

A NEW SPECIES OF *NEOCAECULUS* (ACARI: PROSTIGMATA: CAECULIDAE) FROM BARROW ISLAND, WESTERN AUSTRALIA, WITH A CHECKLIST OF WORLD CAECULIDAE

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(Received 10 May 2013; accepted 17 July 2013; published online 19 December 2013)

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ABSTRACT — *Neocaeculus imperfectus* new species is described from material collected on Barrow Island, Western Australia. Keys to genera and Australasian species of Caeculidae are provided, and the relationship between the genera *Neocaeculus* and *Microcaeculus* is discussed. A checklist of species for Caeculidae is provided.

KEYWORDS — rake-legged mites; Acarina; taxonomy

INTRODUCTION

Barrow Island off the coast of northern Western Australia has been both a Class A nature reserve since 1910, and a working oil field since 1967. Recently, authorisation was given to begin construction of a liquefied natural gas (LNG) plant on Barrow Island, but with numerous conditions in place to minimise the impact on the island's value as a nature reserve. As part of the environmental monitoring requirements for the plant development, ongoing investigations have been conducted of the terrestrial invertebrate fauna of Barrow Island (Callan *et al.*, 2011). Certain species of invertebrate have proven to be extremely abundant on the island. One such species is a mite of the family Caeculidae. Samples taken from vegetation at all localities surveyed contained large numbers of individuals of

this species, often several dozen in a single sample. Nevertheless, despite this species' numerical dominance at this locality, it has not been previously described and represents a new species to science.

The Caeculidae are a family of large, strongly sclerotised mites found worldwide in arid habitats such as deserts and mountains (Otto, 1993; Walter *et al.*, 2009). They are commonly referred to as 'rake-legged mites' due to the presence of elongate spine-like setae on the legs, particularly the first pair, of most species. These spines are used in the capture of smaller arthropods such as Collembola as prey (Otto, 1993). The morphology, ontogeny and natural history of caeculids were reviewed in detail by Coineau (1974a).

The caeculid fauna of Australia has been very little investigated, with only five species described

to date from that continent. These comprise four species of the genus *Neocaeculus* Coineau, 1967a, *N. bornemisszai* Coineau and Enns, 1969, *N. knoeffleri* Coineau and Enns, 1969, *N. johnstoni* Coineau, 1974b and *N. womersleyi* Coineau, 1974b, and one of *Microcaeculus* Franz, 1952, *M. pica* Otto, 1993. A record of *Caeculus* Dufour, 1832 from Australia by Mulaik and Allred (1954) was regarded as doubtful by Otto (1993). The Barrow Island species represents a new member of *Neocaeculus*.

METHODS

Specimens were mostly collected from vegetation using a modified blower-vac; a smaller number were recovered from pitfall traps. Specimens were observed in 70 % alcohol after partial clearing in 50 % lactic acid using a Nikon SMZ1500 stereo microscope; selected specimens were further cleared and slide-mounted using Hoyer's mountant for observation of finer features using a Leica DM2500 compound microscope. Measurements and photographs were taken from the stereo microscope using the NIS-Elements D program; measurements are given in micrometres as means, with the measured range in parentheses; ten adult specimens were measured.

Setae are generally described as clavate, spinose or filiform. Clavate setae are broad and flattened with extensively divided margins; spinose setae are elongate and thick, and when examined at high magnification can be seen to be minutely divided, particularly terminally; filiform setae are fine and entirely undivided. It should be noted, however, that variation in setal morphology is continuous and setae may be intermediate between these classes; the distinction between an elongate clavate seta and a short spinose seta may be somewhat subjective.

Specimens are held by J. Majer, Curtin University; type specimens are to be deposited in the Western Australian Museum, Perth, Australia (WAM).

TAXONOMY

Neocaeculus Coineau, 1967a

Type species. *Neocaeculus luxtoni* Coineau, 1967a, by original designation.

Included species. *N. luxtoni*, *N. bornemisszai* Coineau and Enns, 1969, *N. bruchi* (Berlese, 1916), *N. imperfectus* n. sp., *N. johnstoni* Coineau, 1974b, *N. knoeffleri* Coineau and Enns, 1969, *N. lamoralis* Coineau, 1974a, *N. womersleyi* Coineau, 1974b.

Neocaeculus imperfectus n. sp.

Figures 1-3

Holotype — Adult female, gas treatment plant site, Barrow Island, Western Australia, N. Gunawardene, C. Taylor, 14-24 March 2011, suction (WAM).

Paratypes — Numerous adults and nymphs, as for holotype (WAM).

Other material — Specimens of this species have been collected in numerous samples over several years on Barrow Island, Western Australia. The greater number of specimens have been collected via suction of vegetation; smaller numbers of specimens have been collected in pitfall traps.

Etymology — Latin *imperfectus*, incomplete, referring to the retention of juvenile characters (particularly the lower number of setae) into maturity by this species.

Dorsum (Figures 1A-B) — Idiosoma length 1036 (885 – 1147), width 599 (525 – 663). Cream-coloured sclerites divided by black striated integument. All sclerites with reticulate ornamentation of raised ridges. Aspidosomal sclerite with median rectangular area outlined by dark-pigmented grooves; aspidosomal sclerite length 325 (268 – 375), width 342 (287 – 370); setae *Pa* situated at anteriormost corners of sclerite; setae *Pm* at 0.2 on anterior lateral corners of sclerite; setae *Pp* at 0.7 towards posterior lateral corners of sclerite. Two pairs of eyes on accessory sclerite lateral to rear of aspidosomal sclerite; anterior margin of anterior eyes roughly level with setae *Pp*. Centrodorsal sclerite with paired setae *a1*, *b1*, *c1* present; centrodorsal sclerite length 452 (404 – 515), width 333 (303 – 363). Lateral sclerites

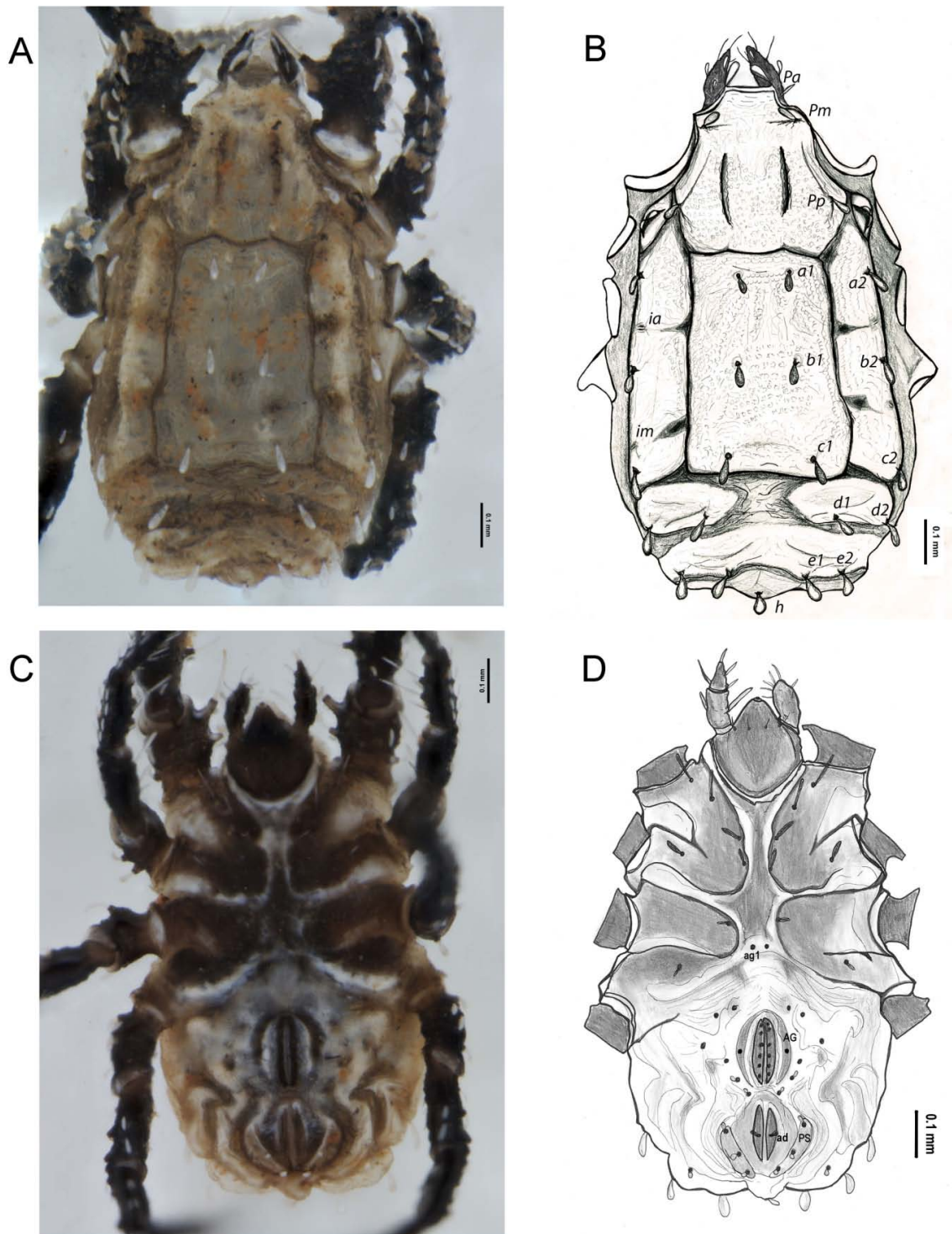


FIGURE 1: *Neocaeculus imperfectus*, idiosoma: A – photograph of dorsum; B – schematic drawing, with representative seta and lyrifissure labels; C – photograph of venter; D – schematic drawing (locations of smaller setae marked with black dot), with labels showing position of setae *ag1* and adanal setae (*ad*), aggenital sclerite (*AG*) and pseudanal sclerite (*PS*).

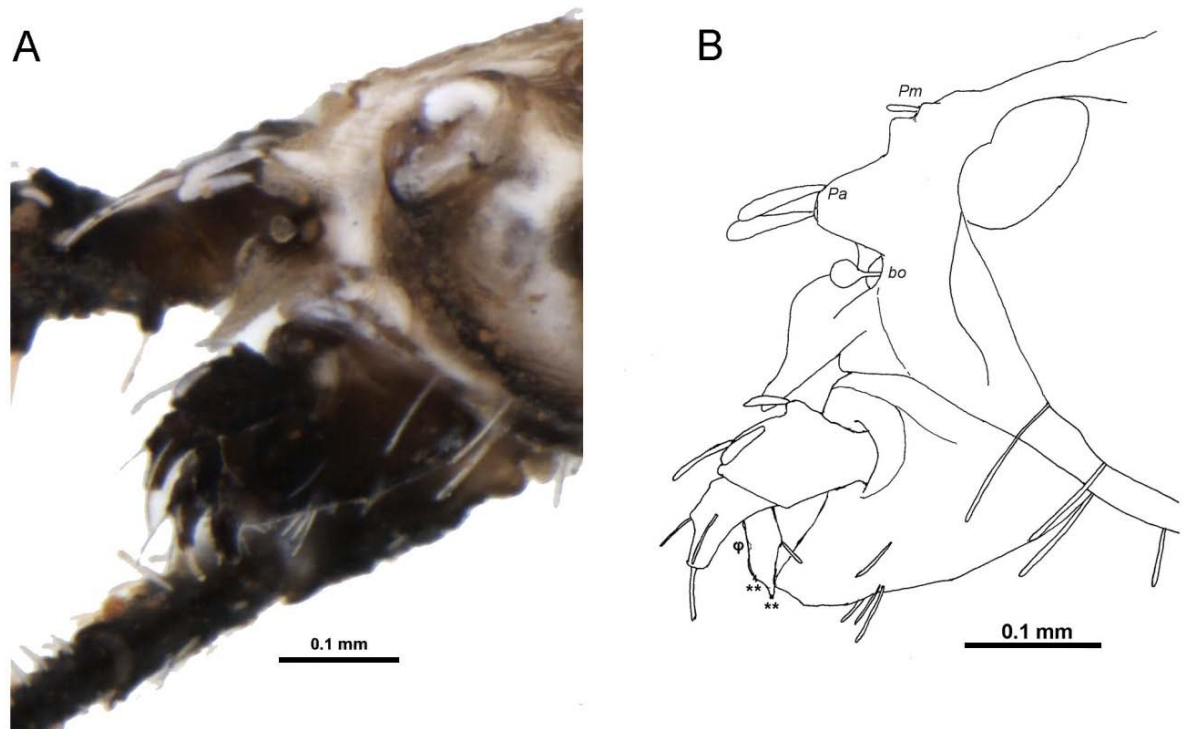


FIGURE 2: *Neocaeculus imperfectus*, gnathosoma, lateral view: A – photograph; B – schematic drawing, with representative seta labels: eupathidia marked with asterisk (*), position of solenidion marked with ϕ .

each subdivided by two transverse pigmented depressions; paired setae *a2*, *b2*, *c2* sequentially placed with one seta on each sub-region of sclerite demarcated by depressions; lyrifissure *ia* transverse, about one-sixth width of lateral sclerite, placed roughly two-thirds of distance posteriad between *a2* and *b2*; lyrifissure *im* angled laterally rearwards, similar in size to *ia*, placed about two-thirds of distance posteriad between *b2* and *c2*. Idiosoma with broadly separated medial sclerites bearing setae pairs *d1*, *d2*, two separated or one transverse posterior sclerites bearing setae pairs *e1*, *e2*, and pluriposterior accessory sclerite bearing upaired seta *hs* with paired setae *h* on striated cuticle lateral to *hs*. Setae *ds* and *es* absent.

Venter (Figures 1C-D) — Epimeres grey-brown; epimeres I separated from gnathosoma by cream collar with cream stripes internal to epimeres I and II, median integument between epimeres I and II and entire integument between epimeres III and IV grey-brown; venter of idiosoma largely cream ex-

cept genital valves dark brown, black stripe external to pseudanal sclerites. Median eye present just behind underside of anterior projection of aspidosomal sclerite; large bothridial setae *bo* present lateral to median eye, with nodulose pyriform caput. Epimere I fused with II, epimere I with four anterior barbed setae with basalmost seta placed close to junction between epimeres I and II, epimere II with one anterior barbed seta close to base; epimere III fused with IV, epimere III with one barbed seta close to anterior medial corner, epimere IV with one barbed seta close to base. Genital valves with six to eight pairs of setiform setae, with setae on each valve somewhat staggered; genital opening length 151 (119 – 163). Eight pairs of aggenital setae present, with one pair of setiform setae on aggenital sclerites; anteriormost pair of clavate aggenital setae *ag1* close to level of anterior of epimere IV; one pair of setiform setae directly anterior to aggenital sclerites; two pairs of barbed setae roughly lateral to anterior ends of aggenital sclerites; remaining four

pairs of barbed or clavate setae forming series running from about level of midline of aggenital sclerites to near posterior ends of aggenital sclerites, with anteriormost pair furthest laterad from aggenital sclerites and posteriormost pair close to aggenital sclerites. Anal valve with one pair clavate setae; pseudanal sclerites with one to three pairs clavate setae; anal opening length 145 (135 – 168).

Gnathosoma (Figure 2) — Gnathosoma uniformly dark brown. Gnathosoma base with two pairs of setiform setae, with median pair placed slightly anterior of lateral pair. Rostral lobes each with distal pair of small setiform setae. Palp with four segments; fused femur-genu with three dorsal barbed setae; tibia with five setae (three dorsal spiniform setae at about mid-length; one proximal anterior ventrolateral setiform seta and one terminal spiniform seta); tarsus with three ventral spinose setae at about 0.5, one dorsal solenidion at about 0.5, and four eupathidia (two paired eupathidia at distal end, two separated dorsal eupathidia close to distal end).

Legs (Figure 3) — Legs black with white setae. Setae of all legs (from the femur onwards) are arranged more or less into five rows that are referred to here as the anterior dorsolateral, median dorsal, posterior dorsolateral, anterior ventrolateral and posterior ventrolateral rows; the median dorsal row on each leg generally only reaches to about halfway along the tibia, so the distal half of the tibia and the tarsus only bear four rows of setae. Dorsal setae are generally short clavate from the trochanter to the genu, becoming more elongate and spinose on the tibia and tarsus. Leg I with anterior ventrolateral and posterior ventrolateral setae borne on long tubercles; femur I with one proximal elongate clavate and one medial spinose seta in each of anterior ventrolateral and posterior ventrolateral rows; genu I with three pairs of anterior ventrolateral and posterior ventrolateral spinose setae, distal two anterior ventrolateral setae longer than proximalmost seta, posterior ventrolateral setae with median seta longer than distal seta which is in turn longer than proximal seta; tibia I with three pairs of anterior ventrolateral and posterior ventrolateral spinose setae, with distal setae longer than proximalmost seta

in both anterior ventrolateral and posterior ventrolateral rows, hidden solenidion present distal to eupathidium at distal end of posterior dorsolateral row, with regressed seta *k'* immediately dorsal to solenidion; tarsus I with three pairs of anterior ventrolateral and posterior ventrolateral small spinose setae, anterior lateral solenidion present at 0.5 below distal anterior dorsolateral eupathidium, distal end of tarsus with three anterior lateral, one posterior dorsolateral and one posterior ventrolateral small solenidion, and one posterior lateral cone-shaped seta; claws unequal with anterior claw smaller. Femur II with two large anterior ventrolateral clavate setae (distal seta longer than proximal), one posterior ventrolateral short spinose seta at 0.5; genu II with two anterior ventrolateral spinose setae, two posterior ventrolateral small spinose setae; tibia II with four anterior ventrolateral spinose setae, five posterior ventrolateral small spinose setae, posterior dorsolateral distal hidden solenidion; tarsus II with five anterior ventrolateral and posterior ventrolateral small spinose setae, anterior lateral hidden solenidion at 0.5, distal end of tarsus with one anterior dorsolateral cone-shaped seta; claws unequal with anterior claw smaller. Femur III with two anterior ventrolateral clavate setae, one posterior ventrolateral small spinose seta; genu III with three anterior ventrolateral clavate setae, two posterior ventrolateral small spinose setae; tibia III with five anterior ventrolateral clavate setae, five posterior ventrolateral small spinose setae; tarsus III with four anterior ventrolateral and posterior ventrolateral spinose setae, distal end of tarsus with two ventral and one posterior lateral horn-shaped setae, one anterior dorsolateral spinose seta, elongate dorsal bothridial seta *bt* slightly behind distal anterior dorsolateral seta; claws subequal, anterior claw only slightly smaller. Femur IV with two anterior ventrolateral clavate setae, one posterior ventrolateral small spinose seta; genu IV with one anterior ventrolateral clavate seta, one posterior ventrolateral small spinose seta; tibia IV with five anterior ventrolateral and posterior ventrolateral spinose setae, one distal posterior lateral hidden solenidion; tarsus IV with four anterior ventrolateral and posterior ventrolateral spinose setae, distal end of tarsus with two ventral large cone-shaped setae, one posterior

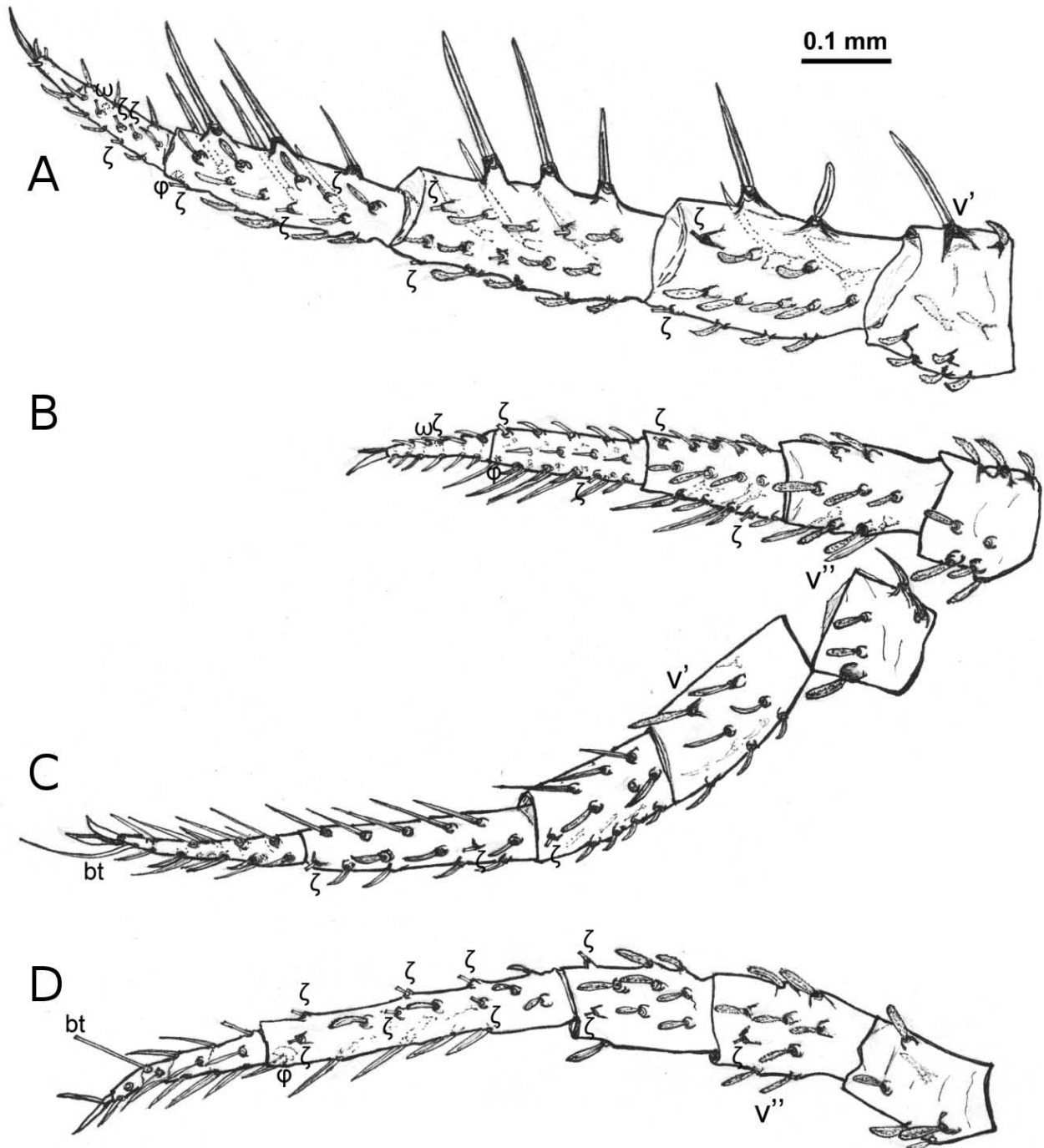


FIGURE 3: *Neocaeculus imperfectus*, legs. A – Leg I in anterior dorsolateral view; B – Leg II in dorsal view; C – Leg III in anterior dorsolateral view; D – Leg IV in posterior dorsolateral view.

Position of eupathidium marked with ζ; φ marks position of hidden tibial solenidium; ω marks position of hidden tarsal solenidium; bt marks tarsal bothridium. The first visible ventrolateral spine is marked on each leg to facilitate orientation; v' indicates the anterior ventrolateral row, v'' indicates the posterior ventrolateral row.

lateral cone-shaped seta, elongate dorsal bothridial seta *bt* about halfway between level of third and fourth anterior dorsolateral setae.

Nymphal stages — Dorsal setation as for adult female. Genital and anal openings successively smaller and less sclerotised; fewer aggenital setae. Epimere I with four setae in tritonymph, three setae in deutonymph and protonymph. Enlarged ventrolateral leg setae similar to adult in tritonymph and deutonymph, though proximal anterior ventrolateral clavate seta on femur I successively smaller in each instar; protonymph leg I with one anterior ventrolateral and posterior ventrolateral large spinose seta on femur I; two anterior ventrolateral and one posterior ventrolateral large spinose seta on genu I; two anterior ventrolateral and two posterior ventrolateral large spinose setae on tibia I.

Variation — Variation in dorsal setation was very uncommon. A single tritonymph was observed with a second slightly smaller pair of setae *Pp* behind the usual pair on the aspidosomal sclerite. Two individuals were also observed in which the setal pair *d2* was doubled (in one of these individuals, on one side only). Variation in ventral and leg setation was more common. At least one larger individual was found with five rather than four setae on epimere I; epimere setae could also vary noticeably in length, being short clavate in some individuals and more elongate in others. Dorsal leg setae could vary in number between individuals. Supernumerary accessory dorsal setae were not uncommon, but the number and arrangement of the larger ventral setae were mostly consistent with variants being very rare.

Comments — Compared to other species in Caeculidae (reviewed by Coineau, 1974a), *Neocaeculus imperfectus* is remarkable in the relative constancy of its setation between instars and can be described as a true neotenous form. Despite the observation of specimen numbers probably into the hundreds, no males have been identified, and the species is probably parthenogenetic.

Neocaeculus imperfectus can be assigned to *Neocaeculus* by the features given in the key to caeculid genera below. Among other Australasian species of Caeculidae, it differs from *N. bornemisszai* and

N. knoeppfleri in the shape of *bo* (globose-capitate vs brush-like and non-capitate; Coineau and Enns 1969). *Neocaeculus imperfectus* can be distinguished from *N. luxtoni* and *Microcaeculus pica* by the absence of the dorsal median accessory setae *ds* and *es*, and in the presence of large spinose setae on trochanter and femur I (Coineau 1967a; Otto 1993). It differs from *N. johnstoni* and *N. womersleyi* in having femur I undivided (Coineau 1974b).

Coineau (1974a) assigned two species from outside Australasia to *Neocaeculus*, the southern African *N. lamorali* and the South American *N. bruchi* (miscited by Coineau, 1974a, as '*N. brucki*'). Both these species have, to date, received only brief descriptions, and potentially important features such as bothridial morphology remain undescribed for both. *Neocaeculus lamorali* may be distinguished from Australasian species by the presence of two pairs of setae *Pp* and the presence of paired setae instead of a single seta *es* (Coineau, 1974a). The initial description of '*Caeculus*' *bruchi* by Berlese (1916) is probably inadequate for its identification, and it was listed as a species *incertae sedis* by Franz (1952). Coineau (1974a) referred to it as a *Neocaeculus* species without redescribing it in detail, commenting only on a single aspect of this species' setal morphology. The distal setae *er* on the leg tarsi of *N. bruchi* are rounded, divergent from the tarsus, and enlarged to a diameter half that of the tarsus, rather than being flattened, distally directed, and relatively smaller in most other species (Coineau, 1974a).

COMMENTS ON RECOGNITION OF *Neocaeculus*

Coineau (1967a) established a new genus *Neocaeculus* for the New Zealand species *N. luxtoni* on the basis that it possessed a reduced dorsal setation like that of *Microcaeculus hispanicus*, but did not have the aspidosomal sclerite extended forward over the gnathosoma as in *Microcaeculus*. He also noted two further features as unique to the new genus: the undivided femora in the legs, and the presence of a distal solenidion on tibia IV. Coineau and Enns (1969), in describing two new species of *Neocaeculus*

lus, provided a list of principal characteristics for the genus: reduced dorsal setation, an enlarged median eye, a single pair of adanal setae, undivided femora, unequal tarsal claws, the distal solenidion of tibia IV, and an antilateral famulus.

The majority of these features are not unique to *Neocaeculus*. A reduced dorsal setation is also found in some *Microcaeculus* species (Coineau, 1974a), as is an enlarged median eye (Coineau, 1968), solenidion on tibia IV (Coineau, 1969b; Otto, 1993) and an antilateral famulus (Coineau, 1968; Coineau and Haupt, 1977). Unequal tarsal claws are found in *Microcaeculus*, *Allocaeculus*, *Andocaeculus* and *Calocaeculus* (Coineau, 1974a). Coineau (1974b) later assigned two Australian species to *Neocaeculus* that had the femora divided into two segments as in other caeculid genera (undivided femora are also present in *Procaeculus*, but an immediate relationship between *Procaeculus* and *Neocaeculus* within Caeculidae seems unlikely — Coineau, 1974a).

A single pair of adanal setae is also found in the Australian species *Microcaeculus pica* (Otto, 1993), which also shares a number of features with particular *Neocaeculus* species that are otherwise not recorded for *Microcaeculus*. Its femora are undivided as in *Neocaeculus luxtoni*, *N. knoeppffleri*, *N. bornemisszai* and *N. imperfectus*. The globose-capitate and relatively short bothridium *bo* morphology found in *M. pica*, *N. luxtoni* and *N. imperfectus* has not been recorded from any other species of Caeculidae, in which *bo* is mostly elongate with the caput narrow or absent (Coineau 1974a). These characters raise the possibility that *M. pica* may be more closely related to other Australian species in *Neocaeculus* than to its current congeners in *Microcaeculus*.

Overall, *Microcaeculus* and *Neocaeculus* are effectively distinguished from each other at present by a single character, the anterior expansion (*Microcaeculus*) or not (*Neocaeculus*) of the aspidosomal sclerite. In light of the conflict in distribution between this and other potentially significant characters, both *Microcaeculus* and *Neocaeculus* deserve a more detailed phylogenetic study in order to test their relative monophyly. Unfortunately, potentially important features such as bothridial and leg morphology

remain undescribed for many species in both genera.

Key to Genera of Caeculidae

1. Tarsal claws of leg I equal in size 2
— Tarsal claws of leg I unequal 3
2. Anterior margin of aspidosomal sclerite concave, gnathosoma entirely visible from above *Procaeculus* Jacot, 1936
— Anterior margin of aspidosomal sclerite convex *Caeculus* Dufour, 1832
3. Dorsodistal bothridia *bt* present on legs I and II *Andocaeculus* Coineau, 1974a
— Dorsodistal bothridia *bt* absent on legs I and II 4
4. Anterior half of aspidosomal sclerite extensively neotrichous *Allocaeculus* Franz, 1952
— Anterior half of aspidosomal sclerite not neotrichous, aspidosomal sclerite with three pairs of setae or, if more, supernumerary setae in posterior part of sclerite only 5
5. Dorsal sclerite neotrichous *Calocaeculus* Coineau, 1974a
— Dorsal sclerite with three or fewer pairs of setae only 6
6. Aspidosomal sclerite expanded anteriorly, overhanging gnathosoma in lateral view *Microcaeculus* Franz, 1952
— Aspidosomal sclerite not anteriorly expanded *Neocaeculus* Coineau, 1967a

Key to Australasian species of Caeculidae

1. Bothridial setae *bo* with globular caput 2
— Bothridial setae *bo* elongate, non-capitate 4
2. Dorsal setae *ds* and *es* both present; enlarged setae on femur I clavate 3
— Dorsal setae *ds* and *es* absent; femur I bearing large spinose setae *Neocaeculus imperfectus*
3. Genu I with pair of large spinose setae; epimere I with three and epimere II with one seta *Neocaeculus luxtoni*
— Enlarged setae on genu I clavate; epimere I with 4-6 and epimere II with 3-5 setae *Microcaeculus pica*

4. Femur I divided (leg I with six post-coxal segments) 5
 — Femur I undivided (leg I with five post-coxal segments) 6
 5. Elongate bothridial seta *bt* present on tarsi III and IV *Neocaeculus womersleyi*
 — Bothridial setae *bt* absent on all tarsi
 *Neocaeculus johnstoni*
 6. Leg I bearing large spinose setae *Neocaeculus knoepffleri*
 — All enlarged setae on leg I clavate
 *Neocaeculus bornemisszai*

SPECIES LIST FOR CAECULIDAE

No complete list of species of Caeculidae has been published since Franz (1952), and the taxonomic literature is somewhat scattered. Coineau (1974a) provided an extensive review of the family, but was primarily focused on ontogeny and comparative morphology rather than taxonomy *per se*. We take the opportunity here to present an up-to-date checklist for the Caeculidae. Taxa are listed alphabetically in their current combinations with synonyms; fossil taxa are marked with a dagger (†). The original descriptions of *Caeculus senegalensis* André, 1938 and *C. uchidai* Asanuma, 1940 allow them to be recognised as species of *Allocaeculus* and *Microcaeculus*, respectively, and they are transferred to those genera.

New taxa presented in Coineau (1974a) were provided with brief differential diagnoses in a taxonomic appendix. Unfortunately, two new generic names referred to by Coineau (1974a) in the body of the text, *Pseudocaeculus* and *Scleroaeculus*, were omitted from the taxonomic appendix, and cannot be regarded as validly published as they each lack a properly designated type species (ICZN, 1999). Coineau has confirmed that their omission was due to mere oversight (Y. Coineau, personal communication, 2012). We feel that further work is necessary to clarify the status of the taxon groups referred to by each of these generic names, and they are here treated as unavailable names pending such investigation.

Coineau (1974a, p. 59) indicated that *Caeculus americanus* and other unspecified species were to be placed in a new genus '*Pseudocaeculus*' but did not directly indicate any reason for doing so other than the fusion of each of the medial and posterior sclerite pairs into a single unpaired sclerite. *Caeculus americanus* Banks, 1899 cannot be regarded as the type species of *Pseudocaeculus* through monotypy as Coineau's (1974a) reference to 'espèces' rather than 'espèce' on p. 59 is a clear indicator that *C. americanus* was not intended to be the only species in the new genus. Taken alone, the fusion of the dorsal plates would seem little reason for establishing a new genus, and Coineau did not establish new genera for species in *Microcaeculus* that similarly varied in the rear dorsal sclerotisation. However, on p. 191, Coineau (1974a) discussed *C. americanus* as one of a group of North American species exhibiting a unique neotrichy of setae *Pa* on the aspidosomal sclerite. As Coineau (1974a) had also established the genus *Calocaeculus* on the basis of its unusual neotrichy pattern, it seems likely that this was also the intended basis for distinguishing *Pseudocaeculus*. Unfortunately, it is currently unclear from published descriptions alone whether North American species such as *Caeculus crossleyi* Hagan, 1985 and *C. lewisi* McDaniel and Boe, 1990 exhibit neotrichy of *Pa* or not. Until such a time as these species can be reviewed in more detail, we treat '*Pseudocaeculus*' as a synonym of *Caeculus*.

For *Scleroaeculus*, Coineau (1974a) included the species *Caeculus deserticolus* Lawrence, 1939 and *Microcaeculus namibensis* Piffel, 1965, but the association of 'gen. n.' with *S. namibensis* only does not constitute a valid type designation for a new genus published after 1931 (ICZN 1999, Art. 68.2.1). Diagnostic features of *Scleroaeculus* were discussed by Coineau (1974a) on pp. 59 (arrangement of dorsal sclerites) and 197 (setation of leg IV). Again, these features remain inadequately described in other species currently assigned to *Microcaeculus*, and *Scleroaeculus* is here retained as a synonym of the latter genus pending further investigation.

CHECKLIST

Allocaeculus Franz, 1952 (type species *Allocaeculus relictus* by original designation)

- A. andalusiacus* Franz, 1952
- A. catalanus* Franz, 1954
- A. circinatus* Coineau, 1974a
- A. dubius* (Kulczyński, 1901)
= *Caeculus dubius* Kulczyński, 1901
- A. echinatus* Franz, 1952
- A. erinaceus* Coineau, 1974a
- A. grandjeani* Franz, 1957
- A. hirsutus* Coineau, 1974a
- A. hoggarensis* (André, 1936)
= *Caeculus hoggarensis* André, 1936
- A. hystriciformis* Franz, 1952
- A. hystrix* (Lawrence, 1939)
= *Caeculus hystrix* Lawrence, 1939
- A. indicus* Piffel, 1959
- A. kalahariensis* Coineau, 1974a
- A. kenya* Franz, 1964
- A. kocheri* Franz, 1964
- A. logonensis* Franz, 1957
- A. meseticola* Franz, 1952
= *Caeculus meseticola* Franz, 1952
- A. mosambicensis* (André, 1936)
= *Caeculus mossambicensis* André, 1936
- A. multispinosus* Franz, 1955
- A. nigeriensis* Coineau, 1974a
- A. ouadaiensis* Franz, 1957
- A. pilosus* (Lawrence, 1938)
= *Caeculus pilosus* Lawrence, 1938
- A. relictus* Franz, 1952
- A. sarhroi* Franz, 1964
- A. schusteri* Franz, 1960
- A. sclerodermatus* (André, 1936)
= *Caeculus sclerodermatus* André, 1936
- A. sculptus* (Karpelles, 1893)

= *Hoplopus sculptus* Karpelles, 1893

= *Caeculus sculptus* (Karpelles, 1893)

A. senegalensis (André, 1938) new combination

= *Caeculus senegalensis* André, 1938

A. spathulifer (Michael, 1890)

= *Caeculus spathulifer* Michael, 1890

A. spinosissimus Franz, 1952

A. spinosissimus rondae Franz, 1952

A. sudanensis (Trägårdh, 1905)

= *Caeculus sudanensis* Trägårdh, 1905

A. tenerifae Franz, 1965

A. tschadensis Franz, 1957

A. tschadensis rifensis Franz, 1960

Andocaeculus Coineau, 1974a (type species *Microcaeculus brundini* by original designation)

A. brundini (Franz, 1962)

= *Microcaeculus brundini* Franz, 1962

Caeculus Dufour, 1832 (type species *Caeculus echinipes* by monotypy)

= *Hoplopus Canestrini* and Fanzago, 1877

(unnecessary replacement name)

= *Pseudocaeculus* Coineau, 1974a (unavailable name)

C. americanus Banks, 1899

= *Pseudocaeculus americanus* (Banks, 1899)

C. archeri Mulaik, 1945

C. calechius Mulaik, 1945

C. clavatus Banks, 1905

C. cremnicolus Enns, 1958

C. crossleyi Hagan, 1985

C. dorotheae Mulaik, 1945

C. echinipes Dufour, 1832

= *Hoplopus echinipes* (Dufour, 1832)

C. echinipes crosbyi Jacot, 1936

C. gertschi Mulaik, 1945

C. hardyi Mulaik and Allred, 1954

C. hypopachus Mulaik, 1945

C. janetae Higgins and Mulaik, 1957b

C. kerrulius Mulaik, 1945

- C. krantzi* Coineau, 1974a
C. lewisi McDaniel and Boe, 1990
C. mariae Higgins and Mulaik, 1957a
C. pettiti Nevin, 1943
C. tipus Mulaik, 1945
C. valverdius Mulaik, 1945
Calocaeculus Coineau, 1974a (type species *Calocaeculus lawrencei* by original designation)
C. lawrencei Coineau, 1974a
Microcaeculus Franz, 1952 (type species *Microcaeculus austriacus* by original designation)
= *Scleroaeculus* Coineau, 1974a (unavailable name)
M. andrei (Lawrence, 1939)
= *Caeculus andrei* Lawrence, 1939
M. austriacus Franz, 1952
M. canariensis Franz, 1965
M. castrii Franz, 1964
M. deserticolus (Lawrence, 1939)
= *Caeculus deserticolus* Lawrence, 1939
= *Scleroaeculus deserticolus* (Lawrence, 1939)
M. franzi Coineau, 1968
M. graecus Franz, 1964
M. hispanicus Franz, 1952
M. insolitus (André, 1935)
= *Caeculus insolitus* André, 1935 [also described as new in André, 1936]
M. insularis Franz, 1964
M. laoshanensis (Jacot, 1936)
= *Caeculus laoshanensis* Jacot, 1936
M. liguricus (Vitzthum, 1933)
= *Caeculus liguricus* Vitzthum, 1933
M. monticolus (Lawrence, 1939)
= *Caeculus monticolus* Lawrence, 1939
M. muscorum (Lucas, 1847) (see note below)
= *Caeculus muscorum* Lucas, 1847
M. namibensis Piffel, 1965
= *Scleroaeculus namibensis* (Piffel, 1965)
M. nicoleae Coineau, 1974a
M. nudus Franz, 1964
M. pisanus (André, 1936)
= *Caeculus pisanus* André, 1936
M. pica Otto, 1993
M. sabulicola Franz, 1952
M. sinensis (Jacot, 1936)
= *Caeculus sinensis* Jacot, 1936
M. sinensis taishanicus (Jacot, 1936)
= *Caeculus sinensis taishanicus* Jacot, 1936
M. steineri Franz, 1955
= *M. hispanicus steineri*
M. steineri delamarei Coineau, 1974a
M. stephani Coineau and Haupt, 1977
M. tibbettsi (Higgins and Mulaik, 1958)
= *Caeculus tibbettsi* Higgins and Mulaik, 1958
M. uchidai (Asanuma, 1940) new combination
= *Caeculus uchidai* Asanuma, 1940
M. weyrauchi Franz, 1964
Neocaeculus Coineau, 1967a (type species *Neocaeculus luxtoni* by monotypy)
N. bornemisszai Coineau and Enns, 1969
N. bruchi (Berlese, 1916)
= *Caeculus bruchi* Berlese, 1916
N. imperfectus new species
N. johnstoni Coineau, 1974b
N. knoeppfleri Coineau and Enns, 1969
N. lamorali Coineau, 1974a
N. luxtoni Coineau, 1967a
N. womersleyi Coineau, 1974b
Procaeculus Jacot, 1936 (type species *Procaeculus bryani* by monotypy)
P. bryani Jacot, 1936
P. brevis (Mulaik, 1945)
= *Caeculus brevis* Mulaik, 1945
†*P. dominicensis* Coineau and Poinar, 2001

- †*P. eridanosae* Coineau and Magowski, 1994
P. magnus Coineau, 1974a
P. mexicanus (Mulaik and Allred, 1954)
 = *Caeculus mexicanus* Mulaik and Allred, 1954
P. orchidicolis (Mulaik and Allred, 1954)
 = *Caeculus orchidicolis* Mulaik and Allred, 1954
P. oregonus (Mulaik and Allred, 1954)
 = *Caeculus oregonus* Mulaik and Allred, 1954
P. potosi (Mulaik and Allred, 1954)
 = *Caeculus potosi* Mulaik and Allred, 1954
P. puertoricus (Mulaik, 1945)
 = *Caeculus puertoricus* Mulaik, 1945
P. willmanni (Vitzthum, 1933)
 = *Caeculus willmanni* Vitzthum, 1933
 = *Procaeculus aitkeni* Coineau, 1967b (see note below)

Names of uncertain status:

Caeculus spathuliger [sic] var. *calidior* Berlese, 1916: Berlese proposed this as a possible name for a specimen from Somalia, but declined to formally establish it until further specimens became available for comparison. As this name does not appear to have been used by any subsequent authors, we believe it is best treated as a *nomen nudum*.

Caeculus hirtipes Berlese, 1910: The description of this species given by Berlese is probably inadequate for its identification, and Franz (1952) listed it as a species *incertae sedis* within Caeculidae. Similarly unidentifiable is the form described as *C. hirtipes* var. *graecus* Berlese, 1910.

Notes:

Microcaeculus muscorum: The publication history of Lucas (1846-1849) has been analysed by Evenhuis (2012). The section including the description of *Caeculus muscorum* (as *Coeculus muscorum*) had most likely been distributed by 15 May 1847.

Procaeculus aitkeni: Despite being described as a new species in Coineau (1969a), a preliminary description of this species had already appeared in Coineau (1967b). Coineau (1969a) noted that this species was uncertainly distinct from *Procaeculus willmanni* (Vitzthum 1933); though a formal synonymy of the two species was never published, Coineau (1974a) later reproduced figures of *P. aitkeni* from Coineau (1969a) labelled as *P. willmanni*.

ACKNOWLEDGEMENTS

We would like to thank Yves Coineau for his helpful correspondence in compiling the checklist of Caeculidae. Two anonymous reviewers provided invaluable guidance in composing the manuscript. Thank you also to Jonathan Majer, Karl Edwards, Brad Scanlon and Morgan Lythe for their work on the current project. Research was conducted and funded as part of the Gorgon Project, which is operated by an Australian subsidiary of Chevron and is a joint venture of the Australian subsidiaries of Chevron (approximately 47 percent), ExxonMobil (25 percent) and Shell (25 percent), Osaka Gas (1.25 percent), Tokyo Gas (one percent) and Chubu Electric Power (0.417 percent).

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