THE SMOOTH EARTH SNAKE, VIRGINIA VALERIAE (BAIRD AND GIRARD), IN KENTUCKY

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TRANSACTIONS OF THE KENTUCKY ACADEMY OF SCIENCE
Volume 32, 1971 — Numbers 1-2
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The distribution and subspecific status of Virginia valeriae in Kentucky have been summarized (Collins, 1962) on the basis of 21 specimens from five counties. This same paper showed that Virginia valeriae is represented in Kentucky by two subspecies, Virginia v. valeriae (known from four specimens collected in McCreary County in southeastern Kentucky) and Virginia v. elegans (represented by 17 specimens taken in Bullitt, Edmonson, Livingston, and Meade counties in the central and western part of the state). Subsequently we have accumulated records of 35 additional specimens of Virginia valeriae from Kentucky, including examples from nine additional counties: Bell, Calloway, Christian, Graves, Hardin, Lyons, Nelson, Trigg, and Wayne.

Blanchard (1923) studied available specimens of Virginia valeriae throughout its range (no specimens from Kentucky were examined), relegated the form Virginia elegans to a subspecies of Virginia valeriae (primarily on the basis of intermediate dorsal scale row counts), and presented characters by which the two subspecies might be separated. Blanchard’s information was based on the measurement of 14 characters of 72 specimens from 15 states.

Based on available Kentucky specimens plus examples from five neighboring states, we have attempted to: 1) show the distribution of the two subspecies of Virginia valeriae in Kentucky, 2) define the area of intergradation (if any) between the two subspecies, 3) analyze variation of 22 meristic and morphometric characters of Virginia valeriae in order to determine those characters which do or do not show significant variation between subspecies or between sexes within subspecies, and 4) present data (very limited) from available field notes, collection dates, and Kentucky specimens which shed light on the natural history of this snake in the state.

Materials: We have examined 56 specimens of Virginia valeriae (45 V. v. elegans and 11 V. v. valeriae) from 14 counties in Kentucky (see Map 1) and obtained detailed data from 42 of these animals. The remaining 14 examples were identified and examined (by Collins, who obtained partial data from them) prior to 1962, but they have since been destroyed or lost by their respective institutions. No specimens have as yet been found in the northeastern quarter of Kentucky, a region where this species is expected to occur since valid records are known from adjacent Ohio and West Virginia. In addition to the Kentucky material, we examined 35 specimens from five other states (Maryland, Ohio, Tennessee, Virginia, and West Virginia) of which 8 were V. v. elegans and 27 were V. v. valeriae.

Specimens were examined from the following institutions: Austin Peay State University, Tennessee (APSU), Carnegie Museum (CM), Chicago
Map 1. The ranges of *Virginia valeriae valeriae* (diagonal lines) and *Virginia valeriae elegans* (stippling) in Kentucky. Solid circles represent the localities of specimens examined.

Academy of Sciences (CA), private collection of Joseph T. Collins (JTC), private collection of James C. List, Muncie, Indiana (JCL), Field Museum of Natural History, Chicago (FMNH), Mammoth Cave National Park, Kentucky (MCNP—collection was destroyed in 1968), University of Kentucky (UK), University of Louisville (UL), United States National Museum (USNM), and the West Virginia Biological Survey, Huntington (WVBS).

**Methods:** In our study, 91 specimens of *Virginia valeriae* were compared using 22 characters (characters 1 through 14 are those used by Blanchard, 1923). All measurements were taken in millimeters. Characters 15 through 22 were measured with dial calipers. The characters examined and measured were:

1. Keeling on anterior dorsal scales—dorsal scales were either keeled (though sometimes faintly) or not keeled on the anterior one-third of the body (snout-vent).

2. Keeling on posterior dorsal scales—dorsal scales were examined as in character 1, but recorded for the posterior one-third of the body (snout-vent). **NOTE:** Keeling on median dorsal scales tends to be so variable among both *V. v. valeriae* and *V. v. elegans* that it is of little value as a character. Care must be exercised in looking for keels because frequently the dorsal scales possess a light-colored median line that superficially resembles a keel. This median line, however, shows no elevation and is not a keel.

3. Number of dorsal scale rows—counted in an oblique line across the body. Counts were initiated on the first dorsal scale row as follows: neck (within one head length of the posterior margin of the parietals), mid-body (center of the snout-vent length), and pre-anal (within one head length anterior to the anus).

4. Number of ventral scales—the number of ventral scutes present, ex-
cluding the anal plate, were counted by Dowling’s (1951) method. Blanchard (1923) did not employ this standardized counting technique, but we feel that the difference in number between his counts and ours would not be significant.

5. Number of subcaudal scales—were counted from the first subcaudal scale contacting another subcaudal scale on the opposite side up to, but not including, the terminal spine. Tails lacking a terminal spine were not counted.

6. Anal plate—determination of whether the anal plate was single or divided.

7. Number of supraocular scales, left and right.

8. Presence or absence of loreal scale.

9. Number of supralabial and infralabial scales, left and right.

10. Number of parietal, prefrontal, and internasal scales.

11. Number of nasal scales, left and right—the nasal was judged to be single unless divided both above and below the nostril.

12. Number of postocular scales, left and right.

13. Presence or absence of apical scale pits.

14. Ratio of tail length to total length—tail length was measured from the posterior margin of the anal plate at midline to the tip of the terminal spine. Tails lacking a terminal spine were not measured.

15. Frontal scale length (FSL)—distance between the anterior and posterior apices of the frontal scale.

16. Frontal scale to rostral scale length (FRL)—distance from the anterior apex of the frontal scale to the most anterior portion of the rostral scale.

17. Head width—the greatest width of the head between the snout and the posterior edge of the parietal scales.

18. Distance from eye to eye (DEE)—the distance between the most convex portion of each eye.

19. Ratio of FSL plus FRL to head width.

20. Ratio of FSL plus FRL to DEE.

21. Ratio of FSL plus FRL to snout-vent length.

22. Ratio of FRL to FSL plus FRL.

Characters of *Virginia v. valeriae* and *V. v. elegans* were examined to ascertain differences between these subspecies as well as sexual dimorphism within them. Most comparisons were made *a priori* by use of the Student’s t-Test (Sokal and Rohlf, 1969) on an Olivelli-Underwood 101 Programm electronic desk computer. Relative degree of anterior and posterior dorsal scale keeling (characters 1 and 2) was computed on the 101 Program by treating presence of keels as a “success”, the total number of specimens examined as *n*, and comparing the ratios of “successes” to *n*’s via Olivetti-Underwood program 5.30 (Williams, 1969). All other ratios tested were transformed to arcsine values (from Rohlf and Sokal, 1969) prior to computation. Terminology used for the degrees of difference noted via the t-Test is as follows: significantly different (*p* < .05), very significantly different (*p* < .01), and highly significantly different (*p* < .001).
The Smooth Earth Snake

Analysis of Character Variation

Characters showing no significance: The two subspecies of Virginia valeriae found in Kentucky are alike in the following characters: Appearance of the anal plate (divided in all specimens), number of supraoculars one on each side of the head in all specimens), presence or absence of loreal scale (present in all specimens), number of supralabial and infralabial scales (generally 6 of each scale on each side of the head, rarely 5 or 7 scales), number of parietal, prefrontal, and internasal scales (two of each in all specimens), number of nasal scales (generally two on each side of the head, rarely one left or one right, or both), and presence or absence of apical scale pits (absent in all specimens).

The frontal scale length (FSL), frontal scale to rostral scale length (FRL), head width, and distance from eye to eye (DEE), and ratios involving these morphometric head characters also showed no diagnostic significance. Snout-vent lengths among specimens of both subspecies were homogeneous, a fact that permitted the above morphometric comparisons to be made without bias. Detailed examination of a sample of the Pennsylvanian subspecies, Virginia valeriae pulchra, showed that when body sizes (snout-vent) differed significantly, differences in apparent head dimensions also occurred.

Virginia v. valeriae shows a greater tendency towards possession of three postocular scales than does V. v. elegans. The difference was of limited significance and would not be useful as a diagnostic character except possibly for large samples.

Characters showing significance: Difference in degree of keeling of dorsal scale rows was highly significant; V. v. elegans has a greater tendency to exhibit keeled dorsal scales both anteriorly and posteriorly than V. v. valeriae.

Other characters that showed either highly significant or very significant differences were (values given are range and mean for V. v. elegans followed by the same for V. v. valeriae): number of ventrals (males) 110-126 (117.3) and 112-118 (114.2), number of ventrals (females) 119-134 (124.7) and 114-127 (119.6) (see Figure 1); number of subcaudals (males) 33-44 (40.1) and 29-37 (33.9), number of subcaudals (females) 24-34 (31.0) and 24-29 (26.3) (see Figure 2); ratio of tail length to total length (males) 0.155-0.222 (0.196) and 0.123-0.218 (0.177), ratio of tail length to total length (females) 0.133-0.241 (0.158) and 0.123-0.187 (0.194) (see Figure 3).

In all characters depicted in Figures 1, 2, and 3, males differed from females within subspecies to a highly significant degree. High significance also exists in the number of dorsal scale rows, with V. v. elegans typically having 17 rows from the neck to the pre-anal region while V. v. valeriae has 15 rows through the same area. Occasional specimens of V. v. elegans show a loss of one anterior dorsal scale row.

Many specimens of Virginia valeriae have been examined by us from a number of states throughout its range. No differences between populations
of the subspecies of this snake in Kentucky and those populations in neighboring states were noted. For purposes of comparison, data from populations in Maryland, Ohio, Tennessee, Virginia, and West Virginia were included with the data from the Kentucky specimens in some of our calculations when the Kentucky sample size was too small to permit accurate computation. This larger sample size gave a more accurate representation of the range of variation to be expected in Kentucky.

Anomalous specimens: Four specimens of *Virginia v. elegans* from western Kentucky, and one *V. v. valeriae* from southeastern Kentucky show anomalous dorsal scale row patterns of 16-17-15, 15-17-15, and 16-17-16-17-15. Blanchard (1923) referred to such specimens from other states as examples of intergradation and used them as a basis for assigning *Virginia elegans* to a subspecific status of *Virginia valeriae*. Examination of variation in over 200 specimens of *Virginia valeriae* throughout its range indicates
that these phenomena may not truly represent intergrades. A detailed examination of geographic variation in this genus is in progress as the doctoral thesis research of the senior author.

Natural History

Habitat: Data from field notes are available for only three specimens. Two specimens of *Virginia v. valeriae* (JTC 42 & 49) were found dead on a highway bordered by heavy forest in McCreary County in southeastern Kentucky. Suitable retreats were available in this area in the form of leaf litter interspersed with large, flat rocks. A single example of *Virginia v.*
elegans (JCL 636) was captured beneath a rock at the foot of a sandstone bluff in Livingston County in western Kentucky. These limited data preclude any attempt to determine whether these two subspecies exhibit distinct habitat preferences in Kentucky.

Annual activity: Collection dates are available for 26 Virginia v. elegans. This subspecies was found during every month from March to September with the months of March through May yielding the most specimens. No significant data are available for V. v. valeriae in Kentucky.

Breeding habits: No information about gestation period or breeding
activity for either Kentucky subspecies is available. However, three female specimens of *Virginia v. elegans* were X-rayed to determine reproductive activity. The largest specimen (APS 321b) from Trigg County had a snout-vent length of 219 mm and contained six enlarged follicles. A second specimen (JCL 1862) from Ballard County had a snout-vent length of 200 mm and also contained six enlarged follicles. The third and smallest animal (APSU 321a) from Trigg County had a snout-vent length of 196 mm and contained four enlarged follicles. There is no way to determine from X rays whether any of these follicles had been ovulated. The size of the three females and their respective follicle number are within the range of variation for this snake when compared with specimens from throughout its range.

In addition, records of brood sizes are available for two female *Virginia v. elegans* from Bullitt County. One specimen (UL 6486a) collected on 18 August 1950 and having a snout-vent length of 235 mm gave birth to five young (UL 6486b-f) measuring 96, 94, 92, 92, and 81 mm snout-vent, respectively. No date of birth was recorded. The second and larger snake (UL 6487a) measured 246 mm snout-vent, was collected on 21 June 1950, and gave birth on 21 September 1950 to a single young specimen (UL 6487b) which measured 96 mm snout-vent.

**Range**

The ranges of *Virginia v. valeriae* and *V. v. elegans* in Kentucky are shown (see Map 1). Most immediately apparent from the map is the lack of records from the northeastern quarter of the state and the hiatus between the ranges of the two subspecies. Collecting of additional specimens of this snake from both the northeastern quarter and the discovery of populations in the hiatus (if they occur there) would contribute much to a more accurate assessment of the distribution and variation of *Virginia valeriae* in Kentucky.

No intergrading individuals or populations between *Virginia v. valeriae* and *V. v. elegans* are recognized from Kentucky. Analysis of variation of 22 meristic and morphometric characters of 91 specimens of this snake from Kentucky and five other states shows that five characters are very or highly significant in separating the two forms. They are: 1) degree of keeling of dorsal scale rows, 2) number of ventral scales, 3) number of subcaudal scales, 4) ratio of tail length to total length, and 5) number of dorsal scale rows.

The natural history of *Virginia valeriae* in Kentucky is poorly known. Available information for *V. v. elegans* on annual activity, follicle number, brood number, and dates of birth are presented. Meager habitat data for both *V. v. elegans* and *V. v. valeriae* are given.

**Specimens Examined**

A total of 53 specimens of *Virginia valeriae elegans* were examined from the following localities:
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KENTUCKY: Ballard County: Blandville (JCL 1862). Bullitt County: Bernheim Forest (UL 6487a-b), Bernheim Forest, 5 mi S Shepherdsville on Ky. Rt. 61 (UL 6485, 6486a-f), 5 mi S Shepherdsville (UL 3346), 5 mi W Shepherdsville on Ky. Rt. 44 (UL 6488). Calloway County: near Murray (JCL 1273), New Concord (JCL 1492). Christian County: Pennyrile State Park (UK R-183). Edmonson County: Mammoth Cave. 25 mi back of Park Hotel (USNM 79291), Mammoth Cave National Park grounds (MCNP 2000). Graves County: 5 mi SE Lowes (JCL 1566). Hardin County: Ft. Knox (JTC 373). Livingston County: 8.6 mi N Smithland (JCL 548-551, 1073, 1078-1081, 1484), 1.5 mi SE Smithland (JCL 636). Lyons County: Duncan's Creek Cove (APSU 193). Meade County: near Otter Creek (UL 3400, 4645), Lapland, 4 mi W Battletown (UL 2900, 3019, 3087), 4 mi NW Battletown (UL 3111). Nelson County: 4 mi E Boston (UK R-1101). Trigg County: S Golden Pond (APSU 600), SW Golden Pond (APSU 861), (in former Kentucky Woodlands Wildlife Refuge near Lyon County line (UL 4636), 1 mi NW Turkey Creek (APSU 321a-b), NNE Fenton near Lyon County line (APSU 475a-b).

TENNESSEE: Stewart County: near Model (APSU 631, 819), SE Model (APSU 594), NW Dover (APSU 296a-b), Ft. Henry (APSU 584), S Fork Panther Creek (APSU 566), 3 mi SW Bumpus Mills (APSU 357).

A total of 38 specimens of *Virginia valeriae valeriae* were examined from the following localities:

KENTUCKY: Bell County: Middlesboro (CA 13309, 13670), Chenoa (UK R-4, R-173, R-209). McCreary County: no other data (JTC 331), W Cumberland Falls on Ky. Rt. 90 (JTC 42), E Monticello on Ky. Rt. 92 (JTC 49), near Cumberland Falls (JTC 320). Wayne County: Wolf Creek Lake (UL 2392, 2398).

MARYLAND: Cecil County: Elk Neck (FMNH 44977).

OHIO: Scioto County: Shawnee State Forest (JTC 32, 420a, 420b), Shawnee State Forest at North Shawnee sawmill (JTC 145).


WEST VIRGINIA: Hampshire County: near Romney (CM 23794). Hardy County: 5 mi S Moorefield (WVBs 1313). Kanawha County: Belle (WVBs 2293). Lincoln County: near Ranger (WVBs 2439). Mineral County: near Reese's Mill (CM 13893), 3 mi SE Keyser (CM 9028), Gerstell Hollow (CM 13826). Wayne County: Wayne (WVBs 3785), 5 mi S Wayne (WVBs 2884), West Huntington (WVBs 2108).

Acknowledgements

For assistance in the field or for the loan of specimens we are indebted to Roger W. Barbour, Lois Bousman, William M. Clay, the late Doris M. Cochran, N. Bayard Green, Corson Jay Hirschfeld, George Innarone, James C. List, Clarence J. McCoy, George T. McDuffie, Burt L. Monroe, Jr., David H. Snyder, and George R. Zug.
Stephen R. Edwards instructed us in the use of the Programma 101. We are also grateful to William E. Duellman and students of the University of Kansas herpetology division who read the manuscript and offered suggestions. Jane W. Collins assisted in typing the manuscript.

**Literature Cited**


*Received February 18, 1971. Accepted March 5, 1971.*