

**CURRENT DISTRIBUTION OF THE COMMON STRIPED SCORPION
(*Centruroides vittatus*) IN ILLINOIS**

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INTRODUCTION

The common striped scorpion (*Centruroides vittatus*) is the most widely distributed scorpion in North America (Shelley and Sissom, 1995). *Centruroides vittatus* is the only scorpion species known from Illinois; as such it is a unique component of the state's invertebrate fauna. The total distribution and status of *C. vittatus* in Illinois has not been previously determined. The most recent museum specimen dates to 1982. *Centruroides vittatus* is considered to be of low-grade medical importance, but its propensity to reside in/around human habitations can bring it into contact with people. The objectives of this study are to update current knowledge of the distribution of *Centruroides vittatus* in Illinois by 1) mapping new localities of *C. vittatus* populations discovered during the survey, 2) document the localities with current voucher specimens, 3) determine the relative abundance of this species at each locality where it is found, e.g. common, uncommon, not found.

MATERIALS AND METHODS

Scorpions were surveyed on bluff slopes and their bases near the floodplain of the Mississippi River in Monroe and Randolph counties, Illinois, from just west of Columbia south to Prairie du Rocher. *Centruroides vittatus* does not occur north of the Missouri River (Shelley and Sissom, 1995). Optimal habitats (talus, bark, logs, debris) were accessed by car or on foot, and localities plotted on topographic and GIS maps (Fig. 1). Local people were questioned about the presence of scorpions on their property. The date, locality, microhabitat, and specimen data (numbers observed, sex, reproductive status, age (instar) class, were recorded. Scorpions were detected by blacklight and cover turning. No more than two (2) voucher specimens from each locality were collected with forceps and plastic containers. Specimens were killed by heat shock (immersion for 5 seconds in hot water), preserved in FAA solution (95% ethanol + 10% formalin + glacial acetic acid + water) and stored in 70% ethanol. Voucher specimens were deposited in the Illinois Natural History Survey (INHS) or the Field Museum of Natural History (FMNH). Photographs (black & white, color slides) were taken of habitat and specimens from new localities. Whenever possible, field work was done during the period of the new moon, in order to maximize the effectiveness of blacklighting (Sissom, et. al., 1990).

RESULTS

Life History

Centruroides vittatus is apoikogenic. Oocytes develop in ovarian follicles, which are attached to the ovariuterus. The oocytes vary in size and yolk content. Ova range from 0.40-0.63 mm (Francke, 1982d). Mating takes place in the fall, occasionally in spring or early summer. Mating dances have been observed in July and October. Formanowicz and Shaffer (1993) found that larger female *C. vittatus* produce more offspring and have a higher total litter mass than smaller females, though they found no significant relationship between offspring size and female or litter size. Their results suggested that large female scorpions with a larger investment in reproduction produced more offspring that were more uniform in size, but not significantly larger, than small females with less investment.

Gestation is approximately 8 months in Arkansas populations, with parturition taking place from May-September, litters range from 13-47, mean 31 (Polis, 1990). The first instar lasts from 3-7 days. Maturity is reached in 18 months to 2 years, at the 5th-6th instar, with a 7th instar possible. With May parturition, juveniles could reach the 4th or 5th instar by winter (W.D. Sissom, pers. comm. 1996). Actual maturation time for Illinois populations is unknown. Initial observations on Illinois *C. vittatus* show a sex ratio biased toward females. At one site, 6 female and 4 males were observed. At Fults Hill Prairie Nature Preserve, 12 adult and juvenile (3rd instar) females and no males were observed. J. Bigelow (pers. comm. 24 June 1996) collected thirty-two specimens of which only 6 were males, from a talus slide N of "G" Road (Monroe County). During this study, a total of 13 females and 2 males were collected, and 5 males and 16 females were observed (not collected).

Habitat

Centruroides vittatus occupies a wide variety of microhabitats in grasslands, deserts, deciduous and coniferous forests, where it inhabits crevices in rock outcrops, canyon walls, and volcanic hills. It climbs into vegetation, hides beneath yuccas, trash dumps, and commonly enters human dwellings. It has been collected from sea level to elevations of 2340 m in Coahuila, Mexico (Shelley, 1994b; Shelley and Sissom, 1995). Other microhabitats recorded for the species include beneath palm branches, rocks, logs and bark in pine forests, under cow dung, old rags and debris at an abandoned campsite, in a sabal palmetto grove, in a cactus rat nest, and in homes, motels, dormitories, and office buildings in Cole, St. Louis, and Taney counties, Missouri, and in similar circumstances in other states (Shelley and Sissom, 1995). During this study, *C. vittatus* was found under limestone talus during the day and on the surface of this substrate at night. under UV light. The striped scorpion is an ecologically plastic species, populations undertake limited movements in Big Bend Ranch, Texas. Movements from a talus-strewn bluff base to the top of a bluff in one summer's time is suggested to be a very likely possibility (W.D. Sissom, pers. comm., June 1996). *Centruroides vittatus* has been found to comprise >80% of scorpion fauna in a community in most Texas sites surveyed by Sissom (in Polis, 1990; pers. comm. 1996).

Activity periods vary with several factors. *Centruroides vittatus* prefers low light intensity (Torres and Heatwole, 1967); blacklighting success varies with the lunar cycle. Studys conducted at Big Bend Ranch, Texas found 15 *C. vittatus* on moonless (new moon) nights; only 5 were observed on full moon nights on the same transect (W.D. Sissom, pers. comm. 1996). Blacklighting was not as effective during field work on *C. vittatus* in Illinois. The loose talus piles with their numerous crevices could have concealed active individuals from exposure to UV light. Many were found by day on the underside of rocks, and may forage this way in/among talus or large rocks at night, making detection by blacklight difficult. This contrasts with the ease of observation of the species in Texas on vertical rock faces or on desert scrub flatlands (T. Anton, pers. obs., 1991).

In Texas, *C. vittatus* has occasionally been found on the surface on 40 F nights. It is postulated, though not proven, that wide temperature fluctuations, not extremes, appear to affect surface activity (W.D. Sissom, pers. comm., 1996).

Centruroides vittatus has an adaptive feature that allows populations to persist in the variable winters characteristic of Illinois. They survive periodic freezing temperatures in their habitat by tolerating limited freezing of body tissues. They contain potent ice-nucleating agents in the gut, which promote ice formation in that body compartment. The chemical composition of these agents was not identified, but they are most likely proteinaceous compounds. Unlike other scorpion species, *C. vittatus* shows only a superficial ability to supercool. Freeze tolerance is well documented in insects, though this is the first observation of scorpion use of this strategy to withstand subzero temperatures (Whitemore, et. al, 1985, in Polis, 1990). Adult *Centruroides vittatus* average 60 mm. in length, and feed on small insects and other terrestrial arthropods.

Distribution

In Illinois, *Centruroides vittatus* has been frequently collected in the vicinity of Fults, Monroe County, on the eastern bank of the Mississippi River (Appendix I), at approximately 38-N, 07'-49.0"W- 90.08'-45.9" at 400' above sea level. In Missouri, it is common south of the Missouri River, but does not appear to occur north of that drainage. They have also been documented from Prairie du Rocher and 2.5 miles north of Prairie du Rocher in Randolph County, approximately seven miles south of Fults (Appendix I; Shelley and Sissom, 1995). During this study, no specimen was collected in Randolph County during field work by us (TGA, MR), and by J. Bigelow (pers. comm. June 1996). Three homeowners contacted in Randolph County (10-69 year residents), in the vicinity of Modoc and Prairie du Rocher said they had seen no scorpion on their property. The reasons for this are unknown, but may include sampling biases, habitat destruction due to ongoing mining/quarrying operations, flooding, or unsuitable habitat. All ten localities in Monroe County documented with voucher specimens collected during this study are shown in

Appendix II, and plotted on a map (Fig. 1).

It is suggested that the Monroe County (Fults) and Randolph County (Prairie du Rocher) populations of *C. vittatus* were natural eastward radiations, originating in Missouri and reaching Illinois via flood rafting, a common and natural means of range expansion for many invertebrate and vertebrate species, or by alterations in the course of the Mississippi, both anthropogenic and natural (Shelly and Sissom, 1995). Relict populations of predominately western species found with Illinois *C. vittatus* include the eastern narrow-mouthed toad (*Gastrophryne carolinensis*), great plains rat snake (*Elaphe guttata emoryi*), coachwhip (*Masticophis flagellum*), and northern flathead snake (*Tantilla gracilis*) (Smith, 1961). These species also occur across the Mississippi River in Missouri. Augmentations to Illinois *C. vittatus* populations from rail, barge or other commercial traffic are considered a secondary possibility. The 1993 flood and past floods of less severity could have transported scorpions to other areas via logs or other organic debris. In an experiment with a single juvenile (2nd-3rd instar) specimen during this study, death by drowning took 2.5 hours.

DISCUSSION

Status recommendations:

Currently, no status recommendation is proffered for Illinois populations of *C. vittatus*. The status of State Threatened would be recommended under the following conditions: 1) improvements, such as widening, of Bluff Road could eliminate by removal the talus piles that are vital to the persistence of *C. vittatus* populations in Monroe County. 2), evidence of collecting for the pet trade. The collecting, breeding and husbandry of venomous arachnids is becoming a popular and lucrative hobby, and, while *C. vittatus* is widespread and abundant throughout its U.S. range, a small, highly localized population of the only known scorpion component of the Illinois fauna may make this species a target for collectors. 3) controlled burns, or illegal, unregulated fire could destroy individuals inhabiting the smaller talus piles. Fire, smoke and excessive heat would preclude escape from a small area of rock surrounded by a hot fire. The example of the

cottonmouth, or water moccasin (*Agkistrodon piscivorous*) is offered as an example for a current "no status" recommendation. This large, venomous pit viper is found in only 8 southern Illinois counties, but is common, and, in some cases, abundant where it is found. Though *C. vittatus* was documented from only 1 Illinois county (Monroe Co.), good numbers were easily found by the writer and other observers. *Centruroides vittatus* is therefore considered locally common.

Medical Importance

Centruroides vittatus is of minor medical importance. The sting causes local pain and swelling, and occasionally other systemic effects. S.R. Ballard (pers. comm. 1995) reported a numbness in the lips and tongue as well as protracted throbbing of the site of a sting sustained on the middle finger of the left hand by an Illinois specimen in 1993. There are unsubstantiated accounts of fatalities due to scorpion envenomation in areas where only *C. vittatus* occurs. Small children and adults having allergic reactions to scorpion venom may be susceptible to severe envenomation.

Future research on Illinois scorpions

In addition to field work to update distribution records, a study of the relationships of mid-western populations of *C. vittatus* is a worthwhile goal. This will involve collecting samples (+/- 30) specimens from localities in Illinois, Missouri, and other states. Analysis of mitochondrial DNA from and between populations may reveal relationships between Illinois populations and those west of the Mississippi, as well as forming a genetic profile of Illinois *Centruroides vittatus* populations. Further study on population characteristics, demographics, fecundity, reproductive investment, and movements in Illinois *C. vittatus* populations would be strongly encouraged if additional state funding becomes available.

Nomenclature

Recently, the possibility of a second scorpion species in Illinois has caused confusion in recent literature regarding the common name of *Centruroides vittatus*. A recent popular book, "Illinois Wilds" (Jeffords, et. al., 1995) contains a color photograph of a scorpion identifiable as *Vaejovis spinigerus* (Vaejovidae) (Sissom, pers. comm., 1996) in the section on hill prairies. The common name given in the book is "plains scorpion". This same photograph and common name appears in an article on hill prairies in a 1994 issue of the Illinois Steward (McClain, 1994). Despite intensive searching for *Vaejovis spinigerus* at Fults Hill Prairie Nature Preserve, no specimens of this western desert scrubland/dry plains species were found. The photograph of the *Vaejovis spinigerus* was reportedly taken at Fults Hill Prairie in 1983. Another article attempted to clarify the identities of these species, and postulated that a third species may be found in the southeastern corner of the state (Zierath, 1996). Such speculation, while intriguing, may cause confusion over the scientific and common name of our single native Illinois scorpion species. Voucher specimens of the other two species must be collected and made available for precise identification. Henceforth, for purposes of clarity, the proper name for Illinois' only currently known scorpion species is the **common striped scorpion**, *Centruroides vittatus* (Say, 1821).

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Appendix I. Illinois *Centruroides vittatus* documented by museum specimens.

Monroe Co.: 4 mi (6.4 km) N Fults, 9 April 1949, D.M. Smith (INHS); 2.5 mi (4 km) N Fults, 13 July 1949, A.G. Wright (INHS); Fults, 9 October 1948, P.W. Smith (CAS); Fults, 16 June 1949, P.W. Smith (INHS); Fults, 15 July 1953, Hensley & Smith (INHS); Fults, "Spring 1971", D. Daleske (FMNH); 4 mi S Valmeyer, 1 May 1956, P.W. Smith (INHS); talus pile 0.4 mi S jct. Bluff/Kaskaskia Rds., 20 July, 1994, S.R. Ballard (FMNH).

Randolph Co.: 2-3 mi (3.2-4.8 km) N Prairie du Rocher, October 1980, R.W. Sites (UMO); Prairie du Rocher, 28 June 1949, Smith & Stannard (INHS); Prairie du Rocher, 29 September 1982, J.H. Gerrard (AMNH).

Presumed introductions/adventives:

Cook Co.: Chicago, 3 June 1922, M. Jensen (FMNH); Chicago "on spinach from Texas", 7 February 1916, U.S. Dohmen (FMNH);

McHenry Co.: Woodstock, October 1951 (CAS).

Appendix II. The following records were documented with current voucher specimens from localities examined during this study, and were collected by the writer and Michael Redmer (Zoology, SIU-Carbondale) from 31 May-July 1996. Numbers, sex and instar class are reported.

Monroe Co.: Fults HPNP, 200 m S FHP parking lot, 31 May 1996, 1 male, 1 female. 1 female observed w/ blacklight on 2 June; 0.7 mi N "G" Rd., 2 June 1996, 1 female; 0.6 mi N Kaskaskia Rd., 31 May 1996, 1 4th instar female; Ivy Rd. at Bluff Rd., 2 June 1996, 1 male, 1 4th instar female; 0.25 mi N "G" Rd., 2 June 1996, 1 female; 0.1 mi N "G" Rd., 14 June 1996, 2 females; 0.7 mi S Kaskaskia Rd., 14 June 1996, 2 (3rd-4th instar) females; Quarry 2 mi N Kaskaskia Rd., 14 June 1996, 1 4th instar male; Quarry 0.4 mi N Steffan Rd., 14 June 1996, 1 4th instar female; Fults Hill Prairie NP, 15 June 1996, 2 females, 1 3rd instar female.

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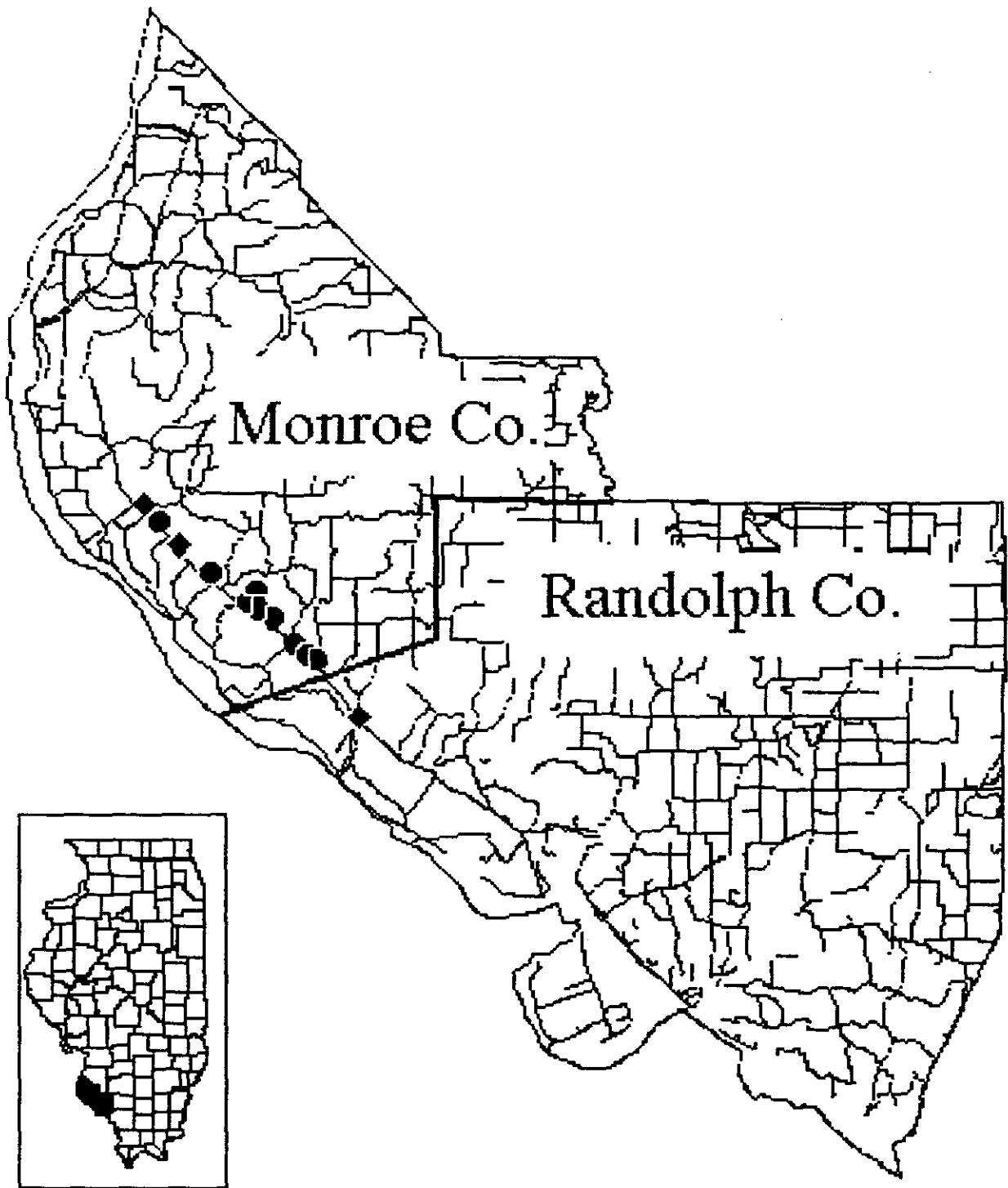


Figure 1. Locality records of the common striped scorpion, *Centruroides vittatus*, in Monroe and Randolph counties, Illinois. Circles indicate localities where we found and collected vouchers in May and June, 1996. Diamonds indicate localities represented by museum specimens, but at which we found no scorpions in 1996. Inset shows location of Monroe and Randolph counties in Illinois.