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Redescription and generic placement of the spider *Cryptachaea gigantipes* (Keyserling, 1890) (Araneae: Theridiidae) and notes on related synanthropic species in Australasia

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Abstract

Cryptachaea gigantipes (Keyserling, 1890) **n. comb.** is redescribed from fresh material, the female is described for the first time and notes on biology are given. *Cryptachaea gigantipes* has been recorded from natural habitats in south-eastern Australia, but is also commonly encountered around houses and other built structures, there and in the North Island of New Zealand. The earliest New Zealand records are from the year 2000 and it would appear that the species has been accidentally introduced due to its synanthropic tendencies. The idea of a recent and limited initial introduction is supported by cytochrome *c* oxidase subunit 1 (COI) sequences, which are extremely homogeneous from New Zealand specimens compared to those from Australia. A comparison of *Cryptachaea gigantipes* with *Cryptachaea veruculata* (Urquhart, 1886) shows the two species are closely related. *Theridion calyciferum* Urquhart, 1886 from New Zealand and *Achaearanea extrilida* (Keyserling, 1890) from Australia are placed in synonymy under *C. veruculata* **n. syn.**

Key words: COI, Australia, New Zealand, bites, biology

Introduction

'*Theridion*' *gigantipes* Keyserling, 1890 is a long-legged theridiid that is common on the exterior of houses in some parts of eastern Australia. The species has often been misidentified as either the cosmopolitan *Parasteatoda tepidariorum* (C. L. Koch, 1841) (e.g. Crowe 2007), or *Cryptachaea veruculata* (Urquhart, 1886), which has rather similar genitalia (e.g. Isbister & Gray 2003). Investigations during the present study have revealed that '*Theridion*' *gigantipes* belongs in the genus *Cryptachaea* Archer, 1946 and has been recorded in New Zealand only since 2000, but may have been present in Auckland as early as the 1980s (D.J. Court pers. comm.). In the course of a comparison between *C. gigantipes* and *C. veruculata*, it became evident that *Achaearanea extrilida* (Keyserling, 1890), from near Sydney, and *Theridion calyciferum* Urquhart, 1886 (currently a junior synonym of *Theridion cruciferum* Urquhart, 1886), from New Zealand, should be synonymised with *C. veruculata.*

In this paper we transfer *T. gigantipes* to *Cryptachaea*. We redescribe the male and describe the female for the first time. As this species is synanthropic and may be capable of anthropogenic dispersal we use COI sequences to compare the diversity of Australian and New Zealand specimens to attempt to find the origin of the New Zealand populations. We record data pertinent to this potentially invasive species and bring it to the attention of arachnologists in other places where it might flourish. We also redress the misplacement of *T. calyciferum* and propose that *Achaearanea extrilida* should be placed as a junior synonym of *Cryptachaea veruculata*.

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Methods

A selection of Australian and New Zealand specimens was examined for this study, thus the records do not represent an exhaustive search of collections. Specimens were examined from the Australian Museum, Sydney (AM), Auckland Museum (AMNZ), Natural History Museum, London (BMNH), Entomology Research Museum, Lincoln University (LUNZ), Ministry for Primary Industries, Christchurch (MPI), Museum of New Zealand Te Papa Tongarewa, Wellington (MONZ), and the New Zealand Arthropod Collection, Auckland (NZAC). New Zealand region names follow Crosby *et al*. (1998).

Specimen examinations, measurements and drawings were made using an Olympus SZ16 microscope fitted with graticule and camera lucida. Photographs in several focal planes were taken using a ColorView I camera mounted on the Olympus SZ16 and layers combined using HeliconFocus software (version 4.21). Plates were composed using Adobe Photoshop (5.0 LE and CS2 9.0). Expanded male pedipalps were prepared by sequential immersion in potassium hydroxide and distilled water. Female genitalia were cleared by temporary immersion in lactic acid. Structure names follow Agnarsson (2004).

To facilitate the identification of immature specimens and as a preliminary investigation of the phylogenetic structure of the genus *Cryptachaea*, we used the mitochondrial gene cytochrome *c* oxidase subunit 1 (COI). COI has been used to examine genetic differences among species and populations in theridiids (e.g. Garb *et al*. 2004; Agnarsson *et al*. 2007; Vink *et al*. 2008, 2009) and other araneoid spiders (e.g. Hormiga *et al*. 2003; Vandergast *et al*. 2004; Smith 2006; Framenau *et al*. 2010). We sequenced fragments of COI from 12 specimens of *Cryptachaea gigantipes* (seven from Australia, five from New Zealand), 15 specimens of *Cryptachaea veruculata* (two from Australia, 13 from New Zealand) and eight specimens of *Cryptachaea blattea* (Urquhart, 1886) (five from the Azores, three from New Zealand). One specimen of each of the three *Cryptachaea* species was immature and it is usually not possible to identify immature *Cryptachaea* species from morphological characters. The identities of these three specimens were confirmed by comparing their COI sequences to those of adult specimens. We also sequenced another three invasive species (*Nesticodes rufipes* (Lucas, 1846), *Platnickina mneon* (Bösenberg & Strand, 1906), *Parasteatoda tepidariorum*) that are also in the subfamily Theridiinae (Table 1).

DNA was extracted non-destructively (Paquin & Vink 2009) from one set of legs 2, 3 and 4 using a ZR Genomic DNA™-Tissue MiniPrep kit (Zymo Research). The following primer combinations were used to amplify and sequence COI fragments from different specimens, as no single primer pair successfully amplified DNA from all specimens: C1-J-1517 (5'-AATCATARGGATATTGGAAC-3') (Thomas & Hedin 2008) plus C1-N-2568 (5'-GCTACAACATAATAAGTATCATG-3') (Hedin & Maddison 2001); LCO-1490 (5'-GGTCAACAAATCATAAA GATATTGG-3') (Folmer *et al.* 1994) plus C1-N-2568; LCO-1490 plus C1-N-2776-spider (5'-GGATAATCAGAAT ANCGNCGAGG-3') (Vink *et al.* 2005); C1-J-1718-spider (5'-GGNGGATTTGGAAATTGRTTRGTTCC-3') (Vink *et al.* 2005) plus C1-N-2568. PCR amplification was performed using *i*-StarTaq™ DNA Polymerase (iNtRON Biotechnology) in a Mastercycler® (Eppendorf) thermocycler with a cycling profile of 35 cycles of 94 ºC denaturation (30 s), 48 °C annealing (30 s), 72 ºC extension (1 min) with an initial denaturation of 3 min and a final extension of 5 min. Excess primers and salts were removed from the resulting double-stranded DNA using a DNA Clean & Concentrator™ Kit (Zymo Research). Purified PCR fragments of DNA were sequenced in both directions at either Macrogen (Seoul) or the Massey Genome Service (Massey University). Sequence data are deposited in GenBank (www.ncbi.nlm.nih.gov/Genbank/). Sequences were edited and compared to each other using Sequencher 4.6 (Gene Codes Corporation). Sequencher was also used for the alignment of COI sequences because there was no evidence of insertions/deletions or stop codons and alignment was straightforward. Uncorrected pairwise distances for the dataset of 1005 nucleotides were calculated using PAUP* version 4.0b10 (Swofford 2002).

Partitioned Bayesian analyses implemented in MrBayes version 3.1.2 (Ronquist & Huelsenbeck 2003) were used to estimate the COI phylogenetic tree topology. MrModeltest version 2.3 (Nylander 2008) implemented in PAUP* version 4.0b10 (Swofford 2002) was used to select the model parameters. Within MrModeltest, the Akaike Information Criterion was used for model selection (Posada & Buckley 2004). Based on the results of Brandley *et al*. (2005), the COI data were partitioned by codon with models selected for each codon; GTR+Γ (Lanave *et al*. 1984; Tavaré 1986; Yang 1994) for the 1st codon positions, GTR (Lanave *et al*. 1984; Tavaré 1986) for the 2nd codon positions and HKY+Γ (Hasegawa *et al.* 1985; Yang 1994) for the 3rd codon positions. Bayesian analyses were conducted by running two simultaneous, completely independent analyses, each with four heated chains and

TABLE 1. Specimens sequenced showing sex, collection localities, dates collected, collectors, museum, haplotype codes and GenBank accession numbers. Haplotype numbers for *Cryptachaea blattea* follow Vink *et al*. 2009.

Species	Sex	Collection details	Haplotype	GenBank accession number
Cryptachaea gigantipes	female	Australia, Queensland, Tambourine Mountain (27°56'S, 153°12'E), 23 Oct 2010, G. Anderson, AM KS116467	1	JN859090
Cryptachaea gigantipes	subadult female	Australia, New South Wales, Blackbutt Reserve (32°56'S, 151°41.5'E), 7 Aug 2011, G. Anderson, AM KS116466	2	JN859091
Cryptachaea gigantipes	female	Australia, New South Wales, Mount Colah (33°40'S, 151°07'E), 30 Apr 2011, H.M. Smith, MONZ AS.002645	3	JN859092
Cryptachaea gigantipes	male	Australia, New South Wales, Mount Colah (33°40'S, 151°07'E), 11 Apr 2011, H.M. Smith, MONZ AS.002646	4	JN859093
Cryptachaea gigantipes	female	Australia, Victoria, Ruffey Lake Park (37°46.5'S, 145°08.2'E), 17 May 2011, G. Anderson, AM KS116469	2	JN859094
Cryptachaea gigantipes	female	Australia, Victoria, Gardiners Creek (37°49.6'S, 145°08.7'E), 26 Dec 2010, G.A. Milledge & H.M. Smith, MONZ AS.002647	5	JN859095
Cryptachaea gigantipes	female	Australia, Tasmania, Prospect (41°28'S, 147°08'E), 8 Sep 2010, J. Douglas, MONZ AS.002648	6	JN859096
Cryptachaea gigantipes	female	New Zealand, Northland, Whangarei (35°45.71'S, 174°21.51'E), 1 Aug 2008, O. J.-P. Ball, MONZ AS.002649	7	JN859097
Cryptachaea gigantipes	subadult female	New Zealand, Auckland, Saint Johns (36°53.0'S, 174°50.9'E), Feb 2009, G. Hall, LUNZ 00012663	7	JN859098
Cryptachaea gigantipes	female	New Zealand, Auckland, Avondale (36°53.4'S, 174°41.0'E), Feb 2009, G. Hall, LUNZ 00012664	8	JN859099
Cryptachaea gigantipes	female	New Zealand, Waikato, Raglan (37°48.10'S, 174°53.41'E), 14 Jun 2011, L.H. Ranson, LUNZ 00012665	7	JN859100
Cryptachaea gigantipes	female	New Zealand, Bay of Plenty, near Whakatane (37°59'S, 176°54'E), 30 Jul 2011, L.H. Ranson, LUNZ 00012666	7	JN859101
Cryptachaea veruculata	female	Australia, New South Wales, Gundabooka National Park (30°33.43'S, 145°35.67'E), 19-22 October 2010, G.A. Milledge & H.M. Smith, AM KS114398	A	JN859102
Cryptachaea veruculata	female	Australia, New South Wales, Lake Peery (30°42.7'S, 143°33.53'E), 27 Oct 2010, G.A. Milledge & H.M. Smith, AM KS114427	A	JN859103
Cryptachaea veruculata	female	New Zealand, Kermadec Islands, Raoul Island (29°18.83'S, 177°57.00'W), 15 May 2011, W.G. Chinn, AMNZ	B	JN859104
Cryptachaea veruculata	female	New Zealand, Kermadec Islands, Raoul Island (29°18.83'S, 177°57.00'W), 15 May 2011, W.G. Chinn, AMNZ	C	JN859105
Cryptachaea veruculata	male	New Zealand, Wellington, Stokes Valley (41°11.2'S, 174°58.77'E), 30 Nov 2008, B.M. Fitzgerald, MONZ AS.002470	D	JN859106
Cryptachaea veruculata	female	New Zealand, Wellington, Stokes Valley (41°11.2'S, 174°58.77'E), 30 Nov 2008, B.M. Fitzgerald, MONZ AS.002470	E	JN859107
Cryptachaea veruculata	female	New Zealand, Mid Canterbury, Christchurch International Airport (43°29.2'S, 172°32.5'E), 2 Apr 2007, M.R. McNeill, LUNZ 00012667	F	JN859108

……continued on next page

TABLE 1. (Contnued)

Species	Sex	Collection details	Haplotype	GenBank accession number
Cryptachaea veruculata	female	New Zealand, Mid Canterbury, Christchurch International Airport (43°29.2'S, 172°32.5'E), 2 Apr 2007, M.R. McNeill, LUNZ 00012668	G	JN859109
Cryptachaea veruculata	female	New Zealand, Mid Canterbury, Christchurch International Airport (43°29.2'S, 172°32.5'E), 2 Apr 2007, M.R. McNeill, LUNZ 00012669	F	JN859110
Cryptachaea veruculata	female	New Zealand, Mid Canterbury, Mary Duncan Park (43°34.5'S, 172°41.3'E), 19 Mar 2007, C.J. Vink, LUNZ 00012670	H	JN859111
Cryptachaea veruculata	female	New Zealand, Mid Canterbury, Somerfield (43°33.75'S, 172°37.67'E), 29 Nov 2008, C.J. Vink, LUNZ 00012671	I	JN859112
Cryptachaea veruculata	female	New Zealand, Mid Canterbury, Somerfield (43°33.75'S, 172°37.67'E), 2 Dec 2008, C.J. Vink, LUNZ 00012672	J	JN859113
Cryptachaea veruculata	male	New Zealand, Mid Canterbury, Somerfield (43°33.75'S, 172°37.67'E), 2 Dec 2008, C.J. Vink, LUNZ 00012673	K	JN859114
Cryptachaea veruculata	female	New Zealand, Mid Canterbury, Kennedys Bush Scenic Reserve (43°38.05'S, 172°37.47'E), 30 Dec 2008, C.J. Vink, LUNZ 00012674	L	JN859115
Cryptachaea veruculata	female	New Zealand, Mid Canterbury, Lincoln University (43°38.59'S, 172°28.18'E), 2 Apr 2007, J. Malumbres-Olarte, LUNZ 00012675	I	JN859116
Cryptachaea blattea	female	Portugal, Azores, Flores, Lagoa dos Patos (39°26'N, 31°14.3'W), 22 Sep 2009, N.R. Fritzén, Fritzén collection	3	JN859117
Cryptachaea blattea	female	Portugal, Azores, Flores, Lagoa dos Patos (39°26.2'N, 31°14.3'W), 22 Sep 2009, N.R. Fritzén, Fritzén collection	3	JN859118
Cryptachaea blattea	female	Portugal, Azores, Flores, Fora da Rocha (39°28'N, 31°15'W), 23 Sep 2009, N.R. Fritzén, Fritzén collection	3	JN859119
Cryptachaea blattea	female	Portugal, Azores, Flores, Fora da Rocha (39°28'N, 31°15'W), 23 Sep 2009, N.R. Fritzén, Fritzén collection	3	JN859120
Cryptachaea blattea	female	Portugal, Azores, Flores, Fajã de Lopo Vaz (39°22.5'N, 31°12.2'W), 21 Sep 2009, N.R. Fritzén, Fritzén collection	3	JN859121
Cryptachaea blattea	subadult male	New Zealand, Kermadec Islands, Raoul Island (29°14.60'S, 177°56.28'W), 17 May 2011, W.G. Chinn, AMNZ	1	JN859122
Cryptachaea blattea	female	New Zealand, Wellington, Papaitonga Reserve (40°38.73'S, 175°13.95'E), 22 Feb 2008, P. Paquin, Paquin collection	1	EU935469
Cryptachaea blattea	female	New Zealand, Mid Canterbury, Lyttleton (43°36.4'S, 172°43.8'E), 27 Oct 2006, M.R. McNeill & C.J. Vink, LUNZ 00012676	3	JN859123
Nesticodes rufipes	female	New Zealand, Mid Canterbury, Hillsborough (43°34.0'S, 172°41.0'E), 31 Jan 2007, M.R. McNeill, LUNZ 00012677		JN859124
Parasteatoda tepidariorum	female	New Zealand, Kermadec Islands, Raoul Island (29°14.60'S,, 177°56.28'W), 17 May 2011, W.G. Chinn, AMNZ		JN859125
Parasteatoda tepidariorum	female	United States of America, New York, Central Park (40°46.7'N, 73°58.4'W), 18 Sep 2011, N. Dupérré, LUNZ 00012678		JN859126
Platnickina mneon	female	New Zealand, Auckland, sea container ex Tonga (36°50.5'S, 174°46.7'E), 6 Apr 2011, M.R. McNeill, LUNZ 00012679		JN859127

sampling every 1000th tree. The analyses were run for 2×10^7 generations by which time the average standard deviation of split frequencies had dropped below 0.002, which indicated that the two tree samples had converged. Tracer version 1.5 (Rambaut & Drummond 2009) was also used to determine if the analyses had sufficient effective sample sizes. MrBayes was used to construct majority rule consensus trees, discarding the first 25% of trees generated as burn-in. TreeView 1.6.6 (Page 1996) was used to view and save trees in graphic format.

Results

We observed eight COI haplotypes among the 12 specimens of *C. gigantipes* (Table 1); two haplotypes among the five New Zealand specimens of *C. gigantipes* and six haplotypes among the seven Australian specimens. No haplotypes were shared between New Zealand and Australia. Intraspecific and interspecific variation in the COI sequences is shown in Table 2. The maximum intraspecific variation we observed in *C. gigantipes* was 1.9%, whereas divergence in *C. veruculata* was as high as 5.0%. The maximum interspecific variation between the species in the subfamily Theridiinae that we sampled was 13.0%.

The phylogenetic analysis of the COI data (Fig. 1) showed that *C. gigantipes* and *C. veruculata* specimens formed two well supported sister clades. The minimum divergence between the two species was 5.7% and the mean divergence was 6.6%. The mean intraspecific divergences in *C. gigantipes* and *C. veruculata*, were 0.8% and 2.8%, respectively. In the *C. gigantipes* clade, the specimen from Queensland was sister to the remaining haplotypes with strong support. New Zealand *C. gigantipes* specimens clustered with Australian specimens from New South Wales, Victoria and Tasmania, although the phylogenetic structure within this clade was not well supported. Specimens of *C. veruculata* from Australia and the Kermadec Islands were sister to the remaining haplotypes in the *C. veruculata* clade. The two specimens of the cosmopolitan species *Cryptachaea blattea* formed a clade that was sister to the Australasian *Cryptachaea* clade.

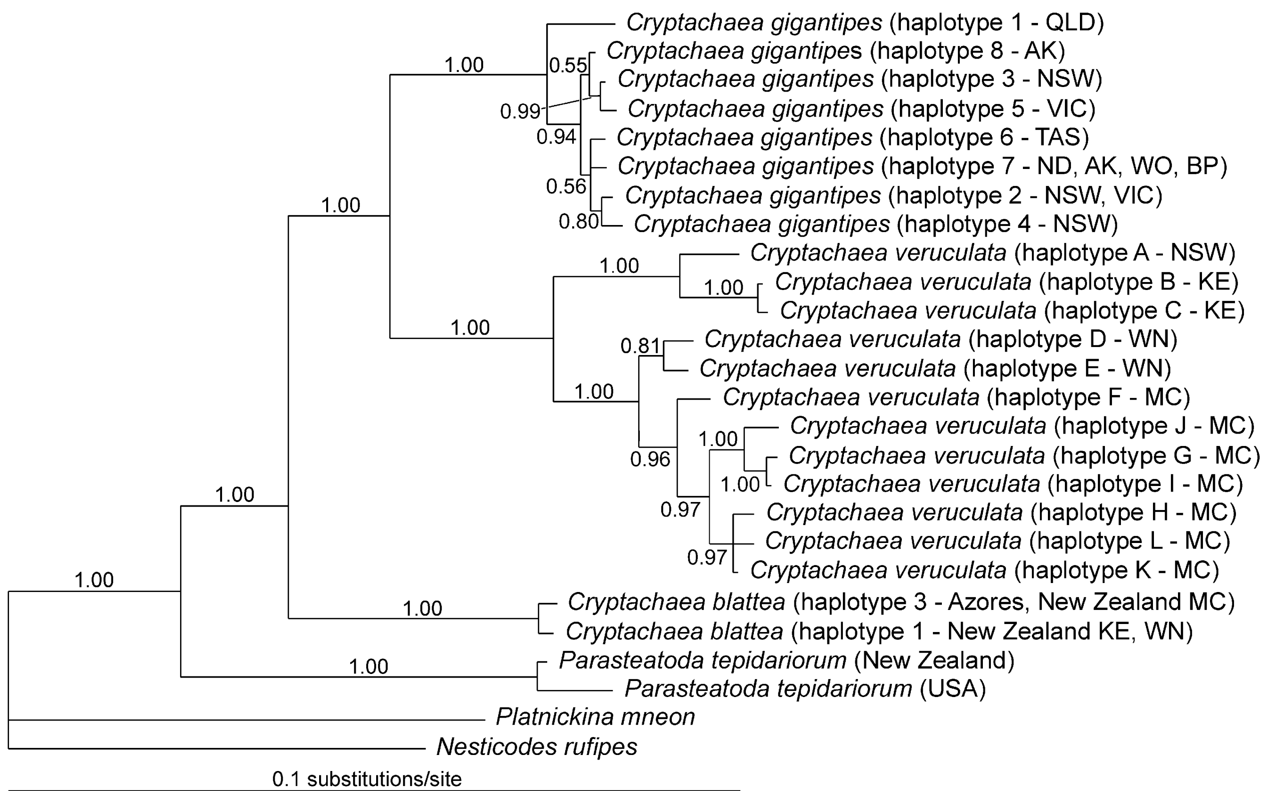


FIGURE 1. Bayesian consensus tree based on cytochrome *c* oxidase subunit 1 (COI) sequence data. Values on branches are posterior probabilities. Haplotype codes are listed in Table 1. Branch lengths are proportional to the expected number of substitutions per site (see scale bar). Abbreviations (Australia): NSW, New South Wales; QLD, Queensland; TAS, Tasmania; VIC, Victoria. Abbreviations (New Zealand): AK, Auckland; BP, Bay of Plenty; KE, Kermadec Islands; MC, Mid Canterbury; ND, Northland; WN, Wellington; WO, Waikato. New Zealand area codes follow Crosby *et al.* (1998).

TABLE 2. Uncorrected distance matrix for cytochrome *c* oxidase subunit 1. Haplotype codes are listed in Table 1.

	Species and haplotype code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	*C. gigantipes* 1																									
2	*C. gigantipes* 2	0.019																								
3	*C. gigantipes* 3	0.017	0.004																							
4	*C. gigantipes* 4	0.019	0.004	0.006																						
5	*C. gigantipes* 5	0.019	0.006	0.002	0.008																					
6	*C. gigantipes* 6	0.017	0.004	0.004	0.004	0.006																				
7	*C. gigantipes* 7	0.019	0.004	0.004	0.006	0.006	0.004																			
8	*C. gigantipes* 8	0.016	0.003	0.001	0.005	0.003	0.003	0.003																		
9	*C. veruculata* A	0.074	0.071	0.069	0.071	0.071	0.069	0.071	0.068																	
10	*C. veruculata* B	0.076	0.073	0.071	0.073	0.073	0.071	0.073	0.070	0.023																
11	*C. veruculata* C	0.077	0.074	0.072	0.074	0.074	0.072	0.074	0.071	0.024	0.001															
12	*C. veruculata* D	0.066	0.063	0.063	0.065	0.065	0.061	0.063	0.062	0.044	0.047	0.048														
13	*C. veruculata* E	0.065	0.062	0.062	0.064	0.064	0.060	0.062	0.061	0.044	0.047	0.048	0.008													
14	*C. veruculata* F	0.065	0.066	0.066	0.068	0.068	0.064	0.066	0.065	0.047	0.049	0.050	0.018	0.016												
15	*C. veruculata* G	0.067	0.068	0.066	0.068	0.068	0.064	0.066	0.065	0.046	0.046	0.047	0.021	0.021	0.017											
16	*C. veruculata* H	0.058	0.061	0.059	0.061	0.061	0.057	0.059	0.058	0.045	0.047	0.048	0.018	0.018	0.016	0.015										
17	*C. veruculata* I	0.066	0.067	0.065	0.067	0.067	0.063	0.065	0.064	0.045	0.045	0.046	0.020	0.020	0.016	0.001	0.014									
18	*C. veruculata* J	0.068	0.069	0.067	0.069	0.069	0.065	0.067	0.066	0.047	0.049	0.050	0.022	0.022	0.018	0.009	0.016	0.008								
19	*C. veruculata* K	0.061	0.064	0.062	0.064	0.064	0.060	0.062	0.061	0.046	0.048	0.049	0.017	0.017	0.013	0.012	0.003	0.011	0.013							
20	*C. veruculata* L	0.062	0.065	0.063	0.065	0.065	0.061	0.063	0.062	0.045	0.047	0.048	0.020	0.018	0.014	0.015	0.006	0.014	0.016	0.003						
21	*C. blattea* 3	0.074	0.075	0.073	0.075	0.075	0.071	0.073	0.072	0.084	0.083	0.084	0.078	0.075	0.083	0.079	0.077	0.078	0.078	0.080	0.079					
22	*C. blattea* 1	0.072	0.076	0.074	0.076	0.076	0.072	0.074	0.073	0.086	0.085	0.086	0.080	0.077	0.085	0.081	0.079	0.080	0.080	0.082	0.081	0.004				
23	*P. tepidariorum* NZ	0.099	0.104	0.103	0.105	0.105	0.101	0.103	0.102	0.103	0.105	0.106	0.099	0.099	0.101	0.103	0.097	0.102	0.106	0.100	0.101	0.097	0.095			
24	*P. tepidariorum* USA	0.106	0.110	0.109	0.111	0.111	0.107	0.109	0.108	0.105	0.109	0.110	0.105	0.103	0.105	0.106	0.103	0.105	0.109	0.104	0.105	0.103	0.102	0.015		
25	*Platnickina mneon*	0.116	0.118	0.116	0.118	0.117	0.114	0.114	0.115	0.115	0.108	0.109	0.112	0.110	0.113	0.108	0.109	0.107	0.110	0.112	0.113	0.105	0.109	0.123	0.130	
26	*Nesticodes rufipes*	0.104	0.107	0.105	0.106	0.107	0.103	0.103	0.104	0.112	0.108	0.109	0.105	0.102	0.105	0.101	0.099	0.101	0.101	0.101	0.102	0.097	0.098	0.112	0.115	0.114

Taxonomy

Family Theridiidae Sundevall, 1833

Genus *Cryptachaea* Archer, 1946

Cryptachaea—Archer 1946: 36, established as a subgenus of *Theridion* Walckenaer, 1805. Type species: *Theridion catapetraeum* Gertsch & Archer, 1942 [=*C. porteri* (Banks, 1896)], by original designation. Elevated to genus by Archer 1950: 14. Considered a junior synonym of *Achaearanea* Strand, 1929 by Levi 1955: 6. Removed from synonymy of *Achaearanea* by Yoshida 2008: 38.

Diagnosis. *Cryptachaea* keys out under *Achaearanea* according to Levi & Levi (1962). Yoshida (2008: 38) distinguished *Cryptachaea* from the other genera with a hooded 'paracymbium' (cymbial hood of Agnarsson 2004) that key out under *Achaearanea*, *Henziectypus* Archer, 1946 and *Parasteatoda* Archer, 1946, as follows: "... from *Henziectypus* by median apophysis attached to embolus with which it forms one sclerite, from *Parasteatoda* by cymbium extend [sic] beyond alveolus, tegulum spherical, and subtegulum shallow and ring-like".

Comments. Yoshida (2008) first transferred *C. veruculata* into the genus *Cryptachaea*, diagnosed partly by fusion of the median apophysis and embolus. In a superficial examination, these sclerites can be seen separately in both *C. veruculata* and *C. gigantipes* (Figs 14, 16). Further examination of these species shows that both sclerites are indeed fused onto a common base, but possibly retain some flexibility by the membranous sections (Fig. 15). The sclerotised part of the base of the median apophysis bears a prominent medial knob, which cradles the base of the embolus. Furthermore, there is a fleshy lobe with a sclerotised tip extending ventrally from the fused part of the median apophysis/embolus (shown as the latter in *C. veruculata* by Merrett & Rowe 1961: fig. 5). The lobe locates firmly in a proventral pocket in the conductor base. This pocket is visible externally as a dark outline in both species (e.g. Fig. 12). These features distinguish the two Australasian species from the cosmopolitan *Cryptachaea blattea*, in which the embolus and median apophysis are fused but neither the knob nor lobe/pocket is present (*C. blattea* specimen examined: AM KS116774, Stokes Valley, Wellington, NZ, coll. B.M. Fitzgerald, Oct. 2011).

We also note that the males of the three *Cryptachaea* species discussed here possess cephalothoracic stridulatory ridges and corresponding abdominal pegs. These characters are present in a number of theridiid genera (Agnarsson 2004) but were not reported by Yoshida (2008) when he revalidated *Cryptachaea*.

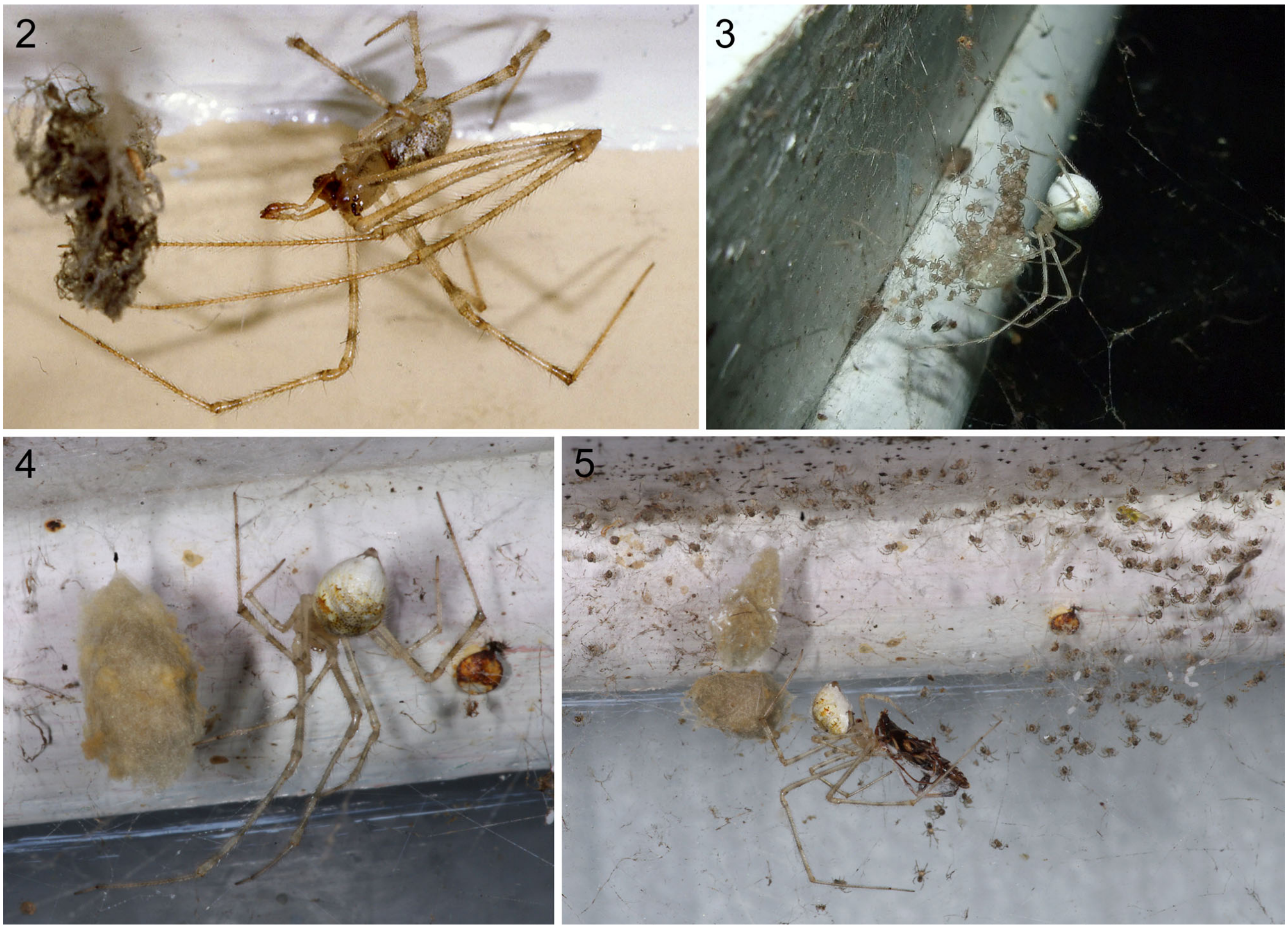
Cryptachaea gigantipes (Keyserling, 1890) new combination
(Figs 2–15, 17–20, 21)

Theridion gigantipes—Keyserling, 1890: 245–246, pl. 22, figs 4, 4a; Hogg 1900: 73; Rainbow 1911: 158.

Type material. [Australia: New South Wales] Head of Middle Harbour, Bradley's collection. Not examined. We were unable to locate the type specimen of *T. gigantipes*; however, Keyserling's description and illustrations are adequate to identify the species. Most of Bradley's collection as referred to by Keyserling and Koch is presumed lost (Framenau 2005) and this species is not listed among the Keyserling types held by the Zoologisches Museum Hamburg (Rack 1961), nor is it recorded in the Natural History Museum London (J. Beccaloni pers. comm.). These are the main collections holding Keyserling's Australian specimens.

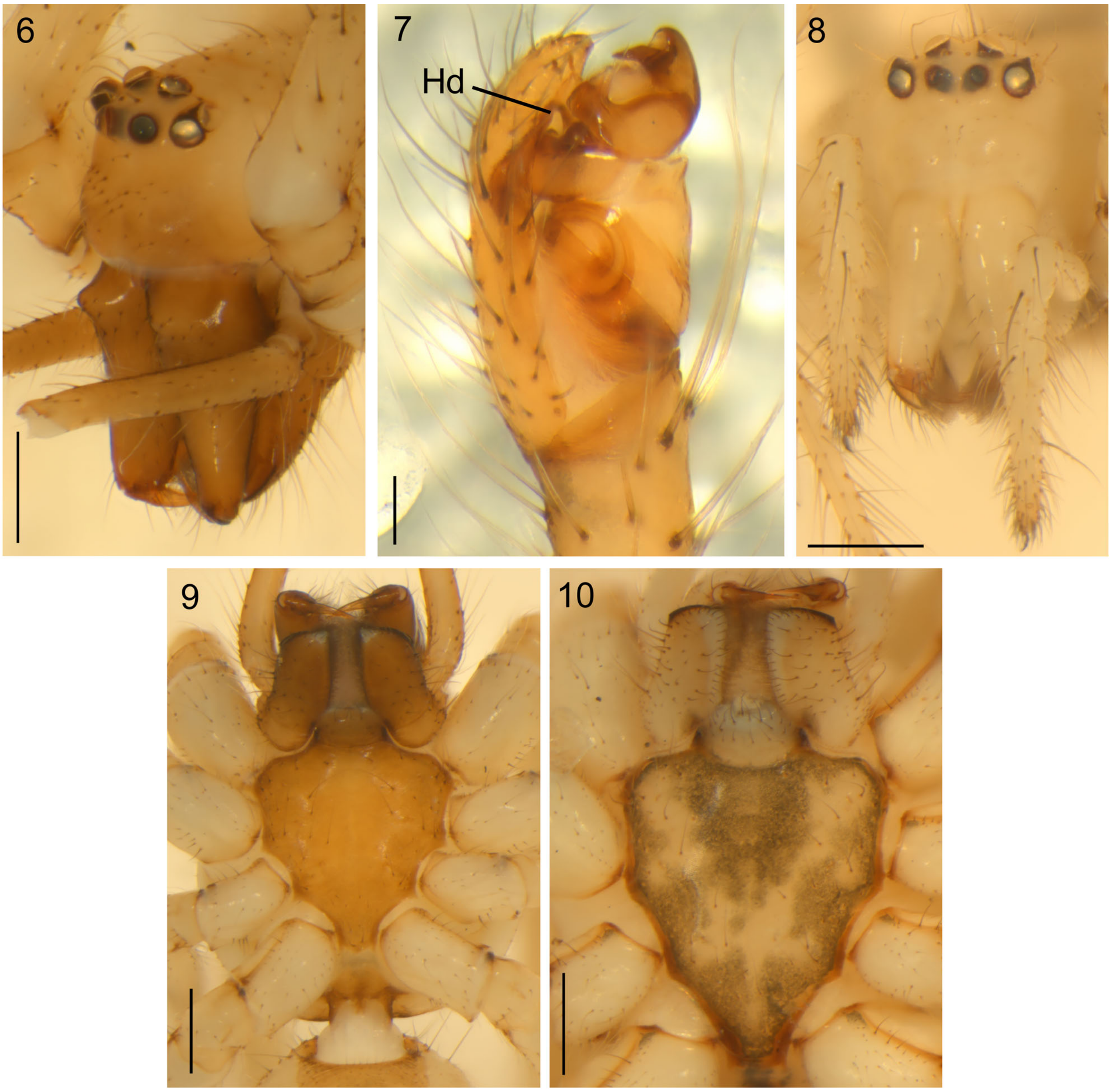
Selected other material examined. AUSTRALIA: Norfolk Island: Kingston [29°03'S 167°57'E], 15 Mar 1995, 1 ♀ (AM KS.55576). Norfolk Island [29°05'S 168°00'E], 27 Apr 1993, H. Sampson, 1 pen. ♂, 1 ♀ (AM KS.43950). **New South Wales**: (no locality), Apr 1952, N.L. Roberts, 1 ♀ (AM KS.31206). Bantry Bay, near Seaforth [33°47'S 151°14'E], 20 Dec 1981, M. Guider, 1 ♂ (AM KS.8521). Beecroft [33°45'S 151°04'E], 24 Jan 1993, J. Noble, 1 ♀ (AM KS.51950); same data, 1 Nov 2000, 1 ♀ (AM KS.70923); same data, with egg sac, 85 eggs, 15 Jan 2002, 1 ♀ (AM KS.76852); same data, 2 Oct 2002, 1 ♂ (AM KS.84275); same data, 5 Feb 2003, 1 ♂ (AM KS.86822); same data, 10 Jan 2003, 1 ♀ (AM KS.86825); same data, with egg sac, 149 eggs, 20 Nov 2003, 1 ♀ (AM KS.88860); same data, with egg sac, 246 eggs, 20 Nov 2003, 1 ♀ (AM KS.88861); same data, 22 Dec 2003, 1 ♀ (AM KS.88869); same data, 22 Mar 2004, 1 ♀ (AM KS.88876); same data, 1 Mar 2004, 1 ♂ (AM KS.88880); same data, 3 Aug 1992, 1 ♂ (AM KS.88903). Beecroft, Observatory Park [33°45'S 151°04'E], 12 Apr

2001, J. Noble, 1 ♀ (AM KS.72885). Bellevue Hill, Sydney [33°53'S 151°17'E], 2 Dec 1955, D. Austin, 1 ♀ (AM KS.68760). Blackbutt Reserve, Newcastle [32°56'07"S 151°41'26"E], 7 Aug 2011, G. Anderson, 1 ♀ (AM KS.116466; GenBank JN859091). Caringbah [34°02'S 151°08'E], 20 May 1979, G. Smith, 1 ♂, 1 ♀, 1 pen. ♂. (AM KS.4645). Cooleman Plains, Zed Cave CP30 [35°37'34"S 148°40'42"E], web in entrance, 29 Jan 1993, S. Eberhard, 1 ♀ (AM KS.34997). Crommelin Research Station, Pearl Beach [33°33'S 151°18'E], inside building, 3 Mar 1984, R.A. Bradley, 1 ♂, 2 ♀, 1 juv. (AM KS.50331). Deua Nat Pk, Deua Cave DE1 [35°49'48"S 149°40'12"E], bat guano in dark zone, 25 Feb 1993, S. Eberhard, 1 ♀ (AM KS.34957). Deua Nat Pk, Deua Cave [35°49'48"S 149°40'12"E], 5 Apr 1986, A.P. Spate, 1 ♀ (AM KS.16890). Epping Strip [33°46'S 151°05'E], 23 Dec 1997, J. Noble, 1 ♀ (AM KS.51934). Georgica Creek [28°39'23"S 153°09'23"E], 18 May 2010, S. Jacobs, 1 ♂ (AM KS.116245). Gerringong [34°44'S 150°50'E], with egg sac 73 eggs, 30 Jan 1989, G. Wishart, 1 ♀ (AM KS.21518). Gosford [33°26'S 151°21'E], 1975, K. Bridger, 1 ♂ (AM KS.35078); same data, 1 ♀ (AM KS.35079). Goulburn [34°44'S 149°44'E], Feb 2005, S. Lamont, 1 ♀ (AM KS.90917). Jamberoo [34°39'S 150°46'E], 28 Dec 1999, J. Noble, 1 ♂ (AM KS.66252). Jamberoo Mountain [34°40'S 150°43'E], 2 May 1997, J. Noble, 1 ♂ (AM KS.51938); same data, 2 Jan 2000, 1 ♂ (AM KS.65676); same data, 10 Jan 2001, 1 ♀ (AM KS.70894); same data, 20 Apr 2002, 1 ♀ (AM KS.79773); same data, 20 Apr 2002, 1 ♂ (AM KS.79774). Jenolan Caves [33°49'18"S 150°01'20"E], 5 ♂, 11 ♀, 20+ juv. (AM KS.83751). Jenolan Caves, Devils Coach House [33°49'S 150°02'E], in thick litter in flood bypass on west side, 13 Dec 1987, G. Smith & L. Wheeler, 1 ♀ (AM KS.19038). Kemps Creek [33°53'S 150°47'E], Jul 1977, D. Hart, 1 ♂ (AM KS.791). Macquarie University, North Ryde [33°46'S 151°07'E], 8 Oct 2009, A. Wignall, 1 ♂ (AM KS.109778); same data, 1 ♀ (AM KS.109779). Minnamurra Falls Reserve [34°38'S 150°44'E], under rock ledge, 20 Apr 1982, C. Horseman, 4 ♀ (AM KS.9018). Mt Colah [33°40'S 151°07'E], 10 Mar 1971, M.R. Gray, 1 ♂, 1 ♀ (AM KS.112621). Mount Colah, Heaney Close [33°39'45"S 151°07'11"E], 15 Jan 2010, G.A. Milledge, H.M. Smith, 1 ♂, 1 ♀ (AM KS.113937); same data, 6 Jan 2011, G.A. Milledge, 1 ♂ (AM KS.114249); same data, 30 Apr 2011, H.M. Smith, 1 ♀ (MONZ AS.002645; GenBank JN859092); same data, 11 Apr 2011, H.M. Smith, 1 ♂ (MONZ AS.002646; GenBank JN859093). Narraweena [33°45'S 151°16'E], 30 Jan 2000, G. Smith, 2 ♀ (AM KS.65022). Newnes State Forest, Birds Rock Flora Reserve, 0.6km from Sunnyside Ridge Rd [33°19'43"S 150°11'33"E], 23 Feb 2006, G.A. Milledge, J. Tarnawski, M. Beatson, 1 ♂, 1 ♀ (AM KS.94509). Near Crommelin Research Stn, Pearl Beach [33°33'S 151°18'E], 31 Mar 1984, R.A. Bradley, 1 ♀ (AM KS.50329). Orange [33°17'S 149°06'E], 20 Apr 2002, J. Noble, 1 ♀ (AM KS.79780); same data, 1 ♀ (AM KS.79781). Pebbly Beach Campsite [35°37'S 150°19'E], 26 Jan 1997, H. Smith, 1 ♀ (AM KS.97231). Rydalmere [33°48'54"S 151°02'06"E], 7 Mar 1966, R.E. Mascord, 1 ♂ (AM KS.115200). Ryde [33°49'S 151°06'E], 17 Mar 1993, E. Pearce, 2 ♂ (AM KS.34923). 'Scalloway', Gerringong [34°44'S 150°47'E], 27 Dec 1986, G. Wishart, ♂ (AM KS.17425); same data, 2 Nov 1986, 1 ♂ (AM KS.17426). St Georges Basin [35°05'S 150°35'E], Jan 1984, I. Buddle, 1 ♀ (AM KS.22666). Sydney [33°52'S 151°13'E], plus young, 27 Oct 1981, 1 ♀ (AM KS.16730). Terrey Hills [33°41'S 151°14'E], 1971, M. Gray, 1 ♂, 1 ♀ (AM KS.112620); same data, 3 Sep 1971, 1 ♀ (AM KS.112622); same data, eating female *Badumna*, 2 Jun 1971, 1 ♀ (AM KS.112616). Thornleigh [33°44'S 151°04'E], 2 Feb 2000, G. Smith, 1 ♀ (AM KS.65015). Willoughby [33°48'S 151°12'E], Apr 1994, W. Cashman, 1 ♀ (AM KS.40614). Wombeyan Caves, Grant's Cave [34°18'41"S 149°57'55"E], on wall, 15 Sep 1979, G. Smith, 1 ♀, 3 juv. (AM KS.19058); same data, W137, entrance zone, 12 Mar 1993, S. Eberhard, 1 ♀ (AM KS.35016). Yarrangobilly, Jillaberan Cave [35°43'30"S 148°29'09"E], 2 Oct 1986, A.P. Spate, 1 ♂ (AM KS.16891). Yarrangobilly, North Glory Cave Y25-3 [35°43'30"S 148°29'09"E], space web, entrance zone, 16 Jun 1993, S. Eberhard, 1 ♀ (AM KS.37472). Yarrangobilly Caves, Glory Cave Y24 [35°43'30"S 148°29'09"E], near twilight zone, 18 Jan 1989, A. Clarke, 1 ♀ (AM KS.31795). Yesabah Bat Cave, YBC1, nr Kempsey [31°05'S 152°43'E], 18 Jul 1971, M. Gray, 1 ♂, 1 ♀ (AM KS.115201). **Queensland**: Elanora [27°08'S 153°27'E], Isbister bite study specimen, 11 Jan 2001, 1 ♀ (AM KS.116847). Tambourine Mountain [27°56'19"S 153°10'47"E], 23 Oct 2010, G. Anderson, 1 ♀ (AM KS.116467; GenBank JN859090). **Tasmania**: Prospect [41°28'S 147°08'E], 8 Sep 2010, J. Douglas, 4 ♀, 2 jj (AM KS.113968); same data 1 ♀ (MONZ AS.002648; GenBank JN859096). **Victoria**: Gardiners Creek Reserve, Box Hill Sth [37°50'34"S 145°07'12"E], 26 Dec 2010, G.A. Milledge, H.M. Smith, 1 ♀ (AM KS.114272); same data 1 ♀ (MONZ AS.002647; GenBank JN859095). Ruffey Lake Park, Doncaster [37°46'30"S 145°08'21"E], 17 May 2011, G. Anderson, 1 ♀ (AM KS.116465); same data, 1 ♀ (AM KS.116468); same data, 1 ♀ (AM KS.116469; GenBank JN859094). **NEW ZEALAND**: **Auckland**: Auckland [36°51'21"S 174°45'42"E], ex lift well, 11 Apr 2011, 1 ♀ (NZAC). Avondale [36°53.4'S 174°41.0'E], on building, Feb 2009, G. Hall, 1 ♀ (LUNZ 00012664; GenBank JN859099). Henderson [36°51.1'S 174°37.7'E], outside wall of house, 27 Feb 2000, B.M. Fitzgerald, 1 ♂, 1 ♀ (MONZ AS.002389). New Zealand Arthropod Collection, Saint Johns [36°53.0'S 174°50.9'E], on building, Feb 2009, G. Hall, 1 subadult ♀ (LUNZ 00012663; GenBank JN859098). Taupaki [36°49.2'S 174°34.1'E], in front porch, 13 Jul 2003, O.R. Green, 2 penultimate ♂ (MONZ AS.002393); same data, 1 immature (MONZ AS.002394); same data, 4 ♀ (MONZ AS.002395); same data, 1 ♀ + spiderlings, 2 ♀ (MONZ AS.002396). **Bay of Plenty**: near Whakatane [37°59'S 176°54'E], 30 Jul 2011, L.H. Ranson, 1 ♀ (LUNZ 00012666). Tauranga [37°41.2'S 176°07.8'E], in house, 21 May 2002, S. Pearson, 1 ♂ (MPI 03/2003/1576). **Coromandel**: Cooks Beach [36°50.3'S 175°44.5'E], under verandah, 18 Nov 2003, B.M. Fitzgerald, 2 ♀ (MONZ AS.002390). Tairua [37°00.5'S 175°50.9'E], outside wall of house, 24 Feb 2002, B.M. Fitzgerald, 1 ♂, 1 ♀ (MONZ AS.002391). **Hawkes Bay**: Napier [39°28.5'S 176°52.8'E], on door, 20 Mar 2007, J. Graham, 1 ♀ (MPI 03/2007/757). **Northland**: Whangarei [35°45.71'S 174°21.51'E], 1 Aug 2008, O.J.-P. Ball, 1 ♀ (MONZ AS.002649; GenBank JN859097). **Waikato**: Hamilton [37°45.4'S 175°16.7'E], in house, 7 Feb 2006, A. Cressy, 2 ♀ (MPI 03/2006/391). Near Eureka [37°43.3'S 175°26.2'E], Nov 2005, 1 ♀ (MPI 3/05/2871). Norrie Ave, Raglan [37°48.3'S 174°52.1'E], outside wall of house, plus egg sac, Aug 2003, L.H. Ranson, 3 ♀ (MONZ AS.002392). Raglan [37°48.1'S 174°53.41'E], 14 Jun 2011, L.H. Ranson, 1 ♀ (LUNZ 00012665). **Wanganui**: Feilding [40°13'S 175°35'E], in bathroom, 13 Nov 2005, L. Fuller, 1 ♀ (MPI 3/05/2905). **Wellington**: Raukawa St, Stokes Valley [41°11.2'S, 174°58.77'E], in car, 4 Feb 2012, B.M. Fitzgerald, 1 ♀ (MONZ AS.002480).



FIGURES 2–5. *Cryptachaea gigantipes* (Keyserling, 1890). 2. Habitus of male (St. Peters, Sydney); 3. Female guarding emerging spiderlings (Coburg, Melbourne); 4. Female with egg sac 27 Sept 2011 (Coburg, Melbourne); 5. Same female, 13 November; spiderlings emerged from first egg sac are nearby in female's web, a recently completed egg sac hangs behind remains of first. Photos 3–5 by Wendy Moore, used with permission.

Diagnosis. The legs of *C. gigantipes* are far longer than those of related species currently known from Australia or New Zealand: the femur and tibia of leg I are each longer than (male) or subequal to (female) the total body length (Figs 2, 5). Male, pedipalp tibia elongate and subequal to cymbium length (Fig. 11; half or a third as long in *C. veruculata* (Fig. 16) and *C. blattea*, respectively). Epigynum with a pair of heavily sclerotised, peg-like protrusions that form a deep U-shape in posterior view (Fig. 19); the shape of these protrusions distinguishes the species from *C. veruculata* in which the protrusions are smaller and more horn-shaped. For comparison with *C. veruculata* and *C. blattea* refer to Merrett & Rowe (1961: figs. 1–7); Dondale (1966: figs 1B–E); Vink *et al*. (2009: figs 1–6); Paquin *et al.* (2010: figs 34.7–8, 34.13–14).



FIGURES 6–10. *Cryptachaea gigantipes* (Keyserling, 1890). 6. Male caput and chelicerae, anterolateral; 7. Male left pedipalp, prolateral, showing cymbial hood; 8. Female eyes and chelicerae, frontal; 9. Male mouthparts and sternum, ventral; 10. Female, ditto. Scale bars, Fig. 7 = 0.1 mm, others = 0.5 mm. Abbreviation: Hd, cymbial hood.

Redescription from recent material:

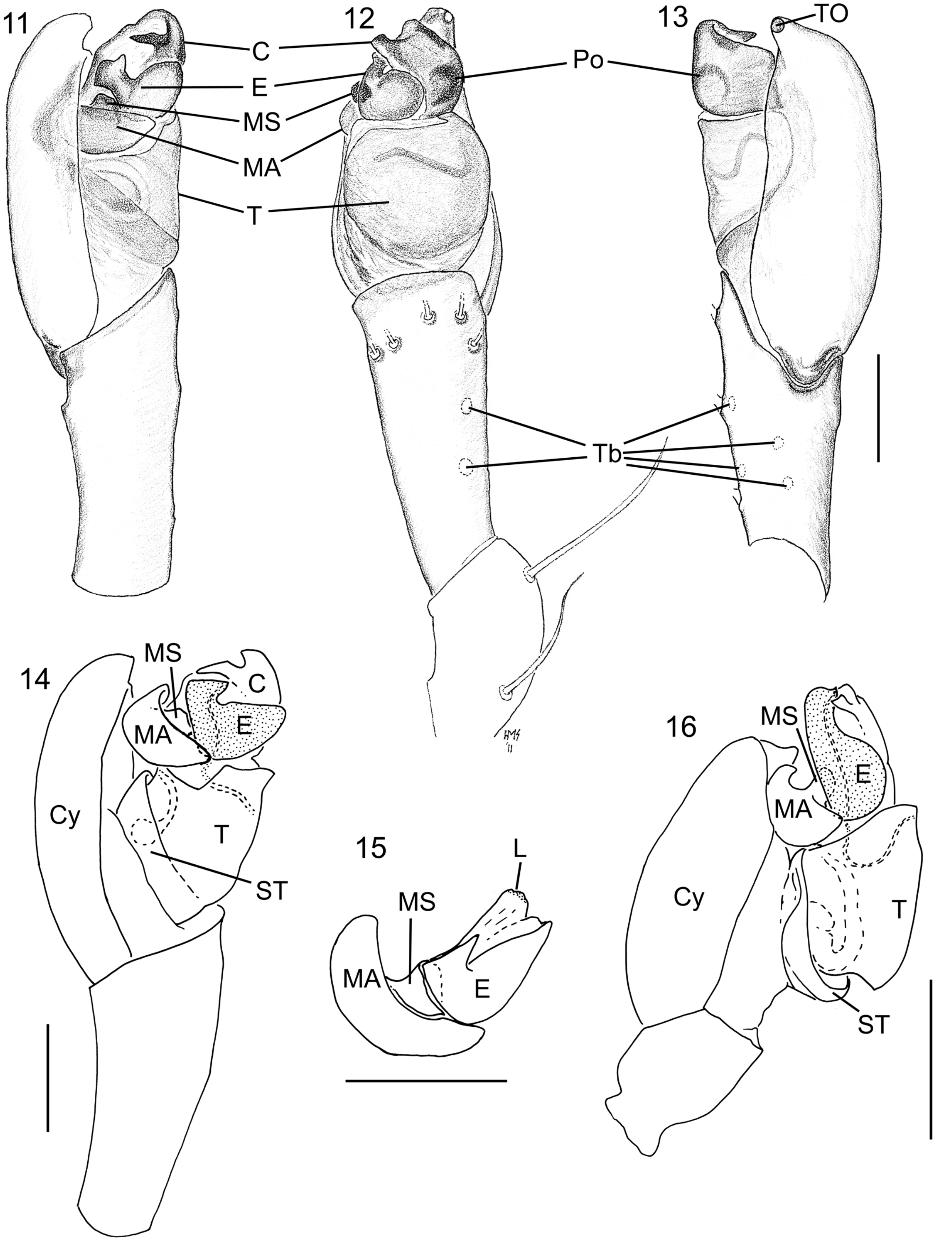
Colour. Generally stronger in male than female; prosoma variable but base colour amber (male) to cream or white (female), often with darker markings (e.g. female KS65015, Fig. 10); chelicerae and mouthparts amber (male) or cream (female) (Figs 6, 8); legs cream with brown or grey bands; abdomen with white ground colour variably marked dorsally and laterally with small spots of black or grey and sometimes reddish or yellow (Figs 2–4); ventrally often with black or grey median longitudinal stripe.

Male. Cephalic region slightly raised, all eyes subequal, clypeus high (Fig. 6); stridulatory ridges sclerotised, in separate patches either side of pedicel; chelicerae with strong anteriorly projecting shelf (Fig. 6); two promarginal cheliceral teeth, distal one finely pointed, more basal one spread into a transverse flange with two or more low points; retromarginal teeth absent; sternum scutiform, about as long as wide and widest between coxae I and II (Fig. 9). Male pedipalp (Figs 7, 11–14) with elongate tibia, tibia with 2+2 trichobothria on retrolateral and retroventral sides (Tb in Figs 12–13); cymbium deeply incised dorsally and with prominent apical tarsal organ (TO), cymbial hood broad (Hd in Fig. 7); median apophysis (MA) strap-like but with prominent sclerotised process (MS), cradling embolus; embolus (E) sclerotised exteriorly with enlarged base and bird-like 'neck', 'head' and 'beak', through which sperm duct exits; membranous hidden part of embolus fused with membranous basal parts of MA forming a lobe (L) (Fig. 15) that fits into pouch (Po) in base of conductor (C) (Figs 12–13); conductor large, retrobasal surface visibly ridged; tegulum ovate, subtegulum barely visible in unexpanded pedipalp. Legs 1-4-2-3, femur and tibia I each distinctly longer than entire body length. Abdomen without tubercle, distinctly longer than wide; sclerotised from genital groove to pedicel with narrow strip surrounding pedicel insertion; two patches of stridulatory pegs on anterior surface aligned with stridulatory ridges of carapace.

Female. Similar to male except as follows: cephalic area flatter, AME smaller (Fig. 8), posterior carapace smooth and without extra sclerotisation, without stridulatory ridges, chelicerae without shelves; basal cheliceral tooth normal but robust; sternum longer than wide, more elongate than male (Fig. 10). Female pedipalp with semipalmate claw. Legs shorter than male. Abdomen, more rounded than male but still longer than wide, without sclerotisation or stridulatory pegs. Epigynum (Figs 17–19) a slightly sclerotised plate with slightly raised anterior rim and bearing two heavily sclerotised projecting knobs (U-shaped in posterior view); copulatory ducts open at apex. Internal genitalia (Fig. 20) with uncoiled copulatory ducts leading to a pair of simple bean-shaped spermathecae, usually visible through cuticle.

Measurements, in mm. Male and female AM KS113937 from Mount Colah, New South Wales; ranges from Australian and New Zealand specimens. **Male.** Total length, 6.10; carapace length, 2.50; width, 1.95; Limbs (femur + patella-tibia + metatarsus + tarsus = total): pedipalp, 1.36 + 0.94 + / + 0.58 = 2.88; leg I, 8.60 + 8.80 + 8.90 + 2.20 = 28.50; leg II, 4.90 + 4.70 + 4.80 + 1.50 = 15.90; leg III, 3.50 + 2.70 + 3.10 + 1.10 = 10.40; leg IV, 5.30 + 4.40 + 5.00 + 1.60 = 16.30. Size range: body length 4.7–7.0 (mean 5.27, n=17), carapace length 2.09–3.2 (mean 2.43, n=17). **Female.** Total length, 6.10; carapace length, 2.25; width, 1.75; Limbs (femur + patella-tibia + metatarsus + tarsus = total): pedipalp, 0.84 + 0.58 + / + 0.76 = 2.18; leg I, 6.80 + 6.60 + 6.80 + 1.90 = 22.10; leg II, 3.80 + 3.80 + 3.70 + 1.30 = 12.60; leg III, 3.00 + 2.10 + 2.40 + 1.00 = 8.50; leg IV, 5.00 + 4.20 + 4.50 + 1.50 = 15.20. Size range: body length 4.5–7.9 (mean 6.0, n=37), carapace length 1.9–3.3 (mean 2.3, n=37).

Biology. The typical natural habitats for *C. gigantipes* in Australia are rocky overhangs and caves. These spiders readily move into areas of human habitation, preferring house eaves, porches and other shelters, sometimes entering buildings. All New Zealand records are synanthropic, leading to this species being dubbed the 'white porch spider' (O. Green pers. comm.). Adult females and juveniles make typical theridiid 'cobwebs' in spaces beneath surfaces and usually rest near the top in a slightly denser area of web. Adult males are free-ranging but are often found in female webs. Egg sacs are brownish and are made within the female's web, near her usual resting place (Figs 4, 5). Egg sacs and emerging spiderlings may be actively protected by the female, e.g. against disturbance by insects attracted by a lit window (Fig. 3). Early spring egg sacs take four or five weeks to emerge; later ones rather less time. The spiderlings remain in the maternal web for some time before dispersing (Fig. 5) (two weeks to about a month noted). They move to the edges of the web and disperse more rapidly when subsequent egg sacs are about to emerge. Females were seen to make two or three egg sacs in quick succession. (Egg sac and spiderling information from W. Moore, pers. comm.). Egg clutch size ranges from 50 to 246 (n=6, from preserved material). One other egg sac (AS.002396) contained 17 eggs, 25 first instar and one second instar spiderling. Various insect taxa have been noted as prey in Australia (including Coleoptera, Diptera, Hemiptera, Lepidoptera (larval and adult), Neuroptera—W. Moore pers. comm.) but several records are for other spider taxa, including several black house spiders (*Badumna insignis* (L. Koch, 1872), Desidae), a male net-casting spider (*Deinopis* sp., Deinopidae), a white-tail spider (*Lampona* sp., Lamponidae) and a male *Cambridgea* sp. (Stiphidiidae) (latter two records from O. Green, pers. comm.). A sequence of photographs of a female *C. gigantipes* (as *Theridion* sp.) killing and eating a black house spider featured recently in a magazine article (Merrick 2012). An adult female was also observed with the dead body of a conspecific female in the web (HMS pers. obs). Female *C. gigantipes* fall prey to pirate spiders (Mimetidae) (HMS pers. obs.), white tail spiders (*Lampona* spp.) and probably to wasps, including the introduced European wasp (*Vespula germanica* (Fabricius, 1793)), one of which was seen searching near a recently deserted *C. gigantipes* web (W. Moore, pers. comm.).



FIGURES 11–16. Male genitalia of *Cryptachaea* species. 11–13. *Cryptachaea gigantipes* (Keyserling, 1890), left pedipalp in prolateral, ventral and retrolateral views; 14. Ditto, expanded, prolateral; 15. Ditto, median apophysis and embolus, proapical view; 16. *Cryptachaea veruculata* (Urquhart, 1886), left pedipalp expanded, prolateral. Scale bars = 0.2 mm. Abbreviations: C, conductor; Cy, cymbium; E, embolus; L, lobe; MA, median apophysis; MS, MA sclerotised process; Po, pouch in conductor; ST, subtegulum; T, tegulum; Tb, trichobothria; TO, tarsal organ.

Despite their common occurrence in human environments, we have only two records of *C. gigantipes* envenoming humans (both recorded as *Achaearanea veruculata*): AM KS.34923 (male) and AM KS.116847 (female) (AM database and G. Isbister spider bites study, see Isbister & Gray 2003). The bites produced symptoms including pain, redness, a swollen area and muscle ache, with duration reported as 24 hours in one case. The only other '*Achaearanea*' species (*sensu* Levi & Levi 1962) named by Isbister and Gray was *P. tepidariorum*, which has previously been reported to bite (see Isbister & Gray 2003 for details). In Isbister and Gray's study these two species and two unidentified '*Achaearanea*' juveniles were responsible for five bites (compared to 23 for *Steatoda* species and 68 for the redback spider, *Latrodectus hasseltii* Thorell, 1870). Isbister and Gray note that despite differences in colour and shape, the spiders responsible for four of these five bites had been misidentified as *L. hasseltii*. They conclude that "*Achaearanea* spp. caused similar but less severe pain compared with [Australian] *Latrodectus* spp." (p. 817).

Distribution. Temperate south eastern Australia from southern Queensland to Tasmania, Norfolk Island, and from several areas (Northland, Auckland, Waikato, Coromandel, Bay of Plenty, Hawkes Bay, Wanganui) of the North Island of New Zealand (Fig. 21). A single recent record from a car in Wellington (MONZ AS.002480) may be an example of anthropogenic dispersal and is the southernmost New Zealand record.

Cryptachaea veruculata (Urquhart, 1886)
(Fig. 16)

Theridion veruculatum—Urquhart 1886: 188, pl. 7, fig. 1.
Theridion nigrofolium—Urquhart 1888: 112, pl. 11, fig. 3 (synonymised by Bryant 1933).
Theridion calyciferum—Urquhart 1886: 192, pl. 7, fig. 4. **syn. nov.**
Theridion extrilidum—Keyserling 1890: 244, pl. 22, fig. 3. **syn. nov.**
Achaearanea veruculata—Merrett & Rowe 1961: 89, figs 1–7; Dondale 1966: 1158, figs 1A–F; Locket, Millidge & Merrett 1974: 53, figs 30, 31A–D; Roberts 1985: 182, fig. 81c; Roberts 1995: 279, unnumbered fig.; Roberts 1998: 293, unnumbered fig.; Le Peru 2011: 434, fig. 655.
Cryptachaea veruculata—Yoshida 2008: 39; Paquin, Vink & Dupérré 2010: 62, figs 34.7–8.

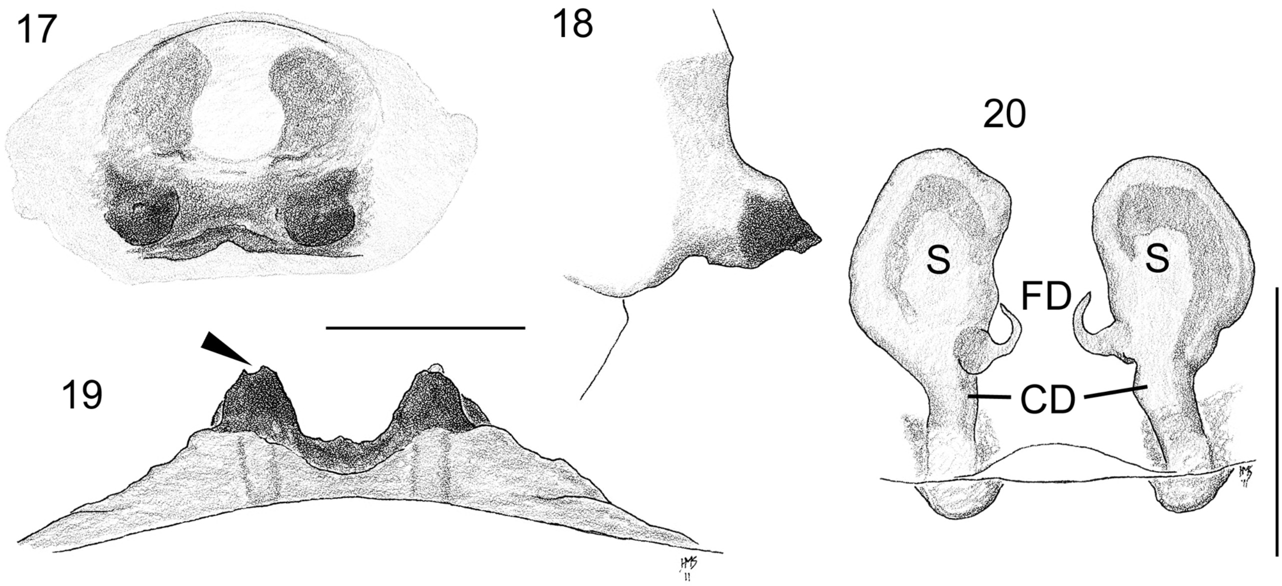
Type material. *Theridion veruculatum*: [New Zealand], Auckland, Te Karaka. Not examined, whereabouts unknown.
Theridion calyciferum : [New Zealand], Auckland, Te Karaka. Not examined, whereabouts unknown.
Theridion extrilidum : [Australia, New South Wales], "Mrs Bradley caught a specimen near Sydney, two others, much brighter, at Cornvall". Keyserling (1890: 245) notes that he is unable to find this locality on the map; it would seem likely that it was a property name. ♀ syntype, BMNH, BM1890.7.1.6816, examined [no locality information other than Australia]. The other specimens have not been located.
Theridion nigrofolium : [New Zealand], Port Waikato. Not examined. ♀ holotype, Canterbury Museum, New Zealand.

Selected material examined. AUSTRALIA: Australian Capital Territory: Corin Dam, 56km West of Canberra [35°34'S 148°23'E], 2 Dec 1969, H. Evans, spider wasp (*Pison* sp.) prey, 3 ♀ (AM KS.81652). Najor Orchard, Canberra [35°17'S 149°08'E], 8 Jan 1963, C.R. Maclennan, 2 ♂, 2 ♀ (AM KS.35076). **New South Wales**: "Rock Glen", Curracabundi National Park, NW of Gloucester, base camp (Rock Glen HS) [31°39'22"S 151°32'01"E], 13-15 Apr 2007, NPA volunteers, 1 ♀ (AM KS.101449). Berry [34°47'S 150°42'E], 28 Aug 1966, R.E. Mascord, 1 ♀ (AM KS.112583). Binnaway [31°33'S 149°23'E], 8 Jan 1975, A. Smith, in mud wasp nest, 1 ♀ (AM KS.35077). Bylong [32°25'S 150°07'E], 8 Nov 1989, R. Griffith, egg sac camouflaged in hazel nut leaves, 2 ♀ (AM KS.23367). Gundabooka National Park, Bennets Gorge picnic area [30°34'37"S 145°41'22"E], 20 Oct 2010, G.A. Milledge, H.M. Smith, 1 ♂, 3 ♀ (AM KS.114364). Gundabooka National Park, start of walk at Dry Tank Campground [30°31'11"S 145°42'53"E], 21 Oct 2010, G.A. Milledge, H.M. Smith, 1 ♀ (AM KS.114315). Lord Howe Is, Stn 18, foredune behind mid North Beach [31°31'06"S 159°02'30"E], 1 Feb 1971, M. Gray, in pandanus bracts, 1 ♂, 3 ♀ (AM KS.81395). Lord Howe Is, Stn 22, plateau summit of Rabbit Island [31°32'12"S 159°03'36"E], 2 Feb 1971, M. Gray, 1 ♂, 2 ♀ (AM KS.81382). Lord Howe Is, Stn 25, Lagoon Rd, N of Blinky Beach Rd t.o. [31°32'30"S 159°04'30"E], 3 Feb 1971, M. Gray, 1 ♀ (AM KS.81392); same data, 2 ♀ (AM KS.81396). Lord Howe Is, Stn 28, NE slope of North Hummock [31°32'48"S 159°05'06"E], 4 Feb 1971, M. Gray, on cedar trunk groove, 1 ♂, 1 ♀ (AM KS.81384). Lord Howe Is, Stn 35, top of Smoking Tree Ridge [31°33'18"S 159°05'06"E], 7 Feb 1971, M. Gray, in dry grass litter, 1 ♀ (AM KS.81394). Lord Howe Is, Stn 41, Goat House Cave [31°33'54"S 159°05'18"E], 10 Feb 1971, M. Gray, palm bracts, 1 ♀ (AM KS.81391). Lord Howe Is, Stn 42, foot of saddle rise, Erskine Valley [31°34'42"S 159°04'30"E], 12-15 Feb 1971, M. Gray, with egg sac, 1 ♀ (AM KS.81383). Lord Howe Is, Stn 7, W slope of Kim's Lookout [31°31'00"S 159°02'54"E], 31 Jan 1971, M. Gray, in fern, 1 ♂ (AM KS.81386). Lord Howe Island [31°33'S 159°05'E], Dec 1923, A Musgrave & G Whitley, 3 ♀ (AM KS.81654). Moree [29°28'S 149°51'E], 18 Apr 1988, P. Twine, 1 ♀ (AM KS.32587). Myuna Bay, Lake Macquarie [33°03'S 151°33'E], 13 Sep 1958, P. Goodwin & R Ford, 3 ♀ (AM KS.81651). Paroo - Darling National Park, Coonavitra addition, N side of Barrier Hwy, old homestead [31°37'26"S 144°15'53"E], 25 Oct 2010, G.A. Milledge, H.M. Smith, 5 ♂, 2 ♀ (AM KS.114319). Paroo - Darling National Park, Tilpilly addition [31°20'47"S 144°23'40"E], 24 Oct 2010, G.A. Milledge, H.M. Smith, 1 ♂, 1 ♀ (AM KS.114160). Paroo - Darling National Park, track to E of Wilga HS [31°27'34"S 143°56'57"E], 25 Oct 2010, G.A. Milledge, H.M. Smith, 1 ♂, 1 ♀ (AM KS.114334). Pomingalarna Park, 8km W of Wagga Wagga [35°04'S 147°22'E], 15 Oct 2001, C.A. Car, 1 ♂, 2 ♀ (AM KS.93834); same data, 21 Aug 2000, C.A. Car, 1 ♂, 3 ♀ (AM KS.93829). Royal National Park [34°07'55"S 151°03'04"E], 29 Sep 1966, R. Mascord, 1 ♀ (AM KS.108020). The Rock Nature Reserve, 30km SW of Wagga Wagga [35°16'S 147°05'E], 21 Aug 2001, C.A. Car, 1 ♂ (AM KS.93922); same data, 31 May 2001, C.A. Car, 1 ♂, 1 ♀ (AM KS.93927); same data, 11 Sep 2001, C.A. Car, 1 ♂, 1 ♀ (AM KS.93955); same data, 27 Oct 2000, C.A. Car, 8 ♂, 2 ♀ (AM KS.93971). **South Australia**: Mylor, 5km S of [35°03'S 138°46'E], 8 Jun 1980, A.D. Austin, 9 ♀ (AM KS.10528). **Western Australia**: Nr Golgotha Cave, Wichcliffe [34°06'S 115°02'E], 23 Jan 1974, M. Gray, 1 ♀ (AM KS.105852). Porongorups National Park, Castle Rock walking trail [34°41'S 117°57'E], 6 Feb 1979, M.R. Gray, in hanging curled bark, with egg sac 1 ♀ (AM KS.14533). Stirling Range [34°22'S 117°48'E], 14 Jan 1974, M.R. Gray, 1 ♀ (AM KS.35075).

NEW ZEALAND: Kermadec Islands: Raoul Island [29°18'50"S, 177°57'0"W], 15 May 2011, W.G. Chinn, 2 ♀ (AMNZ). **Wellington**: Stokes Valley [41°11'12"S, 174°58'46"E], 30 Nov 2008, B.M. Fitzgerald, 1 ♂, 1 ♀ (MONZ AS.002470). Stokes Valley, Raukawa St [41°11'15"S 174°58'31"E], 17 Oct 2011, B.M. Fitzgerald, on carport wall, 2 ♀ (AM KS.116775). **Mid Canterbury**: Christchurch International Airport [43°29'12"S, 172°32'30"E], 2 Apr 2007, M.R. McNeill, 1 ♀ (LUNZ 00012667); same data, 1 ♀ (LUNZ 00012668); same data, 1 ♀ (LUNZ 00012669). Mary Duncan Park [43°34'30"S, 172°41'18"E], 19 Mar 2007, C.J. Vink, 1 ♀ (LUNZ 00012670). Somerfield [43°33'45"S, 172°37'40"E], 29 Nov 2008, C.J. Vink, 1 ♀ (LUNZ 00012671); same data, 1 ♀ (LUNZ 00012672); same data, 1 ♂ (LUNZ 00012673). Kennedys Bush Scenic Reserve [43°38'3"S, 172°37'28"E], 30 Dec 2008, C.J. Vink, 1 ♀ (LUNZ 00012674). Lincoln University [43°38'35"S, 172°28'11"E], 2 Apr 2007, J. Malumbres-Olarte, 1 ♀ (LUNZ 00012675).

Comments. Merrett & Rowe (1961: 89) state that Dr R.R. Forster confirmed their identification of *C. veruculata* by comparison with the type specimens; the type material was reported to contain three species, but the figured specimen agreed with the Scilly Isles material. The whereabouts of this type material is now unknown: it has not been found in Otago Museum (C. Fraser pers. comm.) where Forster probably examined it, nor is it listed among Urquhart's Canterbury Museum material (Nicholls *et al.* 2000). Bryant (1933, pp. 15–16) gave a description of *C. veruculata* "based on the type of *Theridion nigro-folium*". She then added "In the Banks' Collection at the Museum of Comparative Zoology is a specimen of *Theridion veruculatum* received from Urquhart. The two are the same, except that *Theridion nigro-folium* is smaller and darker and possibly the dark rings on the legs are wider. There is no difference in the epigynums". We have not examined the type specimen of *T. nigrofolium*, which Nicholls *et al.* (2000) list amongst the arachnid types held at the Canterbury Museum, because access to the collection is not currently possible due to damage to the building sustained during the Christchurch earthquake in 2011.

Cryptachaea veruculata has a strong abdominal colour pattern, which in combination with the epigynal illustration of *T. calyciferum* by Urquhart (1886), makes it clear that, despite the missing type specimens, these species are conspecific. The type of *Theridion calyciferum* is not in the Canterbury Museum, where all of Urquhart's existing type specimens are housed (Court & Forster 1988; Nicholls *et al.* 2000; Paquin *et al.* 2008) and we consider the type as lost. As noted in the introduction, *T. calyciferum* was incorrectly placed in synonymy under *T. cruciferum* by Roewer (1955). We now consider *T. calyciferum* to be conspecific with *C. veruculata* on the basis of epigynal form (two rearward pointing, conical processes in *T. calyciferum* and *C. veruculata* but only one in *T. cruciferum*). Urquhart's (1886) descriptions of *Theridion calyciferum* and *C. veruculata* also differ from that of *T. cruciferum* with respect to female leg I superior tarsal claw count (7 versus 8) and leg colour pattern (speckled in *T. cruciferum*).



FIGURES 17–20. *Cryptachaea gigantipes* (Keyserling, 1890), female genitalia. 17. Ventral view; 18. Lateral view; 19. Posterior view, entry point of copulatory duct indicated, note entry on other side appears to be blocked by hardened bead of exudate; 20. Dorsal view (internal genitalia). Scale bars = 0.2 mm. Abbreviations: CD, copulatory duct; FD, fertilisation duct; S, spermatheca.

FIGURE 21. Map of locations from which *Cryptachaea gigantipes* (Keyserling, 1890) were examined. Black circles are locations of specimens examined for morphology and white circles are specimens sampled for molecular analyses. The historical record of Hogg (1900) from Macedon, Victoria, is shown as a black square.

The expanded pedipalp of *C. veruculata* is similar structurally to *C. gigantipes* (cf. Fig. 16 and Fig. 14), suggesting a close relationship between the two species. The median apophysis and embolus of *C. veruculata* are fused in a similar way to that of *C. gigantipes*, supporting the diagnosis of Yoshida (2008). The basal sclerotised lobe of the median apophysis (MS) of *C. veruculata* is larger than in *C. gigantipes*, and the lobe that is accommodated in a pouch in the conductor is more robust. The terminal knob of the lobe is well sclerotised and lodged so firmly in the pouch that the conductor was ripped off the tegulum with the median apophysis/embolus unit when this was removed from the bulbus for examination.

Cryptachaea veruculata was first explicitly identified in Australia by Dondale (1966) and is now known to be widespread and common, at least across southern Australia (HMS from AM database). Overall, there is a considerable size range, with some specimens from subtropical moist environments (e.g. Lord Howe Island, Raoul Island) noted as being approximately twice the size of the type of *T. extrilidum* and recent specimens from inland localities, such as Wagga Wagga, Bourke and White Cliffs. *Cryptachaea veruculata* is found throughout New Zealand around houses and also in natural environments (Forster & Forster 1999). However, note that the species illustrated under this name by Crowe (2007) appears to be *C. blattea*.

Discussion

Based on our morphological examinations and the COI phylogeny (Fig. 1), *C. gigantipes* and *C. veruculata* are closely related species, perhaps even sister species. The phylogeny indicates that the two New Zealand haplotypes of *C. gigantipes* are more closely related to Australian haplotypes than to each other, which could suggest multiple colonisations. The limited haplotype diversity of the New Zealand specimens of *C. gigantipes* is consistent with a population established from a small number of individuals. Whilst this could be due to establishment by natural dispersal from a limited population, it is also typical for an accidental human introduction. This latter seems likely given that *C. gigantipes* is often found in and around buildings. There is much higher haplotype diversity and genetic variation in the New Zealand specimens of *C. veruculata*, suggesting that the species has a far longer history in this country.

We do not have enough data to hypothesise whether the current ranges of *C. gigantipes* and *C. veruculata* within Australia are natural or represent human assisted expansion. COI genetic diversity in *C. gigantipes* is quite low (1.9%), but other theridiid species have also been found to have low COI diversity (e.g. Vink *et al*. 2008). The maximum intraspecific variation we observed in New Zealand *C. veruculata* was as high as 5.0%, which is close to the minimum divergence of 5.7% between *C. gigantipes* and *C. veruculata*. However, based on the morphological characters and the clear monophyly of both species in our phylogeny (Fig. 1), we are confident that they are two separate species.

Synanthropic species may often be spread by human movement, as evidenced by some of the other species that share our houses around the globe (e.g. Nyffeler *et al.* 1986; Guarisco 1999; Kobelt & Nentwig 2008; Edwards & Stiles 2011; Vink *et al*. 2011). Examination of a selection of illustrated faunas from Europe (Roberts 1985, 1995), Japan (Yoshida 2003) and North America (Levi 1955; Levi 2005—in which the species does not key out) has not revealed any sign of *C. gigantipes* away from Australasia. Based on specimen records from Australia and New Zealand, *C. gigantipes* should be considered as synanthropic. This, together with the fact that the closely related *C. veruculata* has invaded outside its natural range (Merrett & Rowe 1961) makes *C. gigantipes* another candidate, given the opportunity, for invasion of subtropical to temperate regions, as it has demonstrated in New Zealand.

The synanthropic tendency of such species makes accidental physical contact between humans and spiders likely. Bites from *C. gigantipes* appear to be rare and there is currently no evidence that they are dangerous. However, we suggest that medical staff, and staff in other institutions that receive enquiries from the public, should be aware that *C. gigantipes* does have the potential to inflict painful bites.

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