Integrative taxonomy to investigate species boundaries within Culicoides *(Diptera: Ceratopogonidae): a case study using subgenus* Avaritia *from Australasia and Eastern Asia*

David Gopurenko[1,2*], Glenn Adam Bellis[3,4], Tohru Yanase[5], April Hari Wardhana[6], Arunrat Thepparat[7], Jinglin Wang[8], Huachun Li[8], Ducheng Cai[9] & Andrew Mitchell[10]

[1] *NSW Department of Primary Industries, Wagga Wagga, New South Wales, Australia.*
[2] *Graham Centre for Agricultural Innovation, Wagga Wagga, New South Wales, Australia.*
[3] *Northern Australia Quarantine Strategy, Marrara, Northern Territory, Australia.*
[4] *Research Institute for the Environment and Livelihoods, Charles Darwin University, Northern Territory, Australia.*
[5] *Kyushu Research Station, National Institute of Animal Health, NARO, Chuzan, Kagoshima, Japan.*
[6] *Indonesian Research Centre for Veterinary Science, Bogor, Indonesia.*
[7] *Department of Agricultural Technology, Ramkhamhaeng University, Bangkok, Thailand.*
[8] *Yunnan Animal Science and Veterinary Institute, Kunming, Yunnan, People's Republic of China.*
[9] *College of Environment and Plant Protection, Hainan University, Haikou, Hainan, People's Republic of China.*
[10] *Australian Museum, Sydney, New South Wales, Australia.*

** Corresponding author at: NSW Department of Primary Industries, Wagga Wagga, New South Wales, 2650 Australia.*
Tel.: +61 2 6938 1946, e-mail: david.gopurenko@dpi.nsw.gov.au.

Veterinaria Italiana 2015, **51** (4), 345-378. doi: 10.12834/Vetlt.515.2463.2
Accepted: 21.07.2015 | Available on line: 31.12.2015

IV International Conference on *Bluetongue and Related Orbiviruses*. November 5-7, 2014 - Rome, Italy - Selected papers

Keywords
Arbovirus vectors,
Barcode Index Numbers,
CAD,
COI,
DNA barcoding.

Summary
In this study, species boundaries were examined for 15 described and 2 undescribed species within the economically important *Culicoides* subg. *Avaritia* Fox from Australasia and Eastern Asia. We used an integrative taxonomic approach incorporating DNA barcoding, nuclear gene sequencing, and retrospective morphological analyses. Some arbovirus vector species such as *Culicoides fulvus* Sen and Das Gupta and *Culicoides wadai* Kitaoka were genetically and morphologically uniform across sampled distributions, but others including *Culicoides actoni* Smith and *Culicoides brevipalpis* Delfinado contained 2 or more genetically independent populations of 'cryptic species' that in some cases were sympatric. Some of these 'cryptic species' exhibited consistent morphological differences, while differences are yet to be found for others species. Additionally, an undescribed species, *C. Avaritia* sp. No. 3, was found to be synonymous with *C. fulvus*. These results refine our understanding of the distribution of individual species of *C.* subg. *Avaritia* and demonstrate that species descriptions and distribution records need revision for part of the *Culicoides* fauna. Furthermore, because vector competence studies for most of these species are based entirely on Australian populations, the competence of the putative cryptic species identified elsewhere will require independent assessment. Finally, integrative taxonomic assessment requires genetic and morphological assessment of material from the type localities in order to clarify the status and distribution of species, especially for clades containing cryptic species. International collaboration is needed to facilitate this research.

Tassonomia integrativa per identificare i limiti di specie in Culicoides *(Diptera: Ceratopogonidae): studio di un campione di insetti del sottogenere* Avaritia *Fox proveniente da Australasia e Asia Orientale*

Parole chiave
Arbovirus,
Indice numeri codice a barre (BIN),
DNA barcoding,
CAD,
COI,
Vettore.

Riassunto
In questo studio sono stati esaminati i limiti per 15 specie descritte e 2 non descritte appartenenti al genere *Culicoides*, sottogenere *Avaritia* Fox, provenienti da Australasia e Asia Orientale. Lo studio ha impiegato un approccio tassonomico integrativo che ha incluso *DNA barcoding*, sequenziamento genico e un'analisi morfologica retrospettiva. Alcune specie di vettori di arbovirus come *Culicoides fulvus* Sen e Das Gupta e *Culicoides wadai* Kitaoka hanno mostrato una distribuzione uniforme dei tratti genetici e morfologici. Altre specie, tra cui *Culicoides actoni* Smith e *Culicoides brevipalpis* Delfinado hanno fatto rilevare, invece, 2 o più popolazioni di "specie criptiche" geneticamente indipendenti in alcuni casi anche simpatriche. Alcune di queste hanno mostrato differenze morfologiche significative. Si è visto, inoltre, che una specie non descritta, *Culicoides* subg. *Avaritia* sp. No. 3, è stata identificata come *Culicoides fulvus*. Questi risultati migliorano la comprensione della distribuzione delle singole specie di *Culicoides* subg. *Avaritia* e dimostrano che, per una parte della popolazione di *Culicoides*, le descrizioni di specie e i dati sulla loro distribuzione necessitano di revisione. Inoltre, dato che gli studi di competenza vettoriale per la maggior parte di queste specie sono interamente basati sulle popolazioni australiane, la competenza di "specie criptiche" putative identificate altrove pongono la necessità di valutazioni indipendenti. Infine, la tassonomica integrativa richiede un'analisi genetica e morfologica di materiale proveniente da località-tipo per poter definire lo stato e la distribuzione delle specie, soprattutto per *clades* che contengono "specie criptiche". La collaborazione internazionale è indispensabile per poter eseguire questo tipo di ricerca.

Introduction

Culicoides subgenus *Avaritia* Fox 1955 (Diptera: Ceratopogonidae) includes a high proportion of the biting midge species responsible for transmission of livestock pathogens such as Bluetongue and Akabane viruses (Meiswinkel *et al.* 2004). The subgenus is species rich, with more than 70 described species globally (Meiswinkel *et al.* 2004), including some of the most widely distributed species in the genus (Wirth and Hubert 1989). Accurate identification of species belonging to *Culicoides* subg. *Avaritia* is essential for understanding their vector competence and other important aspects of their biology. However, this is often encroached by both paucity and subtlety of diagnostic morphological features (Wirth and Hubert 1989, Bellis and Dyce 2005). This taxonomic impediment has ramifications for historical species distribution records that in some cases are confounded by misidentifications and/or cryptic species complexes.

Within the Australasian species of *Culicoides* subg. *Avaritia*, instances have been reported where morphological analyses have struggled to place particular specimens into species. For example, specimens with morphology intermediate between *Culicoides dumdumi* Sen and Das Gupta 1959 and *Culicoides fulvus* Sen and Das Gupta 1959 were initially placed as a pale form of *C. dumdumi* (Bellis and Dyce 2005) and subsequently labelled as an undescribed species, *C. Avaritia* sp. No. 3 (Dyce *et al.* 2007). Similarly, variations in the wing pattern of *Culicoides obscurus* Tokunaga and Murachi 1959 were sufficiently distinct to warrant separate treatment (Dyce *et al.* 2007), but it remains unclear if these specimens belong to distinct species or are merely morphological variants of existing species.

Taxonomic descriptions of midge species have recently benefitted from the use of molecular DNA sequence analyses for improved species delimitation (Harrup *et al.* 2015). Increasingly, DNA barcoding (Hebert *et al.* 2003) of the 5'-half of the mitochondrial cytochrome c oxidase subunit I (COI) gene is used as a standardised genetic method to assist insect species identifications (see review, Jinbo *et al.* 2011), particularly when specimens cannot be morphologically identified due to their condition, gender, stage in life cycle, or similarity to other species (Gopurenko *et al.* 2013). DNA barcoding has been used recently to improve our knowledge of the species diversity of several subgenera of *Culicoides* (Pagès *et al.* 2009, Ander *et al.* 2012, Bellis *et al.* 2013a, Bellis *et al.* 2014) and has been used to distinguish both morphologically similar and cryptic species within *Culicoides* subg. *Avaritia* (Pagès *et al.* 2009, Bellis *et al.* 2014). As such, DNA barcoding provides an expedient means to test species hypotheses

Veterinaria Italiana 2015, **51** (4), 345-378. doi: 10.12834/VetIt.515.2463.2

raised by formal taxonomic assessment of specimen morphologies (Hebert *et al.* 2003).

The proliferation of DNA barcoding in taxonomy has been aided by the development of the internet-based Barcode of Life Data system (BOLD) (Ratnasingham and Hebert 2007). BOLD acts as a repository of DNA barcodes associated with particular specimens, as an online search engine for DNA barcode-based species identifications and as a data management platform for assembling barcode datasets. The Barcode Index Number (BIN) system (Ratnasingham and Hebert 2013) permits consistency in reporting molecular operational taxonomic units (MOTUs) (Blaxter 2004) present among specimens. The BIN system uses a refined single linkage algorithm to cluster identical and/or similar DNA barcode sequences as MOTUs labelled with unique alpha-numeric identifiers, independently of the species names loaded onto BOLD. In addition, the BIN system also assists in refining species determinations based on morphology in cases where an existing taxonomic framework is ambiguous (Hausmann *et al.* 2013). Furthermore, the BIN system is useful as an interim taxonomic descriptor in cases where novel species diversity is revealed, but awaiting formal taxonomic description (Ratnasingham and Hebert 2013).

Novel species hypotheses generated by DNA barcoding must, however, always be treated with caution. Biological and historical population processes can distort concordance between gene and species trees (Will and Rubinoff 2004) and lead to instances of erroneous species splitting or lumping in DNA barcode data. We argue that neither morphology nor DNA barcode studies alone hold sufficient answers to taxonomic questions. Large-scale integrative taxonomic efforts incorporating morphological, ecological, and independent multi-locus sequence data from species sampled across their known ranges provide the best means to test species boundaries and refine essential species distribution data (Dayrat 2005, DeSalle *et al.* 2005, Schlick-Steiner *et al.* 2010, Goldstein and DeSalle 2011). To demonstrate the validity of this approach, we present morphological data, DNA barcodes, and additional sequences from an unlinked nuclear gene region for 15 described and 2 undescribed species of *Culicoides* subg. *Avaritia*, sampled from across Australasia and parts of Eastern Asia. Species splits concordantly proposed by the independent molecular analyses were retrospectively examined for evidence of morphological characters supportive of novel species hypotheses, and which could be used with the molecular data for future formal species (re-)descriptions.

Materials and methods

Adult specimens morphologically referable to 15 described species of *Culicoides* subg. *Avaritia*

Table I. *Sampling of* Avaritia *subgenus species from countries in Eastern Asia and Australasia for DNA barcoding and morphology analysis; CAD sampling in parentheses.* Species grouped as earlier reported (Meiswinkel 2004, Meiswinkel *et al.* 2004, Dyce *et al.* 2007, Bellis *et al.* 2014a) except where uncertain.

Group	*Culicoides* spp.	Eastern Asia							Australasia			N
		China	Indonesia	Japan	Laos	Thailand	Timor-Leste	South Korea	Australia	PNG	Solomon Islands	
Actoni	***C. actoni***	22	9	4(3)		1	6(3)		75(6)	6(2)	5	128(14)
	C. minimus						4(2)					4(2)
Boophagus	***C. wadai***			5(2)			46		81	10		142(2)
Imicola	*C. asiana*		2	46(5)	1(1)	2	1(1)					52(7)
	C. brevitarsis	3(3)					12(2)		18(1)	8	11(4)	52(10)
	C. nudipalpis						23(8)		1			24(8)
Jacobsoni	*C. jacobsoni*	1	1(1)	2				1	8	7(6)	5	25(7)
	C. Avaritia sp. No. 2								1(1)			1(1)
Orientalis	***C. dumdumi***								16(8)	2		18(8)
	C. flavipunctatus	3				1	3(1)		2	1(1)		10(2)
	C. fragmentum									6(1)		6(1)
	C. fulvus	15	4(1)			1	21(6)		68(4)	11(2)		120(13)
	C. obscurus						8(1)		17(9)			25(10)
	C. orientalis		2			1	14(8)			12		29(8)
	C. Avaritia sp. No. 3						1		2(2)	1(1)		4(3)
(uncertain)	***C. brevipalpis***	6		4(3)			22(5)		45(1)	11		88(9)
	C. hui	4				1	3			4(2)		12(2)

Bold font = Species implicated in the transmission of livestock arboviruses; Grey backgroung = Species samples from country of type locality; PNG = Papua New Guinea.

including *Culicoides actoni* Smith 1929, *Culicoides asiana* Bellis (Bellis *et al.* 2015), *Culicoides brevipalpis* Delfinado 1961, *Culicoides brevitarsis* Kieffer 1917, the dark form of *C. dumdumi* Sen & Das Gupta 1959, *sensu* Bellis and Dyce 2005, *Culicoides flavipunctatus* Kitaoka 1975, *Culicoides fragmentum* Tokunaga 1962, *C. fulvus* Sen and Das Gupta 1959, *Culicoides hui* Wirth and Hubert 1961, *Culicoides jacobsoni* Macfie 1934, *Culicoides minimus* Wirth and Hubert 1989, *Culicoides nudipalpis* Delfinado 1961, *C. obscurus* Tokunaga and Murachi 1959, *Culicoides orientalis* Macfie 1932, *Culicoides wadai* Kitaoka 1980, and 2 putative species, *C. Avaritia* sp. No. 2 and *C. Avaritia* sp. No. 3 (= pale form of *C. dumdumi sensu* Bellis and Dyce 2005), proposed by Dyce (Dyce *et al.* 2007) (Table I), were collected using light traps or sweep net from various locations in Eastern Asia and Australasia and preserved in 70-95% ethanol. Specimens were identified morphologically using reported keys and illustrations (Wirth and Hubert 1989, Dyce *et al.* 2007, Bellis 2013, Bellis *et al.* 2015). Six species implicated in the transmission of livestock arboviruses and 9 species of unknown vector status were included (Table I). Specimens from countries containing the type locality were obtained for 5 of the 15 described species (Table I). Previously published sequences (Matsumoto *et al.* 2009, Bellis *et al.* 2013b, Bellis *et al.* 2014) of COI (N = 42) and CAD (N = 32) publicly available at GenBank were included in the analysis [refer Annex 1, Supplementary Table I, for source details of all specimens (N = 740) considered here]. Specimen records and associated DNA sequences/GenBank accessions used in this study are available as a dataset (http://dx.doi.org/10.5883/DS-Avaritia) at the Barcode of Life Data System [BOLD, (Ratnasingham and Hebert 2007)][1].

DNA extraction and polymerase chain reaction (PCR) amplification of mitochondrial and nuclear loci were performed as previously reported (Bellis *et al.* 2013a). In brief, specimen PCRs targeted amplification of a 692 base pair (bp) region adjacent to the 5' terminus of the mitochondrial cytochrome c oxidase subunit I (COI) gene overlapping the standard animal DNA barcode region (Hebert *et al.* 2003). A subset of specimens was also targeted for amplification of a 743 bp fragment ('fragment 4') (Moulton and Wiegmann 2004) of the carbamoyl-phosphate synthetase 2, aspartate transcarbamylase, and dihydroorotase (CAD, or 'rudimentary') nuclear gene. PCR products were sent to the Australian Genome Research Facility (Brisbane, Queensland) for purification and bidirectional sequencing using an Applied Biosystems 3730xl DNA Analyser. Forward and reverse strand sequence trace files for each gene were quality checked and assembled by

[1] www.boldsystems.org.

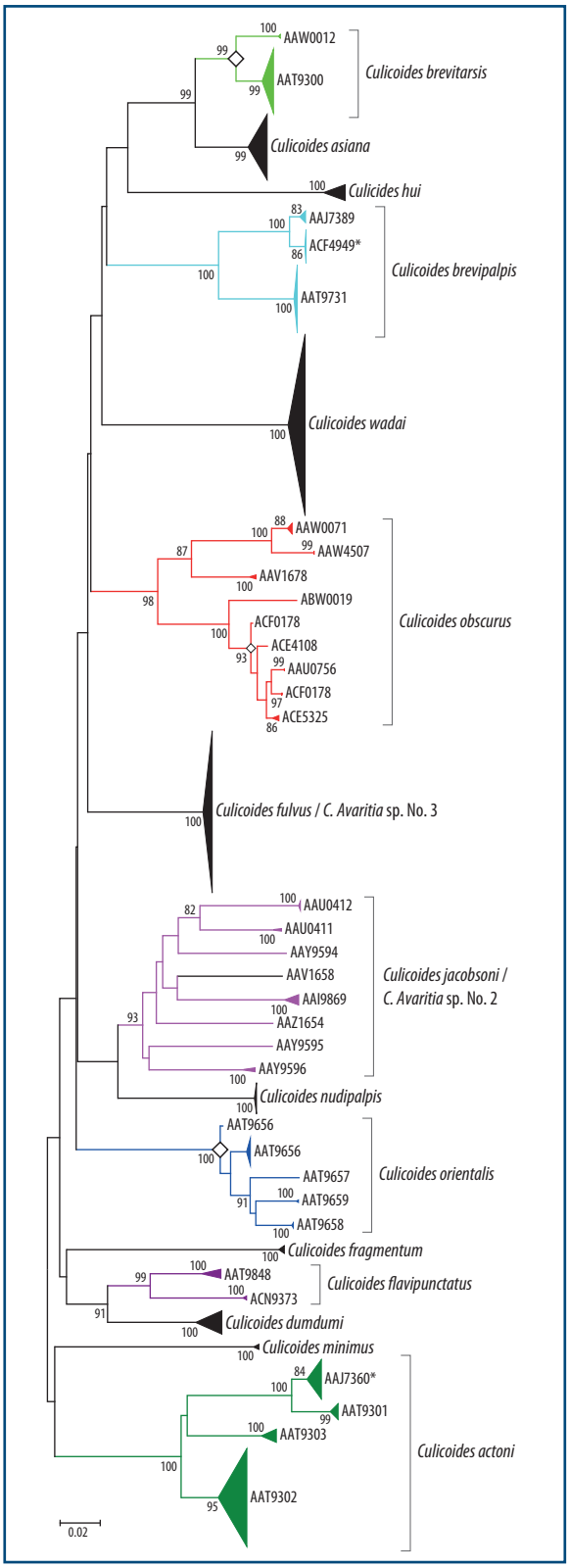

Figure 1. *Neighbor-joining tree of pairwise genetic distances among 740 mitochondrial COI sequences identified among 15* Avaritia *species sampled from Eastern Asia and Australasia.* Coloured branches highlight species with multiple BINs. Sequences collapsed to species or to COI BIN labels where species contain multiple BINs. Open diamond at nodes indicate constituent BINs merged as a single clade at CAD gene (Figure 2). Asterisks indicate COI BIN split by CAD (Figure 2). Clade supports > 70 % as indicated and estimated by 10,000 bootstrap replicates. Scale bar equals two percent K2P sequence distance.

sample ID using Lasergene SeqMan Pro ver. 8.1.0(3) (DNASTAR Inc., Maddison, WI, USA). Final edits to sequence alignments were made using BioEdit ver. 7.0.9.0 (Hall 1999). At each gene, pairwise distances among sequences were estimated using the Kimura 2-parameter (K2P) method (Kimura 1980) and compared as a neighbor-joining (NJ) tree as implemented in MEGA6 (Tamura *et al.* 2013). Clade support values within the trees were estimated using 10,000 bootstrap replicates (Felsenstein 1985). Affiliations between morphologically identified species and COI sequences were examined using the BIN system as implemented in BOLD (Ratnasingham and Hebert 2013). In this study, species determinations were examined for both taxonomic discordance evidenced as shared BINs among species and cryptic diversity indicated by presence of 2 or more divergent BINs within a species. In cases where BIN affiliations indicated either taxonomic discordance or potential cryptic diversity, genetic relationships among specimens at CAD were examined using NJ analysis to determine support for COI BIN relationships. Specimens representing each of the BINs identified by COI analyses were mounted onto slides following earlier methods (Bellis *et al.* 2013a) and examined for morphological differences.

Results

Cytochrome c oxidase subunit I (COI) sequences of up to 726 bp were available for 740 specimens. There was no evidence of insertions or deletions (indels), frameshift mutations, or stop codons among COI sequences, suggesting pseudogenes were absent from the alignment. Neighbour-joining (NJ) analysis resolved 14 of the 17 species as highly supported [100% bootstrap support (BSS)] monophyletic clades (Figure 1). All sequences attributed to *Avaritia* sp. No. 3 (*sensu* Dyce *et al.* 2007), that is pale form of *Culicoides dumdumi sensu* (Bellis and Dyce 2005), were identical to several *C. fulvus* sequence variants, and together these 2 species formed a single clade (BIN AAT9391) with a maximum sequence distance no greater than 2.08% (Table II). *Culicoides jacobsoni* contained multiple clades that differed by up to 15.91% and were paraphyletic with respect to the single specimen of *Avaritia* sp. No. 2 in BIN AAV1658. Intraspecific clade distances > 4% were also evident in 6 other species (Table II). Apart from these 2 instances of species paraphyly, minimum distances among nearest neighbour species ranged from 6.17% to 16.37%, with the closest species relationship evidenced between *C. asiana* and *C. brevitarsis*. Presence of a DNA barcode gap separating intraspecific from interspecific COI sequence variation was apparent in all species except *C. jacobsoni*, which had higher levels of maximum intraspecific distance (15.91%) than the minimum distance (10.46%) to its nearest genetic neighbour species (Table II). Thirty-nine COI BINs were identified among the 17 species (Figure 1 and Table III). Ten species were each represented

Table II. *Summary of intra and interspecific genetic distances among* Culicoides *subgenus* Avaritia *species at mitochondrial COI and nuclear CAD genes, indicating sample size (N), maximum intraspecific distance (D_{max}), minimum distance to nearest neighbour species (NND_{min}), and number of COI BINs identified.*

***Culicoides* spp.**	**COI**				**CAD**		
	N	D_{max}	NND_{min}	**BINs**	**N**	D_{max}	NND_{min}
C. actoni	128	11.50	15.88	4	14	5.55	14.34
C. asiana	52	2.53	6.17	1	7	4.80	4.82
C. brevipalpis	88	9.32	14.72	3	9	4.22	13.29
C. brevitarsis	52	4.84	6.17	2	10	2.99	4.82
C. dumdumi	18	2.42	10.20	1	8	2.67	5.92
C. flavipunctatus	10	8.82	10.20	2	2	3.16*	5.92
C. fragmentum	6	0.51	15.77	1	1	-	9.71
C. fulvus / *C. Avaritia* sp. No. 3	124	2.08	12.13	1	16	4.51	12.62
C. hui	12	2.18	15.43	1	2	0.44	16.25
C. jacobsoni	25	15.91	10.46	7	7	9.42	4.34
C. minimus	4	1.28	16.37	1	2	2.20	13.09
C. nudipalpis	24	0.25	12.55	1	8	0.88	12.18
C. obscurus	25	13.01	12.13	8	10	6.74	9.71
C. orientalis	29	5.29	13.16	4	8	2.56	12.62
C. wadai	142	2.30	15.39	1	2	0.15	13.29
C. Avaritia sp. No. 2	1	-	10.46	1	1	-	4.34

* Specimens available at a single BIN only.

Table III. Culicoides *subgenus* Avaritia *species COI BINs.* Maximum COI percent sequence distance within a BIN (D_{max}), and minimum sequence distance to nearest neighbour BIN (D_{NN}) as reported except where not available (NA). Monophyly of BINs assessed at CAD and indicated as supported or merged. Evidence of morphological characters supportive for independent BIN(s) as reported except where insufficient specimens available.

Species	COI BIN	D_{max}	D_{NN}	CAD	Morphology	Geographic distribution
C. actoni	AAJ7360	1.97	1.93	Merged	Supported	China, Indonesia, Japan, India*
	AAT9301	0.81	1.93			Indonesia, PNG, Thailand, Timor-Leste
	AAT9302	1.44	5.59	Supported	Supported	Australia
	AAT9303	0.55	5.59	Supported	Supported	PNG, Solomon Islands
C. asiana	AAI9876	2.28	5.99	Supported	Supported	Indonesia, **Japan**, Laos, Thailand, Timor-Leste
C. brevipalpis	ACF4949	0.17	1.36	Merged	Supported	PNG, Timor-Leste
	AAJ7389	0.66	1.36			China, Japan
	AAT9731	0.49	7.06	Supported	Supported	Australia, Timor-Leste
C. brevitarsis	AAT9300	1.87	3.14	Merged	Supported	**Australia**, PNG, Solomon Is., Timor-Leste
	AAW0012	0.16	3.14			China
C. dumdumi	AAT9849	2.37	9.28	Supported	Supported	Australia, PNG
C. flavipunctatus	AAT9848	0.17	7.38	NA	Insufficient specimens available	Australia, PNG, Thailand, Timor-Leste
	ACN9373	0.32	7.38	Supported	Insufficient specimens available	China
C. fragmentum	ABA2980	0.50	14.20	Supported	Supported	**PNG**
C. fulvus / *C. Avaritia* sp. No. 3	AAT9391	2.05	10.63	Supported	Supported	Australia, China, Indonesia, PNG, Thailand, Timor-Leste
C. hui	AAZ1835	2.25	14.42	Supported	Supported	China, PNG, Thailand, Timor-Leste
C. jacobsoni	AAI9869	0.86	10.47	Supported	Insufficient specimens available	China, **Indonesia**, Japan, Solomon Islands, South Korea
	AAU0411	NA	8.31	Supported	Insufficient specimens available	Australia, PNG
	AAU0412	0.16	8.31	NA	Insufficient specimens available	Australia
	AAY9594	NA	9.61	Supported	Insufficient specimens available	PNG
	AAY9595	NA	10.34	Supported	Insufficient specimens available	PNG
	AAY9596	0.88	10.34	Supported	Insufficient specimens available	PNG
	AAZ1654	NA	9.17	Supported	Insufficient specimens available	PNG
C. minimus	AAT9304	1.18	13.83	Supported	Supported	Timor-Leste
C. nudipalpis	AAT9660	0.20	10.76	Supported	Supported	Australia, Timor-Leste
C. obscurus	AAV1678	0.59	7.86	Supported	Insufficient specimens available	Australia
	AAW0071	0.38	2.75	Supported	Insufficient specimens available	Timor-Leste
	AAW4507	NA	2.75	Supported	Insufficient specimens available	Australia
	ABW0019	NA	4.23	Supported	Insufficient specimens available	Australia
	ACE4108	NA	1.18	NA	Insufficient specimens available	Australia
	ACE5325	0.62	1.31	Merged	Insufficient specimens available	Australia
	ACF0178	NA	0.98			Australia
	AAU0756	NA	0.98			Australia
C. orientalis	AAT9657	NA	3.85	NA	Insufficient specimens available	PNG
	AAT9656	1.38	3.42	Merged	Supported	Indonesia, PNG, Thailand, Timor-Leste
	AAT9658	0.16	3.69			Timor-Leste
	AAT9659	0.16	3.42			Timor-Leste
C. wadai	AAF1704	2.13	13.59	Supported	Supported	Australia, **Japan**, PNG, Timor-Leste
C. Avaritia sp. No. 2	AAV1658	NA	10.46	Supported	Supported	Australia

Bold font = country of type locality; * = unpublished BOLD specimen in BIN; PNG = Papua New Guinea.

by a single BIN, the remaining 7 species each contained 2 or more BINs. Each BIN was unique to a single species, except BIN AAT9391 which was shared between *C. Avaritia* sp. No. 3 and *C. fulvus*. All BINs were monophyletic in NJ analyses except for BIN ACF0178 in *C. obscurus* and BIN AAT9656 in *C. orientalis*, where specimens in each case failed to resolve as a single clade (Figure 1). The maximum sequence distance observed in species represented by a single BIN ranged from 0.25% (*C. nudipalpis*) to 2.53% (*C. asiana*), whereas maximum sequence distance observed in species containing multiple

bins ranged from 4.84% (*C. brevitarsis*) to 15.91% (*C. jacobsoni*) as reported in Table II.

Nuclear 'rudimentary' (CAD) gene sequences were recovered from 107 specimens representative of 35 of the 39 COI BINs. The maximum sequence length in the CAD alignment was 694 bp. Stop codons were absent among CAD sequences, and the only indel observed was a 3 bp (one codon) insertion in all *C. orientalis* specimens. Heterozygous nucleotide sites were present in most of the CAD sequences and occurred at a ratio of 6:1:38 relative to codon positions, 1, 2, and 3 respectively. Similarly to COI results, all but 3 of the 17 *Culicoides* species were highly supported (100% BSS) as monophyletic at CAD (Figure 2). The exceptions again were *C. Avaritia* sp. No. 3 being nested within the *C. fulvus* clade, and *C. jacobsoni* contained divergent clades that were paraphyletic with respect to *C. Avaritia* sp. No. 2.

Minimum genetic distances to nearest neighbour species at CAD were generally similar in magnitude to that at COI. However, the maximum intraspecific CAD distance in the majority of species represented by a single COI BIN was greater than that observed at COI (Table II). Twenty-four COI BINs were supported as monophyletic at CAD (Figure 2 and Table III). Exceptions occurred where specimens from 2 or more COI BINs merged as a single CAD clade (Table III). This was evident in *C. brevitarsis* (merger of BINs AW0012 and AAT9300), *C. obscurus* (BINs AAU0756, ACE5325 and ACF0178), and *C. orientalis* (all four BINs AAT9656-AAT9659). In addition, specimens in 2 BINs failed to resolve as monophyletic at CAD (Table III). This was evident at *C. actoni* BIN AAJ7360, and at *C. brevipalpis* BIN ACF4949. For each of these BINs, CAD sequences differed by up to 3.8% and were paraphyletic with respect to a nested sister BIN. In these instances, the paraphyletic and nested BINs were treated in subsequent analyses as a single merged group partitioned from all other BINs. Finally, CAD sequence distances between 2 specimens at *C. flavipunctatus* BIN AAT9848 were an order of magnitude greater than that evidenced in this BIN at COI (3.08% vs. 0.16%).

The cryptic species diversity suggested by the presence of multiple COI BINs in species was supported by CAD for *C. actoni* (up to 3 clades), *C. brevipalpis* (2 clades), *C. jacobsoni* (up to 6 clades), and *C. obscurus* (5 clades) (Table III). Each of these species contained BINs that were partially sympatric in distribution, although there was also evidence of allopatric separation among some BINs in *C. actoni*, *C. jacobsoni*, and *C. obscurus* (Table III).

Minor but consistent differences in the relative size of pale markings on the wings were evident among the 3 clades of *C. actoni* and between both clades of *C. brevipalpis* (BIN ACF4949+AAJ7389 and AAT9731). Differences evident among some of the clades of *C. obscurus* and among those of *C. jacobsoni* were difficult to confirm due to the low numbers of specimens available from most of these clades (Table III).

Discussion

In this study, we used an integrative taxonomic approach incorporating independent molecular datasets and morphological data to examine species boundaries of 15 described and 2 undescribed species of *Culicoides* subg. *Avaritia* sampled from regions of Australasia and Eastern Asia. In all but 1 instance, species defined by morphology were monophyletic at mitochondrial COI barcodes and an independent nuclear gene. This is consistent with outcomes of previously reported COI sequence analyses of *Culicoides* subg. *Avaritia* species, which have shown high levels of congruency between morphological species designations and specimen affiliation in genetic clades (Linton *et al.* 2002, Matsumoto *et al.* 2009, Pagès *et al.* 2009, Ander *et al.* 2012, Bellis *et al.* 2014).

The single example of genetic data not supporting previous morphological conclusions concerns *C. Avaritia* sp. No. 3 (*sensu* Dyce *et al.* 2007), that is pale form of *C. dumdumi sensu* (Bellis and Dyce 2005), which genetic analyses could not distinguish from *C. fulvus*. In light of the lack of genetic support for distinguishing these 2 morphs and their sympatric distributions, we consider that the minor morphological differences reported earlier (Bellis and Dyce 2005) are due to intraspecific variation within a single species, *C. fulvus*. Thus we regard these morphs as synonymous. The "dark streak in the anal cell" proposed earlier (Bellis and Dyce 2005) to separate *C. fulvus* and the pale form of *C. dumdumi* from the typical form of *C. dumdumi* remains a reliable morphological character for distinguishing *C. dumdumi* from all known variants of *C. fulvus* (Bellis *et al.* 2015). Consequently, the reported distribution of *C. dumdumi* does not include those areas previously described (Bellis and Dyce 2005, Dyce *et al.* 2007) to contain only *C. Avaritia* sp. No. 3/ pale form of *C. dumdumi*, *i.e.* the Northern Territory of Australia and Timor-Leste.

Eight of the described species examined in this study contained only marginal levels of intraspecific COI variation (D_{max} = 0.25-2.53%, Table II) across their sampled ranges. This, coupled with the consistency of morphological characters, provided strong evidence supporting their current taxonomic status. This was particularly evident in *C. fulvus* and *C. wadai*, each of which contained a single DNA barcode BIN present among specimens sampled from the Northern, Southern, and Eastern extremities of their respective ranges. Other species

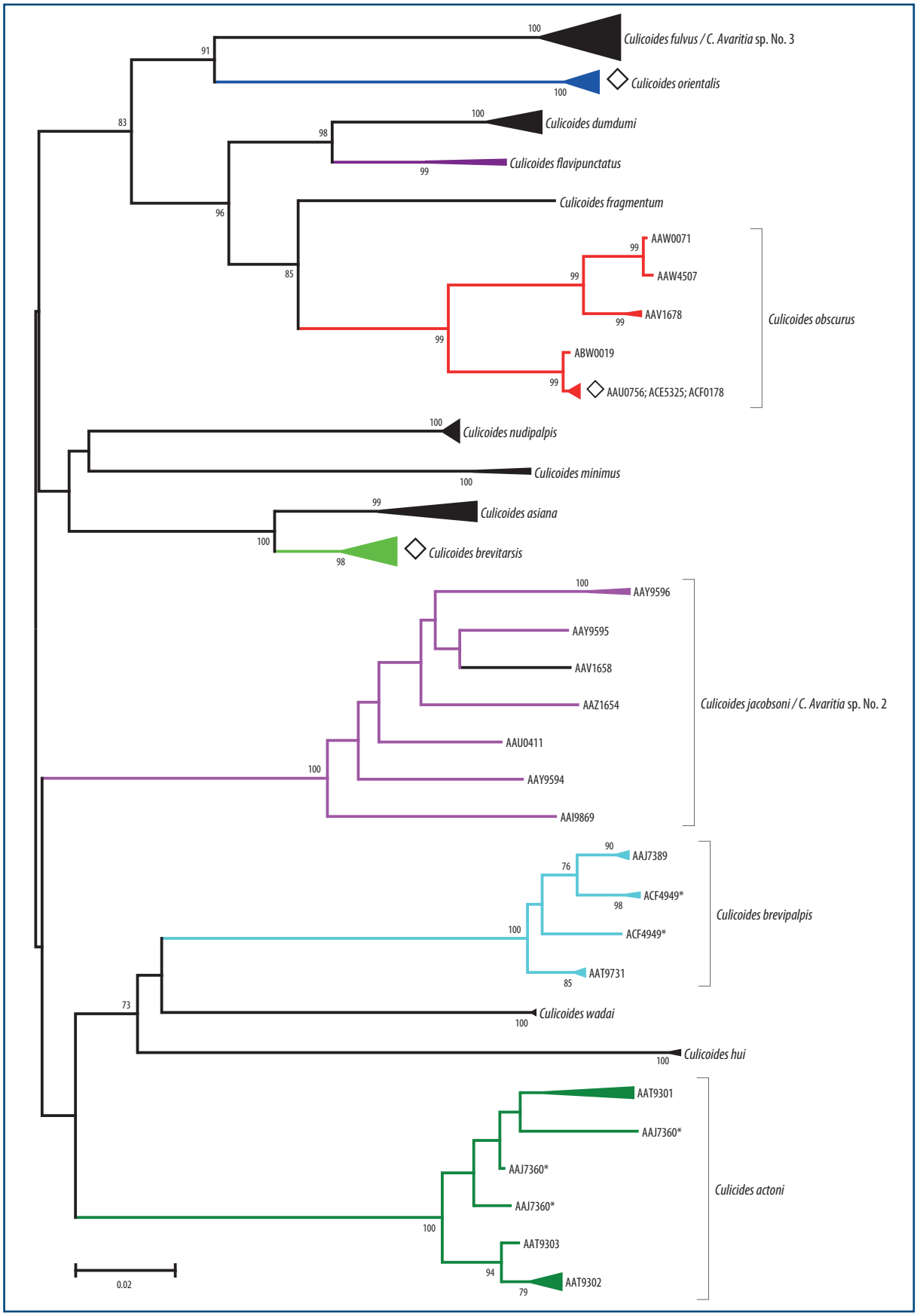

Figure 2. *Neighbor-joining tree of pairwise genetic distances among 107 nuclear CAD sequences representative of 35 COI BINs (Figure 1) identified among 15* Avaritia *species from Eastern Asia and Australasia.* Coloured branches highlight species with multiple BINs. Sequences collapsed to species, or to COI BIN labels where supported by CAD. Open diamonds at tips indicate COI BIN specimens merged as a single clade at CAD. Asterisks indicate COI BIN split by CAD. Clade supports > 70 % as indicated and estimated by 10,000 bootstrap replicates. Scale bar equals two percent K2P sequence distance.

in this category include the widespread Eastern Asian species *C. asiana* and *C. hui*, each containing a single DNA barcode BIN throughout the extremities of their distribution. Species sparsely sampled from areas of either South-Eastern Asia (*C. minimus*), Australasia (*C. dumdumi* and *C. fragmentum*) or both regions (*C. nudipalpis*) contained a single DNA barcode BIN. It remains yet to be seen whether this genetic homogeneity remains apparent after broader geographic sampling. Broader geographic sampling is also warranted to investigate the genetic differences observed between Australian and Vietnamese populations of *C. fulvus* (Mathieu 2012), which were not revealed in our analyses.

In contrast, high levels of intraspecific COI variation (D_{max} > 5.25%, Table II) were found in several of the morpho-species at 1 or both of the genes. In some instances, conflict between mitochondrial and nuclear genealogies was evidenced in species and was apparent either as COI BIN structure unsupported and merged by CAD or as splitting of COI BINs at CAD. In both instances, this can be explained by intrinsic differences in effective population size (N_e) between the mitochondrial and nuclear genomes. Strict maternal inheritance of mtDNA results in a four-fold reduction of N_e available at the mitochondrial genome compared to the nuclear genome, and this difference leads to faster rates of lineage sorting, extinction, and fixation at mitochondrial genes than at nuclear genes (Funk and Omland 2003).

This result has been shown in Table II, where maximum levels of intraspecific distance in species represented by single BINs were generally twice as high at CAD and at COI. In the absence of any supportive morphological features, divergent COI BINs within species that resolved as monophyletic at CAD were conservatively treated here as evidence of maternal intraspecific population genetic structure instead of as potential cryptic species. This was apparent in *C. brevitarsis* and *C. orientalis*, both of which contained COI BINs separated by as much as 3.2% that resolved as a single clade at CAD (Figure 2, Table III). In contrast, evidence of deep sequence divergence (3.1%) at CAD in the single COI BIN for *C. flavipunctatus* BIN AAT9848 was conservatively treated here as evidence of incomplete lineage sorting of divergent nuclear lineages in this species. BIN splitting by CAD was also evident at a single BIN in *C. actoni* (AAJ7360) and in *C. brevipalpis* (ACF4949), in both these instances CAD sequences divergent by up to 3.6%, and were paraphyletic with respect to a nested sister BIN, hence they were conservatively merged as a single group (Table III).

Divergent intraspecific BIN groups supported by CAD analysis were apparent in at least 4 species, signalling a need for retrospective morphological assessment in these species to determine whether BIN groups contained corroborative differences symptomatic of previously undetected species diversity. At least 3 BIN groups were supported by CAD in *C. actoni*. One group consisted of 2 merged BINs (AAJ7360 and AAT9301) found in specimens from Southern India, North to Japan and South-East to Papua New Guinea (PNG). Although data are not available for specimens from the type locality of *C. actoni* in Assam, Northern India, only a single clade was present across Asia spanning either side of the type locality, which suggests a single species being present throughout mainland Asia, including Assam, *i.e. C. actoni sensu stricto*. Similarly, although we have no data from the type locality of the 2 recognised junior synonyms of *C. actoni* viz. *Culicoides okumensis* Arnaud 1956 from Okuma (Okinawa, Japan) nor of *Culicoides imperceptus* Das Gupta 1962 from Kolkata (Calcutta, India), *C. actoni s.s.* is confirmed from Kagoshima, North of Okinawa, and Tamil Nadu in Southern India (refer unpublished COI sequence in Table III), making *C. actoni* the likely species present in Okinawa and Kolkata, respectively. As such, we proposed retaining these 2 species as junior synonyms of *C. actoni*. The remaining 2 BINs in this species are likely to represent previously undescribed species and were allopatric within Australasia (Table III). The minor morphological differences observed between these 3 clades support their status as distinct species, although examination of more specimens is required to confirm the reliability of these differences.

Culicoides jacobsoni contained up to 7 BINS (Table III), at least 6 of which were supported by CAD analysis as genetically distinct units. Most of these BINs were found in Australia and PNG, and separate from a more broadly distributed group (BIN AAI9869) found throughout Eastern Asia and in the Solomon Islands. As for *C. actoni*, data are not available for specimens of *C. jacobsoni* from the type locality at Bukittinggi (*i.e.,* Fort de Kock), West Sumatra, Indonesia, but only a single clade (BIN AAI9869) was present across Asia, including China, Japan, and South Korea, North of the type locality, and from West Java, South of the type locality, suggesting that a single species, *i.e. C. jacobsoni sensu stricto*, is present in Western Indonesia and mainland Asia. The distribution of this single clade also encompasses the type locality of 2 of the junior synonyms of *C. jacobsoni*, *Culicoides buckleyi* Macfie 1937 from Malaysia, and *Culicoides kitaokai* Tokunaga 1963 from Honshu Island, Japan. We propose retaining these species as junior synonyms of *C. jacobsoni*. We have no data from the type locality of the third junior synonym of *C. jacobsoni*, *Culicoides unisetiferus* Tokunaga 1959 from New Britain, PNG, and several of the genetically distinct units identified in this study are present in PNG and *C. jacobsoni sensu stricto* is present in the nearby

Solomon Islands making it difficult to be certain which, if any, may correspond to *C. unisetiferus*. More specimens are required to confirm the validity of morphological differences among the clades of this species, but if morphological differences do exist, the status of *C. unisetiferus* can be confirmed by comparison with the holotype specimen in the Bernice P. Bishop Museum.

Culicoides obscurus sampled primarily from Australia and, to a lesser extent, from Timor-Leste contained at least 5 BIN groups (Table III), which were congruently supported at COI and CAD. There is no molecular data available from the type locality of either *C. obscurus* Tokunaga and Murachi in the Caroline Islands (Palau), nor from the type locality of its junior synonym *Culicoides pungens* de Meijere 1909 in Sumatra, Indonesia. Thus, it is difficult to assign any of the genetically distinct units identified in this study to either of these species. As for *C. jacobsoni*, more specimens are required to confirm the validity of morphological differences between the clades of this species.

Two genetically distinct units of *C. brevipalpis* are allopatric to Eastern Asia and Australasia, but sympatric in Timor-Leste. Morphological re-examination of specimens of these BIN groups, particularly those in sympatry at Timor-Leste, indicated minor but consistent differences in wing pattern supporting the presence of 2 species. The wing photograph in the original description of this species (Delfinado 1961) corresponds to the morphology of specimens from the Australian BIN suggesting that this species is *C. brevipalpis sensu stricto*, although comparison with the holotype specimen is needed to confirm this.

Culicoides flavipunctatus contained evidence of 2 divergent COI BINs (~ 7.4%), separating Chinese specimens from those sampled from Thailand, Timor-Leste, PNG, and Australia (Table III). CAD sequence was unavailable for 1 BIN and insufficient specimens are available to establish morphological differences between these clades. No molecular data are available for specimens from the type locality of this species in Yonaguni, Nansei Islands, Japan.

The results described in this article identify potentially novel species diversity present in several species of *Culicoides* subg. *Avaritia*, including 2 taxa (*C. actoni* and *C. brevipalpis*) implicated in the transmission of arboviruses (Standfast *et al.* 1985). We have used a conservative approach to identify novel species diversity by seeking to confirm congruently supported genetic divisions using retrospective morphological analyses. In cases where previously overlooked or what were thought to be insignificant morphological differences are present between 2 genetically separable clades, we deem these 3 independent pieces of evidence (2 genetic loci plus morphology) as sufficient to describe new species (*e.g.,* Bellis *et al.* 2014), particularly if these clades are sympatric. Where only 2 pieces of evidence exist *e.g.* 1 molecular and 1 morphological or 2 molecular only, we indicate these clades as being potential cryptic species warranting further study. In cases where strong genetic evidence is contrary to inconclusive morphological data, for example *C. Avaritia* sp. No. 3 and *C. fulvus*, we have chosen to place the 2 species in synonymy.

Most studies derive morphological evidence from adult specimens. However, it is worth noting that immature specimens should also be examined before concluding that no morphological differences exist. An absence of morphological data should not preclude the description of new species (Cook *et al.* 2010) and although this is yet to be adopted for *Culicoides*, the absence of morphological differences in the adult (Bellis *et al.* 2014) and pupae (Nevill *et al.* 2007) of 2 genetically separable species, *C. brevitarsis* and *Culicoides bolitinos* Meiswinkel 1989, has in effect acknowledged the presence of such species in the genus. Unfortunately, data are not available from immature or adult male specimens of some of the species treated herein, so full morphological comparisons were not possible. Nonetheless, ideally these should be incorporated into any taxonomic action regarding the status of species.

Additional sampling of BIN specimens, particularly from areas of sympatry, and comparison with type material is required prior to release of any formal taxonomic re-descriptions of species. Regardless, this potentially novel diversity has major implications for understanding the biogeographic origins and phylogeography of individual species of *Avaritia* and demonstrates that taxonomic descriptions and distribution records for portions of the fauna of Australasia and Eastern Asia are likely to need revision. Furthermore, because vector competence studies of these species are based mainly on Australian populations, the competence of the putative cryptic species identified elsewhere will require assessment.

Finally, the importance to this type of study of including material from a wide geographic area, particularly from the type locality of a species and of its junior synonyms, cannot be overstated. Several of the species here shown to be a complex of species have junior synonyms that may represent 1 or more of the cryptic species recognised and consequently be resurrected from synonymy. Inclusion of material from the type locality is particularly important in cases where the type specimen has been lost or is unidentifiable and where original descriptions do not provide enough detail to decide which of the cryptic species is referable to the type specimen. The type localities of Austro-Oriental species of

Culicoides subg. *Avaritia* are from a wide range of countries. International collaboration is, hence, needed to allow this work to progress. This study provides a model for resolving similar problems with morphology-based taxonomy throughout *Culicoides*.

Acknowledgements

Our gratitude goes to the collectors of the specimens used in this study. Without the continuing efforts of these collaborators this work would not have been possible. We thank the National Arbovirus Monitoring Program, the Australian Department of Agriculture, the National Agricultural Quarantine and Inspection Authority of Papua New Guinea, the Solomon Islands Agricultural and Quarantine Service and the Timor-Leste Ministry of Agriculture, Forestry and Fisheries for access to specimens and permission to publish. Funding for the molecular work was provided by the NSW BioFirst Initiative grant to the NSW Agricultural Genomics Centre, Australia. We acknowledge the efforts of anonymous reviewers to improve our manuscript.

References

Ander M., Troell K. & Chirico J. 2012. Barcoding of biting midges in the genus *Culicoides*: a tool for species determination. *Med Vet Entomol*, **27**, 323-331.

Arnaud P. 1956. The heleid genus *Culicoides* in Japan, Korea and Ryukyu Islands (Insecta: Diptera). *Microentomology*, **21**, 84-207.

Bellis G.A. & Dyce A.L. 2005. Intraspecific variation in three species of *Culicoides* in the Orientalis complex of the subgenus *Avaritia* within the Australasian zoogeographic region. *Arbovirus Res Aust*, **9**, 33-36.

Bellis G.A. 2013. Key to females of economically important species of *Culicoides* subgenus *Avaritia* from India using characters visible under a stereomicroscope. (http://www.ibvnet.com/documents/Bellis_2014_Indian_Culicoides_Avaritia_Key.pdf/ accessed on 6 November 2014).

Bellis G.A., Dyce A.L., Gopurenko D. & Mitchell A. 2013a. Revision of the Immaculatus group of *Culicoides* Latreille (Diptera: Ceratopogonidae) from the Australasian biogeographic region with description of two new species. *Zootaxa*, **3680**, 15-37.

Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427.

Bellis G.A., Halling L. & Anderson S.J. 2015. Pictorial key to adult female *Culicoides* Latreille, 1809 (Diptera: Ceratopogonidae) from the Northern Territory, Western Australia and South Australia. *Austral Entomology*, **54**, 28-59.

Blaxter M.L. 2004. The promise of a molecular taxonomy. *Philos T Roy Soc B*, **359**, 669-679.

Cook L.G., Edwards R.D., Crisp M.D. & Hardy N.B. 2010. Need morphology always be required for new species descriptions? *Invertebr Syst*, **24**, 322-326.

Das Gupta S.K. 1962. Some *Culicoides* of Calcutta and the neighbouring areas. *Sci Cult*, **28**, 537-539.

Dayrat B. 2005. Towards integrative taxonomy. *Biol J Linn Soc*, **85**, 407-415.

De Meijere J.C.H. 1909. Blutsaugende Micro-Dipteren aus Niederlandisch Ostindien. *Tijdschr Entomol*, **5**, 191-204.

Delfinado M.D. 1961. The Philippine biting midges of the genus *Culicoides* (Diptera: Ceratopogonidae). *Fieldiana Zool*, **33**, 629-675.

DeSalle R., Egan M.G. & Siddal M. 2005. The unholy trinity: taxonomy, species delimitation and DNA barcoding. *Philos T Roy Soc B*, **360**, 1905-1916.

Dyce A.L., Bellis G.A. & Muller M.J. 2007. Pictorial atlas of Australasian *Culicoides* wings (Diptera, Ceratopogonidae). Australian Biological Resources Study, Canberra, 88 pp.

Felsenstein J. 1985. Confidence limits on phylogenies: an approach using the bootstrap. *Evolution*, **39**, 783-791.

Funk D.J. & Omland K.E. 2003. Species-level paraphyly and polyphyly: frequency, causes, and consequences, with insights from animal mitochondrial DNA. *Annu Rev Ecol Evol S*, **34**, 397-423.

Gopurenko D., Fletcher M.J., Löcker H. & Mitchell A. 2013. Morphological and DNA barcode species identifications of leafhoppers, planthoppers and treehoppers (Hemiptera: Auchenorrhyncha) at Barrow Island. *Records of the Western Australian Museum*, **83**, 253-285.

Goldstein P.Z. & DeSalle R. 2011. Integrating DNA barcode data and taxonomic practice: Determination, discovery, and description. *Bioessays,* **33**, 135-147.

Hall T.A. 1999. BioEdit: a user-friendly biological sequence alignment editor and analysis program for Windows 95/98/NT. *Nucl Acid Symposium Series*, **41**, 95-98.

Hausmann A., Godfray H.C.J., Huemer P., Mutanen M., Rougerie R., van Nieukerken E.J., Ratnasingham S. & Hebert P.D.N. 2013. Genetic patterns in European geometrid moths revealed by the Barcode Index Number (BIN) System. *PLoS ONE*, **8** (12), e84518.

Hebert P.D.N., Cywinska A., Ball S.L. & DeWaard J.R. 2003. Biological identifications through DNA barcodes. *Proc Biol Sci*, **270**, 313-321.

Harrup L.E., Bellis G.A., Balenghien T. & Garros C. 2015. *Culicoides* Latreille (Diptera: Ceratopogonidae) taxonomy: current challenges and future directions. *Infect Genet Evol*, **30**, 249-266.

Jinbo U., Kato T. & Ito M. 2011. Current progress in DNA barcoding and future implications for entomology. *Entomol Sci*, **14**, 107-124.

Kieffer J.J. 1917. Chironomides d'Australie conserves au Musée National Hongrois de Budapest. *Annls Hist -Nat Mus Natn Hung*, **15**, 75-228.

Kimura M. 1980. A simple method for estimating evolutionary rate of base substitutions through comparative studies of nucleotide sequences. *J Mol Evol*, **16**, 111-120.

Kitaoka S. 1975. Five new species of *Culicoides* (Diptera: Ceratopogonidae) of the Nansei Islands. *Natl I Anim Health Q*, **13**, 192-200.

Kitaoka S. 1980. Six new species and males of some species of Japanese *Culicoides* (Diptera: Ceratopogonidae). *Natl I Anim Health Q*, **20**, 11-22.

Linton Y.-M., Mordue (luntz) A.J., Cruickshank R.H., Meiswinkel R., Mellor P.S. & Dallas J.F. 2002. Phylogenetic analysis of the mitochondrial cytochrome oxidase subunit I gene of five species of the *Culicoides imicola* species complex. *Med Vet Entomol*, **16**, 139-146.

Macfie J.W.S. 1932. Some new or little-known Ceratopogonidae. *Ann Mag Nat Hist*, **10**, 485-499.

Macfie J.W.S. 1934. Fauna Sumatrensis. Bijdrage No. 75, Ceratopogonidae (Diptera). *Tijdschr Entomol*, **77**, 202-231.

Macfie J.W.S. 1937. Notes on Ceratopogonidae (Diptera). *R Ent Soc Lond, Proc B*, **6**, 111-118.

Mathieu B. 2012. Les espèces de *Culicoides* du sous-genre *Avaritia* (Diptera: Ceratopogonidae) dans le monde: révision systématique et taxonomique des espèces d'intérêt dans la transmission d'*Orbivirus*. PhD thesis, Université de Strasbourg. 227 pp.

Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55.

Meiswinkel R. 1989. Afrotropical *Culicoides*: a redescription of *C.* (*Avaritia*) *imicola* Kieffer, 1913 (Diptera: Ceratopogonidae) with description of the closely allied *C.* (*A.*) *bolitinos* sp. nov. reared from the dung of the African Buffalo, Blue Wildebeest and cattle in South Africa. *Onderstepoort J Vet*, **56**, 23-39.

Meiswinkel R., Venter G.J. & Nevill E.M. 2004. Vectors: *Culicoides* spp. *In* Infectious diseases of livestock with special reference to southern Africa, Vol. I (J.A.W. Coetzer, G.R. Thomson & R.C. Tustin, eds). Oxford University Press, Cape Town, 93-136.

Moulton J.K. & Wiegmann B.M. 2004. Evolution and phylogenetic utility of CAD (rudimentary) among Mesozoic–aged Eremoneuran Diptera (Insecta). *Mol Phylogenet Evol*, **31**, 363-378.

Nevill, H., Venter G.J., Meiswinkel R. & Nevill E.M. 2007. Comparative descriptions of the pupae of five species of the *Culicoides imicola* complex (Diptera, Ceratopogonidae) from South Africa. *Onderstepoort J Vet*, **74**, 97-114.

Pagès N., Muñoz-Muñoz F., Talavera S., Sarto V., Lorca C., & Núñez N.I. 2009. Identification of cryptic species of *Culicoides* (Diptera, Ceratopogonidae) in the subgenus *Culicoides* and development of species-specific PCR assays based on barcode regions. *Vet Parasitol*, **165**, 298-310.

Ratnasingham S. & Hebert P.D.N. 2007. BOLD, the Barcode of Life Data System. *Mol Ecol Notes*, **7**, 355-364.

Ratnasingham S. & Hebert P.D.N. 2013. A DNA based registry for all animal species: the Barcode Index Number (BIN) system. *PLoS ONE*, **8** (8), e66213.

Schlick-Steiner B.C., Steiner F.M., Seifert B., Stauffer C., Christian E. & Crozier R.H. 2010. Integrative taxonomy: A multisource approach to exploring biodiversity. *Annu Rev Entomol*, **55**, 421-438.

Sen P. & Das Gupta S.K. 1959. Studies on Indian *Culicoides* (Ceratopogonidae: Diptera). *Ann Entomol Soc Am*, **52**, 617-630.

Smith R.O.A. 1929. Two species of *Culicoides* which feed on man. *Indian J Med Res*, **17**, 255-257.

Standfast H.A., Dyce A.L. & Muller M.J. 1985. Vectors of bluetongue virus in Australia. *In* Bluetongue and related orbiviruses (T.L. Barber, M.M. Jochim & B.I. Osburn, eds). Proc. First International Symposium, Monterey, California, 16-20 January 1984. A.R. Liss, New York, *Progr Clin Biol Res*, **178**, 177-186.

Tamura K., Stecher G., Peterson D., Filipski A. & Kumar S. 2013. MEGA6: Molecular Evolutionary Genetics Analysis version 6.0. *Mol Biol Evol*, **30**, 2725-2729.

Tokunaga M. 1962. Biting midges of the genus *Culicoides* from New Guinea (Diptera: Ceratopogonidae). *Pac Insects*, **4**, 457-516.

Tokunaga M. 1963. Some Japanese biting midges breeding in paddy-field water (Diptera, Ceratopogonidae). *Scientific Reports of the Kyoto Prefectural University, Agriculture*, **15**, 37-49.

Tokunaga M. & Murachi E.K. 1959. Diptera: Ceratopogonidae. *Insects Micronesia*, **12**, 103-434.

Will K.W. & Rubinoff D. 2004. Myth on the molecule: DNA barcodes for species cannot replace morphology for identification and classification. *Cladistics,* **20**, 47-55.

Wirth W.W. & Hubert A.A. 1961. New species and records of Taiwan *Culicoides* (Diptera, Ceratopogonidae). *Pac Insects*, **3**, 11-26.

Wirth W.W. & Hubert A.A. 1989. The *Culicoides* of Southeast Asia (Diptera: Ceratopogonidae). *Mem Amer Entomol Inst*, **44**, 1-508.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information.*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. actoni	ww23841	CUSCR2810-14	651[0n]	AAJ7360	KT352682	0		1	China	Zhejiang	Lin`an	30,236	119,718
C. actoni	ww23840	CUSCR2809-14	637[0n]	AAJ7360	KT352581	0		1	China	Zhejiang	Lin`an	30,236	119,718
C. actoni	ww23812	CUSCR2791-14	635[0n]	AAJ7360	KT352590	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23823	CUSCR2802-14	652[0n]	AAJ7360	KT352452	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23835	CUSCR2805-14	642[0n]	AAJ7360	KT352386	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23820	CUSCR2799-14	642[0n]	AAJ7360	KT352717	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23815	CUSCR2794-14	650[0n]	AAJ7360	KT352829	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23813	CUSCR2792-14	637[0n]	AAJ7360	KT352367	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23836	CUSCR2806-14	627[0n]	AAJ7360	KT352248	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23819	CUSCR2798-14	658[0n]	AAJ7360	KT352788	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23833	CUSCR2804-14	652[0n]	AAJ7360	KT352438	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23830	CUSCR2803-14	645[0n]	AAJ7360	KT352814	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23809	CUSCR2790-14	639[0n]	AAJ7360	KT352345	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23817	CUSCR2796-14	647[0n]	AAJ7360	KT352221	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23837	CUSCR2807-14	646[0n]	AAJ7360	KT352552	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23814	CUSCR2793-14	652[0n]	AAJ7360	KT352208	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23821	CUSCR2800-14	652[0n]	AAJ7360	KT352723	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23822	CUSCR2801-14	636[0n]	AAJ7360	KT352235	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23808	CUSCR2789-14	638[0n]	AAJ7360	KT352836	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23816	CUSCR2795-14	637[0n]	AAJ7360	KT352265	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23818	CUSCR2797-14	642[0n]	AAJ7360	KT352567	0		1	China	Hainan	Nada	19,510	109,510
C. actoni	ww23839	CUSCR2808-14	628[0n]	AAJ7360	KT352513	0		1	China	Zhejiang	Lin`an	30,236	119,718
C. actoni	ww15351	CULIC1001-11	630[0n]	AAJ7360	KT352700	0		1	Indonesia	Jawa Barat	Cibinong, Sanja	-6,482	106,854
C. actoni	ww15353	CULIC1003-11	628[0n]	AAJ7360	KT352730	0		1	Indonesia	Jawa Barat	Cibinong, Sanja	-6,482	106,854
C. actoni	ww15352	CULIC1002-11	609[0n]	AAJ7360	KT352798	0		1	Indonesia	Jawa Barat	Cibinong, Sanja	-6,482	106,854
C. actoni	ww15354	CULIC1004-11	641[0n]	AAJ7360	KT352183	0		1	Indonesia	Jawa Barat	Cibinong, Sanja	-6,482	106,854
C. actoni	ww15692	CULIC1447-12	646[0n]	AAJ7360	KT352742	0		1	Indonesia	Jawa Timur	Kediri	-7,891	111,985
C. actoni	ww08997	CULIC701-11	669[0n]	AAJ7360	KT352426	664[27n]	KT352874	1	Japan	Kyushu	Kagoshima	31,600	130,550
C. actoni	ww08999	CULIC703-11	669[0n]	AAJ7360	KT352330	668[23n]	KT352862	1	Japan	Kyushu	Kagoshima	31,600	130,550
C. actoni	ww08998	CULIC702-11	534[0n]	AAJ7360	KT352490	691[0n]	KT352882	1	Japan	Kyushu	Kagoshima	31,600	130,550
C. actoni	AB360971	GBDP4728-08	646(0n)	AAJ7360	AB360971	0		2	Japan	Kyushu	Kagoshima	31,600	130,550
C. actoni	ww06088	CULIC302-11	646[0n]	AAT9301	KT352277	0		1	Indonesia	Jawa Barat	Cibinong	-6,482	106,854
C. actoni	ww06087	CULIC301-11	646[0n]	AAT9301	KT352763	0		1	Indonesia	Jawa Barat	Cibinong	-6,482	106,854
C. actoni	ww15722	CULIC1477-12	596[2n]	AAT9301	KT352833	0		1	Indonesia	Jawa Timur	Kediri	-7,891	111,985
C. actoni	ww15721	CULIC1476-12	646[0n]	AAT9301	KT352522	0		1	Indonesia	Jawa Timur	Kediri	-7,891	111,985
C. actoni	ww09010	CULIC714-11	642[0n]	AAT9301	KT352677	691[0n]	KT352901	1	Papua New Guinea	Morobe	Markham Valley Farm	-6,327	146,387
C. actoni	ww20915	CUACT001-14	658[0n]	AAT9301	KT352618	0		1	Thailand	Trang	Trang	7,831	99,338
C. actoni	ww06080	CULIC294-11	646[0n]	AAT9301	KT352822	662[7n]	KT352919	1	Timor-Leste	Ermera	Eraulo	-8,888	125,511
C. actoni	ww06089	CULIC303-11	646[0n]	AAT9301	KT352768	0		1	Timor-Leste	Lautem	Fuiloro	-8,505	127,240
C. actoni	ww06086	CULIC300-11	641[0n]	AAT9301	KT352337	691[0n]	KT352864	1	Timor-Leste	Lautem	Lospalos	-8,520	126,995
C. actoni	ww06084	CULIC298-11	646[0n]	AAT9301	KT352249	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. actoni	ww06078	CULIC292-11	656[0n]	AAT9301	KT352586	691[0n]	KT352895	1	Timor-Leste	Viqueque	Viqueque	-8,860	126,360
C. actoni	ww06079	CULIC293-11	656[0n]	AAT9301	KT352705	0		1	Timor-Leste	Viqueque	Viqueque	-8,860	126,360

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. actoni	ww05900	CULIC227-11	535[0n]	AAT9302	KT352331	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. actoni	ww08183	CULIC546-11	535[0n]	AAT9302	KT352215	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. actoni	ww08184	CULIC547-11	673[0n]	AAT9302	KT352180	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. actoni	ww10025	CUSCR025-11	635[0n]	AAT9302	KT352549	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. actoni	ww12213	CUSCR2213-11	407[0n]	AAT9302	KT352288	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. actoni	ww12214	CUSCR2214-11	406[0n]	AAT9302	KT352366	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. actoni	ww05899	CULIC226-11	534[1n]	AAT9302	KT352523	677[10n]	KT352885	1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. actoni	ww04917	CULIC033-11	532[0n]	AAT9302	KT352466	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww10052	CUSCR052-11	598[0n]	AAT9302	KT352675	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww04906	CULIC022-11	532[0n]	AAT9302	KT352270	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww04909	CULIC025-11	532[0n]	AAT9302	KT352250	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww04905	CULIC021-11	532[0n]	AAT9302	KT352207	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww10051	CUSCR051-11	600[0n]	AAT9302	KT352355	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww04918	CULIC034-11	532[0n]	AAT9302	KT352456	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww04916	CULIC032-11	532[0n]	AAT9302	KT352400	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww04908	CULIC024-11	532[0n]	AAT9302	KT352403	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww10040	CUSCR040-11	618[0n]	AAT9302	KT352830	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww04915	CULIC031-11	532[0n]	AAT9302	KT352672	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww04910	CULIC026-11	532[0n]	AAT9302	KT352738	677[8n]	KT352911	1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww10055	CUSCR055-11	384[0n]	AAT9302	KT352482	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww10042	CUSCR042-11	456[0n]	AAT9302	KT352445	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww04904	CULIC020-11	532[0n]	AAT9302	KT352812	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww04911	CULIC027-11	532[0n]	AAT9302	KT352464	674[9n]	KT352881	1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww10050	CUSCR050-11	453[0n]	AAT9302	KT352499	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww10054	CUSCR054-11	553[4n]	AAT9302	KT352242	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww04914	CULIC030-11	532[0n]	AAT9302	KT352799	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww04913	CULIC029-11	532[0n]	AAT9302	KT352318	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww04912	CULIC028-11	532[0n]	AAT9302	KT352347	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww04907	CULIC023-11	532[0n]	AAT9302	KT352527	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. actoni	ww10027	CUSCR027-11	635[0n]	AAT9302	KT352709	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. actoni	ww10048	CUSCR048-11	460[0n]	AAT9302	KT352571	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. actoni	ww10026	CUSCR026-11	632[0n]	AAT9302	KT352840	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. actoni	ww10043	CUSCR043-11	589[1n]	AAT9302	KT352496	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. actoni	ww10039	CUSCR039-11	618[0n]	AAT9302	KT352733	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. actoni	ww05867	CULIC194-11	535[0n]	AAT9302	KT352791	0		1	Australia	Western Australia	Kalumburu	-14,283	126,633
C. actoni	ww05869	CULIC196-11	529[0n]	AAT9302	KT352550	677[10n]	KT352890	1	Australia	Western Australia	Kalumburu	-14,283	126,633
C. actoni	ww10046	CUSCR046-11	555[1n]	AAT9302	KT352821	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. actoni	ww10021	CUSCR021-11	499[0n]	AAT9302	KT352545	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. actoni	ww05868	CULIC195-11	540[0n]	AAT9302	KT352412	0		1	Australia	Western Australia	Kalumburu	-14,283	126,633
C. actoni	ww10044	CUSCR044-11	549[0n]	AAT9302	KT352443	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. actoni	ww10056	CUSCR056-11	618[0n]	AAT9302	KT352614	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. actoni	ww15186	CULIC886-11	658[0n]	AAT9302	KT352226	0		1	Australia	Western Australia	Karratha station	-20,883	116,667
C. actoni	ww08187	CULIC550-11	433[0n]	AAT9302	KT352766	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. actoni	ww08186	CULIC549-11	673[0n]	AAT9302	KJ162953	667[21n]	KJ163001	3	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. actoni	ww09782	CULIC766-11	406[0n]	AAT9302	KT352200	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. actoni	ww08185	CULIC548-11	535[0n]	AAT9302	KT352461	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. actoni	ww09783	CULIC767-11	406[0n]	AAT9302	KT352280	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. actoni	ww09779	CULIC763-11	406[0n]	AAT9302	KT352313	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. actoni	ww09781	CULIC765-11	406[0n]	AAT9302	KT352467	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. actoni	ww09780	CULIC764-11	406[0n]	AAT9302	KT352519	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. actoni	ww10074	CUSCR074-11	548[1n]	AAT9302	KT352582	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776
C. actoni	ww10069	CUSCR069-11	618[0n]	AAT9302	KT352222	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776
C. actoni	ww10068	CUSCR068-11	598[0n]	AAT9302	KT352486	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776
C. actoni	ww10058	CUSCR058-11	413[0n]	AAT9302	KT352746	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776
C. actoni	ww10071	CUSCR071-11	545[0n]	AAT9302	KT352780	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776
C. actoni	ww10070	CUSCR070-11	570[1n]	AAT9302	KT352376	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776
C. actoni	ww10073	CUSCR073-11	580[0n]	AAT9302	KT352541	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776
C. actoni	ww10060	CUSCR060-11	618[0n]	AAT9302	KT352212	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776
C. actoni	ww10067	CUSCR067-11	617[1n]	AAT9302	KT352591	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776
C. actoni	ww10065	CUSCR065-11	466[0n]	AAT9302	KT352718	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776
C. actoni	ww10059	CUSCR059-11	612[0n]	AAT9302	KT352227	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776
C. actoni	ww10066	CUSCR066-11	595[0n]	AAT9302	KT352178	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. actoni	ww10061	CUSCR061-11	618[0n]	AAT9302	KT352246	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776
C. actoni	ww10029	CUSCR029-11	634[1n]	AAT9302	KT352732	0		1	Australia	Northern Territory	Victoria River Research Station	-16,400	131,017
C. actoni	ww10076	CUSCR076-11	556[0n]	AAT9302	KT352699	0		1	Australia	Northern Territory	Victoria River Research Station	-16,400	131,017
C. actoni	ww10031	CUSCR031-11	634[1n]	AAT9302	KT352479	0		1	Australia	Northern Territory	Victoria River Research Station	-16,400	131,017
C. actoni	ww10077	CUSCR077-11	589[0n]	AAT9302	KT352633	0		1	Australia	Northern Territory	Victoria River Research Station	-16,400	131,017
C. actoni	ww10028	CUSCR028-11	634[0n]	AAT9302	KT352170	0		1	Australia	Northern Territory	Victoria River Research Station	-16,400	131,017
C. actoni	ww10032	CUSCR032-11	634[1n]	AAT9302	KT352261	0		1	Australia	Northern Territory	Victoria River Research Station	-16,400	131,017
C. actoni	ww10030	CUSCR030-11	635[0n]	AAT9302	KT352342	0		1	Australia	Northern Territory	Victoria River Research Station	-16,400	131,017
C. actoni	ww15500	CULIC1255-12	624[0n]	AAT9302	KT352785	0		1	Australia	Queensland	Webb Crs, Innisfail	-17,533	146,033
C. actoni	ww15499	CULIC1254-12	624[0n]	AAT9302	KT352764	0		1	Australia	Queensland	Webb Crs, Innisfail	-17,533	146,033
C. actoni	ww15497	CULIC1252-12	646[0n]	AAT9302	KT352364	0		1	Australia	Queensland	Webb Crs, Innisfail	-17,533	146,033
C. actoni	ww15498	CULIC1253-12	646[0n]	AAT9302	KT352357	0		1	Australia	Queensland	Webb Crs, Innisfail	-17,533	146,033
C. actoni	ww09011	CULIC715-11	669[0n]	AAT9302	KT352309	675[16n]	KT352860	1	Australia	Northern Territory	Whitestone island	-12,102	132,393
C. actoni	ww10079	CUSCR079-11	618[0n]	AAT9303	KT352181	0		1	Papua New Guinea	Souterhn Highlands	Baba	-6,310	143,950
C. actoni	ww10081	CUSCR081-11	526[0n]	AAT9303	KT352326	0		1	Papua New Guinea	Souterhn Highlands	Baba	-6,310	143,950
C. actoni	ww10080	CUSCR080-11	570[0n]	AAT9303	KT352551	0		1	Papua New Guinea	Souterhn Highlands	Baba	-6,310	143,950
C. actoni	ww08227	CULIC590-11	534[0n]	AAT9303	KT352240	669[22n]	KT352852	1	Papua New Guinea	Western	Indorordoro	-8,054	141,684
C. actoni	ww15078	CULIC869-11	602[0n]	AAT9303	KT352509	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,284
C. actoni	ww14419	CULIC1159-12	627[0n]	AAT9303	KT352808	0		1	Solomon Islands	Western	Tuiai	-7,092	155,863
C. actoni	ww14416	CULIC1156-12	570[0n]	AAT9303	KT352175	0		1	Solomon Islands	Western	Tuiai	-7,092	155,863
C. actoni	ww14414	CULIC1154-12	619[0n]	AAT9303	KT352204	0		1	Solomon Islands	Western	Tuiai	-7,092	155,863
C. actoni	ww14412	CULIC1152-12	646[0n]	AAT9303	KT352292	0		1	Solomon Islands	Western	Tuiai	-7,092	155,863
C. actoni	ww14418	CULIC1158-12	646[0n]	AAT9303	KT352428	0		1	Solomon Islands	Western	Tuiai	-7,092	155,863
C. asiana	ww15691	CULIC1446-12	646[0n]	AAI9876	KT352666	0		1	Indonesia	Jawa Timur	Kediri, Ringinsari	-7,891	111,985
C. asiana	ww15720	CULIC1475-12	406[0n]	AAI9876	KT352198	0		1	Indonesia	Jawa Timur	Kediri, Ringinsari	-7,891	111,985
C. asiana	ww15709	CULIC1464-12	406[0n]	AAI9876	KT352828	0		1	Indonesia	Jawa Timur	Kediri, Ringinsari	-7,891	111,985
C. asiana	ww15368	CULIC1018-11	646[0n]	AAI9876	KT352266	0		1	Japan	Okinawa	Ishigaki	24,345	124,157
C. asiana	ww15366	CULIC1016-11	646[0n]	AAI9876	KT352753	0		1	Japan	Okinawa	Ishigaki	24,345	124,157
C. asiana	ww15367	CULIC1017-11	646[0n]	AAI9876	KT352290	0		1	Japan	Okinawa	Ishigaki	24,345	124,157
C. asiana	ww15369	CULIC1019-11	646[0n]	AAI9876	KT352365	0		1	Japan	Okinawa	Ishigaki	24,345	124,157
C. asiana	ww15384	CULIC1034-11	646[0n]	AAI9876	KT352684	0		1	Japan	Okinawa	Ishigaki	24,345	124,157

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. asiana	ww15383	CULIC1033-11	646[0n]	AAI9876	KT352634	0		1	Japan	Okinawa	Ishigaki	24,345	124,157
C. asiana	ww15385	CULIC1035-11	645[0n]	AAI9876	KT352378	0		1	Japan	Okinawa	Ishigaki	24,345	124,157
C. asiana	ww15361	CULIC1011-11	646[0n]	AAI9876	KT352474	0		1	Japan	Kyushu	Minamikyushu	31,378	130,442
C. asiana	ww15394	CULIC1044-11	646[0n]	AAI9876	KT352360	0		1	Japan	Kyushu	Minamikyushu	31,378	130,442
C. asiana	ww15391	CULIC1041-11	646[0n]	AAI9876	KT352404	0		1	Japan	Kyushu	Minamikyushu	31,378	130,442
C. asiana	ww08443	BREV255-11	714[0n]	AAI9876	KJ162955	691[0n]	KJ163003	3	Japan	Kyushu	Minamikyushu	31,378	130,442
C. asiana	ww15393	CULIC1043-11	646[0n]	AAI9876	KT352471	0		1	Japan	Kyushu	Minamikyushu	31,378	130,442
C. asiana	ww08444	BREV256-11	714[0n]	AAI9876	KJ162956	691[0n]	KJ163004	3	Japan	Kyushu	Minamikyushu	31,378	130,442
C. asiana	ww10568	CUSCR568-11	635[0n]	AAI9876	KT352622	0		1	Japan	Kyushu	Minamikyushu	31,378	130,442
C. asiana	ww10560	CUSCR560-11	635[0n]	AAI9876	KT352607	0		1	Japan	Kyushu	Minamikyushu	31,378	130,442
C. asiana	ww08442	BREV254-11	709[0n]	AAI9876	KT352544	0		1	Japan	Kyushu	Minamikyushu	31,378	130,442
C. asiana	ww15362	CULIC1012-11	626[0n]	AAI9876	KT352487	0		1	Japan	Kyushu	Kanoya	31,383	130,850
C. asiana	ww15364	CULIC1014-11	618[0n]	AAI9876	KT352792	0		1	Japan	Kyushu	Kanoya	31,383	130,850
C. asiana	ww15381	CULIC1031-11	646[0n]	AAI9876	KT352300	0		1	Japan	Kyushu	Kanoya	31,383	130,850
C. asiana	ww15365	CULIC1015-11	646[0n]	AAI9876	KT352262	0		1	Japan	Kyushu	Kanoya	31,383	130,850
C. asiana	ww15363	CULIC1013-11	635[1n]	AAI9876	KT352524	0		1	Japan	Kyushu	Kanoya	31,383	130,850
C. asiana	ww15382	CULIC1032-11	646[0n]	AAI9876	KT352453	0		1	Japan	Kyushu	Kanoya	31,383	130,850
C. asiana	ww15389	CULIC1039-11	646[0n]	AAI9876	KT352608	0		1	Japan	Kyushu	Koshi	32,790	130,742
C. asiana	ww15387	CULIC1037-11	646[0n]	AAI9876	KT352275	0		1	Japan	Kyushu	Koshi	32,790	130,742
C. asiana	ww15388	CULIC1038-11	641[0n]	AAI9876	KT352283	0		1	Japan	Kyushu	Koshi	32,790	130,742
C. asiana	AB360995	GBDP4705-08	444(0n)	AAI9876	AB360995	0		2	Japan	Okinawa	Naha	26,213	127,681
C. asiana	AB360994	GBDP4706-08	444(0n)	AAI9876	AB360994	0		2	Japan	Okinawa	Naha	26,213	127,681
C. asiana	ww15379	CULIC1029-11	646[0n]	AAI9876	KT352328	0		1	Japan	Okinawa	Nakijin	26,676	127,972
C. asiana	ww15374	CULIC1024-11	646[0n]	AAI9876	KT352604	0		1	Japan	Okinawa	Nakijin	26,676	127,972
C. asiana	ww15375	CULIC1025-11	646[0n]	AAI9876	KT352310	0		1	Japan	Okinawa	Nakijin	26,676	127,972
C. asiana	ww15380	CULIC1030-11	630[0n]	AAI9876	KT352321	0		1	Japan	Okinawa	Nakijin	26,676	127,972
C. asiana	ww15378	CULIC1028-11	646[0n]	AAI9876	KT352786	0		1	Japan	Okinawa	Nakijin	26,676	127,972
C. asiana	ww15377	CULIC1027-11	646[0n]	AAI9876	KT352495	0		1	Japan	Okinawa	Nakijin	26,676	127,972
C. asiana	ww15373	CULIC1023-11	630[0n]	AAI9876	KT352323	0		1	Japan	Okinawa	Nakijin	26,676	127,972
C. asiana	ww15376	CULIC1026-11	646[0n]	AAI9876	KT352749	0		1	Japan	Okinawa	Nakijin	26,676	127,972
C. asiana	ww10553	CUSCR553-11	471[0n]	AAI9876	KT352354	0		1	Japan	Okinawa	Yonaguni	24,468	123,005
C. asiana	ww10556	CUSCR556-11	635[0n]	AAI9876	KT352500	0		1	Japan	Okinawa	Yonaguni	24,468	123,005
C. asiana	ww10549	CUSCR549-11	635[0n]	AAI9876	KT352402	0		1	Japan	Okinawa	Yonaguni	24,468	123,005
C. asiana	ww10551	CUSCR551-11	635[0n]	AAI9876	KT352358	0		1	Japan	Okinawa	Yonaguni	24,468	123,005
C. asiana	ww10554	CUSCR554-11	635[0n]	AAI9876	KT352612	0		1	Japan	Okinawa	Yonaguni	24,468	123,005
C. asiana	ww10552	CUSCR552-11	635[0n]	AAI9876	KT352488	0		1	Japan	Okinawa	Yonaguni	24,468	123,005
C. asiana	ww08440	BREV252-11	673[0n]	AAI9876	KT352827	0		1	Japan	Okinawa	Yonaguni	24,468	123,005
C. asiana	ww08437	BREV249-11	697[0n]	AAI9876	KJ162958	691[0n]	KJ163006	3	Japan	Okinawa	Yonaguni	24,468	123,005
C. asiana	ww08438	BREV250-11	673[0n]	AAI9876	KJ162957	691[0n]	KJ163005	3	Japan	Okinawa	Yonaguni	24,468	123,005
C. asiana	ww08439	BREV251-11	673[0n]	AAI9876	KJ162960	691[0n]	KJ163008	3	Japan	Okinawa	Yonaguni	24,468	123,005
C. asiana	ww06258	CULIC420-11	646[0n]	AAI9876	KJ162954	691[0n]	KJ163002	3	Laos	Hatsayfong	Vientiane	17,872	102,664
C. asiana	ww20922	BREV426-14	577[3n]	AAI9876	KT352693	0		1	Thailand	Trang	Trang	7,831	99,338

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. asiana	ww20945	BREV425-14	658[0n]	AAI9876	KT352257	0		1	Thailand	Trang	Trang	7,831	99,338
C. asiana	ww06007	BREV066-11	697[0n]	AAI9876	KJ162959	691[0n]	KJ163007	3	Timor-Leste	Manufahi	Manufahi	-9,100	125,900
C. Avaritia sp. No. 2	ww09628	CULIC751-11	645[0n]	AAV1658	KT352344	683[8n]	KT352866	1	Australia	Queensland	Kuranda	-16,810	145,630
C. Avaritia sp. No. 3	ww06120	CULIC334-11	636[0n]	AAT9391	KT352690	670[20n]	KT352902	1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. Avaritia sp. No. 3	ww06121	CULIC335-11	646[0n]	AAT9391	KT352702	676[14n]	KT352904	1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. Avaritia sp. No. 3	ww06122	CULIC336-11	646[0n]	AAT9391	KT352721	691[0n]	KT352908	1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. Avaritia sp. No. 3	ww06112	CULIC326-11	636[0n]	AAT9391	KT352188	0		1	Timor-Leste	Lautem	Fuiloro	-8,505	127,240
C. brevipalpis	ww23867	CUSCR2822-14	639[0n]	AAJ7389	KT352211	0		1	China	Hainan	Haidian Dao	20,080	110,340
C. brevipalpis	ww23869	CUSCR2824-14	641[0n]	AAJ7389	KT352351	0		1	China	Hainan	Haidian Dao	20,080	110,340
C. brevipalpis	ww23866	CUSCR2821-14	603[0n]	AAJ7389	KT352465	0		1	China	Hainan	Haidian Dao	20,080	110,340
C. brevipalpis	ww23868	CUSCR2823-14	659[0n]	AAJ7389	KT352305	0		1	China	Hainan	Haidian Dao	20,080	110,340
C. brevipalpis	ww23865	CUSCR2820-14	639[0n]	AAJ7389	KT352644	0		1	China	Hainan	Haidian Dao	20,080	110,340
C. brevipalpis	ww23864	CUSCR2819-14	659[0n]	AAJ7389	KT352195	0		1	China	Hainan	Haidian Dao	20,080	110,340
C. brevipalpis	AB360998	GBDP4702-08	444(0n)	AAJ7389	AB360998	0		2	Japan	Okinawa	Naha	26,213	127,681
C. brevipalpis	ww09013	CULIC717-11	673[0n]	AAJ7389	KJ162964	690[1n]	KJ163011	3	Japan	Okinawa	Yonaguni	24,468	123,005
C. brevipalpis	ww09014	CULIC718-11	673[0n]	AAJ7389	KJ162965	686[5n]	KJ163012	3	Japan	Okinawa	Yonaguni	24,468	123,005
C. brevipalpis	ww09012	CULIC716-11	716[0n]	AAJ7389	KJ162963	674[17n]	KJ163010	3	Japan	Okinawa	Yonaguni	24,468	123,005
C. brevipalpis	ww10255	CUSCR255-11	618[0n]	AAT9731	KT352432	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. brevipalpis	ww10310	CUSCR310-11	618[0n]	AAT9731	KT352217	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10343	CUSCR343-11	618[0n]	AAT9731	KT352670	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10341	CUSCR341-11	618[0n]	AAT9731	KT352823	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10344	CUSCR344-11	617[1n]	AAT9731	KT352615	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10334	CUSCR334-11	617[1n]	AAT9731	KT352481	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10308	CUSCR308-11	618[0n]	AAT9731	KT352255	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10333	CUSCR333-11	618[0n]	AAT9731	KT352530	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10338	CUSCR338-11	618[0n]	AAT9731	KT352807	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10335	CUSCR335-11	618[0n]	AAT9731	KT352818	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10300	CUSCR300-11	618[0n]	AAT9731	KT352624	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10305	CUSCR305-11	618[0n]	AAT9731	KT352565	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10342	CUSCR342-11	617[1n]	AAT9731	KT352568	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10302	CUSCR302-11	616[2n]	AAT9731	KT352303	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10339	CUSCR339-11	618[0n]	AAT9731	KT352529	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10304	CUSCR304-11	618[0n]	AAT9731	KT352657	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10306	CUSCR306-11	615[3n]	AAT9731	KT352685	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10301	CUSCR301-11	603[1n]	AAT9731	KT352664	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10340	CUSCR340-11	617[1n]	AAT9731	KT352213	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww10311	CUSCR311-11	618[0n]	AAT9731	KT352579	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. brevipalpis	ww10309	CUSCR309-11	618[0n]	AAT9731	KT352825	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevipalpis	ww12460	CUSCH003-12	643[3n]	AAT9731	KT352751	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevipalpis	ww12476	CUSCH019-12	645[1n]	AAT9731	KT352584	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevipalpis	ww12464	CUSCH007-12	644[2n]	AAT9731	KT352654	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevipalpis	ww12470	CUSCH013-12	646[0n]	AAT9731	KT352727	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevipalpis	ww12480	CUSCH023-12	646[0n]	AAT9731	KT352332	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevipalpis	ww12458	CUSCH001-12	645[1n]	AAT9731	KT352194	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevipalpis	ww12474	CUSCH017-12	646[0n]	AAT9731	KT352503	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevipalpis	ww12472	CUSCH015-12	645[1n]	AAT9731	KT352229	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevipalpis	ww12482	CUSCH025-12	645[1n]	AAT9731	KT352583	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevipalpis	ww10327	CUSCR327-11	614[4n]	AAT9731	KT352252	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevipalpis	ww12484	CUSCH027-12	643[3n]	AAT9731	KT352442	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevipalpis	ww05852	CULIC179-11	696[0n]	AAT9731	KT352617	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevipalpis	ww12468	CUSCH011-12	646[0n]	AAT9731	KT352517	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevipalpis	ww10317	CUSCR317-11	614[4n]	AAT9731	KT352359	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevipalpis	ww12478	CUSCH021-12	646[0n]	AAT9731	KT352302	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevipalpis	ww10315	CUSCR315-11	616[2n]	AAT9731	KT352274	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevipalpis	ww05853	CULIC180-11	715[0n]	AAT9731	KT352713	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevipalpis	ww05857	CULIC184-11	715[0n]	AAT9731	KT352765	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. brevipalpis	ww05855	CULIC182-11	703[3n]	AAT9731	KT352493	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. brevipalpis	ww05856	CULIC183-11	715[0n]	AAT9731	KT352167	469[5n]	KT352845	1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. brevipalpis	ww10269	CUSCR269-11	618[0n]	AAT9731	KT352596	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. brevipalpis	ww10260	CUSCR260-11	618[0n]	AAT9731	KT352341	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. brevipalpis	ww10274	CUSCR274-11	616[2n]	AAT9731	KT352546	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. brevipalpis	ww10268	CUSCR268-11	617[1n]	AAT9731	KT352779	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. brevipalpis	ww06100	CULIC314-11	646[0n]	AAT9731	KT352256	689[2n]	KT352853	1	Timor-Leste	Ainaro	Ainaro	-8,997	125,505
C. brevipalpis	ww06097	CULIC311-11	646[0n]	AAT9731	KT352210	0		1	Timor-Leste	Lautem	Fuiloro	-8,505	127,240
C. brevipalpis	ww06105	CULIC319-11	646[0n]	AAT9731	KT352379	0		1	Timor-Leste	Lautem	Fuiloro	-8,505	127,240
C. brevipalpis	ww12884	CUSCH407-12	615[0n]	AAT9731	KT352811	0		1	Timor-Leste	Lautem	Lospalos	-8,520	126,995
C. brevipalpis	ww12891	CUSCH414-12	623[0n]	AAT9731	KT352286	0		1	Timor-Leste	Lautem	Lospalos	-8,520	126,995

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. brevipalpis	ww06098	CULIC312-11	641[0n]	AAT9731	KT352716	679[8n]	KT352906	1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. brevipalpis	ww06107	CULIC321-11	646[0n]	AAT9731	KT352293	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. brevipalpis	ww10292	CUSCR292-11	617[1n]	ACF4949	KT352711	0		1	Papua New Guinea	East Sepik	East Sepik (Wirui mission)	-4,315	143,046
C. brevipalpis	ww10299	CUSCR299-11	618[0n]	ACF4949	KT352595	0		1	Papua New Guinea	East Sepik	East Sepik (Wirui mission)	-4,315	143,046
C. brevipalpis	ww10285	CUSCR285-11	617[1n]	ACF4949	KT352272	0		1	Papua New Guinea	East Sepik	East Sepik (Wirui mission)	-4,315	143,046
C. brevipalpis	ww10294	CUSCR294-11	617[1n]	ACF4949	KT352391	0		1	Papua New Guinea	East Sepik	East Sepik (Wirui mission)	-4,315	143,046
C. brevipalpis	ww15061	CULIC852-11	625[0n]	ACF4949	KT352468	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,284
C. brevipalpis	ww15062	CULIC853-11	639[0n]	ACF4949	KT352279	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,284
C. brevipalpis	ww15063	CULIC854-11	627[1n]	ACF4949	KT352483	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,284
C. brevipalpis	ww15060	CULIC851-11	646[0n]	ACF4949	KT352680	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,284
C. brevipalpis	ww10279	CUSCR279-11	617[1n]	ACF4949	KT352514	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,285
C. brevipalpis	ww10278	CUSCR278-11	617[1n]	ACF4949	KT352384	0		1	Papua New Guinea	Morobe	Markham Valley Farm	-6,545	146,645
C. brevipalpis	ww10277	CUSCR277-11	461[3n]	ACF4949	KT352726	0		1	Papua New Guinea	Morobe	Markham Valley Farm	-6,545	146,645
C. brevipalpis	ww06101	CULIC315-11	639[0n]	ACF4949	KT352306	0		1	Timor-Leste	Ainaro	Ainaro	-8,997	125,505
C. brevipalpis	ww06102	CULIC316-11	646[0n]	ACF4949	KT352715	686[5n]	KT352905	1	Timor-Leste	Ermera	Eraulo	-8,888	125,511
C. brevipalpis	ww06103	CULIC317-11	646[0n]	ACF4949	KT352558	0		1	Timor-Leste	Ermera	Eraulo	-8,888	125,511
C. brevipalpis	ww06104	CULIC318-11	646[0n]	ACF4949	KT352205	0		1	Timor-Leste	Lautem	Fuiloro	-8,505	127,240
C. brevipalpis	ww06096	CULIC310-11	646[0n]	ACF4949	KT352543	650[13n]	KT352888	1	Timor-Leste	Lautem	Fuiloro	-8,505	127,240
C. brevipalpis	ww12887	CUSCH410-12	638[1n]	ACF4949	KT352741	0		1	Timor-Leste	Lautem	Lospalos	-8,520	126,995
C. brevipalpis	ww12892	CUSCH415-12	611[0n]	ACF4949	KT352172	0		1	Timor-Leste	Lautem	Lospalos	-8,520	126,995
C. brevipalpis	ww12889	CUSCH412-12	622[0n]	ACF4949	KT352647	0		1	Timor-Leste	Lautem	Lospalos	-8,520	126,995
C. brevipalpis	ww12885	CUSCH408-12	619[0n]	ACF4949	KT352484	0		1	Timor-Leste	Lautem	Lospalos	-8,520	126,995
C. brevipalpis	ww12886	CUSCH409-12	624[0n]	ACF4949	KT352441	0		1	Timor-Leste	Lautem	Lospalos	-8,520	126,995
C. brevipalpis	ww06108	CULIC322-11	646[0n]	ACF4949	KT352411	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. brevipalpis	ww06099	CULIC313-11	646[0n]	ACF4949	KT352396	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. brevipalpis	ww06106	CULIC320-11	646[0n]	ACF4949	KT352304	0		1	Timor-Leste	Oecusse	Samora	-8,820	125,854
C. brevipalpis	ww06092	CULIC306-11	646[0n]	ACF4949	KT352512	690[1n]	KT352883	1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. brevipalpis	ww06093	CULIC307-11	646[0n]	ACF4949	KT352269	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. brevitarsis	ww08365	BREV177-11	673[0n]	AAT9300	KT352750	0		1	Australia	Queensland	Bamaga	-10,883	142,383
C. brevitarsis	ww08367	BREV179-11	658[0n]	AAT9300	KT352562	0		1	Australia	Queensland	Bamaga	-10,883	142,383
C. brevitarsis	ww05416	BREV015-11	673[0n]	AAT9300	KT352245	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. brevitarsis	ww05422	BREV021-11	646[0n]	AAT9300	KT352320	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. brevitarsis	ww04499	BREV002-11	697[0n]	AAT9300	KR736116	0		1	Australia	Northern Territory	Berrimah Agricultural Res. Centre	-12,433	130,917

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. brevitarsis	ww04498	BREV001-11	697[0n]	AAT9300	KR736142	0		1	Australia	Northern Territory	Berrimah Agricultural Res. Centre	-12,433	130,917
C. brevitarsis	ww04503	BREV006-11	697[0n]	AAT9300	KR736125	0		1	Australia	Northern Territory	Berrimah Agricultural Res. Centre	-12,433	130,917
C. brevitarsis	ww04500	BREV003-11	697[0n]	AAT9300	KR736147	0		1	Australia	Northern Territory	Berrimah Agricultural Res. Centre	-12,433	130,917
C. brevitarsis	ww08694	BREV302-11	673[0n]	AAT9300	KR736160	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. brevitarsis	ww08725	BREV333-11	663[0n]	AAT9300	KT352201	0		1	Australia	Queensland	Fernvale	-27,433	152,650
C. brevitarsis	ww08730	BREV338-11	673[0n]	AAT9300	KT352374	0		1	Australia	Queensland	Fernvale	-27,433	152,650
C. brevitarsis	ww08729	BREV337-11	657[0n]	AAT9300	KR736109	0		1	Australia	Queensland	Fernvale	-27,433	152,650
C. brevitarsis	ww08960	BREV381-11	673[0n]	AAT9300	KT352714	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. brevitarsis	ww06046	BREV105-11	703[0n]	AAT9300	KJ162974	690[1n]	KJ163021	3	Australia	New South Wales	Grafton	-29,683	152,933
C. brevitarsis	ww08657	BREV265-11	673[0n]	AAT9300	KT352224	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevitarsis	ww08659	BREV267-11	672[0n]	AAT9300	KT352553	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevitarsis	ww08667	BREV275-11	673[0n]	AAT9300	KT352322	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. brevitarsis	ww08673	BREV281-11	673[0n]	AAT9300	KT352532	0		1	Australia	Northern Territory	Victoria River Research Station	-16,400	131,017
C. brevitarsis	ww15069	CULIC860-11	618[0n]	AAT9300	KT352422	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,284
C. brevitarsis	ww08429	BREV241-11	673[0n]	AAT9300	KT352492	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. brevitarsis	ww08418	BREV230-11	673[0n]	AAT9300	KR736138	0		1	Papua New Guinea	Morobe	Markham Valley Farm	-6,545	146,645
C. brevitarsis	ww08435	BREV247-11	673[0n]	AAT9300	KT352701	0		1	Papua New Guinea	Morobe	Markham Valley Farm	-6,545	146,645
C. brevitarsis	ww08428	BREV240-11	673[0n]	AAT9300	KT352806	0		1	Papua New Guinea	Morobe	Markham Valley Farm	-6,545	146,645
C. brevitarsis	ww08419	BREV231-11	673[0n]	AAT9300	KT352214	0		1	Papua New Guinea	Morobe	Markham Valley Farm	-6,545	146,645
C. brevitarsis	ww08423	BREV235-11	673[0n]	AAT9300	KR736135	0		1	Papua New Guinea	Morobe	Markham Valley Farm	-6,545	146,645
C. brevitarsis	ww08398	BREV210-11	673[0n]	AAT9300	KT352697	0		1	Papua New Guinea	East Sepik	Wirui mission	-3,578	143,646
C. brevitarsis	ww06263	CULIC425-11	646[0n]	AAT9300	KT352308	0		1	Solomon Islands	Malaita	Kwailatutu	-8,950	160,767
C. brevitarsis	ww06189	BREV145-11	646[0n]	AAT9300	KT352189	0		1	Solomon Islands	Malaita	Malaita	-8,937	160,774
C. brevitarsis	ww06210	BREV166-11	646[0n]	AAT9300	KT352193	0		1	Solomon Islands	Malaita	Malaita	-8,937	160,774
C. brevitarsis	ww06208	BREV164-11	646[0n]	AAT9300	KR736134	0		1	Solomon Islands	Malaita	Malaita	-8,937	160,774
C. brevitarsis	ww06201	BREV157-11	646[0n]	AAT9300	KR736118	0		1	Solomon Islands	Malaita	Malaita	-8,937	160,774
C. brevitarsis	ww06188	BREV144-11	646[0n]	AAT9300	KR736132	0		1	Solomon Islands	Malaita	Malaita	-8,937	160,774
C. brevitarsis	ww06180	BREV136-11	646[0n]	AAT9300	KJ162971	677[14n]	KJ163018	3	Solomon Islands	Malaita	Malaita	-8,937	160,774
C. brevitarsis	ww14411	CULIC1151-12	653[0n]	AAT9300	KR736120	0		1	Solomon Islands	Western	Tuiai	-7,092	155,863
C. brevitarsis	ww14407	CULIC1147-12	658[0n]	AAT9300	KJ162967	679[12n]	KJ163014	3	Solomon Islands	Western	Tuiai	-7,092	155,863
C. brevitarsis	ww14405	CULIC1145-12	658[0n]	AAT9300	KJ162970	678[13n]	KJ163017	3	Solomon Islands	Western	Tuiai	-7,092	155,863
C. brevitarsis	ww14406	CULIC1146-12	658[0n]	AAT9300	KJ162969	691[0n]	KJ163016	3	Solomon Islands	Western	Tuiai	-7,092	155,863

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. brevitarsis	ww08700	BREV308-11	662[0n]	AAT9300	KT352810	0		1	Timor-Leste	Lautem	Los Palos	-8,520	126,995
C. brevitarsis	ww08714	BREV322-11	673[0n]	AAT9300	KT352472	0		1	Timor-Leste	Oecusse	Pante Makassar	-9,200	124,380
C. brevitarsis	ww08713	BREV321-11	672[0n]	AAT9300	KT352258	0		1	Timor-Leste	Oecusse	Pante Makassar	-9,200	124,380
C. brevitarsis	ww08710	BREV318-11	673[0n]	AAT9300	KT352239	0		1	Timor-Leste	Oecusse	Samora	-8,820	125,854
C. brevitarsis	ww08711	BREV319-11	673[0n]	AAT9300	KR736114	0		1	Timor-Leste	Oecusse	Samora	-8,820	125,854
C. brevitarsis	ww05959	BREV037-11	646[0n]	AAT9300	KJ162975	684[7n]	KJ163022	3	Timor-Leste	Oecusse	Samora	-8,820	125,854
C. brevitarsis	ww08973	BREV394-11	673[0n]	AAT9300	KR736159	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. brevitarsis	ww08975	BREV396-11	673[0n]	AAT9300	KT352307	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. brevitarsis	ww08979	BREV400-11	673[0n]	AAT9300	KT352174	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. brevitarsis	ww05961	BREV039-11	646[0n]	AAT9300	KJ162968	690[1n]	KJ163015	3	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. brevitarsis	ww05947	BREV025-11	646[0n]	AAT9300	KT352572	0		1	Timor-Leste	Viqueque	Viqueque	-8,860	126,360
C. brevitarsis	ww05951	BREV029-11	646[0n]	AAT9300	KT352431	0		1	Timor-Leste	Viqueque	Viqueque	-8,860	126,360
C. brevitarsis	ww06256	CULIC418-11	646[0n]	AAW0012	KJ162972	664[27n]	KJ163019	3	China	Hainan	Mengnya	20,080	110,370
C. brevitarsis	ww06255	CULIC417-11	646[0n]	AAW0012	KJ162966	676[15n]	KJ163013	3	China	Hainan	Mengnya	20,080	110,370
C. brevitarsis	ww06257	CULIC419-11	646[0n]	AAW0012	KJ162973	691[0n]	KJ163020	3	China	Hainan	Sanlian Can	20,080	110,370
C. dumdumi	ww06118	CULIC332-11	510[0n]	AAT9849	KT352508	0		1	Australia	Queensland	Bamaga	-10,883	142,383
C. dumdumi	ww06119	CULIC333-11	510[0n]	AAT9849	KT352831	0		1	Australia	Queensland	Bamaga	-10,883	142,383
C. dumdumi	ww06115	CULIC329-11	510[0n]	AAT9849	KT352169	0		1	Australia	Queensland	Bamaga	-10,883	142,383
C. dumdumi	ww11002	CUSCR1002-11	655[0n]	AAT9849	KT352588	0		1	Australia	Queensland	Bamaga	-10,883	142,383
C. dumdumi	ww10995	CUSCR995-11	654[1n]	AAT9849	KT352273	0		1	Australia	Queensland	Bamaga	-10,883	142,383
C. dumdumi	ww11001	CUSCR1001-11	655[0n]	AAT9849	KT352450	0		1	Australia	Queensland	Boigu Island	-9,230	142,218
C. dumdumi	ww14353	CULIC1097-12	646[0n]	AAT9849	KT352566	685[6n]	KT352894	1	Australia	Queensland	Holloway Beach, Cairns	-16,917	145,767
C. dumdumi	ww14352	CULIC1096-12	646[0n]	AAT9849	KT352397	691[0n]	KT352871	1	Australia	Queensland	Holloway Beach, Cairns	-16,917	145,767
C. dumdumi	ww14355	CULIC1099-12	520[0n]	AAT9849	KT352298	691[0n]	KT352859	1	Australia	Queensland	Mapoon	-11,350	142,333
C. dumdumi	ww06127	CULIC341-11	646[0n]	AAT9849	KT352363	691[0n]	KT352867	1	Australia	Queensland	Mapoon	-11,350	142,333
C. dumdumi	ww06126	CULIC340-11	510[0n]	AAT9849	KT352297	690[1n]	KT352858	1	Australia	Queensland	Mapoon	-11,350	142,333
C. dumdumi	ww14356	CULIC1100-12	520[0n]	AAT9849	KT352435	691[0n]	KT352876	1	Australia	Queensland	Mapoon	-11,350	142,333
C. dumdumi	ww06116	CULIC330-11	510[0n]	AAT9849	KT352395	691[0n]	KT352870	1	Australia	Queensland	Saibai island	-9,370	142,620
C. dumdumi	ww06117	CULIC331-11	510[0n]	AAT9849	KT352520	691[0n]	KT352884	1	Australia	Queensland	Saibai island	-9,370	142,620
C. dumdumi	ww15481	CULIC1236-12	579[1n]	AAT9849	KT352598	0		1	Australia	Queensland	Webb Crs, Innisfail	-17,533	146,033
C. dumdumi	ww15482	CULIC1237-12	611[2n]	AAT9849	KT352419	0		1	Australia	Queensland	Webb Crs, Innisfail	-17,533	146,033
C. dumdumi	ww10999	CUSCR999-11	618[0n]	AAT9849	KT352243	0		1	Papua New Guinea	Souterhn Highlands	Baba	-6,310	143,950
C. dumdumi	ww10992	CUSCR992-11	655[0n]	AAT9849	KT352625	0		1	Papua New Guinea	East Sepik	East Sepik (Wirui mission)	-4,315	143,046
C. flavipunctatus	ww08230	CULIC593-11	433[0n]	AAT9848	KT352635	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. flavipunctatus	ww09637	CULIC752-11	646[0n]	AAT9848	KT352663	0		1	Australia	Queensland	Saibai island	-9,370	142,620
C. flavipunctatus	ww06390	CULIC517-11	634[2n]	AAT9848	KT352692	691[0n]	KT352903	1	Papua New Guinea	Western	Balamuk	-8,550	141,170
C. flavipunctatus	ww20979	CUSCR2930-14	658[0n]	AAT9848	KT352600	0		1	Thailand	Phuket	Nai Yang	8,087	98,295
C. flavipunctatus	ww08220	CULIC583-11	670[0n]	AAT9848	KT352841	0		1	Timor-Leste	Oecusse	Samora	-8,820	125,854

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. flavipunctatus	ww08218	CULIC581-11	671[0n]	AAT9848	KT352658	672[19n]	KT352900	1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. flavipunctatus	ww08219	CULIC582-11	433[0n]	AAT9848	KT352525	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. flavipunctatus	ww23975	CUSCR2852-14	658[0n]	ACN9373	KT352413	0		1	China	Hainan	Haidian Dao	20,080	110,340
C. flavipunctatus	ww23979	CUSCR2853-14	658[0n]	ACN9373	KT352601	0		1	China	Hainan	Haidian Dao	20,080	110,340
C. flavipunctatus	ww23980	CUSCR2854-14	658[0n]	ACN9373	KT352744	0		1	China	Hainan	Haidian Dao	20,080	110,340
C. fragmentum	ww15336	CULIC986-11	610[0n]	ABA2980	KT352470	0		1	Papua New Guinea	Western	Gre via Kiunga	-6,117	141,300
C. fragmentum	ww15337	CULIC987-11	622[0n]	ABA2980	KT352817	0		1	Papua New Guinea	Western	Gre via Kiunga	-6,117	141,300
C. fragmentum	ww15344	CULIC994-11	635[0n]	ABA2980	KT352655	691[0n]	KT352899	1	Papua New Guinea	Western	Gre via Kiunga	-6,117	141,300
C. fragmentum	ww15345	CULIC995-11	620[0n]	ABA2980	KT352754	0		1	Papua New Guinea	Western	Gre via Kiunga	-6,117	141,300
C. fragmentum	ww15339	CULIC989-11	609[0n]	ABA2980	KT352346	0		1	Papua New Guinea	Western	Gre via Kiunga	-6,117	141,300
C. fragmentum	ww15338	CULIC988-11	616[0n]	ABA2980	KT352620	0		1	Papua New Guinea	Western	Gre via Kiunga	-6,117	141,300
C. fulvus	ww05907	CULIC234-11	715[0n]	AAT9391	KT352616	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. fulvus	ww11076	CUSCR1076-11	634[1n]	AAT9391	KT352548	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. fulvus	ww11072	CUSCR1072-11	635[0n]	AAT9391	KT352681	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. fulvus	ww05908	CULIC235-11	715[0n]	AAT9391	KT352782	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. fulvus	ww11074	CUSCR1074-11	634[1n]	AAT9391	KT352606	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. fulvus	ww05909	CULIC236-11	715[0n]	AAT9391	KT352502	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. fulvus	ww11073	CUSCR1073-11	634[1n]	AAT9391	KT352628	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. fulvus	ww11075	CUSCR1075-11	634[1n]	AAT9391	KT352593	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. fulvus	ww06143	CULIC356-11	646[0n]	AAT9391	KT352747	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. fulvus	ww11099	CUSCR1099-11	634[1n]	AAT9391	KT352710	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. fulvus	ww05910	CULIC237-11	715[0n]	AAT9391	KT352683	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. fulvus	ww11077	CUSCR1077-11	634[1n]	AAT9391	KT352767	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. fulvus	ww11098	CUSCR1098-11	634[1n]	AAT9391	KT352311	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. fulvus	ww06142	CULIC355-11	646[0n]	AAT9391	KT352340	690[1n]	KT352865	1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. fulvus	ww11071	CUSCR1071-11	635[0n]	AAT9391	KT352254	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. fulvus	ww04967	CULIC083-11	670[0n]	AAT9391	KT352334	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. fulvus	ww04963	CULIC079-11	670[0n]	AAT9391	KT352271	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. fulvus	ww04968	CULIC084-11	670[0n]	AAT9391	KT352740	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. fulvus	ww04964	CULIC080-11	670[0n]	AAT9391	KT352202	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. fulvus	ww04965	CULIC081-11	670[0n]	AAT9391	KT352264	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. fulvus	ww04966	CULIC082-11	670[0n]	AAT9391	KT352533	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. fulvus	ww11081	CUSCR1081-11	635[0n]	AAT9391	KT352368	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww11078	CUSCR1078-11	634[1n]	AAT9391	KT352410	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. fulvus	ww11097	CUSCR1097-11	633[2n]	AAT9391	KT352758	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww11082	CUSCR1082-11	635[0n]	AAT9391	KT352421	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww11088	CUSCR1088-11	634[1n]	AAT9391	KT352689	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww11092	CUSCR1092-11	634[1n]	AAT9391	KT352815	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww10517	CUSCR517-11	634[1n]	AAT9391	KT352190	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. fulvus	ww11094	CUSCR1094-11	635[0n]	AAT9391	KT352656	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww11089	CUSCR1089-11	634[1n]	AAT9391	KT352339	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww11086	CUSCR1086-11	633[2n]	AAT9391	KT352182	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww11083	CUSCR1083-11	634[1n]	AAT9391	KT352268	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww11096	CUSCR1096-11	633[2n]	AAT9391	KT352504	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww06147	CULIC360-11	646[0n]	AAT9391	KT352838	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. fulvus	ww10698	CUSCR698-11	635[0n]	AAT9391	KT352793	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww11085	CUSCR1085-11	634[1n]	AAT9391	KT352678	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww11090	CUSCR1090-11	634[1n]	AAT9391	KT352251	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww06146	CULIC359-11	646[0n]	AAT9391	KT352547	681[10n]	KT352889	1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. fulvus	ww06149	CULIC362-11	646[0n]	AAT9391	KT352267	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. fulvus	ww11084	CUSCR1084-11	634[1n]	AAT9391	KT352387	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww11080	CUSCR1080-11	635[0n]	AAT9391	KT352434	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww11087	CUSCR1087-11	634[1n]	AAT9391	KT352436	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww11079	CUSCR1079-11	634[1n]	AAT9391	KT352535	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww11093	CUSCR1093-11	634[1n]	AAT9391	KT352820	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww11091	CUSCR1091-11	634[1n]	AAT9391	KT352409	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww10689	CUSCR689-11	635[0n]	AAT9391	KT352447	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww10307	CUSCR307-11	618[0n]	AAT9391	KT352353	0		1	Australia	Northern Territory	Garrathiya	-12,424	136,434
C. fulvus	ww11095	CUSCR1095-11	634[1n]	AAT9391	KT352371	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. fulvus	ww06148	CULIC361-11	646[0n]	AAT9391	KT352795	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. fulvus	ww06144	CULIC357-11	642[4n]	AAT9391	KT352636	667[24n]	KT352897	1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. fulvus	ww12895	CUSCH418-12	587[2n]	AAT9391	KT352626	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. fulvus	ww12896	CUSCH419-12	629[0n]	AAT9391	KT352783	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. fulvus	ww06151	CULIC364-11	646[0n]	AAT9391	KT352696	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. fulvus	ww15723	CULIC1478-12	406[0n]	AAT9391	KT352382	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. fulvus	ww15724	CULIC1479-12	406[0n]	AAT9391	KT352648	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. fulvus	ww11008	CUSCR1008-11	634[1n]	AAT9391	KT352241	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. fulvus	ww11120	CUSCR1120-11	634[1n]	AAT9391	KT352641	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. fulvus	ww11117	CUSCR1117-11	634[1n]	AAT9391	KT352671	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. fulvus	ww11118	CUSCR1118-11	634[1n]	AAT9391	KT352166	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. fulvus	ww11119	CUSCR1119-11	633[2n]	AAT9391	KT352832	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. fulvus	ww11102	CUSCR1102-11	633[2n]	AAT9391	KT352652	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776
C. fulvus	ww11103	CUSCR1103-11	633[2n]	AAT9391	KT352161	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776
C. fulvus	ww11101	CUSCR1101-11	634[1n]	AAT9391	KT352526	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776
C. fulvus	ww11105	CUSCR1105-11	634[1n]	AAT9391	KT352578	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776
C. fulvus	ww11104	CUSCR1104-11	633[2n]	AAT9391	KT352187	0		1	Australia	Northern Territory	MT. Borradaile	-11,929	132,776
C. fulvus	ww15329	CULIC979-11	646[0n]	AAT9391	KT352179	690[1n]	KT352846	1	Australia	Queensland	Sudley via Weipa	-12,667	141,867
C. fulvus	ww15331	CULIC981-11	642[0n]	AAT9391	KT352816	0		1	Australia	Queensland	Sudley via Weipa	-12,667	141,867
C. fulvus	ww15330	CULIC980-11	623[0n]	AAT9391	KT352731	0		1	Australia	Queensland	Sudley via Weipa	-12,667	141,867
C. fulvus	ww23851	CUSCR2816-14	630[0n]	AAT9391	KT352284	0		1	China	Hainan	Nada	19,510	109,510
C. fulvus	ww23852	CUSCR2817-14	638[0n]	AAT9391	KT352686	0		1	China	Hainan	Nada	19,510	109,510
C. fulvus	ww23846	CUSCR2815-14	621[0n]	AAT9391	KT352796	0		1	China	Zhejiang	Lin`an	30,236	119,718
C. fulvus	ww23942	CUSCR2848-14	642[0n]	AAT9391	KT352735	0		1	China	Hainan	Nada	19,510	109,510
C. fulvus	ww23947	CUSCR2849-14	659[0n]	AAT9391	KT352587	0		1	China	Hainan	Nada	19,510	109,510
C. fulvus	ww23926	CUSCR2840-14	617[0n]	AAT9391	KT352734	0		1	China	Hainan	Nada	19,510	109,510
C. fulvus	ww23934	CUSCR2844-14	639[0n]	AAT9391	KT352430	0		1	China	Hainan	Nada	19,510	109,510
C. fulvus	ww23950	CUSCR2851-14	651[0n]	AAT9391	KT352206	0		1	China	Hainan	Nada	19,510	109,510
C. fulvus	ww23940	CUSCR2846-14	639[0n]	AAT9391	KT352424	0		1	China	Hainan	Nada	19,510	109,510
C. fulvus	ww23941	CUSCR2847-14	640[0n]	AAT9391	KT352580	0		1	China	Hainan	Nada	19,510	109,510
C. fulvus	ww23932	CUSCR2843-14	659[0n]	AAT9391	KT352602	0		1	China	Hainan	Nada	19,510	109,510
C. fulvus	ww23931	CUSCR2842-14	599[0n]	AAT9391	KT352621	0		1	China	Hainan	Nada	19,510	109,510
C. fulvus	ww23935	CUSCR2845-14	615[0n]	AAT9391	KT352609	0		1	China	Hainan	Nada	19,510	109,510
C. fulvus	ww23948	CUSCR2850-14	639[0n]	AAT9391	KT352185	0		1	China	Hainan	Nada	19,510	109,510
C. fulvus	ww23927	CUSCR2841-14	637[0n]	AAT9391	KT352800	0		1	China	Hainan	Nada	19,510	109,510
C. fulvus	ww06135	CULIC349-11	646[0n]	AAT9391	KT352632	0		1	Indonesia	Jawa Barat	Cibinong	-6,482	106,854
C. fulvus	ww06136	CULIC350-11	510[0n]	AAT9391	KT352507	0		1	Indonesia	Jawa Barat	Cibinong	-6,482	106,854
C. fulvus	ww15349	CULIC999-11	646[0n]	AAT9391	KT352629	0		1	Indonesia	Jawa Barat	Cibinong, Sanja	-6,482	106,854
C. fulvus	ww15332	CULIC982-11	646[0n]	AAT9391	KT352390	682[9n]	KT352868	1	Indonesia	Jawa Barat	Cikarang, Bekasi	-6,261	107,153
C. fulvus	ww06225	CULIC407-11	646[0n]	AAT9391	KT352757	689[0n]	KT352914	1	Papua New Guinea	West Sepik	Aitape (Raiku Farm)	-3,167	142,350
C. fulvus	ww11100	CUSCR1100-11	635[0n]	AAT9391	KT352797	0		1	Papua New Guinea	Souterhn Highlands	Baba	-6,310	143,950
C. fulvus	ww08225	CULIC588-11	673[0n]	AAT9391	KT352643	0		1	Papua New Guinea	Western	Kautru	-8,054	141,684
C. fulvus	ww05878	CULIC205-11	715[0n]	AAT9391	KT352518	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. fulvus	ww08211	CULIC574-11	673[0n]	AAT9391	KT352623	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. fulvus	ww05875	CULIC202-11	715[0n]	AAT9391	KT352377	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. fulvus	ww06123	CULIC337-11	646[0n]	AAT9391	KT352233	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. fulvus	ww05877	CULIC204-11	694[0n]	AAT9391	KT352457	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. fulvus	ww05876	CULIC203-11	713[0n]	AAT9391	KT352335	612[20n]	KT352863	1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. fulvus	ww08221	CULIC584-11	673[0n]	AAT9391	KT352575	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. fulvus	ww15773	CULIC1528-12	406[0n]	AAT9391	KT352191	0		1	Papua New Guinea	Morobe	Markham Valley Farm	-6,545	146,645
C. fulvus	ww20958	CUSCR2931-14	658[0n]	AAT9391	KT352315	0		1	Thailand	Trang	Trang	7,288	99,338
C. fulvus	ww06137	CULIC351-11	510[0n]	AAT9391	KT352603	0		1	Timor-Leste	Ainaro	Ainaro	-8,997	125,505
C. fulvus	ww06138	CULIC352-11	510[0n]	AAT9391	KT352804	0		1	Timor-Leste	Ainaro	Ainaro	-8,997	125,505
C. fulvus	ww06134	CULIC348-11	646[0n]	AAT9391	KT352813	0		1	Timor-Leste	Ermera	Eraulo	-8,888	125,511
C. fulvus	ww06133	CULIC347-11	510[0n]	AAT9391	KT352427	691[0n]	KT352875	1	Timor-Leste	Ermera	Eraulo	-8,888	125,511
C. fulvus	ww06111	CULIC325-11	646[0n]	AAT9391	KT352234	0		1	Timor-Leste	Lautem	Fuiloro	-8,505	127,240
C. fulvus	ww06130	CULIC344-11	646[0n]	AAT9391	KT352325	0		1	Timor-Leste	Lautem	Fuiloro	-8,505	127,240
C. fulvus	ww06129	CULIC343-11	646[0n]	AAT9391	KT352281	685[6n]	KT352856	1	Timor-Leste	Lautem	Fuiloro	-8,505	127,240
C. fulvus	ww05905	CULIC232-11	715[0n]	AAT9391	KT352703	0		1	Timor-Leste	Lautem	Lospalos	-8,520	126,995
C. fulvus	ww05906	CULIC233-11	715[0n]	AAT9391	KT352574	0		1	Timor-Leste	Lautem	Lospalos	-8,520	126,995
C. fulvus	ww05903	CULIC230-11	694[0n]	AAT9391	KT352405	467[10n]	KT352872	1	Timor-Leste	Lautem	Lospalos	-8,520	126,995
C. fulvus	ww05904	CULIC231-11	715[0n]	AAT9391	KT352299	0		1	Timor-Leste	Lautem	Lospalos	-8,520	126,995
C. fulvus	ww06391	CULIC518-11	602[0n]	AAT9391	KT352610	0		1	Timor-Leste	Bobonaro	Maliana	-9,080	125,290
C. fulvus	ww06140	CULIC353-11	646[0n]	AAT9391	KT352439	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. fulvus	ww06321	CULIC450-11	664[0n]	AAT9391	KT352437	0		1	Timor-Leste	Bobonaro	Maliana	-9,080	125,290
C. fulvus	ww06141	CULIC354-11	635[0n]	AAT9391	KT352177	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. fulvus	ww06387	CULIC514-11	710[0n]	AAT9391	KT352361	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. fulvus	ww06128	CULIC342-11	646[0n]	AAT9391	KT352777	674[17n]	KT352916	1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. fulvus	ww06132	CULIC346-11	510[0n]	AAT9391	KT352253	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. fulvus	ww06110	CULIC324-11	510[0n]	AAT9391	KT352383	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. fulvus	ww06131	CULIC345-11	653[0n]	AAT9391	KT352642	691[0n]	KT352898	1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. fulvus	ww06214	CULIC396-11	646[0n]	AAT9391	KT352260	686[4n]	KT352854	1	Timor-Leste	Viqueque	Viqueque	-8,860	126,360
C. hui	ww24033	CUSCR2727-12	658[0n]	AAZ1835	KT352232	0		1	China	Hainan	Nada	19,510	109,510
C. hui	ww24035	CUSCR2729-12	658[0n]	AAZ1835	KT352698	0		1	China	Hainan	Nada	19,510	109,510
C. hui	ww24034	CUSCR2728-12	658[0n]	AAZ1835	KT352528	0		1	China	Hainan	Nada	19,510	109,510
C. hui	ww24037	CUSCR2731-12	658[0n]	AAZ1835	KT352592	0		1	China	Hainan	Nada	19,510	109,510
C. hui	ww15087	CULIC878-11	646[0n]	AAZ1835	KJ162979	691[0n]	KJ163026	3	Papua New Guinea	West Sepik	Krisa	-2,851	141,284
C. hui	ww15086	CULIC877-11	644[0n]	AAZ1835	KT352473	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,284
C. hui	ww15084	CULIC875-11	617[0n]	AAZ1835	KT352695	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,284

continued

Accession references
1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. hui	ww15085	CULIC876-11	636[0n]	AAZ1835	KT352192	684[2n]	KT352847	1	Papua New Guinea	West Sepik	Krisa	-2,851	141,284
C. hui	ww20917	CUSCR2932-14	658[0n]	AAZ1835	KT352494	0		1	Thailand	Trang	Trang	7,831	99,338
C. hui	ww12919	CUSCR2898-14	625[1n]	AAZ1835	KT352338	0		1	Timor-Leste	Ermera	Eraulo	-8,888	125,511
C. hui	ww12921	CUSCR2899-14	611[1n]	AAZ1835	KT352230	0		1	Timor-Leste	Ermera	Eraulo	-8,888	125,511
C. hui	ww12917	CUSCR2897-14	622[1n]	AAZ1835	KT352506	0		1	Timor-Leste	Lautem	Fuiloro	-8,520	126,995
C. jacobsoni	ww23853	CUSCR2818-14	644[0n]	AAI9869	KT352455	0		1	China	Hainan	Nada	19,510	109,510
C. jacobsoni	ww06091	CULIC305-11	646[0n]	AAI9869	KT352539	686[5n]	KT352887	1	Indonesia	Jawa Barat	Cibinong	-6,482	106,854
C. jacobsoni	AB360991	GBDP4709-08	444(0n)	AAI9869	AB360991	0		2	Japan	Kyushu-chiho	Kagoshima	31,600	130,550
C. jacobsoni	AB360990	GBDP4710-08	444(0n)	AAI9869	AB360990	0		2	Japan	Kyushu-chiho	Kagoshima	31,600	130,550
C. jacobsoni	ww14443	CULIC1183-12	646[0n]	AAI9869	KT352839	0		1	Solomon Islands	Guadalcanal	Tenavatu	-9,439	160,105
C. jacobsoni	ww14444	CULIC1184-12	646[0n]	AAI9869	KT352352	0		1	Solomon Islands	Guadalcanal	Tenavatu	-9,439	160,105
C. jacobsoni	ww14450	CULIC1190-12	646[0n]	AAI9869	KT352646	0		1	Solomon Islands	Western	Tuiai	-7,092	155,863
C. jacobsoni	ww14451	CULIC1191-12	645[1n]	AAI9869	KT352475	0		1	Solomon Islands	Western	Tuiai	-7,092	155,863
C. jacobsoni	ww14456	CULIC1196-12	646[0n]	AAI9869	KT352440	0		1	Solomon Islands	Western	Tuiai	-7,092	155,863
C. jacobsoni	ww24674	CUSCR2774-13	658[0n]	AAI9869	KF297817	0		4	South Korea	Gyeonggi	Yongsan	37,517	126,983
C. jacobsoni	ww09618	CULIC741-11	646[0n]	AAU0411	KT352802	0		1	Australia	Queensland	Kuranda	-16,810	145,630
C. jacobsoni	ww15082	CULIC873-11	639[0n]	AAU0411	KT352228	680[10n]	KT352850	1	Papua New Guinea	West Sepik	Krisa	-2,851	141,284
C. jacobsoni	ww09621	CULIC744-11	646[0n]	AAU0412	KT352385	0		1	Australia	Queensland	Kuranda	-16,810	145,630
C. jacobsoni	ww09620	CULIC743-11	646[0n]	AAU0412	KT352350	0		1	Australia	Queensland	Kuranda	-16,810	145,630
C. jacobsoni	ww09624	CULIC747-11	646[0n]	AAU0412	KT352775	0		1	Australia	Queensland	Kuranda	-16,810	145,630
C. jacobsoni	ww09619	CULIC742-11	646[0n]	AAU0412	KT352165	0		1	Australia	Queensland	Kuranda	-16,810	145,630
C. jacobsoni	ww09622	CULIC745-11	646[0n]	AAU0412	KT352691	0		1	Australia	Queensland	Kuranda	-16,810	145,630
C. jacobsoni	ww09623	CULIC746-11	646[0n]	AAU0412	KT352301	0		1	Australia	Queensland	Kuranda	-16,810	145,630
C. jacobsoni	ww09625	CULIC748-11	646[0n]	AAU0412	KT352510	0		1	Australia	Queensland	Kuranda	-16,810	145,630
C. jacobsoni	ww12135	CUSCR2135-11	624[0n]	AAY9594	KT352448	684[3n]	KT352877	1	Papua New Guinea	West Sepik	Telefomin	-5,123	141,637
C. jacobsoni	ww12136	CUSCR2136-11	624[0n]	AAY9595	KT352778	673[12n]	KT352917	1	Papua New Guinea	West Sepik	Telefomin	-5,123	141,637
C. jacobsoni	ww15359	CULIC1009-11	617[0n]	AAY9596	KT352516	0		1	Papua New Guinea	Western	Gre via Kiunga	-6,117	141,300
C. jacobsoni	ww12137	CUSCR2137-11	626[0n]	AAY9596	KJ162985	691[0n]	KJ163031	3	Papua New Guinea	West Sepik	Telefomin	-5,123	141,637
C. jacobsoni	ww12139	CUSCR2139-11	624[0n]	AAY9596	KT352282	686[5n]	KT352857	1	Papua New Guinea	West Sepik	Telefomin	-5,123	141,637
C. jacobsoni	ww15081	CULIC872-11	642[0n]	AAZ1654	KT352787	673[14n]	KT352918	1	Papua New Guinea	West Sepik	Krisa	-2,851	141,284
C. minimus	ww06083	CULIC297-11	510[0n]	AAT9304	KT352393	682[9n]	KT352869	1	Timor-Leste	Dili	Hera	-8,533	125,633
C. minimus	ww06085	CULIC299-11	647[0n]	AAT9304	KT352476	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. minimus	ww06081	CULIC295-11	646[0n]	AAT9304	KT352203	680[11n]	KT352848	1	Timor-Leste	Oecusse	Pante Makassar	-9,200	124,380
C. minimus	ww06082	CULIC296-11	635[0n]	AAT9304	KT352491	0		1	Timor-Leste	Oecusse	Pante Makassar	-9,200	124,380
C. nudipalpis	ww15725	CULIC1480-12	557[0n]	AAT9660	KT352319	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. nudipalpis	ww05928	CULIC255-11	694[0n]	AAT9660	KJ162990	468[4n]	KJ163036	3	Timor-Leste	Ainaro	Ainaro	-8,997	125,505

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. nudipalpis	ww05930	CULIC257-11	535[0n]	AAT9660	KT352650	0		1	Timor-Leste	Ainaro	Ainaro	-8,997	125,505
C. nudipalpis	ww06168	CULIC381-11	646[0n]	AAT9660	KJ162991	690[1n]	KJ163037	3	Timor-Leste	Lautem	Eraulo	-8,888	125,511
C. nudipalpis	ww06169	CULIC382-11	646[0n]	AAT9660	KT352570	0		1	Timor-Leste	Lautem	Eraulo	-8,888	125,511
C. nudipalpis	ww06172	CULIC385-11	652[0n]	AAT9660	KJ162989	690[1n]	KJ163035	3	Timor-Leste	Lautem	Hera	-8,533	125,633
C. nudipalpis	ww06228	CULIC410-11	510[0n]	AAT9660	KT352659	0		1	Timor-Leste	Dili	Hera	-8,533	125,633
C. nudipalpis	ww06173	CULIC386-11	510[0n]	AAT9660	KT352569	0		1	Timor-Leste	Lautem	Hera	-8,533	125,633
C. nudipalpis	ww12219	CUSCR2219-11	406[0n]	AAT9660	KT352704	0		1	Timor-Leste	Lautem	Los Palos	-8,520	126,995
C. nudipalpis	ww12222	CUSCR2222-11	406[0n]	AAT9660	KT352790	0		1	Timor-Leste	Lautem	Los Palos	-8,520	126,995
C. nudipalpis	ww05924	CULIC251-11	536[0n]	AAT9660	KT352748	0		1	Timor-Leste	Lautem	Lospalos	-8,520	126,995
C. nudipalpis	ww05923	CULIC250-11	644[7n]	AAT9660	KT352835	0		1	Timor-Leste	Lautem	Lospalos	-8,520	126,995
C. nudipalpis	ww06155	CULIC368-11	646[0n]	AAT9660	KJ162993	691[0n]	KJ163039	3	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. nudipalpis	ww06156	CULIC369-11	646[0n]	AAT9660	KT352416	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. nudipalpis	ww06165	CULIC378-11	510[0n]	AAT9660	KT352613	0		1	Timor-Leste	Oecusse	Pante Makassar	-9,200	124,380
C. nudipalpis	ww06164	CULIC377-11	646[0n]	AAT9660	KJ162992	686[5n]	KJ163038	3	Timor-Leste	Oecusse	Pante Makassar	-9,200	124,380
C. nudipalpis	ww06157	CULIC370-11	646[0n]	AAT9660	KJ162995	687[4n]	KJ163041	3	Timor-Leste	Oecusse	Samora	-8,820	125,854
C. nudipalpis	ww06159	CULIC372-11	657[0n]	AAT9660	KT352420	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. nudipalpis	ww06163	CULIC376-11	646[0n]	AAT9660	KT352564	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. nudipalpis	ww06158	CULIC371-11	646[0n]	AAT9660	KJ162994	680[11n]	KJ163040	3	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. nudipalpis	ww06162	CULIC375-11	510[0n]	AAT9660	KT352809	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. nudipalpis	ww06161	CULIC374-11	646[0n]	AAT9660	KT352762	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. nudipalpis	ww06171	CULIC384-11	510[0n]	AAT9660	KT352199	0		1	Timor-Leste	Viqueque	Viqueque	-8,860	126,360
C. nudipalpis	ww06170	CULIC383-11	646[0n]	AAT9660	KT352463	690[0n]	KT352880	1	Timor-Leste	Viqueque	Viqueque	-8,860	126,360
C. obscurus	ww06216	CULIC398-11	646[0n]	AAU0756	KT352720	0		1	Australia	Northern Territory	Rocky Bay	-12,274	136,900
C. obscurus	ww06215	CULIC397-11	646[0n]	AAU0756	KT352594	689[1n]	KT352896	1	Australia	Northern Territory	Rocky Bay	-12,274	136,900
C. obscurus	ww06219	CULIC401-11	510[0n]	AAV1678	KT352312	686[4n]	KT352861	1	Australia	Queensland	Bamaga	-10,883	142,383
C. obscurus	ww06217	CULIC399-11	646[0n]	AAV1678	KT352769	690[0n]	KT352915	1	Australia	Queensland	Mapoon	-11,350	142,333
C. obscurus	ww06218	CULIC400-11	510[0n]	AAV1678	KT352819	0		1	Australia	Queensland	Mapoon	-11,350	142,333
C. obscurus	ww12948	CUSCR2703-12	507[0n]	AAW0071	KT352247	0		1	Timor-Leste	Dili	Hera	-8,533	125,633
C. obscurus	ww12943	CUSCR2702-12	513[0n]	AAW0071	KT352485	0		1	Timor-Leste	Dili	Hera	-8,533	125,633
C. obscurus	ww12946	CUSCR2913-14	543[0n]	AAW0071	KT352462	0		1	Timor-Leste	Dili	Hera	-8,545	125,670
C. obscurus	ww09801	CULIC785-11	407[0n]	AAW0071	KT352398	0		1	Timor-Leste	Dili	Hera	-8,533	125,633
C. obscurus	ww12947	CUSCR2914-14	502[0n]	AAW0071	KT352557	0		1	Timor-Leste	Dili	Hera	-8,545	125,670
C. obscurus	ww12945	CUSCR2912-14	586[3n]	AAW0071	KT352505	0		1	Timor-Leste	Dili	Hera	-8,545	125,670
C. obscurus	ww09802	CULIC786-11	651[0n]	AAW0071	KT352423	687[4n]	KT352873	1	Timor-Leste	Dili	Hera	-8,533	125,633

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. obscurus	ww12944	CUSCR2911-14	510[0n]	AAW0071	KT352317	0		1	Timor-Leste	Dili	Hera	-8,545	125,670
C. obscurus	ww11315	CUSCR1315-11	597[3n]	AAW4507	KT352554	675[3n]	KT352891	1	Australia	Queensland	Bamaga	-10,883	142,383
C. obscurus	ww11068	CUSCR1068-11	633[2n]	AAW4507	KT352554	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. obscurus	ww11067	CUSCR1067-11	632[3n]	AAW4507	KT352554	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. obscurus	ww14363	CULIC1107-12	646[0n]	ABW0019	KT352755	688[3n]	KT352913	1	Australia	Northern Territory	Darwin, Hudson ck.	-12,317	130,933
C. obscurus	ww05915	CULIC242-11	598[5n]	ACE4108	KT352263	0		1	Australia	Northern Territory	Tiwi Islands	-11,566	131,116
C. obscurus	ww06220	CULIC402-11	646[0n]	ACE5325	KT352237	690[1n]	KT352851	1	Australia	Northern Territory	Daliwuy Bay	-12,350	136,933
C. obscurus	ww06221	CULIC403-11	646[0n]	ACE5325	KT352296	0		1	Australia	Northern Territory	Daliwuy Bay	-12,350	136,933
C. obscurus	ww06222	CULIC404-11	646[0n]	ACE5325	KT352536	689[1n]	KT352886	1	Australia	Northern Territory	Darwin, Hudson ck.	-12,317	130,933
C. obscurus	ww14362	CULIC1106-12	646[0n]	ACE5325	KT352209	691[0n]	KT352849	1	Australia	Northern Territory	Darwin, Hudson ck.	-12,317	130,933
C. obscurus	ww05918	CULIC245-11	535[0n]	ACF0178	KT352184	0		1	Australia	Northern Territory	Tiwi Islands	-11,566	131,116
C. obscurus	ww05917	CULIC244-11	693[5n]	ACF0178	KT352760	0		1	Australia	Northern Territory	Tiwi Islands	-11,566	131,116
C. obscurus	ww05916	CULIC243-11	714[1n]	ACF0178	KT352729	472[2n]	KT352910	1	Australia	Northern Territory	Tiwi Islands	-11,566	131,116
C. orientalis	ww15350	CULIC1000-11	624[0n]	AAT9656	KT352329	0		1	Indonesia	Jawa Barat	Cibinong, Sanja	-6,482	106,854
C. orientalis	ww15348	CULIC998-11	624[0n]	AAT9656	KT352531	0		1	Indonesia	Jawa Barat	Cibinong, Sanja	-6,482	106,854
C. orientalis	ww12224	CUSCR2224-11	626[0n]	AAT9656	KT352372	0		1	Papua New Guinea	Souterhn Highlands	Baba	-6,310	143,950
C. orientalis	ww08217	CULIC580-11	673[0n]	AAT9656	KT352295	0		1	Papua New Guinea	Western	Indorordoro	-8,054	141,684
C. orientalis	ww08209	CULIC572-11	716[0n]	AAT9656	KT352661	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. orientalis	ww08214	CULIC577-11	673[0n]	AAT9656	KT352745	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. orientalis	ww08210	CULIC573-11	673[0n]	AAT9656	KT352637	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. orientalis	ww08215	CULIC578-11	673[0n]	AAT9656	KT352759	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. orientalis	ww08222	CULIC585-11	673[0n]	AAT9656	KT352728	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. orientalis	ww08208	CULIC571-11	716[0n]	AAT9656	KT352369	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. orientalis	ww08212	CULIC575-11	644[0n]	AAT9656	KT352676	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. orientalis	ww08206	CULIC569-11	716[0n]	AAT9656	KT352219	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. orientalis	ww08207	CULIC570-11	673[0n]	AAT9656	KT352343	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. orientalis	ww20951	CUSCR2933-14	658[0n]	AAT9656	KT352223	0		1	Thailand	Trang	Trang	7,831	99,338
C. orientalis	ww06177	CULIC390-11	646[0n]	AAT9656	KT352356	0		1	Timor-Leste	Ermera	Eraulo	-8,888	125,511
C. orientalis	ww06176	CULIC389-11	636[0n]	AAT9656	KT352743	674[20n]	KT352912	1	Timor-Leste	Ermera	Eraulo	-8,888	125,511
C. orientalis	ww06223	CULIC405-11	645[0n]	AAT9656	KJ162997	683[8n]	KJ163043	3	Timor-Leste	Dili	Hera	-8,533	125,633
C. orientalis	ww06179	CULIC392-11	646[0n]	AAT9656	KT352454	675[18n]	KT352878	1	Timor-Leste	Lautem	Lospalos	-8,520	126,995
C. orientalis	ww12223	CUSCR2223-11	626[0n]	AAT9656	KT352444	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. orientalis	ww06320	CULIC449-11	581[0n]	AAT9656	KT352348	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. orientalis	ww06319	CULIC448-11	337[0n]	AAT9656	KT352834	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. orientalis	ww06109	CULIC323-11	506[4n]	AAT9656	KT352725	677[17n]	KT352909	1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. orientalis	ww08213	CULIC576-11	673[0n]	AAT9657	KT352446	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,293
C. orientalis	ww06211	CULIC393-11	646[0n]	AAT9658	KT352459	676[18n]	KT352879	1	Timor-Leste	Lautem	Fuiloro	-8,505	127,240
C. orientalis	ww06212	CULIC394-11	646[0n]	AAT9658	KT352605	0		1	Timor-Leste	Lautem	Fuiloro	-8,505	127,240
C. orientalis	ww06178	CULIC391-11	646[0n]	AAT9658	KT352276	680[14n]	KT352855	1	Timor-Leste	Lautem	Lospalos	-8,520	126,995
C. orientalis	ww06318	CULIC447-11	671[0n]	AAT9658	KT352719	694[0n]	KT352907	1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. orientalis	ww06224	CULIC406-11	646[0n]	AAT9659	KT352392	0		1	Timor-Leste	Dili	Hera	-8,533	125,633
C. orientalis	ww06213	CULIC395-11	658[0n]	AAT9659	KT352556	675[19n]	KT352892	1	Timor-Leste	Viqueque	Viqueque	-8,860	126,360
C. wadai	ww11933	CUSCR1933-11	635[0n]	AAF1704	KT352415	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11892	CUSCR1892-11	634[1n]	AAF1704	KT352794	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11893	CUSCR1893-11	635[0n]	AAF1704	KT352417	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11932	CUSCR1932-11	635[0n]	AAF1704	KT352534	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11894	CUSCR1894-11	635[0n]	AAF1704	KT352694	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11937	CUSCR1937-11	635[0n]	AAF1704	KT352168	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11936	CUSCR1936-11	635[0n]	AAF1704	KT352737	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11940	CUSCR1940-11	635[0n]	AAF1704	KT352597	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11942	CUSCR1942-11	635[0n]	AAF1704	KT352674	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11948	CUSCR1948-11	634[1n]	AAF1704	KT352638	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11934	CUSCR1934-11	635[0n]	AAF1704	KT352668	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11901	CUSCR1901-11	635[0n]	AAF1704	KT352573	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11943	CUSCR1943-11	635[0n]	AAF1704	KT352162	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11931	CUSCR1931-11	635[0n]	AAF1704	KT352498	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11938	CUSCR1938-11	634[1n]	AAF1704	KT352803	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww12828	CUSCH351-12	646[0n]	AAF1704	KT352449	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11947	CUSCR1947-11	634[1n]	AAF1704	KT352173	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11904	CUSCR1904-11	557[8n]	AAF1704	KT352561	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11949	CUSCR1949-11	634[1n]	AAF1704	KT352171	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww12827	CUSCH350-12	611[0n]	AAF1704	KT352373	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww12797	CUSCH320-12	646[0n]	AAF1704	KT352394	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11945	CUSCR1945-11	635[0n]	AAF1704	KT352761	0		1	Australia	Northern Territory	Beatrice Hill Farm	-12,650	131,333
C. wadai	ww11916	CUSCR1916-11	635[0n]	AAF1704	KT352801	0		1	Australia	Queensland	Byfield	-22,848	150,651
C. wadai	ww11921	CUSCR1921-11	635[0n]	AAF1704	KT352756	0		1	Australia	Queensland	Byfield	-22,848	150,651
C. wadai	ww11922	CUSCR1922-11	635[0n]	AAF1704	KT352611	0		1	Australia	Queensland	Byfield	-22,848	150,651
C. wadai	ww11924	CUSCR1924-11	635[0n]	AAF1704	KT352497	0		1	Australia	Queensland	Byfield	-22,848	150,651

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. wadai	ww11917	CUSCR1917-11	634[1n]	AAF1704	KT352380	0		1	Australia	Queensland	Byfield	-22,848	150,651
C. wadai	ww11920	CUSCR1920-11	634[1n]	AAF1704	KT352784	0		1	Australia	Queensland	Byfield	-22,848	150,651
C. wadai	ww11919	CUSCR1919-11	635[0n]	AAF1704	KT352433	0		1	Australia	Queensland	Byfield	-22,848	150,651
C. wadai	ww11927	CUSCR1927-11	634[1n]	AAF1704	KT352673	0		1	Australia	Northern Territory	Caiman ck Coburg P	-11,267	132,233
C. wadai	ww09018	CULIC722-11	726[1n]	AAF1704	KT352425	0		1	Australia	Queensland	Coen	-13,950	143,550
C. wadai	ww12829	CUSCH352-12	641[0n]	AAF1704	KT352631	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. wadai	ww04981	CULIC097-11	670[0n]	AAF1704	KT352407	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. wadai	ww12830	CUSCH353-12	639[2n]	AAF1704	KT352164	0		1	Australia	Northern Territory	Douglas Daly Research Farm	-13,917	131,050
C. wadai	ww12838	CUSCH361-12	646[0n]	AAF1704	KT352739	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. wadai	ww11906	CUSCR1906-11	635[0n]	AAF1704	KT352537	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. wadai	ww11908	CUSCR1908-11	635[0n]	AAF1704	KT352774	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. wadai	ww12842	CUSCH365-12	644[2n]	AAF1704	KT352236	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. wadai	ww11914	CUSCR1914-11	635[0n]	AAF1704	KT352244	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. wadai	ww11907	CUSCR1907-11	635[0n]	AAF1704	KT352688	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. wadai	ww12834	CUSCH357-12	574[2n]	AAF1704	KT352469	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. wadai	ww12840	CUSCH363-12	646[0n]	AAF1704	KT352501	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. wadai	ww11912	CUSCR1912-11	635[0n]	AAF1704	KT352640	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. wadai	ww11909	CUSCR1909-11	635[0n]	AAF1704	KT352639	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. wadai	ww11913	CUSCR1913-11	635[0n]	AAF1704	KT352285	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. wadai	ww12843	CUSCH366-12	610[0n]	AAF1704	KT352706	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. wadai	ww11911	CUSCR1911-11	635[0n]	AAF1704	KT352662	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. wadai	ww11910	CUSCR1910-11	635[0n]	AAF1704	KT352585	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. wadai	ww11905	CUSCR1905-11	635[0n]	AAF1704	KT352653	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. wadai	ww12835	CUSCH358-12	625[0n]	AAF1704	KT352291	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. wadai	ww12849	CUSCH372-12	610[0n]	AAF1704	KT352370	0		1	Australia	Northern Territory	Garrathiya	-12,420	136,430
C. wadai	ww11929	CUSCR1929-11	635[0n]	AAF1704	KT352781	0		1	Australia	Northern Territory	Gatji	-12,274	134,819
C. wadai	ww11930	CUSCR1930-11	635[0n]	AAF1704	KT352186	0		1	Australia	Northern Territory	Gatji	-12,274	134,819
C. wadai	ww12872	CUSCH395-12	625[0n]	AAF1704	KT352477	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12856	CUSCH379-12	624[0n]	AAF1704	KT352176	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12862	CUSCH385-12	610[0n]	AAF1704	KT352414	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12870	CUSCH393-12	630[0n]	AAF1704	KT352478	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww06384	CULIC511-11	602[0n]	AAF1704	KT352349	0		1	Australia	Northern Territory	Kalumburu	-14,287	126,646
C. wadai	ww11889	CUSCR1889-11	635[0n]	AAF1704	KT352669	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12851	CUSCH374-12	610[0n]	AAF1704	KT352401	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. wadai	ww12877	CUSCH400-12	625[0n]	AAF1704	KT352630	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12879	CUSCH402-12	625[0n]	AAF1704	KT352216	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12867	CUSCH390-12	610[0n]	AAF1704	KT352589	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12864	CUSCH387-12	610[0n]	AAF1704	KT352712	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12854	CUSCH377-12	625[0n]	AAF1704	KT352667	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12880	CUSCH403-12	646[0n]	AAF1704	KT352388	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12881	CUSCH404-12	646[0n]	AAF1704	KT352736	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12859	CUSCH382-12	618[0n]	AAF1704	KT352327	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12861	CUSCH384-12	610[0n]	AAF1704	KT352278	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12878	CUSCH401-12	610[0n]	AAF1704	KT352665	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12865	CUSCH388-12	610[0n]	AAF1704	KT352429	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12857	CUSCH380-12	624[0n]	AAF1704	KT352259	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12853	CUSCH376-12	610[0n]	AAF1704	KT352771	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12860	CUSCH383-12	606[0n]	AAF1704	KT352163	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12852	CUSCH375-12	610[0n]	AAF1704	KT352660	0		1	Australia	Western Australia	Kalumburu	-14,287	126,646
C. wadai	ww12824	CUSCH347-12	646[0n]	AAF1704	KT352555	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. wadai	ww04982	CULIC098-11	670[0n]	AAF1704	KT352515	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. wadai	ww11897	CUSCR1897-11	635[0n]	AAF1704	KT352289	0		1	Australia	Northern Territory	Katherine Research Station	-14,467	132,267
C. wadai	ww09791	CULIC775-11	648[0n]	AAF1704	KT352645	0		1	Australia	Queensland	Kuranda	-16,817	145,650
C. wadai	ww09790	CULIC774-11	644[0n]	AAF1704	KT352687	0		1	Australia	Queensland	Kuranda	-16,817	145,650
C. wadai	ww12796	CUSCH319-12	646[0n]	AAF1704	KT352197	0		1	Australia	Queensland	Mapoon	-11,350	142,333
C. wadai	AB360997	GBDP4703-08	646(0n)	AAF1704	AB360997	0		2	Japan	Okinawa	Ishigaki	24,345	124,157
C. wadai	AB360996	GBDP4704-08	646(0n)	AAF1704	AB360996	0		2	Japan	Okinawa	Ishigaki	24,345	124,157
C. wadai	ww09015	CULIC719-11	673[0n]	AAF1704	KJ163000	691[0n]	KJ163045	3	Japan	Okinawa	Yonaguni	24,468	123,005
C. wadai	ww09016	CULIC720-11	672[0n]	AAF1704	KT352560	668[23n]	KT352893	1	Japan	Okinawa	Yonaguni	24,468	123,005
C. wadai	AB361005	GBDP4673-08	646(0n)	AAF1704	AB361005	0		2	Japan	Okinawa	Yonaguni	24,468	123,005
C. wadai	ww12800	CUSCH323-12	611[0n]	AAF1704	KT352619	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,284
C. wadai	ww12803	CUSCH326-12	646[0n]	AAF1704	KT352559	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,284
C. wadai	ww12802	CUSCH325-12	619[0n]	AAF1704	KT352314	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,284
C. wadai	ww12801	CUSCH324-12	611[0n]	AAF1704	KT352576	0		1	Papua New Guinea	West Sepik	Krisa	-2,851	141,284
C. wadai	ww12805	CUSCH328-12	636[0n]	AAF1704	KT352287	0		1	Papua New Guinea	East Sepik	Wewak (Wirui Mission)	-3,555	143,625
C. wadai	ww12806	CUSCH329-12	646[0n]	AAF1704	KT352362	0		1	Papua New Guinea	East Sepik	Wewak (Wirui Mission)	-3,555	143,625
C. wadai	ww12813	CUSCH336-12	646[0n]	AAF1704	KT352451	0		1	Papua New Guinea	East Sepik	Wewak (Wirui Mission)	-3,555	143,625
C. wadai	ww12821	CUSCH344-12	646[0n]	AAF1704	KT352770	0		1	Papua New Guinea	East Sepik	Wewak (Wirui Mission)	-3,555	143,625

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. wadai	ww12807	CUSCH330-12	646[0n]	AAF1704	KT352324	0		1	Papua New Guinea	East Sepik	Wewak (Wirui Mission)	-3,555	143,625
C. wadai	ww12812	CUSCH335-12	645[1n]	AAF1704	KT352789	0		1	Papua New Guinea	East Sepik	Wewak (Wirui Mission)	-3,555	143,625
C. wadai	ww12764	CUSCH287-12	646[0n]	AAF1704	KT352599	0		1	Timor-Leste	Ainaro	Ainaro	-8,997	125,505
C. wadai	ww12761	CUSCH284-12	646[0n]	AAF1704	KT352333	0		1	Timor-Leste	Ainaro	Ainaro	-8,997	125,505
C. wadai	ww12768	CUSCH291-12	610[0n]	AAF1704	KT352408	0		1	Timor-Leste	Ainaro	Ainaro	-8,997	125,505
C. wadai	ww12760	CUSCH283-12	610[0n]	AAF1704	KT352460	0		1	Timor-Leste	Ainaro	Ainaro	-8,997	125,505
C. wadai	ww12771	CUSCH294-12	646[0n]	AAF1704	KT352218	0		1	Timor-Leste	Ainaro	Ainaro	-8,997	125,505
C. wadai	ww12766	CUSCH289-12	646[0n]	AAF1704	KT352837	0		1	Timor-Leste	Ainaro	Ainaro	-8,997	125,505
C. wadai	ww12770	CUSCH293-12	610[0n]	AAF1704	KT352294	0		1	Timor-Leste	Ainaro	Ainaro	-8,997	125,505
C. wadai	ww12772	CUSCH295-12	646[0n]	AAF1704	KT352724	0		1	Timor-Leste	Ainaro	Ainaro	-8,997	125,505
C. wadai	ww12767	CUSCH290-12	635[0n]	AAF1704	KT352651	0		1	Timor-Leste	Ainaro	Ainaro	-8,997	125,505
C. wadai	ww12762	CUSCH285-12	646[0n]	AAF1704	KT352521	0		1	Timor-Leste	Ainaro	Ainaro	-8,997	125,505
C. wadai	ww12701	CUSCH244-12	610[0n]	AAF1704	KT352708	0		1	Timor-Leste	Lautem	Fuiloro	-8,520	126,995
C. wadai	ww12698	CUSCH241-12	610[0n]	AAF1704	KT352824	0		1	Timor-Leste	Lautem	Fuiloro	-8,520	126,995
C. wadai	ww12690	CUSCH233-12	646[0n]	AAF1704	KT352707	0		1	Timor-Leste	Lautem	Fuiloro	-8,520	126,995
C. wadai	ww12689	CUSCH232-12	624[0n]	AAF1704	KT352418	0		1	Timor-Leste	Lautem	Fuiloro	-8,520	126,995
C. wadai	ww12693	CUSCH236-12	646[0n]	AAF1704	KT352389	0		1	Timor-Leste	Lautem	Fuiloro	-8,520	126,995
C. wadai	ww12692	CUSCH235-12	611[0n]	AAF1704	KT352627	0		1	Timor-Leste	Lautem	Fuiloro	-8,520	126,995
C. wadai	ww12705	CUSCH248-12	646[0n]	AAF1704	KT352238	0		1	Timor-Leste	Lautem	Fuiloro	-8,520	126,995
C. wadai	ww12688	CUSCH231-12	641[0n]	AAF1704	KT352563	0		1	Timor-Leste	Lautem	Fuiloro	-8,520	126,995
C. wadai	ww12703	CUSCH246-12	646[0n]	AAF1704	KT352160	0		1	Timor-Leste	Lautem	Fuiloro	-8,520	126,995
C. wadai	ww12882	CUSCH405-12	610[0n]	AAF1704	KT352231	0		1	Timor-Leste	Lautem	Lospalos	-8,520	126,995
C. wadai	ww12773	CUSCH296-12	488[0n]	AAF1704	KT352375	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. wadai	ww12776	CUSCH299-12	646[0n]	AAF1704	KT352220	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. wadai	ww06329	CULIC458-11	601[0n]	AAF1704	KT352542	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. wadai	ww12774	CUSCH297-12	646[0n]	AAF1704	KT352458	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. wadai	ww12792	CUSCH315-12	610[0n]	AAF1704	KT352399	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. wadai	ww12795	CUSCH318-12	624[0n]	AAF1704	KT352316	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. wadai	ww12779	CUSCH302-12	646[0n]	AAF1704	KT352649	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. wadai	ww12775	CUSCH298-12	610[0n]	AAF1704	KT352577	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. wadai	ww12780	CUSCH303-12	646[0n]	AAF1704	KT352722	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. wadai	ww12794	CUSCH317-12	610[0n]	AAF1704	KT352805	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. wadai	ww06328	CULIC457-11	673[0n]	AAF1704	KT352511	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217

continued

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.

Annex 1

Publisher: Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale' | **Journal:** Veterinaria Italiana | **Article Type:** Reasearch Article | **Volume:** 51; **Issue:** 4; **Year:** 2015; **doi:** 10.12834/VetIt.515.2463.2

Supplementary Table I. Culicoides *specimen details, including COI and CAD sequence lengths (missing sites in parentheses), associated BOLD process ID and COI BIN, GenBank accession numbers, and sample location information. —cont'd*

Identification	Specimen ID	BOLD ID	COI length	COI BOLD BIN	COI GenBank	CAD length	CAD GenBank	Accession reference	Country	State or Province	Locality	Lat	Lon
C. wadai	ww12781	CUSCH304-12	645[1n]	AAF1704	KT352480	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. wadai	ww06327	CULIC456-11	670[0n]	AAF1704	KT352773	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. wadai	ww11883	CUSCR1883-11	635[0n]	AAF1704	KT352336	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. wadai	ww12793	CUSCH316-12	610[0n]	AAF1704	KT352772	0		1	Timor-Leste	Bobonaro	Maliana	-8,983	125,217
C. wadai	ww12685	CUSCH228-12	610[0n]	AAF1704	KT352540	0		1	Timor-Leste	Oecusse	Samora	-8,820	125,854
C. wadai	ww12728	CUSCH251-12	646[0n]	AAF1704	KT352752	0		1	Timor-Leste	Oecusse	Samora	-8,820	125,854
C. wadai	ww12727	CUSCH250-12	610[0n]	AAF1704	KT352225	0		1	Timor-Leste	Oecusse	Samora	-8,820	125,854
C. wadai	ww12758	CUSCH281-12	646[0n]	AAF1704	KT352196	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. wadai	ww12754	CUSCH277-12	507[5n]	AAF1704	KT352679	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. wadai	ww12744	CUSCH267-12	575[2n]	AAF1704	KT352776	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. wadai	ww12759	CUSCH282-12	420[0n]	AAF1704	KT352489	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. wadai	ww12742	CUSCH265-12	646[0n]	AAF1704	KT352406	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. wadai	ww12757	CUSCH280-12	646[0n]	AAF1704	KT352826	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. wadai	ww12751	CUSCH274-12	646[0n]	AAF1704	KT352538	0		1	Timor-Leste	Cova Lima	Suai	-9,517	125,433
C. wadai	ww12785	CUSCH308-12	630[3n]	AAF1704	KT352381	0		1	Timor-Leste	Viqueque	Viqueque	-8,860	126,360

Accession references

1 = Present study. 2 = Matsumoto Y., Yanase T., Tsuda T. & Noda H. 2009. Species-specific mitochondrial gene rearrangements in biting midges and vector species identification. *Med Vet Entomol*, **23**, 47-55. 3 = Bellis G.A., Dyce A.L., Gopurenko D., Yanase T., Garros C., Labuschagne K. & Mitchell A. 2014a. Revision of the *Culicoides* (*Avaritia*) Imicola complex Khamala & Kettle (Diptera: Ceratopogonidae) from the Australasian region. *Zootaxa*, **3768**, 401-427. 4 = Bellis G, Kim H.C., Kim M.S., Klein T.A., Lee D.K. & Gopurenko D. 2013b. Three species of *Culicoides* Latreille (Diptera: Ceratopogonidae) newly recorded from the Republic of Korea. *Zootaxa*, **3718**, 171-182.