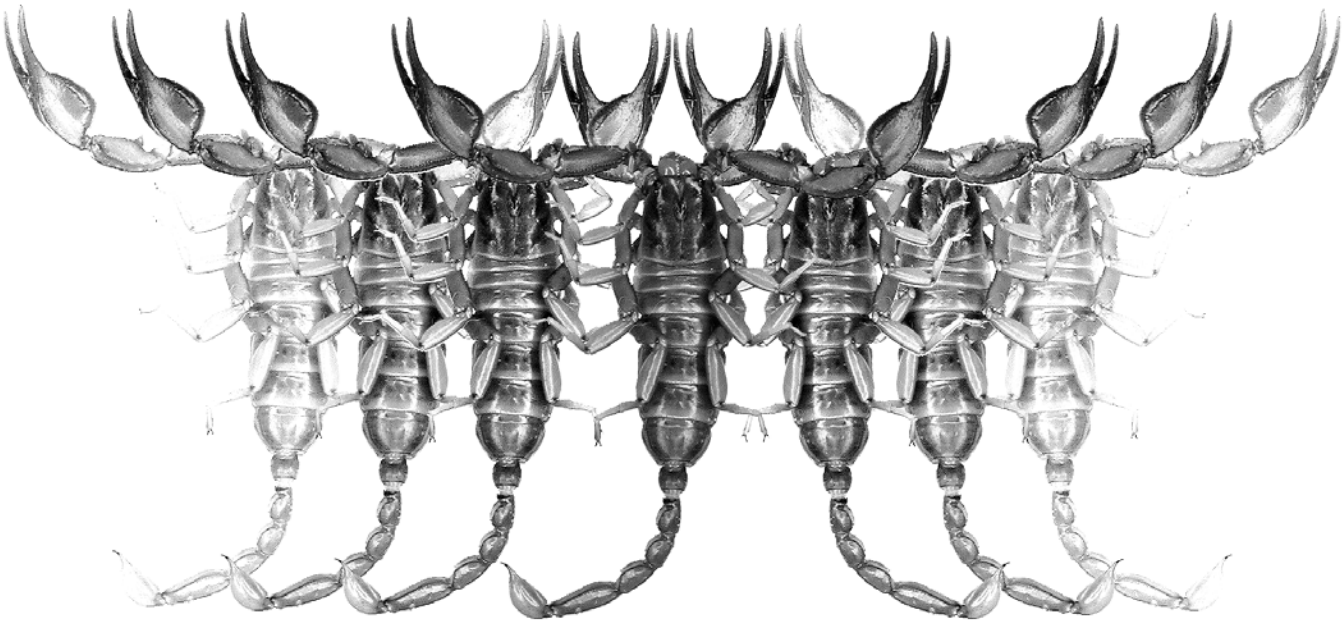
Euscorpius

Occasional Publications in Scorpiology



Laterobasal Aculear Serrations (LAS) in Scorpion Family Vaejovidae (Scorpiones: Chactoidea)

Victor Fet, Michael E. Soleglad and Michael S. Brewer

October 2006 – No. 45

Euscorpius

Occasional Publications in Scorpiology

EDITOR: **Victor Fet**, Marshall University, **'fet@marshall.edu'**

ASSOCIATE EDITOR: **Michael E. Soleglad, 'soleglad@la.znet.com'**

Euscorpius is the first research publication completely devoted to scorpions (Arachnida: Scorpiones). *Euscorpius* takes advantage of the rapidly evolving medium of quick online publication, at the same time maintaining high research standards for the burgeoning field of scorpion science (scorpiology). *Euscorpius* is an expedient and viable medium for the publication of serious papers in scorpiology, including (but not limited to): systematics, evolution, ecology, biogeography, and general biology of scorpions. Review papers, descriptions of new taxa, faunistic surveys, lists of museum collections, and book reviews are welcome.

Derivatio Nominis

The name *Euscorpius* Thorell, 1876 refers to the most common genus of scorpions in the Mediterranean region and southern Europe (family Euscorpiidae).

Euscorpius is located on Website **'http://www.science.marshall.edu/fet/euscorpius/'** at Marshall University, Huntington, WV 25755-2510, USA.

The International Code of Zoological Nomenclature (ICZN, 4th Edition, 1999) does not accept online texts as published work (Article 9.8); however, it accepts CD-ROM publications (Article 8). *Euscorpius* is produced in two *identical* versions: online (ISSN 1536-9307) and CD-ROM (ISSN 1536-9293). Only copies distributed on a CD-ROM from *Euscorpius* are considered published work in compliance with the ICZN, i.e. for the purposes of new names and new nomenclatural acts. All *Euscorpius* publications are distributed on a CD-ROM medium to the following museums/libraries:

- **ZR**, Zoological Record, York, UK
- **LC,** Library of Congress, Washington, DC, USA
- **USNM**, United States National Museum of Natural History (Smithsonian Institution), Washington, DC, USA
- **AMNH**, American Museum of Natural History, New York, USA
- **CAS**, California Academy of Sciences, San Francisco, USA
- **FMNH**, Field Museum of Natural History, Chicago, USA
- **MCZ**, Museum of Comparative Zoology, Cambridge, Massachusetts, USA
- **MNHN**, Museum National d'Histoire Naturelle, Paris, France
- **NMW**, Naturhistorisches Museum Wien, Vienna, Austria
- **BMNH**, British Museum of Natural History, London, England, UK
- **MZUC**, Museo Zoologico "La Specola" dell'Universita de Firenze, Florence, Italy
- **ZISP**, Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia
- **WAM**, Western Australian Museum, Perth, Australia
- **NTNU**, Norwegian University of Science and Technology, Trondheim, Norway

---

Publication date: 26 October 2006

Euscorpius — Occasional Publications in Scorpiology. 2006, No. 45

Laterobasal aculear serrations (LAS) in scorpion family Vaejovidae (Scorpiones: Chactoidea)

Victor Fet [1], Michael E. Soleglad [2] and Michael S. Brewer [1]

[1] Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755, USA
[2] P.O. Box 250, Borrego Springs, California 92004, USA

"... The tactile delights of precise delineation, the silent paradise of the camera lucida, and the precision of poetry in taxonomic description represent the artistic side of the thrill which accumulation of new knowledge, absolutely useless to the layman, gives its first begetter."

Vladimir Nabokov interview,
Wisconsin Studies in Contemporary Literature, 1967, 8(2).

Summary

The discovery of a new structure on the laterobasal aspect of the telson aculeus is described here for the first time. This structure, termed the *laterobasal aculear serrations* (LAS), is a row of minute denticles located on each side of the aculeus base, found exclusively in scorpion family Vaejovidae, thus potentially providing a new synapomorphy for this New World family. The LAS structure of major representative vaejovid genera and *Vaejovis* groups is illustrated with SEM micrographs. Also provided is a comprehensive list of non-vaejovid Recent scorpion genera examined where the LAS structure was found to be absent.

Introduction

In this contribution we describe and illustrate for the first time a new scorpion structure, termed the *laterobasal aculear serrations* (LAS), a minute serrated row located on each side of the base of the scorpion's aculeus. Results presented in this paper show that the LAS structure is only found in the New World scorpion family Vaejovidae, implying that this structure may be an important taxonomic character.

Needless to say, the telson, where scorpion's toxic gland resides, with its spectacular "stinger" (aculeus) has always received a very close attention in literature—and not only in the important studies of toxic gland anatomy (Pavlovsky, 1913). Historically, external anatomy of the telson has provided a number of important taxonomic characters in scorpions, e.g. commonly found parallelisms such as subaculear tooth/tubercle (protuberance), or rare synapomorphies such as enigmatic male glands in some *Hadrurus* and *Hoffmannihadrurus* (Williams, 1970) and some Bothriuridae (Sissom, 1990). Granulation, carination, coloration, setation patterns, size, and the shape of telson, vesicle/aculeus ratio, aculeus curvature all are standard descriptive characters in scorpion systematics (Sissom, 1990), although functional/selective role of such variation in scorpion's most important "working end" has rarely if ever been addressed. In addition, sexual dimorphism is often quite prominent in telson anatomy, so that in some Chactoidea (e.g. Euscorpiidae) and Scorpionoidea (e.g. Hemiscorpiinae) adult males are readily diagnosed by their exaggerated vesicle.

However, it appears that a minute in size but important diagnostic feature (which has a good chance to be a family-level synapomorphy) has been simply overlooked in the scorpion family Vaejovidae.

In this study we have analyzed 80 vaejovid species, spanning all genera and *Vaejovis* groups, using both SEM and regular microscopy. In most cases, multiple species of a genus and specimens per species were examined in order to determine whether this curious LAS structure was found exclusively in Vaejovidae. Inline with this hypothesis, we also analyzed non-vaejovid specimens from over 70 genera representing all parvorders, superfamilies, and families in Recent scorpions in order to determine if the LAS structure was indeed absent in non-vaejovid scorpions. During this

study, over 140 SEM images of the telson aculeus, with or without the LAS structure, were obtained and analyzed.

Methods & Material

The discovery of the LAS is a byproduct of an ongoing reevaluation of the diagnostic characters used in scorpion systematics today, with much of this effort being conducted through SEM microscopy. The use of SEM microscopy has been invaluable in this re-evaluation as evidenced by the recent discovery of the *constellation array* sensilla in all scorpions (Fet et al., 2006a, 2006b) as well as the detailed description of key diagnostic characters in the definition of vaejovid tribe Stahnkeini (Soleglad & Fet, 2006). In the same fashion, the LAS structure was first discovered using SEM microscopy. Since that first discovery, in addition to further SEM analysis, we were able to study this structure using a regular dissection microscope (80x magnification being quite adequate). Regular microscopy was used to accumulate much of the statistical data presented in this paper.

Terminology and conventions

The systematics adhered to in this paper is current and therefore follows the classification as established in Fet & Soleglad (2005) and as modified by Soleglad & Fet (2006). Terminology describing the pedipalp chelal carinae and finger dentition follows that described and illustrated in Soleglad & Sissom (2001).

SEM microscopy

To investigate the scorpion telson, the structures were sonicated in water, and then dehydrated in an ethanol series (50, 75, 95, and two changes of 100%) before being dried and coated with gold/palladium (ca. 10 nm thickness) in a Hummer sputter coater. Digital SEM images were acquired with a JEOL JSM-5310LV Scanning Electron Microscope at Marshall University, Huntington, West Virginia. Acceleration voltage (10–20 kV), spot size, and working distance were adjusted as necessary to optimize resolution, adjust depth of field, and to minimize charging.

Abbreviations

List of depositories: AMNH, American Museum of Natural History, New York, New York, USA; BH, Personal collection of Blaine Hébert; BMNH, British Museum of Natural History, London, England; CAS, California Academy of Sciences, San Francisco, California, USA; FMNH, Field Museum Natural History, Chicago, Illinois, USA; GL, Personal collection of Graeme Lowe, Philadelphia, Pennsylvania, USA; MES, Personal collection of Michael E. Soleglad, Borrego Springs, California, USA; MHNG, Muséum d'Histoire Naturelle de Genève, Geneva, Switzerland; NHMW, Naturhistorisches Museum Wien, Vienna, Austria; USNM, United States National Museum, Smithsonian Institution, Washington, D.C., USA; VF, Personal collection of Victor Fet, Huntington, West Virginia, USA.

Other: ABDSP, Anza-Borrego Desert State Park, San Diego and Riverside Counties, California, USA.

Material examined

The following material was examined for analysis and/or illustrations provided in this paper. In particular, for family Vaejovidae all genera and *Vaejovis* species groups were examined including many species per genus as well as multiple specimens per species. In these cases, statistical data for the LAS structure was gathered. For other Recent scorpions, all families were examined, including most major genera, but in general, only one species per genus was studied. The LAS structure was *not* detected in any of these cases.

Superfamily Pseudochactoidea

Pseudochactidae: *Pseudochactas ovchinnikovi* Gromov, 1998, Babatag, Uzbekistan, 2 ♀ (VF).

Superfamily Buthoidea

Buthidae: *Alayotityus nanus* Armas, 1973, El Cobre, Santiago de Cuba Province, Cuba, ♀ (VF); *Androctonus bicolor* Ehrenberg, 1828, Lhav, Israel, ♂ (MES); *Anomalobuthus rickmersi* Kraepelin, 1900, Bukhara, Uzbekistan, 1 ♂ 1 ♀ (VF); *Buthacus macrocentrus* (Ehrenberg, 1828), Abu Dhabi, United Arab Emirates, ♂ (VF); *Buthus occitanus* Amoreux, 1789, Casablanca, Morocco, (MES); *Centruroides exilicauda* (Wood, 1863), Cabo San Lucas, Baja California Sur, Mexico, ♀ (MES); *Centruroides suffusus* (Pocock, 1902), Durango, Mexico, ♂ (VF); *Compsobuthus matthiesseni* (Birula, 1905), Baghdad, Iraq, ♀ (VF); *Grosphus hirtus* Kraepelin, 1901, Tamatave Province, Perinet, Madagascar, ♀ (MES); *Hottentotta minax* (L. Koch, 1875), Eritrea, ♂ (VF); *Isometrus maculatus* (DeGeer, 1778), Vaite Pava, Makatea, French Polynesia, ♂ (USNM); *Leiurus quinquestriatus* (Ehrenberg, 1828), Saudi Arabia, ♀ (VF), Negev, Israel, ♀ (VF); *Liobuthus kessleri* Birula, 1898, Chardara, Kazakhstan, ♀ (VF); *Lychas* sp., Indonesia, ♀ (VF); *Lychas mucronatus* (Fabricius, 1798), Hanoi, Vietnam, ♀ (VF); *Mesobuthus caucasicus* (Nordmann, 1840), Chardara, Kazakhstan, ♀ (VF); *Mesobuthus eupeus* (C.L. Koch, 1839), Kzyl-Orda, Kazakhstan, ♀ (VF); *Microbuthus* sp., Rusail, Oman, ♂ (GL); *Microtityus jaumei* Armas, 1974, San Juan

Botanical Garden, Santiago de Cuba Province, (VF); *Orthochirus gromovi* Kovařík, 2004, Repetek, Turkmenistan, ♀ (VF); *Parabuthus* sp., Kenya, ♀ (VF); *Polisius persicus* Fet, Capes et Sissom, 2001, Zahedan, Iran, ♂ (USNM); *Razianus zarudnyi* (Birula, 1903), Gachsaran, Fars, Iran, ♀ (USNM); *Rhopalurus junceus* (Herbst, 1800), Sibanicú, Camagüey, Cuba, ♀ (VF); *Tityus nematochirus* Mello-Leitão, 1940, Bucaramango, Colombia, ♂ (MES); *Uroplectes vittatus* (Thorell, 1876), Doddiebum, Zimbabwe, ♂ (VF).

Microcharmidae: *Microcharmus hauseri* Lourenço, 1996, Lokobe Natural Reserve, Île Nosy Be, Madagascar, holotype ♂ (MHNG).

Superfamily Chaeriloidea

Chaerilidae: *Chaerilus variegatus* Simon, 1877, Indonesia, ♂ (MES); *Chaerilus celebensis* Pocock, 1894, Mapur Island, Indonesia, juvenile ♀ (VF).

Superfamily Iuroidea

Caraboctonidae: *Caraboctonus keyserlingi* Pocock, 1893, Chile, ♂ (MES); *Hadruroides charcasus* (Karsch, 1879), Peru, ♀ (MES); *Hadruroides maculatus* (Thorell, 1876), Huancayo, Peru, ♀ (MES); *Hadrurus concolorous* Stahnke, 1969, Santa Rosalía, Baja California Sur, Mexico, ♀ (MES); *Hadrurus obscurus* Williams, 1970, Pinyon Mountain, ABDSP, California, USA, ♂ (MES); *Hoffmannihadrurus aztecus* Pocock, 1902, Tehuacán, Puebla, Mexico, ♂ (MES).

Iuridae: *Calchas nordmanni* Birula, 1899, Anamur, Turkey, ♂ (NHMW); *Iurus dufoureius* (Brullé, 1832), Turkey, ♂ (MES).

Superfamily Scorpionoidea

Bothriuridae: *Bothriurus araguayae* Vellard, 1934, Minas Gerais, Brazil, ♀ (VF); *Bothriurus burmeisteri* Kraepelin, 1894, Gobernador Costa, Chubut, Argentina, ♂ (VF); *Brachistosternus ehrenberghii* (Gervais, 1841), Lima, Peru, ♀ (VF); *Centromachetes pocockii* (Kraepelin, 1894), Lebu, Arauco, Chile, ♀ (VF); *Cercophonius squama* (Gervais, 1843), Engadine, Sidney, Australia, ♀ (VF); *Lisposoma josehermana* Lamoral, 1979, Waterberg, Namibia, subadult ♀ (CAS); *Phoniocercus pictus* Pocock, 1893, Valdivia, Ñancul, Fundo El Linque, Chile, ♀ (VF); *Urophonius granulatus* Pocock, 1898, Chile, (VF).

Hemiscorpiidae: *Cheloctonus* sp., St. Lucia, Kwazulu, Natal, South Africa, ♀ (VF); *Hadogenes troglodytes* (Peters, 1861), Johannesburg, South Africa (MES); *Heteroscorpion goodmani* Lourenço, 1996, Reserve Naturelle Integrale d'Andohahela, Toliara Province, Madagascar, ♂ paratype (FMNH); *Liocheles australasiae* (F., 1796), Bangor, Java, Indonesia, ♀ (VF); *Liocheles karschii* (Keyserling, 1885), Guadalcanal, Solomon Islands, ♂ (MES); *Opisthacanthus lepturus* (Beauvois, 1805), Aguacate, Panama, ♀ (MES).

Scorpionidae: *Bioculus comondae* Stahnke, 1968, Loreto, Baja California Sur, Mexico, ♂ (MES), La Paz, Baja California Sur, Mexico, ♂ (VF); *Didymocentrus leseurii* (Gervais, 1844), Martinique, ♀ (VF); *Heterometrus longimanus* (Herbst, 1800), Mindanao, Philippines, ♂ (MES); *Nebo hierichonticus* (Simon, 1872), Haifa, Israel, ♀ (VF); *Opistophthalmus wahlbergii* (Thorell, 1876), Kalahari Gemsbock Park, Twee Rivieren, South Africa, ♂ (VF); *Pandinus imperator* (C. L. Koch, 1841), ♀ (MES); *Scorpio maurus* Linnaeus, 1758, Tel-Yezucham, Israel, ♀ (MES), Agadir, Morocco, ♀ (VF); *Urodacus manicatus* (Thorell, 1876), Australia, (VF).

Superfamily Chactoidea

Chactidae: *Anuroctonus pococki pococki* Soleglad et Fet, 2004, San Dimas Canyon, Los Angeles County, California, USA ♀ (AMNH); *Anuroctonus pococki bajae* Soleglad et Fet, 2004, ABDSP, California, USA, ♂ (MES), ♂ (VF); *Belisarius xambeui* Simon, 1879, Vall d'en Bas, Girona, Catalunya, Spain, ♀ (VF); *Broteochactas porosus* Pocock, 1900, Mt. Roraima, Venezuela, ♂ paratype (BMNH); *Brotheas granulatus* Simon, 1877, Grande Île, French Guiana, ♂ (MES); *Chactas exsul* (Werner, 1939), Darién, Panama, ♂ (MES); *Hadrurochactas schaumii* (Karsch, 1880), Petite Île, French Guiana, ♂ (MES); *Neochactas delicatus* (Karsch, 1879), Grande Île, French Guiana, ♂ (MES); *Nullibrotheas allenii* (Wood, 1863), Cabo San Lucas, Baja California Sur, Mexico, (MES); *Teuthraustes oculatus* Pocock, 1900, Latacunga, Ecuador, ♀ (WDS); *Uroctonus mordax mordax* Thorell, 1876, Yosemite National Park, California, USA, 1 ♂ 1 ♀ (MES), Weott, California, USA, ♂ (MES); *Uroctonus mordax pluridens* Hjelle, 1972, Santa Clara Co., California, USA, ♂ (MES); *Vachoniochactas* sp., Alto Rio Mavaca, Amazonas, Venezuela, ♂ (CAS).

Euscorpiidae: *Alloscorpiops lindstroemii* (Thorell, 1889), Tak Province, Umphang, Thailand, ♀ (CAS); *Chactopsis insignis* Kraepelin, 1912, Loreto, Peru, ♀ (MNHN); *Euscorpiops* sp. Doi Sutep, Thailand, ♀ (WDS); *Euscorpius flavicaudis* (DeGeer, 1778), Banyuls, France, ♀ (MES); *Euscorpius gamma* Caporiaco, 1950, Postojna, Slovenia, ♀ (VF); *Euscorpius italicus* (Herbst, 1800), Agarone, Ticino, Switzerland, ♂ (MES); *Euscorpius mingrelicus* (Kessler, 1874), Batumi, Georgia, ♂ (MES); *Euscorpius sicanus* (C. L. Koch, 1837), Spilia, Mt. Ossa, Greece, ♀ (VF); *Megacormus gertschi* Díaz Nájera, 1966, Las Vigas, Veracruz, Mexico, ♂ (MES); *Neoscorpiops tenuicauda* (Pocock, 1894), Maharashtra, Bhimashankar, India, ♂ (CAS); *Plesiochactas dilutus* (Karsch, 1881), Portillo Nejapa, Oaxaca, Mexico, ♂ (AMNH); *Scorpiops* sp., Landeur, India, ♀ (USNM); *Troglocormus willis* Francke, 1981, Cueva de la Llorona, Yerbabuena, Tamaulipas, Mexico, ♀ (WDS).

Superstitioniidae: *Superstitionia donensis* Stahnke, 1940, Chariot Canyon, ABDSP, California, USA, ♀ (MES).

Vaejovidae: *Franckeus minckleyi* (Williams, 1968), Cuatro Ciénegas, Coahuila, Mexico, 1 ♂ 2 ♀ (CAS); *Franckeus peninsularis* (Williams, 1980), San Raymundo, Baja California Sur, Mexico, 3 ♂ 1 ♀ paratypes (CAS); *Paravaejovis pumilis* (Williams, 1970), Ciudad Constitución, Baja California Sur, Mexico, 16 ♂ 3 ♀ (MES); *Paruroctonus arenicola nudipes* Haradon, 1984, Kelso Dunes, San Bernardino Co., California, USA, ♂, juv. (GL); *Paruroctonus arnaudi* Williams, 1972, El Socorro, Baja California, Mexico, ♂ topotype (MES); *Paruroctonus bantai saratoga* Haradon, 1985, Death Valley, Inyo Co., California, USA, juv. (GL); *Paruroctonus becki* (Gertsch et Allred, 1965), San Bernardino Co., California, USA, 1 ♀ 1 ♂ (VF); *Paruroctonus boreus* (Girard, 1854), Mercury, Nevada, USA, ♂ (MES); *Paruroctonus borregoensis* Williams, 1972, Palo Verde Wash, ABDSP, California, USA, ♂ (MES), ♀ (VF); *Paruroctonus gracilior* (Hoffmann, 1931), Cuatro Ciénegas, Coahuila, Mexico, 12 ♂ 1 ♀ (MES); *Paruroctonus hirsutipes* Haradon, 1984, Algodones Dunes, Imperial Co., California, USA, juv. (GL); *Paruroctonus luteolus* (Gertsch et Soleglad, 1966), Palo Verde Wash, ABDSP, California, USA, ♂ (MES); *Paruroctonus silvestrii* (Borelli, 1909), Chihuahua Road, ABDSP, California, USA, 10 ♂ 4 ♀ (MES), ♂ (VF); *Paruroctonus stahnkei* (Gertsch et Soleglad, 1966), Mesa, Maricopa Co., Arizona, USA, ♂ (MES), ♀ (VF), La Paz Co., Arizona, USA, ♂ (VF); *Paruroctonus surensis* Williams et Haradon, 1980, Las Bombas, Baja California Sur, Mexico, 2 ♂ (MES); *Paruroctonus utahensis* (Williams, 1968), Samalayuca, Chihuahua, Mexico, ♂ (MES), Kermit, Winkler County, Texas, USA, 1 ♀ 1 ♂ (VF); *Paruroctonus ventosus* Williams, 1972, El Socorro, Baja California, Mexico, ♀ topotype (MES); *Paruroctonus xanthus* (Gertsch et Soleglad, 1966), Algodones Dunes, Imperial Co., California, USA, ♂ (GL); *Pseudouroctonus andreas* (Gertsch et Soleglad, 1972), Chariot Canyon, ABDSP, California, USA, 6 ♂ 1 ♀ (MES); *Pseudouroctonus angelenus* (Gertsch et Soleglad, 1972), Ventura Co., California, USA, ♂ (BH); *Pseudouroctonus apacheanus* (Gertsch et Soleglad, 1972), Pinaleno Mt., Arizona, USA, ♀ (VF); *Pseudouroctonus iviei* (Gertsch et Soleglad, 1972), Little French Creek, Trinity Co., California, USA, 1 ♀ 1 ♂ (MES); *Pseudouroctonus minimus castaneus* (Gertsch et Soleglad, 1972), Vista, California, USA, ♂ (MES); *Pseudouroctonus minimus thompsoni* (Gertsch et Soleglad, 1972), Santa Cruz Island, Santa Barbara Co., California, USA, 2 ♀ 2 ♂ (GL); *Pseudouroctonus reddelli* (Gertsch et Soleglad, 1972), Gem Cave, Conal Co., Texas, USA, 2 ♀ 2 ♂ (MES); *Serradigitus adcocki* (Williams, 1980), Isla Cerralvo, Baja California Sur, Mexico, ♀ (CAS); *Serradigitus baueri* (Gertsch, 1958), West San Benito Island, Baja California, Mexico, ♂ (CAS); *Serradigitus calidus* (Soleglad, 1974), Cuatro Ciénegas, Coahuila, Mexico, ♀ paratype (MES); *Serradigitus gertschi gertschi* (Williams, 1968), Chariot Canyon, ABDSP, California, USA, 2 ♀ (MES); *Serradigitus gertschi striatus* (Hjelle, 1970), Coloma, California, USA, ♀ (VF); *Serradigitus joshuaensis* (Soleglad, 1972), Indian Gorge, ABDSP, California, USA, ♀ (MES), Cottonwood Springs, Joshua National Monument, California, USA, 11 ♀ topotypes (MES); *Serradigitus littoralis* (Williams, 1980), Isla Danzante, Baja California Sur, Mexico, ♀ (CAS), Isla Smith (Coronado), Baja California, Mexico, ♀ (VF); *Serradigitus minutis* (Williams, 1970), Cabo San Lucas, Baja California Sur, Mexico, ♀ (MES); *Serradigitus torridus* Williams et Berke, 1986, Nine Mile Canyon Rd., Kern Co., California, USA, 2 ♀ (GL); *Serradigitus wupatkiensis* (Stahnke, 1940), Wupatki National Monument, Coconino Co., Arizona, USA, ♀ topotype (MES); *Smeringurus aridus* (Soleglad, 1972), Palo Verde Wash, ABDSP, California, USA, 1 ♂ 1 ♀ (MES); *Smeringurus grandis* (Williams, 1970), Oakies Landing, Baja California, Mexico, ♂ (MES); *Smeringurus mesaensis* (Stahnke, 1957), Palo Verde Wash, ABDSP, California, USA, 5 ♀ 11 ♂ (MES); *Smeringurus vachoni immanis* (Soleglad, 1972), 1000 Palms, Riverside Co., California, USA, ♀ (MES); *Smeringurus vachoni vachoni* (Stahnke, 1961), San Bernardino Co., California, USA, ♀ (VF); *Stahnkeus deserticola* (Williams, 1970), Saratoga Springs, Death Valley, California, USA, ♀ (MES); *Stahnkeus harbisoni* (Williams, 1970), Oakies Landing, Baja California, Mexico, ♀ (MES); *Stahnkeus subtilimanus* (Soleglad, 1972), Split Mountain, ABDSP, California, USA, 2 ♀ (MES); *Syntropis macrura* Kraepelin, 1910, Los Aripes, Baja California Sur, Mexico, 1 ♂ 3 ♀ (MHNG); *Uroctonites giulianii* Williams et Savary, 1991, Lead Canyon, Inyo Co., California, USA, 1 ♂ 2 ♀ (CAS); *Uroctonites huachuca* (Gertsch et Soleglad, 1972), Huachuca Mountains, Cochise Co., Arizona, USA, 1 ♀ 1 ♂ (MES); *Uroctonites montereus* (Gertsch et Soleglad, 1972), Hastings National History Reservation, Monterey Co., California, USA, ♂ (MES); *Vaejovis bruneus* Williams, 1970, Loreto, Baja California Sur, Mexico, ♂ (MES); *Vaejovis carolinianus* (Beauvois, 1805), Haralson Co., Georgia, USA, 5 ♀ (MES); *Vaejovis cazieri* Williams, 1968, Cuatro Ciénegas, Coahuila, Mexico, ♂ (MES); *Vaejovis coahuilae* Williams, 1968, Cuatro Ciénegas, Coahuila, Mexico, ♂ (MES); *Vaejovis confusus* Stahnke, 1940, Mesa, Maricopa Co., Arizona, USA, ♂ (MES); *Vaejovis davidi* Soleglad et Fet, 2005, Cuelzalan, Puebla, Mexico, ♀ holotype (AMNH); *Vaejovis decipiens* Hoffmann, 1931, Chínipas, Chihuahua, Mexico, ♀ (MES); *Vaejovis diazi* Williams, 1970, Ciudad Constitución, Baja California Sur, Mexico,

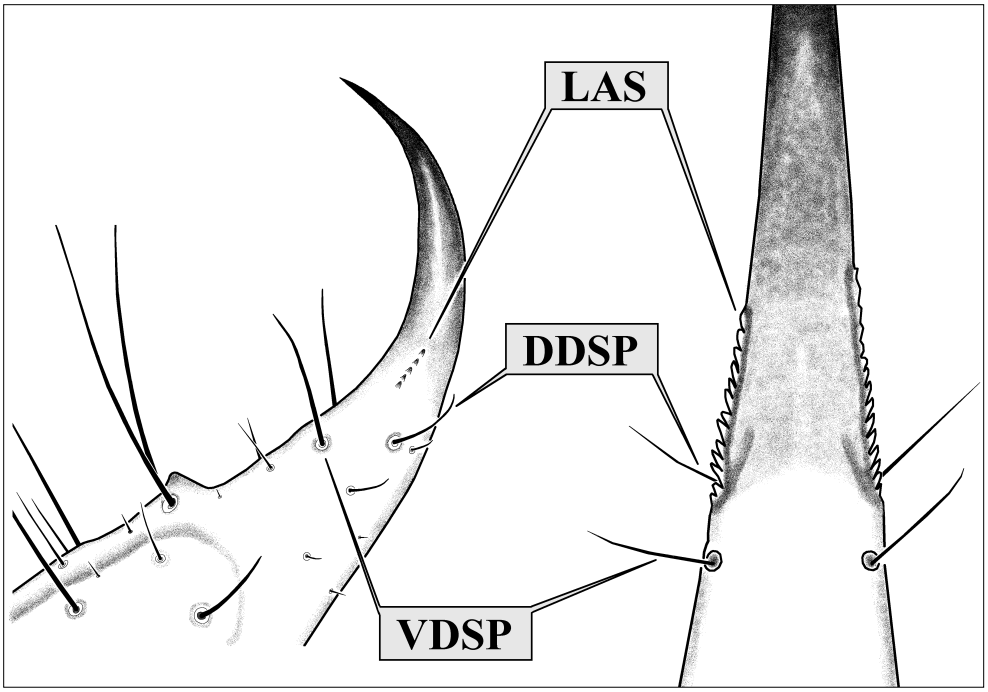


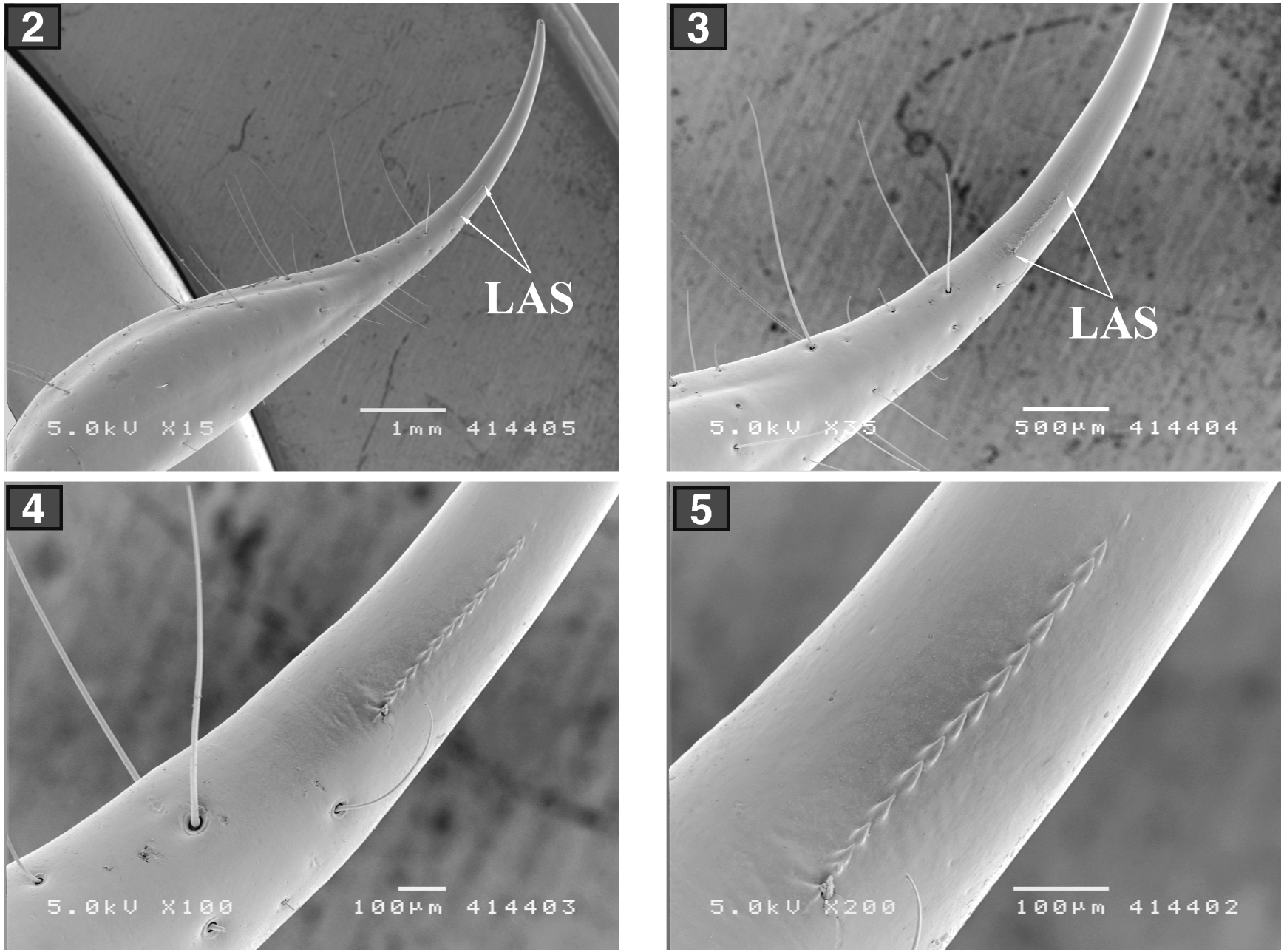
Figure 1: Telson (partial view) of female *Serradigitus joshuaensis* (left), right lateral view, and male *Vaejovis viscainensis* (right), ventral view, showing the position of the Laterobasal Aculear Serrations (LAS) as it relates to landmark setae and aculear pigmentation. VDSP = ventral distal setal pair, DDSP = dorsal distal setal pair.

♀ (MES); *Vaejovis eusthenura* (Wood, 1863), Cabo San Lucas, Baja California Sur, Mexico, ♂ (MES), ♀ (VF); *Vaejovis globosus* Borelli, 1915, Zacatecas, Zacatecas, Mexico, ♀ (MES); *Vaejovis granulatus* Pocock, 1898, Hidalgo, Mexico, ♀ (MES); *Vaejovis gravicaudus* Williams, 1970, Santa Rosalía, Baja California Sur, Mexico, ♀ (MES); *Vaejovis hirsuticauda* Banks, 1910, Indian Gorge Canyon, ABDSP, California, USA, ♀ (MES), Indian Gorge Canyon, ABDSP, California, USA, ♀ (VF); *Vaejovis hoffmanni* Williams, 1970, Rancho Tablón, Baja California Sur, Mexico, 1 ♂ 2 ♀ (MES); *Vaejovis intrepidus cristimanus* Thorell, 1876, Acatlán, Jalisco, Mexico, 2 ♂ (MES); *Vaejovis janssi* Williams, 1980, Isla Socorro, Mexico, 3 ♂ 1 ♀ (MES), 2 ♂ 2 ♀ 4 juv. (CAS); *Vaejovis jonesi* Stahnke, 1940, Sedona, Coconino Co., Arizona, USA, 2 ♀ (MES); *Vaejovis lapidicola* Stahnke, 1940, Williams, Coconino Co., Arizona, USA, ♂ (MES); *Vaejovis magdalensis* Williams, 1971, Los Aripes, Baja California Sur, Mexico, 7 ♂ (MES); *Vaejovis mexicanus* (C. L. Koch, 1836), Aculco, Distrito Federal, Mexico, 2 ♀ (MES), Tlaxcala, Tlaxcala, Mexico, 2 ♂ 2 ♀ (MES); *Vaejovis nigrescens* Pocock, 1898, Pachuca, Hidalgo, Mexico, 2 ♀ (MES); *Vaejovis occidentalis* Hoffmann, 1931, Acapulco, Guerrero, Mexico, ♀ (MES); *Vaejovis paysonensis* Soleglad, 1973, Payson, Arizona, USA, 3 ♀ topotypes (MES); *Vaejovis pococki* Sissom, 1991, Rioverde, San Luis Potosí, Mexico, ♂ (MES); *Vaejovis punctatus* Karsch, 1879, Acatlán, Puebla, Mexico, 11 ♂ 6 ♀ (MES); *Vaejovis punctipalpi* (Wood, 1863), Cabo San Lucas, Baja California Sur, Mexico, ♀ (MES); *Vaejovis puritanus* Gertsch, 1958, Jasper Trail, ABDSP, California, USA, 13 ♂ 1 ♀ (MES); *Vaejovis russelli* Williams, 1971, Deming, Luna Co., New Mexico, USA, ♀ (MES); *Vaejovis solegladi* Sissom, 1991, Cuicitlán, Oaxaca, Mexico, 2 ♀ (MES), Teotitlán, Oaxaca, Mexico, 2 ♀ (MES); *Vaejovis spinigerus* (Wood, 1863), Alamos, Sonora, Mexico, ♀ (MES); *Vaejovis viscainensis* Williams, 1970, Las Bombas, Baja California Sur, Mexico, 8 ♂ 4 ♀ (MES); *Vaejovis vorhiesi* Stahnke, 1940, Huachuca Mountains, Cochise Co., Arizona, USA, 2 ♂ 5 ♀ topotypes (MES); *Vaejovis waeringi* Williams, 1970, Indian Gorge Canyon, ABDSP, California, USA, ♂ (MES); *Vejovoidus longiunguis* (Williams, 1969), Las Bombas, Baja California Sur, Mexico, 4 ♂ 8 ♀ (MES).

Results and Discussion

Laterobasal Aculear Serrations (LAS): its location and structure

The LAS structure is composed of a row of minute denticles located on each side of the laterobasal aspect of the telson aculeus (Fig. 1). The LAS occurs in the region where the aculeus starts narrowing and darkening in color, its surface becoming shiny, always just distal of the ventral and dorsal distal setal pairs (VDSP and DDSP) found on the aculeus base. In addition, just preceding, or sometimes at the LAS base, ventrally we see a wrinkled area in the aculeus cuticle (see Figs. 6–9, 11–13, 14, 16–17, 19–20, 22). These denticles, situated in a straight line essentially parallel with the aculeus, are



Figures 2–5: Laterobasal Aculear Serrations (LAS), right lateral view, *Vejovoidus longiunguis*, female, Viscaino Desert, Baja California, Mexico. **2 & 3.** Showing LAS general location on lateromedial aspect of telson aculeus. **4 & 5.** Successive closeups of LAS. Note the distal position of the LAS with respect to the ventral distal setal pair (VDSP) and dorsal distal setal pair (DDSP) (readily visible in Fig. 4), see Fig. 1 for orientation of these setal pairs.