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SCORPIONS OF IDAHO

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Idaho State University

DEPARTMENT OF BIOLOGY
Pocatello, Idaho 83209

February 25, 1976

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Dr. Robert C. Anderson
Department of Biology
Idaho State University
Pocatello, IDAHO 83209

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Robert C. Anderson, Ph.D.
Associate Professor

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SCORPIONS OF IDAHO

ROBERT C. ANDERSON
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ABSTRACT

Studies conducted from 1970-1973 indicate the presence of *Paruroctonus boreus* (Girard), *Hadrurus spadix* Stahnke, *Anuroctonus phaidactylus* (Wood), and *Vaejovis confusus* Stahnke (Scorpionida: Vaejovidae) in Idaho. Two of these four species, *A. phaidactylus* and *V. confusus*, represent new records for Idaho and an extension in the range of these organisms to the north. Generally, Idaho Scorpionida are smaller than other specimens of the same species reported and analyzed from more southern latitudes. Characteristics of surface activity vary, but such activity is of longest duration for *P. boreus* which can be found on the surface from mid-March to mid-October.

INTRODUCTION AND METHODS

Scorpions are among the first and oldest known terrestrial Arthropoda. Living species range in size from 13 mm to 210 mm, and a fossil species nearly 1 meter in length has been reported (Kjellesvig-Waering, 1972). Although most species are tropical and subtropical organisms living in humid as well as arid conditions, a number of species abound at more southern and northern latitudes.

Scorpions occupy a unique position in the animal kingdom and much remains to be learned of their distribution, habits, and physiological processes. For example, it has been known for more than 25 years that scorpions fluoresce under ultraviolet light (Stahnke, 1972), and since the advent of an efficient, portable UV source and following the report of Honetschlager (1965) on its utility in scorpology, the fluorescence phenomenon has expanded the field and taxonomic information being generated for these animals. However, although the fluorescence factor is known to occur primarily in the outer layer of the cuticle (Pavan, 1958), it has yet to be chemically defined.

Idaho occupies an interesting geographical location for resolving distributional patterns of some North American Scorpionida, and it was with this in mind that an investigation on the occurrence and distribution of scorpions within the state was started in 1970. Most material collected and analyzed for this study was obtained with a Burgess "Safari Lite" equipped with an 8 watt, GE F8T5/BLB tube having a radiation peak of 356 nm. Specimens were preserved using the procedures described by Williams (1968). On occasion, dead and brittle but intact specimens were analyzed after treatment in lactophenol (Krantz, 1971), a softening procedure which does not alter exoskeletal dimensions.

The author is indebted to the many students, colleagues, and citizens who have supplied specimens and information during this study. A special debt of gratitude is due Mr. Greg Tourtlotte and Dr. Charles Baker for their assistance in the field, and Dr. Willis Gertsch, Dr. Stanley Williams, and Mr. Michael Soleglad for critically evaluating the manuscript. Thanks are also due Erica Hansen for assisting with the figures, and Dr. D. M. Allred for kindly providing Utah specimens of *Vaejovis confusus* Stahnke for examination. The studies reported herein were supported in

part by Faculty Research Grants at Idaho State University.

KEY TO SCORPIONS OF IDAHO

All Scorpionida presently known from Idaho are members of the family Vaejovidae. The key provided is not phylogenetic and does not necessarily reflect the most significant phylogenetic separation criteria.

1. Four lateral eyes on each side of carapace (Fig. 1); telson of mature male abruptly constricted near base of aculeus (Fig. 2d); pedipalps large with black fingers; segment IV of postabdomen lacking ventral keels — *Anuroctonus phaiodactylus* (Wood) (Fig. 3 and 12b).
- 1¹. Three lateral eyes on each side of carapace; telson of male not bulbous near base of sting; pedipalps narrower with light brown or tan fingers 2
2. Medioventral margin of moveable finger of chelicera with one conspicuous large tooth (Fig. 5); entire carapace, including interocular area, dark brown or black — *Hadrurus spadix* Stahnke (Fig. 6 and 12a).
- 2¹. Moveable finger of chelicera without large tooth; carapace tan 3
3. Ventral margin of cheliceral moveable finger usually weak to mediumly crenulate; genital operculum of female separated on posterior one-fifth; inner margin of fixed finger of pedipalp scalloped (Fig. 7a); palm of pedipalp with prominent, granulose keels and almost as wide as fixed finger is long; segments of preabdomen dark brown or black dorsally with light posterior and lateral margins resulting in a banded appearance — *Paruroctonus boreus* (Girard) (Fig. 9 and 12c).
- 3¹. Ventral margin of cheliceral moveable finger smooth; genital operculum of female fused; fixed finger of pedipalp not scalloped on inner margin; palm of pedipalp without conspicuous keels and about one-half as wide as fixed finger is long; preabdomen uniformly tan — *Vaejovis confusus* (Stahnke) (Fig. 11 and 12).

ANUROCTONUS PHAIODACTYLUS (WOOD)

Centrurus phaiodactylus Wood, 1863, Proc. Acad. Nat. Sci. Philadelphia, p. 111; 1863, J. Acad. Nat. Sci. Philadelphia (2) 5:372.
Uroctonus phaeodactylus Karsch, 1879, Mitt. des Munchener Entol. Vereins, p. 102.

Uroctonus phaiodactylus Banks, 1900, The American Nat., p. 424; 1904, Proc. Calif. Acad. Sci., p. 365.

Anuroctonus phaiodactylus Banks, 1910, Pomona Coll. Jour. Entol., p. 188; Ewing, 1928, Proc. U.S.N.M., pp. 14-15; Hjelle, 1972, Occas. Papers of the Calif. Acad. Sci., No. 92, pp. 7-9.

Anuroctonus phaeodactylus Pocock, 1902, Biol. Centrali-Americana, Arachnida, Scorpions, Pedipalpi and Solfugae, p. 14; Gertsch, 1958, Amer. Mus. Nov., No. 1903, p. 14; Gertsch and Allred, 1965, Brig. Young Univ. Sci. Bull., Vol. 6, No. 4, pp. 11-12.

Although this species probably has a spotty distribution throughout southeastern Idaho, only one population is known in the state at present (Fig. 4). This species, sometimes referred to as "the dusky-footed" or "shining-sting" scorpion, is noted for its tendency to occur in non-random, colonial fashion (Williams, 1966). Heretofore known only from Utah, Nevada, Baja California, and California,

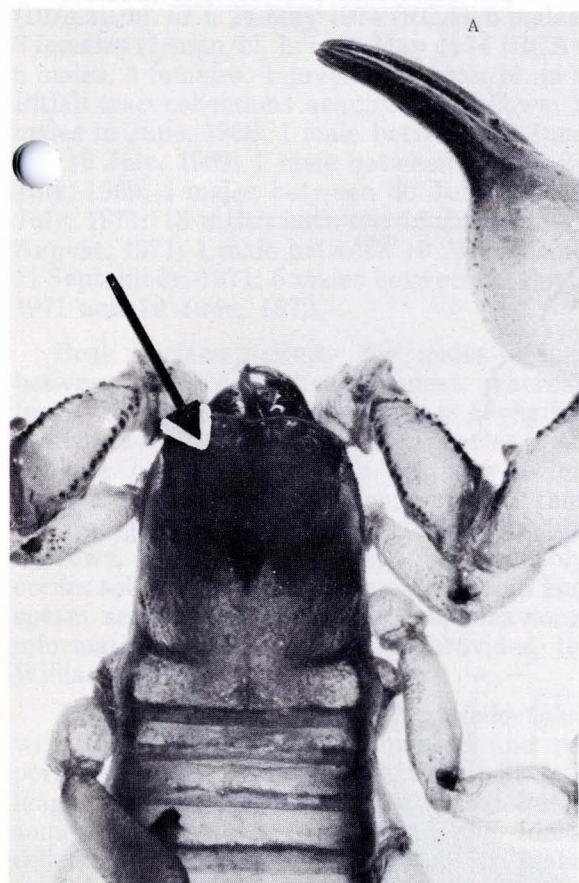


Figure 1. Carapace of *Anuroctonus phaiodactylus* (Wood) indicating position of lateral eyes.

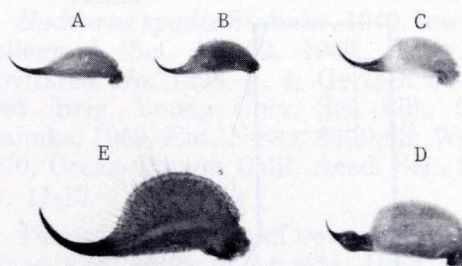


Figure 2. Telsons of Idaho Scorpionida. (A) *Vaejovis confusus* Stahnke; (B) *Paruroctonus boreus* (Girard); (C) *Anuroctonus phaiodactylus* (Wood) female; (D) *A. phaiodactylus*, male; (E) *Hadrurus spadix* Stahnke.

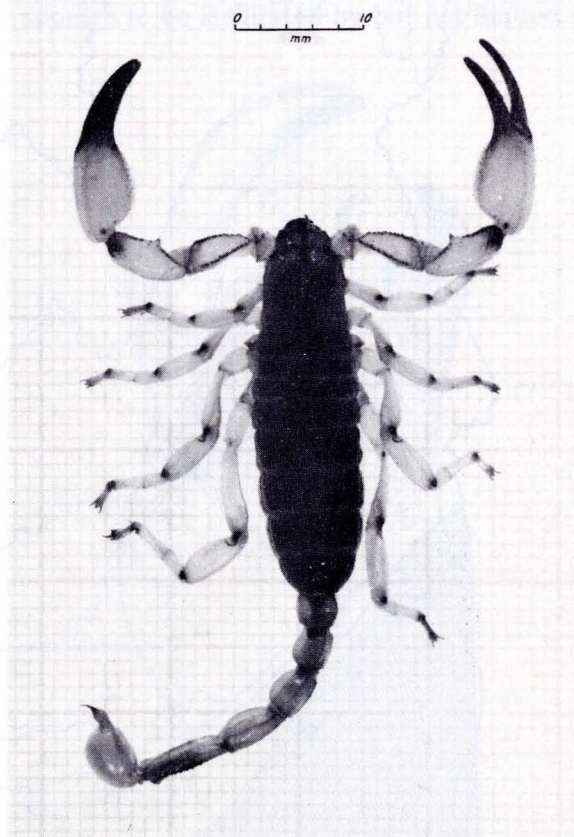
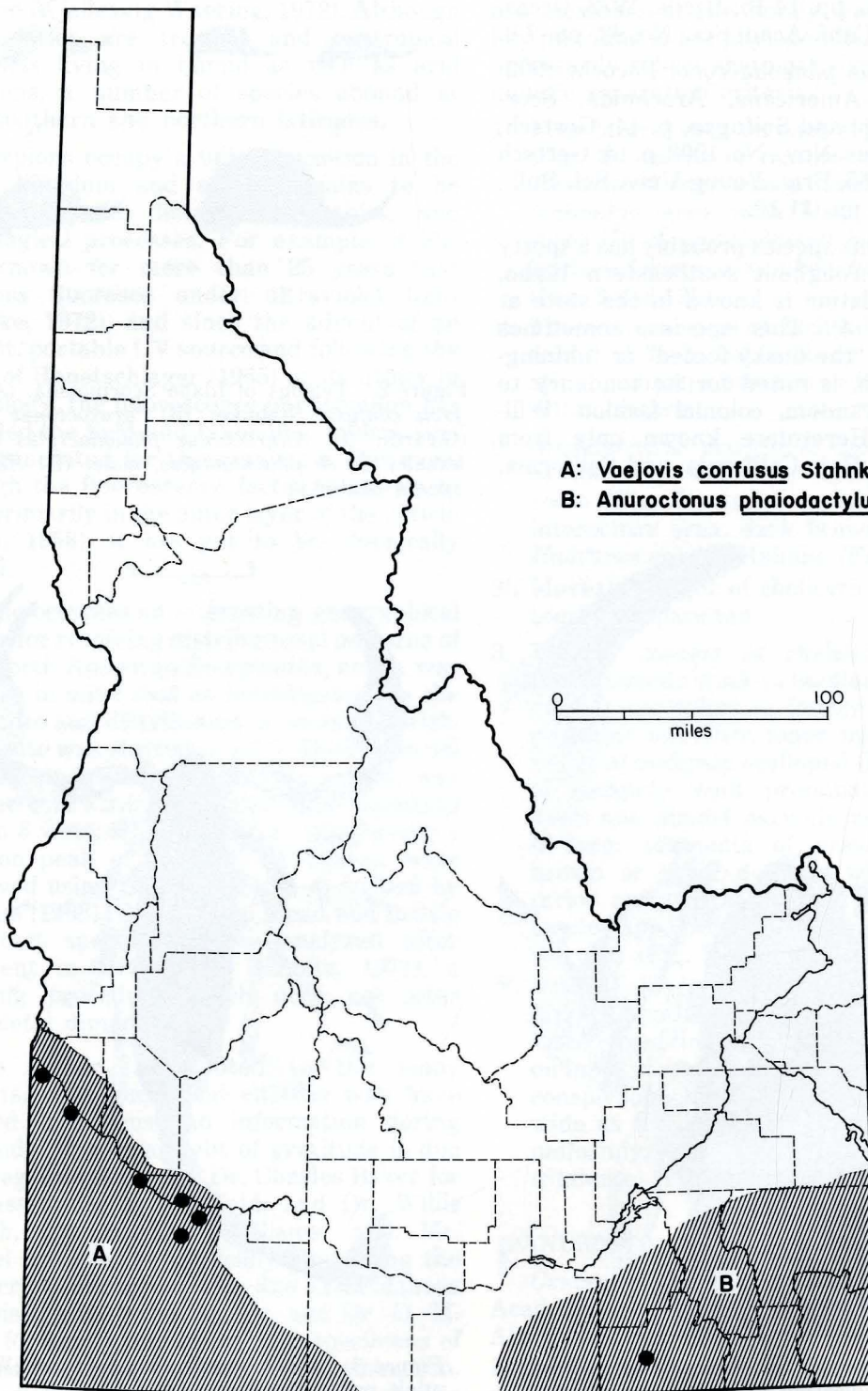


Figure 3. *Anuroctonus phaiodactylus* (Wood), adult male (each division = 1 mm.).

Figure 4. Collection sites and probable distribution pattern of *Vaejovis confusus* Stahnke and *Anuroctonus phaiodactylus* (Wood) in Idaho.



the collections from Idaho represent both a state record and an extension of the range of *A. phaiodactylus* to the north. *A. phaiodactylus* is monotypic, being the only species known for the genus.

All records of *A. phaiodactylus* in Idaho are from specimens collected in Oneida County, about 3 miles NW of Holbrook in the Curlew National Grasslands. The population occupies about 4 sq. mi. on a gradual south-facing slope of compact soil. Big sage, rabbitbrush, crested wheatgrass, Idaho fescue, cheatgrass, and balsam root predominate. The area, located at approximately 42.3° N. latitude, receives an average of 12-14 inches of precipitation each year and is at an elevation of about 4,000 ft.

RECORDS — IDAHO: Oneida County; 3 mi. NW Holbrook, 7 July 1970 (RCA), 11 males; 29 July 1970 (RCA), 2 males; 17 June 1971 (RCA), 15 males, 4 females (10/man hr. by blacklight); 25 June 1971 (RCA & R. Rhoades), 3 males (1/man/hr); 10 August 1971 (RCA), 1 male; 25 July 1973 (RCA), 21 males (10/man/bl. hr.); 24 May 1974 (RCA), 5 males, 3 females (7/man/bl. hr); 28 May 1974 (RCA), 6 males, 3 females, 1 juvenile (7/man/bl. hr); Pitfall trap collections acquired as follows: 3 males in June, 1968; 1 male between 28 June and 16 July, 1969; 1 male between 13 and 27 July, 1969; 4 males between 30 June and 16 July, 1971; 13 males between 16 July and 10 August, 1971; 1 male between 10 August and 11 September, 1971; 5 males between 11 Sept. 1971 and 10 June, 1972.

Peak surface activity for males occurs between mid-July and mid-August, whereas female occurrence on the surface is negligible or absent beyond mid-June. The species is an obligate burrower and the scarcity of immature forms in the collections suggests that these stages feed and grow exclusively within burrows. Female surface activity probably occurs solely for the purpose of courtship and sperm acquisition. Ecological and behavioral information on this species is provided by Williams (1966).

A comparison of Idaho *A. phaiodactylus* with the Utah specimens analyzed and reported by Johnson and Allred (1972) indicate a longer carapace, metasoma, and telson but a somewhat smaller mesosoma in the Idaho collections. A similar comparison of Idaho specimens with those collected at the Nevada Test Site and analyzed by Gertsch and Allred (1965) indicate that, although the pectine tooth

counts are essentially equal, the Nevada specimens (males) are approximately 10-15 percent larger (Table 1).

HADRURUS SPADIX STAHNKE

Hadrurus spadix Stahnke, 1940, Iowa State College J. Sci. 15:102, 1945, Amer. Mus. Novitates, No. 1298, p. 4; Gertsch & Allred, 1965, Brig. Young Univ. Sci. Bill., 6(4):14; Stahnke, 1969, Ent. News, 80(3):62; Williams, 1970, Occas. Papers Calif. Acad. Sci., No. 87, pp. 11-13.

This species is one of seven known in the genus, and occurs in Arizona, Utah, Nevada, Oregon, California as well as Idaho (Williams, 1970). *Hadrurus* spp. scorpions are among the largest Scorpionida in the western hemisphere and characteristically possess numerous large bristles on the appendages and telson. For these reasons they are sometimes called "giant hairy scorpions." *Hadrurus spadix* differs from other *Hadrurus* spp. in having the interocular space of the carapace black, and a yellowish metasoma. Distribution of this species throughout its range, particularly on the margins, appears to be facilitated by but not limited to

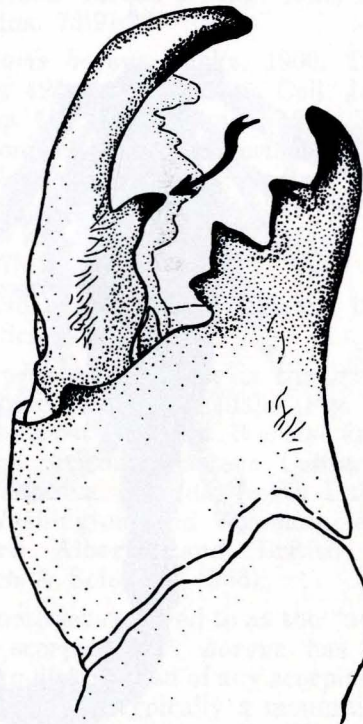


Figure 5. Right chelicera of *Hadrurus spadix* Stahnke indicating position of large tooth on medio-ventral margin of moveable finger.

major river systems, principally the Snake, Humboldt, and Colorado rivers, their environs and tributaries.

Hadrurus spadix is known from 7 counties in Idaho and is most abundant within 10 miles on either side of the Snake River between Twin Falls and Boise (Fig. 8). In addition to the Owyhee, Elmore, Ada, and Canyon County records reported by Williams (1970), this species is here reported to also occur in Power, Twin Falls, and Gooding Counties. The following records are representative for Idaho :

RECORDS — IDAHO: Ada County: 20 mi. S. Kuna, 10 July 1970 (D. Burham & T. Davis), 1 male; Canyon County: 15 mi. S. Nampa, 31 July 1973 (RCA & C. W. Baker), 2 males; Elmore County: 14 mi. S. Mountain Home, 1 August 1971 (RCA), 2 males; Gooding County: 3 June 1970 (G. Mathews), 1 female at Bliss; Niagra Spgs., 17 June 1970 (RCA), 1 female; 2 mi. S. Bliss, 19 July 1971 (RCA), 1 male; Owyhee County: Bruneau State Park, 2 June 1970 (RCA & C. W. Baker), 5 females; 18 June 1970 (RCA), 1 female; Strike Reservoir, 16 July 1971 (Terch & Runyan), 2 females, 1

male; 6 mi. S. Marsing, 1 August 1971 (RCA), 1 female; 16 mi. W. Grandview, 31 July 1973 (RCA & C. W. Baker), 14 males, 3 females, Murphy 31 July 1973 (RCA & C. W. Baker), 9 males, Power County: 22 mi. SW American Falls, 21 July 1971 (RCA), 2 males; Twin Falls County: 6.5 mi. S. Hagerman, 19 July 1971 (RCA), 1 female; 7 mi. W. Castleford, 19 July 1971 (RCA), 1 male.

Although the records cited by Williams (1970) for 44 specimens of this species in Idaho indicate an approximate 1:1 male to female sex ratio regardless of the time or location, data based on nearly 70 specimens collected via blacklight from 1970-1973 indicate a preponderance of females during June, and a preponderance of males during late July and August. In view of these apparently variable activity periods, one should be cautious when interpreting the meaning of summary sex ratio data with time. The male to female sex ratio of 6:1 reported by Gertsch and Allred (1965) for *H. spadix* at the Nevada test site probably reflects more mobility by the males than by the females as their data is based on

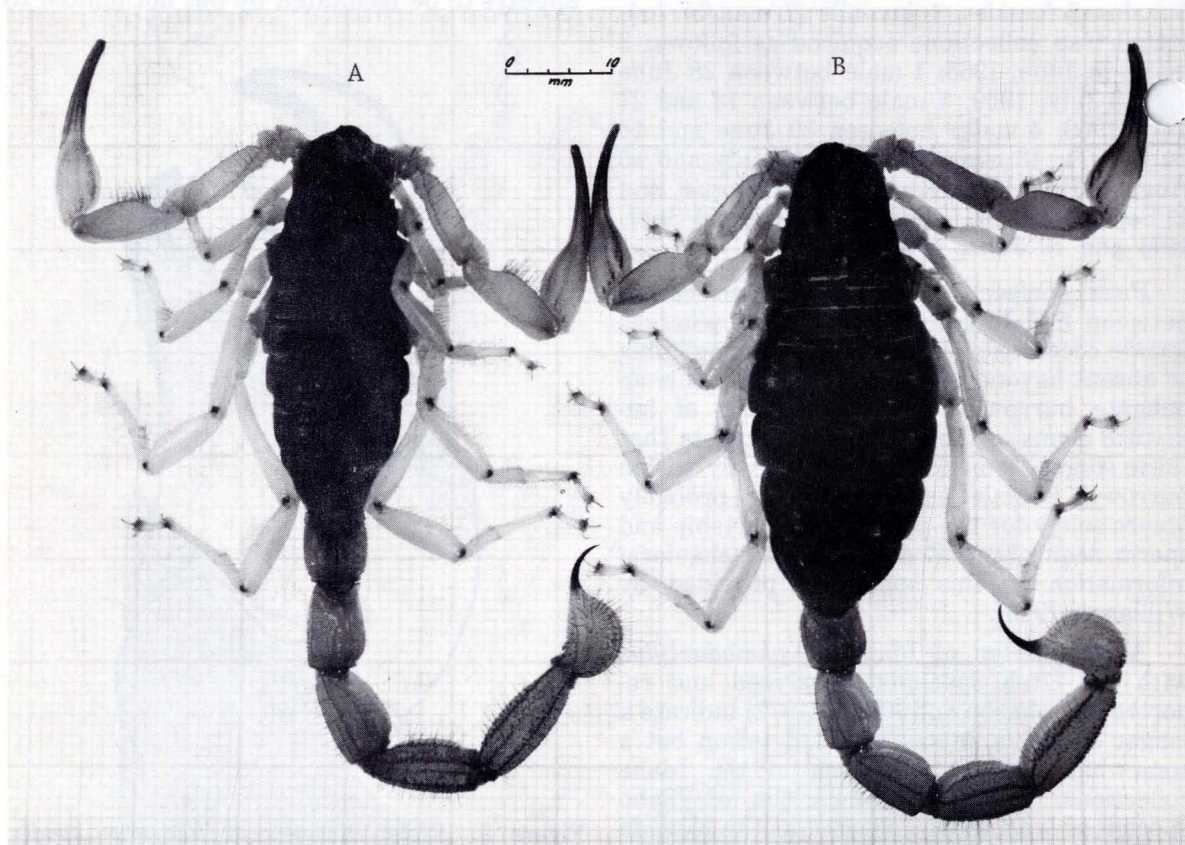


Figure 6. *Hadrurus spadix* Stahnke. (A) adult male; (B) adult female.

pitfall collections and not blacklight. Immature as well as adult specimens were collected in Idaho from May through September.

In Idaho *H. spadix* occurs almost exclusively in sandy areas and only occasionally has been collected on hard surfaced soil. The frequency of surface activity varied during the study period to a maximum of approximately 3-4/man/bl. hr. from May through July to 6/man/bl. hr. in late July and August.

Individuals comprising local populations often appear to be of the same age as indicated by similarity in size. For example, all nine specimens collected at Murphy, Idaho 31 July 1973 were within less than 1 gm. total weight and varied less than 10 mm. in total length. Although it is possible that such an occurrence reflects synchrony of development following a recent introduction, the exact significance of this phenomenon needs further study.

Sexual dimorphism is less pronounced in *H. spadix* than for other Scorpionida. Although the telson and metasomal segments IV and V, as well as the anterior margin of the humerus, tend to be more hirsute in males than in females, the most reliable means for distinguishing the sexes in this species is on the basis of the pectines. Pectine teeth are longer and more numerous in mature males than in females. Also, in females, the distance between the point of attachment of the pectine to the body and the base of the first tooth is greater than the greatest width of the anterior and middle lamellae. In males, these para-

meters are more equitable, or the width of the lamellae is greater.

Mr. Doyle Wilson, operator of a sand pit operation at Grandview, Idaho, submitted a mature female of this species (via R. Beach) which was collected from a cavity in yellow sand 6 to 8 ft. below the surface of the ground in July, 1973. This observation is of particular significance because knowledge regarding subsurface activities of Scorpionida is lacking.

A comparison of Idaho *H. spadix* with specimens from Arizona analyzed by Stahnke (1945) and Williams (1970) indicate that with few exceptions, all taxonomic characters, including pectine tooth counts, are larger in the Arizona specimens. A similar comparison with specimens of *H. spadix* from Nevada and analyzed by Gertsch & Allred (1965) indicate a similar relationship, except that the pectine tooth counts are more nearly equal.

PARUROCTONUS BOREUS (GIRARD)

Scorpio (Telegonus) boreus Girard, 1854, in Marcy, Exploration of the Red River Basin of Louisiana in the year 1852. 33rd Congress, 1st session, Senate Executive Document, p. 257.

Vaejovis boreus Ewing, 1928, Proc. U.S. Nat. Mus. 73(9):12.

Vejovis boreus Banks, 1900, The Amer. Nat., p. 424; 1910, Pomona Coll. Jour. Entomol., pp. 187, 189; Stahnke, 1940, Iowa State Coll. Jour. Sci. 15:101; Gertsch, 1958, Amer. Mus. Nov. No. 1903, p. 6; Gertsch and Allred, 1965, Brig. Young Univ. Sci. Bull., 6(4):9; Gertsch and Soleglad, 1966, Amer. Mus. Nov. No. 2278, p. 7

Paruroctonus boreus Williams, 1972, Calif. Acad. Sci., Vol. 94, p. 3

Paruroctonus boreus is the most widely distributed scorpion in Idaho (Fig. 10) and is often the most abundant. It is also known from northern Arizona, eastern California, Colorado, Montana, Nevada, North Dakota, Oregon, Washington, and Wyoming, as well as southern Alberta and British Columbia (Gertsch & Soleglad, 1966).

Sometimes referred to as the "northern or boreal scorpion," *P. boreus* has the most northern distribution of any scorpion in North America and is typically a mountainous high altitude, cold-hearty species. The thick, dorsally keeled chelae and "banded" preabdomen are sufficient to separate *P. boreus* from other Idaho Scorpionida. The size of the pectines and

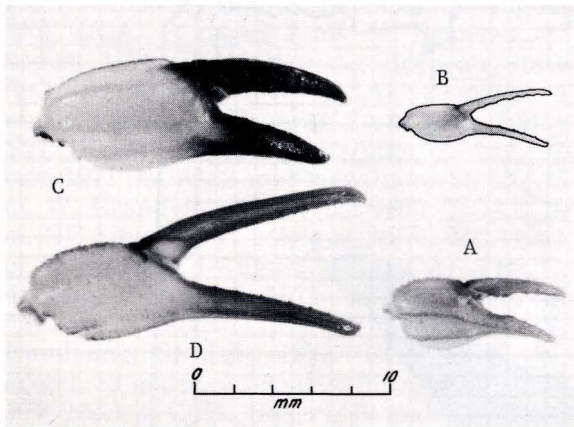
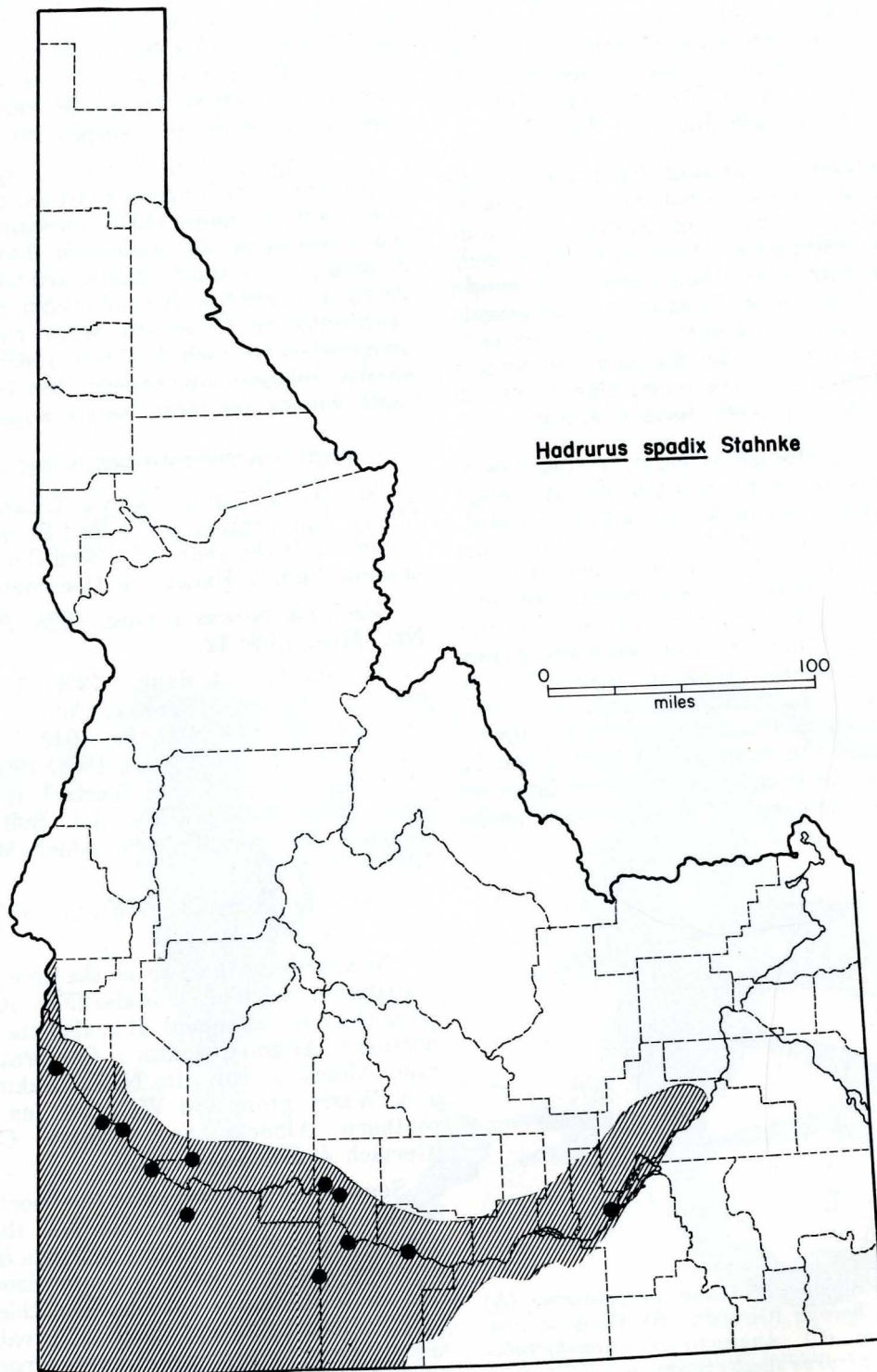


Figure 7. Pedipalps of Idaho Scorpionida. (A) *Paruroctonus boreus* (Girard); (B) *Vaejovis confusus* Stahnke; (C) *Anuroctonus phaidactylus* (Wood); (D) *Hadrurus spadix* Stahnke.

Figure 8. Collection sites and probable distribution pattern of *Hadrurus spadix* Stahnke in Idaho.



pectinal teeth, as well as the number of pectinal teeth, is greater in the males than in females. The pectines of live males are often visible when viewed from above while those of the female are not. Genital papillae are present and are often exposed from beneath well divided operculae in males. This species has been collected from 17 Idaho Counties.

RECORDS — IDAHO: Bannock County; Pocatello, 12 May 1970 (RCA), 9 juveniles, 2 adults; 28 July 1970 (RCA), 5 males, 1 female, 1 juvenile; 5 August 1970 (RCA), Mink Creek, 3 males; 14 April 1971 (RCA), 4 males, 3 females; Custer County; East Fork, 29 May 1970 (A. V. Fisher), 1 male; Challis, 28 July 1970 (J. Austin), 2 males, 1 juvenile; Twin Falls County; 2 mi. S. Thousand Spgs., 30 May 1970 (RCA & C. Nicholson), 1 male, 1 juvenile; 7 mi. W. Rogerson, 27 August 1970 (RCA), 2 males, 1 female; 10 mi. S. Rogerson, 27 August 1970 (RCA), 1 male; 7 mi. W. Castleford, 19 July 1971 (RCA); 7 mi. S. Hagerman, 19 July 1971 (RCA); Ada Co.; 1 mi. NW Swan Falls, 16 May 1970 (D. R. Brothers), 2 males; Swan Falls, 10 July 1970 (D. Burham & T. Davis), 1 male; 9 mi. N. Bruneau, 28 August 1970 (RCA), 2 males; Owyhee County; Murphy, 15 July 1970 (L. M. Bresnahan), 1 juvenile; Bruneau Dunes State Park, 2 June 1970 (RCA & C. W. Baker), 2 males, 1 juvenile; 4 mi. W. Hammett, 13 August 1970 (RCA), 4 males, 1 female; 8 mi. N.E. Three Creek, 27 August 1970 (RCA), 3 males; 9 mi. S. Bruneau, 28 August 1970 (RCA), 6 males, 3 females, 1 juvenile; 3 mi. W. Bruneau, 28 August 1970 (RCA), 5 males; 21 mi. S. Bruneau, 28 August 1970 (RCA), 1 male; 1 mi. N. Bruneau, 28 August 1970 (RCA), 1 male; Bruneau State Park, 28 August 1970 (RCA), 2 males, 1 female, 1 juvenile; Bruneau State Park, 7 May 1971 (RCA) 1.6 specimens/man/bl. hr.; 15 June 1971 (RCA), 2 specimens/man/bl. hr.; 15 mi. W. Grandview, 1 August 1971 (RCA); 10 mi. NE Silver City, 1 August 1971 (RCA); 11 mi. W. Murphy, 1 August 1971 (RCA); 3 mi. E. Marsing, 1 August 1971 (RCA); 6 mi. S. Marsing, 1 August 1971 (RCA); 16 mi. W. Grandview, 31 July 1973 (RCA & C. W. Baker), 13 males, 4 females; Murphy, 31 July 1973 (RCA & C. W. Baker), 19 males; Lincoln County; Shoshone, 29 May 1970 (Mi Pate), 3 males, 1 female; 23 mi. SE Dietrick, 10 August 1970 (RCA), 16 males, and 1 female; Power County; 1 mi. S. Massacre Rocks State Park, 25 July 1970 (RCA), 2 males; 22 mi. SW

American Falls, 21 July 1971 (RCA), 8 specimens/man/bl. hr. Oneida County; 6 mi. N. Holbrook, 8 August 1970 (RCA), 1 male and 1 juvenile; Bingham County; 33 mi. SE Arco, 9 August 1970 (RCA), 5 males, 1 female, 1 juvenile; Jefferson County; Menan Buttes, Menan, 29 August 1970 (RCA), 6 males, 1 female; 2 mi. NW Mud Lake, 18 August 1971 (RCA); Fremont County; St. Anthony Sand Dunes, 29 August 1970 (RCA), 2 males, 1 female; Payette County; 7 mi. N. Payette, 21 August 1970 (C. Shurtleff), 1 male; Elmore County; 2 mi. NW Glenns Ferry, 28 August 1970 (RCA), 1 male; Cassia County; 4 mi. W. Malta & 5 mi. N. Malta, 23 July 1971 (RCA & G. Tourtlotte), 11 males; Gooding County, Niagra Springs, 26 July 1971 (RCA); Butte County; 7 mi. E. Howe, 18 August 1971 (RCA); 11 mi. NW Howe, 18 August 1971 (RCA); 12 mi. SW Howe, 18 August 1971 (RCA); Camas County; Soldier, collected by Webster, 1923, reported by Gertsch & Soleglad, 1966.

Acquisition of 4 male *P. boreus* 2 mi. S. Asotin, Washington from hills bordering the Snake River on 3 June 1970 (RCA & C. W. Baker) would indicate that this species probably occurs on both sides of the Snake River from Payette to Moscow, wherever conditions are suitable. This species occurs in those habitats occupied by the other Scorpionida, but most commonly occurs and is characteristic for rocky hillsides. This species commonly occurs at all elevations to 6,000 ft. in Idaho and probably occurs between 6,000 and 7,000 on south-facing slopes in some areas. Hjelle (1972) reported the collection of one female *P. boreus* by C. D. Smith & F. Ennik on a dry wash at 9,270 ft. in the Inyo National Forest of California, September 10, 1968.

Tourtlotte (1973) has provided information on the biology and ecology of this species in Idaho, and noted surface activity from March 21 to October 13, 1972 on the foothills surrounding Pocatello. Observations conducted during other years have indicated that surface activity in early spring and fall is quite variable, and apparently may occur whenever ground and/or air temperature is sufficiently warm enough to permit movement regardless of time of year. Tourtlotte (1973) indicated that movement of the males was approximately five times the distance of females, and that sex ratios varied according to the time of year and method of sampling. As females apparently remain in or near burrows more frequently than males, conventional methods

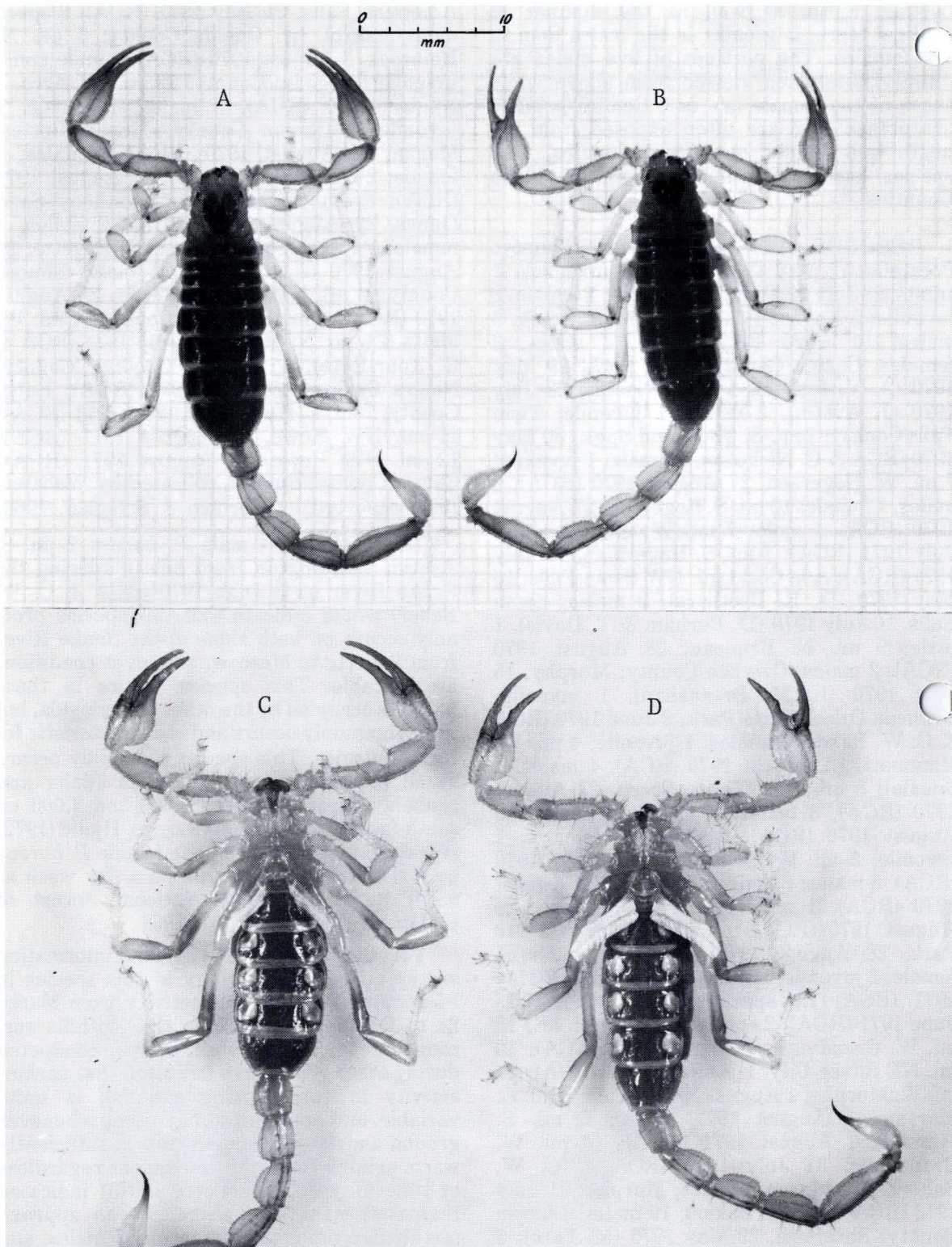
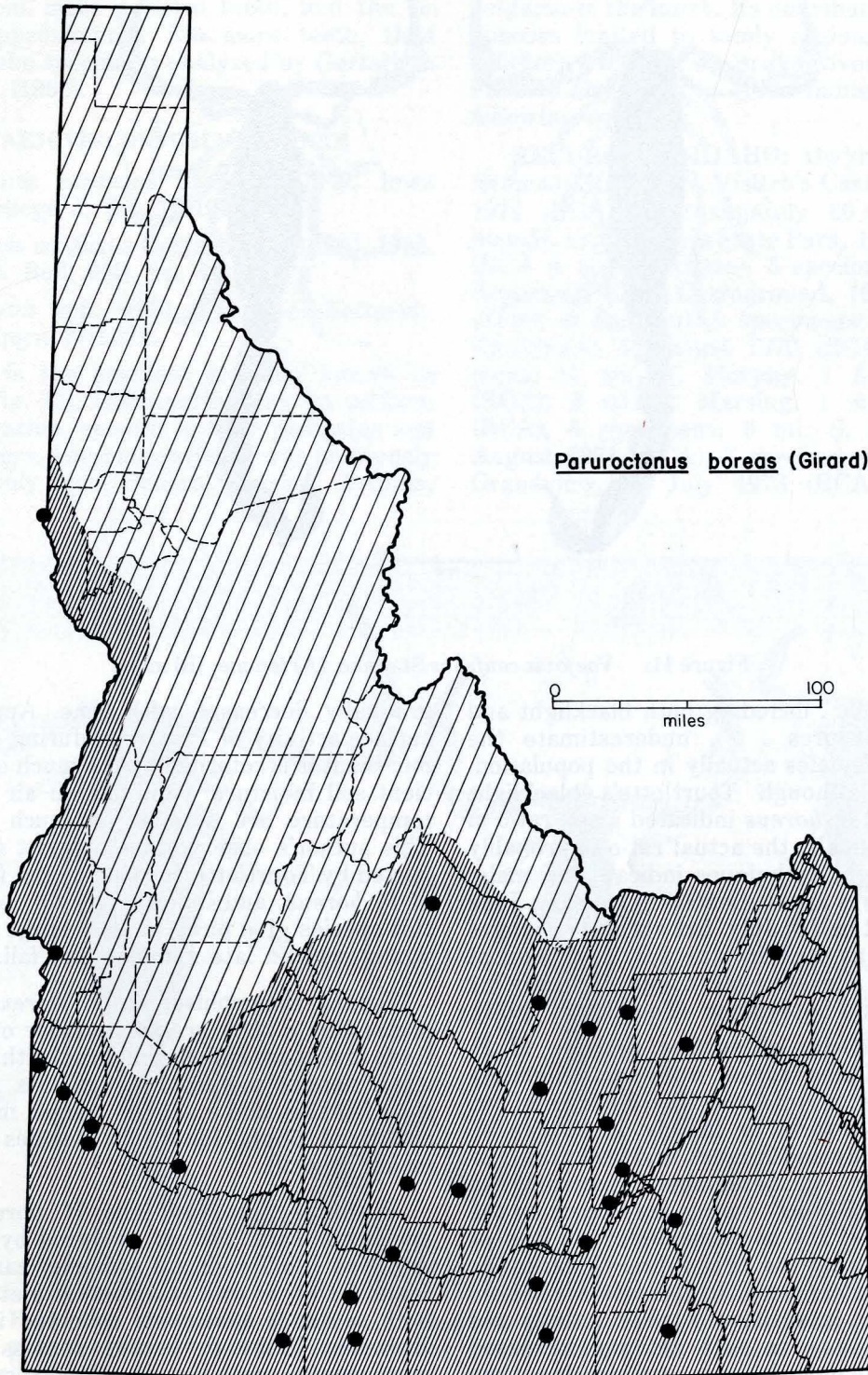


Figure 9. *Paruroctonus boreus* (Girard). Dorsal aspect of female (A). and male (B); Ventral aspect of female (C), and male (D) showing larger pectines of the male (each division = 1 mm.).

Figure 10. Collection sites and probable distribution pattern of *Paruroctonus boreus* (Girard) in Idaho.



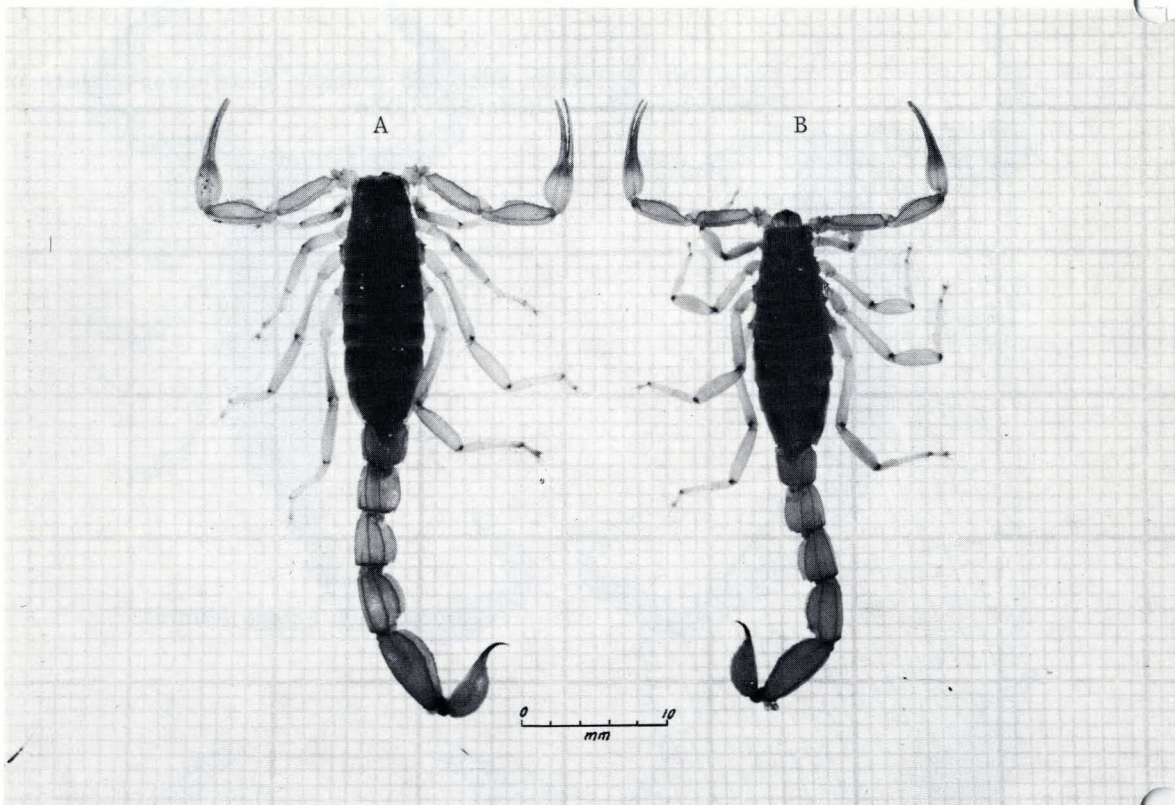


Figure 11. *Vaejovis confusus* Stahnke. (A) female; (B) male.

of sampling . . . including both blacklight and pitfall procedures . . . underestimate the number of females actually in the population. Therefore, although Tourtlotte's blacklight data for 142 *P. boreus* indicated a sex ratio of 1.8 males/female, the actual ratio is probably 1:1. Blacklight techniques indicate the male: female ratio is approximately 1:1 during June and the first half of July, but abruptly changes to as high as 20:1 in late July and August followed by a leveling-off to approximately 1:1 again in mid-September (Tourtlotte, 1973).

The intensity of surface activity of *P. boreus* in Idaho varies from approximately 2/man/bl. hr. in April and May, 5-6/man/bl. hr. in June, 6-7/man/bl. hr. in July, 12-15/man/bl. hr. in late July and August, and less than 3 or 4/man/bl. hr. in September. According to Tourtlotte (1973), *P. boreus* may occur on the surface during any nocturnal hour, but is most abundant during the first 2 hrs. of darkness. His observations seem to indicate a relationship between intensity of surface activity and ground moisture as such activity increased three to four days following precipitation, then

gradually decreased with time. Apparently, surface activity of *P. boreus* during the summer months is retarded by too much or insufficient soil moisture even though air and soil temperature are suitable for such activity. This author's observations support those reported by Tourtlotte relating to the fecundity of *P. boreus*, and indicate gravid females of this species give birth to an average of 34 ± 3 young each in late summer and fall.

Sexual dimorphism in *P. boreus* is expressed by a 33% greater number of pectine teeth in mature males compared with females, more slender metasomal segments in males than females, and a slightly longer mesosoma and fixed finger length in females than in males (Fig. 9).

A comparison of Idaho *P. boreus* with specimens from Nevada analyzed by Gertsch & Allred (1965) indicate a shorter carapace in Idaho males, as well as a shorter metasoma in both sexes of specimens collected in Idaho. However, Idaho *P. boreus* possess slightly more pectine teeth than the Nevada specimens

analyzed. A comparison of Idaho *P. boreus* with specimens collected in Utah and analyzed by Johnson and Allred (1972) show no overt differences between the two regions. The male specimens of *P. boreus* analyzed and reported in the present report possess approximately 10 percent more pectinal teeth, and the females approximately 5% more teeth, than those Idaho specimens analyzed by Gertsch & Sologlad (1966).

VAEJOVIS CONFUSUS STAHNKE

Vaejovis confusus Stahnke, 1940, Iowa State College J. Sci. 15:101.

Vaejovis confusus Gertsch and Allred, 1965, BYU Sci. Bull. 6(4), pp. 4-8.

Vaejovis spp., 1971, Pan Pac. Entomol., Proceedings, 47(1):78.

This is the smallest scorpion known in Idaho (Fig. 12). Distinguished by its uniform tan coloration, smooth narrow pedipalps and long fingers, *Vaejovis confusus* was previously known only from Sonora, Mexico, Arizona,

southern Nevada, southern California, and Utah (Williams & Hadley, 1967; Johnson & Allred, 1972). The present notations of its occurrence in Idaho represent a new state record for this species, and as for *A. phaidactylus*, an extension in the range for *V. confusus* to the north. Its distribution in Idaho appears limited to sandy regions along the southern border of the Snake River from Twin Falls to Oregon (Fig 4), as indicated by the following records:

RECORDS — IDAHO: Owyhee County; Bruneau State Park Visitor's Center, 13 Aug. 1970 (RCA), approximately 60 specimens/man/bl. hr.; Bruneau State Park, 15 June 1971 (RCA & G. Tourtlotte), 3 specimens; Strike Reservoir, Cove Campground, 16 July 1971 (Terch & Runyan), 6 specimens; 16 mi. W. Grandview, 1 August 1970 (RCA), 5 specimens; 11 mi. W. Murphy, 1 August 1970 (RCA); 3 mi. E. Marsing, 1 August 1971 (RCA), 4 specimens; 6 mi. S. Marsing, 1 August 1971 (RCA), 7 specimens; 16 mi. W. Grandview, 31 July 1973 (RCA & C. W.

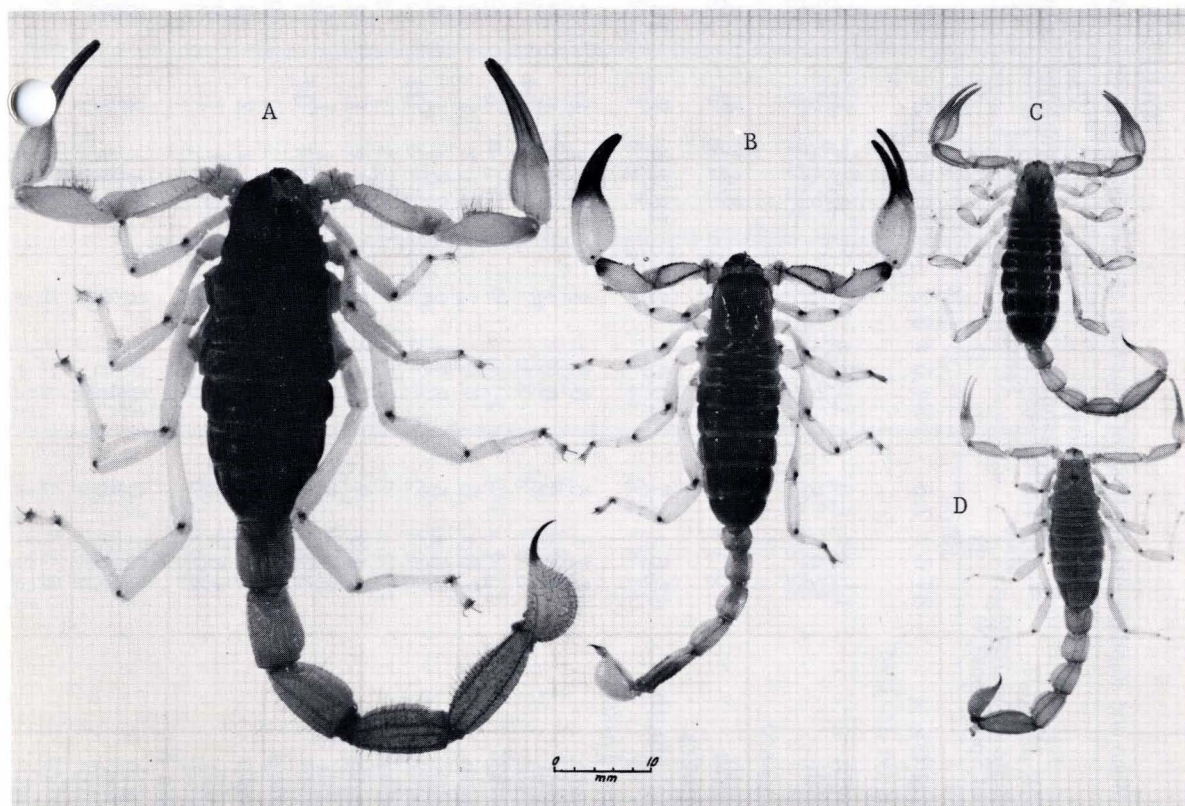


Figure 12. Scorpions of Idaho. (A) *Hadrurus spadix* Stahnke; (B) *Anuroctonus phaidactylus* (Wood); (C) *Paruroctonus boreus* (Girard); (D) *Vaejovis confusus* Stahnke.

TABLE 1

Mean and standard error analysis of important characteristics of Scorpionida collected in Idaho, 1970-1973. Measurements in millimeters.

	Hadrurus spadix Stahnke		Vaejovis confusus Stahnke		Paruroctonus boreus (Girard)		Anuroctonus phaiodactylus (Wood)
	Males	Females	Males	Females	Males	Females	Males
Number of Specimens (N)	23	21	36	12	25	25	25
Total length	87.6 ± 7.5	84.5 ± 3.2	36.7 ± 1.3	35.7 ± 3.4	43.1 ± 1.3	46.6 ± 1.3	53.2 ± 1.1
Carapace							
length	11.2 ± 1.0	11.6 ± .4	4.6 ± .1	4.8 ± .3	5.0 ± .2	5.6 ± .1	8.8 ± .2
width	8.9 ± .8	8.6 ± 1.0	3.4 ± .2	3.4 ± .3	3.9 ± .2	4.3 ± .2	6.5 ± .1
Mesosoma							
length	19.3 ± 1.1	20.2 ± 1.6	8.4 ± .4	8.9 ± 1.2	11.9 ± .7	14.3 ± .7	14.4 ± .6
Metasoma							
total length . .	43.6 ± 3.7	40.0 ± 1.2	18.4 ± .7	16.8 ± 1.5	20.3 ± .6	20.1 ± .6	21.7 ± .5
14 Metasoma 1							
length	6.1 ± .5	5.8 ± .3	2.6 ± .1	2.3 ± .2	2.8 ± .1	2.9 ± .1	2.7 ± .1
width	5.8 ± .5	6.0 ± .2	2.8 ± .1	2.7 ± .3	2.6 ± .1	2.9 ± .1	3.4 ± .1
Metasoma 2							
length	7.6 ± .6	7.0 ± .2	3.1 ± .1	2.8 ± .2	3.3 ± .1	3.3 ± .1	3.2 ± .1
width	5.6 ± .5	5.7 ± .2	2.8 ± .1	2.6 ± .3	2.5 ± .1	2.8 ± .1	3.2 ± .1
Metasoma 3							
length	8.4 ± .7	7.6 ± .2	3.3 ± .1	2.9 ± .3	3.6 ± .1	3.5 ± .1	4.1 ± .1
width	5.7 ± .5	5.7 ± .2	2.7 ± .1	2.6 ± .3	2.5 ± .1	2.7 ± .1	3.0 ± .1
Metasoma 4							
length	9.7 ± .8	8.8 ± .3	4.1 ± .2	3.8 ± .4	4.3 ± .1	4.3 ± .1	4.9 ± .1
width	5.7 ± .5	5.7 ± .2	2.7 ± .1	2.5 ± .3	2.3 ± .1	2.5 ± .1	2.9 ± .1
Metasoma 5							
length	11.8 ± 1.0	10.9 ± .3	5.4 ± .2	5.0 ± .5	6.3 ± .2	6.3 ± .2	6.8 ± .2
width	5.4 ± .5	5.5 ± .2	2.7 ± .1	2.6 ± .3	2.2 ± .1	2.5 ± .1	2.4 ± .1
Telson							
length	12.3 ± 1.1	12.4 ± .4	5.3 ± .2	5.2 ± .5	5.9 ± .2	6.5 ± .2	8.3 ± .2

15	Vesicle							
	length	8.2 ± .7	7.7 ± .3	3.8 ± .1	3.6 ± .3	4.1 ± .1	4.4 ± .2	7.0 ± .2
	width	5.5 ± .5	5.7 ± .2	2.5 ± .1	2.4 ± .3	2.2 ± .1	2.5 ± .1	3.4 ± .1
	depth	4.9 ± .4	5.1 ± .2	1.8 ± .1	1.8 ± .2	1.9 ± .1	2.2 ± .1	3.2 ± .1
	Aculeus							
	length	4.2 ± .3	4.7 ± .2	1.6 ± .1	1.6 ± .2	1.7 ± .1	2.0 ± .1	1.2 ± .1
	Humerus							
	length	9.4 ± .8	8.9 ± .3	3.9 ± .1	3.8 ± .3	4.2 ± .1	4.4 ± .1	5.7 ± .1
	width	2.7 ± .2	2.8 ± .1	1.2 ± .04	1.3 ± .1	1.3 ± .1	1.4 ± .1	2.5 ± .1
	Brachium							
	length	10.4 ± .9	10.3 ± .3	4.3 ± .1	4.4 ± .3	4.5 ± .1	4.8 ± .1	6.7 ± .1
	width	3.6 ± .3	3.7 ± .1	1.4 ± .04	1.5 ± .1	1.8 ± .1	2.1 ± .1	2.9 ± .1
	Chela							
	length	17.4 ± 1.5	17.0 ± .5	6.7 ± .2	6.8 ± .6	7.8 ± .2	8.2 ± .3	14.0 ± .2
	width	3.6 ± .3	3.6 ± .1	1.3 ± .04	1.4 ± .2	2.6 ± .1	2.6 ± .1	4.4 ± .1
	depth	5.2 ± .4	5.3 ± .2	1.4 ± .1	1.5 ± .2	3.4 ± .1	3.5 ± .1	5.6 ± .1
15	Moveable Finger							
	length	11.8 ± 1.0	11.5 ± .4	4.5 ± .1	4.6 ± .4	5.0 ± .1	5.2 ± .2	7.8 ± .2
	Fixed Finger							
	length	8.7 ± .7	8.6 ± .3	3.4 ± .1	3.6 ± .3	3.4 ± .1	3.9 ± .1	5.8 ± .1
	Pectine Teeth							
	left	35.5 ± 3.4	27.4 ± 1.1	16.6 ± .2	13.5 ± .4	30.5 ± 1.0	20.9 ± .5	8.5 ± .3
	right	35.8 ± 3.1	27.7 ± 1.2	16.7 ± .2	13.5 ± .5	30.0 ± .9	21.2 ± .5	8.4 ± .3
	RANGE IN TOTAL LENGTH OF N (in mm.)	72-94	71-101	29-45	30-46	39-52	41-53	49-58
	RANGE IN NUMBER PECTINE TEETH .	31-47	23-36	16-18	13-15	26-34	18-23	7-10

Baker), 3 males, 1 female; Murphy, 31 July 1971 (RCA & C. W. Baker), 1 male; Twin Falls County; 7 mi. S. Hagerman, 19 July 1971 (RCA), 4 specimens.

Although on one occasion (Bruneau State Park, 13 August 1970) *V. confusus* were captured at the rate of approximately 60/man/bl. hr., this species is generally not abundant in the state and seldom occurs at a capture density greater than 2/man/bl. hr. The high density observed at the Bruneau site in August, 1970 has not been repeated in subsequent years.

The sex ratio for all specimens collected within the state is 3 males/female. However, these collections were obtained solely by blacklight techniques and are probably somewhat biased in favor of males because of the more frequent surface activity periods of male vaejovids generally. Sexual dimorphism occurs in *V. confusus* but is not as pronounced as for *P. boreus*. The pectine tooth count is about 20% greater for males than for females, with the former possessing about 17 teeth/pectine and the latter about 14 teeth/pectine. The metasomal segments are consistently more slender in the males than in the females, making the entire metasoma more slender in the former (Table 1).

A comparison of Idaho *V. confusus* with those analyzed by Gertsch & Allred (1965) from the Nevada Test Site indicate that the mesoma and metasoma of Idaho specimens are somewhat shorter, with each female metasomal segment of Idaho specimens being approximately $\frac{2}{3}$ the length and width of the Nevada specimens. Other female characters, including number of pectine teeth, are smaller in the Idaho specimens and, although this situation is also true for many male characters, the magnitude of the difference is not as large in the males.

SUMMARY AND DISCUSSION

Establishing the existence of four species of Scorpionida in Idaho, species which are not uncommon in their regions of occurrence, is of significance because Idaho represents the northern limits in the range of three of the four species, and two of these, *V. confusus* and *A. phaiodactylus* represent new state records. In view of the fact that so little is known of scorpion growth patterns and longevity, it is difficult to speculate on the somewhat smaller size of Idaho specimens relative to specimens

from more southern latitudes. As scorpions can live for many years, it is possible the differences in size indicate comparatively young populations . . . especially in those species exhibiting the greatest differences.

Much remains to be learned on matters relating to ecological, behavioral, and physiological processes of scorpionida. Burrow and overwintering characteristics, movement, migration, and distribution patterns, intraspecific age distribution and the effects of age, if any, on surface activities, and the composition and significance of the cuticular fluorescent substance are only a few of the many questions and problems which are in need of further investigation.

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