Mouse spider bites (*Missulena* spp.) and their medical importance

A systematic review

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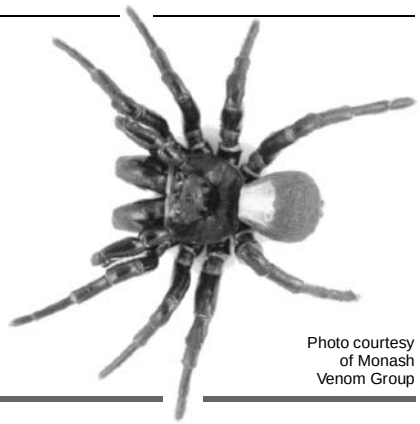

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ABSTRACT

Objective: To determine the clinical significance of definite bites by mouse spiders (Actinopodidae: *Missulena* spp.) from published case reports/series and museum records.

Data sources: A computerised literature search of MEDLINE and EMBASE was undertaken. All cases reported to major Australian museums and reports from venom researchers working with mouse spiders were also reviewed. Textbooks on clinical toxinology were searched and further reports of cases were located.

Study selection: All cases of definite spider bites where the spider was collected and identified by an expert as a mouse spider were included.

Data extraction: All reports were evaluated and the following data extracted: patient demographics (age, sex, geographical location, season), bite site, local and systemic effects, and hospital attendance. Clinical effects were classified into three groups: severe neurotoxic envenoming, local neurotoxic effects or mild systemic effects, and minor local effects.

Data synthesis: Forty definite bites were identified from around Australia, with only one case of severe envenoming (a 19-month-old child). Local neurotoxic effects occurred in six cases and minor systemic effects in five. There was no evidence of envenoming in most bite victims, and the rate of severe envenoming was 2.5% (95% CI, 0–13%). There were no recorded deaths.

Conclusions: In most cases, bites by mouse spiders cause only minor or moderate effects. Severe envenoming is rare and far less common than for funnel-web spider bites. Mouse spider bites do not appear to be a major medical problem.

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MOUSE SPIDERS HAVE been recognised for decades,[1,2] although there have been few published reports of definite bites.[3,4] A single report of a severe bite in a 19-month-old child by the eastern mouse spider (pictured) has, in the absence of other reports, caused significant concern about the severity of mouse spider bites.[5]

Mouse spiders (Actinopodidae: *Missulena* spp.) are mygalomorph spiders that have a body length of 10–35 mm and an obvious bulbous head. They are often mistaken for funnel-web spiders (*Atrax* spp.) by non-experts because of their similar appearance. Mouse spiders occur throughout mainland Australia and the three commonest species are the eastern mouse spider (*Missulena bradleyi*, pictured), the red-headed mouse spider (*M. occatoria*) and the northern mouse spider (*M. pruinosa*). The eastern mouse spider occurs in eastern Australia from Queensland to Victoria in a distribution similar to that of funnel-web spiders. The red-headed mouse spider occurs across most of the mainland, except southern Victoria and northern Australia. The male of this species has a bright red cephalothorax. The northern mouse spider is restricted to tropical northern Australia and is most commonly encountered around Darwin.[4]

Recently, researchers demonstrated that mouse spider venom is similar to funnel-web spider venom.[6] These venom studies also showed that the in-vitro effects of mouse spider venom are readily reversed by funnel-web spider antivenom.

The increasing concern about mouse spider bites makes it important to determine their medical significance. This review includes all reported bites in the literature and museum reports.

METHODS

Multiple sources were used to identify all mouse spider bites reported in Australia. Only definite bites were included where the spider had been collected and identified by an expert. Bite reports were gathered from:

- a systematic review of the literature;
- collation of all cases reported to major museums; and
- reports from venom researchers working with *Missulena* spp.

MEDLINE and EMBASE (as at 2 November 2003) were searched using the terms "Missulena", "Actinopodidae" and "Mouse Spider". Textbooks on clinical toxinology were also searched and further reports of cases were found. All reference lists were also searched and authors were contacted where possible.

Major museums that employ an arachnologist who could search for *Missulena* specimens responsible for bites were contacted. Museums contacted were the Australian Museum, Museum Victoria, the Queensland Museum, the South Australian Museum and the Western Australian Museum. Additional arachnologists were contacted for any other records or specimens. Venom researchers working with *Missulena* spe-

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cies and clinical toxicologists were also contacted, and asked if they were aware of any unreported definite bites. Museums, arachnologists and venom researchers were contacted from 1 August to 24 November 2003.

The following data were extracted from all reports of definite mouse spider bites: victim demographics (age, sex, geographical location, season), bite site, local and systemic effects, and hospital attendance. Clinical effects were classified into three groups: severe neurotoxic envenoming (similar to funnel-web spider envenoming), local neurotoxic effects or mild systemic effects, and minor local effects. Bites from mouse spider species were correlated with reported effects.

RESULTS

Searching MEDLINE and EMBASE identified one case series from 45 "hits".[4] Searching major clinical toxinology textbooks[7,8] and reference lists identified the rest. Most reported cases were in museum publications, conference abstracts and non-peer-reviewed publications.[1-3,5,9] One series of seven bites by *M. pruinosa*,[4] a report of two *M. bradleyi* and one *M. occatoria* bites[2] and three separate case reports of *Missulena* spp. bites were identified (13 bites)[1,3,5] (Box 1). A further 13 cases (nine new ones) were reported recently, but were not available on MEDLINE at the time of the search.[10]

Eighteen further bites were identified from the records of museums, including 10 cases from the Queensland Museum (an 11th bite is the same as reported by Lake[1]), seven cases from the Australian Museum, and one case from the Western Australian Museum (Box 1). There were no records of bites from Museum Victoria and the South Australian Museum, and no further reports were identified from contacting venom researchers, clinical toxicologists and arachnologists.

All 40 definite bites are recorded with clinical information in Box 1. Only one bite caused severe neurotoxic envenoming, giving a severe envenoming rate of 2.5% (95% CI, 0–13%). Six bites, all by *M. bradleyi*, caused minor local neurotoxic effects (paraesthesiae, numbness and diaphoresis). Minor systemic effects (headache and nausea) occurred in five cases. Nine children were bitten by *M. bradleyi*. Three of these children were younger than 2 years, and suffered only minor effects.

The seasonality of bites by the three main species (31 bites) is presented in Box 2.

DISCUSSION

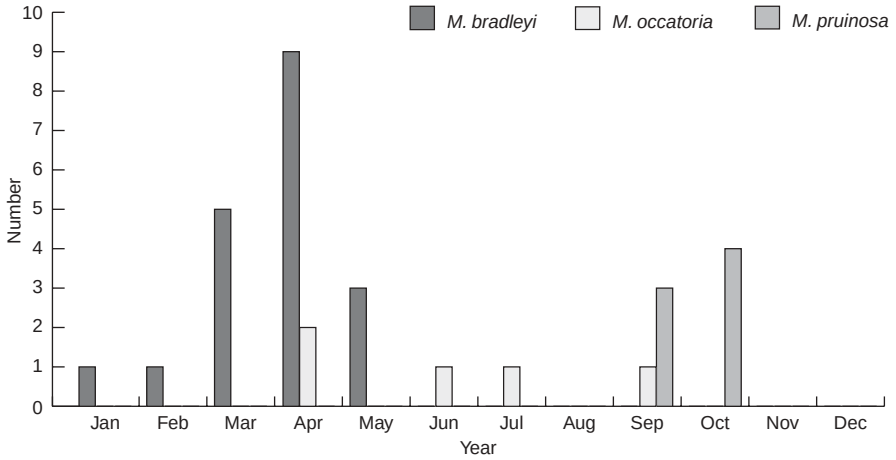
Bites by mouse spiders have been reported from most parts of Australia,

1: Forty reported cases of mouse spider bites

Species*	Clinical details	No.	Source
M. bradleyi	A man and a 15-month-old child. No effects	2	Musgrave[2]
	A 19-month-old child. Severe neurotoxic envenoming similar to funnel-web spider envenoming, with hypertension, muscle spasms, opisthoclonus and unconsciousness. Appeared to respond to funnel-web antivenom	1	Rendle-Short[5]
	Man bitten three times. No initial effects. After 48 hours, he developed an inflamed 15 cm region that became purulent and indurated. This resolved with antibiotics	1	Lake[1] (also in Queensland Museum records)
	Four bites in adults and two bites in children. Three showed local paraesthesiae, and two of the three had minor systemic effects	6	Isbister and Gray[10]
	One bite in an adult. No effect	6	Australian Museum records (1936–1989)
	Five bites in children. No major effects reported. One girl had numbness in the bitten hand; one boy had "sweats" and was taken to hospital		
	Three adults and one 7-year-old boy. All had local pain. One adult had numbness of the fingers and toes	4	Queensland Museum records (1968–1998)
M. occatoria	Woman bitten by a female spider. Local swelling only	1	Musgrave[2]
	Woman bitten by a female spider, and a 14-month-old child bitten by a male spider. Both suffered no effects	2	Queensland Museum records (1968–1998)
	Three-year-old child. Local pain	2	Isbister and Gray[10]
	56-year-old man. Severe local pain and headache		
M. pruinosa	Three cases. Minor local effects only	3	Isbister et al[4]
	Four cases (one child). Local effects; two patients had headaches	4	Isbister and Gray[10]
M. granulosa	Adult. Pain with the bite, and a small lump	1	Western Australian Museum records (2000)
	Thirty-six-year-old woman. Local effects only	1	Isbister and Gray[10]
M. dipsaca	Woman. Minor effects only	1	Faulder[3]
Missulena spp.	One bite in a 6-month-old child. Developed a red and swollen finger for 4 hours, but no other effects	1	Australian Museum records (1936–1989)
	Four reported bites, all by female spiders, one in a 4-year-old child. No major effects reported. Pain, nausea and vomiting occurred in one case	4	Queensland Museum records (1968–1998)

* All bites were by male spiders unless otherwise noted.

2: Seasonality of 31 reported mouse spider bites for the three major species



The month of the bite was not reported for one *M. bradleyi* bite.[5]

and in almost all cases only minor or moderate effects have occurred requiring no major intervention. There is one severe case of a young child who received funnel-web spider antivenom and appeared to have some response.[5] This demonstrates that severe envenoming from mouse spiders is likely to be rare (2.5%) and these spiders are unlikely to be a major concern. However, in regions where funnel-web spiders are endemic, the similar appearance of mouse spiders means that all bites by big black spiders should be initially managed as for a funnel-web spider bite.[11]

It is unclear why the bites of these spiders cause little effect when the venoms of at least two species have been shown to be similar to funnel-web spider venoms[6,12,13] and their effects can be reversed by funnel-web spider antivenom.[6] Recently, the toxin δ-missulenatoxin-Mb1a was isolated from the venom of *M. bradleyi*, and was shown to be 88% homologous with the medically important δ-atracotoxin-AR1a (previously "robustoxin") from the Sydney funnel-web spider.[13] It has been suggested by some that it may be that most bites are "dry" bites, but it is unclear why venom would rarely be injected by the spider.

The rate of severe envenoming in mouse spider bites (2.5%) is less than that for funnel-web spiders, which is thought to be between 10% and 25%, depending on species.[10] In addition, only one case of severe envenoming from a mouse spider could be identified, whereas at least 5–10 cases of severe funnel-web spider envenoming occur each year in eastern Australia.[14] Therefore, severe mouse spider envenoming is an extremely rare event and unlikely to be a major medical issue.

The small sample of cases makes it difficult to differentiate between species, but the eastern mouse spider (*M. bradleyi*) appears to be the most venomous — it caused the only severe envenoming, and most of the moderate envenomings in the recent prospective series.[10]

Mouse spider bites show a seasonal pattern of bites corresponding to the spring months in northern Australia and the autumn–early winter months in more southerly regions. Box 2 demonstrates this best for *M. bradleyi* in eastern Australia and *M. pruinosa* in the Northern Territory.

Because of the similarity between mouse spiders and funnel-web spiders and the similar distribution of the eastern mouse spider and funnel-web spiders, it is advisable that all such cases in eastern Australia be observed in an emergency department for 4 hours after the bite to exclude major envenoming. In regions of Australia outside the distribution of funnel-web spiders a shorter observation period of 1–2 hours may be more appropriate. Work in animals indicates funnel-web spider antivenom may be considered for treatment of mouse spider bites if there is severe systemic neurotoxic envenoming.[6] A pressure bandage with immobilisation is appropriate first aid for mouse spider bites.

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COMPETING INTERESTS

None identified.

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