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Bites by spiders of the family Theraphosidae in humans and canines

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Abstract

Spiders of the family Theraphosidae occur throughout most tropical regions of the world. There have only been three case reports of bites by these spiders in Australia. The aim of this study was to describe the clinical effects of bites by Australian theraphosid spiders in both humans and canines. Cases of spider bite were collected by the authors over the period January 1978–April 2002, either prospectively in a large study of Australian spider bites, or retrospectively from cases reported to the authors. Subjects were included if they had a definite bite and had collected the spider. The spiders were identified by an expert arachnologist to genus and species level where possible. There were nine confirmed bites by spiders of the family Theraphosidae in humans and seven in canines. These included bites by two *Selenocosmia* spp. and by two *Phlogiellus* spp. The nine spider bites in humans did not cause major effects. Local pain was the commonest effect, with severe pain in four of seven cases where severity of pain was recorded. Puncture marks or bleeding were the next most common effect. In one case the spider had bitten through the patient's fingernail. Mild systemic effects occurred in one of nine cases. There were seven bites in dogs (*Phlogellius* spp. and *Selenocosmia* spp.), and in two of these the owner was bitten after the dog. In all seven cases the dog died, and as rapidly as 0.5–2 h after the bite. This small series of bites by Australian theraphosid spiders gives an indication of the spectrum of toxicity of these spiders in humans. Bites by these spiders are unlikely to cause major problems in humans. The study also demonstrates that the venom is far more toxic to canines.

Keywords: Theraphosid spiders; *Selenocosmia* spp; Phlogiellus spp; Spider bite; Arachnidism; Canine

1. Introduction

Spiders of the family Theraphosidae, better known in many parts of the world as tarantulas, are familiar to both the general public and to toxin researchers. Theraphosid spiders occur in all parts of the world, and are variously referred to as tarantulas, bird-eating spiders or in Australia, whistling spiders. They are the largest of the mygalomorph spiders with some species in South America (*Grammostola* spp.) being 27 cm from the apex of the first legs to the apex of the fourth pair and a body size of 7–10 cm (Bucherl, 1971). In Australia they occur in the warmer tropical and temperate parts of the country (Fig. 1) (Raven and Gallon, 1987).

They are increasingly being kept as pets in Australia, like in many other parts of the world. There has been a significant amount of research done on the venoms of theraphosid spiders, including *Selenocosmia* spp. (Atkinson, 1993), *Ornithoctonus huwena* (previously *Selenocosmia*) (Liang et al., 2000), *Acanthoscurria* spp. (Bettini and Brignoli, 1978), the *Pterinochilus* group (Escoubas et al., 1999; Bettini and Brignoli, 1978), the *Brachypelma* group (Escoubas et al., 1997) and recently *Grammostola spatulata*

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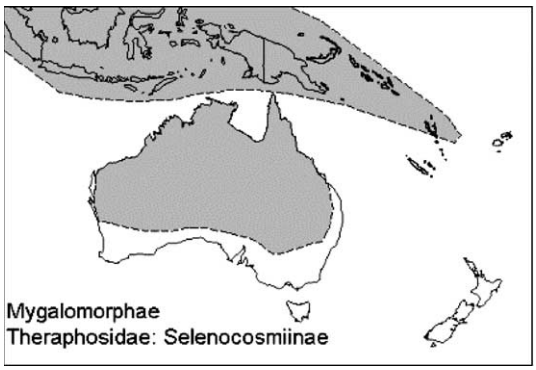

Fig. 1. Distribution of all theraphosid spiders in Australia and the Pacific region belonging to four genera in the subfamily Selenocosmiinae.

(Bode et al., 2001). A number of novel toxins have been discovered in the venom of these spiders, including toxins acting at potassium channels, calcium channels and the recently discovered acid-sensing ion channels (ASIC) (Escoubas et al., 2000).

Despite the reputation of these spiders and the increasing numbers kept in captivity, bites by these spiders have only been rarely reported (Bettini and Brignoli, 1978; Musgrave, 1949; Robinson and Griffin, 1985; Lim and Davie, 1970; Isbister et al., 2001; Lucas et al., 1994; Takaoka et al., 2001; Vetter and Visscher, 1998). Bites appear to cause only minor effects (Lucas et al., 1994; Isbister et al., 2001; Lim and Davie, 1970), based on the lack of case reports of severe effects in the literature. However, the hairs (setae) of South American theraphosid spiders have been responsible for urticating skin reactions and ocular injuries (Cooke et al., 1973; Blaikie et al., 1997; Castro et al., 1995; de Haro and Jouglard, 1998; Traub et al., 2001), that can cause more severe effects.

Despite reports of minor effects in humans, a number of studies have demonstrated significant toxicity of theraphosid venoms in various animals, including rats, mice, cats, birds and dogs (Bettini and Brignoli, 1978; Bucherl, 1971; Atkinson, 1993). It is also recognised that theraphosid spiders can cause more severe effects in domestic animals, including death. There are several reports of canine fatalities, for example a *Selenocosmia* spp. envenoming from Darwin, Australia (Robinson and Griffin, 1985), and reports of fatalities in canines and felines from Australian theraphosid spiders in Queensland (Raven, 2000).

The aim of this study was to characterise the clinical effects of Australian theraphosid spiders in both humans and canines.

2. Methods

Cases were collected by the authors over a 25 year period from January 1978 to April 2002 by three different processes including bites to both humans and canines.

1. Definite theraphosid spider bites were recruited prospectively as part of a larger study of Australian spider-bites from February 1999 to April 2002 (Isbister and Gray, 2002).
2. Records of the Queensland Museum collected from January 1978 to December 2001.
3. Reports to JS at the University of James Cook from January 1997 to December 2001.

Cases of spider bite were only included if there was a definite bite and the spider was collected at the time of the envenoming (Isbister, 2002).

In the prospective study the following was recorded for each human spider bite: demographics (age, gender, geographical location), circumstances of the bite (location, time, date, season), bite site, local and systemic effects (onset, duration, severity), and past medical history. Less clinical information was available for human bites in the records of Queensland Museum and those reported to JS.

Details were also collected for the cases of spider bite in canines, including age, size, breed of dog and whether the bite was fatal or not.

Spiders were collected directly from the patient or mailed to the authors for identification. Spider identification was done by an expert arachnologist, MG or RR, in all cases. Identification was done to genus level in all cases by RR, and species where possible. Some specimens were undescribed and were given morphospecies status.

3. Results

There were nine confirmed bites by theraphosid spiders in humans, four of these were from the prospective study and were followed up (Table 1). There were seven definite bites in canines (Table 2), two in which the spider had then bitten a person (included in the seven cases). These included bites by *Selenocosmia* spp. and *Phlogiellus* spp (Table 1, Fig. 2). Bites occurred mainly in Queensland and western NSW consistent with the distribution of the family Theraphosidae in Australia (Figs. 1 and 3).

The nine spider-bites in humans caused only minor effects. Local pain and puncture marks were the commonest clinical effects (Fig. 4), although the presence of fang marks was not reported in cases eight and nine. Severe pain occurred in four of seven bites (57%) where this information was available. In one case the spider had bitten through the patient's fingernail. Mild systemic effects occurred in one case. Clinical effects had resolved within 24 h in seven cases. One patient had delayed itchiness that persisted for 48 h (Table 1). Another patient bitten on the toe had a painful metatarso-phalangeal joint for 9 days.

There were seven bites in dogs (Table 2), and in two of these the owner was bitten after the dog. In all seven cases

Table 1
Details of the circumstances, clinical effects and spider identifications for nine bites, in humans, by theraphosid spiders

	Age/sex[a]	Pain[b]	Bite site	Other effects	Systemic	Comments	Spider ID	Date	Location
1	M	Severe	Finger	Puncture marks and swelling for 24 h	Malaise for 6 h		*Phlogiellus* ' sp.pq113'	October	Northern Queensland
2	M	Severe	Finger	Puncture marks and tenderness	No	Bitten through finger nail	*Phlogiellus* ' sp.pq113'	October	Northern Queensland
3	M	Moderate	Finger	Swelling	No		*Phlogiellus* ' sp.cn8'	September	Northern Queensland
4	M 46	Severe	Thumb	Puncture marks, tenderness and tingling for 4 h	No	Gardening	*Phlogiellus* ' sp.pq113'	Febuary	Northern Queensland
5	M 74	Moderate	Finger	Bleeding; tenderness and swelling for 2 h	No	History of ischaemic heart disease	*Phlogiellus* ' sp.pq113'	January	Northern Queensland
6	F 34	Moderate	Foot	Tenderness for 18 h, delayed itchiness for 2 days	No		*Selenocosmia* sp nov 'shaggy dog'	January	Queensland
7	M 36	Severe	Toe	Local pain for 90 min with redness. Painful metotarso-phalangeal joint for 9 days	No		*Selenocosmia stirlingi*	Febuary	Far west NSW
8	F	Present	Finger	nil	No		*Selenocosmia stirlingi*	–	Northern Queensland
9	U	Present	Finger	nil	No		*Phlogiellus* sp.	–	Northern Queensland

[a] Male or female where available, U = unknown.
[b] Severity of pain or 'present' if severity unknown.

the dog died. In one case a four year old, approximately 40 kg, Alsatian died within 2 h of the bite. In two cases small or juvenile dogs died in less than an hour. In the other four cases the exact time of death was unknown. In the two cases where the owner of the dog was also bitten and went to hospital, the dog was found dead when they arrived home.

Of the four cases of bites in humans collected in the prospective study, further details were available. Bites occurred at all times of the day, including the evening and night. Three of the four bites occurred outdoors. In one case the spider was found indoors and it was raining at the time.

4. Discussion

This is the first series of bites by Australian theraphosid spiders which, although not large, gives an indication of the spectrum of toxicity of these spiders in humans. The study suggests that bites by these spiders are unlikely to cause major problems in humans. The study also demonstrates that the venom appears to be far more toxic to canines than humans with a 100% case fatality rate in the study.

Australia's theraphosids include four genera. *Phlogiellus* is a small grey thin-legged animal found in the rainforests of

Table 2
Details of seven bites in canines all resulting in death of the dog

Canine	Spider ID	Effects	Estimation of time to death	Location
4 Year old adult Alsatian (40 kg)	*Phlogiellus* 'sp.cn8'	Fatal	2 h	Northern Queensland
4 Year old adult 'pig' dog (50 kg)	*Phlogiellus* 'sp.cn8'	Fatal	< 5 h	Northern Queensland
Unknown breed	*Selenocosmia* sp nov 'shaggy dog'	Fatal	< 18 h	Queensland
Unknown breed	*Phlogiellus* sp.	Fatal	Unknown	Northern Queensland
6 Month old, unknown breed	*Phlogiellus* sp.	Fatal	30 min	Northern Queensland
Silky Terrier	*Selenocosmia stirlingi*	Fatal	30 min	Northern Queensland
8 Week old, unknown breed	*Selenocosmia* sp nov 'shaggy dog'	Fatal	Unknown	North-western NSW

Fig. 2. Spider responsible for the bite in patient number seven, *Selenocosmia stirlingi.*

north Queensland and accounted for half of the bites in this study. It is also common throughout the Pacific and eastern Asia. Two other genera, *Selenocosmia* and *Selenotypus* are larger thick-legged spiders found throughout most of northern Australia and presumably much of the arid south.

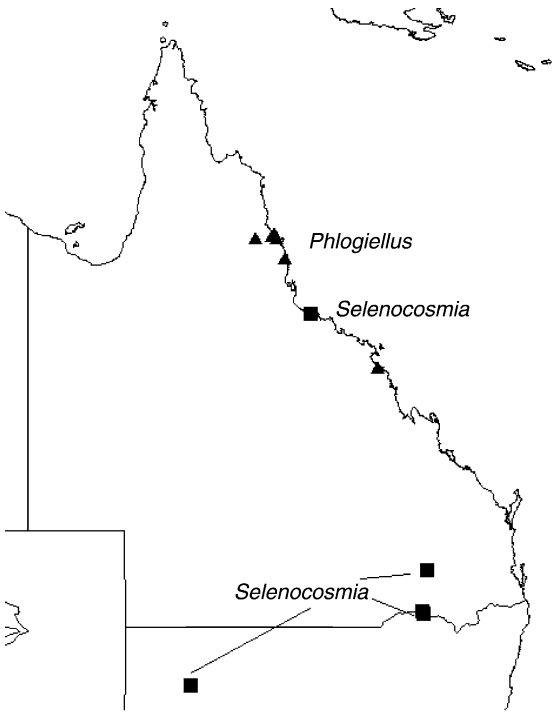

Fig. 3. Distribution 16 theraphosid spider bites in Australia. *Phlogiellus* spp. marked by filled triangles and *Selenocosmia* spp. marked by filled squares.

Fig. 4. Photograph of bite site of patient number one—bite on finger by a *Phlogiellus* sp.

Selenotholus is a large spider known only from the Northern Territory.

Spiders of the genus *Selenocosmia* are the most common theraphosids in Australia and were responsible for the other bites in the study (Fig. 2). There are currently two groups in this genus, namely *S. crassipes* and *S. stirlingi*. *S. crassipes* occurs in coastal rainforests and vine thickets. The males are often boldly marked in light and dark brown markings on the legs. *S. stirlingi* occurs in dry areas of Queensland and western NSW and are grey to brown in colour (Fig. 2). *Selenocosmia* prey upon small mammals, presumably the chicks of ground nesting birds, frogs and insects. Their natural enemies are large centipedes, probably large wolf spiders, large birds and burrowing mammals.

The small sample of bites in the study limits conclusions about whether severe effects may occur in humans. It is recognised that in bites by Australian funnel web spiders (*Atrax* and *Hadronyche* spp.), major envenoming only occurs in about 10–20% of cases (Sutherland and Tibballs, 2001), but in these cases envenoming may be life-threatening. Thus, with only nine bites in this series of two different genera of Theraphosidae, the possibility of severe effects from bites by these spiders cannot be excluded. However, except for a few poorly reported cases (Musgrave, 1949; Bucherl, 1971), there have been no severe effects reported for theraphosid spiders and no deaths worldwide. The only large series of bites reported from Brazil demonstrated there were no major effects in 48 theraphosid spider bites involving spiders from two genera (*Acanthoscurria* and *Vitalius*) (Lucas et al., 1994). Despite the increasing number of these spiders being kept as pets in Australia and the presence of a long-established tarantula pet industry in the United States and Europe, no reports of severe human envenoming are known. Consequently, it seems reasonable to conclude that this family of spiders is unlikely to be dangerous to humans. However, further larger

studies in different parts of the world, including Australia, are required to confirm this.

The clinical effects reported in this study are similar to reports of theraphosid spiders in other parts of the world. The largest series is reported from Brazil with 48 bites, the majority by *Acanthoscurria gomesiana* (37) and the rest, which could be identified past family, by *Vitalius* sp (Lucas et al., 1994). The predominant effect was local pain and there were no cases of systemic envenoming. There are a few reports by Asian theraphosid spiders (Takaoka et al., 2001; Lim and Davie, 1970). In one of two cases reported from Japan, the patient was described to have arthritic stiffness for a few weeks after the bite (Takaoka et al., 2001). This also occurred in one patient in our study, but the mechanism of such an effect is unclear.

There have been only three case reports of bites by these spiders previously in Australia (Isbister et al., 2001; Robinson and Griffin, 1985; Raven and Gallon, 1987). In the more recent report the effects included severe pain for a few hours but other effects were minimal (Isbister et al., 2001). In one earlier report more severe effects occurred, but these were probably not directly related to effects of the venom (Robinson and Griffin, 1985). In this case the patient was bitten while in bed and the spider recovered from the bedclothes the next morning. There were puncture marks evident of a bite, but the subsequent delayed development of large red area around the bite site with generalised systemic features are more consistent with a secondary infection. The other case was an older report to the Queensland Museum (pre 1970) where an adult human female was bitten by a male *Phlogiellus* spp. This initially caused local pain and swelling, then paraesthesia in the bitten hand. It was also reported that there was severe nausea and vomiting for 6–8 h in this case (Raven and Gallon, 1987). Based on the nine patients in this study, the main clinical effect of bites by Australian theraphosid spiders is severe local pain, usually with puncture marks, and general systemic effects such as nausea and vomiting are uncommon (Raven and Gallon, 1987; Robinson and Griffin, 1985). In no case was there severe or life-threatening toxicity, such as that seen with Australian funnel web spiders (Sutherland and Tibballs, 2001).

Early investigators working with animals demonstrated significant toxicity of some groups of these spiders in rodents, guinea pigs, dogs and birds (Bettini and Brignoli, 1978; Bucherl, 1971). Others were more toxic to cold blooded animals (Bettini and Brignoli, 1978; Bucherl, 1971). These investigators concluded that some members of the family Theraphosidae were highly toxic to humans based on their effects in small mammals, and so a significant danger. This is not supported by this study or previous series and case reports (Lucas et al., 1994; Robinson and Griffin, 1985; Lim and Davie, 1970; Takaoka et al., 2001). An explanation for this discrepancy may be differential relative toxicity between different vertebrates, and may not be related to size of the animal because some dogs, as in our study, are quite large and close to the weight of small humans. Support for this hypothesis can be seen (in the opposite direction) with Sydney funnel web spiders, *Atrax robustus*. The venom of this spider is highly toxic and potentially lethal to humans, but has almost no effect in most non-primates, including rodents and domestic animals such as dogs (Sutherland and Tibballs, 2001).

There has been little work done on the venoms of Australian theraphosid spiders. One study in rodent organ systems examined the venoms of 12 Australian spiders, including *S. stirlingi*, one species of Australian funnel web spiders, *Hadronyche infensus* and two other trapdoor spiders (Families: Nemesiidae and Idiopidae) (Atkinson, 1993). The study mainly examined effects on heart rate, respiratory rate and electrocardiograph (ECG). The venom of *S. stirlingi* caused severe hypoventilation and apnoea in rats, and a slowing of heart rate and distortion of the ECG after apnoea (Atkinson, 1993). Of all venoms tested, it appeared that in rats only *S. stirlingi* venom had a toxicity approaching that of *H. infensus* (Atkinson, 1993). This would be consistent with the severe effects that occurred in dogs in this study, and reports of deaths in cats and other small animals (Raven and Gallon, 1987). Venoms of other Australian theraphosids have not been investigated.

Bites by spiders of the family Theraphosidae appear to cause only minor effects in the majority of cases. Local pain is the commonest effect and systemic features are rare. Contact reactions from the hairs of some of these spiders are more likely a health hazard than the spider bite, particularly if they enter the eye. Further collection of definite bites by other species within the family, with expert identification of spiders (Isbister, 2002), will be important to determine if all spiders in the family cause similar minor effects.

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