

Notes on the genus *Draculoides* Harvey (Schizomida: Hubbardiidae), with the description of a new troglobitic species

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Abstract – A second species of *Draculoides*, *D. bramstokeri* sp. nov., is described from coastal caves of Barrow Island and Cape Range, Western Australia. The species differs from *D. vinei* (Harvey) in the shape and setation of the male flagellum and the presence of a female gonopod. The diagnoses of *Draculoides* and *D. vinei* are emended. Both species included in the genus are cavernicoles.

INTRODUCTION

The Australian schizomid fauna has recently been shown to consist of a diverse assemblage of species attributable to five genera (Harvey 1992). Amongst the most peculiar was a genus known only from a single cavernicolous species, *Draculoides vinei* (Harvey), which was shown to be abundant in the deep limestone caves of Cape Range, Western Australia (Vine *et al.* 1988; Humphreys *et al.* 1989; Humphreys 1990; Harvey *et al.* 1993). The discovery of a second species in the coastal caves of the Cape and in shallow limestone caves on Barrow Island provides an opportunity to test the generic characters used by Harvey (1992) to define *Draculoides*, and to examine the relationship between two troglobites separated by relatively small distances.

This paper is dedicated to Barbara York Main, whose prodigious arachnological accomplishments include one of the first papers on Australian schizomids (Main 1980).

All specimens examined are lodged in the Western Australian Museum, Perth (WAM), and methods of examination and notation follow Harvey (1992), with the exception of the flagellar setae, which follow the emendations of Cokendolpher and Reddell (1992). These emendations are cited here, to aid Australian students of the order, with the notation of Harvey (1992) followed by that of Cokendolpher and Reddell (1992): dm2=dm4, dl2=dl3, vm3=vm4 and vm4=vm5.

SYSTEMATICS

Family Hubbardiidae Cook

Genus *Draculoides* Harvey

Draculoides Harvey 1992: 82–83.

Type species

Schizomus vinei Harvey, 1988, by original designation.

Diagnosis

Pedipalpal trochanter without mesal spur. Movable cheliceral finger with 1–2 accessory teeth. Female genitalia **with or without** gonopod, and with 4 anteriorly directed ducts, sometimes subdivided, and sometimes connected basally before connection with bursa. Male flagellum laterally compressed.

Remarks

Draculoides was erected for a single species, *D. vinei* (Harvey) from Cape Range, Western Australia. The new species described below fits comfortably within *Draculoides*, but a major difference in the morphology of the female genitalia requires that the diagnosis be altered as indicated above by the bold notation. The presence of a gonopod in *D. bramstokeri* (Figure 8) indicates that the lack of a gonopod is apomorphic for *D. vinei*, which qualifies previous notions of character polarity discussed by Harvey (1992).

Relationships

Although *Draculoides* is well defined cladistically (Figure 1, Table 1), its relationships remain obscure, mainly due to the lack of suitable detailed descriptions of a large percentage of the Old World schizomids.

A cladistic analysis of the two known species of *Draculoides* highlights the significantly apomorphic nature of *D. vinei* compared with *D. bramstokeri* (Figure 1, Table 1). The character state polarities are justified as follows:

1. Flagellar seta dl1 is large in males of all species of Australian Hubbardiidae (where males are known), with the exception of *D. vinei*, and the

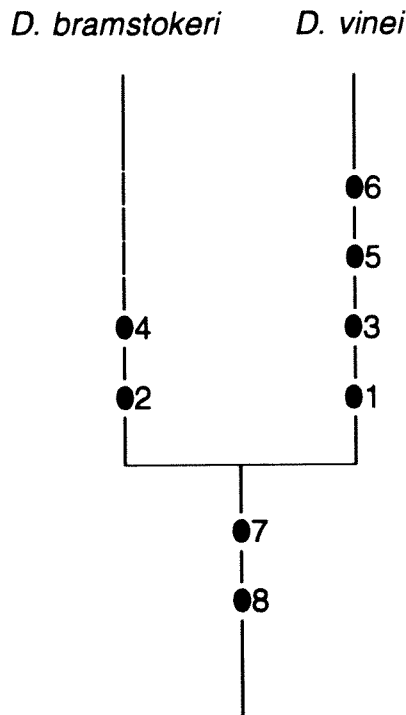


Figure 1 Cladogram depicting character state transformations in *Draculooides* (● = apomorphy).

small size is considered apomorphic.

2. The anterior displacement of flagellar seta vm1 in male *D. bramstokeri* (Figure 4) is unique amongst known male Australian hubbardiids, and is considered apomorphic.

3. The posterior constriction of the male flagellum is characteristic of *D. vinei*.

Table 1 Character matrix for cladistic analysis of *Draculooides* species.

Character states: plesiomorphy; apomorphy	<i>D. bramstokeri</i>	<i>D. vinei</i>
1. Male flagellum, seta dl1: large; very small	0	1
2. Male flagellum, seta vm1: on same level as vm2; anterior to vm2	1	0
3. Male flagellum, posterior constriction: absent; present	0	1
4. Female flagellum, seta vm2: on same level as dm1; anterior to dm1	1	0
5. Gonopod: present; absent	0	1
6. Size: small; large	0	1
7. Male flagellum: dorso-ventrally compressed; laterally compressed	1	1
8. Pedipalpal trochanter, mesal spur: present; absent	1	1

4. The anterior displacement of flagellar seta vm2 in female *D. bramstokeri* (Figure 6) is unique amongst known Australian hubbardiids, and is considered apomorphic.

5. The lack of a gonopod in female Australian hubbardiids is unique to *D. vinei*, despite its absence from some non-Australian schizomids (Cokendolpher and Reddell 1992).

6. The large size of adult *D. vinei* is unmatched amongst most other hubbardiids, including all Australian species.

7. Amongst the Hubbardiidae, the lateral compression of the male flagellum is unique to *Draculooides*.

8. The presence of a mesal spur on the pedipalpal trochanter was tentatively suggested as a synapomorphy for Hubbardiidae by Cokendolpher and Reddell (1992), with subsequent losses in several taxa. *Draculooides* is such a taxon.

Key to species of *Draculooides*

1. Males 2
Females 3
- 2(1). Flagellum constricted posteriorly in dorsal and ventral views; flagellar seta dl1 very small; flagellar seta vm1 on same level as vm2; carapace 1.74–1.89 mm in length
..... *D. vinei* (Harvey)
- Flagellum not constricted posteriorly in dorsal and ventral views; flagellar seta dl1 large; flagellar seta vm1 anterior to vm2; carapace 1.18–1.51 mm in length
..... *D. bramstokeri*, sp. nov.
- 3(1). Gonopod absent; carapace 1.66–2.07 mm in length *D. vinei* (Harvey)
- Gonopod present; carapace 1.26–1.47 mm in length *D. bramstokeri*, sp. nov.

***Draculooides vinei* (Harvey)**

Figures 1, 2

Schizomus vinei Harvey 1988: 16–19, figs 1–9.

Draculooides vinei (Harvey): Harvey 1992: 83, figs 1, 3, 7–11 (full synonymy); Adams and Humphreys 1993: 151–153; Harvey *et al.* 1993: 130.

Diagnosis

♂: dl1 very small; vm1 on same level as vm2. ♀: gonopod absent. Large body size, e.g. carapace length 1.74–1.89 (♂), 1.66–2.07 (♀) mm.

Remarks

The distribution of this species in the caves of Cape Range (Figure 2) is based on the records

provided by Harvey (1988, 1992) and Harvey *et al.* (1993), as well as some recently collected material from caves C-29, C-91, C-188, C-215 and C-312. Harvey (1992) claimed that flagellar seta dl1 is absent in males of *D. vinei*. In fact, it is present but quite small, and was overlooked in Harvey's (1992) setal notation as it was considered to be a microseta.

Draculoides bramstokeri sp. nov.

Figures 1-11

Draculoides sp.: Harvey *et al.* 1993: 130.

Holotype

♂, Ledge Cave (Cave B-1), Barrow Island, Western Australia, Australia, 20°48'S. 115°20'E., 6 Sept. 1991, W.F. Humphreys, B. Vine (WAM 93/2094).

Paratypes

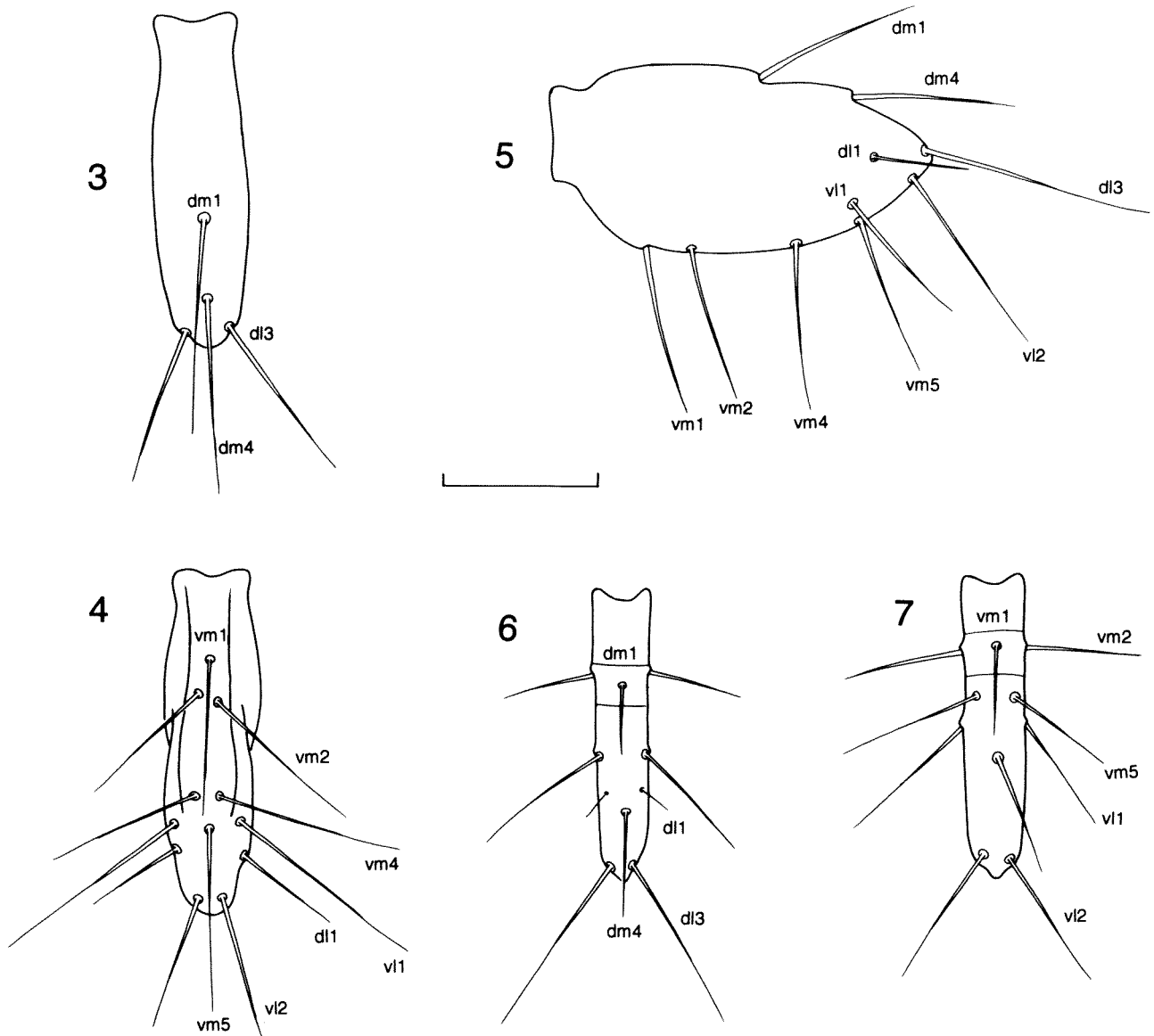
Australia: Western Australia: Barrow Island: 1♀, same data as holotype (WAM 93/2095); 1♂, 1♀, Cave B-1, 20°48'S. 115°20'E., 10 Sept. 1991, W.F. Humphreys, B. Vine, D. Goodgame (WAM 93/2096-2097); 1♂, Cave B-1, 20°48'S. 115°20'E., 25 April 1992, W.F. Humphreys, B. Vine (WAM 93/2098); 1♂, 3 juveniles, Cave B-1, 20°48'S. 115°20'E., 25 April 1992, W.F. Humphreys, B. Vine (WAM 93/2099-2102).

Other Material Examined

Western Australia: Barrow Island: 1 juvenile, 1 damaged specimen (cephalothorax only), Cave B-1, 20°48'S. 115°20'E., 12 Sept. 1991, W.F. Humphreys, B. Vine, J. Angas (WAM 93/2103-2104); 3 juveniles, Cave B-1, 20°48'S. 115°20'E., 29 November 1992, W.F. Humphreys, R. Wood (WAM 93/2105-2107); 1 juvenile, Cave B-1,



Figure 2 Map of north-western Australia showing known distributions of *Draculoides vinei* (Harvey) (●) and *D. bramstokeri*, sp. nov. (○).



Figures 3–7 *Draculoides bramstokeri*, sp. nov.: 3–5, flagellum, holotype male: 3, dorsal; 4, ventral; 5, lateral; 6–7, flagellum, paratype female (WAM 93/2095): 6, dorsal; 7, ventral. Scale line, 0.2 mm.

20°48'S. 115°20'E., 25 July 1992, W.F. Humphreys, B. Vine (WAM 93/2108); 2 macerated specimens, Bore WB2, 20°52'S. 115°21'E., remains in water-sample from water bore, 27 July 1992, W.F. Humphreys, B. Vine (WAM 93/2109–2110); 1 juvenile, Cave B–6, 20°51'S. 115°23'E., 24 April 1992, W.F. Humphreys, D. Brooks (WAM 93/2111); 1♂, Cave B–10, 20°49'S. 115°23'E., 26 April 1992, W.F. Humphreys, D. Brooks (WAM 93/2112); 1♂, 2 juveniles, Cave B–10, 20°49'S. 115°23'E., 25 July 1992, W.F. Humphreys, B. Vine (WAM 93/2113–2115). **Cape Range:** 1♂, 1♀, Cave C–452, 21°58'S. 114°07'E., 11 August 1992, W.F. Humphreys, D. Brooks (WAM 93/2116–2117); 2♀, Cave C–452, 21°58'S. 114°07'E., 11 January 1994, R.D. Brooks (WAM 94/42–43); 1 juvenile, bore E2, 21°56'S. 114°07'E., trap, 24 June 1993, W.F. Humphreys, R.D. Brooks (WAM 93/2118); 2

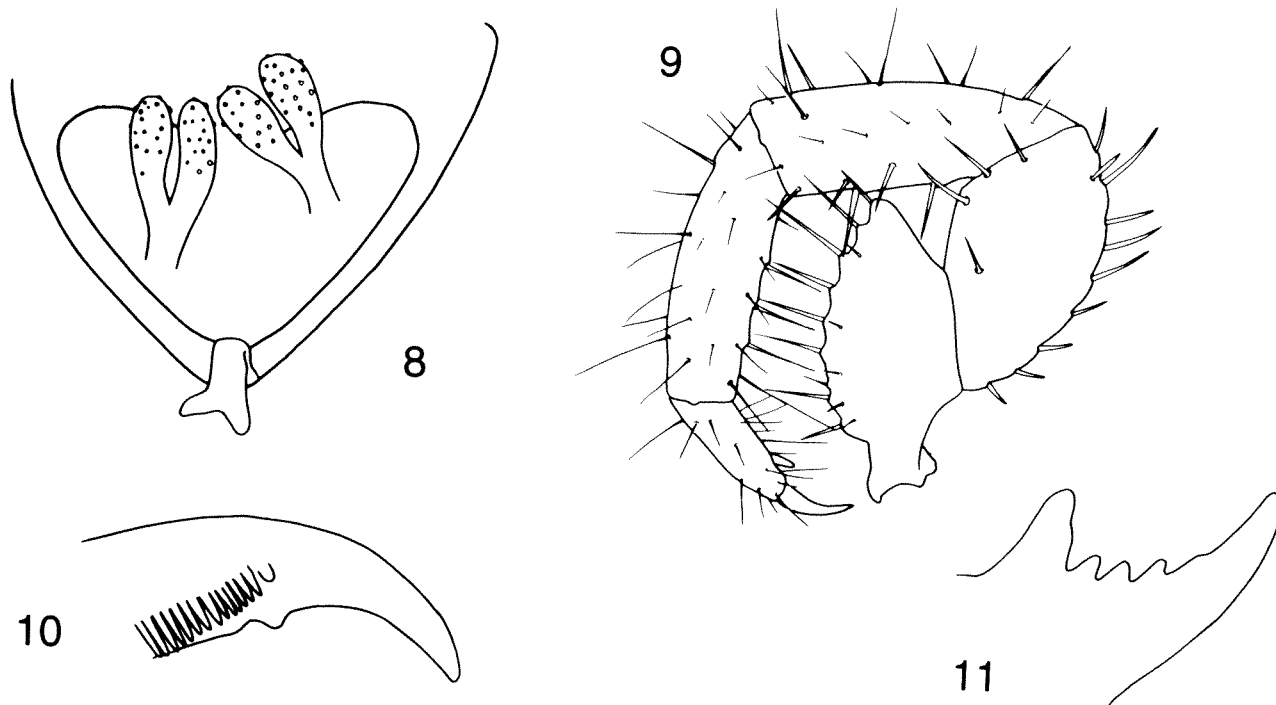
juveniles, bore E2, 21°56'S. 114°07'E., trap, 3 August 1993, R.D. Brooks, W.F. Humphreys (WAM 93/2119–2120); 3 juveniles, bore E2, 21°56'S. 114°07'E., haul net, 17 June 1993, R.D. Brooks, W.F. Humphreys (WAM 93/2121–2123).

Diagnosis

♂: flagellar seta dl1 large; vm1 situated anterior to vm2. ♀: gonopod present. Small body size, e.g. carapace length 1.18–1.51 (♂), 1.26–1.47 (♀) mm.

Description

Colour light yellow-brown. Carapace with 9 setae, arranged 2: 1: 2: 2: 2; anterior margin drawn to a sharply downturned point between chelicerae; eye spots absent. Mesopeltidia widely separated. Metapeltidium divided. Anterior sternum with 12 setae, including 2 sternapophysial setae; posterior



Figures 8–11 *Draculoides bramstokeri*, sp. nov.: 8, spermathecae, dorsal, paratype female (WAM 93/2095); 9–11, holotype male: 9, left pedipalp, lateral; 10, movable finger of left chelicera, lateral; 11, fixed finger of left chelicera, lateral.

sternum triangular, with 6 setae. Chaetotaxy of tergites I–IX: 2+4 (microsetae diagonal): 2+6 (microsetae in column): 2: 2: 2: 2: 4: 4; tergite XII with very small dorsal process. Flagellum of ♂ (Figures 3–5) laterally compressed; 4.00 times longer than broad; seta dl1 large; vm1 anterior to vm2. Flagellum of ♀ (Figures 6–7) 3 segmented, first segment slightly longer than second, third longest; seta vm2 slightly anterior to dm1. Female genitalia (Figure 8): 4 spermathecae, each pair connected basally before connection with bursa; evenly covered with small pores; small gonopod present, barely bifurcate distally. Pedipalp (Fig. 9): not sexually dimorphic; without apophyses; trochanter with sharply produced distal extension, ventral margin with stout setae, without mesal spur; tibia and tarsus lacking spines; tarsus with spurs; claw 0.63 (♂), 0.60 (♀) length of tarsus. Chelicera: fixed finger (Figure 11) with 2 large teeth plus 3–4 smaller teeth between these, basal tooth with 1 small, blunt, lateral tooth, distal tooth with 1 small, blunt, lateral tooth; brush at base of fixed finger composed of 8 (♂), 9 (♀) setae, each pilose in distal half; lateral surface with 4 large, lanceolate, terminally pilose setae; movable finger (Figure 10) file composed of 14 (♂), 17 (♀) long lamellae, small blunt guard tooth present subdistally, 1 accessory tooth present near middle of file. Legs: tarsus I with 6 segments; femur IV 3.17 (♂), 2.96 (♀) times longer than wide.

Dimensions (mm), holotype ♂ (paratype ♀, WAM 93/2095): Body length 4.3 (5.1). Carapace

length/width 1.28/0.73 (1.40/0.81). Chelicera 0.95 (1.07). Flagellum 0.48/0.12 (0.41/0.07). Pedipalp: trochanter 0.68 (0.67), femur 0.66 (0.70), patella 0.72 (0.74), tibia 0.68 (0.71), tarsus 0.32 (0.35), claw 0.20 (0.21), total excluding claw 3.06 (3.17). Leg I: trochanter 0.46 (0.49), femur 1.63 (1.48), patella 2.19 (1.89), tibia 1.74 (1.48), metatarsus 0.41 (0.46), tarsus 0.65 (0.72), total 7.08 (6.52). Leg II: trochanter 0.26 (0.26), femur 1.17 (1.13), patella 0.67 (0.64), tibia 0.90 (0.86), metatarsus 0.63 (0.58), tarsus 0.49 (0.52), total 4.12 (3.99). Leg III: trochanter 0.26 (0.25), femur 0.99 (0.98), patella 0.44 (0.43), tibia 0.59 (0.57), metatarsus 0.65 (0.61), tarsus 0.50 (0.51), total 3.43 (3.35). Leg IV: trochanter 0.41 (0.41), femur 1.49 (1.39), patella 0.69 (0.66), tibia 1.18 (1.06), metatarsus 0.96 (0.87), tarsus 0.62 (0.62), total 5.35 (5.01).

Variation: carapace length for all adults, 1.18–1.51 (♂, n=7), 1.26–1.47 (♀, n=5) mm.

Remarks

Draculoides bramstokeri is quite similar to *D. vinei* from Cape Range, Western Australia, but differs by the size of seta dl1 in the male flagellum, the presence of a gonopod, and by its smaller size. Specimens of *D. bramstokeri* have been collected from five caves or bores on Barrow Island, and specimens have been sighted, but not collected, in cave B–3, which is indicated on Figure 2.

Biogeography

The two known species of *Draculoides* have

similar, but apparently non-overlapping distributions. *D. vinei* is restricted to the cavernous Tulki Limestone of the Cape Range Formation where numerous specimens have been collected (Harvey *et al.* 1993). *D. bramstokeri* occurs in caves on Barrow Island and on the Cape Range coastal plain (Figure 2). The presence of *D. vinei* in cave C-215 reported by Harvey *et al.* (1993) was based on a single juvenile specimen. This cave is formed in Tulki Limestone, of Lower Miocene age, that reaches sea level on the western coastal plain of the peninsula. The cave contains the millipede *Stygiochiropus communis* Humphreys and Shear which occurs in sympatry with *D. vinei* throughout much of Cape Range (Humphreys and Shear 1993), whereas C-452 contains an undescribed *Stygiochiropus*. Hence the specimens from C-215 could represent either *D. vinei* or *D. bramstokeri* and so adult specimens are required to establish the identity of this isolated population.

Barrow Island is also part of the Cape Range Formation but the Tulki-like Poivre Formation is younger (Middle Miocene; McNamara and Kendrick 1994). The anticlinal system appears to have been fully emergent, at least on Cape Range, since the Miocene (Wyrwoll *et al.* 1993). Barrow Island and the Cape Range peninsula have been isolated by the sea since the Holocene rise in sea level but they would have been connected by the emergent North West Shelf for the greater part of the last several million years (Humphreys 1993). Widespread populations in the subterranean voids of this shelf are envisaged, allowing genetic interchange throughout the area in the terrestrial components of the subterranean fauna (Humphreys 1993), as is found in the aquatic subterranean fauna (Adams and Humphreys 1993). For this reason *D. bramstokeri* would not be expected to show the considerable protein heterogeneity found in *D. vinei*, with populations in the various caves forming complex electrophoretic substructuring (Adams and Humphreys 1993).

As *D. vinei* is apomorphic relative to *D. bramstokeri* in many morphological characters (Fig. 1), it may have been isolated in the Tulki Limestone from a more widespread population either by higher sea levels or, as suggested for an amphipod species (Humphreys 1993), by the elevation of the Cape Range anticline.

Other karst systems are not yet known from the southwestern Pilbara region of Western Australia, but if they occur, may be found to contain further schizomid species.

Etymology

This species is named for Bram Stoker (1847–1912), author of the novel *Dracula*, which was first published in 1897.

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