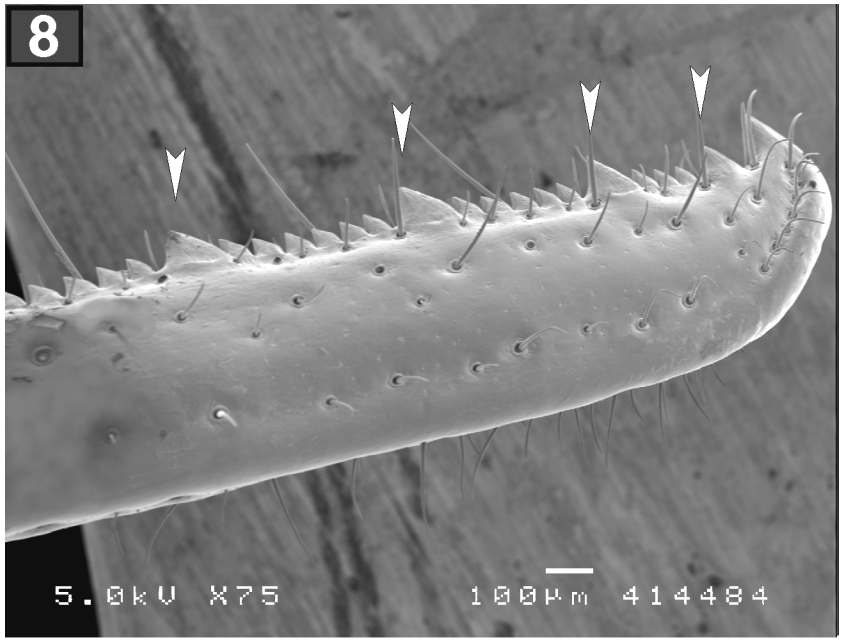

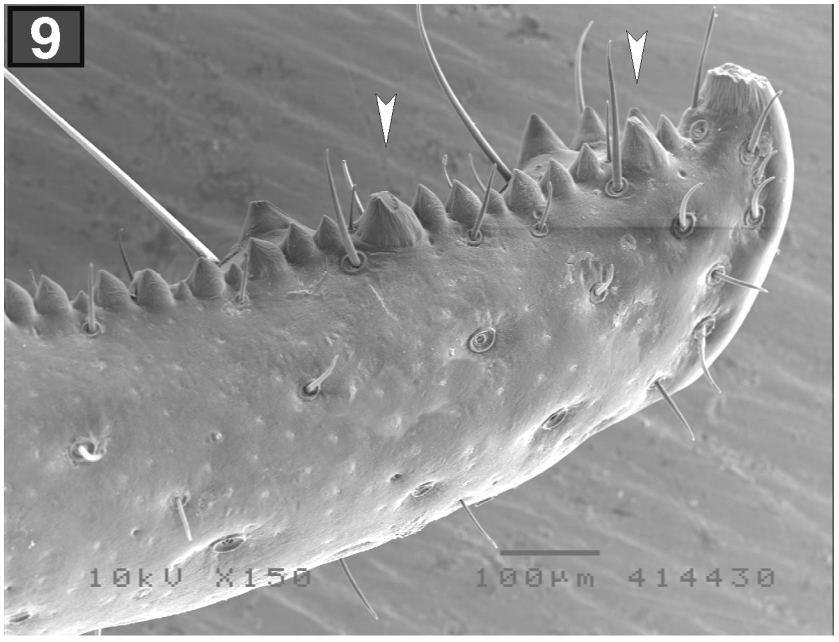

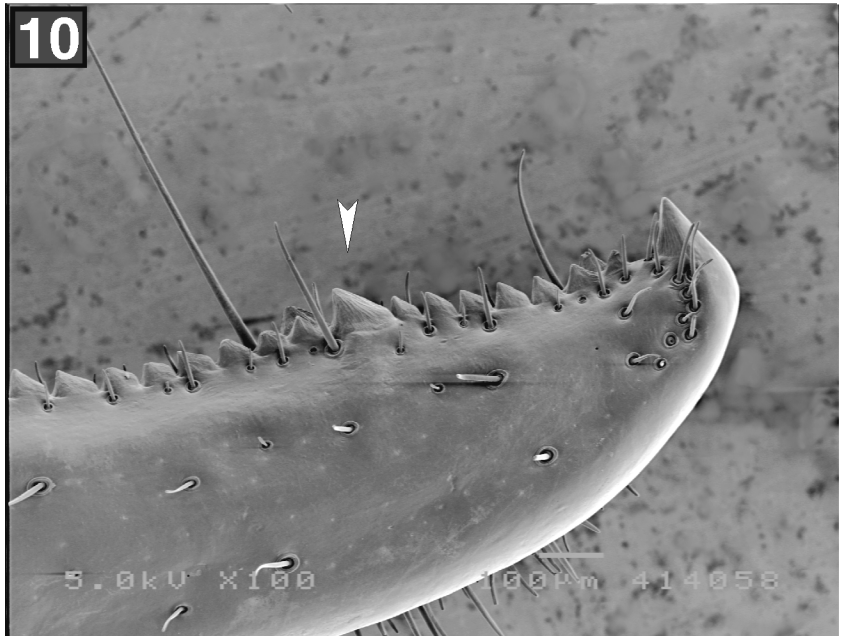

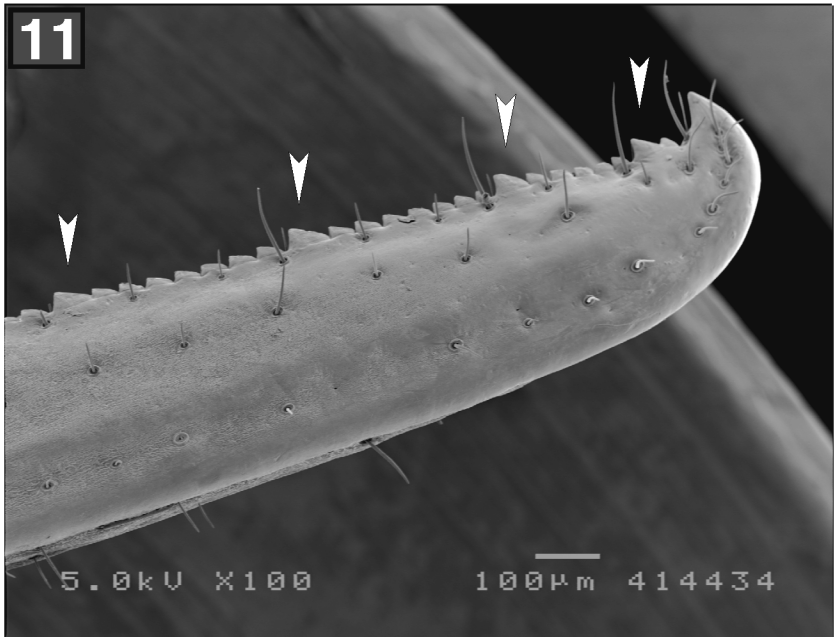

Figures 8–11: Distal aspect of movable finger, external view, showing conspicuous differences between *OD* and *MD* denticles of select vaejovids. Note, *OD* denticles are situated slightly external of *MD* denticle row. White arrows indicate *OD* denticles. **8.** *Vaejovis eusthenura*, Cabo San Lucas, Baja California Sur, Mexico. **9.** *Vaejovis carolinianus*, Tishomingo State Park, Mississippi. **10.** *Vejovoidus longiunguis*, Vizcaino Desert, Baja California, Mexico. **11.** *Vaejovis hirsuticauda*, Indian Gorge, ABDSP, California.

	*MD*_L/FF_D	% Length Decrease
Stahnkeus deserticola	0.182	-
Stahnkeus harbisoni	0.162	-
Stahnkeus subtilimanus	0.173	-
Serradigitus adcocki	0.164	-
Serradigitus armadentis	0.182	-
Serradigitus baueri	0.118	-
Serradigitus bechteli	0.173	-
Serradigitus calidus	0.202	-
Serradigitus g. gertschi	0.200	-
Serradigitus gramenestris	0.182	-
Serradigitus haradoni	0.147	-
Serradigitus hearnei	0.167	-
Serradigitus joshuaensis	0.160	-
Serradigitus littoralis	0.139	-
Serradigitus minutis	0.159	-
Serradigitus pacificus	0.179	-
Serradigitus torridus	0.191	-
Serradigitus wupatkiensis	0.200	-
Stahnkeus* + *Serradigitus	**0.118–0.202 (0.171) [18]**	-
***Franckeus* + "nigrescens" group**	0.053–0.139 (0.094) [6]	**45.0 %**
"eusthenura" group	0.058–0.100 (0.082) [10]	**52.0 %**
"mexicanus" group	0.064–0.093 (0.077) [6]	**55.0 %**
Smeringurus* + *Paruroctonus* + *Vejovoidus	0.059–0.089 (0.071) [14]	**58.5 %**
Paravaejovis	0.064 [1]	**62.6 %**
"punctipalpi" group	0.053–0.071 (0.063) [7]	**63.2 %**
Pseudouroctonus* + *Uroctonites	0.032–0.057 (0.040) [9]	**76.6 %**

Table 3: Morphometric ratio of chelal fixed finger *median (MD) denticle length/fixed finger depth* of tribe Stahnkeini as it compares to other genera and *Vaejovis* groups. The fixed finger depth is measured at the position of outer (*OD*) denticle three excluding the denticle; *MD* length is calculated from the longest *MD* denticle in close proximity to *OD–3* from its tip to the juncture of the adjacent denticle (i.e., does not include the denticle base positioned on the finger). *Length decrease* is based on the mean as it relates to genera *Stahnkeus* + *Serradigitus*. Minimum–maximum (mean) [number of samples]; *MD*_L = median (*MD*) denticle length; FF_D = fixed finger depth.

aligned with *ID–3*; still further basad, 5–8 (6.11) *MD* denticles separate *OD–2* and *OD–3*, followed by 1–3 *MD* denticles, the most proximal one aligned with *ID–4*. At this point *OD–3* and *ID–4* are not adjacent, the latter being positioned more proximally on the finger. From this point, we cannot reliably detect further basal *OD* denticles. We consider this arrangement generally diagnostic of the serrated condition of these denticles in Stahnkeini. Consequently, the number of denticles groups as discussed by Williams & Berke (1986) and Sissom & Stockwell (1991) is not really an accurate depiction of this character: it is more accurate to talk about *discernable* denticle groups, since the basal *OD* denticles are not absent, but instead are not distinguishable from the surrounding *MD* and therefore the denticle groups are not actually "missing".

***MD* + *OD* denticle density.** Presumably, due to this flattening as also suggested elsewhere for the *MD* lengthening, individual *MD* denticles are wider at their base (i.e., along the finger length) as would be caused by their highly elliptical bases, thus their numbers are relatively decreased as compared to other vaejovids. This is particularly interesting observation since the chelal fingers in Stahnkeini, in general, are relatively the longest occurring in family Vaejovidae. Tables 1–2 present statistical data that establishes a *density quotient* of *MD* and *OD* denticles on the chelal movable finger (using the sum of the number of these two denticle types). The *MD* + *OD* density quotient is calculated by dividing the number of *MD* + *OD* by the ratio of the movable finger length divided by the carapace length. The latter ratio normalizes the movable finger length with respect to the adult scorpion size, represented here by the carapace length. Therefore, the *density quotient* presented in Tables 1–2 is essentially independent of the length of the movable finger.

Tables 1–2 provide three groups of interesting information where Stahnkeini is compared to other representative vaejovid genera and *Vaejovis* groups: (1) the movable finger, as compared to the carapace length, is the longest in any vaejovid assemblage, in general the finger being longer than the carapace. Genus *Franckeus* and the "nigrescens" group also exhibit comparable elongated chelal fingers (in the slender monotypic genus

Syntropis, this ratio is 1.291 (after Stahnke, 1965: 261)); (2) from this, we see that the density quotient is a function of the relative finger length (as compared to the carapace length). Since Stahnkeini generally has fingers longer than the carapace, the density value for this group is less than its absolute number of denticles. In contrast, for genera *Pseudouroctonus* and *Uroctonites*, which, in general, have the shortest fingers in the vaejovids, the density value is greater than the actual number of denticles (i.e., the movable finger in this assemblage is in general shorter than the carapace); (3) accompanying the density data are actual counts of *MD* + *OD* of the specimens. The genera *Pseudouroctonus* and *Uroctonites* have some of the highest actual denticle counts in the family due to their somewhat small *MD*. In contrast, tribe Stahnkeini has the smallest numbers of denticles.

It is clear from these data that the tribe Stahnkeini has the lowest denticle density, averaging 37 denticles. Its actual denticle counts are also among the lowest, averaging 40 denticles, only genus *Paravaejovis* has a lower number, 26, but due to its quite short fingers, we calculate a slightly larger density value. Figs. 8–11 depict the distal aspect of the movable finger of several vaejovid genera and groups, illustrating the proportional size of the *MD* denticles as compared to *OD*. These figures reveal the somewhat small, compact *MD* denticles which are in high contrast to the larger slightly externally positioned *OD* denticles.

Elongated *MD* denticle. We hypothesize here that the flattening of the individual *MD* denticle is the probable cause of the lengthening of the denticle. This lengthening, plus its flattening, contributes to the "serrated" appearance of the *MD* denticle row and intervening *OD* denticles. In order to quantify this lengthening, we constructed a morphometric ratio based on the fixed finger depth and the length of a *MD* denticle. Table 3 shows the result of these data and the methods of measurement as compared to a representative set of vaejovid genera and *Vaejovis* groups. What is apparent, even from these limited data, is that Stahnkeini indeed exhibits considerably longer *MD* denticles than any of the other vaejovid genera or *Vaejovis* groups. When compared to other genera and groups, the decrease in *MD* length is even more exaggerated, especially when compared to *Pseudouroctonus* and *Uroctonites*, where we see a decrease of 77 %! It is interesting to note here that these genera happen to exhibit relatively the most dense number of *MD* in the family (see discussion elsewhere), thus explaining their somewhat petite size. Also of interest, in genus *Franckeus* and the "nigrescens" group, an ecological counterpart of Stahnkeini, the *MD* denticle is 45 % shorter than in Stahnkeini. This is an important observation because these two taxonomic assemblages both have elongated slender fingers, thus relatively quite similar in overall morphometrics. This implies that the slender fingers seen in Stahnkeini are probably not a factor in this *MD* denticle length difference.

History of the character. Stahnke (1940a), in his unpublished thesis, defined this character as follows: "… fingers of the pedipalps bear a longitudinal row of subequal, sharply pointed, tooth-like granules, terminated distad by an extremely large, somewhat curved tooth …". As was the case with the modified basal pectinal teeth of the female (discussed elsewhere), Stahnke (1940b) did *not* mention this character in his very brief synopsis of *Vejovis wupatkiensis* (now placed in *Serradigitus*). Therefore, Stahnke's original description of *V. wupatkiensis* in fact included no diagnostic characters! Thirty-four years later, Stahnke (1974: 130), in his definition of genus *Serradigitus*, described this character: "… inner edge of the pedipalp tarsus has a continuous row of conspicuously serrate, subequal denticles, uninterrupted, or indefinitely so, by larger denticles … terminal denticle is abnormally large and claw-like and bears on its terminus an elongated whitish cap … interior lateral, large flanking denticles vary in position and number from six on the type-species up to 16 on other species …". This description by Stahnke is quite accurate and, in many aspects, covers some of the more subtle characteristics of the serrated condition discussed in this paper, including, for example, the indistinguishable *MD* denticle groups, as well as the variable number of inner (*ID*) denticles found on the fingers, a distinction now used in this paper to define genus *Stahnkeus*.

It is interesting to compare the depiction of this character throughout the years by other scorpiologists. We divide this comparison into four character components discussed herein: the serrated *MD* denticles, enlarged distal denticle with "whitish cap", the indistinguishable denticle groups, and the occurrence of *IAD* denticles (the latter applicable to *Stahnkeus* only). Gertsch & Allred (1965) and Johnson & Allred (1972), for species *Vejovis wupatkiensis* (now in *Serradigitus*) did not mention any of these character components. Williams (1968, 1970a, 1970b) and Hjelle (1970) only mentioned the enlarged distal denticle (omitting reference to the "whitish cap"), and ignored the other components. Soleglad (1972) commented on the serrated denticles, enlarged distal tooth and the presence of *IAD* (*Vejovis subtilimanus*, now in *Stahnkeus*) but did not mention the "whitish cap" or indiscernable *MD* groups. Again, Williams (1980), defining several new species now placed in *Serradigitus*, concentrated on the enlarged distal denticle and number of *MD* denticle groups, but ignored the serrated construction of the *MD* row (the *IAD* was discussed and illustrated for *Vaejovis harbisoni*, now placed in *Stahnkeus*). Similarly, Williams & Berke (1986), as they resurrected genus *Serradigitus*, continued with the same depiction as that followed by Williams (1980), again omitting the serrated nature of the *MD* denticle row.

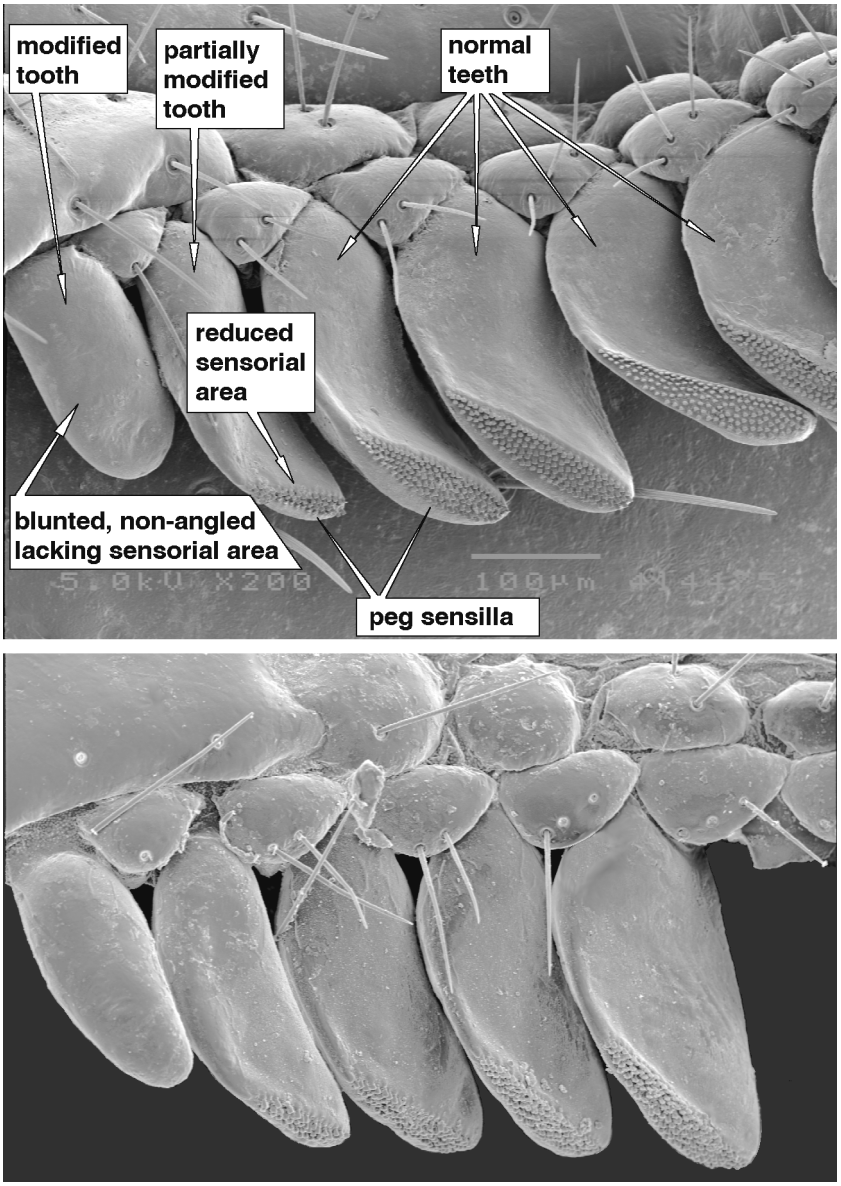

Figure 12: Basal pectinal teeth of female *Serradigitus joshuaensis* (top), Borrego Springs, California, and female *Serradigitus minutis* (bottom), Cabo San Lucas, Baja California Sur, Mexico, showing details of specialized tooth modifications. Note that the basal tooth exhibits *all* modifications: Laterally symmetric, and for these species, blunted in appearance (i.e., not elongated as exhibited in many Stahnkeini species), smooth, thus completely lacking a sensorial area. The second tooth exhibits partial modifications, slight angling and a reduced sensorial area. Note, though reduced in area, the density of the individual peg sensilla is the same as that found in the normal tooth. Other teeth lack these modifications, showing distal angling and a full-sized sensorial area.

Sissom & Stockwell (1991) commented correctly on all components associated with this character, including the *IAD* exhibited in a couple of their new species. Stockwell (1992) only included the indiscernable denticle *MD* groups in his key couplet, ignoring the other character components.

Pectines of the female. The modified basal pectinal teeth of the female in tribe Stahnkeini is quite unique in Vaejovidae. We consider it a primary synapomorphy for this tribe. This character involves three distinct modifications, which are found on at least the basal tooth and may include two, three, or even sometimes four basal teeth:

(1) the tooth is smooth distally, lacking a sensorial area (i.e., the area which contains the peg sensilla);

(2) the size and proportion of the individual tooth is usually manifested as a somewhat swollen elongated tooth, but sometimes it is shaped as a shorter and more rounded tooth; and,

(3) the distal aspect of the tooth lacks the exterodistal angling as seen on normal teeth, thus its lateral sides are in most cases nearly symmetric.

Of these three modifications, we consider the absence of the sensorial area to be the most significant. In fact, one could argue that the lack of this sensory area is the cause, in part, of the other two modifications. For example (Fig. 12), the second tooth, which exhibits a greatly reduced sensorial area, does not angle externally as much as the other more distal teeth which have a normally developed sensorial area. Generally, a scorpion's pectinal tooth angles exterodistally to