 1 ♀, 1 ♂ (KS.103221), Stewarts Brook State Forest, [as previous], 15 Nov 2007, under bark and logs, G.A. Milledge, A.D. Hegedus, L. Kampen. 1 ♂ (KS.65898), Toonumbar National Park, 5 km S Hanrahans, Murray Scrub Rd, 28°28'S, 152°43'E, 350 m, 17-18 Dec 1998, yellow pans, D. Bickel. 1 ♀ (KS.9235), Washpool State Forest, Coobadjah Ck, 0.6 km from Moongem Rd, 29°16'S, 152°22'E, 13 Feb 1982, C. Horseman. 1 ♂ (KS.115467), Werrikimbe National Park, 31°11'56"S, 152°10'23"E, 1025 m, 1 Dec 1997, sticky trap, E. Tasker. 1 ♀ (KS.66689), Werrikimbe National Park, [as previous], 9-14 Apr 1998, sticky trap, E. Tasker, on *E. cameronii*. 1 ♂ (KS.66670), Werrikimbe National Park, 31°10'23"S, 152°09'45"E, 1060 m, 3-8 Jul 1998, sticky trap, E. Tasker, on *E. divea*. 1 ♂ (KS.66672), Werrikimbe National Park, 31°11'24"S, 152°09'39"E, 1030 m, 3-8 Jul 1998, sticky trap, E. Tasker, on *E. cameronii*. 1 ♀ (KS.66688), Werrikimbe National Park, 31°16'50"S, 152°03'19"E, 1045 m, 29 Jan-4 Feb 1998, sticky trap, E. Tasker, on *E. campanulata*. 2 ♂, 1 ♀ (KS.115440), Werrikimbe National Park, Gunny Bag, 31°16'42"S, 152°05'05"E, 1040 m, 1-7 Dec 1997, sticky trap, E. Tasker. QUEENSLAND. 1 ♀, 1 ♂ (KS.103220), Tingalpa Creek, Buhot Creek Reserve, 27°35'27"S, 153°10'19"E, 17 Feb 2008, beat, sweep and under bark, H. Smith, G. Anderson. Lamington [SEM of male palp from Lamington specimen sent by R.J. Raven, actual specimens not examined].

Discussed specimens of uncertain status: NEW SOUTH WALES. 2 ♂ (KS.31719, KS.31742), 'Scalloway', Willowvale, 34°44'11"S, 150°47'23"E, 6 Dec 1986 and 11 Mar 1987, in pool, G. Wishart; 1 ♂ (KS.119166), 1 ♀ (KS.119075), Mount Gibraltar Reserve, S of Mittagong, 34°27'59"S, 150°25'48"E,

17 Sep 2012, under bark, G. Milledge, H. Smith, female adult at collection, male matured c. 1 Oct 2012.

Distribution

Australia: Great Dividing Range from Barrington area of New South Wales to south-eastern Queensland (Fig. 16, includes Lamington record). Three males from the Illawarra area south of Sydney, show very slight variations in the pedipalp; however, the only co-collected female has quite different duct configuration (looking more like a banded-legged *T. macleayi*). Further males and females are required to assess this population.

Comments

The northern females have shorter, more tightly looped, copulatory ducts and the sinuous path of the ventral duct may be straightened. As in other species, there is considerable variation in size and colour. In *T. erici* the northern specimens are smallest by far (the large female holotype is typical of Barrington specimens). When alive, some specimens have a bright white terminal spot on the dorsal abdomen.

Toxopsoides kathleenae sp. nov.

(Figs 6c, 10-12, 16)

Type Material

Australia, NEW SOUTH WALES. Holotype ♀ (KS.118805), Watagans National Park, Watagans Forest Rd, 33°02'17"S, 151°22'27"E, 20 Mar 2012, beat/sweep and hand collecting, G.A. Milledge, H.M. Smith. Paratypes: 1 ♂ (KS.118806), 2 ♂, 1 ♀ (KS.118165), data as holotype. 1 ♀ (KS.74975), Hornsby, Waitara Creek, 33°42'52"S, 151°05'22"E, 28 Oct 2001, G.A. Milledge, H.M. Smith. 1 ♀ (KS.100617), 1 ♂ (KS.100621), Hornsby, Waitara Creek, [as previous], 29 Apr 2007, G.A. Milledge, H.M. Smith.

Etymology

This species is named in honour of my mother, Kathleen Smith, for her encouragement of independent thought.

Diagnosis

Leg femora darkening distally but without, or with only vague, banding distinguishes specimens from *T. huttoni* and *T. erici* (Fig. 10a,b). Female: from all other species by short, broad area of spermatheca and ducts in ventral view (broader than long, or subequal) and prominent, broad ventral distal loop (Fig. 11a). Male: from faded *T. huttoni* and *T. erici* by presence

of anterior prong from tegular extension (pointer Fig. 12d); from *T. macleayi* by short embolus, visible over c. 1/2 height of bulbus in prolateral view (Fig. 12a, cf. 2/3 in *T. macleayi*, Fig. 15a).

Description

Generally similar to *T. huttoni* except in coloration and genitalia, as follows. Female. Carapace with similar patterning but suffused dark brown overall (Fig. 10a); abdomen generally dark dorsally with paler patterning of variable extent along midline; legs without strong dark markings. Epigynum with strong posteriorly pointing foveal teeth (Fig. 11b). Spermathecae rounded; in ventral uncleared view copulatory duct visible looping around anterior spermatheca and passing posteriorly medially (Fig. 11a); ducts relatively broad. Male. Colour similar to female but legs usually paler (Figs 10b-d). Tegular envelope with anterior prong (Figs 6c, 12c, d); embolus shorter than most *T. huttoni*. Conductor comma-shaped, with small rugose prominence and cup-like hollow separating fold enclosing embolus (embolus just visible in cleft between tegulum and tegular process in Fig. 6c). Cleft between tegulum and tegular process narrower than in *T. huttoni* and shorter than in *T. erici*.

Measurements (in mm). Female. Carapace length range, 1.65 to 2.10. Specimen KS.118805. Total length, 5.31; carapace length, 2.10; width, 1.70; height, 0.95; caput width, 1.03; clypeus height, 0.06; abdomen length, 3.05; width, 2.05; labium length, 0.28; width, 0.35; sternum length, 1.10; width (max), 1.00; Eyes: AME, 0.18; PME, 0.20; ALE, 0.13; PLE, 0.24; EGW, 0.86 MOQAW, 0.36; MOQPW, 0.48; MOQL, 0.44. Limbs (femur + (patella-tibia) + metatarsus + tarsus = total): pedipalp, 0.75 + 0.88 + 0.78 = 2.40; leg I, 1.80 + 2.64 + 1.44 + 0.60 = 6.48; leg II, 1.84 + 2.40 + 1.40 + 0.64 = 6.28; leg III, 1.76 + 2.16 + 1.56 + 0.48 = 5.96; leg IV, 2.08 + 2.68 + 2.08 + 0.92 = 7.76. Ratio leg I / carapace width: 3.81. Male. Carapace length range, 1.35 to 2.20. Specimen KS.118806. Total length, 4.31; carapace length, 2.10; width, 1.80; height, 0.83; caput width, 0.98; clypeus height, 0.05; abdomen length, 2.35; width, 1.40; labium length, 0.25; width, 0.35; sternum length, 1.15; width (max), 1.03; Eyes: AME, 0.19; PME, 0.19; ALE, 0.10; PLE, 0.21; EGW, 0.81 MOQAW, 0.39; MOQPW, 0.44; MOQL, 0.44. Limbs (femur + (patella-tibia) + metatarsus + tarsus = total): pedipalp, 0.78 + 0.68 + 0.88 = 2.33; leg I, 2.28 + 3.08 + 1.80 + 0.76 = 7.92; leg II, 2.40 + 3.00 + 1.76 + 0.80 = 7.96; leg III, 2.24 + 2.72 + 1.88 + 0.76 = 7.60; leg IV, 2.52 + 3.20 + 2.60 + 1.00 = 9.32. Ratio leg I / carapace width: 4.40.

TOXOPSOIDES IN AUSTRALIA



Figure 10. *Toxopsoides kathleenae* sp. nov. a, Female (holotype) habitus, dorsal; b, d, male (KS.118806), habitus, dorsal, ventral; c, male (KS.118808), live (photo Carl Bento, Australian Museum).

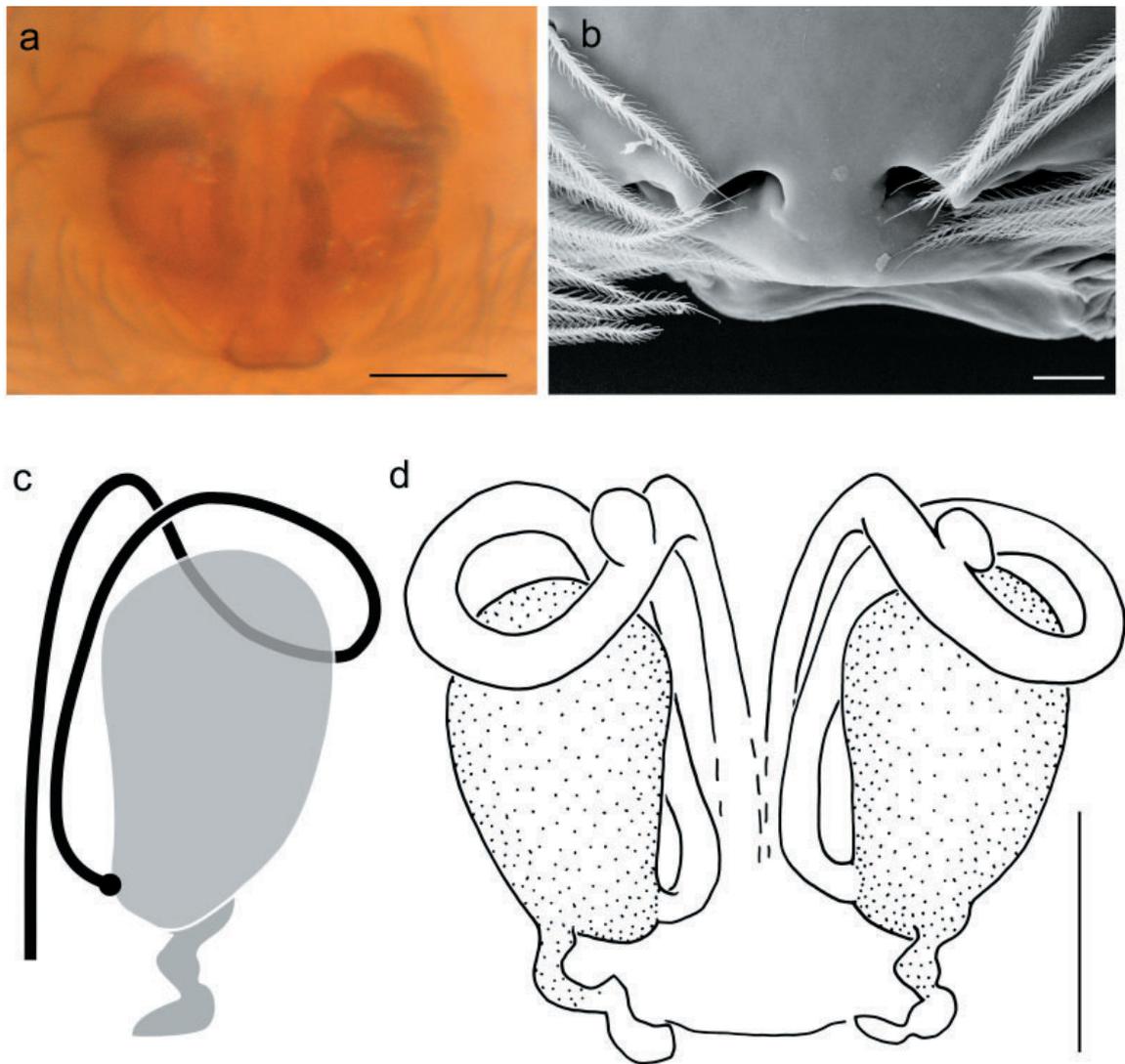


Figure 11. *Toxopsoides kathleenae* sp. nov., female genitalia. a, Ventral photograph (KS.74975); b, epigyne detail of foveae (unregistered specimen, The Glen); c, diagrammatic ventral view of left spermatheca and duct based on Fig. 11d; d, dorsal (internal), cleared (KS.118222). Scale bars a, d, 0.1 mm; b, 20 μ m.

Material Examined

Australia, NEW SOUTH WALES. 3 ♂ (KS.115756), Berowra Valley Regional Park, fire trail, 33°39'25"S, 151°06'51"E, 1 May 2011, beat/sweep and hand collecting, G.A. Milledge, H.M. Smith. 1 ♂ (KS.118234), Heaton State Forest, Macleans Lookout, 32°57'27"S, 151°25'03"E, 463 m, 21 Mar 2012, beat, sweep, litter and hand collecting, G.A. Milledge, H.M. Smith. 1 ♀ (KS.100618), 1 ♂ (KS.100619), 1 ♂ (KS.100622), 2 ♂, 1 ♀ (KS.101480), 1 ♀ (KS.79603), Hornsby, Waitara Creek, 33°42'52"S, 151°05'22"E, 29 Apr 2007 (2), 22 Apr 2007, 11 Jun 2007, 20 Jul 2002, G.A. Milledge, H.M. Smith. 3 ♂, 1 ♀ (KS.118808), Hornsby, [as previous], 20

May 2007, under bark (1 ♂ on SEM stubs s/684, s/685). 1 ♀ (KS.49770), Jamieson Park Narrabeen, 33°43'S, 151°18'E, 5 m, 6-20 Nov 1995, pitfall trap, M.R. Gray, H.M. Smith, *Eucalyptus botryoides* - *Allocasuarina torulosa* open forest. 1 ♂ (KS.69222), Kirkconnell, 33°27'S, 149°51'E, 13 Apr 1972, G.S. Hunt. 1 ♀ (KS.111113), Mount Colah, Berowra Valley Regional Park, 33°39'29"S, 151°06'50"E, 4 Apr 2010, hand collected, G.A. Milledge, H.M. Smith. 1 ♂ (KS.87619), Rookwood Cemetery, 33°52'S, 151°04'E, 13 Jul 1969, D. Grant. 1 ♂, 1 ♀ (KS.101490), 2 ♂ (KS.104129), 1 ♂ (KS.104130), 1 ♀ (KS.104131), 1 ♂ (KS.104132), 1 ♀ (KS.104133), The Glen Nature Reserve, Etheridges Rd, off Glen

TOXOPSOIDES IN AUSTRALIA

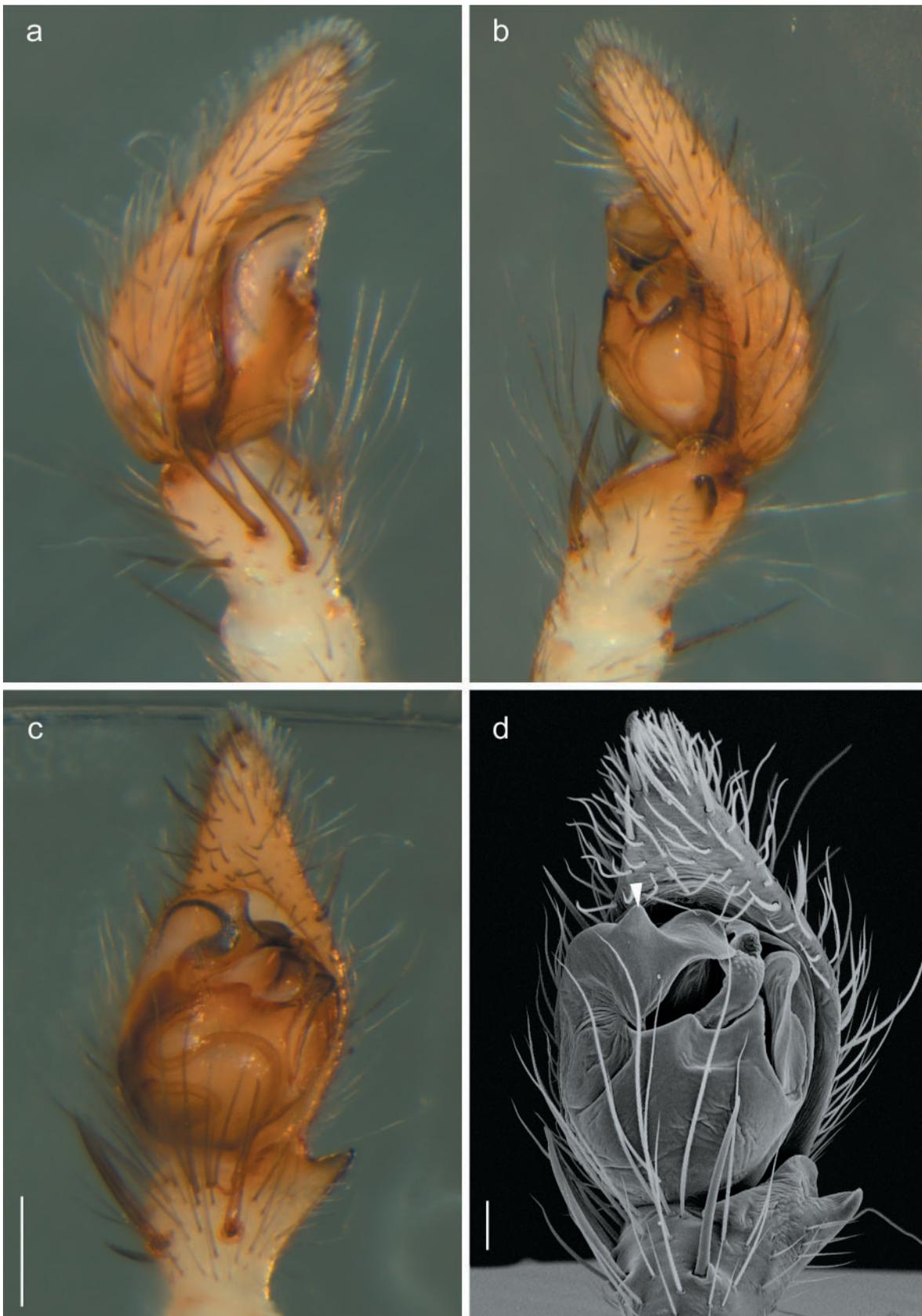


Figure 12. *Toxopsoides kathleenae* sp. nov., male left pedipalps. a-c, Prolateral, retrolateral and ventral (KS.118806); d, ventral SEM (KS.118808), pointer indicates anterior prong. Scale bars: c, 0.2 mm; d, 60 μ m.



Figure 13. *Toxopsoides macleayi* sp. nov. a, b, Female (KS.106059): a, habitus, dorsal; b, habitus, ventral; c, male (KS.119067), habitus, dorsal.

Rd, 32°09'56"S, 152°00'16"E, 2 Jun 2007, H.M. Smith. 1 ♂, 1 ♀ (KS.101488), 1 ♂, 1 ♀ (KS.101489), The Glen Nature Reserve, junction of Glen Rd and McKays Trail, 32°09'59"S, 152°00'06"E, 2 Jun 2007, H.M. Smith. 1 ♀ (KS.118298), Watagans National Park, fire trail near Sandy Knob, 33°02'42"S, 151°21'56"E, 492 m, 22 Mar 2012, beat/sweep and hand collecting, G.A. Milledge, H.M. Smith. 1 ♂, 3

♀ (KS.118222), Watagans National Park, Georges Rd, 1 km W of Heaton Rd, 32°58'12"S, 151°23'26"E, 415 m, 21 Mar 2012, beat/sweep and hand collecting, G.A. Milledge, H.M. Smith. 2 ♂, 1 ♀ (KS.118283), Watagans National Park, Watagans Forest Rd, Jiliby State Conservation Area, 33°03'01"S, 151°20'07"E, 398 m, 22 Mar 2012, G.A. Milledge, H.M. Smith. 1 ♂ (KS.118181), Watagans National Park, Watagans

TOXOPSOIDES IN AUSTRALIA

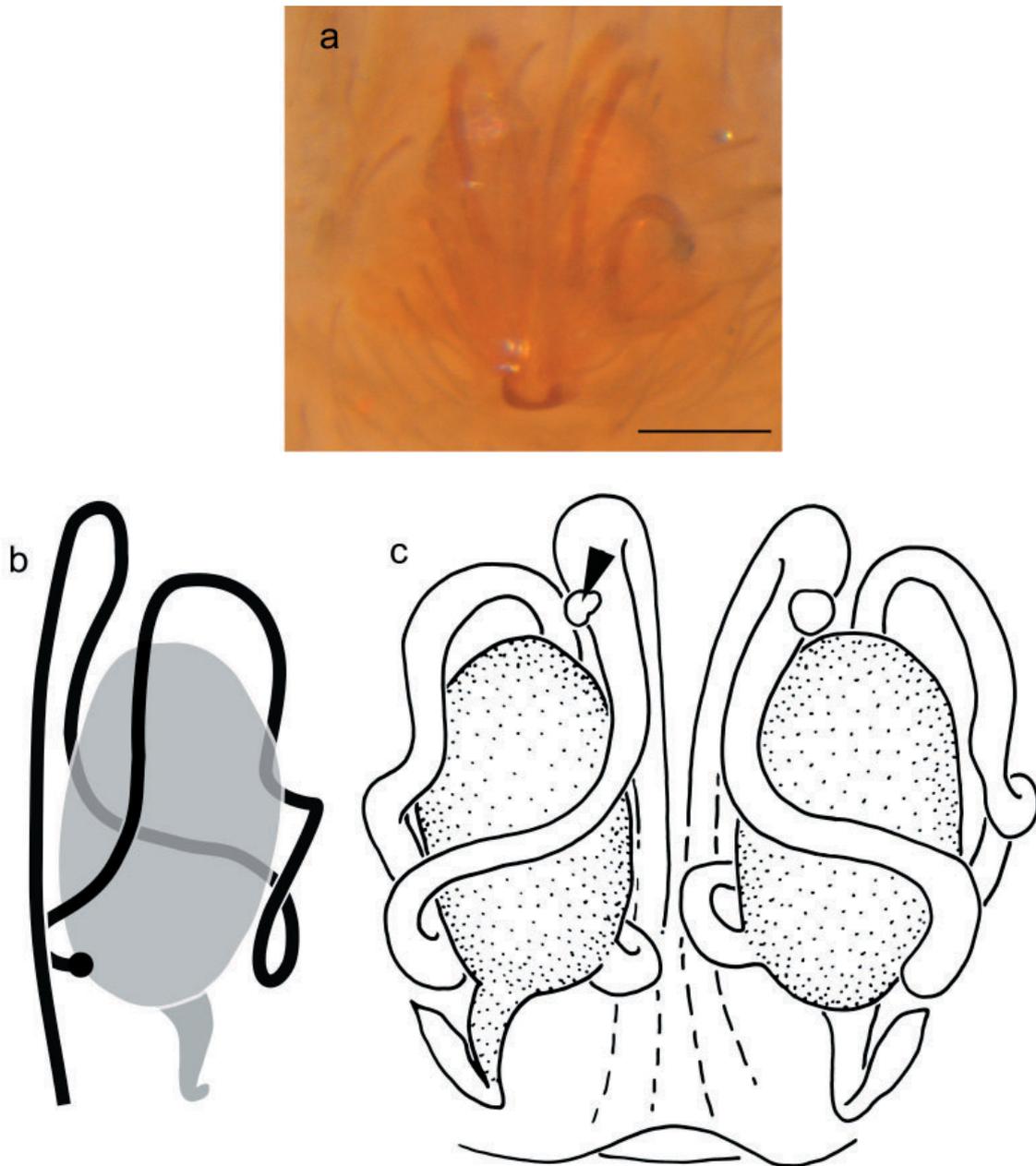


Figure 14. *Toxopsoides macleayi* sp. nov., female genitalia. a, Ventral photograph (KS.119069); b, diagrammatic ventral view of left spermatheca and duct based on Fig. 14c; c, dorsal (internal), cleared (KS.106059). Pointer indicates nodule. Scale bars 0.1 mm.

Forest Rd, near old quarry, 33°00'32"S, 151°23'43"E, 20 Mar 2012, beat/sweep and hand collecting, G.A. Milledge, H.M. Smith.

Distribution

Australia: Sydney Basin and Hunter region (Fig. 16). A possible distribution west of the Blue Mountains indicated by the single male from Kirkconnell (KS.69222) requires further specimens for confirmation.

Comments

Specimens from the Sydney Basin are almost all smaller than those from further north. The single male from west of the Blue Mountains is similar to those from the northern populations. Some Sydney specimens were noted to have a bright yellow-orange terminal spot on the dorsal abdomen when alive. Specimens almost devoid of paler markings are quite common in this species and *T. macleayi*.

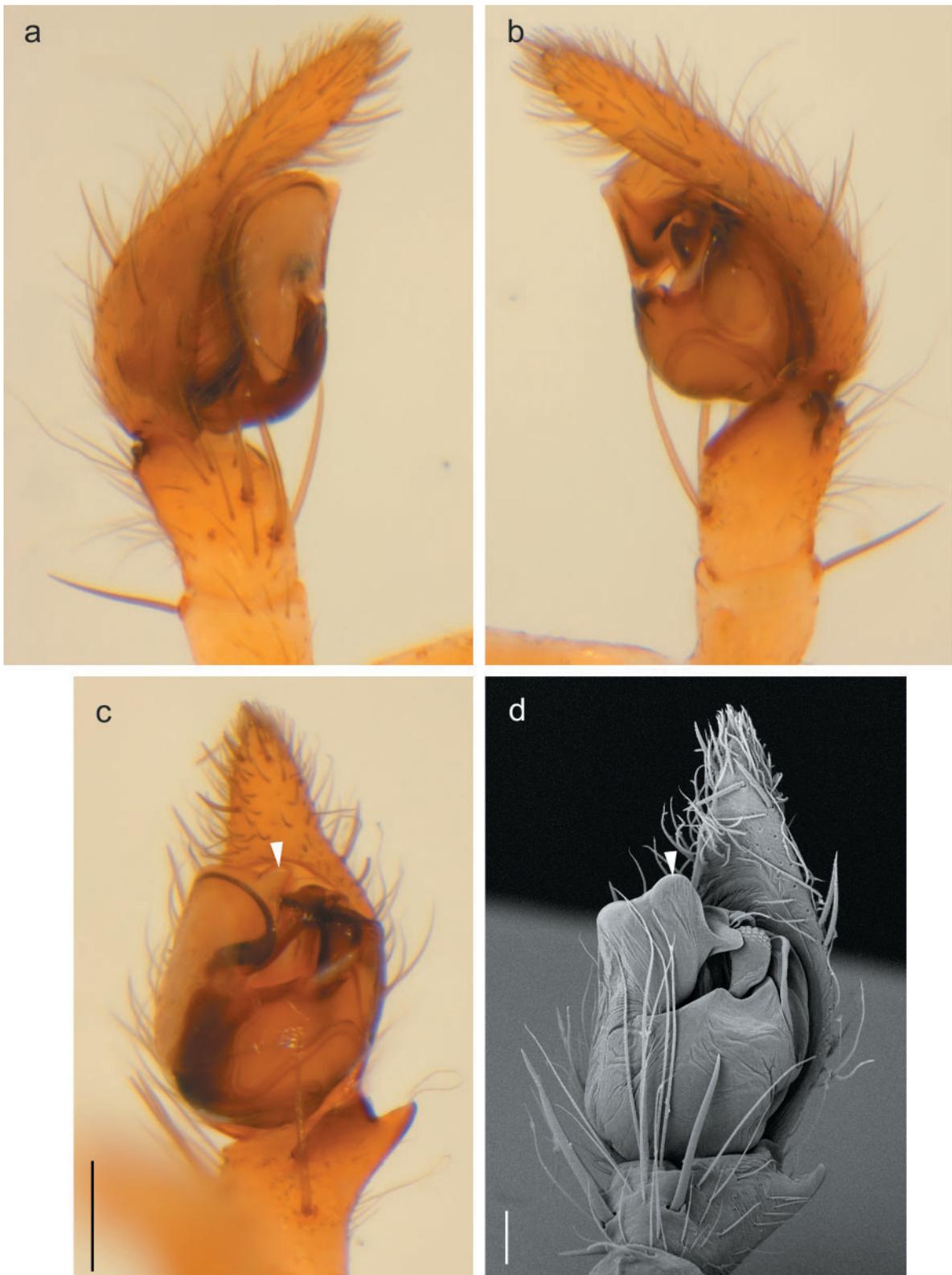


Figure 15. *Toxopsoides macleayi* sp. nov., male left pedipalps. a-c, Prolateral, retrolateral and ventral (KS.119067); d, ventral SEM (KS.115589). Scale bars: c, 0.2 mm; d, 0.1 mm. Pointers in c, d indicate anterior prong.

TOXOPSOIDES IN AUSTRALIA

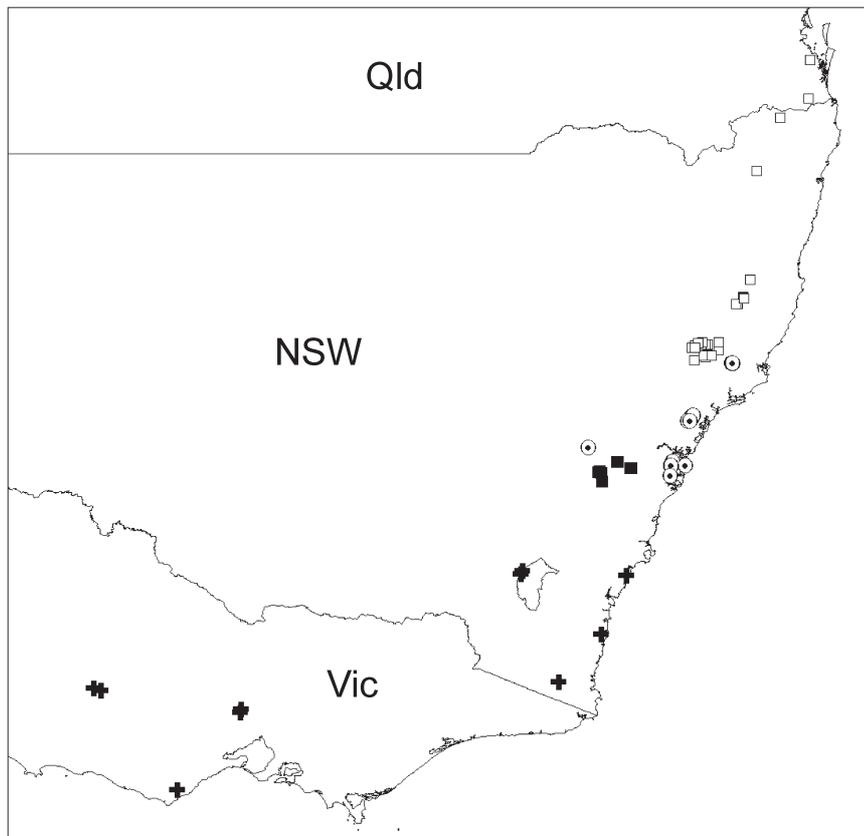


Figure 16. Map of south-eastern Australia, showing the Australian distributions of the four *Toxopsoides huttoni* group species. [+] *T. huttoni* Forster and Wilton; [unfilled square] *T. erici* sp. nov.; [circle/dot] *T. kathleenae* sp. nov.; [filled square] *T. macleayi* sp. nov.

Toxopsoides macleayi sp. nov.
(Figs 6d, 13-16)

Type Material

Australia, NEW SOUTH WALES. Holotype ♀ (KS.119277), Blue Mountains National Park, Murphy's Glen camping area, S of Woodford, 33°46'07"S, 150°29'11"E, 3 Nov 2008, night collecting, G.A. Milledge, H.M. Smith. Paratypes: 2 ♀ (KS.106059), data as holotype. 1 ♂, 1 ♀ (KS.119067, KS.119069), Medlow Bath, 33°41'S, 150°17'E, under bark on gum tree, M. Ward colln. 1 ♂ (KS.22538), Jenolan Caves Area, Southern Limestone Area, 33°49'S, 150°02'E, 14 Aug 1989, pitfall trap, G.S. Hunt.

Etymology

This species is named for the Macleay Museum in The University of Sydney. Several specimens were unearthed as a result of work carried out under the Macleay Miklouho-Maclay Fellowship.

Diagnosis

Leg femora mottled or darkening distally but

without distinct banding distinguishes specimens from *T. huttoni* and *T. erici* (Fig. 13a). Female: from all other species by narrow posterior plate and three narrow loops of copulatory ducts in ventral view, including one lateral loop (Fig. 14a, b). (See comment about similar undescribed female, below). Male: from faded *T. huttoni* and *T. erici* by presence of anterior prong from tegular extension (Figs 15c, d); from *T. kathleenae* by long embolus, visible over c. 2/3 height of bulbus in prolateral view (Fig. 15a, cf. 1/2 in *T. kathleenae*, Fig. 12a).

Description.

Generally similar to *T. kathleenae* except in genitalia, as follows. Female. Epigynum with long thin posteriorly pointing foveal teeth. Spermathecae long ovoid; in ventral uncleared view (Fig. 14a) copulatory ducts often visible from fovea onwards; three separate loops visible, including small lateral loops; ducts rather narrow. Male. Pedipalp: similar to *T. kathleenae*, with anterior tegular prong and similar conductor shape, but embolus long, as in *T. erici* (Fig. 15a, c). Cleft between tegulum and tegular process

similar to *T. kathleenae*.

Measurements (in mm). Female. Carapace length range, 1.85 to 2.30. Specimen KS.119277. Total length, 4.65; carapace length, 1.85; width, 1.53; height, 0.84; caput width, 0.94; clypeus height, 0.06; abdomen length, 2.90; width, 2.05; labium length, 0.23; width, 0.29; sternum length, 1.00; width (max), 0.88; Eyes: AME, 0.14; PME, 0.19; ALE, 0.13; PLE, 0.23; EGW, 0.80 MOQAW, 0.34; MOQPW, 0.44; MOQL, 0.40. Limbs (femur + (patella-tibia) + metatarsus + tarsus = total): pedipalp, $0.68 + 0.80 + 0.70 = 2.18$; leg I, $1.68 + 2.28 + 1.32 + 0.60 = 5.88$; leg II, $1.60 + 2.12 + 1.28 + 0.60 = 5.60$; leg III, $1.60 + 1.92 + 1.24 + 0.64 = 5.40$; leg IV, $1.92 + 2.44 + 1.88 + 0.80 = 7.04$. Ratio leg I / carapace width: 3.84. Male. Carapace length range, 1.95 to 2.25. Specimen KS.119067. Total length, 4.30; carapace length, 1.95; width, 1.72; height, 0.72; caput width, 0.97; clypeus height, 0.04; abdomen length, 2.45; width, 1.30; labium length, n/a; width, 0.30; sternum length, 1.13; width (max), 0.98; Eyes: AME, 0.16; PME, 0.18; ALE, 0.11; PLE, 0.21; EGW, 0.79 MOQAW, 0.34; MOQPW, 0.43; MOQL, 0.39. Limbs (femur + (patella-tibia) + metatarsus + tarsus = total): pedipalp, $0.78 + 0.68 + 0.88 = 2.33$; leg I, $2.20 + 3.08 + 1.76 + 0.76 = 7.80$; leg II, $2.16 + 2.92 + 1.80 + 0.76 = 7.64$; leg III, $2.20 + 2.68 + 1.92 + 0.76 = 7.56$; leg IV, $2.56 + \text{n/a} + \text{n/a} + \text{n/a} = \text{n/a}$. Ratio leg I / carapace width: 4.53.

Material Examined

Australia, NEW SOUTH WALES. 1 ♀ (KS.106075), Blue Mountains National Park, Murphy's Glen camping area, S of Woodford, 33°46'07"S, 150°29'11"E, 4 Nov 2008, night collecting, G.A. Milledge, H.M. Smith. 2 ♀ (KS.119068, KS.119070), Medlow Bath, 33°41'S, 150°17'E, under bark on gum tree, M. Ward colln. 1 ♀ (KS.30002), Kanangra-Boyd National Park, Blood Filly Creek near Jenolan Caves, 33°51'S, 150°03'E, 27 Mar 1976, in logs, M.R. Gray, G.S. Hunt, J. McDougall. 1 ♀ (KS.106136), Kanangra-Boyd National Park, Boyd River campsite, 33°58'18"S, 150°03'21"E, 5 Nov 2008, night collecting, G.A. Milledge, H.M. Smith. 1 ♂ (KS.115589), Mt Edwards, Boyd Plateau, 33°50'S, 150°00'E, 15 May 1971, under log, M.R. Gray.

Distribution

Australia: Great Dividing Range to the west and south-west of Sydney (Fig. 16).

Comments

None of the three males known for this species is in perfect condition, but the one used for measurements represents the only one to be from the same locality

as the females of the species. The male specimen used for SEM (KS.115589) has a rather broader anterior tegular prong than the other two males (and this part of the palp has warped in SEM preparation), but appears to agree otherwise. The described male has eight pairs of ventral tibial macrosetae on left leg one, i.e. one more than other described specimens of the *T. huttoni* group; on the right are seven large and one small macrosetae on the prolateral side (matching the left) but one large macroseta is missing from the retrolateral sequence; here macrosetae spread out to fill the space, so they are no longer paired (offset visible in Fig. 13c).

A female from the Illawarra area south of Sydney, discussed under *T. erici*, has superficially similar epigynum and ducts to *T. macleayi* in ventral view (although the lateral loops are more anterior); however the legs of that specimen (like *T. erici*) are strongly banded, and the course of the copulatory ducts can be seen to be quite dissimilar when traced in the excised epigynum. Very darkly coloured specimens were found in Blue Mountains specimens of this species and in *T. kathleenae*.

DISCUSSION

Toxopsoides is a rather a mysterious element of the New Zealand fauna. The male and female spiders later described as *Toxopsoides huttoni* were either overlooked or were not available to Ray Forster at the time of writing his Desidae volume (III) on New Zealand spiders (Forster 1970) and the species was added, under subfamily Toxopinae, in the final pages of Volume IV. The original description remains the only published record of the species, indeed the genus, in New Zealand (Vink et al. 2011: 35).

In Australia, the genus *Toxopsoides* has been recognised for many years (Davies 1986) but no specific name has been used. Based on material in the Australian Museum collections, I can report that *Toxopsoides* relatives can be found in all temperate forested areas of Australia, including Tasmania and the south-west of Western Australia, and northwards into the subtropics of south-east Queensland. The species that are most common in survey collections are from pitfall traps, which probably explains why it has taken so long to recognise *T. huttoni* itself, which is primarily a tree-trunk dweller.

Of the 22 *Toxopsoides* species tentatively identified under 'Toxopidae genus 1' in Gray and Cassis (1994) from the north-east forests of New South Wales, only one, *T. erici*, is described here; the other species belong among the relatives I have

TOXOPSOIDES IN AUSTRALIA

termed the *Toxopsoides* group. I have seen many more species belonging in these as yet undefined groups from southern NSW, from other states and the ACT. In several species I have examined in any detail the specific boundaries were unclear and there may be complexes. Even within the *T. huttoni* group, specific boundaries need much more work to fully comprehend. In many cases, populations from physically separated areas show slight, but consistent differences—or one sex appears identical whilst the apparently corresponding partner is different. Some examples are discussed under their relevant species entries above.

Not all *T. huttoni* group species known to me have been included here, but all species known from both sexes and paired with reasonable certainty have been described. Although many *Toxopsoides* specimens would no doubt be available through the other Australian museums, it is not the intention of this paper to thoroughly investigate species boundaries and variation. Rather, I wish to take the first steps to tie *T. huttoni* firmly to Australia and demonstrate that further closely related species occur here.

The final note here concerns the familial placement of *Toxopsoides*. The suite of characters listed in the generic diagnosis for species of the *T. huttoni* group do not fit neatly into any current family definition. Whilst some male palpal characters, such as the broad median apophysis and membrane-enclosed embolus, at least superficially resemble those seen in other taxa of Desidae (e.g. *Badumna* Thorell or *Phryganoporus* Simon), the grate-shaped tapetum is not currently recorded within that family—nor from any of the ‘fused paracribellar clade’ that otherwise held all the desid taxa tested by Griswold et al. (2005). Although the grate-shaped tapetum originally defined the Lycosoidea (Homann 1971), Gray and Smith (2002, 2008) substantiated the occurrence of the character in the non lycosoid family Stiphidiidae. Reviewing their own results (Griswold 1993, Griswold et al. 1999), and those of Silva Dávila (2003) and Raven and Stumkat (2005), Griswold et al. (2005) have concluded that the grate-shaped tapetum appears to have little phylogenetic value, and they no longer recover a monophyletic ‘lycosoid’ clade. Despite this, the combined characters of *Toxopsoides* (three claws, two rows of tarsal trichobothria lengthening distally, grate-shaped tapetum, pretarsus, strongly recurved eye rows, multiple paired macrosetae on venter of anterior tibiae and metatarsi, absence of locking tegular/subtegular lobes) appear to fit within a loose concept of Lycosoidea slightly better than the clades entirely lacking a grate shaped tapetum. However, with no satisfactory alternative at the present time,

I leave *Toxopsoides* in the Desidae pending further research—a decision supported by researchers working on the higher systematics of Lycosoidea and related taxa (C.E. Griswold pers. comm.).

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REFERENCES

- Davies, V.T. (1986). ‘Australian spiders Araneae, collection, preservation and identification’. Queensland Museum Booklet no. 14. (Queensland Museum: Brisbane).
- Forster, R.R. (1964). The spider family Toxopidae (Araneae). *Annals of the Natal Museum* 16: 113-151.
- Forster, R.R. (1970). The spiders of New Zealand. Part III. *Otago Museum Bulletin* 3: 1-184.
- Forster, R.R. and Wilton, C.L. (1973). The spiders of New Zealand. Part IV. *Otago Museum Bulletin* 4: 1-309.
- Gray, M.R. and Cassis, G.A. (1994). Results of ground dwelling invertebrate fauna surveys of north-east NSW forests. North East Forests Biodiversity Study Report No. 3c, unpublished report (NSW National Parks and Wildlife Service).
- Gray, M.R. and Smith, H.M. (2002). *Therlinya*, a new genus of spiders from eastern Australia (Araneae: Amaurobioidea). *Records of the Australian Museum* 54: 293-312.
- Gray, M.R. and Smith, H.M. (2008). A new subfamily of spiders with grate-shaped tapeta from Australia and Papua New Guinea (Araneae: Stiphidiidae: Borralinae). *Records of the Australian Museum* 60: 13-44.
- Griswold, C.E. (1993). Investigations into the phylogeny of the lycosoid spiders and their kin (Arachnida: Araneae: Lycosoidea). *Smithsonian Contributions to Zoology* 539: 1-39.
- Griswold, C.E., Coddington, J.A., Platnick, N.I. and Forster, R.R. (1999). Towards a phylogeny of entelegyne spiders (Araneae, Araneomorphae, Entelegynae). *Journal of Arachnology* 27: 53-63.

- Griswold, C.E., Ramírez, M.J. Coddington, J.A. and Platnick, N.I. (2005). Atlas of phylogenetic data for entelegyne spiders (Araneae: Araneomorphae: Entelegynae) with comments on their phylogeny. *Proceedings of the California Academy of Sciences* 56 (Suppl. II): 1-324.
- Hickman, V.V. (1940). The Toxopidae, a new family of Spiders. *Papers and Proceedings of the Royal Society of Tasmania*. 1939: 125-130.
- Homann, H. (1971). Die augen der Araneae: Anatomie, Ontogenese und Bedeutung für die Systematik (Chelicerata, Arachnida). *Zeitschrift für Morphologie der Tiere* 69: 201-272.
- Raven, R.J. and Stumkat, K.S. (2005). Revisions of Australian ground-hunting spiders: II. Zoropsidae (Lycosoidea: Araneae). *Memoirs of the Queensland Museum* 50: 347-423.
- Silva Dávila, D. (2003). Higher-level relationships of the spider family Ctenidae (Araneae: Ctenoidea). *Bulletin of the American Museum of Natural History* 274: 1-86.
- Vink, C.J., Hutton, R.W. and Fraser, C. (2011). The mysterious Waitetola, type locality of several New Zealand spiders. *The Weta* 41: 35-37.

