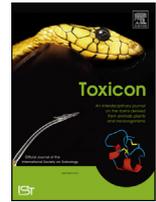




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Verified spider bites in Oregon (USA) with the intent to assess hobo spider venom toxicity



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ABSTRACT

This study compiled 33 verified spider bites from the state of Oregon (USA). The initial goal was to amass a series of bites by the hobo spider to assess whether it possesses toxic venom, a supposition which is currently in a contested state. None of the 33 bites from several spider species developed significant medical symptoms nor did dermonecrosis occur. The most common biters were the yellow sac spider, *Cheiracanthium mildei* ($N = 10$) and orb-weavers of the genus *Araneus* ($N = 6$). There were 10 bites from three genera of funnel web spiders of the family Agelenidae including one hobo spider bite and one from the congeneric giant house spider which is readily confused as a hobo spider. The hobo spider bite resulted in pain, redness, twitching in the calf muscle and resolved in 12 h. Also generated from this study were possibly the first records of bites from spiders of the genera *Callobius* (Amaurobiidae) and *Antrodiaetus* (Antrodiaetidae), both with minor manifestations.

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1. Introduction

For many decades and continuing to current day, the spider bite literature has suffered from the proliferation of envenomation reports where spider involvement is suspected or presumed (Anderson, 1991; Vetter and Isbister, 2008; Nentwig et al., 2013). The lack of evidence-based medicine has resulted in misdiagnoses and the artificial expansion of incorrect bite signs and symptoms in the medical literature (Vetter and Isbister, 2008). A call for more stringent requirements in the publication of spider bite reports includes greater proof of spider involvement, preferably verified bites with the offending culprit caught in the act of biting and identified by a qualified

arachnologist (Anderson, 1991; Isbister, 2002; Vetter and Isbister, 2008). Indeed, this appears to be occurring with greater frequency in the spider bite literature (e.g., Nentwig et al., 2013).

In North America, the widow spiders (genus *Latrodectus*) were generally accepted to be medically important in the early part of the 20th century (Vetter and Isbister, 2008) and the brown recluse, *Loxosceles reclusa*, was established to cause dermonecrosis in 1957 (Atkins et al., 1957). The hobo spider, *Eratigena agrestis* (see note below regarding a genus name change), was added to the list of toxic North American spiders in 1987 even though Vest (1987a,b) presented this arachnid as a “probable” but not definitive cause of dermonecrosis. Despite this non-definitive assertion, the medical community, news media and the general public quickly embraced this newly implicated spider as a toxic entity such that, without additional proof, it was considered to be a major source of dermonecrosis in the Pacific Northwest, elevated to

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importance through repetitive citation in the medical literature rather than the accumulation of verified bite information (Vetter and Isbister, 2004). However, using electrically milked hobo spider venom, Binford (2001) could not replicate the dermonecrosis-inducing effect in the same strain of rabbits used to initially implicate the spider as being toxic. This spider is European in origin and is not considered toxic in the Eastern Hemisphere. The evidence that a hobo spider bite leads to necrotic skin lesions is suspect (Binford, 2001; Vetter and Isbister, 2004). Hence, hobo spider toxicity has been seriously challenged.

Using verified spider bites (accompanied by the spider) reported to the Oregon Poison Control Center (OPC), this study was initiated with the intent to ascertain whether hobo spider bites were indeed toxic. Although the medical importance of the hobo spider was the instigating factor, we collected data on all verified bites reported to the OPC. This allowed us to determine the degree to which hobo spiders are involved in envenomations in the Oregon area. Additionally, another European immigrant, the congeneric giant house spider, *Eratigena atrica*, is also found in the Pacific Northwest (Vetter et al., 2003), is readily misidentified as a hobo spider due to similarity in appearance and could be involved in bites; we hoped to provide information on envenomations of this spider as well which to date has not been implicated as medically important.

[Taxonomic note: there has been an important change involving the taxonomy of the genus *Tegenaria*. Bolzern et al. (2013) determined through molecular and morphological analysis that the spider genus *Tegenaria* was not monophyletic and reassigned several species to other genera. The hobo spider, *Tegenaria agrestis*, was transferred to a new genus *Eratigena*, an anagram of *Tegenaria*. Several species of closely related taxa were synonymized under *E. atrica* including a second Pacific Northwest inhabitant, the giant house spider, which has been referenced in the literature under the names of *T. gigantea* and *Tegenaria duellica*, causing disagreement among arachnologists over its correct specific epithet (Vetter et al., 2003). This synonymy now renders this disagreement moot as *E. atrica* is considered to have moderate variation in its genitalic structure and is absorbing these other species.]

2. Materials and methods

2.1. Collection of verified spider bite reports

This was a prospective observational study of verified spider bites in Oregon, USA. IRB approval was obtained. After an extensive media campaign, patients who reported a spider bite to the OPC were identified by researchers and invited to participate. Inclusion criteria were any persons who saw or felt themselves get bitten by a spider and immediately obtained the spider at or near the bite site. Patients were contacted within one week of their bite and basic demographics were obtained, as well as circumstances surrounding the bite and any local or systemic symptoms as well as any pertinent past medical history. Patients were sent a container in which to place the spider and were asked to return the container to the OPC. Patients were contacted by phone for 1 and 3 weeks after the bite.

Patients who had persistent symptoms after the 3 weeks, were followed until resolution of all symptoms.

Spiders were identified to the lowest taxon possible. Immatures were often only identifiable to genus, although some were assigned to species due to the presence of only one species of that genus in the area. Some specimens were missing critical body parts or were destructively captured which precluded identification to species.

3. Results

3.1. Bite demographics

In a 3-year period, 33 verified spider bites with the offending spider identified by an arachnologist were reported to the OPC (Table 1). These bites included spiders of at least 13 species, in 10 genera in seven families. Bite victims included 21 females (mean age = 39.6 ± 22.7 , range = 1.7–76) and 12 males (mean age = 44.0 ± 13.2 , range = 24–67) with an overall mean age of 41.2 ± 19.7 years (range = 1.7–76). Ten bites occurred outdoors, 22 indoors with one of unknown location.

3.2. Bite manifestation

None of the verified spider bites in this study resulted in serious injury or dermonecrotic lesions. Of the 33 bite victims, 28 reported redness (85%), 26 pain (79%), 26 swelling (79%) and 17 itching (52%). Only 15 (45%) reported systemic symptoms such as headache, nausea, anxiety, fatigue, fever, and vision changes with only two persons reporting more than one symptom. Mean time to resolution of all symptoms was 7.8 ± 15.3 days (range = 0.13–84) with most signs and symptoms except for small amount of redness and swelling at the bite site resolving within 24 h.

The body part that was envenomated most often was the hand with nine incidents followed by the arm, leg and neck (four each), the back, finger and foot (two each) and single episodes of bites to the abdomen, ear, eyelid, face, lip and scrotum.

3.3. Agelenidae

3.3.1. *Eratigena* (formerly *Tegenaria*)

Three episodes involved bites by a male hobo spider, *E. agrestis*, a female giant house spider, *E. atrica*, and an immature of undeterminable species. The hobo spider bite to the leg of a 48-year old man elicited pain, redness, and twitching of the calf muscles with symptoms resolving in 12 h. The giant house spider bite to a hand elicited pain, itching, redness, no systemic symptoms and resolved in a day. The immature *Eratigena* bite had pain, itching, swelling and redness on the hand of a 45-year old male victim, which took 10 days to resolve.

3.3.2. *Agelenopsis*

Four bites to appendages were administered by three male *Agelenopsis pennsylvanica* and a male *Agelenopsis oregonensis* with pain, swelling and redness for all and itching for the *A. pennsylvanica* bites. One bite resulted in

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