

# Distribution of the Brown Recluse Spider (Araneae: Sicariidae) in Georgia with Comparison to Poison Center Reports of Envenomations

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**ABSTRACT** Georgia is on the southeastern margin of the native range of the brown recluse spider, *Loxosceles reclusa* Gertsch and Mulaik. The brown recluse is not a common Georgia spider and has limited distribution in the state. Using recent submissions, previously published records, and examination of museum specimens, we document the spider's presence in 31 (19.5%) of Georgia's 159 counties, with almost all being found in the northern portion. The spider was collected almost exclusively north of the Fall Line (a transition zone separating the Piedmont and the Coastal Plain geological provinces). Only two locations in the southern Coastal Plain province produced *L. reclusa* specimens; these southern finds are considered spiders that were transported outside their range. There were six finds of the non-native world tramp species, *L. rufescens* (Dufour), three south of the Fall Line. In conspicuous contrast, over a 5-yr period, a Georgia poison center database recorded 963 reports of brown recluse spider bites from 103 counties. These figures greatly outnumber the historic verifications of brown recluses in the state for both specimen quantity and county occurrence, indicating improbable spider involvement and the overdiagnosis of bites. In the southern half of the state, medical diagnoses of brown recluse spider bites have virtually zero probability of being correct. Bite diagnoses should be made with caution in north Georgia given the spider's spotty distribution with low frequency of occurrence.

**KEY WORDS** *Loxosceles reclusa*, brown recluse spider, Arachnida, distribution, overdiagnosis

The brown recluse spider, *Loxosceles reclusa* Gertsch and Mulaik, is well known for causing dermonecrotic lesions in humans. Its native range is the south and central midwestern United States (Gertsch and Ennik 1983, Swanson and Vetter 2005, Vetter 2008), and it is rarely found outside of this distribution (Vetter and Bush 2002a, b, Vetter 2005, 2008). Despite the infamy of the spider and exaggerated claims of supposed envenomations, there is a surprising paucity of information regarding its distribution in many states (Vetter 2008). The southeastern margin of the endemic area of *L. reclusa* runs through central Georgia (Gertsch and Ennik 1983, Swanson and Vetter 2005). It is readily found in Tennessee to the north and Alabama to the west (Cooperative Economic Insect Report 1971, Vetter 2008) but is not native to nor often found in Florida to the south (Vetter et al. 2004). Therefore, brown recluse spiders are likely to be native to north Georgia but absent in the southern portions, with a zone of attrition somewhere in between.

Chamberlin and Ivie (1944) listed 350 spider species from the "Georgia area" (most of Georgia and South Carolina) with the brown recluse not among them, supporting the notion that the spider is an uncommon entity in both states. Gorham (1968a) described collections of *L. reclusa* from 4 of Georgia's 159 counties (Fulton, Oglethorpe, Spalding, Walton), with a correction of one county locality (Pike not Spalding) and one addition (Paulding) in Gorham et al. (1969). A nationwide map verifies brown recluse spiders in eight Georgia counties (adding Coweta, Douglas, Spalding) (Cooperative Economic Insect Report 1971). Howell (1974) lists 12 counties (adding Butts, Cobb, Gordon, Henry, and Troup but omitting Oglethorpe) from which brown recluse spiders have been recovered. In the most recent taxonomic revision of the genus, Gertsch and Ennik (1983) mentioned that specimens were collected from 12 Georgia counties but list only 2 (Cobb, Henry). Swanson and Vetter (2005) showed the range of the brown recluse as including the northwestern portion of Georgia based on the sparse information mentioned above.

Reports of envenomations from brown recluse spiders, both diagnoses by the medical community and self-assessments by the nonmedical general public, occur throughout North America despite the rarity or nonexistence of the spider over much of the continent (Vetter and Bush 2002b, Vetter et al. 2003, 2004, Bennett and Vetter 2004, Swanson and Vetter 2005, Frith-

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sen et al. 2007, Vetter 2008). Medical authors cite spider bite data from the annual report of poisonings and injuries from the American Association of Poison Control Centers (AAPCC) (see Vest 1996 for an example). Although AAPCC data are fairly reliable for conditions where the causative agent is readily determinable (e.g., snake bite, acetaminophen poisoning), the data for spider bite reports are virtually useless (Vetter and Furbee 2006). For example, Florida has no native *Loxosceles* populations of any species and finds are both very rare and highly circumscribed. However, from a 6-yr AAPCC database from the three Florida poison centers, 85% of the 844 reports of *Loxosceles* envenomations were made by nonmedical personnel and originated from  $\approx 75\%$  of its counties (Vetter et al. 2004). Unfortunately, medical authors incorrectly use the AAPCC data set to substantiate brown recluse spider presence in an area by virtue of bite reports without realizing that the general public makes the majority of the reports to poison centers.

Because of the high profile status of the brown recluse spider and the overdiagnoses of *Loxosceles* bites by medical personnel from areas of North America lacking the spiders, we performed a survey in Georgia to determine the distribution of the spider in greater detail than has been attempted before. We also compared the known distribution and quantity of *Loxosceles* spiders in Georgia to a 5-yr database for bite reports made in the state.

### Materials and Methods

Spider specimens were procured from various sources. In 2002, a website was established on the Department of Entomology webpage at the University of Georgia announcing the Georgia Brown Recluse Project and the desire for spider submissions. One of us (N.C.H.) presented seminars to the pest control industry throughout Georgia soliciting submissions and, through the media (radio and newspaper interviews), requesting samples from the general public. Another author (L.M.A.) is the arthropod identification specialist at the diagnostic laboratory of the Georgia Experiment Station of the University of Georgia and receives arthropods from throughout the state. Several *Loxosceles* datapoints were recovered from the Distance Diagnostics through Digital Imaging system, which is a mechanism for University of Georgia extension specialists to submit electronic images and obtain quick identifications. Records are stored in a permanent database; *Loxosceles* records were retrieved along with collection information. Additional data were generated by a 5-yr study that offered to identify any spider thought to be a brown recluse (Vetter 2005). We sought as many previously published records of *L. reclusa* in Georgia as we could locate. The first two authors also made a collecting trip to state parks (examining mostly storage buildings) and other sites (junk yard, behind roadside stores) through north Georgia in October 2006. This study was terminated in May 2008.

From museums, one of us (R.S.V.) requested brown recluse spider specimens (either the entire collection if small or just Atlantic seaboard state specimens if the collection was large) from the following: American Museum of Natural History (New York, NY), National Museum of Natural History (i.e., Smithsonian; Washington, DC), Field Museum of Natural History (Chicago, IL), California Academy of Sciences (San Francisco, CA), Denver Museum of Nature and Science (Denver, CO), Florida State Collection of Arthropods (Gainesville, FL), Burke Museum of Natural History (Seattle, WA), and Clemson University Arthropod Museum (Clemson, SC). The Georgia Museum of Natural History was also searched.

Putative spider bite data were procured from the Georgia Poison Center, which provided a 5-yr data set for brown recluse bite reports in Georgia. The information included data of bite report, county if known, and age and sex of the alleged bite victim. However, this data set did not provide sufficient data breakdown to separate categories between medical and nonmedical sources as was done in other studies for Florida (Vetter et al. 2004) and Pennsylvania (Vetter et al., unpublished data).

### Results

We provide evidence of brown recluse spiders in 31 (19.5%) of Georgia's 159 counties (Table 1; Fig. 1), with almost all finds being restricted to the northern third of the state. Published records indicate brown recluse spiders being verified in 13 counties; we uncovered *L. reclusa* in 23 counties, 18 of which were previously not listed as having these spiders. Although it would be more informative to present information such as the number of recluse spiders found per county compared with the total number of spiders submitted, this is not feasible considering the varied methods by which the data were generated. Additionally, because of the low final number of recluses ( $\approx 100$  specimens), percentages of spiders per county would vary wildly and provide almost no coherent biological meaning.

One submission was a male *L. reclusa* involved in a verified bite incident near Rome (Floyd County). Brown recluse spiders have been verified in two locations from the southern half of Georgia. One site was a woodworking shop in Brunswick (Glynn County) with several specimens collected (transported lumber from Alabama was the suspected mechanism of movement) and the other, from Warner Robins (Houston County), was intercepted from household goods being unpacked by a couple who had moved from Tennessee. Many of the county records that we present here are finds of single specimens, each being the only record from that county or are finds where the spider represented a healthy population from a single structure in the county. The seasonality of collections shows that brown recluse spiders were most commonly found during the warmer months (Fig. 2). Our collecting trip through north Georgia yielded no specimens of brown recluse spiders nor evidence of diag-

**Table 1.** Collections of the native brown recluse spider, *L. reclusa*, and the non-native, worldwide tramp, *L. rufescens*, in Georgia

County	City/town if known	Year	Sources
<i>Loxosceles reclusa</i>			
Butts			Howell 1974
Chatooga	Summerville	2005, 2007	This study
Cherokee	Canton	2004	This study
Clarke	Winterville <sup>a</sup>	1982	This study
Cobb	Powder Springs <sup>b</sup>	1969	Gertsch and Ennik 1983
Coweta	4 locations	2004–2007	CEIR 1971, this study
Dade	Trenton, 1 other	2006	This study
Douglas	Ridley, Coleman		CEIR 1971
Fayette	Fayetteville, 1 other	2003, 2007	This study
Floyd	Rome, outside Rome	2005, 2006	This study
Forsyth	Alpharetta <sup>c</sup>	2004	This study
Fulton	Atlanta <sup>c</sup> (2x), Alpharetta <sup>c</sup> (2x), 1 other	1967, 2003, 2005	Gorham 1968a, this study
Glynn	Brunswick	2007	This study
Gordon	Plainville, Calhoun, 1 other	2003, 2006	Howell 1974, this study
Gwinnett	Auburn, Lilburn, Dacula	2005, 2006	This study
Hall	Gainesville	2005	This study
Henry <sup>d</sup>		1969	Howell 1974
Houston	Warner Robins	2005	This study
Morgan	Madison	2006	This study
Newton	Covington (2x)	2001, 2003	This study
Oconee	Watkinsville	2004	This study
Oglethorpe	Maxeys	1967	Gorham 1968a
Paulding			CEIR 1971
Pike	Concord (2x), 1 other	2005, 2007	CEIR 1971, this study
Polk	Cedartown	2003	This study
Spalding	Griffin (5x)	1961, 2004, 2005, 2006, 2008	CEIR 1971, this study
Troup			Howell 1974
Walton	Walnut Grove	1967	Gorham 1968a
Walker	Chickamauga	2006	This study
Whitfield	Dalton	2007	This study
Wilkes	Washington	2001	This study
<i>Loxosceles rufescens</i>			
Bibb	Macon	2007	This study
Bulloch	Statesboro <sup>e</sup>	1984	This study
Cobb	Atlanta <sup>c</sup>	1945	Gertsch and Ennik 1983
DeKalb	Atlanta <sup>c</sup> or nearby		Gorham et al. 1969
Muscogee		1969	Gertsch and Ennik 1983
Tift	Tifton		Gorham 1968b

Years were not always provided for the collection. CEIR refers to the Cooperative Economic Insect Report.

<sup>a</sup> Specimens in the University of Georgia Museum.

<sup>b</sup> Female in the American Museum of Natural History.

<sup>c</sup> City/town is located in more than one county.

<sup>d</sup> Male in the California Academy of Sciences, immature in the American Museum of Natural History.

<sup>e</sup> Specimens in the National Museum of Natural History.

nostic shed skins, the latter indicating historic presence at one time. Park personnel were of the opinion that the spiders were either not found in their parks or sightings were extremely rare. In extreme contrast, the general public, submitting spiders of all species over the duration of the study, were vigorously confident of the brown recluse's presence throughout Georgia by way of alleged local envenomation incidents or misidentification of harmless spiders.

Gorham (1968b) mentioned a collection of *L. rufescens* (Dufour) (a non-native worldwide tramp species) from Tifton (Tift County). Gorham et al. (1969) showed a map with an additional find of *L. rufescens* near Atlanta but no definitive location is mentioned in the text (the indicator star on the map appears to be in DeKalb County). Gertsch and Ennik (1983) list two additional *L. rufescens* finds from Cobb and Muscogee Counties. This species was discovered in two new locations during the course of the study (Table 1).

In this study, >1,000 spiders were submitted to the Athens campus as possible *L. reclusa* spiders; an unknown number of additional non-*Loxosceles* data points were lost in the first year because of miscommunication to a student employee of how data were to be recorded. Of 1,061 recorded datapoints, only 19 of these were brown recluses. From a subsample of 101 non-*Loxosceles* spiders randomly chosen from the total, the majority were *Kukulcania hibernalis* (Hentz) (Filistatidae) (34%), wolf spiders (Lycosidae) (25%), and orb weavers (Araneidae) (13%). Most submissions originated from the Atlanta metropolitan area and suburbs, reflecting the human population concentration in north Georgia. However, spider specimens were submitted from the majority of Georgia's counties, showing general concern that brown recluse spiders are common throughout the state.

The poison center data showed 963 reports of brown recluse spider bites in 103 (64.8%) of Geor-

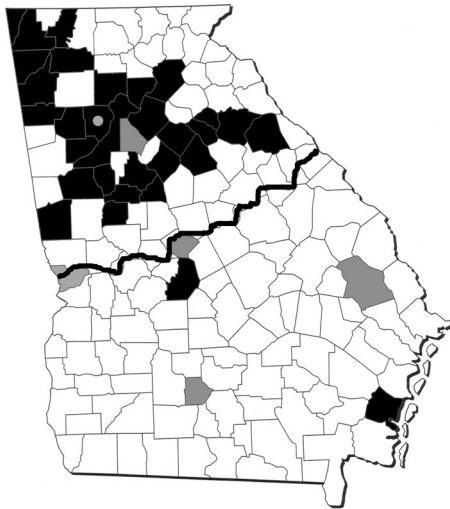


Fig. 1. Distribution of the brown recluse spider in Georgia. The thick black line running diagonally through the state is known as the Fall Line and separates, geologically, the northern Piedmont province from the southern Coastal Plain province. Counties in which the brown recluse spider, *L. reclusa*, has been found are shaded in black, whereas finds of the non-native *L. rufescens* are shaded in gray. The gray dot in Cobb County indicates both species were found there.

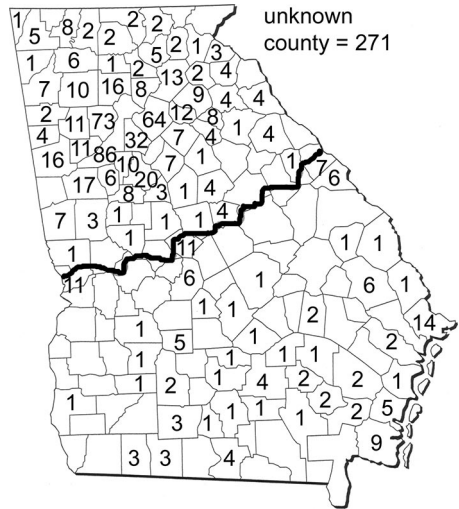


Fig. 3. Distribution of reports of brown recluse spider bites made to poison control centers from a 5-yr data base. A total of 963 reports were made, of which 691 were from known county origin. The thick black line running diagonally through the state is known as the Fall Line.

gia's 159 counties in a 5-yr period (Fig. 3). Of these, 691 were of known county origin, with most reports occurring in the northern portion of the state; however, 132 (19.1%) emanated from south of the Fall Line where recluses are virtually nonexistent (Figs. 1 and 3).

Specimens that were not destroyed from sticky trap or traumatic capture and were of museum caliber will be deposited in the American Museum of Natural History in New York.

Discussion

In Georgia, the brown recluse spider has been most reliably documented in the northern portion of the state. Although not all northern counties have had *L.*

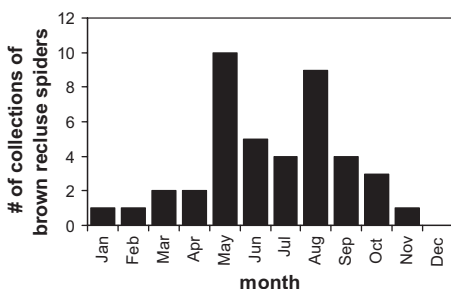


Fig. 2. Seasonality of collections of brown recluse spiders in Georgia where dates of collection were known. A collection refers to one location producing spiders at one sampling and could represent several specimens taken contemporaneously.

*reclusa* recorded therein, it seems feasible to assume that the spiders do exist there at some low incidence given the continuity of its distribution in states to the north and west (Cooperative Economic Insect Report 1971, Vetter 2008). The lack of brown recluse spider verifications in north Georgia is most probably because of both low population and undersampling. Of the 31 counties with confirmed brown recluse presence, 29 occurred north of the Fall Line, a distinct geologic boundary that separates the Piedmont province (consisting of old, hard rock formations, higher elevation, and uneven terrain) from the southern Coastal Plain (consisting of new, soft rock formations, lower elevation, and flat terrain). It is a transition area characterized by waterfalls, riffles, and shoals as the faster-flowing northern streams slow to become the meandering streams of south Georgia. It seems feasible that the distribution shown here accurately reflects the lack of brown recluses in the southern half of the state, bolstered by the absence of known populations of *L. reclusa* in neighboring Florida (Vetter et al. 2004). The two finds of *L. reclusa* in the Coastal Plain province in south Georgia should be interpreted as isolated discoveries of transported specimens outside of its native range. These scenarios would also be consistent with observations from other southern states in the Gulf Coast region; as one approaches the coast, brown recluse populations diminish significantly (Vetter 2008) and are usually found as intercepted itinerants.

If the distribution of *L. reclusa* in Georgia is accurately depicted, a geological correlation becomes apparent. Brown recluse populations overlap with three large physiographic geological provinces in the northern portion of the state (Ridge and Valley, Blue Ridge, Piedmont) (Hodler and Schretter 1986). (Some ref-



erences include an additional province of the Appalachian Plateau in the northwesternmost tip of the state). This Coastal Plain exclusion seems to be an accurate predictive variable, at least along the southeastern margin of the range of the brown recluse spider in North America; this conclusion is based on the results of this study, published records of the Cooperative Economic Insect Reports from neighboring states, brown recluse spider submissions to one of us (R.S.V.), examination of museum specimens (R.S.V., unpublished data), and an annotated South Carolina spider list (Gaddy and Morse 1985). In South Carolina, finds of *L. reclusa* are extremely rare, and the spider is considered to be non-native to the state (Frithsen et al. 2007). In Alabama, brown recluses are very common in the Piedmont portion of the state (with most northern counties producing specimens) and found only sporadically in counties in the southern Coastal Plain (Cooperative Economic Insect Report 1971; R.S.V., unpublished data). However, this geological correlation is surely not the only environmental variable limiting populations of *L. reclusa* because the spiders are also found in northern Louisiana, a state entirely within the Coastal Plain province. Therefore, the correlation between geological province and brown recluse distribution may just be a convenient coincidence where other factors have overriding restricting importance. Nonetheless, in the southeastern edge of its distribution, there is a striking trend for brown recluses to be associated with Piedmont and other inland physiographic provinces and to be nonexistent or extremely rare in the coastal areas. At the northern portion of its range, brown recluse distribution seems to be limited by minimum winter temperatures, causing the spider to be extremely rare in the northern third of Illinois (Cramer and Maywright 2008).

In general, the brown recluse is not common in Georgia nor it is widespread. This seems logical because one does not expect high concentrations of an organism on the fringe of its native distribution as it dissipates into nonexistence; brown recluse spiders are quite rare at the periphery of their range. Even though the densely populated city of Atlanta is well within the range of *L. reclusa* as presented in Fig. 1, few brown recluse spiders have ever been submitted from this major metropolitan area and its suburbs (Table 1). Additionally, only two brown recluse spiders have ever been found in Clarke Co. despite a strong, long-extant entomology program at the University of Georgia in Athens (i.e., the constant presence of a phalanx of avid arthropod collectors for decades). Georgia has a long arachnological history dating back to the late 18th century when John Abbot collected extensively in the state and illustrated specimens (Chamberlin and Ivie 1944). In the 6 yr that our study was conducted, we found a total of 58 historic records and recent submissions of recluse spiders, represented by  $\approx$ 100 spiders. To put this in perspective, from endemic *L. reclusa* areas where populations are common and abundant, a family in Lenexa, KS, collected 2,055 *L. reclusa* in 6 mo in their home where, on six occasions,

100 or more *L. reclusa* spiders were collected per week from the main house during the course of the study (Vetter and Barger 2002); arachnologists collected 1,150 *L. reclusa* spiders in an Oklahoma barn in three consecutive nights (Vetter 2008). Of the 1,061 Georgia spiders submitted as brown recluses to the Athens campus for this study, only 19 (1.8%) were such. In the nationwide *Loxosceles* study of Vetter (2005), people from endemic states such as Missouri, Oklahoma, and Kansas submitted brown recluse spiders 75–89% of the time. Additionally, the three most common families of non-*Loxosceles* spiders submitted as brown recluses from Georgia were in the top five non-*Loxosceles* families submitted in a nationwide Internet study; when examined at the genus level, *Kukulcania* spiders (Filistatidae) were the most common non-*Loxosceles* spider submitted from both Georgia and nationwide (Vetter 2005, this study).

The number of Georgia reports of brown recluse spider bites to poison centers overwhelms the arachnological data in both numbers and logic. Reports emanate from 103 counties in a 5-yr database and yet the total historical presence of *Loxosceles* spiders of any species can only be verified for 36 counties. Although the majority of the AAPCC reports are from north Georgia, this is also the area of densest human population. If the percentage of bite reports made by medical personnel for Florida (14.7%) (Vetter et al. 2004) and Pennsylvania (15.8%) (Vetter et al., unpublished data) is similar for Georgia,  $\approx$ 144 reports (15% of 963) would have been made by medical personnel in 5 yr, which is still greater than the historical quantity of brown recluses documented in the state. The overdiagnosis of brown recluse bites by medical personnel has already been established for several American states and Canada (Vetter 2008). There is no reason to believe that the Georgia medical community and its general public are not likewise inaccurately overdiagnosing this affliction. Although the information regarding the overdiagnosis of brown recluse bites in North America where the spider is rare or nonexistent is becoming well known among entomologists, the medical community in nonendemic areas is still relying on the brown recluse as an etiology for necrotic skin lesions. Brown recluse spider bite diagnoses are logistically improbable in the southern half of Georgia and should be made with caution in the northern half. Many medical conditions result in dermonecrotic lesions that have been or could be mistaken for brown recluse spider bites (Swanson and Vetter 2005); Georgia medical personnel should give greater consideration to these differential diagnoses rather than necrotic spider bite.

This project more than doubled the number of Georgia counties previously known to have brown recluse spiders. We hope that this study will instigate more interest in the distribution of the brown recluse in other states and that increased collecting efforts will more accurately document the whereabouts of this medically important spider. However, it seems that this information will not change significantly for Georgia, considering the state's lengthy history of arach-

nology, the numbers of all spider species collected over centuries by arachnologists, and those suspect recluse spiders submitted by the concerned general public in contrast with the low numbers of *Loxosceles* spiders known from throughout the state.

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