

# An Infestation of 2,055 Brown Recluse Spiders (Araneae: Sicariidae) and No Envenomations in a Kansas Home: Implications for Bite Diagnoses in Nonendemic Areas

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**ABSTRACT** During a 6-mo period, 2,055 brown recluse spiders, *Loxosceles reclusa* Gertsch and Mulaik, were collected in a 19th-century-built, currently occupied home in Lenexa, KS. We conservatively estimate that at least 400 of these spiders were large enough to cause envenomation. Additional collections from more typically infested homes in Missouri and Oklahoma in 2001 yielded 45 and 30 brown recluse spiders, respectively. Despite these infestations, no envenomations of the inhabitants of these three homes occurred. Considering the levels of infestations with no bites in the homes presented here, nonendemic areas in the United States, which typically lack recluse spider populations and have had zero to few verified specimens of the spider, do not have sufficient numbers of brown recluse spiders to make envenomation a likely scenario. Despite this, physicians from nonendemic recluse areas often diagnose brown recluse bites which, therefore, are unlikely to be correct.

**KEY WORDS** *Loxosceles reclusa*, Arachnida, synanthropy

THE BROWN RECLUSE SPIDER, *Loxosceles reclusa* Gertsch and Mulaik, is well known by the medical community and general public to cause dermonecrotic lesions. Although the spiders are virtually limited to their endemic range (southeastern Nebraska to Texas, east to southernmost Ohio and Georgia) (Gertsch and Ennik 1983; Vetter 2000a, 2000b), brown recluse bites are diagnosed throughout North America, typically based solely on clinical examination with no evidence of spider involvement (Vetter and Bush 2002a). The brown recluse is then incorrectly perceived to be common, widely dispersed, and a frequent cause of dermonecrosis throughout North America (Vetter 2000b; Vetter and Bush 2002a, 2000b). In contrast, the distributional evidence resoundingly refutes this notion. This misconception is a source of consternation for arachnologists in nonendemic recluse areas attempting to educate nonarachnologists about the local absence of *Loxosceles* spiders, often to no avail. This heightened awareness of brown recluse spiders has caused physicians in nonendemic regions to locally diagnose more bites annually than the historic total of verified specimens found in the same area (Vetter 2000b; Edwards 2001; Vetter and Bush 2002a, 2000b), giving a low probability of a diagnosis being correct.

Despite the high-profile infamy of the brown recluse spider, there is a paucity of original comprehensive natural history research on the spider (i.e., most available information is a reiteration of a few earlier

studies). Hite et al. (1966) and Horner and Stewart (1967) are commonly cited sources, although their studies have dealt more with the life history characteristics of the spider than its synanthropic relationship (i.e., association with humans). Hite et al. (1966) mentions that many brown recluse spiders were found in homes, churches, schools, and other structures, but do not delineate the number of structures or the methods of collection. The only quantified references of brown recluse synanthropy of which we are aware include Cross (1971), who collected 52 spiders on two occasions in several buildings at a dilapidated, rural Mississippi homesite and Gooch (1999) mentions 44 being caught in sticky traps in 24 h under one couch in Memphis, TN, and another 300 collected in a Texas home although without mention of the collection period. Medical and public literature often emphasizes the rare, deleterious, and horrific aspects of brown recluse venom toxicology, inflating the spider's propensity for causing dermonecrotic damage. It is rarely pointed out that most brown recluse spider bites have inconsequential resolution (Wright et al. 1997, Cacy and Mold 1999). In this study, we offer what we feel is a more common yet neglected life history characteristic: in endemic areas, brown recluse spiders can be very abundant in homes with no envenomations of the occupants.

## Materials and Methods

This report centers around the extraordinary collection of brown recluse spiders from a heavily infested home in Lenexa, KS, ~33 km southwest of

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Kansas City. The house was originally constructed in the 1850s of 45-cm-thick exterior limestone walls and consists of three floors encompassing 270 m<sup>2</sup> of living space. Attic space adjoins east and west second floor walls with another attic above, all with floors covered with 8 cm of blown insulation. The roof has original wood shingles covered by three layers of asphalt shingles. House additions were made during the 1920s and in the 1960–1970s; the first addition enclosed an exterior wall. Interior stone walls are covered with plaster. There are several outbuildings, including a horse barn, chicken coop, garage, and open-sided hay barn. This home is on 4 ha of property surrounded by trees and pasture, 0.2 km away from the nearest neighbor. As a historic note, it reputedly served as the residence of Wild Bill Hickok during the mid-19th century.

Since 1996, a family of two parents and two children, 13 and 8 years of age in 1996, has lived in this home. The previous occupants had lived there for 20 yr and the house was never vacant as far as can be determined. Although the current family had seen spiders for the 5–½ yr of occupancy, it was not realized until mid-June 2001 that these were brown recluses (initial specimens verified by B. Cutler, University of Kansas). D.K.B. started killing and tallying brown recluse spiders in mid-June 2001 and initially contacted R.S.V. on July 5, 2001. With the exception of the first 34 specimens, all spiders were recorded in categories of large, medium, and small per night; a subsample of these categories were sent to R.S.V. for measurement. Although many spiders were destructively sampled to prevent escape, specimens were collected and preserved in alcohol whenever feasible. Whether a spider was destroyed or preserved, it was still tallied within its size category so that a fairly accurate estimate of the total sampled demographic population could be made.

Collections were performed nightly, most often by two people for ≈90 min, from mid-June until mid-September 2001, with the exception of two 4-d vacancies during July and August. Collecting shifted to approximately once weekly from mid-September through November. Additional recluse captures or kills were separately recorded (but still added to daily totals) when they were found during incidental encounters. Fifteen flat-tray sticky traps (Catchmaster mouse and insect glue board, model #72MB, Atlantic Paste and Glue Co., Brooklyn, NY) were deployed inside the house from 22 June to 1 August and another 36 traps were deployed from 1 August to 1 November. All sticky traps were sent to R.S.V. for recluse verification and cephalothorax measurement. No insecticide treatments were used in the home at any time.

Because the 19th-century-built Kansas home may not be the typically infested Midwestern American domicile, information is presented for two additional homes. The first is in Des Peres, MO, 17 km west of St. Louis. This 158-m<sup>2</sup> home was built in 1946 of brick on poured concrete foundation construction. The home consists of two floors plus a 93-m<sup>2</sup> finished, concrete floor basement and attached garage. It is located on a 0.2-ha lot in a suburban neighborhood surrounded by mature oak, pine, and maple trees. The current in-

habitants (two parents and two children, 2 years of age and newborn in 1999) have occupied the home since 1999. Brown recluse spiders were collected and tallied during incidental encounters and from five flat-bed sticky traps (model XP-Glue 4, Zep Commercial, Cartersville, GA) for the entire year of 2001. Hand-collected spiders were preserved in alcohol and mailed to R.S.V. for measurements and sex determination. Sticky traps were individually placed in plastic bags and likewise mailed.

A homeowner from Tulsa, OK, contacted R.S.V. in November 2001 as the study was about to be terminated. Her 167-m<sup>2</sup> home is situated on a 1-ha property and was built in 1963 on poured concrete foundation with one floor and no basement but with a storm shelter connected to the back porch and a barn with one horse. It is in a semirural area bordered by smaller lot housing and a 40-ha farm. The current inhabitants (one parent and three children, ages 7, 11, and 17 in 1997) have occupied the home since 1997. The homeowner sent R.S.V. several sticky traps [three *Stick-em* glue traps (flat-tray style), model 122, J.T. Eaton, Twinsburg, OH, and two Victor mouse glue traps (triangular tent style), Woodstream, Lititz, PA], which were deployed in 2001, plus a few spiders collected after a pesticide treatment. Five additional spiders killed or preserved earlier in the year were tallied. Many additional dead brown recluse specimens were not collected from the storm shelter because of mold encrustation and fragile condition.

Cephalothorax lengths of all spiders received by R.S.V. were measured with a Wild M5A microscope and a 10-mm ocular micrometer (Wild Heer-brugg, Heer-brugg, Switzerland).

## Results

In the Lenexa, KS, home, 2,055 brown recluse spiders were collected or killed in 6 mo, 842 from sticky traps and 1,213 from manual sampling (Table 1). Of the 1,179 manually collected brown recluse spiders sorted into size categories, there were 323 large (27.4%), 255 medium (21.6%), and 601 small spiders (51.0%) (Table 1; Fig. 1). There was a proportional decrease in large and medium manually sampled spiders as the year progressed (Fig. 1). Sticky traps yielded a very high percentage of small spiders, most being second-instar spiderlings (Table 1) but also retained 51 large and medium spiders, at least 25 of which were adults.

Of the 1,213 manually sampled brown recluse spiders, 90 (52.2% of which were large) were found during incidental encounters, occurring in every room in the house including high human use areas such as bedrooms, kitchen, and bathroom. These encounters included one large recluse crawling up an arm as stored bedding was shoved into a washing machine, a medium recluse crawling on a person in bed, and a medium recluse crawling on a finger when picking up clothing. Despite the high density of brown recluses, none of the four family members has ever shown

**Table 1.** Brown recluse spiders from the Lenexa, KS, home that were sorted by size category by D.K.B. in Kansas (hand-sampled). Sticky trap spiders were measured with a microscope by R.S.V. and then assigned to size category as determined by the hand-collected subsamples. An additional 34 spiders were collected and discarded prior to size categorization

	Small	Medium	Large
Hand-collected/killed (June–November)	601	255	323
15 Sticky traps (June–July)	364	9	10
36 Sticky traps (August–October)	427	15	17
	1,392	279	350
Subsample measures			
Cephalothorax length of category (mm)	1.24 ± 0.38	2.74 ± 0.40	3.60 ± 0.45
Subsample size	61	39	23

evidence of a recluse bite, either during the duration of the study or in 6 yr of home occupancy.

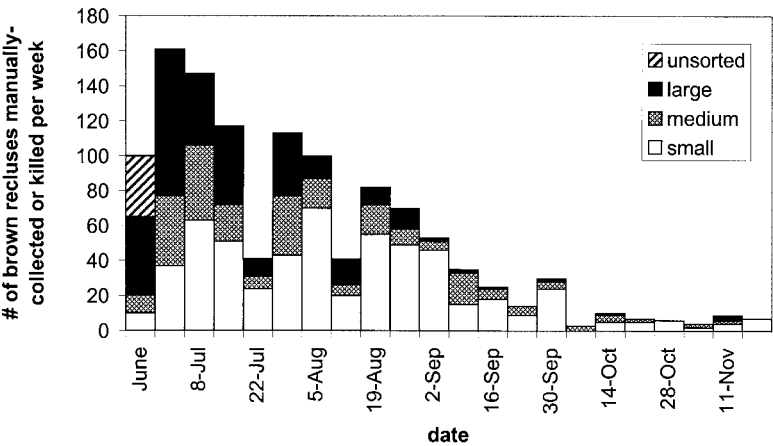
From the Missouri home, 45 brown recluses were collected. Using the size categories determined for the Kansas home, there were 21 large, 16 medium, and 8 small spiders including 7 mature males and 19 mature females. Many of these were caught in sticky traps and one mature female dropped on the homeowner’s arm while dressing. From the Oklahoma home, 30 brown recluses were trapped or killed in 2001. Of the 20 measurable spiders in sticky traps that could be delegated to a size category as detailed above, there were 12 large, 6 medium, and 2 small spiders. None of the four family members of either home experienced bites during the duration (2 yr and 4 yr, respectively), of home occupancy.

Discussion

The Kansas home produced an amazing number of brown recluse spiders in 6 mo of collecting. The decrease in large and medium spiders from early to late season (Fig. 1) was probably a result of the natural demographic development through the season and the removal of larger specimens that were easier to detect and capture. Brown recluse spiders can live several years (Hite et al. 1966, Horner and Stewart 1967), so the latter reason may be more critical in

explaining the proportional dwindling of the large and medium spiders. Sticky traps were more effective in removing small spiders compared with manual sampling (Table 1). In the Missouri and Oklahoma homes, a moderate amount of brown recluse spiders were collected but this is probably within the realm of the total brown recluses found annually by the average homeowner having infestations of the spider.

To assess the potential health risk in the Kansas home, we chose the mid range of medium brown recluses (approximately 5 mm in body length) as the size threshold for envenomation capability. This size threshold was chosen based on unpublished data by R.S.V. that indicate that non-*Loxosceles* spiders 5 mm in body length have caused verified envenomations. The maximum estimate of the number of potentially bite-capable spiders in this highly infested home is 488 spiders (i.e., all large plus one half of the medium spiders that were segregated by size; Table 1). Despite a conservative estimate of 400 envenomation-capable brown recluses in the Kansas home (≈20% of the total recluses captured), no envenomations of the occupants occurred. Similarly, in a Chilean survey, the five most heavily infested domiciles averaged 163 *L. laeta* spiders, ranging from 106 to 222 potentially dangerous spiders with no reports of envenomations from these homes (Schenone et al. 1970).



**Fig. 1.** Demographics of brown recluse spiders manually captured per wk in the Lenexa, KS, home. Decreases for the wk of 22 July and 12 August were a result of 4-d vacancies of the house. After mid-September, collections became intermittent as spider populations diminished and collecting frequency decreased.

Considering the number of brown recluse spiders found in the homes in this study without envenomation, for bite diagnoses in nonendemic recluse territory to be correct, nonendemic areas would need to support hundreds to thousands of brown recluse spiders. In contrast, in nonendemic areas, typically no brown recluse populations are known and verified finds are <10 per state (Gertsch and Ennik 1983, Vetter and Bush 2002b, R.S.V. et al. unpublished data). Current emerging research is showing that many medical afflictions manifest in dermatologic lesions that are misdiagnosed as brown recluse bites (Russell and Gertsch 1983; Russell 1986; Vetter and Visscher 1998; Vetter 2000a, 2000b; Roche et al. 2001; Osterhoudt et al. 2002; Vetter and Bush 2002a, 2002c). In nonendemic recluse areas, more proof of recluse involvement (i.e., verification of *Loxosceles* spiders at the specific alleged envenomation locale) should be required before the wound is attributed to brown recluse spiders.

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