A new genus and species of cave spider from Ascension Island (Araneae: Linyphiidae)

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Summary

A new genus, *Catonetria*, is established for a blind spider, *C. caeca* n. sp. (Linyphiidae) from a cave on Ascension Island, Atlantic Ocean. Ancestors of the species probably reached this isolated volcanic island by ballooning and subsequently adapted to obligate cave life; a surface-living sister species has not yet been found on the island.

Introduction

Ascension Island is an extremely isolated oceanic island, at 7° 57′ S, 10° 22′ W in the mid-Atlantic. It is 1,540 km SSW of Cape Palmas (Liberia) and 2,250 km from the coast of Brazil. The nearest island is St Helena, 1,300 km SE. The oldest dated rocks are about 1.5 million years old (Harris, 1986).

Only a few studies have previously been made of the terrestrial invertebrate fauna of the island (Dahl, 1892; Duffey, 1964) and none on the biology of its volcanic caves. In March–April 1990 N. P. and M. J. Ashmole carried out systematic trapping and searching for invertebrates in barren lava habitats and caves on the island. Methods were those developed by Ashmole *et al.* (1992) for field work on volcanic islands, and involved a combination of pitfall traps, baited traps and timed hand searches. Information on the locations and characteristics of many caves was obtained from a manuscript by James (1985); one other cave was found by searching.

The spider described here was obtained in Packer's Hole, at Universal Transverse Mercator Grid reference ES 694 245, which at an altitude of *c.* 185 m a.s.l. is the highest fully dark cave known on the island. It is a narrow, sharply inclined cleft 49 m long and 18 m deep (James, 1985), apparently formed by collapse. Cinders from the surface outside trickle into the cave via the entrance and various cracks, covering the floor of the outer section. The walls and roof, and the floor of the inner section are largely covered with fine volcanic dust. Rough measurements of humidity indicated an RH of up to 95%. There was evidence of the presence of landcrabs *Gecarcinus lagostomus* M. Edw. and of black rats *Rattus rattus* (L.). Traps set in the dark inner part of the cave caught none of the species described here, but did catch two female Gnaphosidae of a species that was also found in surface habitats. The other invertebrates obtained in the traps comprised platyarthrid Isopoda *Niambia longiantennata* (Taiti & Ferrara, 1991), entomobryid Collembola (a blind, cave-adapted species of *Pseudosinella* and a species of *Seira*), blattid Dictyoptera *Periplaneta americana* (L.), and phorid Diptera *Megaselia curtineura* (Brues) (Disney, 1991); there were also immature Psocoptera. The spider described here, together with a minute juvenile that was subsequently lost, were the only animals found during three hours of hand searching in the dark part of the cave. They were on tiny filmy webs that were very hard to see; a few other webs were detected but appeared to be unoccupied.

Genus Catonetria, new genus

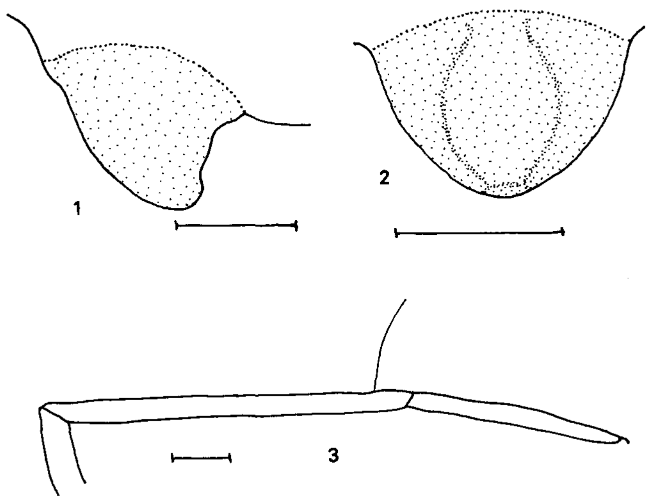
Type species: Catonetria caeca, new species.

Etymology: From the Greek *kato*, in the underworld, and *netria*, a female spinner. Gender feminine.

Diagnosis: The female of the single species is diagnosed by the absence of eyes, by the almost white colour, by the metatarsal trichobothria, and by the epigynum (Figs. 1–2). Males are not known.

Description: The single known species (female only) has total length 1.25 mm. The species is cave-dwelling, blind and whitish in colour. The carapace is unmodified; the chelicerae have moderately sized teeth in the anterior row. The legs are long and slender, with tibia I l/d *c.* 16. The tibiae have two dorsal and no lateral spines, and the femora and metatarsi are spineless. A trichobothrium is present on metatarsi I–IV, with TmI 0.85; the trichobothrium on metatarsus IV is slightly bent (Fig. 3). The palp is clawless. The epigynum is a simple scape, so pale in colour that the detail is difficult to see (Figs. 1–2). Since the only specimen available was the holotype, it was decided not to detach the epigynum for examination of the internal structure; the very faint lines visible on the caudal side of the scape, however, probably mark the position of the internal ducts leading from the spermathecae to openings at the posterior of the scape.

Included species: Only the type species.



Figs. 1–3: *Catonetria caeca*, n.sp. **1** Epigynum, lateral; **2** Epigynum, caudal; **3** Leg IV, metatarsus and tarsus. Scale lines = 0.1 mm.

Distribution: Known only from a cave, Ascension Island.

Taxonomic position: The form of the epigynum, a simple scape, indicates that *Catonetria* lies in the group of genera described earlier (Millidge, 1984) as the subfamily Drapetiscinae; recent reconsideration of this subfamily has led to the conclusion that it is too heterogeneous to be a monophyletic group (Millidge, 1993). The location of the metatarsal trichobothria, and the bent trichobothrium on metatarsus IV, are almost identical with the characters of *Drapetisca* itself; the epigynum, however, is differently shaped from that of *Drapetisca*. There are several genera (*Laminicauda* Millidge and *Neomaso* Forster in particular) in South America which have the epigynum in the form of a simple scape, and several species of *Laminicauda* are present on the remote South Atlantic islands of Tristan da Cunha (Millidge, 1985, 1991). In the absence of the male, however, the present Ascension Island species cannot be assigned to any known genus, and a new genus is considered necessary. The male, when discovered, should serve to clarify the taxonomic position of *Catonetria*.

***Catonetria caeca*, new species** (Figs. 1–3)

Material examined: Ascension Island, Packer's Hole Cave: female holotype, and one juvenile (now lost), 26 March 1990, National Museums of Scotland, Edinburgh; N. P. Ashmole leg.

Etymology: The specific name is a Latin adjective meaning "blind".

Diagnosis: The female is diagnosed by the absence of eyes, by the whitish colour, by the metatarsal trichobothria, and by the epigynum (Figs. 1–2). The male is not known.

Female holotype (all measurements in mm): Total length 1.25. Carapace length 0.5. Carapace white. Eyes absent, but with a few very faint reflecting spots in ocular area. Chelicerae pale yellow, with moderate sized teeth in anterior row. Abdomen white, fairly globular. Sternum whitish. Legs very pale yellow, long and slender. TmI 0.85; TmIV *c.* 0.9, slightly bent (Fig. 3). Measurements:

	Fe	Pa	Ti	Mt	Ta	Total
I	0.85	0.12	0.78	0.65	0.43	2.83
IV	0.78	0.13	0.75	0.63	0.37	2.66

Epigynum (Figs. 1–2).

Discussion

The number of troglobitic spiders (i.e. spiders obligately associated with the subterranean environment) known from volcanic caves and interstitial spaces on oceanic islands has been rising rapidly in recent years (Gertsch, 1973; Ribera *et al.*, 1985; Howarth, 1988; Merrett & Ashmole, 1989; Peck, 1990; Oromi *et al.*, 1991). The present discovery is of interest, however, in view of the extreme isolation of Ascension Island and its geological youth. Evolutionary adaptation to cave life involves physiological changes concerned with water balance that are incompatible with survival on the surface (Howarth, 1983), so it may be presumed that the ancestors of *C. caeca* that colonised Ascension were epigean species. Linyphiid spiders are unlikely candidates for trans-oceanic rafting on floating objects, but are well known for their abilities at long-distance dispersal by air (Darwin, 1912; Crosby & Bishop, 1936; Bristowe, 1939; Duffey, 1956; Southwood, 1962). One might therefore predict the presence of an epigean sister species of *Catonetria caeca* in surface habitats on Ascension. No such species has yet been discovered, the only linyphiids recorded by Duffey (1964) being *Bathyphantes* sp. and *Lepthyphantes* sp., and none being found during the recent work in barren surface habitats by N. P. and M. J. Ashmole (unpublished data).

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The activity cycle of the social spider *Phryganoporus candidus* (Araneae: Desidae)

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Summary

Regular observations of *Phryganoporus candidus* (= *Badumna candida*) (L. Koch) colonies over a two-year period showed that colony activity began at sunset and fell off between 2200 and 2400 h. Three components of activity were measured: web work, predation and extra-nest activity. Web work peaked before predation each evening. The activity cycle of *P. candidus* appears to be both exogenous and endogenous.

Introduction

Spiders of the genus *Amaurobius*, to which *Phryganoporus candidus* was previously referred (Gray, 1983), undertake more than 90% of their activity during the hours of darkness (Cloudsley-Thompson, 1957). Moreover, all of the permanent-social spiders, such as *Agelena consociata* Denis, are more or less nocturnal in habits (Cloudsley-Thompson, 1986), and this seems to be true also for colonial orb-weavers such as *Eriophora bistriata* (Rengger) (Fowler & Diehl, 1978), but very few studies on any spiders have considered whether these daily rhythms are exogenous, endogenous or composite (an example of the latter is the 24-hour cycle of photoreceptor physiology in the posterior median eyes of *Deinopis subrufa* L. Koch (Blest, 1978)). If circadian (endogenous) rhythms follow and reflect monophyletic and very ancient lineages in animals (Pittendrigh, 1966), then most 24-hour activity cycles of animals are likely to be composite, in so far as the cycles will also relate to extrinsic factors. For example, spiders of the genera *Dictyna* and *Mallos* become active in the early evening, a time when dipterans and other insect prey are themselves most active (Jackson, 1978).

Biological clocks in general (and in the present context, circadian rhythms in particular) have been classified in various ways. One such classification recognises "pure" rhythms (e.g. colour change in crabs), interval timers (e.g. pupal eclosion) and continuously consulted clocks (e.g. time-compensated sun orientation in bees) (Pittendrigh, 1958, in Saunders, 1982). These kinds of classifications reflect the fact that various behavioural and physiological activities of organisms will differ in their responses to photoperiodic and other environmental cycles in nature. Hence we might expect feeding activity to be more opportunistic, and less endogenous, in many animal species, than some other functions. Among spiders, web-spinning activity seems to be an especially finely-tuned circadian rhythmic behaviour (Tietjen, 1986).

This paper describes how feeding, spinning and extra-nest activity (defined below) relates to the 24-hour cycle in *Phryganoporus candidus* (L. Koch). As *Badumna candida* this is one of three species that together form what Gray (1983) has called the *candida* species group of the genus *Badumna*. A current revision, unpublished at the time of writing, proposes that *B. candida* revert to *Phryganoporus candidus* (L. Koch) (M. R. Gray, pers. comm.). Consequently, the latter name is used throughout this study.

Nests of this species are founded early in the year by individual females, and are subsequently enlarged by the female and her offspring (Main, 1971). Average colony size is about 100 spiders; most dispersal occurs between December and February in the Townsville area. Full details of the life cycle will be published separately.

Methods

Some observations were carried out in an area of open dry sclerophyll woodland surrounding James Cook University, Townsville, Queensland, in locations selected mainly for proximity and/or convenience of access, especially when working in the dark. Most observations, however, were carried out on 20 nests transported from the field to my garden, where they were housed in hanging wire-mesh frames. Five nests were relocated in this way in August 1987 and were disposed of in March 1988. Ten newly-collected nests then took their place from April 1988 until March 1989. Another five nests followed, between April 1989 and February 1990.

Observations were informal in the first year. In the second year, the following three main components of

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