NOTES ON AUSTRALIAN CAVE HARVESTMEN

(Abridged version. A fuller account is to be published elsewhere)

by

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Whilst some components of the arthropod fauna of Australian caves are comparatively well known, members of the order Opiliones (harvestmen) have been little studied. Harvestmen, however, are important predators in many caves, as are their arachnid relatives, the spiders and pseudoscorpions. In Australia there is growing interest in ecological relationships within cave communities (Harris, 1970; Richards, 1971) and it seems desirable to expand the fragmentary notes hitherto published on Australian cave harvestmen.

Harvestmen have a nearly world-wide distribution but most of the 3,500 or so species are found in moist forested areas from the tropical to temperate zones. The layman often confuses harvestmen with spiders and in some museums it is not unusual to find specimens in bottles ostensibly containing only spiders. Harvestmen have the following characteristics, which, taken together, readily distinguish them from other arachnid orders. The cephalothorax is broadly joined to the abdomen and this immediately separates them from the spiders which have a narrow "waist", the pedicel. The chelicerae are pincers, not fangs. The second legs are usually the longest and are the main tactile organs. They generally tap the ground ahead when the animal is moving. Harvestmen usually have two eyes on a median eye-mound. A pair of stink glands opens onto the body above the legs and a defensive secretion is released when the animal is seriously disturbed.

General comments on the Australian cave harvestmen fauna

The order Opiliones is divided into three suborders, each of which is represented in Australia. The only Australian species of the primitive mite-like Cyphophthalmi is found in leaf litter (Forster, 1955). Cavernicoles have been recorded in Europe and South Africa (Vandel, 1965).

The suborder Palpatores is represented in Australia by the family Phalangiidae (sub-family Megalopsalinae) and the Acropsopilionidae. Species in the latter group are usually found in leaf litter and have not been recorded in caves. The Megalopsalinae occur in Australia and New Zealand, usually in lower vegetation strata and under logs. They are extremely long-legged and are sometimes confused with the familiar daddy-long-legs spider. As in other Phalangiidae, there are no troglobitic species in the Megalopsalinae, though they may occupy an important position in the cave food web (Richards, 1960; 1963; 1971). Large numbers may be found in the twilight zone of the cave and constitute part of the parietal fauna. It is probably best to regard the cave as an extension of the normal sheltered surface habitat.

Members of the suborder Laniatores have robust, heavily sclerotized bodies. They are readily distinguished from the Palpatores by their strong raptorial pedipalps, nearly always heavily armed with spines and a strong claw. Most species are found under or in rotting logs, under loose-fitting rocks, or in leaf litter and moss in forested areas. Several cavernicoles have been described from temperate latitudes.

Three families occur in Australia, the Phalangodidae, Assamiidae and Triaenonychidae. Most phalangodids and assamiids occur in northern Australia, none occur in Tasmania (or New Zealand). They do not have any cave adapted representatives in Australia, though many phalangodids in Europe and North America are true troglobites often possessing extreme cave adaptations including complete eye and pigment loss and marked leg elongation (Vandel, 1965; Goodnight and Goodnight, 1960; 1967). The few specimens collected in Australian caves can probably be classified as "accidentals".

Australian Laniatores possessing some degree of "cave adaptation" belong to the Triaenonychidae, sub-family Triaenonychinae, which also includes all the cave adapted New Zealand species. The Triaenonychidae have an essentially southern distribution: southern Africa, Madagascar, Australia (where they have a typically Bassian distribution), New Caledonia, New Zealand and southern South America. Four described species occur in North America, two of which have been recorded in caves. Cavernicolous Triaenonychidae are listed in Table 1 with an indication of the cave adaptations they possess. Two closely related families contain cavernicolous representatives. The Erebomastridae contains some interesting cave species (Briggs, 1969) while the Travuniidae of Europe and Japan contains many species with striking cavernicolous modifications.

Cavernicolous adaptations in Australian harvestmen

In general, cavernicolous harvestmen exhibit, to varying degrees, three modifications which are regarded as cave adaptations: long and thin legs, depigmentation and eye regression.

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Table 1: Cavernicolous Harvestmen of the family Triaenonychidae

Country	Species	L	T	C	D	R	S	Source
South Africa	*Speleomontia cavernicola* Lawrence	X			X	X		Lawrence (1931)
	Larifuga sp.							Lawrence (1964)
Madagascar	*Ivohibea cavernicola* Lawrence						X	Lawrence (1959)
	Tanalaius milloti Lawrence						X	"
	Millomontia brevispina Lawrence	X			X?			"
	Decarynella gracillipes Fage	X	X	X	X			Fage (1945) Lawrence (1959)
Australia	*Holonuncia cavernicola* Forster	X			X			Forster (1955)
	Holonuncia sp. *ex* Colong Cave	X			X	X		Hunt (in prep.)
	Holonuncia spp. *ex* NSW caves	X			X			"
	new genus, new species *ex* Victoria	X		X	X			"
	Monoxyomma cavaticum Hickman	X	X	X	X			Hickman (1958)
	Monoxyomma sp. *ex* Mole Creek	X	X	X	X			Hunt (in prep.)
	Calliuncus sp. *ex* Western Australia	X			X			"
New Zealand	*Hendea myersi cavernicola* Forster	X	X		X			Forster (1954)
	H. spina Forster	X	X		X			Forster (1965)
	H. takaka Forster	X			X			"
	H. maini Forster	X	X		X			"
	H. aurora Forster	X			X			"
	H. coatesi Forster	X	X		X			"
	H. townsendi Forster	X	X		X			"
	Nuncia (Nuncia) marchanti Forster	X	X		X			"
	N. (N.) kershawi Forster	X	X		X			"
	N. (N.) townsendi Forster	X	X		X			"
United States	*Sclerobunus cavicolens* (Banks)	X		X?	X			Goodnight and Goodnight (1943)
	Zuma acuta Goodnight and Goodnight				X		X	Briggs (1967)

L, T, C, D and R = possible cavernicolous adaptations   S = found also on surface

L = long and thin legs
T = increase in tarsal segmentation
C = modification of tarsal claws
D = depigmentation
R = eye regression

The Australian cave species listed in Table 1 have relatively longer legs than surface species, except *Monoxyomma rotundum* Forster from northern Queensland. The two Tasmanian species of *Monoxyomma* show greatest lengthening. Because of their sensory role, it migl t be expected that the second pair of legs in cave harvestmen are more greatly elongated relative to the other legs. No significant difference has been detected in Australian species, however.

Forster (1965) recognised a tendency for increased tarsal segmentation correlated with increased leg length in New Zealand cave species. The Tasmanian *Monoxyomma* spp. are the only Australian species in which this is evident.

Another modification which seems to occur in some cave forms affects the tarsal claw. In *M. cavaticum*, *Monoxyomma* sp. from Mole Creek, and the species in the Buchan area, the claws are greatly elongated. In *Monoxyomma* spp.

there may be some tendency for shortening of the lateral prongs on the claws of legs 3 and 4, as is the case for *Decarynella gracillipes* Fage of Madagascar (Lawrence, 1959) and *Sclerobunus cavicolens* (Banks) of the United States (Goodnight and Goodnight, 1943).

Partial depigmentation has affected the majority of Australian cave species, as is the case for the New Zealand fauna (Forster, 1965). Most are straw-yellow or orange in colour whilst closely related surface species are orange-brown, reddish-brown or dark-brown.

Complete loss of eyes has been recorded in only one triaenonychid, the South African *Speleomontia cavernicola* Lawrence. *Holonuncia* sp. from Colong Caves, New South Wales* has much smaller eyes than other cave or surface species in the genus and is the only Australian harvestman to have undergone eye regression. The retina and lens are still present, however. The eyemound is also relatively low in the Colong species, paralleling a similar trend amongst cave harvestmen in other countries.

As the biology of Australian species has not been studied and the fauna outside caves not adequately sampled, no attempt is made in this paper to assign species to the categories of troglobite or troglophile. Many European species, thought to be restricted to caves, have subsequently been found on the surface (Juberthie, 1964).

Composition and distribution of the Australian Cave Harvestman fauna

Only three described triaenonychid genera in Australia contain cave adapted species: *Holonuncia* Forster, *Monoxyomma* Pocock and *Calliuncus* Roewer. A new genus will probably be erected for the Victorian cave species.

New South Wales. Although Forster (1955) placed specimens from Jenolan and Yarrangobilly Caves in the same species, *Holonuncia cavernicola*, it is now clear they are distinct (Hunt, in prep.). Hamilton-Smith (1967) records *H. cavernicola* from Basin Cave, Wombeyan, and from Wyanbene Cave near Braidwood. Again, it seems that these forms belong to different species. Until a study of the New South Wales cave harvestmen is complete, the name *H. cavernicola* should only be applied to the Jenolan Caves populations. *Holonuncia* spp. have also been collected at the Isaacs Creek (where the population may be in danger), Tuglow, Colong, Cleifden, Bungonia and Wee Jasper Caves. The genus has numerous surface representatives, including an undescribed species from bush-land in Sydney's suburbs.

Victoria. The species collected from caves in the Buchan area apparently belong(s) to a new genus which is very closely related to *Holonuncia* and has affinities with the Tasmanian species placed in *Monoxyomma.* Further male specimens are required before the status of different populations in the Buchan area can be assessed.

Tasmania. One species, *Monoxyomma cavaticum* Hickman occurs in the Hastings and Ida Bay caves in the south but a closely related species has recently been collected from the Mole Creek Caves in northern Tasmania. One surface species, *M. silvaticum* Hickman, has been described from north-east Tasmania (Hickman, 1958), and has recently been collected in a mine adit at Lottah and a small granite cave near Scottsdale. These three species will have to be removed from *Monoxyomma* and placed in a new genus (Hunt, in prep.).

Monoxyomma cavaticum is apparently common in Mystery Creek and Exit Caves, Ida Bay, where it is found associated with the glow-worm *Arachnocampa (Arachnocampa) tasmaniensis* Ferguson (Goede, 1967). *Hendea myersi cavernicola* Forster preys on New Zealand glow-worms (Richards, 1960) and this may also be true for *M. cavaticum.*

Western Australia. The only species to show cavernicolous modifications is *Calliuncus* sp. from Labyrinth Cave, Margaret River area, in the South-West (Table 1).

Large numbers of the megalopsaline *Spinicrus minimus* Kauri occur just inside entrances of various caves in the Margaret River—Augusta area and the triaenonychid *Nunciella aspera* (Pocock) has been taken under rocks in the entrance doline of Strongs Cave (Hunt, 1971). The former is probably the species to which Hamilton-Smith (1967) refers. Neither is confined to caves.

An interesting new species wrongly determined as *Spinicrus* sp., has been collected from several caves and dolines on the Nullarbor Plain (Richards, 1971). Numerous individuals were taken on the surface at night in the vicinity of Lynch Cave (J.W.J. Lowry, pers. comm.).

Spiracle structure indicates the Nullarbor species is more closely related to species in the south-west of Western Australia than to those in eastern States. The structure is so radically different that the Western Australian species will have to be placed in a new genus. Spiracle structure has been regarded as a useful family character (Silhavy, 1970) but in the Megalopsalinae appears to be of value at the generic level.

Contrary to Richards (1971), the Nullarbor harvestman does not fill a gap in an east-west distribution of the genus *Spinicrus* Forster, but links this component of the Nullarbor fauna with species to the west.

* Maps showing locations of cave areas are given by Matthews (1968).

Conclusions

It is evident that there are gaping lacunae in our knowledge of Australian cave harvestmen; even the basic systematics remain to be worked out. Taxonomic confusion has resulted in mistaken generalizations about the zoogeography of Australian species. A taxonomic study of the Australian cave triaenonychids is in preparation but more material, especially series containing both sexes and samples of the surrounding surface fauna, is required before the amount of intraspecific variation, interspecific affinities and cavernicolous adaptations can be assessed. Any observant speleologist, equipped with a bottle containing 70% ethyl alcohol (or methylated spirits), a pencil and note book, can make a useful contribution in this regard. Care should be taken not to "over-collect", however, as many populations may be quite small and extremely vulnerable to the predations of over-zealous collectors.

A study on the biology of Australian cave harvestmen is also overdue, especially with regard to the degree of physiological adaptation to the cave environment.

Addendum

Since writing, a new cavernicolous species has been collected by T. Goede in King Georve V Cave at Hastings, Tasmania. The species is closely related to *Lomanella exigua* Hickman but the appendages are much elongated and the body depigmented. *L. exigua* has been collected from surface habitats about 15 miles to the north, but to date *L. raniceps* Pocock is the only *Lomanella* species to be taken from surface habitats at Hastings.

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Erratum

According to Juberthie (1964) the South African triaenonychid *Speleomontia cavernicola* is eyeless but Lawrence's (1931) description indicates this species has well developed eyes. Juberthie has been followed in this paper but presumably in error.

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