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SYSTEMATICS AND BIOLOGY OF THE CRYPTOGLOSSINI
(COLEOPTERA: TENEBRIONIDAE)

The Ohio State University

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SYSTEMATICS AND BIOLOGY OF THE CRYPTOGLOSSINI
(COLEOPTERA:TENEBRIONIDAE)

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

by

Rolf L. Aalbu, B.S., M.A.

****

The Ohio State University
1985

Reading Committee:
Dr. Donald E. Johnston
Dr. David J. Horn
Dr. Charles A. Triplehorn

Approved By:

Charles A. Triplehorn
Adviser
Department of Entomology
To My Wife Denise
And My Parents Irene and Olaf
ACKNOWLEDGEMENTS

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VITA

EDUCATION:

CALIFORNIA STATE UNIVERSITY, LONG BEACH (1969-1973)
   Bachelors of Science in Zoology:

CALIFORNIA STATE UNIVERSITY, LONG BEACH (1973-1977)
   Master of Arts in Entomology
   Title of Thesis: A Comparison of Selected Groups of Coleoptera Occuring in Two Desert Palm Oases Using an Ethylene Glycol Based Trapping System.

THE OHIO STATE UNIVERSITY (1981-Present)

CREDENTIAL: California Community College Credential BIOLOGICAL SCIENCES, ZOOLOGICAL SCIENCES

MEMBERSHIP IN ACADEMIC AND PROFESSIONAL ORGANIZATIONS:


PUBLICATIONS (most recent)


EMPLOYMENT AND EXPERIENCE


1983-85  **GRADUATE TEACHING ASSOCIATE** O.S.U. Department of Entomology Instruction of Laboratory section of Systematic Entomology, Insect Morphology, Medical Entomology and Immature Insects.


1980  **ENTOMOLOGIST** U.S. Peace Corps, assigned to U.S.A.I.D. Crop Protection Center in Cameroon, Africa. Responsibilities: designing bilingual training program and materials in Entomology, Agriculture, Ecology, and Integrated Pest Management; developing instructional aids and a National Plant Protection Newsletter; establishing a National teaching and reference collection with emphasis on Arthropods of economic importance in Cameroon; assisting with field investigations with international agencies on particular pest problems.

1979  **FIELD ECOLOGIST** State of California Department of Food and Agriculture, Laboratory Services. Work involving Ecological Studies and Surveys of the Arthropod fauna of California Deserts and Sand Dunes.


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INTRODUCTION

The Cryptoglossini are members of the subfamily Tentyriinae, a large, diverse lineage which constitutes about one half of all known species of Tenebrionidae. Species are found worldwide except for Australia and New Zealand with most known tribes and species being from the Ethiopian and Palearctic regions. Tentyriine beetles have adaptively radiated throughout most of the arid regions on earth and are often highly specialized for certain habitats.

Species of the tribe Cryptoglossini are relatively large, flightless beetles which are irregularly distributed throughout much of the highly arid areas of the Southwestern United States and Mexico. Although not necessarily rich in species, the Cryptoglossini can contribute to a significant portion of the animal biomass in certain geographic areas (see Biology).

Although one genus of the tribe, Asbolus (formerly Cryptoglossa), has been previously revised systematically (Blaisdell, 1945; Triplehorn, 1964), no concerted attempt has been made, aside from occasional keys, to treat the other genera or the tribe as a whole. These keys have often proven unreliable when tested with the numerous additional specimens which have been accumulating in museum collections.

Recently revisionary and other systematic works have attempted to not only include dry, "dead bug" external morphological information, but also take into account information on biology, life stages, and internal structures.

I chose to examine this tribe systematically for three reasons:
1. Due to numerous collecting trips in the southwestern USA, Mexico and Baja California, specimens of Cryptoglossini have been accumulating in my collection for some time, to many of which I was reluctant to place
determination labels as existing keys are unclear. Additionally, having kept live populations in the past, I knew species of Cryptoglossini were relatively easy to maintain in laboratory colonies. This possibility allowed incorporation of information from the immature stages and internal hard and soft structures to the systematic treatment.

2. The Cryptoglossini are biologically interesting. Many are specialized and occasionally restricted to certain ecological areas (as sand dunes, caves etc.), often expressing remarkable adaptive morphological, physiological or behavioral traits.

3. A number of recent studies have greatly increased our knowledge of the age, origin, and climatic history of the North American desert regions. Especially useful is information on the numerous islands around the peninsula of Baja California, on many of which are found populations of Cryptoglossini. This new information allows for the first time formulation of hypotheses on the probable age of isolation and evolutionary distributional patterns of some of the populations and species.

The purpose of this study is dual in nature. First to revise the tribe to species level applying modern, phylogenetic methodology including the determination of its place in the higher classification of the Tenebrionidae and providing dependable diagnostic keys to the genera and species. Secondly to incorporate in this study as much biological, distributional, and evolutionary information as current knowledge permits.
Table 1. List of Lending Institutions and Individuals (collections, acronyms, curators)

<table>
<thead>
<tr>
<th>Institution/Collection</th>
<th>Location</th>
<th>Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASUT: Arizona State University</td>
<td>Tempe, Arizona.</td>
<td>Martin Brendell</td>
</tr>
<tr>
<td>CDAE: California Department of Food &amp; Agriculture</td>
<td>Sacramento, California.</td>
<td>Fred Andrews.</td>
</tr>
<tr>
<td>CNCI: Canadian National Collection</td>
<td>Ottawa, Ontario, Canada.</td>
<td>Quentin D. Wheeler.</td>
</tr>
<tr>
<td>CSLB: California State University</td>
<td>Long Beach, California.</td>
<td>Brett C. Ratcliffe</td>
</tr>
<tr>
<td>DBTC: Donald B. Thomas Collection</td>
<td>Kerrville, Texas.</td>
<td>Larry E. Watrous.</td>
</tr>
<tr>
<td>DEUN: University of Nebraska</td>
<td>Lincoln, Nebraska.</td>
<td>Ginter Ekis.</td>
</tr>
<tr>
<td>EMSU: Utah State University</td>
<td>Logan, Utah.</td>
<td>Wilford J. Hanson.</td>
</tr>
<tr>
<td>FMNH: Field Museum of Natural History</td>
<td>Chicago, Illinois.</td>
<td>Larry E. Watrous.</td>
</tr>
<tr>
<td>KSUC: Kansas State University</td>
<td>Manhattan, Kansas.</td>
<td>H. D. Blocker.</td>
</tr>
<tr>
<td>LACM: Los Angeles County Museum</td>
<td>California.</td>
<td>Alfred Newton.</td>
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</tbody>
</table>
Clarence D. Johnson.
NSDA: Nevada State Department of Agriculture, Reno, Nevada. R. C. Bechtel.
OSUC: The Ohio State University, Columbus, Ohio. Charles A. Triplehorn.
OSUO: Oregon State University, Corvallis, Oregon. Gary L. Peters.
PURC: Purdue University, West Lafayette, Indiana. Arwin Provonsa.
RLAC: Rolf L. Aalbu Collection.
RLBC: Richard L. Berry Collection, Columbus, Ohio.
TAMU: Texas A & M University, College Station. Sammie J. Meritt.
UCRC: University of California, Riverside, California. Saul I. Frommer.
UCSM: University of Alberta, Edmonton, Canada. George E. Ball.
WSCI: Walter Suter Collection, Laramie, Wyoming.
ZMUM: Zoological Museum, Moscow State University, USSR. N. B. Nikitsky.
The first member of Cryptoglossini described was *Cryptoglossa bicostata* by Solier (1836:680-681) from a specimen from the M. Dupont collection which had been labeled "Zopherus bicostatus". He distinguished this genus by the form of the mentum (with an anterior excavation), the form of the head and epistoma, and the form of the thorax. Unfortunately the specimen described was missing legs and the apical portions of both antennae. According to Lacordaire (1859:139, see below), this genus was placed by Solier near *Akis* because of the form of the mentum.

Mannerheim (1843:279-280) described *Centrioptera caraboides*, a new genus and species, from a specimen given to him from "California" by D. Wrangel (Mus. Imp. Acad. Scien. Petrop.). No relationships to any other genera were mentioned. LeConte, in his "Descriptions of New Species of Coleoptera from California" (1851) described three additional species which he collected in 1850-51 in California. The first two, *verrucosus* and *laevis* (p. 129-130), he assigned to a new genus *Asbolus* which he distinguished by the compressed antennae and short, truncate, 11th segment. The third, *muricata* he assigned to Mannerheim's *Centrioptera* and distinguished it from Mannerheim's species by the "unicarinate mentum" and the posteriorly "little expanded" elytra. In 1854 (p. 84), Leconte described a fourth species, *infraustus* which he hesitantly assigned to the genus *Asbolus*. This species was mentioned as agreeing closely with his previously described species except for the apex of the mentum, and the last antennal segment being "oval and pointed, not truncate". A "close affinity to *Centrioptera*" was also mentioned, but disagreeing in that this species had a less produced prosternum and non-emarginate mentum.

Lacordaire (1859:134-139) was the first to attempt to incorporate these in a classification. Many of the characters used in his classification have since been found to be unreliable especially in higher categories. In his classification, the cryptoglossines were placed in his Section II, Cohorte I, which included many groups, some now known to belong to other subfamilies. The cryptoglossines were placed in the tribe "Scaurides" based on labrum little or not distinct, prothorax feebly produced forward, ligula hidden by mentum, mesocoxae with
visible trochantins, tarsal setation patterns etc., all characters which have since been found unreliable for tribal separation (Doyen, 1972). The "Scaurides" included true scaurines (*Scaurus, Cephalostenus* and *Herpiscius*), the "Scotobiines" (*Psammetichus, Leptynoderes, Diastoleus, Scotobius* and *Emalodera*), [both of these groups, except *Psammetichus*, now belonging to the Tenebrioninae] and the "Nyctoporides" (*Nyctoporia, Ammophorus, Eulabis, and Epantius, these last two now Tenebrionines) and the "Centriopterides". It is not known why Lacordaire named this group "Centriopterides", rather than "Cryptoglossides" based on priority, although only *C. muricata* is mentioned as having been dissected.

In this "Group IV", the subtribe "Centriopterides", he included the genera *Cryptoglossa, Centrioptera* and *Cerenopus* (now *Cerenopini:Tenebrionidae*). Inclusion of this last genus in this group led to some later classificatory problems (see status of *Threnus*).

LeConte (1862:218-220), in his classification of the "Coleoptera of North America", correctly removed from the Cryptoglossini the genera *Eulabis, Epantius* and *Cerenopus* which he placed in the tenebrionine tribe Scaurini. He included both the "Nyctoporini" and "Cryptoglossini" as subtribes of the Cryptoglossini separated by the form of the genae (produced vs not produced) and tarsal setation characteristics. Three genera were included in the "subtribe" Cryptoglossini. He transferred his *Asbolus infaustus* to a new genus *Oochila*, which he based on the broadly concave form of the mesosternum and the oval terminal joint of the antennae. *Asbolus* was placed as a synonym of *Cryptoglossa* which was characterized by the broadly concave form of the mesosternum and the truncate terminal segment of the antennae.

In 1870 (p. 401-406), Motschoulsky described two new genera (*Amblycyphrus* and *Threnus*) which have been included in most catalogs and lists as members of the Cryptoglossini. These types have apparently remained unknown until now, and are discussed under the section "Limits of the Cryptoglossini".

Horn in the same year (1870) published his Revision of the Tenebrionidae of America. In this comprehensive revision, he separated out the Tenebrioninae from the rest of the Tenebrionidae but divided the rest into the Tentyriinae and Asidinae (both now considered Tentyriinae) based on the visibility of the mesotrochantin. He placed
both the Cryptoglossini and the Nyctoporini in the
Asidinae dividing these two tribes by the produced genae
and characters of the legs and tarsi. Only two genera were
included in the Cryptoglossini: Cryptoglossa and
Centrioptera. These were separated based on the form of
the terminal antennal segment. LeConte's genus Oochila was
synonymized by Horn under Centrioptera mentioning that the
form of the mesosternum was of little systematic value.
Although C. caraboides was mentioned as being unknown to
Horn, no mention was made in his revision of C. bicostata.

A number of additional species were described by
Horn, Champion, Blaisdell, Casey and Parker, including an
additional genus (Schizillus, Horn 1874). One genus,
Cryptoglossa, [now Asbolus] has been revised
systematically by Blaisdell (1945) and Triplehorn (1964).
Recently, a number of Ecological and Physiological studies
have also utilized species of Cryptoglossini. A Catalog of
published Studies and notes on the Cryptoglossini is
presented on Table 2.

The taxonomic weakness in most of the above early
works has resulted from these authors' inability to
examine other workers' types. This weakness has been not
only often reflected in their keys (which often included
characters inadequate for the separation of species) but
also has created new classificatory problems. Blaisdell
(1924:88) described C. texana without having seen C.
inhausta, relying instead on Horn's 1870 key which is
somewhat misleading in that infausta is described as
elytra being "striato-puntate, not at all spiculiferous".

The above is certainly also true of the species
Cryptoglossa bicostata. This type species has remained
unknown to workers until very recently (Triplehorn, 1972).
Lacordaire (1859:138) mentioned that Solier described
Cryptoglossa bicostata based on a specimen (lacking both
antennae and legs) which had been sent to him from Mexico.
He remarks "I have before me a specimen from the borders
of New Mexico and California..., with the head and
prothorax finely rugulose, the elytra are covered by sharp
tubercles, those of the 5th row reunited forming a costa".
Lacordaire characterized Cryptoglossa as having the last
segment of the antennae truncate. It is unclear what
species Lacordaire examined, perhaps a specimen of A.
verrucosus.
Table 2. Historical Catalog of previous published studies
and notes on the Cryptoglossini

<table>
<thead>
<tr>
<th>Author</th>
<th>Year(s)</th>
<th>Pages/Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solier</td>
<td>1836</td>
<td>680-681 (new genus &amp; species).</td>
</tr>
<tr>
<td>Mannerheim</td>
<td>1843</td>
<td>279-280 (new genus &amp; species).</td>
</tr>
<tr>
<td>LeConte</td>
<td>1851</td>
<td>129-130, 142-143; 1854:84, 1861:337, 1862:220 (new genera &amp; species); 1862:218-220 (classification); 1866:59 (list).</td>
</tr>
<tr>
<td>Lacordaire</td>
<td>1859</td>
<td>134-139 (classification).</td>
</tr>
<tr>
<td>Motschulski</td>
<td>1870</td>
<td>401-406 (new genera and species).</td>
</tr>
<tr>
<td>Champion</td>
<td>1884</td>
<td>73, 1892:508-509, 572 (new species); 1884:vii (distribution).</td>
</tr>
<tr>
<td>Riley</td>
<td>1893</td>
<td>235-252 (distribution).</td>
</tr>
<tr>
<td>Fall &amp; Cockrell</td>
<td>1907</td>
<td>202 (distribution).</td>
</tr>
<tr>
<td>Casey</td>
<td>1907</td>
<td>513 (new species).</td>
</tr>
<tr>
<td>Leng</td>
<td>1920</td>
<td>224 (catalog).</td>
</tr>
<tr>
<td>Casey</td>
<td>1924</td>
<td>306-308 (new species).</td>
</tr>
<tr>
<td>Bradley</td>
<td>1930</td>
<td>184 (classification).</td>
</tr>
<tr>
<td>Blackwelder</td>
<td>1944</td>
<td>515-516 (catalog).</td>
</tr>
<tr>
<td>Arnett</td>
<td>1960</td>
<td>652 (classification); 1960:672 (distribution).</td>
</tr>
<tr>
<td>Papp</td>
<td>1961</td>
<td>106-107 (catalog).</td>
</tr>
<tr>
<td>Thomas</td>
<td>1979</td>
<td>568-574 (distribution &amp; biology).</td>
</tr>
<tr>
<td>Doyen &amp; Opler</td>
<td>1973</td>
<td>305-316 (distribution).</td>
</tr>
<tr>
<td>Hadley</td>
<td>1979</td>
<td>367-369 (physiology).</td>
</tr>
<tr>
<td>Reddell</td>
<td>1982</td>
<td>274 (distribution).</td>
</tr>
</tbody>
</table>
MATERIALS AND METHODS

Over 9700 adult and immature specimens, representing all known species of Cryptoglossini were examined. Additionally, over 300 adult specimens were collected in the field and maintained alive during the course of this study. From these, supplemental systematic and biological data was obtained.

The following publications were found very useful in the location of difficult to find distributional localities: Gerhard et al (1967) and Lumholtz (1912) for Mexican localities and Reddell (1982) for Texan and Mexican Caves.

Collecting Techniques

Pitfall traps have been successfully utilized many times in the collection of ground dwelling arthropods. The method found most effective in capturing Cryptoglossini and perhaps most ground dwelling Tentyriinae is the placement of numerous dry plastic "punch cup" containers as pit traps in selected localities as under bushes, near rocks or near the entrance to rodent burrows in the late afternoon and collecting these early the next morning. This not only assures many live adult specimens for rearing studies, but provides additional biological information as substrate type, type of burrow etc.

One modification of pitfall traps is the addition of a bait with permits supplemental specimens to be trapped. Molasses bait has yielded numerous specimens of *A. verrucosus* and *C. muricata* in traps at Joshua Tree National Monument, California (E. Sleeper, personal communication). Another modification is supplying the trap with a non-evaporative preservative which allows preservation of specimens until the trap is removed. Ethylene glycol is readily soluble in water enabling specimens to easily be cleaned and sorted. Ethylene glycol also permits placement of traps for long durations. I utilized this method effectively for periods of up to three years in areas of Baja California with usually no loss in quality in the trapped specimens. These ground
traps consisted of coffee cans approximately 13.5 cm. in depth with a 10 cm. diameter opening filled one quarter to one half (250 to 500 ml.) with ethylene glycol depending on the estimated trapping period. The traps were buried in the ground to the rim of the can. A large rock of approximately 15 x 15 cm. was placed on three or four smaller rocks to protect the can from rain and larger animals but permitted arthropods to enter the trap. The use of different commercial brands of ethylene glycol has also yielded different collected species and numbers indicating a possible differential attraction to one or more of the commercially added chemicals to the ethylene glycol (Aalbu, 1977). This type of lure was not noticed in species of Cryptoglossinini trapped. Adults were also surface collected at night by use of headlamps or lanterns.

As most adults are surface active in the summer months, all live collections were made at that time. Collection localities and dates for laboratory specimens are as follows: Mexico, Nuevo Leon, Huasteca canyon, VI-17-82, C. infausta and A. mexicanus; Mexico, Durango, 27.1 mi. S Ceballos, VII-9-82, C. infausta; California, San Bernardino Co., Mitchell Caverns, VIII-27-82, S. nunenmacheri; California, Imperial Co., 2 mi. S Glamis, VII-28-82, A. laevis and A. verrucosus; Utah, Arches Nat. Mon., VII-VIII-83, S. nunenmacheri; Mexico, Baja California Sur, cape region, VIII-83, C. asperata.

Rearing Techniques

Species of Cryptoglossinini were found to be generally very vigorous, easily capable of enduring transport back to the laboratory. Even live transport via surface mail proved successful. The beetles were maintained in the laboratory in plastic, open top, rearing containers 13 mm high half-filled with a fine sterilized sand (able to pass through a 0.8 mm. sieve). A plastic tube was inserted into the sand in the center to the bottom to allow the addition of water to the lower layers of sand without wetting the top. Occasionally, a small amount of water was sprinkled on the top of the sand. A maximum of seven beetles was kept in each container. Cultures were kept at room temperature (uncontrolled at approximately 21 degrees C.) and fed mixtures of dry dog food, cereals, assorted grains, and various bits of vegetable matter. The rearing containers were examined every two weeks to detect eggs or larvae by sifting the sand through the sieve.
Approximately every 3 months, the sand was sterilized to prevent fungal or acarine infestation by washing with water (floating off detritus) and oven-drying.

Rearing procedures were similar to those of Brown (1973). Larvae were transferred to smaller containers with pre-mixed sterilized sand (10 parts sand to 1 part food) over a 2 cm. layer of plaster of paris with a watering tube inserted into the plaster. Enough water was added to moisten the lower 1 cm. of sand. To prevent cannibalism, larger larvae were kept in separate containers.

Optical Equipment and Illustrations

All examinations, dissections and drawings were made with the aid of a Wild M5A Dissecting Stereomicroscope equipped with a 1.25X Wild drawing tube. Observations needing higher resolution were obtained by use of an AO Spencer Microstar Compound Microscope also with drawing tube attachment. Scanning electron micrographs were provided by Laboratory Services, California Department of Agriculture (see Acknowledgements).

Dissections and Measurements

When large series of specimens of one species were available, as from my own collection, representatives of both sexes were completely disarticulated from both ingroup and outgroup. Whenever possible, alcohol preserved or fresh specimens were used for disarticulation. Disarticulation procedure was as follows: Adults were relaxed in hot detergent water, washed, and transferred to solutions of up to 20% KOH (due to the high melanization of the cuticle), and placed in a double boiler system (as discussed below under internal structures) for varying amounts of time up to 30 minutes. Following this, specimens were washed in water and disarticulated under the dissection microscope. Disarticulated parts were stored in alcohol and later examined in water or glycerin.

Immature specimens were killed in boiling water and transferred to 70% ETOH for preservation. Larval structures were cleared in hot 10% KOH and examined in temporary glycerin mounts. Female internal cuticular structures were prepared and examined using a method similar to that suggested by Tschinkel and Doyen (1980) except for the following: Internal structures were examined by removing the visible abdominal sterna along
with the internal abdominal structures usually from dried museum specimens and cleared by placing these in a solution of 10% KOH in a 15 ml. pyrex tube. The tubes were then placed on a rack in a larger container of boiling water (allowing placement of 5 tubes) for varying amounts of time depending on the size of the specimen. The contents were not permitted to boil. Specimens were then washed in water. Unused structures as the digestive system and large tracheae were dissected out in water under a dissecting microscope. Female structures were then stained in a 2% aqueous merbromin solution and rinsed in 70% ethanol. Delicate dissections were completed in glycerin where specimens were stored temporarily. Measurements were made with the aid of a precise microscale.

Morphological Terminology

Descriptive terminology conforms to Doyen (1966, 1982 & 1984), unless more precise terms are required. Puncture terminology is adapted from Berry (1980). The terminology used for the internal female reproductive tract and ovipositor follows that of Tschinkel & Doyen (1980) which is adapted from Happ & Happ (1970). Immature terminology generally follows Brown (1973) and Doyen (1979). Descriptive format conforms to Aalbu (1985). The term "spicule" is used throughout to specify stout, sclerotized, usually melanized, rigid setae found in immatures.

Structures Examined

As many external and internal structures as possible were examined on adult specimens. Many adult structures, which have been found very useful at higher levels of separation in Tenebrionidae (Doyen et al 1982), such as adult internal skeletal features, mouthparts, female external and internal reproductive tract configuration, were found to be of somewhat less use at generic or specific levels. Traditionally useful structures as genitalia and associated terminal segments were found very useful at generic or specific level differentiation. A number of continuous (qualitative) characters, as external sculpturing features, were also found useful, although some of these (perhaps because adaptive in nature) were found more likely to generate homoplasous states as reversals or parallelisms.

Only external cuticular features and mouthparts were
examined on immature specimens. Again, traditionally useful features as configuration and setation of mouthparts, legs, terminal segment structure, and setation were found to be most useful.

Criteria For Ranking Taxa

Since all known evidence supports the universality of sexual reproduction in species of Cryptoglossini, Mayr's (1969) biological species concept with modifications made by Whitehead (1972) was utilized. This concept defines a species as populations or groups of populations through which gene flow actually or potentially exists, but which are reproductively [intrinsically] isolated from all other such populations or groups of populations. The rank of subspecies was employed in this analysis. The working criteria for ranking subspecies was adapted from Kavanaugh (1979). The subspecies category was recognized if two populations [or groups of populations] (1) are allopatrically separated by recognizable environmental barriers; (2) if differences between members of each are constant but less distinctive than differences between members of two closely related sympatric species on one or more structural character such as sculpturing or size etc.; (3) if the geographical pattern of variation in distinguishing characters is nonclinal or distinctly step clinal.

Phylogenetic Methods

Phylogenetic relationships among groups were hypothesized by the presence of shared derived character states (synapomorphies) in the sense of Hennig (1966). This method has been adequately reviewed previously, as by Wiley (1981), and is perhaps best summarized by Kavanaugh (1972). Only strictly monophyletic groups were recognized. These hypotheses are not only falsifiable, but I believe also present the best available attempt to reconstruct evolutionary relationships among taxa. Polarity hypotheses were based on the following criteria, which include outgroup comparison, ontogeny and a type of character correlation method listed below in decreasing order of confidence which I have placed in them. Commonality was not used as a criterion in this analysis. Only characters polarized by outgroup comparison (1) and those with supporting ontogenetic evidence (2) were analyzed in the computer generated cladograms discussed below.
1. Outgroup Comparison. In the sense of Watrous and Wheeler (1981), this method essentially states that character states with two states in in-groups, one in out-group, the one appearing in both in- and out-group is considered plesiomorphic.

2. Ontogeny. Character transformation series with available supporting ontogenetic evidence were given equal weight as those having been inferred by outgroup comparison. For example, a useful transformation series in the Cryptoglossini is the progressive state of the eye towards complete division into upper and lower groups of facets. In Cryptoglossa, the upper and lower portions of the eye are broadly connected by a width of at least 5 facets. In Asbolus this width is "reduced" to 3 or fewer facets. In Schizillus, the eyes are completely divided. Outgroup genera have both interconnected eyes (Nyctoporis, as well as most Psammeticus) and divided eyes (Ammophorus and some Psammeticus). In the early pupal stage of Schizillus nunenmacheri as well as in Asbolus mexicanus, a thin connecting line of melanized optic tissue is seen subcutaneously connecting the upper and lower facets, suggesting possible evolutionary progression toward complete division of the eyes.

3. Complex Character Correlation. When the polarity of character states is not readily inferred by outgroup comparison (complex, often continuous, multistate characters not found in outgroups or with both states commonly found in outgroups) the polarity of these is inferred by correlation with the polarities of characters already assessed through outgroup comparison. When specific character state information is not available in certain OTU's (e.g. missing immature stage characters), the polarity of these missing states cannot be inferred. Available character states from OTU's where the characters are not missing still present useful information. These characters, using only OTU's where these are available, are assessed separately by outgroup comparison and presented in a separate cladogram (Fig. 160). This allows critical comparison of OTU's distribution on cladograms based on different data. Missing character states from OTU's are marked (U) in the list of Distribution of Character States (Appendix C).

Three methods of cladogram generation were employed: (1) The Wagner tree method of Farris (1970, 1973) with
Wagner program version 25/8/78 (Wagner-78). This program allows the use of multistate characters but only Wagner parsimony. (2) The Phylip (Phylogeny Inference Package, version 2.5) program of J. Felsenstein (1983). This program allows various types of parsimony methods to be employed including Wagner, Dollo and Camin-Sokal. (3) An independent hand-generated cladogram based on Hennigian augmentation methods with polarization procedures as described above.

First, a number of trials were run with Wagner 78 using multistate characters. Conflicting characters were then critically reexamined. Because of the relatively small number of characters and OTU's, character transformation series were reduced in most cases to additive binary characters (and in all cases for use with the Phylip programs) in the sense of Farris et al., (1970). All the above methods were compared and assessed together in a generalized, most parsimonious, consensus tree (Fig. 161). Results, as well as cladistic relationships, are discussed under Cladistic Relationships Among Genera and Species of Cryptoglossini.

Future Work

This study is by no means complete. Much additional distributional and biological information can be gathered especially by more extensive collection surveys of the dry thorn-scrub regions of Sinaloa, Nayarit, Jalisco and Colima in Mexico which present a distributional gap in the Cryptoglossini. Also additional collections on islands in the Gulf of California such as San Estaban and San Pedro Martir would be useful. Along with this, additional specimens as well as biological notes should be gathered on rarely collected species as C. bicostata and C. caraboides. Immature stages of many species remain unknown.

Species of Cryptoglossini, because of their size and relative maintenance ease in laboratory situations, offer a unique opportunity to examine specialized desert organisms in detail at close range over a period of time and so present ideal subjects for ecological and physiological studies. Additionally, because of the relative ease in working with these beetles in the field, detailed bioecological studies of species are possible. Such studies might include the A. laevis-A. papillosus relationship in Algodones dunes mentioned in the next
section. Physiological studies could include the examination of the physiological aspects of the death feign behavior in species of *Asbolus*, also discussed in the next section.
BIOLOGY

Available biological information on the Cryptoglossini has been limited to a small number of studies, often representing only a few species, which are summarized below. Additional information is presented in this section on the biology, from personal observations and other sources, including notes on the life history, feeding habits, predators, parasites, defense, competition, and economic importance of the Cryptoglossini. Adaptive features of the Cryptoglossini as well as biological notes on highly specialized species are discussed below. Habitat biology of individual species is summarized in the taxonomic treatment of each species.

ECOLOGICAL DISTRIBUTION

A. ADAPTATIONS TO ARIDITY

Species of the tribe Cryptoglossini are distributed in most of the major temperate and subtropical deserts of North America including the Sonoran, Mojave, Chihuahuan, Viscaino, Hildalgan, and parts of the Great Basin Desert. To have evolved into successful competitive organisms in these areas, the Cryptoglossini have adapted in various ways, within their inherent phylogenetic possibilities, to the sometimes extreme temperature and humidity conditions found in these deserts.

Since smaller animals, as insects, have relatively high surface-area: volume ratios, they risk rapid dessication in dry air (Crawford 1981). For this reason, the major problem insects encounter in desert environments is water loss. Water is lost mainly through transpiration (combined cuticular and respiratory water loss) but also through defecation, defensive secretions and oviposition. Adaptations to desert conditions can thus be categorized into ecological adaptations (finding or creating moist conditions) and morpho-physiological adaptations (protection & resistance against dessication) (Ghilarov 1964).

ECOLOGICAL

The Tenebrionidae, and especially the Tentyriinae, are among the insects best adapted to life in deserts. This has been accomplished in desert tenebrionids by use of a number of successful ecological strategies. Perhaps
the major strategy which has led to their success is the ability to penetrate the ground surface in various ways to seek refuge underground from the extreme environmental conditions. This has been accomplished in two ways: 1. By penetrating naturally existing crevices, cracks, fissures or caves or by utilizing the cavities, tunnels or burrows of other animals; and 2. By creating such burrows or spaces by physically digging into the substrate.

Other ecological strategies employed by desert organisms include the timing of both daily and seasonal activities, such as reproduction and feeding, to coincide with the most favorable environmental conditions. Although most of the Tentyriinae follow crepuscular to nocturnal surface activity patterns, certain Old World species (Adesmia, Zophosis) are capable of surviving daylight temperatures by moving from refuge to refuge at very high running speeds. Cryptoglossines are mainly crepuscular to nocturnally surface active, only occasionally venturing out on cloudy days or in shaded areas. Seasonal and daily activity patterns of individual species of Cryptoglossini, when known, (excepting those discussed below) will be summarized under the taxonomic treatment.

MORPHOLOGICAL

Morphological adaptations to desert environments found in tentyriines involve various aspects of body shape, structures of legs and antennae as well as surface setation and sensory structures. As members of the Tentyriinae, the Cryptoglossini lack abdominal defensive glands, although it is still unclear whether these have been lost as an adaptive strategy for aridity (thus preventing the added water loss through secretions) or whether defensive glands were never developed in the tentyriine lineage (see discussion under Higher Classification of the Cryptoglossini).

Works by Pierre (1958) and more recently Medvedev (1965) have greatly contributed toward our understanding of the adaptive morphology of desert tenebrionid beetles especially in reference to locomotion on or in various substrate types. Medvedev studied the effects of the properties of the substrate on leg structure morphology of Central Asian tenebrionid beetles. He described characteristics associated with various surface substrates. Substrates included were compact soils, sand dunes, poorly consolidated sands, and well-consolidated
sands. In addition, he considered whether the beetles were of the "digging" type or whether they used natural or other existing shelters for refuge. Medvedev concluded that leg structure in tenebrionid species is closely related to their environmental conditions (substrate conditions) and behavioral features (capacity for rapid movement, digging and climbing).

Two types of digging tenebrionid beetles were also characterized by Medvedev. The first was found to dig directly into the substrate, not constructing burrows. These were usually small forms with streamlined shapes (head withdrawn into prothorax, prothorax merging smoothly with elytra) and enlarged protibiae. The second was found to construct more or less clear burrows when digging. In these, as most of the digging was done with the legs, the body was less streamlined. Furthermore, the body was often found to bear sharply protruding sculpturing, in the form of tubercles, carinae, asperations and granulae. Although certain species occasionally utilize existing burrows, most species of the Cryptoglossini clearly fit into this second digging group.

Medvedev (1965) introduced a number of body measurement relationships to explain quantitative expressions of certain adaptive morphologies especially in reference to leg structure. A number of Medvedev's measurement relationships were examined in species of Cryptoglossini. Two were found of interest: (1) The "coefficient of long-leggedness" (the ratio of mean arithmetic length of all legs without tarsi to the arithmetic mean of the following quantities: length of underside of body without the head; length and breadth of pronotum; length and breadth of elytra and body height), with short legged, relatively slow moving species having a ratio of less than 1.0 and long legged, running species with ratios of more than 1.5; and (2) The ratio of the length of the largest setae on the plantar surface of the first segment of the hind tarsus to the dorsoventral thickness of the segment, high ratios indicating psammophilous digging species. Table 3 lists these ratios in species of Cryptoglossini. Of these, in the "coefficient of long-leggedness", two species stand out; A. laevis with a low coefficient and S. nunenmacheri with a high coefficient. A high tarsal-setal ratio are among features listed by Medvedev characteristic of sand inhabiting Tenebrionidae (see Psammophily). High ratios are found mainly in species of Asbolus, with A. laevis
Table 3: LOCOMOTORY MEASUREMENTS IN THE CRYPTOGLOSSINI

<table>
<thead>
<tr>
<th>Species</th>
<th>1. CLL</th>
<th>2. TSR(N)</th>
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<tbody>
<tr>
<td>Cryptoglossa bicostata Solier</td>
<td>.99</td>
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</tr>
<tr>
<td>Cryptoglossa caraboides (Mannerheim)</td>
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</tr>
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<td>.44(10)</td>
</tr>
<tr>
<td>Cryptoglossa seriata (LeConte)</td>
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<tr>
<td>Cryptoglossa spiculifera (LeConte)</td>
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<td>.65(10)</td>
</tr>
<tr>
<td>Cryptoglossa asperata (Horn)</td>
<td>.85</td>
<td>.46(10)</td>
</tr>
<tr>
<td>Cryptoglossa variolosa (Horn)</td>
<td>.84</td>
<td>.49(10)</td>
</tr>
<tr>
<td>Cryptoglossa michelbacheri (Blaisdell)</td>
<td>.84</td>
<td>.56(10)</td>
</tr>
<tr>
<td>Asbolus verrucogus LeConte</td>
<td>.92</td>
<td>.74(15)</td>
</tr>
<tr>
<td>Asbolus laevis LeConte</td>
<td>.78</td>
<td>1.51(30)</td>
</tr>
<tr>
<td>Asbolus mexicanus (Champion)</td>
<td>.95</td>
<td>.75(10)</td>
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<tr>
<td>Asbolus papillosus (Triplehorn)</td>
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<td>.78(30)</td>
</tr>
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<td>Schizillus laticeps Horn</td>
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<td>.68(10)</td>
</tr>
<tr>
<td>Schizillus nunenmacheri Blaisdell</td>
<td>1.02</td>
<td>.97(10)</td>
</tr>
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<td><strong>Cryptoglossa average</strong></td>
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<td><strong>Asbolus average</strong></td>
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<td>.89(95)</td>
</tr>
<tr>
<td><strong>Schizillus average</strong></td>
<td>.96</td>
<td>.82(20)</td>
</tr>
</tbody>
</table>

(1) CLL = Coefficient of Long-leggedness (see text)
(2) TSR = Tarsal-Setal Ratio
(3) (N) = Number examined
having by far the highest ratio. Relationships of both these ratios are discussed in the section "special habitats". It should be noted that the tarsal setal average ratios reflect a value somewhat under the actual value as plantar setae tend to get somewhat worn in older individuals.

Andrews et al. (1979) examined substrate "preference" in a number of Coleoptera by recording monthly pitfall trap contents in three transects around Eureka Valley sand dunes, California. Substrates included moving dunes, sand flats (immediately around dunes), playa edge, alkali scrub and rocky hillside (see Andrews et al. 1979: fig.16). Among the Tenebrionidae trapped were *A. verrucosus* and *C. muricata*. *A. verrucosus* results were: 7% moving sand, 41% sand flats, 6% sand flat-rocky hillside border, 0% rocky hillside, 28% alkali scrub, 14% sand flat-alkali scrub border and 3% playa edge. These results perhaps indicate a substrate "preference" of sand flat-alkali scrub, for a total of 89% of the specimens of *A. verrucosus* trapped. *C. muricata* results were: 7% sand flat-rocky hillside border, 92% rocky hillside, and 0% for the rest of the substrates indicating a strong substrate "preference" for the "rocky hillside" substrate.

A similar study was undertaken (Jenkins, 1971) in Joshua Tree National Monument, California. Among species examined were *A. verrucosus*, *C. muricata* and *S. laticeps*. *A. verrucosus*, was trapped most abundantly in small scattered sand dunes around a dry lake. *C. muricata* was found in all localities surveyed but was most abundant in a flat area of coarse grained sandy soil with Joshua trees, yucca, cholla, and creosote bushes. *S. laticeps* was absent from the sand dune area and most abundant at Pinyon Wells, a rocky canyon transition between the yucca habitat and pinyon habitat at an elevation of 4000 feet.

These two studies support the adaptive morphology of tenebrionid legs to certain substrates proposed by Medvedev (1965) in tarsal-setal relationships of *A. verrucosus* and *C. muricata*. One would expect that *C. muricata*, with a smaller average tarsal setal ratio (.56) would be found on a more compact substrate than *A. verrucosus* with a higher average ratio (.74). This relationship with *S. laticeps*, on the other hand, is less clear with an intermediate average ratio of .68. *S. laticeps* inhabits rocky canyon areas (see section under *S. laticeps*). Analysis of substrate type in these areas would
prove interesting. It is possible that the substrate of this area is less compact than that of the flat areas.

Adaptive morphology to selective substrate utilization can also be found in the mobile immature stages of the Tentyriinae. Schulze (1974) characterized adaptive conditions found in sand dune dwelling members of Zophosini and Adesmiini. In general, dune inhabiting members of both lineages were found to have these characteristics: (1) prolonged segments; (2) a strongly elongated last notum with the disc covered with microsetae; (3) legs broadened with dorso-ventral flattening of the claws; (4) increased number and stoutening of the setae on the ventral surface of the legs. Larvae of the Cryptoglossini reflect some of these adaptations, including (3) and (4) above, as well as another. In species of Cryptoglossini, the configuration of the upper surface of the mandibles is concave and strongly produced laterally just apically from the basal lateral membranous areas. These shovel-like modifications give the mandibles extra surface area for use in pushing up the soil or sand when progressing through the substrate. Similar modifications are also found in other sandy soil dwelling tentyriines as the Asidini (Brown 1973).

The subelytral cavity (a tightly sealed air pocket into which the abdominal spiracles open) has been found by a number of investigators to be an effective method in reducing transpiratory water loss (for review see Ahearn & Hadley 1969). For this reason, many desert inhabiting tenebrionid beetles (such as the Cryptoglossini) have become flightless with the elytra highly fused to the rest of the abdomen, trading the advantages of flight for the advantages of reduced transpiratory water loss. The adaptive advantages of this "dead air" space in relation to temperature was further studied by Hadley (1970). He suggested that a possible thermal advantage of the cavity is the separation of the upper body covering from the internal soft tissues creating a buffer zone which delays heat transfer to the beetle's more sensitive internal structures. Hadley suggested that this might act as an early warning system allowing the beetle to seek shelter before overheating its internal organs while the external temperatures on the upper body surface perhaps reached lethal levels. It is possible that the additionally inflated pronotum found in certain cryptoglossines as *A. verrucosus*, *A. laevis* and *A. papillosus*, (as well as in
other tentyriines) also adds in providing protection to the internal structures of the thorax as part of the "early warning" system.

**PHYSIOLOGICAL**

The transpiratory water loss, in form of percent initial weight loss as a function on both temperature and humidity, was compared in specimens of both *A. verrucosus* and *E. armata* (Tenebrioninae, Eleodiini) by Ahern and Hadley (1969). *E. armata* was found to have greater water loss than *A. verrucosus* at all temperatures and humidities tested. *A. verrucosus* was able to tolerate temperatures over 40 degrees centigrade (30 degrees C in *E. armata*) without a significant increase in water loss. *A. verrucosus* was also able to tolerate a wide range of humidities without significant water loss unlike *E. armata* which lost significant amounts of water at all three humidities tested (0, 40, and 75, per cent relative humidity). One half of the water loss in *A. verrucosus* was attributed to secretions (see Defense). Ahern and Hadley (1969) also found that there was a significant reduction in the amount of water loss with increased dessicating conditions in *A. verrucosus*.

Cuticular transpiration and transitional temperatures were further examined by Hadley (1978) in *A. verrucosus*, *C. muricata*, *C. variolosa* as well as *E. armata* by correlating the transpiratory data with the quantity and chemical nature of their epicuticular lipids (which act as waterproofing substances). Hydrocarbons were found to be the predominant cuticular lipid comprising over 90% of the total lipids extracted from each species. Of these the ratio of straight-chain (n-alkanes) to branched hydrocarbons was found to be of particular interest. *A. verrucosus* was found to have the highest percentage of straight chain hydrocarbons (78.5%) compared to 7.7% in *E. armata* (*C. muricata* and *C. variolosa* each had 55.3% and 53.1% respectively) while *E. armata* had the highest percentage of branched hydrocarbons. Hadley suggested that the tight molecular packing possible with straight-chain hydrocarbons (thus increasing waterproofing) is not possible with the branched hydrocarbons. Transition temperatures (temperature at which cuticular permeability abruptly increases) averaged 51.5°C for all three Cryptoglossini tested (40°C *E. armata*)

Certain species of Cryptoglossini (*A. verrucosus*, *A.
mexicana, A. laevis and A. papillosus exhibit distinct color phases due to the build-up of wax layers on the cuticle surface. This phenomenon was examined in A. verrucosus (which perhaps has developed this feature to the greatest extent of any Cryptoglossini) by Hadley (1979). He discovered wax filaments composed mainly of lipids (hydrocarbons with 88% n-alkanes) but also included were proteins and other substances. These wax filaments spread from the tips of "miniature tubercles" found on the sides of the larger tubercles on the elytral surface and on most of the cuticular surface of the body (with up to 1200 per square millimeter) (see Hadley 1979 for illustration). He found that this meshwork of wax fibers (of 0.14 um in width), which accumulates under low ambient humidity, reduces the transcuticular water loss and results in giving the beetle a light-bluish color. Transitional color phases (from light to dark) were found to correlate positively with the percent relative humidity tested. It is possible that this wax covering may also aid in lowering the surface temperature of the body by acting as a reflective surface, as also suggested by Hadley. Laboratory specimens of A. verrucosus, kept during the present study at somewhat fluctuating room temperatures and humidities (temperature averaging 21 degrees centigrade), seemed to retain their wax layer at a fairly constant state (personal observation) until shortly after death or when a drop of water was added directly to the cuticular surface (causing the wax layer and bluish coloration to turn black).

B. SPECIAL HABITS

PSAMMOPHILY

Medvedev (1965) characterized the adaptive morphological features of the legs of sand dune dwelling Tenebrionidae. Due to the slight mechanical resistance of the substrate, the fauna of aeolian sands was found to be particularly rich in both of Medvedev's digging forms (see above). As a consequence of the low cohesiveness of sand grains, more energy must be expended by burrow constructing forms in clearing out sand from existing passages than in their construction. Among features listed by Medvedev as characteristic of sand dwelling tenebrionids which normally construct burrows in sand are: (1), broadened apical parts of the tibia including a flattening of the spurs and claws and (2), high tarsal plantar surface setal length-dorsoventral height ratios.
The long setae on the tarsi enable the beetles to use these as sand "brushes" when digging.

The evolutionary advantages of psammophily are not clearly understood. Since present extremely arid areas in many parts of the world are of fairly recent origin (Axelrod 1979), psammophilous tenebrionids undoubtedly evolved from faunas of compact soils, perhaps by way of fixed sands. Tenebrionids possibly became psammophilous to take advantage of the high amount of organic detritus which accumulates on leeward side of barchan dunes at all times due to wind action or perhaps the post-rain plant blooms which sometime cover sand dunes. Recent studies have also suggested that soil temperatures may actually be lower under plants on sand dunes than in interdune areas (Hennessy et al 1985). Clearly many genera belonging to many tribes of Tentyriinae have psammophilous species. The Cryptoglossini is no exception. These can be found in the genus Asbolus including A. laevis, A. verrucosus, and A. papillosus. All three of these species occur sympatrically on and around a number of sand dunes. These species represent progressive adaptive evolution towards psammophily. This is reflected by examination of their tarsi (see Table 1). Of these three, A. laevis is perhaps the most highly adapted to aeolian sands, with an average tarsal setal ratio of 1.51. Although A. verrucosus and A. papillosus have similar average tarsal-setal ratios (.74 & .78 respectively), only A. papillosus (besides A. laevis) is apparently restricted to sand dunes (see below).

The relationship between A. laevis and A. papillosus merits mention. Both A. laevis and A. papillosus occur sympatrically on a number of sand dunes. When they do so, as in the Algodones Dunes of Imperial County, California, A. papillosus is much less likely to be encountered (approximately 100 to 1 specimens in most collections from the same area). A. laevis and A. papillosus are externally very similar. Indeed, one of the main external characters which differentiates A. laevis from A. papillosus is the presence in A. laevis of the long "sand brushes" on all tarsal segments (Fig. 114). Internally A. laevis is very different from A. papillosus. A. laevis is characterized by having a shortened, widened, ovipositor (only 2/3 the length of that of A. papillosus or other species of Asbolus, Fig. 111) as well as a widened corresponding male aedeagus (Figs. 81-84). The Algodones Dunes (a separate, northern extension of the Grand Desierto of Sonora, Mexico) extend over 80 kilometers in a northwest-southeast
direction and are 5 to 10 miles wide. As most of the prevailing winds which sweep the dunes originate from the west, the sand is characterized by strikingly different grain sizes. These form an east-west gradient of large size grains at the western edge of the dunes and minute grains in the east. It is possible that *A. laevis* has adapted for oviposition in aeolian sand of a certain grain size. *A. laevis* is very abundant on the eastern edge of the dunes, where most of the collections of arthropods have been made. Further study of the relationship of grain size to ovipositor size in these dunes might clarify this relationship.

**PHOLEOPHILY TO TROGLOPHILY**

The deeper a burrow extends down from the surface, the less diurnal temperature fluctuation and less variation in relative humidity will be present at the bottom, although a great range in both temperatures and humidities may be encountered when moving from the surface to the bottom of a burrow (Hadley, 1970). Aside from the total absence of light, excepting near entrances, caves are usually characterized by relatively constant humidities and temperatures which correspond to the yearly mean of the area (Barr, 1968). Without the presence of light energy, cave ecosystems are almost entirely dependent on the transfer of organic food energy from the outside for survival (Barr, 1968). Since food is a limiting factor in caves, most species of arthropods found in caves are euryphagous. Most available food energy in desert caves enters with rodents (especially packrats: *Neotoma* sp.), bats, and occasionally birds (such as swallows and owls). These bring in twigs, cacti, grass, leaves, dead animals, etc. from the outside and also leave varying amounts of fecal material which add to the organic matter.

As seen above, certain species of Cryptoglossini are able to tolerate a wide range of temperatures and humidities. This is perhaps an adaptive ability associated with spending a great percentage of their lifetime varying distances under the ground surface. These abilities, as well as their euryphagous feeding habits, have perhaps led to the habitual colonization of caves by at least two species of cryptoglossines, *S. nunenmacheri* and *A. mexicanus*.

In 1978, a yearlong survey was conducted of the
Coleoptera of Mitchell Caverns, San Bernardino County, California (Aalbu 1979). Ethylene glycol pitfall traps were used to survey the Coleoptera at selected sites inside and outside the caverns. Two species of cryptoglossines were collected in the traps during this survey, *Schizillus laticeps* and *Schizillus nunenmacheri*. Surprisingly, only *Schizillus nunenmacheri* was found inside the caverns. All specimens of this previously rare, but locally abundant species, were found or collected in traps in the caverns. Not only was it one of the few species of beetles to be trapped in the lower cavern, but numerous larvae of this species were found living in the deepest pit of the caverns. These perhaps feed on the highly organic cave dust and debris of the area. A number of *S. nunenmacheri* were found hanging upside down from the tips of stalactites in the deeper areas of the caves, perhaps a unique strategy to obtain the few water droplets percolating down during drier periods.

Another species, *S. laticeps*, which is found in the same geographic area, seems to occupy a different niche. Although one specimen of *S. laticeps* was found near one of the cave entrances, none was found inside the caverns. *Schizillus nunenmacheri* also differs morphologically from *S. laticeps* by being more slender, the elytra less sculptured, with much more slender antennae (the third segment being more than three times as long as in *S. laticeps* as well as having somewhat longer legs (see Table 3).

Characteristics usually associated with cave organisms include delayed reproduction, increased longevity, smaller number of total eggs produced by females, and larger eggs (Culver, 1982). According to the classification of cave animals used by Barr (1968), *Schizillus nunenmacheri* fits best into his category of a troglophile (species which live, reproduce, and complete their entire life cycles within caves although they may be found outside of caves in dark, sheltered microenvironments). Troglophiles may exhibit some degree of evolutionary modification associated with caves. Troglophiles seem preadapted to living in caves, usually being found in moss, leaf litter, soil, mammal burrows or underground nests, under decaying logs, rocks, or similar dark microhabitats. *Schizillus nunenmacheri* also seems to be associated with packrats (*Neotoma* sp.) and has been trapped just outside of packrat nests in other rocky areas.
Asbolus mexicanus is relatively abundant in many limestone caves in the Chihuahuan desert in Texas (6 caves) and the Mexican states of Chihuahua (1 cave), Coahuila (6 caves), Durango (2 caves) and Nuevo Leon (6 caves). In fact, approximately 70 percent of the specimens examined were collected in caves. Associated ecological data labels include: on dry silt, near entrance, on bat & swallow guano, on guano, in dusty dry entrance, at base of vertical entrance, in cave, near cave entrance, entrance sink, twilight zone on bird guano, on bat guano, etc. Asbolus mexicanus was also found to have relatively larger eggs (see Immature Descriptions) than other species of Asbolus. It is possible that Asbolus mexicanus, like Schizillus nunenmacheri, reproduces in caves or similar habitats.

LIFE HISTORY AND FEEDING

LIFE HISTORY

Species of Cryptoglossini are very long lived as adults, field collected specimens having been kept alive in laboratory conditions for up to seven years (Asbolus verrucosus: Blaisdell collection). Adult longevity was estimated for species of Cryptoglossini in laboratory colonies. These data are summarized in Table 4. The Cryptoglossini, as many other Tentyriinae, are rather long lived, most having three or more years life cycles with both the larvae and several generations of adults overwintering. It is possible that in desert areas, slow growth may be associated with seasonally restricted ingestion, as suggested by Crawford (1981).

The duration of the immature stages in the Cryptoglossini was found to be similar to other previously examined tentyriines as the Asidini (Brown, 1971) and the Coniontini (Doyen, 1984) with: (1) eggs taking one to two weeks to hatch; (2) the first instar lasting approximately one week; (3) a wide variation in the number of instars; and (4) larvae reaching maturity in 6 to 8 months and remaining a number of months as mature larvae. The pupal stage in the Cryptoglossini examined (A. mexicanus and S. laticeps) was found to be quite short lasting approximately only two to three weeks. Oviposition timing and the number of eggs laid was found to vary greatly. Eggs were always laid singly, just below the surface, the actual oviposition causing a visible surface perforation.
Table 4: LONGEVITY IN THE CRYPTOGLOSSINI

Species: [starting population]; approximate average adult laboratory longevity estimate

(Percent remaining alive at indicated time)

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<tr>
<td>Schizillus nunenmacheri</td>
<td>3</td>
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</table>

* insufficient data or numbers too small for reliable estimate
FEEDING

One of the major obstacles tenebrionids face in the desert is not what to feed on, but how to find the sparsely distributed food over relatively vast areas (Schulze 1974). Although some tenebrionids are selective feeders (as certain fungi) most have omnivorous feeding habits, feeding on almost any organic matter. This euryphagous adaptive strategy has undoubtedly contributed to the success of tenebrionids in deserts. The Cryptoglossini clearly fall in this category. Dissected gut contents of specimens of _A. papillosus_ from Devil's Playground, San Bernardino Co. Calif., were even found to contain numerous Meloidae triangulin larvae although it is not known if these were ingested alive or dead.

PREDATORS, PARASITES, DEFENSE AND COMPETITION

PREDATORS,

Animals known to prey on adult tenebrionid beetles include vertebrates such as birds (road runners, sage grouse and others), mammals (shrews, mice, skunks), reptiles and amphibians (toads, lizards) as well as arthropods (spiders, scorpions, centipedes, ants, carabids, and asilid flies) (for review, see Allsopp 1980). Among spiders, black widows have been observed to feed on _C. muricata_ and other tenebrionids (personal observation). Immatures are also subject to predation and parasitism when foraging above ground at night (personal observation). The larvae of cryptoglossines have also been observed to be cannibalistic in artificial rearing conditions (personal observation).

PARASITES

A number of flies (sarcophagids, tachinids), and wasps (ichneumonids, braconids, bethylids) have been found to be parasitic on tenebrionid beetles (for review see Allsopp, 1980). Doyen (1984) noticed that the wasp _Microctonus eleodis_ (Viereck) parasitised diverse genera of tenebrionids (as _Eleodes_, _Eusattus_ and _Edrotes_) but failed to attack _A. laevis_ and _A. verrucosus_. Approximately one month after the establishment of the laboratory colonies of cryptoglossines, tachinid flies, _Catagoniopsis specularis_ (Aldrich & Weber) (determined by S. A. Kuba: Laboratory Services-Entomology, California Dept. of Food and Agric., Sacramento) were reared from
specimens of both *A. verrucosus* (1) and *A. laevis* (6) collected in the Algodones sand dunes, Imperial Co., California. These were first noticed as pupal cases while sifting the sand for eggs, followed soon by the death of the parasitised adult beetle. The pupae were separated and allowed to emerge in separate containers and saved as voucher specimens. Emergence of the adult parasites averaged 15 days after separation. This species has not been previously recorded as parasitic on tenebrionids, although another species *Catagoniopsis meracanthae* (Green) was found to be parasitic on the larva of *Meracantha contracta* (Palisot de Beauvois), (Tenebrioninae: Amarygmini) (Arnaud 1978:126).

**DEFENSE**

Tenebrionid beetles employ a variety of defenses against predators and parasites. The abdominal defensive secretions or sprays, present in certain groups, has led to these being referred to as "stink bugs". These defensive secretions are often effective in discouraging predators, particularly smaller ones such as scorpions (Hadley, 1968), lizards and ants (Slobodchikoff, 1979). These may also aid in a beetle's ability to forage organic debris around ant mounds (Slobodchikoff, 1979). However, recent studies have shown that these may not always be an effective defense against certain vertebrate predators such as skunks (Slobodchikoff, 1978) or grasshopper mice (Eisner and Meinwald, 1966). In some cases the odor of the defensive spray may even act as an attractant to the predators (Slobodchikoff, 1978).

The Cryptoglossini, lacking abdominal defensive glands as other members of the Tentyriinae, have developed other defensive strategies to compete with species that possess these. Defense mechanisms found in the Tentyriinae may be grouped into vagile (defense by escape, either to a nearby shelter or by outrunning the predator) and sessile defenses. Sessile defenses can be categorized into warning defenses or passive defenses. Warning defenses include head standing (mimicking the behavior of beetles having abdominal defensive secretions), and sound production by either stridulations (usually involving the physical scraping of often serrated, hard body structures), or by rapid substatral tapping with the abdomen as found in species of *Eusattus* (Tschinkel et al, 1976) and African molurines. Passive defenses include the presence of a thick integument or death feigning, which usually involves
some degree of leg folding. Often, species possess a combination of one or more of these types of defenses.

The Cryptoglossini employ a number of these defenses to repel predators and perhaps parasites. A survey of the live populations was undertaken to determine the type and extent of defensive response behavior in the laboratory species of Cryptoglossini by physically irritating specimens for approximately 15 seconds. Defensive behavior observed included escape to shelters, death feigning and head standing. Escape to nearby shelters was most common in species of Cryptoglossa, as in C. asperata, which was timed after disturbance to travel at the speed of 1 meter in 17 seconds until shelter was reached.

Head standing was found to be the most immediate defense in all Cryptoglossa observed but absent in all Asbolus and Schizillus except for A. laevis. This involved the stiffening and straightening of the hind legs thereby raising the abdomen. Occasionally, this behavior was repeated in several quick successions in effect raising and lowering the abdomen several times (A. laevis). This behavior was further developed in A. laevis also by lifting the hind legs off the ground (by also straightening the middle legs) and swinging these quickly back and forth.

Death feigning generally involves the stiffening of the body and legs. This seems to have evolved into a three step behavior in some species of cryptoglossines. First, the body is stiffened and the legs are stretched straight out. Secondly, the two forelegs, and the mesothoracic and metathoracic legs on each side are intertwined forming three "spikes" from the beetle. Finally, these combined legs are brought in toward the body by bending the femoral-tibial joints. This behavior most commonly results in the beetle's resting on its back. Although this death feign behavior may last an extended period, recovery is very fast lasting only a few seconds (the beetle almost immediately righting itself). The physiological mechanism for this behavior and subsequent fast recovery are unknown. The extent and timing of this behavior was examined in the laboratory specimens. Only C. asperata was found not to use death feigning as a defensive strategy. This behavior was found most highly developed in Asbolus with occasional specimens retaining the death feign position for over three hours. The selective advantage of such long duration death feigns
behavior is unclear. It is possible that this reflects a polymorphic behavioral character. Further field centered studies of the defensive behaviors in species of crytoglossines might clarify the extent and range of some of these behaviors.

It should also be mentioned that Ahearn (1969) found certain specimens of *A. verrucosus* to produce "quinone secretions" which acted "similarly to the defensive quinones of tenebrionines as *Eleodes*" when specimens were subjected to long periods of high temperatures. As members of the Tentyriinae, Cryptoglossines lack abdominal defensive glands and so associated quinone secretions. It is possible Ahearn mistook body fluids which may escape from the body at near lethal temperatures for these secretions. Also mentioned were oral "spitting" (regurgitations?) secretions which Ahearn called "characteristic of this species". I have not yet found any evidence of this type of defense among the cryptoglossine specimens examined, even when holding absorbant paper against the oral opening of the specimens. Again, this oral "secretion" may be due to the effects of near lethal temperatures.

**COMPETITION**

As suggested above, cryptoglossines, and perhaps other tentyriines seem to have a competitive edge (being able to tolerate more "extreme" environmental conditions) over non-tentyriine tenebrionids. These others, as the genus *Eleodes* which is very often found in the same areas as cryptoglossines, perhaps have other advantages in their ability to discourage predators (by the abdominal defensive glands) thereby taking advantage of food piles as those found around harvester ant mounds without risking attack. The only other tentyriine tribe with members approximately equal in size to the cryptoglossines, the Asidini, (often occurring sympatrically with cryptoglossines) employ a distinctly different adaptive strategy from both *Eleodes* and species of the Cryptoglossini. In these, although larval life is apparently prolonged (Brown 1973), adult life is usually limited to approximately one month, usually during periods of maximum plant productivity as after rainy seasons when these beetles emerge in large numbers.

With essentially similar euryphagous habits, one might suspect that interspecific competition might also
exist between sympatric species of Cryptoglossini for the limited food resources found in desert environments. Available data suggests that this is not the case. As has been shown above, specimens of *C. muricata* and *A. verrucosus* were found to be nearly mutually exclusive on substrates around the Eureka Valley Dunes by Andrews (1979). The two species of *Schizillus*, where they occur sympatrically, were also found to utilize different niches by Aalbu (1979). Ahern (1970) using a pit-trap survey of South Mountain Park, near Phoenix, Arizona (an area of Lower Sonoran Desert vegetation, composed mainly of creosote bush and bursage), found *A. verrucosus* to be a less mobile species than either *C. muricata* or *C. variolosa*, the two other cryptoglossines in the area. Specimens of *A. verrucosus* were also much more likely to be encountered in the near vicinity of creosote bushes (*Larrea sp.*) where the soil tended to be of a softer, finer texture compared to the sandy, well packed soil on the open, flat expanses. Ahern suggested a possible association between *A. verrucosus* and bushes of *Larrea*. Although this remains to be substantiated, other yentrytines have been found previously to depend heavily on certain perennials for "food and shade" (Roer, 1975).

*C. muricata* and *C. variolosa*, were also found to be most abundant at different times of the year (*C. muricata* in June and *C. variolosa* in August) thus avoiding competition (Ahern 1970). Data supporting this June seasonal surface activity period in *C. muricata* (in an areas where *C. variolosa* does not occur) was previously presented by Tanner and Packham (1965) from studies conducted in Nye County, Nevada and by Jenkins (1971) from studies conducted in Joshua Tree National Monument, California. Jenkins further suggested that some species could be used as ecological indicator species for certain faunal regions which included the Mojave, Colorado (Sonoran) and Coastal regions. These included *C. muricata* as a Colorado Desert indicator and *S. laticeps* as a Mojave Desert indicator. Both these species occur commonly in both these desert areas, refuting this concept.

A similar substrate-vegetation study (unpublished personal observations) was conducted around the immediate area of the Algodones Sand Dunes of Southern California in the spring of 1979. Substrates examined included: desert microphyll woodland, creosote bush scrub, desert psammophytic scrub and aeolian (wind blown, vegetationless) sand dunes. Although *Asbolus laevis* was
found to occur in some numbers in all the immediate areas along the dune edges including the desert microphyll woodland and creosote bush scrub, it was most abundant in the desert psammophytic scrub areas on the dunes and slightly less abundant on the open (vegetationless) sand dunes. *A. verrucosus* was not found in the open sand dunes. It was most abundant in the creosote bush scrub and microphyll woodland and less abundant on the psammophytic scrub. All these studies indicate a probable avoidance of competition in sympatric species of Cryptoglossini by niche exclusion most likely involving selective substrate specialization or seasonality.

**ECONOMIC IMPORTANCE**

The Cryptoglossini have been found to be of significant ecological importance in some areas. On the Algodones Sand Dunes of Southern California, *Asbolus laevis* is possibly the most abundant beetle on the sand surface often allowing one to count over 100 visible specimens from one viewpoint. Thomas and Sleeper (1977) estimated population densities of other species, *C. muricata* and *A. verrucosus* (using the Geometric recapture model), to be up to 309 and 2500 (individuals per hectare) respectively at the 95% confidence level. Another model, the Jolly Stochastic Estimator, gave higher estimates (+-2116 per hectare for *C. muricata* 95%) (Thomas and Sleeper 1977). Thomas (1979) further determined the (adult) biomass of *A. verrucosus* at a site in the northern Mojave Desert (Rock Valley, Nevada) to be 275 grams per hectare which was more than the combined biomass of all mammals, birds, lizards and snakes (a total of 263 g/ha) in the same area.

While no members of the Cryptoglossini have been directly implicated in damage to field crops or stored food products, biological notes from such labels as these: alfalfa field, under alfalfa bales, indian fish traps, bee hive on ground, on bales near alfalfa field, ex. barley field; from specimens of *A. verrucosus*, indicate at least close proximities to economically important plants. Certainly the potential for damage (if not actual damage) is present, especially in areas where these beetles consist of high percentages of the animal biomass. Many tentyriines (with essentially the same omnivorous habits as cryptoglossines) have been reported as pests of a large number of crops including tobacco, cotton, mallow (*Malva sp.*), tomatoes, grapes, beans, chilies, lima beans, corn,
groundnuts, potatoes, soybeans, sunflowers, cucurbits, coffee and grain crops (Allsopp 1980), all of which may be grown in the geographic range of the Cryptoglossini. Usually the damage is not uniform in the field but in localized areas. Papp and Pierce (1960) also reported *Nyctoporis carinata* (Nyctoporini), a member of the sister group of the Cryptoglossini, as a stored food pest in the Mojave Desert of California. For a review of control measures effective on false wireworms see Allsopp 1980.
HIGHER CLASSIFICATION OF CRYPTOGLOSSINI

MONOPHYLY OF THE TENTYRIINAE

Recent works on the higher classification of tenebrionids have stressed the independence of the tentyriine lineage from other Tenebrionidae. Doyen (1972) went as far as to suggest separate familial status for the Tentyriinae based on the following characters: (1) Absence of visible membranes between terminal sternites [but present in Pimeliini and Platypotini, considered tentyriines by Doyen]; (2) Absence of abdominal defensive glands; (3) Aedeagus with tegmen ventral [inverted from "normal" position]; (4) Larvae with forelegs greatly enlarged for digging; (5) Larvae with mandibles bearing a dorsolateral membranous prominence densely set with coarse setae.

Relatively few recent works involving the higher classification of the Tenebrionidae have attempted to incorporate phylogenetic (cladistic) methods in the presentation of relationships between their OTU's. The first attempt to do this was perhaps by Watt (1974*) who distinguished the Tenebrionidae from other closely related families. He separated the Tentyriinae from other closely related subfamilies based on the following characters which he considered synapomorphies: Adults with (1) aedeagus inverted; (2) defensive glands absent. Larvae with (1) legs specialized for digging; (2) mandibles with membranous elevation bearing numerous setae.

In 1980 Tschinkel and Doyen examined the female internal reproductive tracts of various subfamilies of Tenebrionidae concentrating mainly on the subfamilies Coelometopinae and Diaperinae. They found certain characters of the female tract to be very helpful in understanding higher relationships within the family often enabling conclusions to be reached that were not as apparent by use of other characters. Only 10 species of

* In the same year, another revisionary work appeared (Skopin, 1974). This study, apparently a doctoral dissertation in Czech is mentioned by Kwieton (1982) as employing weighted phenetic methods.
the subfamily Tentyriinae were examined. They found the internal tract of the tentyriines they examined to be highly diversified. One of the characters that Tschinkel and Doyen found diagnostic to a higher level in tenebrionids is the transition of the bursa copulatrix from the primary ventral to the secondary dorsal condition with absence of a bursa copulatrix as an intermediate condition. This transition, or transformation series, is summarized below because of its later importance in the text.

1. In the plesiomorphic condition, the vagina ends in a blind sac termed the primary bursa copulatrix. There is also a singlular structure dorsally on the vagina termed the accessory gland. In this condition, no spermathecae are present.

2. In the second or intermediate condition, the primary bursa copulatrix has collapsed to form the spermatheca, thus the vagina ends with the spermatheca and gland now termed the spermathecal accessory gland. In this configuration no bursa copulatrix is present.

3. In the third condition, there is a dorsal evagination on the vagina before the spermatheca which forms the secondary dorsal bursa copulatrix.

Due to the presence in tentyriines of both derived, fairly uniform ovipositors and the consistent absence of the primitive bursa copulatrix (ventral) in species they examined, Tschinkel and Doyen (1980) suggested that tentyrioids did not diverge from the most primitive tenebrionids (Lagriinae), but rather from a more advanced, tenebrionine form.

The latest attempt to consolidate the higher classification of the Tenebrionidae has been that of Doyen and Tschinkel (1982). Incorporating their findings from studies of the defensive glands, ovipositors and female genital tubes (Tschinkel et al 1980), they compared the stability of both cladistic and phenetic methods using various hand and computerized tree generating techniques. The configuration of the internal female reproductive tract was found to be of maximum use in resolving higher classification of the Tenebrionidae. The following structures were found to be of substantial but subsidiary use: ovipositor structure; defense glands and associated structures; mouthparts; internal skeletal anatomy; and
wing venation and configuration. Few larval characters were utilized in their analysis. Doyen and Tschinkel concluded that it was unclear from present evidence whether tentyrioids diverged from the laggine or tenebrionine lineage, they stated "determining the proper position of the Tentyrioids remains the major task in working out the main lines of evolution in Tenebrionidae".

Listed below are the combination of adult characters and immature characters (from Aalbu 1985) which are diagnostic for the subfamily Tentyriinae.

1. Absence of abdominal defensive glands; 2. Aedeagus with tegmen ventral*; 3. Absence of visible membranes between terminal sternites, hinging membrane always internal, articulation between sternites medial; 4. Larvulae having labrum with two spicules in middle of disc and (5) single spicule on dorsolateral membranous areas of mandibles. Mature larva with (6) antennae 3-segmented, with 3rd segment often reduced; (7) Mola prominent, strongly sclerotized, without fine, transverse ridges; (8) Gula distinct; (9) Prothoracic sternellum (postcoxale) greatly enlarged; (10) Prothoracic legs greatly enlarged and modified for digging [this adaptive character to soil inhabitation is independently derived in many tenebrioninae]; (11) Tarsungulus divided into a heavily sclerotized apical lobe and a weakly sclerotized base; (12) Prothoracic legs always with different setal pattern from others; (13) Hypopharyngeal sclerome usually concave anteriorly, rarely convex, never tridentate, dorsal surface smooth; and (14) Dorsolateral and/or ventrolateral surface of mandibles with a membranous area bearing spicules [in the larva of other Tenebrionidae, setae on the mandibles are apparently never restricted to a membranous dorso or ventrolateral region].

Of all the above characters, only the following seems to be a consistent, unique, synapomorphy uniting the Tentyriinae: (1) Larvulae with labrum with two spicules in middle of disc.

* Kwieton (1982) [as well as Skopin 1974, according to Kwieton] regards the ventral position of the tegmen to be plesiomorphic (unlike all other workers) but does not explain this view in his 1982 paper. Instead he cites his thesis (1980: a doctoral dissertation in Czech, Charles University, Prague) for "evolutionary explanation".


This character excludes the Pimeliini and Platyopini (Pimeliinae) which I believe should be removed from the Tentyriinae (as implied by Doyen et al 1982) and earlier proposed by Keleinikova (1963). In the Pimeliinae, the adults have visible membranes between the terminal sternites and the larvulae bear eight labral spicules (six lateral spicules and two mid spicules) in the middle of disc (as in the rest of the Tenebrionidae). The character "mandibles of mature larva with dorsolateral surfaces with a membranous area bearing spicules" is unique to the Tentyrinae–Pimeliinae complex. I believe the Pimeliinae to be the sister lineage to the Tentyriinae.

The plesiomorphic or apomorphic evolutionary relationship of the glandless condition in the Tentyriinae remains unclear. Tschinkel et al (1980:356) [refuting the earlier interpretation of Doyen (1972)] tentatively concluded that the tentyrioid tenebrionids were secondarily glandless because of "greater affinities" for tenebrionid groups with glands than those primitively glandless. Later, (Doyen et al 1982) the implication was that tentyriines are primitively glandless because the hinging membrane between visible sternites 3 and 5 (morphologically 5 & 7) is internal and the articulation is medial as found in the Belopini and Zolodinini (Lagriinae). In some lagriines (which also lack defensive glands) the membranes are external and the hinging is lateral as in lagriines and tenebrionines which possess glands (Doyen et al 1982). This last position is supported by internal studies currently in progress (see below), and by Kwieton (1982).

**SYSTEMATIC POSITION WITHIN THE TENTYRIINAE**

The Tentyriinae is presently composed of over 435 genera placed into 41 described tribes. Koch (1955) proposed South Africa as evolutionary center for the subfamily, the greatest number of tribes being known from that area (12). Because of great diversity of adaptive morphological specializations found in tentyriine beetles, strikingly similar morphological forms often recur on different continents. As a consequence, tribal limits and relationships within the subfamily have often been unclear, with traditional characters used to separate higher taxa often proving unreliable. These have also led to differing opinions over tribal limits and their phylogenetic positions within the subfamily Tentyriinae. A number of recent comparative studies on Tentyriinae have
emphasized the lack of close relationships between similar morphological forms from different biogeographical areas as the Old and New World (Doyen 1968, 1972:370).

Evidence from adults:

Tribes that have generally been considered to be phylogenetically close to the Cryptoglossini, the Asidini (46 genera, worldwide except Australia), the Akidini (5 genera, Palearctic), the Nyctoporini (2 genera, Nearctic & Neotropical), and the Elenophorini (2 genera, Nearctic & Neotropical) all include members of Horn's (1870) "Asidinae". This concept, adapted from Lacordaire (1859) and also used by LeConte, bases the "Asidine" lineage on (1) the mesocoxal cavities being laterally open and (2) the mesotrochantin visible. These characters separated the "Asidinae" from the "Tentyriinae" (mesocoxal cavities enclosed by sterna; mesotrochantin concealed). These characters have been found unreliable as both states exist in members of the tribe Asidini (Brown 1974). Another character which has been used to separate major lineages of Tentyriinae is whether the stipes and cardo are hidden by an enlarged mentum. This enlarged mentum condition exists consistently in many tribes (e.g. Erodiini, Adesmiini, Tentyriinae, Zophosini and others). This enlarged mentum is absent in the Cryptoglossini, Nyctoporini and some Asidini and Elenephorini.

Kwieton (1981) was the first to include the Cryptoglossini in a higher classification using phylogenetic methods. He placed the Cryptoglossini in his supertribe Nyctoporites which he mentions as being near another supertribe the Stenosites. In the Nyctoporites he included the tribes Elenophorini, Cryptoglossini and Nyctoporini (in which he included Psammeticus). Again, his published proposed groupings are only supported by citing his 1980 PhD thesis for "evidence". Doyen et al (1979) placed Psammeticus in the Elenophorini based on a number of external and internal similarities with Megelenophorus including the presence of an epipleural ridge modified as a strigil.

Evidence from immature stages:

The immature stages of the Tentyriinae are poorly known in comparison to the rest of the Tenebrionidae. A summary of previous descriptive work on tentyriine immature stages is presented in Aalbu 1985. Descriptions
of possible outgroups for the Cryptoglossini include the Nyctoporini (Watt, 1974), Akidini (Marcuzzi et al. 1960), and Asidini (Brown 1973). The Tentyriinae can be grouped into two major lineages based on the configuration of the labrum in the first instar larvulae. In one group (which somewhat corresponds to the "Tentyriinae" of Horn [1870]) composed mainly of smaller species, the labrum is incised (cleft) medially (e.g. Tentyriinae, Triorophini, Zophosini). In the second group (which somewhat corresponds to the "Asiinae" of Horn (1870), composed mainly of larger species, the labrum of the first instar larvula is unmodified. A summary of character combinations of adult and immature stages is presented in Table 5). These character combinations suggest close relationship between the Cryptoglossini, Nyctoporini and Elenophorini.

Internal Evidence:

In order to attempt to resolve phylogenetic relationships within the Tentyriinae and to determine outgroups for the Cryptoglossini as well as other tribes currently under study (e.g. Triorophini), I began a comparative study of the female internal cuticular structures within the subfamily with a goal of clarifying underlying higher relationships. Tentyriines present an ideal group for this type of study having rather uniform generalized external ovipositors but being internally quite variable. So far, 70 genera representing 30 tribes of the subfamily have been examined. Although this represents approximately 75 percent of the known tribes, it represents only approximately 16 percent of the known genera although most genera not yet examined belong to large tribes or small isolated tribes, where the acquisition of enough specimens to dissect is difficult. Although this study is in a preliminary stage, I believe certain phylogenetic implications can be drawn.

The preliminary results from these studies support both the close relationship of the Tentyriinae to the lagriine lineage as well as the primitive absence of defensive glands. Evidence for this stems mainly from the finding of the plesiomorphic condition of the bursa copulatrix (in the sense of Tschinkel et al. 1980, described above) in at least two tribes of the Tentyriinae. The lack of bursa copulatrix, or intermediate condition, was found to be the most prevalent condition in the tentyriines examined. Other characters which were
Table 5: Presence and combination of adult and immature characters used in outgroup determination 1.

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<tbody>
<tr>
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<td>+</td>
<td>-</td>
<td>+</td>
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<td>+</td>
<td>+</td>
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<td>+</td>
<td>?</td>
</tr>
<tr>
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<td>-</td>
<td>+</td>
<td>+</td>
<td>+*</td>
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<tr>
<td>NYCTOPORINI</td>
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<tr>
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<tr>
<td>ASIDINI</td>
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</table>

* but very faint.

Character Descriptions:

1. Clypeal area indented.
2. Epistomal-clypeal (frons) area produced anteriorly concealing labrum.
3. Labrum exposed, strongly sclerotized and melanized.
4. Labrum concealed, very weakly sclerotized and melanized.
5. Mentum moderately large to small, cardo and stipes exposed.
6. Larvulae with labrum not incised.
7. Mature larva with Y shaped epicranial suture present on head.
8. Mature larva with mandibles laterally expanded near membranous dorso- or ventrolateral regions.
9. Mature larva with mandibles laterally expanded near apical margins, membranous areas ventral.
10. Mature larva, with urogomphi present.
11. Mature larva, with spicules on abdominal tergite 9 restricted to lateral margins.
12. 1st instar larvulae: eggburster spicules present on meso, metathorax and all except terminal abdominal segments.
found very useful are the configuration of the spermatheca and spermathecal accessory gland. Tschinkel et al (1980) and Doyen (1984) believed the plesiomorphic state of the configuration of the spermatheca to be long, thin, and multiple, with the apomorphic configurations being short, thick, and single. Certain tribes and groups of genera were found to share many internal characters, suggesting close relationships. Two of these groups were:
1. The "ASIDINE TRIBES" including the New and Old World Asidini and Craniotini.
2. The "NYCTOPORINE TRIBES" including the Cryptoglossini, Nyctoporini, and Psammeticus (currently placed in the Elenophorini).

Some of these relationships are presented in Table VI. Relationships among other groups are not as clear. Examination of additional genera in these groups and others will clarify these relationships. One must keep in mind that only with the investigation of a substantial fraction of taxa in each group can valid conclusions be generated concerning true phylogenetic relationships of larger taxa. It is not within the scope of this dissertation and yet premature to attempt a reclassification of the tribes of the Tentyriinae using cladistic methodology, only to establish a functional outgroup for the Cryptoglossini.

FUNCTIONAL OUTGROUP

As mentioned above all the species of Cryptoglossini were found to be extremely similar internally to both Nyctoporis (Ammophorus and Elenophorus* were not examined due to lack of specimens to dissect) and Psammeticus of the Elenophorini but not to Megelenophorus. Megelenophorus internally was more similar to some of the "asidine" groups sharing the synapomorphic configuration of the spermatheca with the Asidini and Akidini. Also, in Megelenophorus, but not in Psammeticus, the mentum is large concealing the cardo and stipes. Adult and immature *It is possible that Elenophorus does not belong with Megelenophorus because of the lack of strigil modification on the epipleural ridge as well as other internal skeletal characters (as suggested by Doyen et al 1979). This would leave Megelenophorus and Psammithicus unplaced in any tribe. Examination of the internal structures of Elenophorus and Ammophorus may help clarify these relationships.
<table>
<thead>
<tr>
<th></th>
<th>Number of spermatheca</th>
<th>Configuration of spermatheca</th>
<th>Configuration of spermathecal accessory gland</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AKIDINI</strong></td>
<td>1 or few</td>
<td>thick short</td>
<td>short</td>
</tr>
<tr>
<td><strong>ASIDINI</strong></td>
<td>1 or few</td>
<td>thick short</td>
<td>short</td>
</tr>
<tr>
<td><strong>MEGELENOPHORUS</strong></td>
<td>few (5)</td>
<td>thin short</td>
<td>short</td>
</tr>
<tr>
<td><strong>PSAMMETICUS</strong></td>
<td>many</td>
<td>thin very long</td>
<td>short</td>
</tr>
<tr>
<td><strong>NYCTOPORIS</strong></td>
<td>many</td>
<td>thin very long</td>
<td>long</td>
</tr>
<tr>
<td><strong>CRYPTOGLOSSINI</strong></td>
<td>many</td>
<td>thin very long</td>
<td>short &amp; long</td>
</tr>
</tbody>
</table>
character combinations also support close relationship between the Nytoporini and Cryptoglossini.

For the above reasons, the Nyctoporini was considered to be the sister tribe of the Cryptoglossini. Nyctoporis was utilized as a primary outgroup for polarization of characters. Ammophorous and Psammeticus were also utilized but to a lesser extent (the internal tract configuration and immature stages of Ammophorous are unknown; the immature stages of Psammeticus are unknown). This concept is not new; LeConte (1862:219) considered the Nyctoporini as a subtribe of the Cryptoglossini. I was fortunate that both the mature larva and pupa of Nyctoporis carinata and N. cristata have been previously described (Watt 1974), providing this useful outgroup information.

**LIMITS OF THE CRYPTOGLOSSINI**

A number of genera have historically been included in catalogs under Cryptoglossini but have remained unknown to later workers. Other genera have been placed in the Cryptoglossini but clearly belong elsewhere. The systematic position of these genera is discussed below. Only the first of these, Amblycyphrus asperatus, a homonym, is retained in the tribe.

**The Systematic Status of Amblycyphrus asperatus and Threnus niger Motschoulsky**

*Amblycyphrus* Motschoulsky 1870:401
*A. asperatus* Motschoulsky 1870:404
Gebien 1910:120-121, 1937:701 (catalog)

*Threnus* Motschoulsky 1870:404
*T. niger* Motschoulsky 1870:406
Gebien 1910:120-121, 1937:701 (catalog)
Leng 1920:224
Bradley 1930:184 (classification).
Arnett 1960:652 (classification), 1960:672 (distribution)

These two genera, described by Motschoulsky in 1870, are known only from the types as no specimens belonging to these have since been identified. The types were deposited in the Moscow State Museum, then the Imperial University
Museum, in Moscow, USSR. During the course of this study, I was very fortunate to be able to examine these types.

In his description (1870:401-404) Motschoulsky assigned Amblycyphrus, as a "Melasoma of the tribe of the Akitites", mentioning that this genus was most closely related to Centrioptera Mannerheim. Motschoulsky distinguished Amblycyphrus from Centrioptera by the following characters: (1) "retractile labrum, which is often entirely hidden under the clypeus"; (2) "mandibles, which are more distinctly denticulate"; (3) "less thickened, non-moniliform antennae with a non-transverse subapical segment"; (4) "finely punctate elytral striae with the asperities being more obtuse but more pronounced"; (5) "more parallel prosternum, terminating arrow shaped and not emarginate"; (6) "non-bilobed mesosternum"; and (7) "more slender legs with longer apical tarsal segment", all unreliable, non diagnostic characters. Motschoulsky also distinguished this genus from Asbolus LeConte mentioning "the genus Asbolus of M. LeConte has a generally shorter form, with the elytral asperities of the elytra tuberculate and much more developed, the truncate, very transverse, apical segment, the visible labrum etc."

Unlike Amblycyphrus, Motschoulsky assigned Threnus, as a "Melasoma of the tribe of the Centriopterides" and compared this genus not to Centrioptera but to Cerenopus LeConte [Tenebrioninae:Cerenopini] (Lacordaire, in 1859 had included Cerenopus in the Centriopterides). Motschoulsky distinguished Threnus from Cerenopus by: (1), antennae distinctly enlarged toward extremity; (2), elytra not enlarged posteriorly; (3), epistoma less produced posteriorly; and (4), dissimilar dentition on inflated parts of femora and tibia.

After translating the French and Latin descriptions in Motschoulsky's paper (prior to examination of the types), I had come to the conclusion that: (1) Threnus niger, listed from San Francisco, Calif. was undoubtedly an Argoporis, probably Argoporis apicalis californica Berry (1900), the only Argoporis from California having males with single spines on the metafemora and (2), that Amblycyphrus asperatus which Motschoulsky compared with Centrioptera muricata in his manuscript and described from Nova Helvetia (New Switzerland, which I found to be an old name for Sacramento, California), was definitely not Schizillus laticeps, the only cryptoglossine which might
occur close to Sacramento.

After receiving the specimens, I was presented with the following bibliographical problems and made the following observations:

(1) The specimen labeled [Threnus niger Mots., Calif.] (green label with black handwritten ink) is an Argoporis, but Argoporia constanzae constanzae Berry 1980, a species which occurs in Baja California Sur. The problem in this case is that the genus Argoporia Horn, was also described in 1870 in Horn's "Revision of the Tenebrionidae of America North of Mexico" (p. 325).

(2) The other specimen is labeled "Centrioptera asperata Mots., Calif.", not Amblycyphrus asperatus (also green label with black handwritten ink). This specimen turns out to be not Centrioptera asperata Horn, as I first suspected but what Blaisdell in 1921 described as Centrioptera dulzurae. The problem in this case is that Centrioptera asperata Horn was also described in 1870 p.279 which makes these homonyms.

I puzzled on how to resolve these problems. Was there any possibility in finding out which of these two publications (both apparently published in 1870) was published first? My copy of Motschoulsky's 1870 paper consists of a xerox I made of pages 378 to 407 (plus the two illustration pages) when I visited the Canadian National Collection in Ottawa, Canada. I found the following "clues": (1) on page 378 (the page before Motschoulsky's manuscript begins), at the bottom is listed "Moskau d. 23 October 1870" which may (or may not) suggest that Motschoulsky's manuscript was released from the presses sometime following that date. Also (2), on pages 383 and 399 are found the subscript "No. 2 1870". Similarly (3), in Horn's publication, which may be easier to date, numbered subscripts are found throughout the manuscript, for instance before Centrioptera on page 277 is the subscript "Amer. Philoso. Soc. Vol. XIV.-70"; on the same page as Argoporia is a different number "Ameri. Philoso. Soc. Vol. XIV.-82". Furthermore (4), at the end of the publication on page 402 in his "Remarks" section, Horn cites "Helops punctatus......VI, 1870" suggesting perhaps that Horn's manuscript was also late 1870 if he was aware of other works of that year when writing the manuscript.
I was very fortunate to be able to solicit the help of Ted Spilman (United States National Museum, Washington D.C.) to help me resolve this problem. He mentioned that because Horn cites Gemminger 1870 (p. 402) [Col. Heft VI:123, which had to be published before March 21, 1870 because the article by Gemminger was cited in Trans. Ent. Soc. London 1870:13–118, which was in turn listed as being on the table at the meetings of the Society on March 21, 1870 (Proc. Ent. Soc. London 1870:XV)] Horn's 1870 was published after March 1870. Nothing further could be found on the Motschoulsky 1870 publication.

It is stated in the Rules of Zoological Nomenclature that when an exact date of publication within a year cannot be determined, the last date of that year, December 31st, should be considered to be the date of publication. Therefore both articles should be dated December 31, 1870. It is then up to the first reviser of the group to select which should be considered first. Since less disruption of current literature and classification will result, I thereby select Horn 1870 as having priority over Motschoulsky 1870. The proposed changes are listed below:

For *Amblycyphrus asperatus* Motschoulsky:
refer to section under *Cryptoglossa spiculifera pectoralis* (Blaisdell).

For *Threnus niger* Motschoulsky:

*Argoporis* Horn 1870:325

*Threnus* Motschoulsky 1870:404

NEW SYNONYMY

*Argoporis niger niger* Motschoulsky 1870:406

NEW COMBINATION

*Argoporis constanzae constanzae* Berry 1980:35

NEW SYNONYMY

*Argoporis niger inflata* Berry 1980:36

NEW COMBINATION

The Systematic Status of *Eschatoporis nununmacheri*
Blaisdell

*Eschatoporis* Blaisdell 1906:76.

*E. nununmacheri* Blaisdell 1906:79.

Gebien 1910:120–121, 1937:701 (catalog)

Leng 1920:224

Bradley 1930:184 (classification).

Arnett 1960:652 (classification),
Blaisdell in 1906 described a new genus and species from Marin County, California. He compared this genus to the tribe Scaurini and suggested a possible relationship with the tribe except for a few "disturbing elements". He proposed one of the two following solutions: 1. redefinition of the tribe Scaurini to include *Eschatoporis* or 2. a new tribe, *Eschatoporini*, be erected. No relationship to any known cryptoglossine species was mentioned.

It is hard to understand why Gebien in both his catalogs (1910, 1937) placed *Eschatoporis* under the Cryptoglossini rather than under the Scaurini as suggested by Blaisdell. Perhaps he relied on Lacordaire's (1859) classification placing the genera Scaurini under the tribe Cryptoglossini: LeConte (1862:219) had removed the "scaurine" (Tenebrioninae) genera *Eulabis*, *Epantius*, and *Cerenopus* from the Cryptoglossini. The placement of *Eschatoporis* in this position was adopted by Leng (1920:224) in his catalog and also subsequent classifications (Bradley, 1930 and Arnett, 1960). Blackwelder, in his 1944 checklist, apparently chose to omit the genus.

The systematic position of *Eschatoporis* within the Tenebrionidae is currently being resolved separately (Aalbu et al., in preparation). Details will not be included here. *Eschatoporis* is clearly not a member of the Cryptoglossini or the subfamily Tentyriinae. It belongs instead to the subfamily Lagriinae although its exact position within the subfamily is not yet clear. One problem is the unavailability of specimens (only very few being known to science), which makes internal examination very difficult.

CHARACTERS AND CHARACTER STATES

Character and character state descriptions, presented in Appendix B are discussed below. Cladistic relationships among taxa are presented in the next section.

CONFIGURATION OF THE EYES AND HEAD [EXCLUDING ANTENNAE] (characters 1-6)
In the Cryptoglossini, Nyctoporini and Elenephorini, the upper apex of the head (clypeus and epistoma) is strongly produced anteriorly concealing a very weakly sclerotized and melanized labrum. In Schizillus laticeps the apex of the clypeus is further produced anterodorsally becoming strongly deflexed over the labrum (1). The configuration of the lateral epistomal canthus is variable in the Nyctoporini and Elenophorini. In Nyctoporis and Ammophorus, it is slightly inflated laterally in front of the eyes as it is in Cryptoglossa and slightly more so in Asbolus. In Schizillus, the epistomal canthus is strongly inflated laterally, functionally dividing the dorsal and ventral lobes of the eyes (2). Similar conditions are found in Megelenophorus, Elenophorus and Psammeticus but in these the epistomal canthus is inflated more anteriorly, not functionally dividing the eyes.

The eyes in most Cryptoglossini are dorsoventrally elongate, slightly concave anteriorly and with the dorsal lobe distinctly composed of a larger group of facets than the ventral lobe. In both the Nyctoporini and Elenophorini the eyes are more or less semicircular (with the anterior aspect strongly concave). In Cryptoglossa the eyes are slightly narrowed mesally (with a width of at least 5 facets). In Asbolus, the eye width at center is narrowed to at most 3 facets. In Schizillus the dorsal and ventral portions are completely divided (3). The eyes are also completely divided in Elenophorus and nearly so in certain species of Psammeticus (e.g. P. gracilis Er.).

In Nyctoporis, Megelenophorus, Elenophorus and some species of Psammeticus, the antero-lateral mandibular process of the subgena is formed into a strongly produced, acute, spikelike process lateral to the mentum. In some species of Psammeticus and in Ammophorus, the apex is divided into two apical spikes (apex centrally concave). This strongly produced apex of the anterior mandibular process of the subgena is found only in one species of Cryptoglossini (C. bicostata). In all others it is reduced to a broadly rounded lobe (Schizillus and some Asbolus) or a slightly produced lobe with the apex sharp but obtuse (all other Cryptoglossa) (5). In Asbolus verrucosus, A. laevis and A. papillosus the mandibular process is not produced antero-mesally (4). Cryptoglossa bicostata exhibits a unique configuration of the mentum where the anterior margin (ventral aspect) is centrally deeply excavate. A similar, but not identical configuration is
also present in *Megelenophorus* and *Elenophorus*.

**ANTENNAL LENGTH AND CONFIGURATION (characters 7-10)**

The configuration of the antenna is highly variable among the Tentyriinae. In most species, the antennal segments are broadly oval in cross section to round to the apex. Rounded antennal segments are found in *Nyctoporis, Psammeticus, Elenophorus* and *Ammophorus*. Broadly oval apical segments are found in *Megelenophorus* and in *Cryptoglossa*. In *Schizillus* and *Asbolus* the apical segments are flattened, narrowly oval in cross section (9).

The length of the third segment is also variable. In most genera the third segment is subequal to the next two combined as found in the Nyctoporini and most Cryptoglossini and Elenophorini. In *Schizillus nunenmacheri* the third segment is elongate (equal to the next 3 combined segments) (7). Similar elongate third segments are found in *Megelenophorus, Elenophorus* and some species of *Psammeticus* (as *P. crassicornis* Wat.).

In most species of Tentyriinae, the apical sensory area of the terminal segment of the antenna is subtriangular in configuration (Figs. 54-55). In *Asbolus*, the sensory area on the terminal segment is greatly reduced in size with a subtruncate apex (8) (Figs. 56-57). A similar, but different configuration exists in *Ammophorus* where the sensory aspect of the segment is concavely impressed into the base of the segment. In *Schizillus*, the base of the apical segments is elongate, longer than wide from a lateral aspect (10). This configuration is not found in outgroup genera.

**THORAX CONFIGURATION (characters 11-14)**

In *Asbolus laevis* and *A. papillosus* the upper surface of the pronotum is inflated in a subglobose configuration. In *A. verrucosus* this inflation is more accentuated and with additional lateral inflated lobes (11). A similar inflation of the pronotum is found in *Elenophorus, Megelenophorus* and in *Psammeticus* (where the mesal aspect of the pronotum is costate). The functional adaptive significance of this type of inflation is hypothesized in the section on biology.

In *Nyctoporis* and *Psammeticus*, the surface
sculpturing of the pronotum consists of confluent, large, deeply impressed, often rugulose punctures. In Ammophorus, the punctures are dense, but smaller, not as deeply impressed. Pronotal sculpturing in the species of Cryptoglossini varies from large deeply impressed punctures especially on the lateral margins as found in Cryptoglossa variolosa to nearly smooth (sparse, minute punctures) (12 & 13). In Megelenophorus, the surface sculpturing of the pronotum is papillose, in Elenophorus the surface is smooth, impunctate.

In Nyctoporis and some species of Psammeticus, the prosternal process (lateral aspect) is moderately to deeply produced posteriorly to the procoxae. Similar configurations are found in Asbolus, Schizillus and most species of Cryptoglossa where the prosternal process is deeply produced posteriorly to the procoxae. In Caraboides, C. michelbacheri and C. spiculifera, the prosternal process consists of a slightly produced, mucronate posterior lobe. In Caraboides the process is not produced behind the procoxae as is found in Ammophorus, Megelenophorus and some species of Psammeticus.

LEGGS AND ASSOCIATED STRUCTURES (characters 15-18 and 28-29)

In most species of tentyriines, similar sculpturing patterns are found on all legs. In certain species of cryptoglossines unique configurations are found on the meso and metafemur. In Schizillus nunenmacheri, the lateral aspect of the metafemur is smooth (impunctate) (16). A similar condition is found on the mesal surface of the metafemur of Caraboides. In this species the mesal surface is also concave (15). This modification is apparently associated with the serrate mesal margins or surface found on the metafemur of certain Cryptoglossa (17). This structure is most highly developed on species with spiculiferous rows on the pseudepipleural margins of the elytra. Perhaps this structure is a type of locking mechanism developed as a defensive strategy. A similar but different structure is found on the metafemur of Psammeticus and Megelenophorus. In these, a stout setal comb is present on the mesal margins of the metafemora. This is utilized as a stridulatory organ, although it is not known if this structure is defensive in nature. A unique setal modification, associated with psammophyly, is found on the anterior lateral aspects of the tarsal segments in A. laevis (18). In this species, the setae are
long and slender (see biology).

In most species of Cryptoglossa, a unique sexual modification is also found on the postero-basal region of the meso, and metafemur in males. In these a distinct raised, elongate flat tubercle is present (28). *C. variolosa* exhibits the greatest development of this structure. In *C. muricata* the tubercle is centrally concave and secretory (29).

**ELYTRAL SURFACE STRUCTURE (characters 19-22)**

Elytral surface sculpturing is extremely variable in species of Tentyriinae. Furthermore, surface sculpturing characters are often continuous and variable within species. A number of different surface sculpturing characters have previously been utilized as diagnostic to species of Cryptoglossini. Many were examined in this study. Very few proved reliable in hypothesizing phylogenetic relationships. In *C. bicostata*, the elytra have two distinct costate elytral intervals (20). Costate elytral intervals are found in *Psammaticus*, *Elenophorus*, *Megalelenophorus* and one species of *Nyctoporis* (*Nyctoporis carinata* L.) but not in *Ammophorus* and all other species of *Nyctoporis* making accurate polarization of this character more difficult. In all species of *Nyctoporis*, and most *Psammaticus*, the elytral intervals form strong rounded tuberculations. This type of sculpturing is also found in some species of *Cryptoglossa*. In some species these tuberculations are strongly flattened and coalesced forming confused asperations obscuring the intervals. In one species group of *Cryptoglossa*, distinct acute, muricate to spiculate elevations separated by flattened areas are present on the intervals along the postero-pseudepipleural ridge (19). In *C. caraboides* and *C. michelbacheri*, a single strongly developed spiculate row is present in one interval along the posterior pseudepipleural margin. In *C. spiculifera* two spiculate rows are present (21). Spiculate intervals are not found in either the Nyctoporini or Elenophorini. In only one species of Cryptoglossini, *Asbolus laevis*, the elytral surface is distinctly smooth along the pseudepipleural margins (22).

**OVIPOSITOR AND ASSOCIATED FEMALE STRUCTURES (characters 23-27)**

The ovipositors of tentyriines are often generalized
adaptative structures used for the penetration of dry, often hard soils in arid environments. Few characters of systematic value are found on tentyrine ovipositors. In *Psammeticus, Elenophorus, Megelenophorus* and in most *Cryptoglossa*, the 4th lobe of the coxites is apically sclerotized with subapical vestiture (apical to the gonostylus) reduced to minute, slender setae. In *Nyctoporis*, with species found under bark, the 4th lobe is weakly sclerotized and the subapical setae are long and slender. In *Cryptoglossa bicostata* and *Asbolus*, the subapical setae are short, thickened and positioned apically on the 4th lobe of the coxites. In *Schizillus*, the apical vestiture is composed of very short, strongly sclerotized, thick, peglike spicules (23).

In most *Tentyriinae* the mesal arm of the spiculum ventrale is distinctly longer than wide (in *Nyctoporis* it is approximately three times as long as wide). Short spicula ventrale are found in all *Cryptoglossini*, in *Psammeticus* and in species of *Akidini*. In the *Cryptoglossini*, with the exception of *A. laevis*, the spiculum ventrale is slightly but distinctly longer than wide. In *A. laevis*, the spiculum ventrale is distinctly wider than long (see Figs. 122-130) (25). This proportion is also found in species of *Akidini* (as *Moricosa planata* Fab.) although the general configuration of the spiculum is different in species of this tribe. The shortened spiculum ventrale in *A. laevis* is associated with a very short ovipositor in which the paraproct is only slightly longer than the coxites instead of equal to subequal twice the length of coxites or longer as found in all other *Cryptoglossini*, *Nyctoporis, Psammeticus, Elenophorus* and *Megelenophorus* (24).

Only two internal reproductive tract characters were found reliable in this study. These both involved the spermathecal accessory gland. In *Nyctoporis, Psammeticus*, and *Cryptoglossa* the spermathecal accessory gland is very long and thin (Fig. 110). In most species of *Schizillus* and *Asbolus*, it is somewhat shortened and distinctly thicker (Fig. 109), but in *Asbolus laevis* the spermathecal accessory gland is thick but also very long (Fig. 111) and in *Schizillus laticeps* the gland is thick and short (Fig. 112) (26-27).

**AEDEAGAL CONFIGURATION AND ASSOCIATED MALE STRUCTURES:**
(characters 30-36)
One of the most valuable set of characters for defining species and clarifying relationships among closely related species of Cryptoglossini involves the configuration of the male genitalia. The tentyroid aedeagus is relatively constant and simple in structure (Koch, 1955). It is divided into an inner tubiform penis (or median lobe, formed from two lateral rods which are more or less fused dorsally) which fits into an apical set of parameres joined to a basal structure. Due to the few available outgroup specimens for study, only species of Nyctoporis and Psammeticus were examined for polarization determination.

The apical vestiture on the parameres was found to vary in composition and position. In Asbolus and Nyctoporis, clearly visible short setae are present on the apical lateral aspect of the parameres (Figs. 65-84). In Schizillus and Cryptoglossa, the setae are greatly reduced, visible only at high magnification (31). The hypothesized plesiomorphic position of these setae is ventral or dorso-lateral as found in Asbolus, Schizillus and Nyctoporis. In Cryptoglossa, these are positioned on the sublateral ventral surface (32).

The configuration of the parameres is also diagnostic. In Asbolus, Nyctoporis and Psammeticus the parameres (in lateral aspect) are gradually bent dorsally. In Schizillus, the parameres are abruptly bent dorsally at the subapex. In most species of Cryptoglossa, the parameres are straight but in Cryptoglossa bicostata an unusual configuration is found where the parameres are bent ventrally forming spatulate apical lobes (Fig. 13-14) (36). In Nyctoporis, Psammeticus, and some species of Cryptoglossa, the dorso-ventral configuration of the apex is narrow with the subapex laterally straight to concave (Figs. 17, 21 & 99). In Schizillus, Asbolus and other species of Cryptoglossa, the subapex is laterally distinctly convex to angulate (35).

The hypothesized plesiomorphic configuration of the median lobe is with a broad base in which the lateral rods are only gradually joined toward the apex. This configuration is found in Nyctoporis and Asbolus. In Cryptoglossa and Psammeticus, the base of the median lobe is narrow and the rods are abruptly joined near the base. In Schizillus, the base of the median lobe is broad but the rods are abruptly joined at base.
Another character found on males and useful to separate genera is the dorsal configuration of the 8th sternite. In Schizillus, Asbolus, Nyctoporis and Psammaticus, the apical lateral lobes extend to center and the mesal aspect is angulate (Fig. 131). In Cryptoglossa the apical lateral lobes are confined to lateral edges and the central aspect is concave (30).

IMMATURE STAGE STRUCTURES (characters 35-47)

Immature stages are described starting on page 128. It is important to note here that the following characters, although assessed through outgroup comparison with the previously described larvae of the Nyctoporini, Asidini and Akidini, are based on relatively few specimens. I have attempted to use characters where clear distinctions seem to prevail. Other described specific data (as spicular configurations of the legs) has been included for comparative use when additional material is known. The eggs of tentyriines are unusually large compared to other Tenebrionidae. Crytoglossines have large eggs even for tentyriines. Of all known described eggs, I know of none larger in the Tenebrionidae than the eggs of S. nunenmacheri (see figs. 115-121) (37).

All other utilized characters involve the mature larva. The number of epipharyngeal apical spicules in examined species of Schizillus, Asbolus and Nyctoporis is three (Fig. 134). In the species of Cryptoglossa examined, this number is at least four (Figs. 133 & 142) (38). The configuration of the central epipharyngeal microspicules in Nyctoporis and examined species of Cryptoglossa is widely separated pairs (Figs. 133 & 142). In examined species of Schizillus and Asbolus the configuration is closely separated pairs (Fig. 134). The plesiomorphic number of the labral medial spicules for the Cryptoglossini is hypothesized to be approximately 20 as found in Nyctoporis, Asbolus and most Cryptoglossa examined. In Schizillus, approximately forty central labral spicules are found. The reverse is seen in Cryptoglossa muricata where the spicular number is reduced to less than 15 (40). Most spicules found on tentyriine larvae tend to be elongate (at least .15mm). In two species of Cryptoglossa examined, both the central labral spicules and those of the ninth abdominal tergum are very short (less than .1mm) (41 & 48).

The hypothesized plesiomorphic configuration of the
dorsal surface of the left incisor lobe of the mandibles is tridentate with a distinct toothlike process on dorso-mesal surface (Fig. 135) as found in Nyctoporis and examined species of Cryptoglossa. In both examined species of Schizillus and Asbolus the left incisor lobe lacks this process (1).

A somewhat unusual feature is found on the mesal cuticular surface of the prosternum in Cryptoglossa. In examined species of this genus, bare areas (which may be sensory) are present (43). In C. infausta these are oval but in C. muricata and C. variolosa, these are distinctly semicircular and more sharply defined (Fig. 144) (44). The degree of melanization found on the prosternum as well as on the protergal margins varies slightly in most species examined from unmelanized to slightly melanized. In species of Asbolus examined, it is distinctly strongly melanized (46).

The number of apical spicules on the protarsangulus has been used previously in keys to separate tentyriines (Kelejnikova, 1970). In the Cryptoglossini, two apical spicules on the protarsangulus occurs in only one of the species examined (C. variolosa, Fig. 146) (45).

The configuration of the ninth abdominal tergum often provides useful, reliable characters for use in systematics. For instance in all known mature larvae of the Akidini, urogomphi are consistently present. The plesiomorphic configuration of the ninth abdominal tergum is hypothesized to be an unmodified round lobe with surface vestiture of irregularly placed spicules. This configuration is found in many tentyriines. In Nyctoporis and in examined species of Schizillus and Asbolus, the spicules are irregularly placed in two rows along the upper lateral ridge. In examined species of Cryptoglossa only one uneven to even row is formed (Fig. 149) (7).

In most larvae of tentyriinae, the third antennal segment is reduced in size. In Nyctoporis and in examined species of Schizillus and Asbolus, it is very small and situated in the center of the semicircular sensorium (Fig. 139). In examined species of Cryptoglossa it is further reduced in size (Figs. 138 & 140) (49).
CLADISTIC RELATIONSHIPS AMONG GENERA AND SPECIES OF THE CRYPTOGLOSSINI

(Refer to Figures 160-161 (Appendix A) and Appendix B and C)

Cladograms of hypothesized relationships based on both adult characters (Fig. 161) and immature characters (Fig. 160) were found to be congruent in placement of represented taxa. This provided added support to the hypothesized phylogeny of the tribe (at least in species where data on both life stages were available).

Cladograms were all rooted by including the hypothetical OTU, PLES, possessing all hypothesized plesiomorphic character states. The Wagner 78 program (using options HOM, DAT, HYP, CON, APO, and CHG) was in general found to be more useful than the Phylip program in resolving relationships. Of Phylip programs utilized, MIX was found to be most useful. This program combines both Camin-Sokal and Wagner parsimony in which changes from states 0 to 1 are more probable than changes from states 1 to 0. Most complex or conflicting characters were rejected if relationships between OTU's could be resolved without their use. Two complex characters were retained in the consensus adult cladogram because of their aid in resolving trichotomies. These both involved surface sculpturing configurations of the pronotum (characters 12 and 13). One trichotomy in the adult cladogram was not resolved (see below).

Homoplasy was measured simply as the percent of total characters, generating homoplasous states. By definition, this algorithm leads to greater homoplasy counts with use of reduced characters (binary) than with use of multistate characters. Inclusion of complex characters also leads to a greater homoplasy percentage. In the consensus adult cladogram, although 30% of characters used generated homoplasy, only characters 12, 13, and 35, because of their presumed adaptive nature, generated multiple homoplasies. No homoplasy was generated on the immature cladogram.
ADULTS:

The Cryptoglossini clearly form three monophyletic clusters which are delineated as genera. These three genera are distinguished from each other by four or more apomorphic characters. Two of these, Asbolus and Schizillus, are monophyletic in sharing the following synapomorph characters: reduced mesal eye width, antennal and aedeagal configuration and length and width of the spermathecal accessory gland (characters 3, 9, 26, 27, and 35). These are separated from the rest of the tribe, which is composed of one genus, Cryptoglossa. The species in this genus share synapomorph characters involving the configuration of the eighth abdominal sternite and configuration of the aedeagus in males (characters 30, 32, 33 and 36[-1state]).

The genus Cryptoglossa does not form clear species groups. Instead, species branch out progressively, each possessing more apomorphic states along clades. Although Cryptoglossa bicostata Solier is positioned in a basal configuration on this monophyletic lineage, and includes a number of autapomorph characters (6, 20, 35[-1 state] and 5[0 state]), I see no value (aside from historical preservation of the name Centrioptera in the literature) in retaining this species as a monotypic genus. This species is separated from the other genera by only one apomorphic character, the serrate margins on the metafemur (character 17, reversed later along the clade) and one reversal, the apical vestiture of the coxites (character 23).

C. infausta, along with C. bicostata, is separated from the rest of the species of Cryptoglossa in lacking the flat tuberculate structures on the postero-basal regions of the meso- and metafemur. I was not able to resolve the relationship between C. asperata and C. variolosa which, together with the rest of the species, form the only unresolved trichotomy on the adult cladogram. The remainder of the species of Cryptoglossa are monophyletic in 19 and 35, characters of aedeagal configuration and elytral sculpturing. C. muricata is autapomorphic in possession of distinct secretory cells on the surface of the tuberculate pads. C. michelbacheri, C. spiculifera, C. caraboides and C. seriata, are monophyletic in sharing a reduced prosternal process which is completely absent in C. seriata. C. michelbacheri retains the plesiomorphic configuration of the lateral
surface scurpturing of the pronotum. This sculpturing is reduced and absent in C. spiculifera and absent in C. caraboides and C. seriata (13 [state 2]). C. caraboides is unique in possessing character 15, the smooth concave surface sculpturing of the metafemur. C. seriata possesses a number of autapomorphies (characters 17, 14 [state 2], 35 [state 2], and 21) but also two reversals (characters 28 and 19). These reversals involve the loss of elytral spicules and tuberculations on the meso-metafemur of males.

Species of the genus Asbolus are monophyletic sharing the following synapomorphies: antero-mesal extension of the subgena reduced to absent, and antennal apex truncate (characters 4 and 8). Two reversal are also found on this cluster, both involving configuration of the aedeagus (characters 31 and 34). A. mexicanus is basal on the cluster forming the genus Asbolus in lacking the inflated pronotum of other species (character 11). The species also retains a slight antero-mesal extension of the subgena, absent on other species (character 4). A. verrucosus is unusual in its autapomorphic rugose-granulose surface sculpture (characters 12 and 13) and lateral lobes on the pronotal gibbosity. A. laevis and A. papillosus share a smooth surface sculpture on the pronotum. Salient differences between these and other pairs (e.g. S. laticeps and S. nunenmacheri) are listed under species diagnostic combinations. Species of the genus Schizillus are monophyletic sharing the following synapomorphies: inflated epistomal canthus, divided eyes, antennal configuration, female coxite vestiture and aedeagal configuration (characters 2, 3 [state 2], 10, 23 [state 2], and 36.

IMMATURES:

The integrity of the monophyletic generic clusters are maintained in the hypothesized cladogram based on immature characters. Again, two basic clusters are formed with Asbolus and Schizillus on one side and Cryptoglossa on the other. Examined species of Asbolus and Schizillus are monophyletic in sharing characters of the configuration of the mesal epiphryngeal microspicules and mandibles (characters 39 and 42). Examined species of Cryptoglossa share characters of the apical epiphryngeal spicules, and configuration of the prosternum, ninth abdominal tergum and antenna. C. variolosa and C. muricata form a monophyletic pair in characters 41, 44 and 48,
involving spicular length and configuration of the prosternum.
CHECKLIST OF THE GENERA AND SPECIES OF CRYPTOGLOSSINI

CRYPTOGLOSSA Solier 1836:680
Centrioptera Mannerheim 1843:279 NEW SYNONYMY
Oochila LeConte 1862:220
Amblycyphrus Motschoulsky 1870:401 NEW SYNONYMY

C. bicostata Solier 1836:680
C. infausta (LeConte) 1854:84 NEW COMBINATION
Centrioptera spiculosa Champion 1892:508
Centrioptera texana Blaisdell 1924:88 NEW SYNONYMY
C. variolosa (Horn) 1870:280 NEW COMBINATION
C. asperata asperata (Horn) 1870:279 NEW COMBINATION
C. asperata planata Blaisdell 1923:250 NEW SYNONYMY
C. asperata discreta (Blaisdell) 1923:249 NEW COMBINATION
C. asperata subornata (Blaisdell) 1923:249 NEW COMBINATION
C. muricata (LeConte) 1851:142 NEW COMBINATION
Centrioptera utensis Casey 1907:513 NEW SYNONYMY
Centrioptera sculptiventris Blaisdell 1923:247 NEW SYNONYMY
Centrioptera elongata Casey 1924:306 NEW SYNONYMY
Centrioptera serrata Casey 1924:306 NEW SYNONYMY
C. michelbacheri (Blaisdell) 1943:227 NEW COMBINATION
C. caraboides (Mannerheim) 1843:280 NEW COMBINATION
C. spiculifera spiculifera (LeConte) 1861:337 NEW COMBINATION
C. spiculifera pectoralis (Blaisdell) 1921:198 NEW COMBINATION
Amblycyphrus asperatus Motschoulsky 1870:404 NEW SYNONYMY
Centrioptera dulzurae Blaisdell 1921:199 NEW SYNONYMY
Centrioptera chamberlini Blaisdell 1923:246 NEW SYNONYMY
C. seriata seriata LeConte 1861:337 NEW COMBINATION
C. seriata cerralvoensis Aalbu NEW SUBSPECIES

ASBOLUS LeConte 1851:129
A. verrucosus LeConte 1851:129 NEW COMBINATION
A. verrucosa carinulatus Blaisdell 1924:308 NEW SYNONYMY
A. laevis LeConte 1851:130 NEW COMBINATION
A. laevis subsimilis Casey 1924:308 NEW SYNONYMY
A. mexicanus mexicanus (Champion) 1884:73 NEW COMBINATION
Cryptoglossa m. granulifera Champion 1892:508 NEW SYNONYMY
A. mexicanus angularis (Horn) 1894:414 NEW COMBINATION
A. papillosus (Triplehorn) 1964: NEW COMBINATION

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**SCHIZILLUS** Horn 1874:36

*S. laticeps* Horn 1874:33

*Schizillus convexus* Blaisdell 1921:203 NEW SYNONYMY

*Schizillus lomae* Blaisdell 1921:206 NEW SYNONYMY

*Schizillus opacus* Casey 1924:307 NEW SYNONYMY

*S. nunenmacheri* Blaisdell 1921:204

*Schizillus beali* Parker 1955:149 NEW SYNONYMY
KEY TO THE GENERA OF CRYPTOGLOSSINI

1. Eyes with dorsal and ventral portions completely divided by epistomal canthus, epistomal canthus strongly inflated laterally; male aedeagus (lateral configuration) subapically abruptly bent dorsally (Figs. 104 & 108) ........................................SCHIZILLUS p. 118

1'. Eyes with dorsal and ventral portions narrowed at center, not completely divided; epistomal canthus slightly inflated laterally; male aedeagus (lateral configuration) straight, bent ventrally or gradually bent dorsally ........................................2

2. Antennae in cross section flattened, narrowly oval, with size of sensory area on terminal segment reduced, truncate (Fig. 57); eyes strongly narrowed at center to width of 3 facets; males with apical invaginations in 8th sternite (dorsal configuration) extending to center, central aspect angulate (Fig. 131); aedeagus with base of median lobe (dorsoventral configuration) broad, lobes gradually fused toward apex (Figs. 65-84) .........................................ASBOLUS p. 101

2'. Antennae in cross section broadly oval, with size of sensory area subtriangular (Fig. 55); eyes only slightly narrowed at center (eye facets at center 5 or more); males with apical invaginations in 8th sternite (dorsal configuration) confined to lateral edges, central aspect concave (Fig. 132); aedeagus with base of median lobe (dorsoventral configuration) narrow, lobes abruptly fused at base (as in Fig. 12) .............. ........................................CRYPTOGLOSSA p. 68
KEY TO THE KNOWN MATURE LARVAE OF THE CRYPTOGLOSSINI

1. Central microspicules of epipharynx arranged in widely separated pairs (Figs. 133, 142); apex of epipharynx with at least 4 major lateral spicules of equal size (Fig. 133); left incisor lobe of mandibles tridentate, with toothlike process on dorso-mesal surface (Fig. 135); prosternum with central bare areas.............. Cryptoglossa

1'. Central microspicules of epipharynx arranged in closely separated pairs (Fig. 134); apex of epipharynx with 3 major lateral spicules (Fig. 134); left incisor lobe of mandibles bidentate, without distinct toothlike process on dorsal-mesal surface; prosternum without central bare areas .................. 4

2. Prosternum with central bare areas oval in shape; mesal aspect of labrum and ninth abdominal tergum (lateral areas) with spicules at least .15 mm in length............ Cryptoglossa infausta

2'. Prosternum with central bare areas semicircular in shape (Fig. 144); mesal aspect of labrum and ninth abdominal tergum (lateral areas) with spicules less than .1 mm in length.................................3

3. Protarsangulus (basal lobe, apex) with one spicule; labrum with approximately 18 mesal spicules............... Cryptoglossa muricata

3'. Protarsangulus (basal lobe, apex) with two spicules (Fig. 146); labrum with less than 15 mesal spicules ................. Cryptoglossa variolosa

4. Protergal margins and prosternum slightly melanized; labrum with 40 or more mesal spicules......SCHIZILLUS 5

4'. Protergal margins and prosternum strongly melanized; labrum with less than 37 mesal spicules......ASBOLUS 6
5. Labrum with approximately 46 mesal spicules; protibia with numerous (10+) elongate, thin secondary spicules on anterior mesal apical aspect.....Schizillus laticeps

5'. Labrum with approximately 40 mesal spicules; protibia with few (<5) elongate, thin secondary spicules on anterior mesal aspect, none apically...... Schizillus nunenmacheri

6. Labrum with approximately 36 mesal spicules; protibia with numerous (10+) elongate, thin secondary spicules on anterior mesal basal aspect.......Asbolus verrucosus

6'. Labrum with approximately 23 mesal spicules; protibia with few (<7) elongate, thin secondary spicules on anterior mesal basal aspect........Asbolus mexicanus
CRYPTOGLOSSA Solier

[crypto: Gr., hidden. glossa: Gr., tongue]

Type Species: Cryptoglossa bicostata Solier, 1836:680, listed as Zopherus bicostatus on pl.24 fig 11-13.

Centrioptera Mannerheim 1843:279-280. NEW SYNONYMY
Amblycyphrus Motschoulsky 1870:401,404. NEW SYNONYMY


KEY TO THE ADULT SPECIES AND SUBSPECIES OF CRYPTOGLOSSA

1. Mentum (ventral aspect) with anterior margin centrally deeply excavate; two elytral intervals forming costa; male genitalia with apex of parameres spatulate (Figs. 1, 13 & 14).........................C. bicostata Solier.

1'. Mentum (ventral aspect) without centrally deeply excavate anterior margin; elytra without costa........2

2. Prosternum produced behind procoxae.....................4

2'. Prosternum not produced behind procoxae................
.................................C. seriata (LeConte)........3

3. Elytral surface evenly serially punctate (Fig. 51)...
.................................C. seriata seriata (LeConte)

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3'. Elytral surface serially punctate centrally, laterally confusedly subasperate (Fig. 52); Cerralvo Island, Gulf of California .............................................. C. seriata cerralvoensis NEW SUBSPECIES

4. Prosternum only feebly produced behind procoxae, apex mucronate; elytra with one or two distinct spiculate elytral intervals on pseudopileural margins, spiculate rows occasionally weakly produced .......... 5

4'. Prosternum strongly, deeply produced behind procoxae, apex rounded; elytral intervals asperate to muricate, not spiculate ........................................... 8

5. Elytra with one distinct strongly spiculate row on pseudopileural margins, upper surface serially punctate to granulate, not muricate ....................... 7

5'. Elytra with two distinct strongly spiculate rows on pseudopileural margins (spiculations may be weakly produced in some populations), upper surface muricate laterally; pronotum with upper lateral surface sculpturing with sparse, small to minute punctures .... C. spiculifera (LeConte) .......... 6

6. Elytra from dorsal view with lateral margins broadly rounded, not parallel; two distinct spiculate rows on elytra well developed; second to fourth visible abdominal sternite nearly impunctate; Cape Region of Baja California (Fig. 48) ............................................. C. s. spiculifera (LeConte)

6'. Elytra from dorsal view with lateral margins parallel to subparallel; two distinct spiculate rows less well developed; second to fourth visible abdominal sternite densely punctate; Baja California except Cape Region (Fig. 49) .......... C. s. pectoralis (Blaisdell)

7. Pronotum with upper lateral surface sculpturing with sparse minute punctures; metafemur with mesal aspect smooth, impunctate, concave (Fig. 30), central Mexico ......................... C. caraboides (Mannerheim)

7'. Pronotum with upper lateral surface sculpturing with dense medium sized punctures; lateral margins expanded; metafemur with mesal aspect as in pro-mesofemora, punctate, not concave (Fig. 29) Baja California Sur .......... C. michelbacheri (Blaisdell)
8. Body with dorsal configuration broad, suboval; elytra confusedly asperate, asperations strongly flattened; males with postero-basal regions of meso, metafemur not modified as distinct raised elongate, flattened tubercles (Fig. 2)..............C. infausta (LeConte)

8. Body with dorsal configuration subparallel; elytra asperate, muricate or asperate-tuberculate; males with postero-basal regions of meso, metafemur distinctly modified as distinct raised elongate, flattened tubercles.........................9

9. Head, pronotum and undersurface deeply, coarsely, densely punctured with medium to large punctures; elytra confused asperate; males with meso, metafemoral tubercle large, flattened, well developed; (Fig. 6) E. Chihuahuan desert...............C. variolosa (Horn)

9'. Surface of pronotum laterally with only medium to minute punctures, mesally with only only sparse, small to minute punctures; elytra asperate, asperate-tuberculate or muricate; metafemoral tubercle small, flattened to concave.................10

10. Elytral surface sculpturing distinctly muricate; apex of murications sharp, subspiculate; males with meso, metafemoral tubercles concave, furnished with secretory cells (Fig. 5)...............................C. muricata (LeConte)

10'. Elytra distinctly asperate to tuberculate; males with meso, metafemoral tubercles flat, without secretory cells (Figs. 8-10)...............C. asperata (Horn)...11

11. Elytral surface sculpturing strongly tuberculate, tubercles discrete, distinctly separated; elytral intervals with widely spaced, small granules; under-surface coarsely, densely punctured; (Fig. 9) islands, Gulf of California.................................C. a. discreta (Blaisdell)

11. Elytral surface sculpturing flattened-asperate to asperate-tuberculate, elytral tubercles coalescing at base; under surface less coarsely, densely punctured ........................................12

12. Elytral asperations strongly flattened, mesal area serially punctate; (Fig. 10) islands, Gulf of
California.................\textit{C. a. subornata} (Blaisdell)

12'. Elytral asperations strongly subtuberculate to tuberculate (Fig. 8).............\textit{C. a. asperata} (Horn)

\textbf{SYNOPSIS OF THE SPECIES OF CRYPTOGLOSSA}

BODY elongate subparallel to suboval, black. Head with epistomal canthus slightly inflated laterally; eyes dorsoventrally elongate, slightly narrowed at center; ventral aspect of mentum with or without anterior excavate margin; subgena with anterior mandibular process slightly to strongly produced anterior-mesally; antenna with third segment subequal in length to next two segments; apical segments broadly oval in cross section, base of apical segments (lateral configuration) wider than long, sensory area on terminal segment subtriangular (Figs. 54-55). PRONOTUM with upper surface flattened, convex; prosternal process variable; mesosternum variable; tarsal setation short, spinose. ELYTRA with surface sculpturing variable. FEMALE: Coxites, apical aspect of 4th lobe variable; ovipositor proportions (coxite-paraproct baculi, ventral length ratio) with paraproct equal to subequal twice length of coxites; spiculum ventrale configuration slightly longer than wide (Figs. 122-124, 127). Internal cuticular structures of known species with bursa copulatrix absent; spermathecal accessory gland very long, thin; spermatheca multiple very long, thin (Fig. 110). MALE with postero-basal regions of meso, metafemur sometimes modified as distinct raised elongate, flattened tubercles; apical invaginations on dorsal aspect of 8th sternite confined to lateral edges, central aspects concave (Fig. 132). Aedeagus with base of median lobe (dorsoventral configuration) narrow; lateral rods abruptly joining near base; parameres with apical setae greatly reduced, visible only at high magnification, positioned ventral sublateral (Figs. 11-26, 31-46 & 93-100). IMMATURE STAGES: (known mature larvae) Head with third antennal segment minute; apex of epipharynx with at least four major lateral spicules of equal size; epipharyngeal central microspicules arranged in widely separated pairs (Figs. 133 & 142); mandibles with dorsal aspect of left incisor lobe of mandibles tridentate, with toothlike process on dorso-mesal surface (Figs. 135-136). Protarsangulus (basal lobe, apex) with one or two spicules; prosternum (mesal cuticular surface), with central bare areas; protergal margins and prosternum very slightly to not melanized.
Abdomen, ninth abdominal tergum with lateral spicules irregularly arranged into uneven row.

**Cryptoglossa bicostata** Solier

(Figures 1, 3, 11-14)


DIAGNOSTIC COMBINATION: (Fig. 1) Body elongate parallel. HEAD with ventral aspect of mentum with anterior margin centrally deeply excavate; subgena with anterior mandibular process strongly produced antero-mesally, apex sharp, acute. PRONOTUM with upper surface flattened, broadly convex; lateral margin broadly arcuate; upper mesal surface with small, sparse punctures, upper lateral surface with small, moderately dense punctures; prosternal process (lateral configuration) strongly, deeply produced behind procoxae, apex acute; mesosternum modified to receive prosternal process with two acute anterior-lateral projections. Mesofemur, metafemur, similar in sculpturing to profemur. ELYTRA (dorsal configuration): elongate, subparallel, flattened centrally; with two lateral costate ribs positioned as in Figure 1; lateral apical aspects with sculpturing strongly tuberculate; tubercles arranged in even to uneven rows; elytra with apex everted. FEMALE: Coxites, apical aspect of 4th lobe set with minute slender setae; spiculum ventrale configuration slightly longer than wide. Internal cuticular structures unknown. MALE with postero-basal regions of meso, metafemur not modified with distinct raised tubercles. Aedeagus (Figs. 11-14): parameres with apex strongly spatulate ventrally (Fig. 13, 14); apical setae greatly reduced, visible only at high magnification, positioned ventrally.

MATERIAL EXAMINED: (4 from the following 3 localities) MEXICO, PUEBLA, Env. de Tehuacan, 1903, L. Diguet col. (2) MNHP; MEXICO, PUEBLA, Tehuacan, VII-25-56, V. D. Roth col. (1) CNCI; MEXICO, OAXACA, Yagul, Hwy 190, 15 mi. S Oaxaca, VII-7-70, D. Bixler col. (1) OSUC.

DISTRIBUTION: (Fig. 3) Cryptoglossa bicostata is only known from the few localities listed above. It is apparently restricted to the dry areas of the Valleys of
Tehuacan and Oaxaca in Southern Mexico.

BIOLOGICAL NOTES: Nothing is known about the biology of this rare species aside from the few notes provided by Triplehorn et al (1972). Attempts to collect additional specimens of this species in 1982 in the Yagul area, the only known specific collection locality, unfortunately proved fruitless.

DISCUSSION: As mentioned previously in the text, this species has remained unknown to workers until relatively recently. Close examination of Cryptoglossa bicostata, with additional complete specimens, has led to changes and modifications in the generic concepts and limits within the Cryptoglossini (See discussion in Cladistic Relationships...). Two of the above examined specimens are from the Musee National D'Histoire Naturelle in Paris. These were previously borrowed by C. A. Triplehorn who found them in the R. Oberthur collection. It is possible that one of these two specimens may actually prove to be the type although no such label is attached to either specimen. Both of these specimens are in rather poor condition: the terminal segments on the antennae are missing and the legs have apparently been reglued to the specimens. For these reasons, I will refrain from formally designating one of these as a Lectotype.

Cryptoglossa infausta (LeConte)  
(Figures 2, 4, 15-18, 133)

Cryptoglossa infausta (LeConte), 1854:84 NEW COMBINATION  
Oochila infausta LeConte, 1862:220  
Centrioptera spiculosa Champion, 1892:508  
Centrioptera texana Blaisdell, 1924:88 NEW SYNONYMY.

DIAGNOSTIC COMBINATION: (Fig. 2) Body suboval, lateral margins convex. Head with ventral aspect of mentum without anterior excavate margin; subgena with anterior mandibular process slightly produced anterio-mesally, apex sharp, obtuse. PRONOTUM with upper surface flattened, broadly convex; lateral margin broadly arcuate; upper mesal surface with small to minute, sparse punctures, upper lateral surface with medium to large, dense punctures; prosternal process (lateral configuration) strongly, deeply produced behind procoxae, apex rounded ventrally concave; mesosternum declivous with only slight obtuse elevations modified to receive prosternal process.
Mesofemur, metafemur, similar in sculpturing to profemur. ELYTRA with confused, strongly flattened asperations, apex of asperations obtuse; asperations more evenly arranged on lateral pseudepipleural margins. FEMALE: Coxites, apical aspect of 4th lobe sclerotized, glabrous; spiculum ventrale configuration slightly longer than wide. Internal cuticular structures with bursa copulatrix absent; spermathecal accessory gland very long, thin; spermatheca multiple very long, thin. MALE with postero-basal regions of meso, metafemur not modified with distinct raised tubercles. Aedeagus (Figs. 15-18): parameres with apex not spatulate ventrally, gradually tapering toward apex, dorsoventral aspect of subapex concave; apical setae greatly reduced, positioned ventral sublateral. IMMATURE STAGES: (Mature Larva) Head with labrum bearing approximately 21 mesal spicules (Fig. 133). Protarsangulus (basal lobe, apex) with one spicule; prosternum (mesal cuticular surface), with central bare areas oval in shape; protergal margins and protesternum very slightly melanized. Mesal aspect of labrum and ninth abdominal tergum (lateral areas) with spicules at least .15 mm in length.

TYPES: Red (pink) disc., Cochila infausta (LeC.), MCZC type No. 4519, LeConte collection. MEXICO, DURANGO; Villa Lerdo, TYPE, SYNTYPE, SPICULOSA, Hoge col., (1) BMNH.

MATERIAL EXAMINED: (250 from the following 79 localities) silver square (1); TEXAS (9); TEXAS, Berninda, (1). TEXAS, BREWSTER CO.: (25 specimens/ 14 localities) Big Bend Nat. Pk., (6); BBNP, Pine Cyn., 4700', (1); BBNP, Santa Elena Cyn., (1); BBNP, Santa Elena Crossing, (1); BBNP, Boquillas Cyn., (1); BBNP, Boquillas, 1850', (3); BBNP, Panther Jct., 4000', (1); BBNP, Hot Springs, 1900', (3); BBNP, Green Gulch, 5000', (1); BBNP, Glen Springs, 3000',
(1); Chisos Mts., (2); Chisos Mts., the Basin (2); Horse Cyn., Black Gap Refuge, (1); Terlingua creek, Terlingua, (1). VAL VERDE CO.: (28 specimens/ 14 localities) Del Rio, 955', (5); Wren Cave, 36 mi. N Del Rio, (2); Ladder Cave, 15 mi. NW Del Rio, (1); Devil's River, Del Rio, (1); Devil's River, (5); Devil's River, 26 mi. N Comstock, (1); Comstock, (5), 12 mi. W. (1); Langtry, 15 mi. NW, (1); Fisher's Fissure, 2 mi. W Langtry, (1); Langtry, 15 mi. NW, (1); Pecos Cyn., at Hwy 90, W of Comstock, (1); Pecos High Bridge, (2) Pecos River, (1). UVALDE CO.: (25 specimens/ 3 localities) Uvalde, 930', (18); Sabinal (6), 16 mi. NW, (1). LA SALLE CO.: (20 specimens/ 2 localities) Encinal, (7); Cotulla, (13). HIDALGO CO.: (5 specimens/ 3 localities) Mission, (1); Edinburg, (4); Sullivan City, (1). TERREL CO.: Dryden, 2.5 mi. N (3). STARR CO.: (2 specimens/ 2 localities) Roma, 3.5 mi. N (1), 2.5 mi. N (1). KINNEY CO.: Bracketville, 6 mi. E (5). DIMMIT CO.: (2); Brundage, (1) Winterhaven, (1). MEDINA CO.: Hondo (3), 20 mi. N (1). ZAVALA CO.: Nueces Riv., (1). Batesville, (1). MAVERICK CO.: (1) Eagle Pass, (1). KIMBLE CO.: Junction, 5 mi. W (4). BLANCO CO.: Gould Davis Cave, (4). CONAL CO.: New Braunfels, (2). WEBB CO.: Laredo, (2). KNOX CO.: Vera, 8 mi. N (3). PRESIDIO CO.: Presidio, (1). JEFF DAVIS CO.: Limpia Cyn. (1). ZAPATA CO.: Zapata, (3). MEXICO, DURANGO; (13 specimens/ 2 localities) Villa Lerdo, (12) 3 mi. W Lerdo, (1). COAHUILA; (43 specimens/ 11 localities) San Felipe Salinas (1); Sierra de los Burros (2); Sabino, 41 mi. S. (1) Don Martin Dam, 8 mi. S Juarez, (1); Saltillo, 19 mi. W (1); Cabos, 4000', (1); Arroyo de la Zorra (30); Cueva de las Animas, 56 km. E Monclova (1); Cueva de los Grillos (1); Rancho la Golondrina, Rio Sabinas, (3); San Carlos, (1). NUEVO LEON; (31 specimens/ 4 localities) Huasteca Cyn., nr. Monterrey, 3000' (25); Monterrey, 5 mi. S (1); Rancho Presa Nueva, (4); Cienega de Flores, (1). TAMAULIPAS; (3 specimens/ 3 localities) Guemez, (1); Jiminez, (1); Abasolo, (1). Doubtful localities: UTAH, WAYNE CO.: base of Henry Mts., nr. Hanksville, (2).

DISTRIBUTION: (Fig. 4) Cryptoglossa infausta is broadly confined to eastern areas of the Chihuahuan Desert.

LABEL BIOLOGICAL NOTATIONS: light, BL, under Opuntia, under rock; CAVES: on bat & swallow guano, on dry silt near entrance.

BIOLOGICAL NOTES: Little is known about the biology of C. infausta. A number of specimens have been collected in
caves [10 specimens/6 localities: Texas, Blanco Co., Gould Davis Cave (4); Val Verde Co., Wren Cave, 36 mi. N Del Rio (2); Fisher’s Fissure, 2 mi. W Langton (1); Ladder Cave, 15 mi. NW Del Rio (1); Mexico, Coahuila, Cueva de las Animas, 56 km. E Monclova (1); Cueva de los Grillos (1)] but this represents only a small fraction of specimens examined. This is unlike A. mexicanus, another species also found in the same caves but much more abundantly and with a much higher percentage of total specimens known from caves. C. infausta is perhaps only accidentally found in caves.

DISCUSSION: Blaisdell in 1924 (p. 88) described Centrioptera texana from one specimen ("probably female" according to Blaisdell) without having examined the type of C. infausta. This is clearly mentioned by him (1923:252), although in 1924, (p. 87) Blaisdell stated that in 1923 "all of the known species, with the exception of C. utensis Casey had been at hand". Blaisdell diagnosed C. texana as differing from all other species in "its strongly declivous mesosternum and densely, strongly, punctate head". Blaisdell was perhaps misled by Horn’s 1870 (p. 279) key in which C. infausta is characterized by having "elytra striato-punctate, not at all spiculiferous". Blaisdell used this character in his 1923 key to separate C. texana from all other species. The elytral sculpturing on C. infausta is somewhat variable, but in all specimens I have examined (including the type of C. infausta listed above), at least some of the aspersations on the declivous margins of the elytra along the pseudepipleural edge are submuriurate, clearly not striato-punctate.

Cryptoglossa variolosa (Horn)

(Figures 6, 7, 19–22, 110, 122, 135–136, 142, 144, 146)

Cryptoglossa variolosa (Horn) NEW COMBINATION
Centrioptera variolosa Horn 1870:280

DIAGNOSTIC COMBINATION: (Fig. 6) Body elongate, subparallel, head, pronotum, lower surface deeply punctate. Head with ventral aspect of mentum without anterior excavate margin; subgena with anterior mandibular process slightly produced anterio-mesally, apex sharp, obtuse. PRONOTUM with upper surface flattened, broadly convex; lateral margin arcuate, everted basally; upper
mesal surface with large moderately dense to sparse punctures, upper lateral surface with large, dense punctures; prosternal process (lateral configuration) strongly, produced behind procoxae, apex rounded; mesosternum declivous with only slight obtuse elevations modified to receive prosternal process. ELYTRA with confused, strongly flattened asperations, apex of asperations obtuse; asperations more evenly arranged on lateral pseudepipleural margins. FEMALE: Coxites, apical aspect of 4th lobe sclerotized, glabrous; ovipositor proportions (coxite-paraproct baculi, ventral length ratio) with paraproct equal to subequal twice length of coxites. Spiculum ventrale configuration slightly longer than wide (Fig. 122). Internal cuticular structures with bursa copulatrix absent; spermathecal accessory gland very long, thin; spermatheca multiple very long, thin (Fig. 110). MALE with postero-basal regions of meso, metafemur modified as a distinct raised elongate, large flattened tubercle. Aedeagus (Figs. 19-22): parameres with apex not spatulate ventrally, gradually tapering toward apex; dorsoventral aspect of subapex concave (Fig. 21), apical setae greatly reduced, positioned ventral sublateral. IMMATURE STAGES: (Mature Larva) Head with epipharynx with at least 4 major lateral spicules of equal size (Fig. 142); epipharyngeal central microspicules arranged in widely separated pairs; labrum with less than 15 mesal spicules; mandibles with dorsal aspect of left incisor lobe of mandibles tridentate, with toothlike process on dorso-mesal surface (Fig. 135-136); protarsangulus (basal lobe, apex) with two spicules (Fig. 146); protergum (mesal cuticular surface), with central bare areas semicircular in shape (Fig. 144); protergal margins and prosternum very slightly melanized. Mesal aspect of labrum and ninth abdominal tergum (lateral areas) with spicules less than .1 mm in length.

TYPES: Apparently two holotypes: Ariz., MCZC Type No. 7187, *Centrioptera variolosa* Horn, LeConte collection, female; and Ariz., MCZC Type No. 8007, *Centrioptera variolosa* Horn, Horn collection. I am designating the specimen from the LeConte collection (with the priority of type no.) as Lectotype. PARATYPES: Ariz., LeConte collection, (3) with male designation; no data except Horn collection, H7243, (4); Ariz., Horn collection, H7243, (2) [one with female designation]. SYNTYPES: *Centrioptera variolosa* Horn Type, SYNTYPE, (2) BMNH.

MATERIAL EXAMINED: (683 from the following 162
localities): NO DATA: (2). CAL: (1). SO. CAL: (1). ARIZONA (491 specimens/110 localities): (35); Hot Springs, (4); Brush Corral (1); Marinette (1); Riverside (ARIZ) (1). ARIZONA, YAVAPAII CO. (23 specimens/8 localities): Date Creek Wash at Hwy. 93 (1); Congress (9), 2 mi. NE (3), 3 mi. N on Date Creek rd. (2); Congress Jct. (2); Haslampa Dist. (2) Bumble Bee (1); nr. Kirkland (3). MARICOPA CO. (70 specimens/15 localities): (1); Phoenix (26); Tempe (16); Wickenberg (6); Paradise Valley (1); Higley (1); Mesa (2); Granite Reef Dam (1); Beeline, .5 mi. S, 100 yds. E. Verde River (2); Scottsdale (1); Aguila (3); Gila Bend (2); South Mt. (1); Verde River (2); South Mt.Pk. (5).

PIMA CO. (276 specimens/59 localities): (1); canyon back of Smugglers (1); Tucson (125), Desert Lab. (5), Santa Cruz riv. (3), E desert (1), 2700' (5), 3000' (1), 2950' (1), S of (2), 20 mi. E, Tanque Verde Cyn. (1), 4 mi. E (4), 14 mi. NW (1), 12 mi. NW (3), Catalina Foothills (1), Saguaro Nat. Mon. (1); Sabino canyon, Santa Catalina Mts., 13 mi. NE Tucson (21), 3200' (6), 2600' (1), 2500' (2), Lower Cyn. (2), 3400' (2), upper Cyn. (1); Continental (4); Rillito (2); Ajo (2); Marana (1); Organ Pipe Cactus N. M. (2), Arch Cyn. (1), Dripping Springs (7); Blackdike Prspt, Sierritas, 3750, 31 56'N 111 16'W (1), Robles Ranch (2); nr. Coyote Springs (6); Santa Cruz Village, Cobabi Mts., 3100', 32 1'N 111 54'W (1); Green Valley (11); Ajo, 23 mi. E (1); Ajo Mts. (1), Alamo Cyn. (1); Santa Catalina Mts. (4), Gen. Hitchcock Campgrd. (1), Lower Bear Cyn. (1), Molino Basin (1); Rincon Mts. (2); Santa Rita Mts. (7), 4500' (1), Box Cyn (1), Madera Canyon (3), Agua Caliente Cyn. (1); Tucson Mts. (1), 3000' (2); San Xavier Mission (2), 2600' (6), Baboquivari Mts. (2), Mt. Mildred (1), Baboquivari Cyn., W side (1); San Xavier Mts. (1); Sells, Hwy. 86, 14 mi. W (1); Coyote Mt. (1); T135R11W.S12, (2). GILA CO. (20 specimens/6 localities): Roosevelt (2); Globe (11), 3600' (3); San Carlos, Gila River Valley (1); Roosevelt Lake (1); Cuttler (2). PINAL CO. (54 specimens/10 localities); Catal Springs (6); Casa Grande (4), Oracle, nr. (2); Superstition Mts., N. of Boulder Cyn., 1900' (2); Picacho (28); Peralta Cyn. (1); Sacaton (3); Tiger (1); Florence (5); Superior (2).

COCHISE CO.: Douglas (1); Benson (1). SANTA CRUZ CO.: Pena Blanca (2); Nogales (1). YUMA CO. (8 specimens/4 localities): Salomi, 10 mi. N Mojave Desert (2); Wendenc, 12 mi. E (3); Yuma (2); Hope, 10 mi. W (1). MOJAVE CO.: (2); Wikieup, 7 mi. S (2); Kingman (1). GRAHAM CO.: San Carlos Indian Res. (1). COCONINO CO.: Flagstaff (1).
[doubtful locality]. NEW MEXICO; GRANT CO.: Pleasanton (1). MEXICO; SONORA (90 specimens/37 localities): San
Pedro Bay (4); San Carlos Bay (4); Hermosillo (6), 29 mi. N (2), 18 mi. S (3), Rancho Salada, 25 mi. N (5), 19 mi. (1), 2.5 mi. N (1), 3 mi. N (1); Benjamin Hill, 5 mi. S (3); Kino Bay (1); Tecoripa (1); Alamos (7), 10 mi. W (1); Llano (3); Guaymas (10), Cerro Bocochibampo (3), 45 mi. N (1); Cerro Masiaca, 11 rd. mi. SSE Bacabachi, 2655-10924, 750' (2); Rio Cuchuaqui, 7 mi. S Alamos (2); Mocuzari, 2 mi. W (3); Santa Ana, 8 mi. S, 680m (1), 6 mi. W (1), 5 mi. NE (1); Estacion Llamo, 19.4 mi. S 700m (1); Bahia San Franciscoquito (1); Navajoa, 6 mi. E (2); Cornelio (1); Imura's, 3 mi. S (1); Copete Mine, Carbo (1); Casa Blanca, 2 mi. S (1); km. 2231, Hwy 15 (1); km. 2055, Hwy 15, S of Hermosillo (1); Ninas Nuevas, nr. Alamos (7); El Oasis (4); Sierra Tetalejo, 35 mi. S Hermosillo (1); km. 93, Mex. 15, S. Guaymas (1). ISLA TIBURON: (1); SE end of (1). ISLA PATOS: (43). MEXICO; SINALOA: (14 specimens/6 localities) (3); Los Mochis (2), 10 mi. N (1); Mazatlan (2); Topolobampo (5); Guamuchil (1). CALIFORNIA; SAN BERNARDINO CO.: Needles, 550-750' (2); Rice, (2). Doubtful Localities: CALIFORNIA; RIVERSIDE CO.: Riverside (1). CALIF; [Kern Co.] 8 mi. N Randsburg, (1); MISSISSIPPI; La Fayette Co. (1).

DISTRIBUTION: (Fig. 7) Cryptoglossa variolosa is a rather widespread species in the eastern portion of the Sonoran Desert, occuring from Northern Arizona to Sinaloa, Mexico.

LABEL BIOLOGICAL NOTATIONS: under stone, under Larrea, under Opuntia, under cactus, under stones about lawn, under cholla debris, light, sycamore-oak-mesquite, under stones, saguaro & rocks, mesquite-cholla, BL, under dead saguaro.

BIOLOGICAL NOTES: What is known on the biology of C. variolosa is presented in the section on biology. C. variolosa is usually found at slightly higher elevations than C. muricata which in Arizona is apparently restricted to the Lower Colorado subregion of the Sonoran Desert. C. variolosa is more commonly found in the Arizona upland, and Sonoran plains and foothills subregions of the Sonoran Desert, areas of greater concentration of succulent vegetation than the Lower Colorado subregion. Males of this species exhibit the greatest development of the flattened, smooth tuberculate projections on the posterior basal areas of the meso- and metafemora, although the function of these is not known.

DISCUSSION: C. variolosa is one of the most distinct
species of Cryptoglossa characterized by the deeply punctate head, thorax and undersurface with punctures of unusually large size compared to other species.

Cryptoglossa asperata (Horn)  
(Figures 8-10, 97-100, 124)

Cryptoglossa asperata (Horn) NEW COMBINATION  
Centrioptera asperata Horn 1870:279

Cryptoglossa asperata asperata (Horn) NEW COMBINATION  
C. asperata planata Blaisdell 1923:250 NEW SYNONYMY

Cryptoglossa asperata discreta (Blaisdell) 1923:249;  
1943:219 NEW COMBINATION

Cryptoglossa asperata subornata (Blaisdell) 1923:249  
1943:219 NEW COMBINATION

DIAGNOSTIC COMBINATION: (Figs. 8-10) Body elongate, subparallel. Head with ventral aspect of mentum without anterior excavate margin; subgena with anterior mandibular process slightly produced antero-mesally, apex sharp, obtuse. PRONOTUM with upper surface flattened, broadly convex; lateral margin broadly arcuate; upper mesal surface with minute sparse punctures, upper lateral surface with medium to large dense punctures; prosternal process (lateral configuration) strongly, broadly produced behind procoxae, ventral aspect broadly expanded, apex rounded; mesosternum and metasternum on the same plane, mesosternum modified to receive prosternal process with two obtuse anterior-lateral projections. ELYTRA: with confused, strong subtuberculate, elevated asperations; apex of asperations obtuse; asperations more evenly arranged on lateral pseudopleural margins. FEMALE: Coxites, apical aspect of 4th lobe sclerotized, glabrous; Spiculum ventrale configuration slightly longer than wide (Fig. 124). Internal cuticular structures with bursa copulatrix absent; spermathecal accessory gland very long, thin; spermatheca multiple very long, thin. MALE with postero-basal regions of meso, metafemur modified as a distinct raised elongate, tubercle. Aedeagus (Figs. 97-100): parameres with apex not spatulate ventrally, gradually tapering toward apex; dorsoventral aspect of subapex concave (Fig. 99), apical setae greatly reduced, positioned ventral, sublateral.

TYPES: Holotype: Cal. [yellow square] MCZC type No. 8006, C. asperata Horn, Horn collection. C. asperata discreta
Blaisdell, CASC type 1157, female, allotype CASC No. 1158, male, Salinas Bay, Carmen Island, Gulf of California, VI-16-1921, E. VanDuzee col., C. asperata subornata
Blaisdell, CASC type 1159, female, allotype CASC No. 1160, male, West Galleras Island, Gulf of California, VI-13-1921, J. Chamberlin col., C. asperata planata
Blaisdell, CASC type 1161, female, allotype CASC No. 1162, male, Ildefonso Island, Gulf of California, VI-17-1921, V. Owen col.

PARATYPES: C. subornata: Escondido Bay, VI-14,21, J. Chamberlain col., (1) CASC.

Cryptoglossa a. asperata (Horn)

MATERIAL EXAMINED: (333 from the following 83 localities):
MEXICO, BAJA CALIFORNIA SUR: (272 specimens/75 localities): La Paz (20), Hotel Calafia (4), Hotel Guaycura (1), 22 mi W (1), 25 mi. W (18), 44 km, W 0.2 km. S km, 44 on Hwy 1 (2), 15 mi. W (1), 10 mi. NW (3), 21 mi. W (28), 26 mi. W (2), 2 mi. S (4), 7 mi. SW (1), 13.1 mi. NW rd. to Rodriguez (1) 4.0 km SW (1) 18 mi. W (4); El Cien, 3.3 mi. S (17); Todos Santos, Playa Los Cerritos, 11.2 mi. S (2), 5.5 mi NW rd. to La Pastora (1), 28-29 km. N 270m (1) 28 km. N (1); 4.9 mi. E Mex 1 on Hutamonte-San Jose Rd. (7); Loreto (1), Punta El Bajo (4), arroya Gua (1), 29.5 mi. S (1), 33.8 mi. NNW (1), 20 mi. N (1), 30.1 rd. mi. S. Loreto, S. micro Ligui (1); San Pedro Dist. (2); San Pedro (6), 7 mi. S (2), 2.0 km. S (1); San Antonio Dist. (7); San Antonio (1), 5.0 km. E (2); Comondu (3), 20 mi. N (10); El Triunfo (16), 2 mi. E (2); Conception Bay (7), Coyote Cove (8); Los Planes, 8.8 mi. NE, junc. of Punta Arena & Baja Los Muertos rds. (8); Baja Los Muertos (1), 2 mi. W (2); Mulege (1), 8 km. S (1), 10 km. SE (2), 4.5 mi. S (1); San Lucas beach area (1); Santa Rita 9 km. SE (km 148) 75m (1), 6 mi. S (1); Santispaguis de la Conception, 2 mi. N (1); Moroccan Bead, 2 mi E El Coyote, NE of La Paz (1); mainland adj. to Santa Catalina Isl. (1); San Ignacio, 2 mi. E (1); San Jose Magdalena, 2.5 km. W 310m (9); Ligui, 2.0 km. N 9m (12), Santa Rosalia, 38.6 km. S 10m (1), 30.0 km. SSE 50m (1); Juncacito, 3 km. N (3); Escondido Bay (1); Los Dolores Ranch, across I. San Jose (1). Villa Insurgentes 77.2 km NE (6), 30 mi. E (3); Rancho Ba. Muertos 2.0 km NW (1); Las Cruces, 20.0 km NW (1); trail to Guajademi (2); Las Tinajitas, Sierra Giganta (3); Puerto Escondido (1). BAJA CALIFORNIA SUR, ISLANDS: CORONADOS ISLAND (3). DANZANTE ISLAND: NW side (1). ILDEFONSO ISLAND: (44).
Cryptoglossa a. subornata (Blaisdell)

TYPE LOCALITY: West Galeras Island, Gulf of California.

BAJA CALIFORNIA SUR, ISLANDS: (114 specimens/11 localities).: CARMEN ISLAND: Puerto Balandra (11), Salinas Bay (2). MONSERATE ISLAND: Las Galeras W. island, (3) Las Galeras E. island (17). SANTA CATALINA ISLAND: (40) sand wash SW tip (5). SW end at navigation light, (1), Isla Catalan (Santa Catalina Island) (11). CERRALVO ISLAND: (7), S. end of island (9), Ruffo Ranch (8).

Cryptoglossa a. discreta (Blaisdell)

TYPE LOCALITY: Salinas Bay, Carmen Island, Gulf of California.


DISTRIBUTION: (Fig. 27) Cryptoglossa asperata (Horn) is broadly distributed in Baja California Sur and adjacent gulf islands. Specimens have mainly been collected from the Cape Region and the east coast the area above the Cape. Cryptoglossa a. subornata is mainly found on the northern islands (Monserate, Santa Catalina, and Carmen) although a population is found on Cerralvo Island in the south (see discussion). On Carmen Island, both the subspecies C. a. subornata and C. a. discreta are found. C. a. discreta is distributed mainly on the southern islands (San Diego, Espiritu Santo, Gallina, San Francisco, San Jose and Partida). C. a. asperata, is the only subspecies found on the mainland, as well as some adjacent gulf islands (Coronados, Danzante and Ildefonso).

LABEL BIOLOGICAL NOTATIONS: Stream estuary, walking on ground at night, cereal bowl pit trap, sand dunes, BL, Cape Thorn Forest, gulf coast desert, beach dunes, sand wash, Magdalenan plain, Cape gulf coast scrub, disturbed mesquite, ethylene-glycol pitfall trap in sandy desert wash, arid scrub, coastal dunes.

DISCUSSION: Blaisdell in 1923 described three varieties of
C. a. asperata. I have examined specimens of all of these. The variety C. a. planata was described uniquely from Ildefonso Island. Blaisdell diagnosed this variety by the following two characteristics: (1) more elongate form, (2) less strongly sculptured than C. a. discreta but more strongly sculptured than C. a. subornata. I have examined specimens from this island and see no validity in retaining this name. These specimens fall well within the range of those found on the mainland. Furthermore, examination of the characteristics of the island (Tables 7 and 8) reveals that although the rocks which formed the island are fairly old (Miocene, Pliocene), the island is believed to be of Pleistocene origin. Examination of the minimum channel depth between the island and mainland (less than 99 meters) and the maximum elevation on the island, also reveals that this island could have possibly been connected to the mainland (during the peak of a glacial period) or submerged (during the peak of an interglacial period) when the ocean level in the area may have varied from the present level to plus or minus 150 meters (Case et al 1983). This last continental melting of the ice is placed at between 15000 and 10000 years ago when many land bridges may have been submerged (Case et al 1983).

The subspecies C. a. discreta Blaisdell is more distinct, especially on certain islands as San Jose where the most extreme of this species occurs. Blaisdell characterized this species by the distinctly separated elytral tuberculations separated by widely spaced granules (as opposed to coalescing asperate tubercles in C. a. asperata). This subspecies is known from the following islands: San Diego, Espiritu Santo, Gallina, San Francisco, San Jose and Partida.
Table 7: Gulf Island Data 1: Principle rock, probable origin and probable age of island*.

<table>
<thead>
<tr>
<th>Island</th>
<th>Principle rock:</th>
<th>Probable origin:</th>
<th>Probable age:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerralvo:</td>
<td>bas, Mio vol.</td>
<td>fau/upl</td>
<td>Pli</td>
</tr>
<tr>
<td></td>
<td>Ple mar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Espiritu Santo:</td>
<td>Mio vol., Ple mar</td>
<td>fab/upl</td>
<td>Ple</td>
</tr>
<tr>
<td>San Francisco:</td>
<td>Mio vol</td>
<td>fab</td>
<td>Pli</td>
</tr>
<tr>
<td>San Jose:</td>
<td>Mio vol, Pli &amp;</td>
<td>fab/upl</td>
<td>Pli</td>
</tr>
<tr>
<td></td>
<td>Ple mar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>San Diego:</td>
<td>bas</td>
<td>fau ero</td>
<td>---</td>
</tr>
<tr>
<td>Santa Catalina:</td>
<td>bas</td>
<td>fau ero</td>
<td>---</td>
</tr>
<tr>
<td>Monserrate:</td>
<td>Mio vol, Pli mar</td>
<td>upl</td>
<td>Ple</td>
</tr>
<tr>
<td>&amp; Galeras</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coronados</td>
<td>Mio Hol vol, Pli</td>
<td>upl ero eru</td>
<td>Ple/Hol</td>
</tr>
<tr>
<td></td>
<td>Ple mar sed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carmen</td>
<td>Hol vol, mar sed</td>
<td>eru</td>
<td>Hol</td>
</tr>
<tr>
<td>San Ildefonso</td>
<td>Mio vol, Pli</td>
<td>upl</td>
<td>Ple</td>
</tr>
<tr>
<td>Danzante</td>
<td>Mio vol,</td>
<td>fau, ero</td>
<td>Ple</td>
</tr>
<tr>
<td>San Lorenzo</td>
<td>bas, Pli sed,</td>
<td>upl</td>
<td>Ple</td>
</tr>
<tr>
<td>and Animas</td>
<td>Mio vol, bat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salsipuedes</td>
<td>Mio vol,</td>
<td>upl</td>
<td>Ple</td>
</tr>
</tbody>
</table>

Explanation of acronyms used:

- Ple = Pleistocene
- Mio = Miocene
- Hol = Holocene
- upl = Uplift
- bas = basement
- vol = volcanic
- fau = faulting
- fab = fault block
- ero = erosion
- bat = basalt
- mar = marine
- sed = sedimentary
- --- = no data

* Modified from Case and Cody (1983)
Table 8: Gulf Island Data 2: Area, highest elevation, nearest mainland and minimum channel depth between island and mainland*.

<table>
<thead>
<tr>
<th>Island</th>
<th>area (sq/km)</th>
<th>highest elevation (m)</th>
<th>nearest mainland (km)</th>
<th>minimum ocean depth (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerralvo</td>
<td>416</td>
<td>759</td>
<td>11</td>
<td>504</td>
</tr>
<tr>
<td>Espiritu Santo</td>
<td>257</td>
<td>567</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>San Francisco</td>
<td>6.7</td>
<td>----</td>
<td>8</td>
<td>63</td>
</tr>
<tr>
<td>San Jose</td>
<td>504</td>
<td>624</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>San Diego</td>
<td>4.3</td>
<td>----</td>
<td>17</td>
<td>189</td>
</tr>
<tr>
<td>Santa Catalina</td>
<td>112</td>
<td>462</td>
<td>13</td>
<td>158</td>
</tr>
<tr>
<td>Monserrate</td>
<td>50.4</td>
<td>219</td>
<td>13</td>
<td>158</td>
</tr>
<tr>
<td>Coronados</td>
<td>22.1</td>
<td>279</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>Carmen</td>
<td>392.6</td>
<td>471</td>
<td>6</td>
<td>47</td>
</tr>
<tr>
<td>San Ildefonso</td>
<td>6.7</td>
<td>116</td>
<td>10</td>
<td>&lt;99</td>
</tr>
<tr>
<td>Danzante</td>
<td>4.9</td>
<td>----</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>San Lorenzo**</td>
<td>42.5</td>
<td>&gt;300</td>
<td>18</td>
<td>243</td>
</tr>
<tr>
<td>Salsipuedes</td>
<td>1.2</td>
<td>&lt;300</td>
<td>19</td>
<td>243</td>
</tr>
</tbody>
</table>

* Partly modified from Case and Cody (1983)

** Including San Lorenzo Norte (Animas)
A few of these islands are thought to be of Pliocene origin (San Francisco, San Jose) although others are thought to be of Pleistocene (Espiritu Santo) or even Holocene (Carmen) origin. Examination of channel depth between the mainland and these islands suggests that most of these (except possibly San Diego) may have been connected to the mainland as recently as 10000 years ago. It is also possible that this subspecies may have originated in an earlier land separation and has subsequently merged with *C. a. asperata* more recently on some islands.

*Cryptoglossa a. subornata* is the most distinct subspecies. Blaisdell (1923:249) characterized this subspecies by the much less developed elytral sculpturing with weakly developed tubercles. This subspecies is found on Carmen, Monserate, Santa Catalina and Cerralvo Islands. These islands vary in hypothesized date of origin, but, with the exception of Carmen, all have channel depths and elevations that suggest the lack of a recent connection to the mainland. Carmen island is puzzling. Both *C. a. subornata* and *C. a. discreta* are found on this island. Each population is quite distinct. It is possible that the channel between this island and the mainland (of 45 meters) has been slowly filling in recent times. All of these island localities are in the same general area (around the 26th parallel) except Cerralvo (near the 24th parallel). Cerralvo Island is one of the older islands, thought to be of Pliocene origin. This island is perhaps the most interesting in the study of the Cryptoglossini. A number of the subspecies (see below) found on the island are not the same as found on the adjacent mainland only 11 kilometers away but similar or the same as those found much further north. Other biological studies on the islands in the Gulf of California have revealed a number of endemic plants and animals on the island (see Case et al 1983). It is perhaps possible that this island may have had a connection to the areas further north sometime in the past rather than to the adjacent cape region.

*Cryptoglossa muricata* (LeConte)

(Figures 5, 23–26, 28)

*Cryptoglossa muricata* (LeConte) NEW COMBINATION

*Centrioptera muricata* LeConte 1851:142

*Centrioptera utensis* Casey 1907:513, NEW SYNONYMY
**Centrioptera sculptiventris** Blaisdell 1923:247

**NEW SYNONYMY**

**Centrioptera elongata** Casey 1924:306 **NEW SYNONYMY**

**Centrioptera serrata** Casey 1924:306 **NEW SYNONYMY**

**DIAGNOSTIC COMBINATION:** (Fig. 5) Body elongate, subparallel. Head with ventral aspect of mentum without anterior excavate margin; subgena with anterior mandibular process slightly produced antero-mesally, apex sharp, obtuse. PRONOTUM with upper surface flattened, broadly convex; lateral margin arcuate; upper mesal surface with minute to small sparse punctures, upper lateral surface with medium to large, dense punctures; prosternal process (lateral configuration) strongly, produced behind procoxae, apex rounded; mesosternum modified to receive prosternal process with two anterior-lateral projections. ELYTRA: with upper surface sculpturing muricate; sterna moderately to densely punctured. FEMALE: Coxites, apical aspect of 4th lobe sclerotized, glabrous. Internal cuticular structures with bursa copulatrix absent; spermathecal accessory gland very long, thin; spermatheca multiple very long, thin. MALE with postero-basal region of mesofemur modified as a distinct raised elongate, tubercle, central aspect concave, secretory cells present. Aedeagus (Figs. 23-26): parameres with apex not spatulate ventrally, gradually tapering toward apex; dorsoventral aspect of subapex straight to convex (Fig. 25), apical setae greatly reduced, positioned ventral sublateral. IMMATURE STAGES: (Mature Larva) Head with labrum with approximately 18 mesal spicules. Protarsangulus (basal lobe, apex) with one spicule; prosternum (mesal cuticular surface), with central bare areas semicircular in shape; protergal margins and prosternum very slightly melanized. Mesal aspect of labrum and ninth abdominal tergum (lateral areas) with spicules less than .1 mm in length.

**TYPES:** Holotypes: (*C. muricata*) gray disc, MCZC type 4517, LeConte Collection. (*C. serrata*) Las Vegas Nev., V-28-05, T. Spalding col., Casey bequest 1925, USNM Type 46367. (*C. utensis*) Ut. Casey bequest 1925, USNM Type 46368. (*C. elongata*) La Puerta, San Diego Co., Cal., Casey bequest 1925, USNM Type 46369. (*C. sculptiventris*) San Pedro Bay, Sonora, Mexico, E. Van Duzee col., CASC types 1155 (female) and 1156 (Allotype male).

**PARATYPES:** (*C. muricata*) LeConte Collection (5 specimens): Cal, yellow square, Horn collection, H7240 (1); Cal., Horn collection, H7240 (1); gold disc (2); Ariz., (1). Horn
Collection (5 specimens): Cal, yellow square, H7241 (1); Cal., Horn collection, H7241 (1); Ariz., Horn collection, H7241 (1); Ariz., Horn collection (1); Cal., Horn collection (1). (*E. elongata*) USNM paratype No. 46369.

MATERIAL EXAMINED: 3661 from the following 301 localities. NO DATA: (6). CALIFORNIA (2963 from the following 220 localities): (13); SOUTHERN (9); COLORADO DESERT (3). INYO CO.: (1784 specimens /56 localities): (2); Saline Valley (25), Racetract Valley Rd. (803), Warm Springs Rd. (93), Inyo Mts. (6), Grapevine Canyon Rd. (478), Grapevine Canyon, 4000' (8), 4400' (17), 3800' (6), 2500' (12), 2700' (14), 1200' (14), 3000' (5), 2300' (1), 2200' (7), 1360' (13), 3400' (8), 5000' (1), Palm Spring (1), Saline Valley Dunes (3), Hunter Cyn., 2200' (2), 2300' (6), 3200' (4); Inyo Mts., Lead Cyn. (1) Lead Cyn., mouth, 3300' (5), Lower Lead Cyn. (1), north Paiute Cyn., 2400' (1), Marble Cyn., 6200' (12), Long John Cyn., 5600' (6), Fish Lake Valley, 5200' (3), Fish Lake Valley, 6 mi. S, 4 mi. E Oasis, 5200' (2); Death Valley (12), 2 mi. N, 6 mi. E Stovepipe Wells (2), Daylight Pass, 4300' (1); 19 mi. N Ridgecrest, Baby Mt., sand dunes, 2600' (1); Mesquite Spr. campg. (1); Ballarat, 1061' (1); Owens Lake Valley (76); Owens River Gorge, 4450' (4); Coso Range, Upper Cactus Flat, 5000' (1); 5 mi. N, 2 mi. W Bishop, 4500' (1); Eureka Valley (82) 8 mi. N, 4 mi. W sand dunes, 3300' (5), 15 mi. N, 12 mi. W sand dunes, 4000' (1), 15 mi. N, 11 mi. W sand dunes, 3800' (10), 16 mi. N, 11 mi. W sand dunes, 4100' (2), 15.5 mi. N, 12 mi. W sand dunes, 4000' (3), 12 mi. N, 10 mi. W sand dunes, 3400' (2), 16 mi. N, 12 mi. W sand dunes 4100' (3); 3.5 mi. S, 5 mi. W Deep Springs College, 5200' (1); Olancha, (2); Panamint Valley (5), Panamint Valley Dunes (1); Argus Mts. (3), Sheppard Cyn. (1); Old Condidence Mill, Armagosa Res., (1). RIVERSIDE CO.: (352 specimens / 51 localities): (14); Indio, (2); 1000 Palms (5), 5 mi. E (3), 7.3 mi. E (3), 3.7 mi. E (2) 4 mi. E (2), 1000 Palm Cyn., (1) 1000 Palms Oasis, 5 mi. E (3); Palm Springs (35), depot, .2 mi. S freeway, 1300' (3), Palm Cyn., Palm Springs (2); Palm Cyn., (4); Whitewater canyon (6), 2 mi. N (1), Palm Oasis (9), 2200' (16), 1700' (6); Painted Canyon (40), 500' (10); Pushawalla Palms, 1000' (2), Joshua Tree Nat. Mon., Pleasant Valley 2 (2), Pinyon Wells (2), Pinto Wash Well (1); 3 mi. S Banning (2); Riverside Mts. (1), south side Riverside pass rd. (9), Riverside pass rd. crest (38), Santa Rosa Mts., Bear Creek, 700-2000' (1); Magnesia Cyn. (2); Chuckawalla Mts., Corn Spring, 7.5 mi. SE Desert Center, 1600' (3); Tahquitz Cyn. (1); Blythe (2), 14 mi. W
(1); 1/4 mi. S Scissors Crossing, Carrizo Cr. & Hwy. 74, Santa Rosa Mts., 1200' (4); Deep Cyn. res. (1); Andreas Cyn. (7); Palm Desert (1); Cathedral City (3); Hidden Springs (1); Riverside (1); Salton Sea (2); Corona (1); Cabazon (1); Deep Canyon (47), 1200' (2); Deep Canyon, Coyote Creek (4); Carrizo Creek (4); Deep Cyn. res. (1); W. Sharer's Well (1); Palm Desert (1), P. Boyd Desert Research Center, 3.5 mi. S Palm Desert (38). IMPERIAL CO.: (94 specimens / 27 localities) (1); Ogilby Hills, 400' (6), 340' (1), 360' (4); 1.5 mi. ESE Ogilby, base of Ogilby Mts. (1); Cargo Muchacho Mts. (2), 400' (2), 480' (14); Desert toward Yuma, Cal. (1); Mountain Springs, 2300' (1); Glanis, Algodones Dunes (2), 3.5 mi. WNW, 280' (2), 3.5 mi. SE (1), 7 mi. SE (1), 5 km. N (1), 11.2 mi. SE (1); Walter's camp, 3.9 mi. N (25), 9.3 mi. N (20), 9 mi. S (1); 12.4 mi. ENE Holtville (1); .75 mi. E Coachella Drop #1, Algodones dunes (1); Andrade (1); Palm Springs [Mountain] (1); Gray's Well (1); San Felipe Wash (2); El Centro (1). SAN BERNARDINO CO.: (602 specimens / 35 localities): (2); Kingston Range (1); 1.1 mi. NW rd. summit (1); Providence Mts. St. Rec. Area, Mitchell Caverns St. Park (1), Park headquarters, 4300' (1), Mitchell Caverns area (2); Marble Mts., 1 mi. E Kelbaker rd. on gaspipe rd. (17), Cadiz summit, 1250' (32); 3 mi. NE Death Valley Nat. Mon. Saratoga Springs, (1); Sheep hole Mts., 1 mi. N Sheep hole Summit, 2300' (3), Cyn. at N end (1); 2 mi. S Ibex Pass, (2); 10 mi. S Kelso, (1); S edge, Kelso Dunes (2); Amboy, 4.3 mi. W (23), 3.4 mi. W (4), Amboy crater (3); Barstow, 10 mi. S. (11); 29 Palms (3); Bell Mt. (6); 4 mi. S Stoddard Mt. on Stoddard well rd. (3); 2 mi. NW Afton (5); 4 mi. S Cadiz (1); Lenwood (1); 11.2 mi. N Goffs (1); Victorville (3); Needles (2); Yucca Valley (1); San Brdno. Mts., Lucern Valley, N slope (3); Between Kramer & Adelanto (2); Morongo Valley (1); Adelanto, 4 mi. N (1); 16 mi. S Vidal Jct. (1); Mts. W of Cottonwood, Mojave River (2); Pisgah Crater (455); 1.7 mi. NW Old Dale Jct. (3). SAN DIEGO CO.: (84 specimens / 30 localities): (15); San Diego (9); Dos Cabezas Springs (1); Anza Borrego St. Park (4), Sheep Cyn. (10), Split Mt. (1); Lake Jennings (1); 5 mi. W Yaqui Well, 1500' (3); Mission Valley (1); desert edge (1); Caliente (2); Valle de San Felipe, Scissors Crossing, 2240'-2800' (2), 6.5 mi. N 2700' (3), 6.9 mi. NW 2900' (1), 8.2 mi. NW 3200' (1), 5.5 mi. NW (2); Vallecito (1); San Felipe (1), 2 mi. SE (1); Mason Valley (3); Poway (1); Torrey Pines (1); Borrego Valley (1); 6-6.5 mi. N Jct. Borrego Spr. rd. & Digio rgi o rd., Anza Borrego St. Pk. (1); Borrego (5), nr. (1); Borrego Springs (3), Box Cyn., S of (1), Palm Cyn. (6);
Palm Cyn., Borrego Valley (1). KERN CO.: (19 specimens /11 localities): Cantil, Mojave desert (1); NW Randsburg (1); 1 mi. N Boron (1); Lost Hills (2); Tehachapi Pass (1); Jawbone Cyn. (1); Inyokern (5), 11 mi. S (1); Mojave (3); 19 mi. NW East Mojave (2); Last Chance Cyn. (1). LOS ANGELES CO.: (3 specimens /3 localities): (1) Los Angeles (1), Elizabeth Cyn. (1). MONO CO.: (4 specimens /2 localities): White Mt. Coldwater Cyn., 6.8 mi. S Jct. Randsbury Rd. & Hwy 14 (2), Hwy 14 & Hwy 178 (2). VENTURA CO.: Sespe Cyn. (1). NEVADA (489 from the following 7 localities). NYE CO.: (482 specimens /4 localities): Mercury, Nevada Test Site (479); Big Dune (1); 3.5 mi. ESE Lathrop Wells (1); Rock Valley (1). CLARK CO.: (6 specimens /2 localities): Newberry Slope (5); Hwy. 77, 15 mi. N Davis Dam (1). WASHOE CO.: NE shore, Pyramid Lake, Hells Kitchen area (1). UTAH, WASHINGTON CO.: (5 specimens /3 localities) Terry's Ranch, Beaver Dam wash (1); St. George (3); Crafton (1). ARIZONA, (62 specimens /32 localities): (11); Yute Mts. (1). MOHAVE CO.: (8 specimens /3 localities): 3 mi. N, 7 mi. E Littlefield, Virgin river (6); 8 mi. S Havasu (1); Oatman (1). YUMA CO.: (18 specimens /10 localities): Yuma (6); Martinez lake (2); Parker (2); nr. Dateland (1); Kofa Mts., Voodoo Well (1); Imperial Dam (1); Dome (1); 4 mi. E Welton (2); Palms (1); Buckthorn tanks, Tule Mts. (1). SANTA CRUZ CO.: Pajarita Mts. (1). PIMA CO.: (7 specimens /5 localities): Organ Pipe Cactus Nat. Mon. (3), campground (1), W. slope, Diablo Mts. (1); Tucson (1); Growler Pass, Growler Mts. (1). MARICOPA CO.: (19 specimens /11 localities) South Mt. Pk. (7); Granite Reef (1); Phoenix (1); Tempe (1), Tempe Desert (2); Gillespie Dam (1); 14 mi. N Ajo (1); Gila Mts. (1); Gila Bend (1); Verde River (2); McDonell Mts. (1). MEXICO, BAJA CALIFORNIA NORTE: (100 specimens /25 localities) San Felipe (9), 5 mi. N (1), 31 mi. N (1), 15 mi. S. (1); Mexicali, km 88, 60 mi. S (1); Puertecitos (4), 14 mi. S (2), 3 mi. N (1); Los Medanos (1); 1 mi. S Bahia de los Angeles (1); 25 mi. N. Ba. San Luis Gonzaga (1); Baja Charlie (1); 6.2 mi. W Bahia de los Angeles (17); 19 km N San Borja, 27 km W Punta Arena (1); Valle Montevideo, La Laguna wash, 18 km. W Los Angeles Bay, 380m (5); Los Angeles Bay (3); 11.3 km. N Guerrero Negro (1); 43 km ESE of jct. Hwy 1 (by road to LA Bay) (1); 11.0 km WNW Bahia de Los Angeles, 207m (3); Diablito Cyn., E slope Sierra San Pedro Martir (1); 65 mi. S San Felipe (1); Las Atractas de Arriela (1); sulfur mine, 23 mi. S. San Felipe (2). PARTIDA ISLAND: (1); La Puerta (40); La Puerta Valley (4). MEXICO, SONORA: (18 specimens /13 localities) Cholla Bay (4); San Luis, 25 mi. S (1) 52 mi. E (1);
Caborca, 7 mi. NW 1000' (1), 23 mi. W Caborca (1); Sonoyta, 24 mi. SW (2), 30 mi. SW (3); Choya Bay (2); La Chaya (1); 1/2 bet. Sonoyta & Puerto Penasco (1); Rocky Point (1); Puerto Penasco (1); Punta Chollas (1). Doubtful locality: COLORADO, EL PASO CO.: Black Forest, 6893', (2).

DISTRIBUTION: Fig. 28 Cryptoglossa muricata is abundant from the northern Sonoran Desert region to the northern limits of the Mojave Desert.

LABEL BIOLOGICAL NOTATIONS: Larrea divericata patch in desert pavement, desert wash, edge of wash sandy soil among Larrea divericata, coarse sandy soil, white light, grassy knoll near spring in narrow Cyn., ethylene glycol pitfall trap sage brush in Cyn. bottom, desert wash, Franseria domosa assc., (FD), Larrea assc., (LD), Sueda-Atriplex assc., (SA), Indian fish traps, juniper scrub, ethylene glycol pitfall trap [Dupont], ground trap, sand wash, Larrea-Palo Verde, under boards, dead on surface, under cow dung, night, in desert wash, under rock, pitfall trap, on alluvium near rocks, alluvium near Hyptis emnorryi, at light, on Hyptis, pit trap under Hyptis, near stream, sandy desert wash, mesquite-creosote, ethylene glycol pitfall trap rocky hillside, creosote scrub, ethylene glycol pitfall trap sandy desert wash, mesquite-creosote scrub, under rocks, sift, ethylene glycol pit trap, night walking, ethylene glycol pitfall trap near Neotoma nest, desert hillside wash, rocky hillside, cereal bowl pitfall trap, dusk, sand on lava flow, along wash in creosote, hymenoclea, and quail bush area, cholla-ocotillo, cowchip, pasture, acacia-erigonium, board, floating in water, salt flats, nr. cattleguard, coastal dunes.

DISCUSSION: Cryptoglossa muricata is easily distinguished from other species by the muricate elytra, sculpturing of the pronotum with deep small to medium punctures, subparallel form and unique secretory structures on postero-basal region of mesofemora in males.

Cryptoglossa michelbacheri (Blaisdell), (Figures 29, 31-34, 47 & 123)

Cryptoglossa michelbacheri (Blaisdell), NEW COMBINATION

Centrioptera michelbacheri Blaisdell, 1943:227.

DIAGNOSTIC COMBINATION: (Fig. 29) Body elongate,
Head with ventral aspect of mentum without anterior excavate margin; subgena with anterior mandibular process slightly produced anterio-mesally, apex sharp, obtuse. PRONOTUM with upper surface flattened, broadly convex; lateral margin broadly arcuate; upper mesal surface with minute sparse punctures, upper lateral surface with medium to large, dense punctures; prosternal process in lateral configuration slightly, shallowly produced behind procoxae; metafemur, with mesal and lateral surfaces similar to pro, mesofemur; metafemur, with medial edge serrate spiculate, modified as locking mechanism with spiculate pseudepipleural margins of elytra. ELYTRA with dorsal configuration elongate convex, broadly curved centrally, with one distinct spiculate row longitudinally along pseudepipleural ridge. Sternal sculpturing punctate. FEMALE: Coxites, apical aspect of 4th lobe sclerotized, glabrous; Spiculum ventrale configuration slightly longer than wide (Fig. 123). Internal cuticular structures with bursa copulatrix absent; spermathecal accessory gland very long, thin; spermatheca multiple very long, thin. MALE with postero-basal regions of meso, metafemur modified as a distinct raised elongate, flattened, tubercle. Aedeagus (Figs. 31-34): parameres with apex not spatulate ventrally, gradually tapering toward apex; dorsoventral aspect of subapex broadly convex (Fig. 33), apical setae greatly reduced, positioned ventral sublateral.


PARATYPES: Mexico, Baja California Sur, 25 mi. S Santa Rosalia, VII-25-38, Paratype, Michelbacher & Ross cols., (4) CASC.

MATERIAL EXAMINED: (293 from the following 6 localities) MEXICO, Baja California Sur, Santa Rosalia, 38.6 km. S (3), 12.8 mi. SSE (2), 25 mi. S (4); Mulege, 5.7 mi. SE (38), 10 km. SE (2), 8 km. SE (244).

DISTRIBUTION: (Fig. 47) This species has the smallest known range of any Cryptoglossini, being restricted completely to the area around the north end of Conception Bay, Baja California Sur, Mexico.

LABEL BIOLOGICAL NOTATIONS: walking dunes at night, cereal bowl pit trap, sand dunes, ethylene glycol pitfall trap, tropical-scrub.
BIOLOGICAL NOTES: Nothing is known of the biology of \textit{C. michelbacheri}. I have collected numerous specimens of this species utilizing long duration ethylene-glycol pitfall traps near the sand dunes north of Shark's Point (8 km. SE Mulege) at the mouth of Conception Bay, but I believe it is not confined to the immediate sand dune area.

DISCUSSION: This distinct species is most closely related to \textit{C. caraboides} from which it can be distinguished by its more inflated shape and densely punctured sides of the pronotum.

\textit{Cryptoglossa caraboides} (Mannerheim)  
(Figures 3, 35-38, & 40)

\textbf{Cryptoglossa caraboides} (Mannerheim) NEW COMBINATION  
\textbf{Centrioptera caraboides} Mannerheim, 1843:280  
LeConte 1851:143. Champion 1892:508.

DIAGNOSTIC COMBINATION: (Fig. 40) Body elongate, subparallel. HEAD with ventral aspect of mentum without anterior excavate margin; subgena with anterior mandibular process slightly produced antero-mesally, apex sharp, obtuse. PRONOTUM with upper surface flattened, broadly convex; lateral margin evenly arcuate; upper mesal surface with minute sparse punctures, upper lateral surface with small, moderately dense punctures; prosternal process in lateral configuration feebly, shallowly produced behind procoxae, apex subacute; mesosternum modified to receive prosternal process with two lateral, anterior projections; metafemur, with mesal and lateral surfaces similar to pro, mesofemur; metafemur, with medial edge serrate spiculate, modified as locking mechanism with spiculate pseudepipleural margins of elytra; tarsi with short spinose setation. ELYTRA with dorsal configuration elongate convex, broadly curved centrally, with one distinct spiculate row longitudinally along pseudepipleural ridge. Sternal sculpturing punctate. FEMALE: Coxites, apical aspect of 4th lobe sclerotized, glabrous. Internal cuticular structures with bursa copulatrix absent; spermathecal accessory gland very long, thin; spermatheca multiple very long, thin. MALE with postero-basal regions of meso, metafemur modified as a distinct raised elongate, flattened, tubercle. Aedeagus (Figs. 35-38): parameres with apex not spatulate ventrally, gradually tapering toward apex; dorsoventral aspect of subapex broadly convex (Fig. 37), apical setae
greatly reduced, positioned ventral sublateral.

MATERIAL EXAMINED (16 from the following 7 localities): NO DATA (1); MEXICO, PUEBLA (1), Metamoros Izucar (6), 8 mi. S Izucar de Metamoros (1); MEXICO, GUERRERO, Mochitlan (1), 2.2 mi. S Rio Balsas, 1850' (1); 3 mi. N Chilapancingo, (4); MEXICO, MORELOS Yautepec (1).

DISTRIBUTION: (Fig. 3) Known only from the Valley of Tehuacan, Balsas river valley and surrounding areas.

LABEL BIOLOGICAL NOTATION: arid trop scrub.

DISCUSSION: This species has remained unknown to most workers. Blaisdell failed to include this species in his 1923 key to the species of Centrioptera. Cryptoglossa caraboides is most closely related to Cryptoglossa michelbacheri from which it can easily be distinguished by its smooth upper pronotal surface and its unique smooth concave mesal aspect of the metafemora.

Cryptoglossa spiculifera LeConte
(Figures 39-46 & 48-50)

Cryptoglossa spiculifera (LeConte) NEW COMBINATION

Cryptoglossa spiculifera spiculifera (LeConte) 1861:337
Centrioptera spiculifera LeConte 1861:337
Cryptoglossa s. pectoralis (Blaisdell) 1921:198
NEW COMBINATION AND STATUS
Amblycyphrus asperatus Motschoulsky 1870: NEW SYNONYMY
Centrioptera dulzurae Blaisdell 1921:199 NEW SYNONYMY
C. chamberlini Blaisdell 1923:246 NEW SYNONYMY

DIAGNOSTIC COMBINATION: (Figs. 48-49) Body elongate, subparallel. Head with ventral aspects of mentum without anterior excavate margin; subgena with anterior mandibular process slightly produced antero-mesally, apex sharp, obtuse. PRONOTUM with upper surface flattened, broadly convex; lateral margin evenly, broadly arcuate; upper mesal and lateral surfaces with minute sparse punctures; prosternal process in lateral configuration feebly, shallowly produced behind procoxae, apex subacute; mesosternum declivous anteriorly; metafemur, with mesal and lateral surfaces similar to pro, mesofemur; metafemur, with medial edge serrate spiculate, modified as locking mechanism with spiculate pseudepipleural margins of
ELYTRA upper surface submuricate, laterally muricate; pseudepipleural margins with two distinct spiculate rows. FEMALE: Coxites, apical aspect of 4th lobe sclerotized, glabrous; Spiculum ventrale configuration slightly longer than wide. Internal cuticular structures with bursa copulatrix absent; spermathecal accessory gland very long, thin; spermatheca multiple very long, thin. MALE with postero-basal regions of meso, metafemur modified as a distinct raised elongate, flattened, tubercle. Aedeagus (Figs. 39-46): parameres with apex not spatulate ventrally, gradually tapering toward apex; dorsoventral aspect of subapex broadly convex (Figs. 41 & 45), apical setae greatly reduced, positioned ventral sublateral.

TYPES: Holotype: Centrioptera spiculifera San Lucas, MCZC Type No. 4516, LeConte collection [seems to have been collected dead from condition of specimen]. Paratypes: Cal. [yellow square], Horn collection H7240, (1) MCZC; [gold disc, cut on corner], Horn collection, (3) [one with female designation] MCZC.

Cryptoglossa spiculifera spiculifera:

MATERIAL EXAMINED: (214 from the following 59 localities)
NO DATA (5). L. CAL.: (6). MEXICO: (2). MEXICO, BAJA CALIFORNIA SUR: (189 specimens/58 localities) Puerto San Carlos (3), 2.0 km. N 24112Bb (7), 6.2 km. N (1); San Lucas del Cabo (10), 4.0 km. NE 22109Aa (3); San Jose del Cabo, (7), 8 km. N 23109Dc (1); 6 mi. E (2); Puerto Escondido, 1 mi. S (3); La Paz (9), 18 mi. W (4), 22 mi. W (6), 14 mi. NW (1), 13.1 mi. NW on road to Rodriguez (2), 19.2 mi. W, Rodriguez (1), 15 mi. W (14), 5.6 mi. E, Los Cruces (1), 20 mi. NW (1), 4.0 km. SW (1), 7 mi. SW (1), 26 mi. W (1), 2 mi. S (1), 15 mi. W (8), 8 mi. SE (2); San Antonio (2), 3 mi. N (3), 2.6 mi. E (2); Santiago, 2 mi. S (1), 8 km. S, Trop. Cancer, 2327/10913 (2); El Cien, 3.3 mi. S (22); El Triunfo, (6), .7 mi. NW (1); Todos Santos, 14 mi. N (1), 6 mi. E (1), Hondo wash, 17 mi. N (4); San Perdito, 5.6 mi. SE (1); El Pescadero (9); Punta Arenas lighthouse, 2404/10950 (1); Boca de la Sierra (1); Guajademi, Trail top (1); Las Cuevas (7); Los Planes, 8.8 mi. NE, jct. of Punta Arena & Bahia Los Muertos rds. (2); San Pedro (1); Santa Rosa (10); Venancio (1); El Medano river xing, 7.4 km. W Santa Rita rd to Punte Chale (1); San Jorge (5); bet. San Jose del Cabo & Triunfo (4); Triunfo (2); Santiago (2); Magdalena Bay (2); El Refugio, 15 mi. N El (1); 1 mi. SW St. Catarina (3); S. Rosalia
(2). MONSERATE ISLAND (1); ESPIRITU SANTO ISLAND (1); PARTIDA ISLAND (3). Doubtful locality: CAL: San Bernardino Mts., (1).
INTERMEDIATE FORMS: San Jose Comandu, 1 km E (2), 7.3 mi. N (2); Boca de San Andreitico, 1 km S (2); Puerto San Carlos, 2 km. N (2); Villa Insurgentes, 77.2 km NE 2537/11115 (1); San Jorge, 1.5 mi. E (3).

DISTRIBUTION (Fig. 50) Baja California Sur, Mexico (see discussion below).

LABEL BIOLOGICAL NOTATIONS: beach scrub, cape thorn forest, agricultural area, light, walking on ground at night, cereal bowl pit trap, cape dry thorn beating and sweeping, sandstone caves, thorn scrub, disturbed mesquite, Magdalenan coast scrub, Magdalenan plain, sand dunes.

Cryptoglossa spiculifera pectoralis (Blaisdell)

MATERIAL EXAMINED: (62 from the following 28 localities)
NO DATA: (2) CAL: San Diego Co., (1) Riverside Co., (1) LOWER CAL: (1). MEXICO, BAJA CALIFORNIA SUR: (57 specimens/25 localities) San Ignacio, Rancho El Mesquital, 21.4 mi. E (9), 2 mi. E (8), 13 mi. N (1); San Isidro, 3.5 km. NW (1); Arroyo San Gregorio, 13 air km WNW La Purissima (1); San Miguel Comandu, 2 mi. SW (1); Santa Rosalia, 30.0 km SSE 2705/11212, (2) 38.6 km. 2701/11206 (1), 20 mi. W (1); Loreto, El Bajo (10); Comandu (1), 20 mi. N (3); San Angel, 3 mi. SW (1); El Arco, 2 mi. NW (1) 23 mi. NW (2); Bahia Los Muertos, 2 mi. W (1); Santispaguis de la Conception, 2 mi. N (1); mainland adj. to Santa Catalina Island (1); Calamajue (1); Bahia Conception (1); Rancho Tablon, 7 km N 2737/11321 (5); Laguna de Ojo, (2); 4.9 mi. E Mex. 1 on Hutomonte-San Jose Rd. (2); San Javier (1). CORONADO ISLAND: (6); SW end (1).
SAN MARCOS ISLAND: (1). COYOTE ISLAND: Coyote Bay (1).
CARMEN ISLAND: Porto Ballandra (1). MONSERATE ISLAND: (1).
CERALVO ISLAND: SE end (1). MEXICO, BAJA CALIFORNIA NORTE: (43 specimens/18 localities) Guerrero Negro, 6 mi. N (2), 9 km N (1), 11.3 km N (6); Catavina, 2.5 mi. NW (4), 2.1 mi. NW (1); Ejido Morelos, 5.4 km. W, 2017/11407 (2); San Pedro Martir cyn, Diablito (1); n. San Simon, (2); Punta Arena, 27 km. W, 19 km. N San Borja (1); Las Arractras de Arriela (1); Bahia de Los Angeles (5), 6.2 mi. W (4), 22 mi. S (2); Rancho Santa Inez (1), 9 km NW 2946/11446 (6); Punta Prieta, (2); El Progresso, 35 mi. S, El Arroyo Catavina (1); Escondido Bay, (1). CEDROS ISLAND: (9),

LABEL BIOLOGICAL NOTATIONS: under stones, osprey nest, pelican nest, cereal bowl pit trap, walking dunes at night, oasis in creek bottom, gulf coast desert, arid scrub, sand dunes, ethylene glycol pitfall trap, sandstone arroyo, collected while walking at night.

DISTRIBUTION (Fig. 50) Baja California, Mexico and San Diego County, California (see discussion below).

BIOLOGICAL NOTES: Little is known of the biology of Cryptoglossa spiculifera. Blaisdell noted in 1921 (p. 201, referring to C. dulzurae) that although he had collected only one live specimen around his ranch in Poway, San Diego County, California, numerous dead specimens had been found in nests of wood rats.

DISCUSSION: Centrioptera pectoralis was described by Blaisdell (1921:198) as differing from C. spiculifera in "its more elongate oblong form, smaller elytral spiculae, more strongly declivous mesosternum and more abundant punctuation on the ventral surface". These characters, although continuous in nature, would perhaps be sufficient to separate these into distinct species were it not for some intermediate forms, mainly from the areas around San Jose Commondu (see above). The male genitalia (Figs. 39-46) of these two subspecies are also virtually identical with no consistent differences. An interesting population of C. s. pectoralis is found on Cerralvo Island. These specimens are approximately equal in elytral sculpturing to the most northern specimens (see discussion on this island under C. asperata).

Blaisdell's in 1921 (p. 201) also described the species Centrioptera dulzurae from two specimens from Dulzura and Poway, San Diego County, California. Centrioptera dulzurae was distinguished from C. pectoralis (described by Blaisdell on the previous page) by its smaller, less elongate size, fewer punctures on the undersurface and less developed elytral spiculations. This population, which represents the northern extent of C. spiculifera, exhibits the least development of the spiculate rows on the pseudepipleural margins. It is notable here that Blaisdell (1921:200) mentions that Horn had previously identified "this specimen (the type C. dulzurae) more than twenty-five years ago" (around 1896)
as *C. asperata* Horn. The species, described as *Amblycyphrus asperatus* by Motchoulsky in 1870, corresponds to this "northern race" of *C. spiculifera*. This coincidence is interesting as both Horn's *C. asperata* and Motchoulsky's *Amblycyphrus asperatus* were both described in 1870.

Blaisdell's *C. chamberlini* represents a somewhat unique race found on Salsipuedes and San Lorenzo Islands in the Gulf of California near the 29th parallel. This species was distinguished by Blaisdell from *C. spiculifera* and *C. pectoralis* by the mesosternum and metasternum being on the same horizontal plane. This character is somewhat variable in the specimens examined. These islands, of hypothesized Pleistocene origin (Case et al 1983), have a sufficient channel depth between them and the mainland and elevation to have been isolated for a length of time, certainly beyond the last glaciation. Only few specimens of this population are known. From careful comparison of these to mainland specimens, I cannot find a consistent character, even continuous in nature, to distinguish this population. I have therefore decided to include this isolated population a members of the subspecies *C. a. pectoralis*.

*Cryptoglossa seriata* LeConte
(Figures 51-53, 93-96, 127)

*Cryptoglossa seriata seriata* LeConte 1861:337

*Oochila seriata* (LeConte) 1866:59


**NEW COMBINATION**

**DIAGNOSTIC COMBINATION:** (Fig. 51-52) Body subparallel to elongate-oval. Head with ventral aspect of mentum without anterior excavate margin; subgena with anterior mandibular process slightly produced antero-mesally, apex sharp, obtuse. PRONOTUM with upper surface flattened, broadly convex; lateral margin evenly arcuate; upper mesal and lateral surfaces with minute sparse punctures; prosternal process in lateral configuration not produced behind procoxae; mesosternum modified with two obtuse anterior projecting elevations; metafemur, with mesal and lateral surfaces similar to pro, mesofemur; metafemur, with medial edge unmodified. ELYTRA (dorsal configuration): elongate, subparallel centrally serially punctate; laterally
serially punctate to subasperate. FEMALE: Coxites, apical aspect of 4th lobe sclerotized, glabrous; Spiculum ventrale configuration slightly longer than wide (Fig. 127). Internal cuticular structures with bursa copulatrix absent; spermathecal accessory gland very long, thin; spermatheca multiple very long, thin. MALE with posterobasal regions of meso, metafemur not modified with distinct raised tubercules. Aedeagus (Figs. 93-96): parameres with apex not spatulate ventrally, dorsoventral aspect of subapex angulate, convex (Fig. 95), apical setae greatly reduced, positioned ventral sublateral.

TYPES (All MCZC; Holotype: Q. seriata LeConte, S. Lucas, MCZC Type No. 4518, LeConte collection. Paratypes: no data, (3) LeConte collection; Nevada, Horn collection (H7244), C. seriata LeConte, (1); Cal, [yellow square] Horn collection (H7244), (1); Cal, Horn collection (H7244), (1); Cal, Horn collection (1).

MATERIAL EXAMINED (209 from the following 69 localities): MEXICO, BAJA CALIFORNIA SUR (202 specimens/ 61 localities) Cabo San Lucas (3), 9 mi. N, 1000' (2), 2 mi. NE (4), 4.0 km. NE 22109Aa, 15 m (2), rd. from San Lucas to Todos Santos (1); La Paz (2), 17.1 mi. S (16), 4 mi. E on road to Los Cruces (1), 14.5 mi. E on road to Los Cruces (1), 5.6 mi. E on road to Los Cruces (1), 15 mi. W (1), 16 mi. S (1); El Triunfo (3), 2 mi. NW (6), 7.5 mi. W (2); Todos Santos, 6 mi. E. (2), 14 mi. N (2), 11.2 mi. S playa Los Cerritos (1), 17 mi. N. Hondo wash (3); San Bartolo, 2.3 mi. SW (2), microwave station (2), 5 mi. W (2), 1.5 mi. NW (2), 15.0 km. W, 540m (1); San Perdito, 5.6 mi. SE (1); Valle Perdito, 8.8 km. NW 540m (2), 3.8 km. SE 549m (1); Miraflorres (5), 4.2 mi. W (5), 5 mi. S (3); San Pedro Dist. (10); San Pedro (25), 3 mi. N (2), 7 mi. S (2), 2.0 km. S (9); San Antonio Dist. (7); San Antonio (3), 2.6 mi. E (1); San Bartolome Dist. (1); San Jose del Cabo (4), 10 mi. SW (9), 12 mi. SW (1), 6 mi. N (1); Santa Rosa (8); Santa Anita, 7 mi. N (1); Santiago (2), 12 mi. N. (2), 11 mi. W 285m (4), 2 mi. S (2), 7 mi. W Sierra de la Victoria Mts., 1600' (2); Canyon San Bernardo, 9 mi. up, Boca De La Sierra, 1500' (3); Boca De La Sierra (3); San Jose Viejo, 3 mi. N (2); Migriff [Nigrino], 1 mi. E (1); La Burrera, 400-575m. (1); Punta Palmula, 1 mi. SW (5); La Rivera [La Ribera], 3 mi. N Agua Amarga (1); Las Cuevas, (5); Las Cruces 20.0 km. NW 120 m (5); Boca de Palmarita [probably south coast], 1-3m (1); St. Catarina, 1 mi. SW (1); La Huerta, 549m. (1), 2 mi. E (3). NO DATA: (3). N. AMERICA
The following are old, doubtful localities: ARIZ, CALIFORNIA (1). SO. CALIFORNIA (3). CALIFORNIA, San Diego (1). CALIFORNIA, Riverside Co. (2). LOWER CALIFORNIA (2); San Felipe (3).

DISTRIBUTION: (Fig. 53) Cape thorn forest and Gulf coast desert regions of the Cape area of Baja California Sur and Cerralvo Island.

LABEL BIOLOGICAL NOTATIONS: Cape Thorn, on ground at night, cape dry thorn forest, cape thorn forest, transition cape thorn, dune scrub, gulf coast desert.

_Cryptoglossa seriata_ **cerralvoensis** Aalbu NEW SUBSPECIES

(Figure 52)

DIAGNOSIS: _Cryptoglossa seriata seriata _cerralvoensis_ (Fig. 52) can be easily distinguished from _Cryptoglossa seriata seriata_ (Fig. 51) by its more confusedly asperate elytra. In _Cryptoglossa seriata seriata_ the elytra are centrally and laterally serially punctate, in _Cryptoglossa seriata cerralvoensis_ the elytra are distinctly laterally subasperate (Fig. 52). This subspecies is known only from Cerralvo Island, the type locality.

HOLOTYPE: Cerralvo Island, Ruffo Ranch, X-30-61, R. C. Banks and M. Soule cols. CASC.


DISCUSSION: It is unclear why Blaisdell, who mentions having examined at least three specimens from Cerralvo Island (1923:247), failed to notice this consistent difference in elytral sculpturing. The hypothesized origin of Cerralvo Island, along with other physical characteristics are discussed under _C. asperata_ Horn.
ASBOLUS LeConte

[Asbolus: Gr. soot, dirt]

Type Species: **Asbolus verrucosus** LeConte 1851:129


**KEY TO THE ADULT SPECIES AND SUBSPECIES OF ASBOLUS**

1. Pronotum inflated, gibbous; anterior mandibular process of subgena not produced antero-mesally, apex flat.................................2

1'. Pronotum not inflated, broadly convex; anterior mandibular process of subgena slightly produced antero-mesally, apex curved.................................A. mexicanus (Champion)........4

2. Pronotum evenly inflated, sculpturing finely punctate to smooth; elytral intervals smooth or finely granulate........................................3

2'. Pronotum with inflation forming distinct lateral gibbose lobes; sculpturing on mesal surface consisting of rugose granulations, upper lateral surface also with intermixed small, dense punctures; elytral intervals strongly tuberculate to verrucose, occasionally joined to form carinae (Fig. 61).........................A. verrucosus LeConte
3. Pronotum and elytra with surface sculpturing smooth except for row of granulate punctures on elytral pseudopileural margins; tarsal setation with long brushlike setae on lateral, apical aspects of tarsal segments (Fig. 114).................A. laevis LeConte

3'. Pronotum and elytra with surface sculpturing finely papillose; tarsal setation short spinose (Fig. 113) ........................................A. papillosus (Triplehorn)

4. Elytra with surface sculpturing smooth to granulose, intervals flat (Fig. 58)...............................

4'. Elytra with surface sculpturing with at least some intervals forming elongate tuberculations (Fig. 59) ................................A. mexicanus angularis (Horn)

SYNOPSIS OF THE GENUS ASBOLUS

BODY elongate-oval, black to bluish white. Head with apex of clypeus (apical aspect), straight, truncate; epistomal canthus slightly inflated laterally; eyes dorsoventrally elongate, narrowed at center to three facets in width; ventral aspect of mentum without anterior excavate margin; subgena slightly to not produced anterior-mesally; antenna with third segment subequal in length to next two segments; apical segments flattened, narrowly oval in cross section, base of apical segments (lateral configuration) wider than long, sensory area on terminal segment reduced, truncate (Figs. 56-57).

PRONOTUM with upper surface variable; prosternal process in lateral configuration deeply produced behind procoxae, ventral aspect broad, concave; metafemur with mesal, lateral aspects with sculpturing similar to pro, mesofemur; tarsal setation variable.

ELYTRA: elongate oval with upper surface sculpturing variable.

FEMALE: Coxites, apical aspect of 4th lobe set with thickened setae, not strongly sclerotized; ovipositor proportions (coxite-paraproct baculi, ventral length ratio) variable; spiculum ventrale configuration slightly longer than wide to wider than long. Internal cuticular structures with bursa copulatrix absent; spermathecal accessory gland long to very long, thick; spermatheca multiple very long and thin (Figs. 109, 111).

MALE with postero-basal regions of meso, metafemur
unmodified; apical invaginations on dorsal aspect of 8th sternite extending to center, central aspect angulate, as in Fig. 131. Aedeagus (Figs. 65-84): base of median lobe (dorsoventral configuration) broad; lateral rods gradually joining toward apex; parameres with apical setae clearly visible, short, position dorso-lateral.

IMMATURE STAGES: (Mature Larva) Head with third antennal segment very small, not minute; epipharyngeal apical spicular configuration with 3 major lateral spicules; epipharyngeal central microspicules arranged in closely separated pairs as in Fig. 134; labrum with less than 37 mesal spicules; mandibles with dorsal aspect of left incisor lobe bidentate, without distinct toothlike process on dorsal-mesal surface. Prosternum (mesal cuticular surface), without presence of bare areas; protergal margins and prosternum moderately to strongly melanized. Abdomen, ninth abdominal tergum with lateral spicules irregularly arranged into two uneven rows.

Asbolus mexicanus (Champion)
(Figures 58-60, 65-72)

Asbolus mexicanus mexicanus (Champion) NEW COMBINATION
Cryptoglossa mexicana Champion 1884:73
Cryptoglossa m. granulifera Champion 1892:508

NEW SYNONYMY
Asbolus mexicanus angularis (Horn) 1894:414
NEW SYNONYMY AND COMBINATION
Cryptoglossa angularis (Horn) 1894:414

DIAGNOSTIC COMBINATION: (Figs. 58-59) Body elongate-oval. HEAD with subgena slightly produced anterio-mesally, apex curved. PRONOTUM with upper surface flattened, lateral margins subarcuate; upper mesal and lateral surfaces with minute sparse punctures; tarsal setation short spinose. ELYTRA: with surface sculpturing variable, smooth to granulose to intervals forming rough, elongate tubercules. FEMALE: Spiculum ventrale configuration slightly longer than wide. Internal cuticular structures with spermathecal accessory gland long, thick. MALE aedeagus (Figs. 65-72); parameres gradually tapering toward apex; apical setae clearly visible, short, position dorso-lateral. IMMATURE STAGES: (Mature Larva) Head with labrum with approximately 23 mesal spicules, spicules moderately short (approximately .12 mm). Protibia with few (<7) elongate, thin secondary spicules on anterior mesal basal aspect;
protergal margins and prosternum moderately melanized; Abdomen, ninth abdominal tergum with lateral spicules irregularly arranged into two unequal rows; spicules moderately short (approximately .12 mm).

TYPES: MEXICO; COAHUILA: Monclova, B.C.A. Col.IV.1., Cryptoglossa mexicana Champion: TYPE [orange label], SYNTYPE [blue label], Dr. Palmer col., (1) BMNH.

SYNTYPES: MEXICO; COAHUILA: Monclova, B.C.A. Col.IV.1., Cryptoglossa mexicana Champion: SYNTYPE [blue label], Dr. Palmer col., (2) BMNH.

Asbolus mexicanus mexicanus (Champion)

MATERIAL EXAMINED: (242 from the following 73 localities)
NO DATA: (1) TEXAS; EL PASO CO: El Paso, (6); Fort Bliss, (3). TEXAS; UVALDE CO: Sabinal (3), 16 mi. NW, (1). TEXAS; PRESIDIO CO: John's Guano Mine, 32 mi. NNW Presidio (1).
MEXICO; COAHUILA (46 specimens/11 localities): (1) Monclova, (3) Cueva de los Escavabos (base of Sierra de Mayran), (5) Cueva de la Herradura (10 km E Hermanas), (6) Cueva de los Grillos (base of Sierra de Mayran), (2) Cueva de Yeso, (base of Sierra de Mayran), (1) Cueva de las Animas (21 km. WNW Candela, 760m), 56 km. E Monclova, (16)
Cueva de Leon (Sierra de Santa Rosa, 52 km WNW Melchor Musquiz), (1) Matamoros, (1) Sierra de Los Burros, (11) Arroyo de la Zorra, (8) MEXICO; CHIHUAHUA: Cueva del Diablo (4 km W Salaicas), (1) MEXICO; DURANGO (5 specimens/2 localities); Cueva del Guano (Sierra de la
Espana, 20 km S Ciudad Lerdo), 33 km S Torreon, (3) Cueva de la Siguerita (Cerro Siguerita, near Rancho Descubridora), 40 km WNW Mapimi, (2). MEXICO; NUEVO LEON (28 specimens/7 localities): Grutas de Garcia (7 km NW Villa de Garcia, (1) Grutas de San Bartolo (16 km S Monterrey) (5), Grutas Sur de San Bartolo (16 km S Monterrey), (2) Cueva de Carrizal, 15 mi. SE Candela, (6) guano of Bat cave, (7) Sabinal Hildalgo, (1) Sabinal Hildalgo, Cave in bat dung, (6). COAHUILA; 5 mi. N Saltillo, (1) 7 mi. N Parras de la Fuente, (9).

DISTRIBUTION (Fig. 60) Asbolus m. mexicanus is broadly distributed the Chihuahuan desert and surrounding areas. Many specimens are known from caves (approximately 70 percent of material examined collected in caves).

LABEL BIOLOGICAL NOTATIONS: mentioned in Biology section.

Asbolus mexicanus angularis (Horn)

MATERIAL EXAMINED: (37 from the following 20 localities) ARIZONA; (1); PIMA CO., Ajo Mission, (1); Organ Pipe Nat., Mon., Dripping Springs, (2). CALIFORNIA; SAN DIEGO CO; Borrego cyn. (1). RIVERSIDE CO; (3 specimens/3 localities) Deep cyn. (1), 8 mi. N Jct. Deep creek & Horsethief creek (1); Carrizo Creek (1). IMPERIAL CO; 3.9 mi. N Walter’s Camp (3). BAJA CALIFORNIA NORTE: (10 specimens/5 localities) Rosarito, 6.2 mi NE (1); Catavina, 2.5 mi. NW (6) 2.1 mi. NW (1); Calamajue cyn. (1); Catavinacito (1). BAJA CALIFORNIA SUR: (19 specimens/9 localities) 4.9 mi. NE Mex. 1 on Hutomonte-San Jose rd. (2); La Paz (1), 23 km. W (1); Las Cuevas (5), .5 mi. N (1); 3.2 km S El Arco (2); Santiago (1); Cacahillas Mts., nr. La Paz, La Piedra Pintata (4); 48 km SW Santa Rosalia, rancho Candelaria area (2). BAJA CALIFORNIA SUR: ISLA PARTIDA (1).

LABEL BIOLOGICAL NOTATIONS: on dunes at night, in small cave at night, at night on ground, thorn scrub, [VIII-23-75, sandstone caves, kept alive until III-10-78], sandstone caves, ethylene glycol pitfall trap.

DISTRIBUTION (Fig. 60) Asbolus m. angularis is distributed in the Sonoran Desert regions from Southwestern Arizona in the north to the thorn forests of the Cape region of Baja California Sur. Asbolus m. angularis, like S. nunenmacheri, has been rarely collected except in some localized areas. Only very few specimens are known from the northern part of its range in Arizona and California.
where specimens are sometimes confused with *S. laticeps*, which are more abundant. *Asbolus m. angularis* is more commonly encountered in Baja California Sur.

**BIOLOGICAL NOTES:** Like *Asbolus m. mexicanus*, many specimens of *Asbolus m. angularis* have been found in caves. This species was collected abundantly on the ceiling of a small cave at night near Catavina, Baja California Norte.

**DISCUSSION:** After careful examination of all specimens, I see no validity in retaining *A. m. granulifera* as a valid subspecies. This variation of *Asbolus m. mexicanus* was described as having the elytral intervals with granular punctations instead of smooth. As previously mentioned by Triplehorn (1964) occasional localized populations can have individuals which together exhibit the full range of elytral sculpturing from smooth to granulate elytral intervals. It is also notable here that many large series of *Asbolus m. mexicanus* from certain caves exhibit practically no deviation from smooth elytral intervals.

*Asbolus m. angularis* exhibits an even greater variation in elytral sculpturing. This ranges from having elytral intervals with only few elongate tubercules (found in specimens from Arizona), usually situated near the basal angles of the elytra, to specimens with most elytral intervals raised into uneven elongate tuberculate series, as in figure 59. Specimens from the Cape region of Baja California exhibit the greatest development in this sculpturing. One can recognize a transitional series from the Cape specimens to totally smooth *Asbolus m. mexicanus* specimens from the Chihuahuan desert. For this reason, I have synonymized *Asbolus angularis* under *Asbolus mexicanus*. It is retained as a valid subspecies for the following two reasons: 1, There is a distinct gap in distribution of the species formed by the mountain ranges of the continental divide creating a step cline; and 2, the male aedeagus (Figs. 65-72) of *Asbolus m. angularis* is consistently slightly different from that of *Asbolus m. mexicanus* in specimens examined in having a slightly broader apical aspect of the parameres (Fig. 71).

*Asbolus verrucosus* LeConte (1851:129)
(Figures 61, 64, 73-76, 109 & 130)

*Asbolus verrucosus* LeConte NEW COMBINATION
Asbolus verrucosa LeConte 1851:129
Cryptoglossa verrucosa LeConte, Horn 1870:280,
Cryptoglossa v. carinulatus Blaisdell 1945:25

NEW SYNONYMY

DIAGNOSTIC COMBINATION: (Fig. 61) Body elongate-oval, subglobose, black to bluish white. Head with subgena not produced antero-mesally, apex flat. PRONOTUM with upper surface strongly inflated, forming two lateral lobes; margins subarcuate; upper mesal surface with rugose granulations, upper lateral surface also with intermixed small, dense punctures; tarsal setation short spinose. ELYTRA: with elytral intervals strongly tuberculate to verrucose, occasionally joined to form carinae. FEMALE: Ovipositor proportions (coxite-paraproct baculi, ventral length ratio) with paraproct subequal to twice length of coxites. Spiculum ventrale configuration slightly longer than wide (Fig. 130). Internal cuticular structures with spermathecal accessory gland long, thick (Fig. 109). MALE aedeagus (Figs. 73-76): with lateral configuration of median lobes broad near subapex; parameres gradually tapering toward apex. IMMATURE STAGES: (Mature Larva) Head with labrum with approximately 36 mesal spicules moderately short (approximately .1 mm); Protibia with numerous (10+) elongate, thin secondary spicules on anterior mesal basal aspect; prosternum (mesal cuticular surface); protergal margins and prosternum strongly melanized; abdomen, ninth abdominal tergum with lateral spicules irregularly arranged into two uneven rows, spicules moderately short (approximately .1 mm).

TYPES: Holotype: [gold dot], Cryptoglossa verrucosus LeConte, MCZC Type No. 4514, LeConte collection. Paratypes: [gold dot], LeConte collection (4) MCZC; Cal. Horn collection H7238, (2); Ariz, Horn collection H7238, (4).

VII-7-41, [inYoensis det. Blais. PARATYPE], I. LaRivers col., (1) NSDA.

MATERIAL EXAMINED: (1948 from the following 388 localities). NO DATA: (15); CALIFORNIA: (21); CALIFORNIA (SOUTHERN): (5); CALIFORNIA (COLORADO DESERT): (13); CALIFORNIA, SAN BERNARDINO CO (252 specimens/58 localities): (8); Mojave desert, (9); Cadiz Sand Dunes, (27); Ibex Sand Dunes, (5); Kelso, 15 mi. SW (1); 8 mi. S (1); Kelso Sand Dunes, (12); Bell Mountain, (1); Baker, 17.5 mi. SE, Cronese Valley, (3); Cronese lk. (1); Twentynine Palms, (2); 23 mi. E (1); 6 mi. E Agric. Insp. Sta. Amboy Rd., 1900', (1); Stoddard Mt. 4 mi. S on Stoddard Well Rd., (1); Afton cyn. campg. (1); Helendale, (2); Amboy, 4.3 mi. W sand on lava flow, (7); 3.4 mi. W (5); Amboy Crater, (1); Dumont Sand Dunes, (2); at St. Hwy. 127, (5); Marble Mt. 1 mi. E Kelbaker rd. on gaspipe rd., (2); Ridgecrest, 9 mi. N, 10 mi. E 3000', (5); 3100', (4); Chubbuk, (2); Earp, (3); Saratoga Springs, Death Valley Nat. Mon., (15); Rice, 3 mi. W. sand dunes, (1); Newberry Springs, (1); Victorville, (1); Mojave Desert, Rt. 18 W (1); Pisgah Crater, (26); Joshua Tree Nat. Mon. (1); Indian Cove, JTNM (1); Barstow, (15); desert near (3); 15 mi. S (1); 10 mi. S (5); Dale Dry Lake, (18); Needles, (27); Llano, Mojave desert nr. (1); New York Mts., (1); Yermo, (4); 5 mi. NE (1); 6 mi. E, Mojave River dry bed, (6); Old Dale, (3); Old Dale Jct., 1.8 mi. NW (5); 1.7 mi. NW (2); Randburg, (1); Keys Ranch, (2); Waterman Cyn., (1); Col. River, (1); El Mirage Lake, (1); Providence Mts., (1); Vidal Jc., 10 mi. W (1); Zzyzx, 1 mi. S sand dunes, (2); Essex, (1); Long cyn., NW fork (2); Salt Springs, (1). INYO CO.: (371/45 localities): Cantil Fremont Valley, 4 mi. ESE 2000', (16); Balfarat, (2); Shoshone, (1); Olancha, 5 mi. NE (1), 5 mi. E sand dunes, (1); Chicago Valley, sand dunes 2300', (2); Lone Pine, 3 mi. N sand dunes, (1); Alabama Hills, 2 mi. N, 2 mi. W Lone Pine, 4400', (1); Keeler, 5 mi. SSE (1); Eagle Borax Works, (1); Stovepipe Wells, Death Valley Nat. Mon., (7), sand dunes near, (8); Saratoga Springs, Death Valley Nat. Mon., (3); Sheep Creek Springs, Death Valley, (3); Panamint Mts., (2); Death Valley, (14), sand dunes (2); Furnace Creek, Death Valley Nat. Mon., (4) [check#]; Armagosa Desert, (2); Mesquite Springs, Death Valley Nat. Mon., El. 1067m, (1); Salt Creek Wells, Death Valley Nat. Mon., (1); Panamint Valley, (1) Dunes, (11), dunes, 2600', (9); 15 mi. S Panamint City, (1); Panamint Springs, 10 mi. N, Panamint Valley, sand dunes, (1); Saline Valley, (12), 1360', (5), 1200', (8), 1100', (1), dunes, (26), dunes N.
of dry lake, 1000', (9), Warm Springs road, (6); Eureka Valley, (123) sand dune at S. end (1), sand dunes, 15.5 mi. N., 12 mi. W 4000', (3), 15 mi. N., 11 mi. W 3800', (4), 16 mi. N., 12 mi. W 4100', (22), 15 mi. N., 12 mi. W 4000', (1), 12 mi. N., 10 mi. W 3400', (8); Owens Lake Valley, (41); Olancha Dunes, S. end of Owens Lake, (1); Olancha, 5 mi. E Sand Dunes, (1); Baby Mt. 19 mi. N Ridgecrest, 2600', sand dunes, (2); Ridgecrest, 9 mi. N, 10 mi. E 3000', (1), (25/63 localities). (24); Imperial Valley, (12); Salton Sea, (1); Picacho, (2); Florence, 3 mi. S (1); Colorado river bank (1); Kane's Springs, Salton Sea, (1); Paymer Lake, 5 mi. E Calipatria, at check sta., (1); Calexico, 15 mi. E. (2); Westmoreland, (3); Salton, (1); Brawley, (3); Niland, (1); La Puerta, (30); Holtville, (6); 10 mi. E (1); Grays Well, (2); Salton Station, (1); Yuma, (1); El Centro, (15), near, (1); Ogilby, 5 mi. N (1), 6 mi. N (1), 3.5 mi. W [Algodones Dunes], 32 48'48"N 114 53'51"W (2); Coachella Bridge #1, 2.5 mi. NE 32 51'41"N 115 4'6"W (1); Coachella Bridge #3, 1 mi. E 33 2'59"N 115 14'10"W (1); Walter's Camp, 3.9 mi. N (15), 9.3 mi. S (8); Seeley, (4); Winterhaven, (2), 3 mi. E sand dunes, (1); Carrizo Creek, (2); Travertine Rock, (1); Ogilby Hills, El. 360', (4); Cargo Muchacho Mts., El. 480', (1), El. 440', (2); Wiley's Well rest area, (1); East Mesa Geothermal Site, 8.0 mi. ESE Holtville, El. 55', (6); Glamis [Algodones Dunes] (12), 5 km. S (1), 3.5 km. NW (5), 3 mi. NW (16), 3.5 km. SE (7), 6 mi. W (6), 7 mi. SE 32 55'20"N 114 59'14"W (4), 13.7 mi. NW 33 6'31"N 115 0'5"W (1), 7 mi. W (31) Coachella Canal, 7 mi. W (5), 1 mi. N (2), 1.5 mi. W (4), 10.5 mi. W (1), 1.5 mi. NW (1), 1.3 mi. W (1), 2.7 mi. NW (1), 5 km. N (4), 1 mi. W (1), 1 mi. W 105m, (4), 2.3 mi. N (2), 3 mi. NE (1), 2.7 mi. N. (3), 5.5 mi. S. El. 280', (1), 3.5 mi. WNW 280', (7), 2 mi. S (1). RIVERSIDE CO.: (438 specimens/65 localities) Riverside Co, (11) Riverside, (4); Blythe, (1); Indian Wells, (5); Ereda, 7 mi. SE (14); Riverside Mts., S side Riverside Pass Rd., (7); Blythe, (14), 1 mi. W sand dunes, (25), 3 mi. W (3), 18 mi. W (3), 22 mi. W (1); Thermal, (2); Indio, (44), dunes 2 mi. W. (1), 22 mi. S (1), termination of Dillon Rd. nr. (1), 4 mi. W (1), 4 mi. N (1); Palen Dry Lake, 3 mi. N sand dunes, (3); Palen Dunes, (7); Rice, 3 mi. S (1); Rice Dunes, (22); Anza, (1); 1000 Palms, (4), 3.7 mi. E (2), cyn., (1), 4 mi. E (2); 1000 Palms Oasis, 5 mi. E. 1000 Palms, (9); Salton, -265', (1); Salton Sea, (1), n. end (3), beach, (1); Dos Palmas, (1); Palm Springs, (38), nr. Date Grove, (1); Colorado Riv., (1), bet. Blythe & Yuma, (1); Cathedral City, (6); Deep Cyn., Palm Desert,
(1); Mecca, Salton Sea, (3); Ford's Wells, (3); Pahrump Mt., (1); Thermal, (1); Olmeno Well, (1); Desert Center, (2); Chuckwalla Mts., (2); Corn Springs, 7.5 mi. SE Desert Center, (2); Whitewater, (1); Coachella Valley, (8); Coachella, (12); Palm Cyn., (8); North Palm Spring, 3 mi. E (1); Valerie Jean, (2); La Quinta, (1); H. Minrl., 4.5 N (1); JTNM, Lower Covington Flat, (2); JTNM, Pinto Wash Well (2); JTNM, Squaw Tank, 7 mi. S (1), 1.7 mi. S (1), JTNM, Sunrize Well, (1); JTNM, Pleasant valley, (8); JTNM, Pleasant valley 1, (52); JTNM, Pleasant valley 2, (31); JTNM, Pleasant valley 3, (27); JTNM, Pleasant valley, Fried Liver Wash, (1). SAN DIEGO CO.: (110 specimens/27 localities) San Diego Co. (11), Fonts' Point, (2); Borrego Springs, (9), 3 mi. E, dump, (4), 5.4 mi. E (15), 3 mi. SE (3); Borrego, (19); Borrego St. Pk., sand dunes near dump, (2); Sentenac Cyn., (1); Julian, (1); Chula Vista, (1); La Puerta, (9); Oceanside, (1); Carizo, (1); San Diego, (9); Clark Dry Lake, (1); Borrego Valley, (6); Borrego Mountain, (1); Coyote Cyn., Anza Borrego St. Pk., (3); an Felpe Cr., (2); Borrego Desert sand dunes, (1); Agua Caliente Sp., (1); Anza Desert, (1); Sheep cyn., Anza Borrego St. Pk., (2); Fonts' Point, sand dunes, (2); Vallecito Mts., (1); Mason Valley, (2). KERN CO.: (17 specimens/8 localities) Ridgecrest, 6 mi. N, 2 mi. W 2200', (3); Cantil, (6), 4 mi. ENE, Fremont Valley, Koehn Dry Lake, 1940', (1); Inyokern, 4 mi. W (1); Red Rock Cyn., (1); Bakersfield, (1); Mojave, (1); Calienta, (3). LOS ANGELES CO.: (37 specimens/14 localities) Los Angeles Co. (7); Black Butte, Antelope Valley, (6); Elizabeth Cyn., (1); Lovejoy Buttes, (1); Alpine Buttes, (2); Palmdale, 15 mi. NE (1); Los Angeles, (1); Topanga Cyn., (1); Lancaster, (9); Pasadena, (2); Kings River Cyn., (2); Piute Butte, (1); Dead Indian Creek, (1); Antelope Valley, (2). SISKIYOU CO.: Upper Soda Spring (1). LASSEN CO.: S. Red Rock, (1). MARIN CO.: (1 specimen) Paradise Cove (doubtful locality. NEVADA Buptal Sp. (1); Rox, (1). NEVADA, NVE CO.: (85 specimens/5 localities) Big Dune, Armagosa Desert, (31); Mercury, Nevada test site, (50); Armagosa Desert, sand dunes in (1); Pahrump, (2); Fairbank springs, Ash Medows, (1). LYON CO.: (1 specimen), Mason, 4500-5700'. CHURCHILL CO.: (3 specimens/2 localities) Sand Mt. 9 mi. W Frenchman, (1); Indian Lake, sand, (2). MINERAL CO.: (3 specimens/3 localities) 5 mi. N Mina, sand dunes, (1); Telephone Cyn., Pilot Mts., (1); Thorne, (1). LINCOLN CO.: (6 specimens/4 localities) Game Range Dunes, 23 mi. S Alamo, (2); Alamo, (2); Ash Medows, Fairbanks Ranch, 2300', (1); Jct. Hwy. 93-25, El. 4000', (1). CLARK CO.: (16 specimens/7 localities) Searchlight, (2);
Ill. Charleston Mts., (1) Las Vegas, (5), 8 mi. NE (1); Indian Springs, (4); Fort Mohave Indian Reservation, (2); Mesquite, (1). UTAH, (4); Morrissey, Utah Esp. Sta., (1). UTAH, KANE CO.: 3 mi. N Kanab (1). WASHINGTON CO.: (8 specimens/3 localities) Washington, 2 mi. E (1); St. George, (6); Terry's Ranch, Beaver Dam wash, (1). ARIZONA, (53). Palmerlee, (1). Quinlan Mts., (1). MOHAVE CO.: (8 specimens/4 localities) Littlefield, 3 mi. N, 7 mi. E, Virgin River, (4); Kingman, (2); Sandy Pt., Lake Mead, (1); Ft. Mohave, Mohave Valley, (1). YAVAPAII CO.: (2 specimens/2 localities) Camp Verde, (1); Prescott, (2). YUMA CO.: (127 specimens/20 localities) Yuma Co. (2); Bouse, 8.3 mi. N, (3), 1 mi. NW (3); Salome, 10 mi. SE (3); Yuma, (38), desert toward (26); Parker, 15 mi. SE (2), 18 mi. SE (1); Papago Wells, (11); Cibola, (4); Ligurta, (2); Welton, (4); Aztec, (4); Somerton, (4); Wenden, 12 mi. E (6); San Luis, 6 mi. N (1); Yuma Proving Grounds, (1); Hope, 10 mi. W (1); Ehrenburg, (1). BILL WMS. FORK, (10). PIMA CO.: (50 specimens/15 localities) Pima Co. (1); Tucson, (25), Santa Cruz River, (1) Papago Indian Res., (2), 16 mi. E (3), S. of (2); Baboquivari Mts., (2); Green Valley, (1); Continental (1); Pima Reservoir, (1); Organ Pipe Nat. Mon., (4); Ventana Cyn., Catalina Mts., (1); Lukeville, (1); Canada del Oro, 5300', (3); Ajo, 15 mi. S. (2). PINAL CO.: (24 specimens/6 localities) Superior, (1); Picacho, (8); Apache Jct., 30 mi. E (1); Riverside, (1); Casa Grande, nr. (1); Florence, (12). MARICOPA CO.: (77 specimens/25 localities) Desert Rose, (1); Gillespie Dam, (1); Phoenix, Tempe Desert, (32); 20 mi. E (1); Tempe, (13); Tempe Desert, (2); Wickenburg, 2 mi. E (1); Sentinal, 5 mi. W (1); El Mirage, (1); Buckeye, (2); Ajo, 14 mi. N (1); Verde River, (1); Mesa, (1); Ft. McDowell, 2 mi. S (1); Chandler, (1); Paradise Valley, (3); Scottsdale, (1), 5 mi. E, Papago Indian Res., (1); Aguila, (1); South Mt. Pk., (6); Tonopah rest stop, 18 mi. W. Tonopah, (1); Gila Bend, (1); Paloma, (1); Norton's, (2). APACHE CO.: (2 specimens/2 localities) (1) White Mts., 6500', (1). COCHISE CO.: (3 specimens/3 localities) Sam Simon (1); Huachuca Mts., (2). GRAHAM CO.: (1 specimen) Indian Hot Springs. SANTA CRUZ CO.: (2 specimens/2 localities) Madera Cyn., (1); Patagonia, (1). NEW MEXICO, HILDAIAGO CO.: (4 specimens/3 localities) Rodeo, (2), 9 mi. W (1); bet. Red Rock & Lordsburg, (1). MEXICO, SONORA: (119 specimens/26 localities) Sonora, (2); El Golfo, 6 mi. N. (2); Sonoyta, 50 mi. SW (1), 10 mi. W 1200', (1), 30 mi. SW 500', (1), 24 mi. SW (1); Puerto Penasco, (6); Benjamin Hill, 13 mi. S (2); Piacate Dunes, 8 km. E Gustavo Satevo, (2); San Luis, (1), 25 mi. S (3),
52 mi. E. (1); Huatabampo, (1); Hermasillo, at El Paso (1), 3 mi. N (1); Desemboque, (70); Estero de Sargente, 23 km. S Desemboque, (2); Cholla Bay, (9); La Choya, (3); Choya Bay, (1); 1/2 bet. Sonoyta & Punto Penasco, 500', (1); Quitorac, (2); Guaymas, (2); km. 93 on Mex. 15 S Guaymas, (1); Los Vidrios, (1); Ciudad Obregon, 16 mi. NE (1). BAJA CALIFORNIA NORTE: (98 specimens/27 localities)
Lower Cal., (2); Baja California Norte, (3); San Felipe, (21), 65 mi. NNW (1), 36 mi. N (3), 8 mi. N (2), 3 mi. N (2), 12 mi. S. (1); Sulfur Mine, 23 mi. S (5), 5 mi. N (4), 15 mi. S. (9), 27 mi. N. (1); Laguna de Salada, (2); San Fransisquito Bay, (1); Mexicali, (1); Calexico, (1); Los Medanos, (1); Punta San Felipe, 5 mi. NW (1); Parsebu, (1); Guadalupe Cyn., Sierra Juarez, (1); San Felipe Valley, sand dunes, S end Diablo dry lake, (9); Bahia San Luis Gonzaga, (2); Santa Rosa, (3); La Ventana, (1); Las Arrastras, 7 mi. N. (2); Punta San Fermin, (1); La Puerta (17). [Doubtful Localities]: NEW MEXICO: Roswell, (I doubt this locality CAT '70) (1) NEW MEXICO: Taosca, Taos Ski Valley, 9500', along Rio Hondo, 19 mi. N. Taos, (2). TEXAS: (2); COL.? (2).

DISTRIBUTION: (Fig. 64) This species has a wide distribution in and around the Sonoran Desert region ranging from Churchill County Nevada in the north to San Fransisquito Bay in Baja California and Huatabanpo in Sonora.

LABEL BIOLOGICAL NOTATIONS: under trash; ground, late pm; shade wash, afternoon; indian fish traps; under salt bush; under rock; under debris; on ground; bee hive on ground; in fallen palm; sandy arroyo; boards; cotton; board; cowchip; hanging bait; ex. debris; rotten saguaro; on bales near alfalfa field; under alfalfa bales; dead saguaro; mesquite area; under stones; ex. Gossypium; ex. caborca; under burlap bags; ex. barley field; on sand dune among Larrea; BL; beneath larrea div.; under railroad tie; on dunes at night; ex. lupinus; ex. pluchea; ex. Plantago sp.; mesquite creosote; ground trap; can trap; pit fall; pit trap; sift; pitfall trap among Oryzopsis; ethylene glycol pitfall trap at base of palo verde; on sand dune, sand dune with creosote and sand verbenas; along wash in Creosote-Hymenoclea; among Erigonium; in grassy riparian side canyon; edge of wash, sandy soil among Larrea divaricata; desert wash; coarse sandy loam soil; sandy wash; rocky hillside; Atriplex scrub association (A); Sarcobatus-Atriplex-Parryi association (SAP); Sarcobatus-Atriplex-Confertifolia association (SAC); Atriplex-
Franseria association (AF); cereal bowl pitfall trap under Petelonyx thurberi; on sand dune; under creosote; walking dunes at night; walking dunes at midday.

BIOLOGICAL NOTES: This species is discussed in the section "Biology". Asbolus verrucosus is recorded as the longest lived cryptoglossine with a 7 year adult life.

DISCUSSION: Asbolus verrucosus is a very distinct species easily distinguished by the shape and sculpturing of the pronotum and elytra. Blaisdell's (1945:25) subspecies C. v. carinulatus has been distinguished by the tubercules on the elytral intervals being fused to form subcostate carinae which are more or less continuous. Specimens of Asbolus verrucosus which form this type of elytral sculpturing have been previously recorded from the Death Valley area of Inyo County, California. Triplehorn (1964), with 4 unvarying specimens available for study, justifiably believed these supported the retainment of the subspecies name. However, with many additional specimens to examine from Inyo County and surrounding areas, I have found this type of elytral sculpturing variable enough to not justify the retainment of A. v. carinulatus. Certain populations tend to be fairly constant in this type of elytral sculpturing (as those from Death Valley and Ibex Dunes) while in many others, the full range in sculpturing can be found. Furthermore, specimens from the areas of Bahia San Luis Gonzaga and San Fransisquito Bay, the most southern range of the species in Baja California Norte, also exhibit this type of carinate sculpturing.

Asbolus papillosus (Triplehorn)
(Figs. 62, 77-80, 85, 113, 126)


DIAGNOSTIC COMBINATION: (Fig. 62) Body elongate-oval, subglobose, black, opaque. Head with subgena not produced anterio-mesally, apex flat. PRONOTUM with upper surface inflated, subglobose; lateral margins arcuate; upper mesal and lateral surfaces with very few minute punctures; tarsal setation short spinose (Fig. 113). ELYTRA: surface sculpturing with sparse, granular elevations. FEMALE: ovipositor proportions (coxite-paraproct baculi, ventral length ratio) with paraproct subequal to twice length of coxites. Spiculum ventrale configuration slightly longer
than wide (Fig. 126). Internal cuticular structures with spermathecal accessory gland long, thick. MALE aedeagus (Figs. 77-80): parameres tapering toward apex, sides almost straight.


MATERIAL EXAMINED: (130 from the following 31 localities). CALIFORNIA: (3). CALIFORNIA, IMPERIAL CO. (42 specimens/18 localities): Yuma (2); Algodones Dunes, 0.75 mi. E Coachella Drop No. 1, (1), 2.5 mi. NE Coachella Bridge No. 1, (1), Glamis (16), 3.5 mi. SE (Algodones Dunes) (4), 3 mi. N (1), 7 mi. NW (1), 7 mi. SE (Algodones Dunes) (1), 6 mi. NW (Algodones Dunes) (1), 13.7 mi. NW (Algodones Dunes) (1), Sand Hills 5 mi. SW (1), 1 mi. W el. 105' (1), 2.7 mi. NW (5), 1.3 rd. mi. W (1), 3.5 mi. WNW el. 280' (2), 6.2 mi. W, el. 300' (1); Grey's Well, Colorado Desert (1). RIVERSIDE CO: Blythe, 3 mi. W (1). SAN BERNARDINO CO. (75 specimens/6 localities): Kelso Sand Dunes, 8 mi. SW Kelso, 2500' (11); Ibex Sand Dunes, D.V.N.M. (4); Krammer Hills, blow sand (2); Dumont Dunes (1); Afton Rd., 23 mi. SW Baker (56); Kelso, 2 mi. S (1). KERN CO. (3 specimens/2 localities) Boron (2); .5 mi. N, 2300' (1). MEXICO, SONORA: (4). [doubtful localities]: CALIFORNIA, MONO CO: Mammouth (1); ARIZONA, Tucson (1).

DISTRIBUTION: (Fig. 85) *Asbolus papillosus* is only known from inland sand dunes in the Colorado and Mojave subregions of the Sonoran Desert region. It is recorded from the following dune fields in California: San Bernardino County, Ibex Dunes near Saratoga Springs, Death Valley National Monument; Dumont Dunes; Devil's Playground (Kelso Dunes); Imperial County, Algodones Dunes. Although the species is recorded from Sonora, no specific locality is given. It is my belief that this species, like the following sympatric species *A. laevis*, is distributed at least as far south as the Grand Desierto of Sonora. Both the Algodones Dunes in California and the Grand Desierto of Sonora are believed to have been formed from the Cenezoic Colorado River delta sediment (Merriam 1969).

BIOLOGICAL LABEL NOTATIONS: sand dunes, sand dune ascc., blow sand, cereal bowl pit trap, walking dunes at night, pit trap in *Ephedra* area, night on sand.

BIOLOGICAL NOTES: In areas where *Asbolus papillosus* and *A.
laevis occur sympatrically (as in the Algodones Dunes), Asbolus papillosus has been much less frequently collected (see Biology). In areas where only Asbolus papillosus is found (as Ibex, Dumont and Kelso Dunes), the species is much more abundant. The relationship between A. laevis and A. papillosus is discussed in the section on Biology.

DISCUSSION: This species was described from three specimens by Triplehorn (1964:48) as a subspecies of A. laevis. This subspecies was characterized by the granulate punctures on the elytra and more dull luster than A. laevis. Close examination of genetalia and other internal structures has revealed two quite distinct species (see discussion in Biology section).

**Asbolus laevis LeConte**
(Figs. 63, 82-84, 86, 111, 114, 125,)

**Asbolus laevis** Leconte, 1851:130. NEW COMBINATION

*Cryptoglossa laevis* Leconte, 1851:130;

**Cryptoglossa l. subsimilis** Casey 1924:308.

**DIAGNOSTIC COMBINATION:** (Fig. 63) Body elongate-oval, black, glabrous. Head with subgena not produced antero-mesally, apex flat. **PRONOTUM** with upper surface inflated, subglobose; lateral margins arcuate; upper mesal surface impunctate; lateral surface with very few minute punctures; tarsal setation with long brushlike setae on lateral, apical aspects of tarsal segments (Fig. 114).

**ELYTRA:** with surface sculpturing smooth except for row of granulate punctures on pseudepipleural margins. **FEMALE:** ovipositor proportions (coxite-paraproct baculi, ventral length ratio) with paraproct only slightly longer than coxites; spiculum ventrale configuration slightly wider than long (Fig. 125). Internal cuticular structures with spermathecal accessory gland very long, thick (Fig. 111). **MALE** aedeagus (Figs. 82-84): lateral configuration of median lobes broad near subapex; parameres broad, gradually tapering toward apex.

**TYPES:** ARIZONA, **subsimilis,** Casey, Casey bequest 1925, TYPE No. 46371, USNM.

**MATERIAL EXAMINED:** (743 from the following 104 localities). CALIFORNIA: (2); Colorado Desert (5).

CALIFORNIA, IMPERIAL CO. (526 specimens/50 localities):
Imperial Co., (13); Imperial Valley, (1); Seeley, (4); Colorado Desert, Holtville, (2); East Mesa Geothermal Site, 8.0 mi. ESE Holtville, El. 55, (7); 10 mi. E Holtville, (1); Algodones Dunes, 12.4 mi. ESE Holtville, 32 44'34"N, 115 11'53"W, Site 30, (1); 12 mi. W Winterhaven, (7); 14 mi. W Winterhaven, (1); Winterhaven, (3); Grey's Well, (2); 10 mi. W Bradley, (1); 5 mi. W Ogilby, Glamis sand dunes, (5); 29 mi. E Calexico, sand dune area, (1); Westmoreland, (4); sand hills W of Yuma, Ariz., (3); Algodones Dunes, 2 mi. SW Cactus, 32 50'00"N, 114 54'48"W, Site 5, (1); Algodones Dunes, 3.5 mi. W Ogilby, 32 48'48"N, 114 53'51"W, Site 6, (2); Algodones Dunes, 4 mi. SSW Ogilby, 32 45'35"N, 114 51'32"W, Site 7, (2); Algodones Dunes, 5.25 mi. WSW Ogilby, 32 47'30"N, 114 55'19"W, Site 8, (1); Algodones Dunes, 1 mi. NE Osborne Park, 32 59'44"N, 115 8'35"W, Site 22, (1); Algodones Dunes, 5.5 mi. SE Hwy 78 on Sand Highway, 32 54'57"N, 115 7'3"W, Site 23, (1); Algodones Dunes, 2.5 mi. NE Coachella Bridge No. 1, 32 51'41"N, 115 4'6"W, Site 24, (1); Algodones Dunes, 0.75 mi. E Coachella Drop No. 1, 32 40'37"N, 114 58'33"W, Site 25, (2); Algodones Dunes, 1.5 mi. SW Coachella Bridge No. 1, 32 50'3"N, 115 7'11"W, Site 29, (3); Algodones Dunes, 3.5 mi. N Coachella Bridge No. 3, 33 5'48"N, 115 7'26"W, Site 32, (1); Algodones Dunes, 1 mi. E Coachella Bridge No. 3, 33 5'48"N, 115 14'10"W, Site 33, (1); Algodones Dunes, 5.1 mi. SE Coachella Bridge No. 3, 33 0'13"N, 115 11'17"W, Site 34, (1); Glamis, (187); 3.5 mi. NW Glamis, Algodones Dunes, (10); 3 mi. NW Glamis, (11); 5 mi. N Glamis (6); 6.2 mi. N Glamis, (2); 8 mi. N Glamis, (1); 1.3 rd. mi. W Glamis, (21); 1 mi. W Glamis, el. 105 m, (15); 2.3 mi. W Glamis, (1); 6 mi. W Glamis, (4); Coachella canal, 7 mi. W Glamis, (3); 3 mi. NE Glamis, (1); 1.8 SW Glamis, (1); 2.7 mi. NW Glamis, (18); Algodones Dunes, 9.5 mi. NW Glamis, 32 4'27"N, 115 12'45"W, Site 37, (1). 3.5 mi. WNW Glamis, el. 280', (119); Algodones Dunes, 3.5 mi. SE Glamis, 32 57'4"N, 115 1'59"W, (22); Algodones Dunes, 7 mi. SE Glamis, 32 55'20"N, 114 59'14"W, Site 4, (12); Algodones Dunes, 6 mi. SSE Glamis, 32 55'29"N, 114 59'41"W, Site 12, (1); Algodones Dunes, 3.5 mi. S Glamis, 32 55'45"N, 115 2'36"W, IV-13-79, Site 18, (1). 3 mi. NW & 1.4 mi. SW Glamis, (3); Sand Hills 1 mi. W Glamis, (14). SAN BERNARDINO CO (3 specimens/3 localities): Barstow, (1); Lucerne Valley, (1); Morongo Valley, (1). LOS ANGELES CO (2 specimens/2 localities): Little Dalton Canyon, (1); Gorman, (1). RIVERSIDE CO (50 specimens/9 localities): 3 mi. W Blythe, (14); Indian Wells, (1); Palm Springs, (1); Indio, (25); Thousand Palms, (2); 3 mi. W Indio, (2); 4 mi. W Indio,
Coachella Valley, sandy arroyo, (3); 18 mi. S Palm Springs, (1); Salton Sea, (1). SAN DIEGO CO (66 specimens/12 localities): San Diego Co., (1); Borrego Desert, sand dunes, (4); Borrego State Park, sand dunes near dump, (3); Borrego State Park, (1); Borrego Springs, (4); Fonts Point, (2); Borrego, (44); Borrego Valley sand dunes, (2); Anza Borrego, Clark lake, (2); on county rd. 52, Anza Borrego St. Pk., (1); 3 mi. W Borrego Springs, (1); 3 mi. E Borrego Springs, (1). ARIZONA, (3). ARIZONA, YUMA CO (7 specimens/3 localities): Yuma, (6); 10-15 mi. NE Yuma, (1); Roll, (1). MEXICO, BAJA CALIFORNIA NORTE, (32 specimens/9 localities): 65 mi. NNW San Felipe, sand dune, (7); Los Medanos, (12); 23.9 km. W Mexicali at km 23.9 on Mex. Hwy. 2, (1); 65 mi. N San Felipe, (6); 66 mi. N San Felipe, 25', (1); 10.3 mi. SW Los Medanos, el. 4m, (1); km. 88, 60 mi. S Mexicali, (1). Los Medanos Dunes, 66 mi. N. San Felipe, El. 50', (2); Laguna Salada, (1). MEXICO, SONORA, (47 specimens/12 localities): Sonora, (1); 50 mi. SW Sonoyta, sand dune, (9); 5 mi. E Puerto Penasco, sand dunes, (1); Bahia Cholla, (2); 25 mi. S San Luis, (2); Puerto Penasco, (1); 30 mi. SW Sonoyta, 500', (7); 102 mi. W Sonoyta, (1); 83 km. S Organ Pipe Monument, (1); Cholla Bay, (1); vic. La Salina, Bahia San Jorge, coastal sand dunes, (4); 24 mi. SW. Sonoyta, (17).

DISTRIBUTION: (Fig. 86) Like A. papillosus, A. laevis is restricted to sand dunes. Although A. laevis does not occur on some of the more northern dunes where A. papillosus is found, the range of A. laevis presently extends somewhat south of that of A. papillosus.

LABEL BIOLOGICAL NOTATIONS: walking dunes at night, cereal bowl pit trap, ex. sand dune, pitfall at night, near creosote bush, sand dunes, sand dune assoc., sand dune area, night on sand, blacklight trap, sandy arroyo, sand dunes near dump, on sand dune at night, sifted from sand under plants on dunes.

BIOLOGICAL NOTES: The biology of this species is discussed in "Biology".

DISCUSSION: This distinct species can easily be recognized by the smooth sculpturing of the upper surface and the tarsal setal modifications for psammophilic digging.

SCIZILLUS Horn
SCHIZILLUS Horn

[schizo Gr. cleft, split; illos Gr. squinting, looking obliquely]

Type Species: Schizillus laticeps Horn 1874:33


KEY TO THE ADULT SPECIES OF SCHIZILLUS

1. Third segment of antenna subequal to next three combined; apex of clypeus (apical aspect), horizontal, truncate; lateral aspect of metafemur smooth, impunctate; aedeagus (dorsoventral configuration) with subapex of parameres angulate; females with spermathecal accessory gland long (Fig. 88).....................S. nunenmacheri Blaisdell

1'. Third segment of antenna subequal to next two combined; apex of clypeus (apical aspect), strongly deflexed over labrum; lateral aspect of metafemur punctate, not smooth; aedeagus (dorsoventral configuration) with subapex of parameres angulate; females with spermathecal accessory gland short (Figs. 89 & 112).....................S. laticeps Horn

SYNOPSIS OF THE GENUS SCHIZILLUS:

BODY elongate suboval. HEAD with apex of clypeus (apical aspect), straight, truncate to strongly deflexed over labrum; epistomal canthus strongly inflated laterally; eyes with dorsal and ventral portions completely divided; subgena with anterior mandibular process broadly produced antero-mesally, apex obtuse. Antenna with base of apical segments (lateral configuration) longer than wide (Fig. 87), in cross section flattened, narrowly oval; third segment variable; terminal segment with sensory area subtriangular (Fig. 87). PRONOTUM with upper surface flattened, broadly convex; upper central surface with small to minute punctures, lateral surface with small, sparse punctures; prosternal process strongly, broadly produced behind procoxae, ventral aspect broad; metafemur
Type Species: Schizillus laticeps Horn 1874:33


KEY TO THE ADULT SPECIES OF SCHIZILLUS:

1. Third segment of antenna subequal to next three combined; apex of clypeus (apical aspect), horizontal, truncate; lateral aspect of metafemur smooth, impunctate; aedeagus (dorsoventral configuration) with subapex of parameres angulate; females with spermathecal accessory gland long (Fig. 88) .................... S. nunenmacheri Blaisdell

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BODY elongate suboval. HEAD with apex of clypeus (apical aspect), straight, truncate to strongly deflexed over labrum; epistomal canthus strongly inflated laterally; eyes with dorsal and ventral portions completely divided; subgena with anterior mandibular process broadly produced antero-mesally, apex obtuse. Antenna with base of apical configuration) longer than wide (Fig. 87), in cross section flattened, narrowly oval; third segment variable; terminal segment with sensory area subtriangular (Fig. 87). PRONOTUM with upper surface flattened, broadly convex; upper central surface with small to minute punctures, lateral surface with small, sparse punctures; prosternal process strongly, broadly produced behind procoxae, ventral aspect broad; metafemur mesal aspect with sculupturing similar to pro, mesofemur, lateral aspect variable; tarsal setation short, spinose.
mesal aspect with sculpturing similar to pro, mesofemur, lateral aspect variable; tarsal setation short, spinose. ELYTRA in dorsal configuration suboval to elongate suboval; surface sculpturing with irregular submuricate punctures; Sternal sculpturing variable. FEMALE with apical vestiture of 4th lobe of coxites consisting of very short, strongly sclerotized, thick, peglike spicules (Fig. 112); ovipositor proportions (coxite-paraproct baculi, ventral length ratio) paraprocts subequal to twice length of coxites; spiculum ventrale slightly but distinctly longer than wide (Figs. 128-129). Internal cuticular structures with bursa copulatrix absent; spermathecal accessory gland thick, length variable; spermatheca multiple very long and thin (Fig. 112). MALE with postero-basal regions of meso, metafemur unmodified; apical invaginations on dorsal aspect of 8th sternite extending to center, central aspect angulate (Fig. 131). Aedeagus (Figs. 101-108), base of median lobe (dorsoventral configuration) broad; lateral rods (dorsal aspect) abruptly fused at base; lateral configuration of median lobes broad near subapex; parameres broadly tapering toward apex; apical vestiture with setae greatly reduced, visible only at high magnification, positioned laterally. IMMATURE STAGES: (Mature Larva) Head with third antennal segment very small, snot minute; epipharyngeal apical spicular configuration consisting of 3 major lateral spicules; epipharyngeal central microspicules arranged in closely separated pairs; labrum with many (+40) medial spicules, spicules long (+.20 mm); mandibles with dorsal aspect of left incisor lobe bidentate, without distinct toothlike process on dorsal-mesal surface. Prosternum (mesal cuticular surface), with bare areas absent, unmelanized to slightly melanized. Abdomen, ninth abdominal tergum with lateral spicules irregularly arranged into two uneven rows; spicules long (+.20 mm).

**Schizillus laticeps** Horn (Figures 89, 91, 105-108, 112 & 128)

**Schizillus laticeps** Horn 1874:36. Blaisdell, 1921:201; Casey, 1924:307; Parker, 1955:150.

**Schizillus convexus** Blaisdell 1921:203 Parker, 1955:150. NEW SYNONYMY

**Schizillus lomae** Blaisdell 1921:206
Parker, 1955:150. NEW SYNONYMY

Schizillus opacus Casey 1924:307
Parker, 1955:150. NEW SYNONYMY

DIAGNOSTIC COMBINATION: (Fig. 89) HEAD with apex of clypeus strongly deflexed over labrum; Antenna with third segment subequal in length to next two segments. PRONOTUM with upper surface flattened, narrowly convex; upper central surface with small to minute punctures, lateral surface with small, sparse punctures; lateral aspect of metafemur, not smooth, impunctate, similar to mesofemur; ELYTRA suboval in dorsal configuration, slightly elongate; surface sculpturing with irregular submuricate punctures; Sternal sculpturing punctate to smooth. FEMALE: Spiculum ventrale configuration slightly longer than wide (Fig. 128). Internal cuticular structures (Fig. 112) with spermathecal accessory gland thick, short. MALE aedeagus (Figs. 105-108): median lobes (lateral aspect) broad near subapex; parameres in dorsal configuraton with parameres broadly rounded near apex, not angulate (Fig. 107). IMMATURE STAGES: (Nature Larva) labrum with many (approximately 46) medial spicules, spicules long (.25 mm). Protibia with numerous (10+) elongate, thin secondary spicules on anterior mesal apical aspect. Abdomen, ninth abdominal tergum with lateral spicules irregularly arranged into two uneven rows; spicules long (.25 mm).

TYPES: Schizillus laticeps Horn, Holotype, MCZC type No. 4520, LeConte collection. Lectotype [designator unknown]: Schizillus laticeps Horn, MCZC Lectotype No. 8008.

PARATYPES: Paratypes: Cala, LeConte collection, (1) MCZC; Cala, L.Cal., Reinecke col., LeConte collection, (1) MCZC; Cal. Horn collection H7246 (1). Schizillus opacus Casey: Holotype: Las Vegas Nev., Tom Spalding, USNM Type No. 46370, Casey bequest 1925. CALIFORNIA, Paratype 8008, (1) ANSP; SYNTYPES: CALIFORNIA; Crotch, Syntype, Schizillus laticeps Det. Horn. (1) BMNH; CALIFORNIA; F. Bates, 87-19, Syntype, Schizillus laticeps type, Det. Horn. (1) BMNH; Schizillus laticeps n. gen et spec. very rare, Sharp Collection 1905-313, Syntype, (1) BMNH. TOPOTYPES: CALIFORNIA, Mojave Desert, typical species 1, laticeps, 7246, Fenyes, (1) FMNH; CALIFORNIA, San Bernardino Co., Summit Canyon, typical species, X-1885, laticeps, under yucca trunks, 7246, Fenyes, (1) FMNH.

MATERIAL EXAMINED: (892 from the following 114 localities). CALIFORNIA, (1); Southern, (4); Coso Valley,
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(3); CALIFORNIA, SAN BERNARDINO CO. (446 specimens/ 56 localities): (3); Mitchell Caverns State Park, Mitchell Caverns, El. 4400' (7); Mitchell Caverns State Park, Park Headquarters, spring area, El. 4300' (1); Kingston Range, 1.1 mi. NW Road Summit, (2); Gold Valley, 1.3 mi. S Mid Hills campg. (27); Clark Range, Mohawk Hill, (6); Cima, (1); Hesperia, (18); 10 mi. S Cajon Pass, (1); Joshua Tree, (3); Keystone canyon, (1); Deep Creek public camp. (1); Ord Mts., (1); Barstow, (1); near Barstow, (2); Mojave, Deep Creek campg. (1); Cajon Pass, (18); Cajon Pass, 11 mi. W Victorville, (2); Providence Mts., (6); Adelanto, Mojave Desert, (3); Mt. Pass, (2); n. edge Mojave Desert, (2); Calhoun, 4-5000', (2); Phelan, (5); March's Ranch Rd., 2 mi. E. Balwin Lake, 5-6000', (4); Ivanpah Mts., 11 mi. S. Windmill, (2); 10 mi. S Barstow, (2); 2 mi. W 395, 8 mi. E Phalon, (1); 3.2 mi. N Toll Rd. P. C., (1); Providence Mountains, Cedar Canyon, (2); Granite Mts., nr. Cottonwood Springs, 5700', 5100' (13); Granite Mts., Granite Cove, 15 mi. SW Kelso, (1); Co., Victorville, (2); 3 mi. N Yucca Valley, (1); N of Baldwin lake, 5000', (1) Cedar canyon, .8 mi. E. Black canyon, near Kelso, 5535', (2); Mojave Desert, (1); Sky Valley, (1); San Bernardino Mts., Lucerne Valley, Crystal Rock Ranch, (1); Lucerne Valley, north slope, (31); Joshua Tree National Monument (JTNM), Pinyon Wells, (43) JTNM, Quail Guzzler, (22); JTNM, Lower Covington Flat, 5000'. (43); JTNM, Indian Cove, (1); JTNM, Upper Covington Flats, (10); JTNM, Pleasant Valley, Fried Liver Wash, (9); JTNM, Pleasant Valley 3, (10); JTNM, .7 mi S Squaw Tank, (9); JTNM, 3.7 mi S Squaw Tank, (1); JTNM, 4.7 mi S Squaw Tank, (1); JTNM, 5.7 mi S Squaw Tank, (1); Pisgah Crater, (8); JTNM, 49 Palms (palm oasis), el. 2800'. LOS ANGELES CO., (9 specimens/ 7 localities): Palmdale, (1); Pearblossom, (1); Eagle Rock, (1); Palmbats ?, (1); Tapia canyon, (1); Piute Butte, (1); Little Rock, Mojave Desert, (3); Juniper Hills, (1). RIVERSIDE CO., (7 specimens/ 6 localities): Whitewater Canyon, Berlese Neotoma at base of Prosopis, (2); Andreas Canyon, Palm Springs, (1); Riverside, (1); Indio, (1); JTNM, Cottonwood Springs, (1); Cactus Spring trail between Hwy 74 & Horsethief creek, Deep Canyon area, (1). FRESNO CO. (20 specimens/ 4 localities): 8 mi. NNW Coalinga, Los Gatos canyon, (1); 2 mi. W Fresno Co.–San Benito Co. line, Big Panoche, (17); Jacalitos Canyon, near Coalinga, (1); Fresno, (1). KERN CO., (16 specimens/ 12 localities): 4 mi. S Onyx, (2); Tehachapi, (1); A.B. (airforce base), 20 mi. SW Mojave, under juniper, (1); Red Rock canyon, (1); 5 mi. NW Dove Well, (1); Dove Well, (1); Dove Springs Canyon, 3/ 4 mi. N Ricardo, w of Hwy 6, (1);
Short Canyon, 6 mi. W. Inyokern, (1); Short Canyon, 6.5 mi. N Inyokern, (2); 7 mi. NW Inyokern, (1); NE El Paso Mts., (3); Red Rock, (1). SAN DIEGO CO., (3 specimens/ 3 localities): Mason Valley, (1); near Glomus ?, (1); Dos Cabezas Springs, (1). INYO CO., (374 specimens/ 18 localities): Panamint Valley, (1); Lava Beds, 4.5 mi. N Brown, (1); Tuttle Creek, 2 mi. SW Lone Pine, (1); 5 mi. N, 2 mi. W Bishop, 4500, (3); Panamint Range, Butte Valley, Anvil Spring, 4200', (2); 4 mi. N, 2.5 mi. W Deep Springs College, Gilbert Summit, 6400', (2); CDFA; Inyo Mts., Whipperswill Canyon, 61,6200', (3); Inyo Mts., Long John Canyon, 5600', (7); Grapevine Canyon Road, (289) Grapevine Canyon, Saline Valley, El. 3000-5700', (37); Saline Valley Dunes, (1); Owens Valley, Tuttle creek, 4350-4520', (12); Owens River, 4450', (1); Owens River Gorge, 4500', (5); Owens River, Lower Gorge, 4450', (5); Independence, (3) 3 mi. N. Trona, (1); 5 mi. W Westguard Pass, (1). ORANGE CO., Santa Ana, (1). ARIZONA, YAVAPAI CO., Yarnell Weaver Mts., (1); PIMA CO., Tucson, (1) [questionable locality]. NEVADA, NYE CO., (3 specimens/ 2 localities): 3 mi. N, 17 mi. E Tonopah, Monitor Summit, El. 6400', (2); 25 mi. E Tonopah, Toyabe Nat. For., caves, (1). ESMERALDA CO., (2 specimens/ 2 localities): (1); Chiatovitch Creek, Fish Lake Valley, (1). UTAH, WASHINGTON CO. 8 mi. W. Santa Clara, (2); MEXICO, BAJA CALIFORNIA NORTE, (3 specimens/ 3 localities): 2 mi. NW Santa Ynez Ranch, (1); 2.1 mi. N. Catavina, (1); 5 km. N. Catavina, Blue Palm Canyon, (3).

DISTRIBUTION: (Fig. 91) S. laticeps is very abundant especially in the Mojave desert area in San Bernardino and Inyo and parts of Kern, Los Angeles and Riverside counties. Isolated populations are found in Baja California Norte (Catavina area), and in Northern Fresno County (Big Panoche area).

LABEL BIOLOGICAL NOTATIONS: under rock, open ground, ethylene glycol pitfall trap near Neotoma nest, ethylene glycol pitfall trap, spring area, under logs, old can trap, under yucca trunks, ethylene glycol pitfall trap, Dow (Dowguard), Dupont (Xerex), Union Carbide (Prestone II), Berlese Neotoma at base of Prosopis, Ground trap, pitfall, under juniper.

BIOLOGICAL NOTES: Schizillus laticeps has been collected in higher elevations than any other species of cryptoglossine with locality notes of up to 1950 meters. This species is found commonly in most of the desert
mountain ranges in the Mojave Desert.

DISCUSSION: Blaisdell in 1921 (p. 201) listed what he considered to be the "salient generic characters" of Schizillus. These were: (1) "completely divided eyes, (2) transverse mentum, (3) broader genae, (4) front (frons) hemihexagonal and (5) antenna eleven segmented, first joint stout and invisible from above, terminal joint oval and smaller than the preceding". He stated, "in regard to the size of the eleventh joint, I must differ from Dr. Horn, for it is smaller than the preceding". Blaisdell also included a key, (p. 207) to separate the existing species of Schizillus. He redescribed S. laticeps from a series taken by J. Slevin in 1913, but apparently did not examine the type. I have examined a series (9) collected by Slevin in 1916 [California, San Bernardino Co., Hesperia, IX-24-16, J. R. Slevin col. CASC] and determined as Schizillus laticeps by Blaisdell. Blaisdell made the following comments: "in laticeps, the sculpturing resembles that observed in Eleodes consobrina LeConte; the epipleura are sparsely and very obsolescently punctate and smooth. It is a large and more elongate species with the abdomen very smoothly sculptured. Blaisdell suggested the following diagnostic characters for S. laticeps: "abdomen very finely and sparsely punctate; third joint about twice as long as wide, distinctly shorter than the next two taken together, fourth, fifth, and sixth subequal in length.

Blaisdell described Schizillus convexus from two female specimens. He mentioned that S. convexus differed from S. laticeps in: "body more convex and not so broad; body beneath much more densely and strongly punctate; pronotum more distinctly punctate, especially within the angles; and mentum less transverse, densely punctured, with the sides broadly arcuate and the surface at the apex impressed so as to make the margin appear slightly emarginate. The following diagnostic characters were suggested for the species: "abdomen very distinctly, rather closely punctured, punctures moderate in size; third joint distinctly twice as long as wide, fourth longer than fifth".

Blaisdell described Schizillus lomae from one specimen, a male. He suggested this species was "very distinct" based on the following characters: mentum "cordato-oval, slightly transverse, apex slightly emarginate, lobes acutely rounded into the broadly arcuate
sides; surface distinctly but not strongly convex, closely punctured, punctures moderate in size; and scutellum equilaterally triangular, short and transverse in all other species. The following diagnostic characters were suggested for the species: "humeri obsolete, elytra broadly oval and third (antennal) joint a little longer than fourth, the latter relatively longer than in *laticeps*'.

Casey described *Schizillus opacus* from a unique type of undetermined sex. He apparently did not examine the type of *S. laticeps*. Neither was he apparently aware of Blaisdell's earlier descriptions of other species. Casey listed the following differences between *S. opicus* and *S. laticeps*: "eleventh antennal segment rounded, obtusely pointed and much shorter and narrower than the tenth (in *laticeps*, eleventh antennal segment broadly oval, stouter than preceeding); mesosternum gently sloping, impressed and smooth medially as in *Cryptoglossa*, coarsely rugose along the edges (in *laticeps*, the mesosternum is "nearly vertical, emarginate in front")". Parker (1955:150) made the following comments concerning *S. opacus*: "the pronotum is relatively much more transverse, punctate, (than *S. beali*) and the legs are closely, strongly punctate". Parker did not examine the type.

*Schizillus laticeps* Horn is a fairly wide ranging, variable species. I have studied the types of all the taxa listed in the above synonymy. All the characters listed above by Blaisdell, Casey and Parker have proved to be detailed observations of few specimens and unreliable when tested with additional material. The sculpturing of the sterna mentioned above as a diagnostic character, appears to be a clinal variation, with specimens from Catavina (Baja California Sur) having inpunctate sterna. Specimens from Big Panoche (2 mi. W Fresno Co.-San Benito Co. line), the northernmost isolated population of *S. laticeps*, averaged somewhat larger in size than the norm for the species as a whole, being also somewhat more elongate. The genitalia of these proved identical to other populations.

*Schizillus nunenmacheri* Blaisdell

(Figures 88, 92, 101-104, 129, 134, 145)

*Schizillus nunenmacheri* Blaisdell, 1921:204; Parker, 1955:149,150.
Schizillus beali Parker, 1955:148-9. NEW SYNONYMY

DIAGNOSTIC COMBINATION: (Fig. 88) Body elongate suboval. HEAD with apex of clypeus (apical aspect) horizontal, truncate; antenna with third segment equal in length to next three segments combined. PRONOTUM with upper surface flattened, narrowly convex; upper central surface with small to minute punctures, lateral surface with small, sparse punctures; prosternal process broadly, deeply produced. ELYTRA with dorsal configuration suboval; surface sculpturing with irregular submuricate punctures; Sterna with sparse punctures. FEMALE Spiculum ventrale configuration slightly longer than wide (Fig. 129). Internal cuticular structures with spermaphcal accessory gland thick, long. MALE aedeagus (Figs. 101-104): with lateral configuration of median lobes narrow near subapex; parameres in dorsal configuraton angulate near apex (Fig. 103). IMMATURE STAGES: (Mature Larva) Head with labrum bearing many (approximately 40) medial spicules (Fig. 134), spicules long (approximately .22 mm); Protibia with few (<5) elongate, thin secondary spicules on anterior mesal aspect, none apically (Fig. 145). Abdomen, ninth abdominal tergum with lateral spicules irregularly arranged into two uneven rows; spicules long (.22 mm).

MATERIAL EXAMINED: (109 from the following 7 localities) CALIFORNIA, SAN BERNARDINO CO., Providence Mts. State Recreation Area Mitchell Caverns State Park, Mitchell Caverns, El. 4400', (99); Pisgah Crater, (2) INYO CO., Inyo Mts., Lead Canyon, El. 6000', (1); Rose Valley, 2 mi. N. Little Lake Fossil Falls, (1); Saline Valley, Grapevine Canyon Rd., (1); ARIZONA, COCONINO CO., 5 mi. N. Moenkopi, sand dunes/ dry canyon, (1) UTAH, GRAND CO., Arches Nat. Mon. Devils Garden Campg., (5). Specimens have been collected every month of the year.

DISTRIBUTION: Schizillus nunenmacheri is known only from the very few localities mentioned above with the addition of Goldfield, Nevada, the type locality.

LABEL BIOLOGICAL NOTATIONS: ethylene glycol pit trap, ethylene glycol pitfall trap near Neotoma nest, sand dunes/ dry canyon, found dead under canyon ledge.

BIOLOGICAL NOTES: The biology of this species is covered in the biology section "Pholeophily to Troglophily".

DISCUSSION: Blaisdell characterized Schizillus nunenmacheri by the following characters: (1) obsolete
sculpturing, (2) third antennal segment equal to next four together, (3) less rounded sides of pronotum (than *laticeps*), and (4) mentum smooth but partially hidden. Parker in 1955 described a new species of *Schizillus*, *S. beali* from two specimens (male & female) from the area around Moenkopi, Arizona. He listed the following diagnostic characters: (1) third antennal segment not quite as long as the following two and one-half segments, (2) mentum sparsely, coarsely punctate laterally and on apical half, (3) rectangular basal pronotal angles, (4) well formed strial punctures of the elytra and (5), shorter, broader, carinate prosternal process (than in *S. nunenmacheri*). Parker did not see the unique type of *Schizillus nunenmacheri* but examined loaned specimens of *S. laticeps*). Dr. Hugh Leech (Calif. Acad. Sciences) examined the holotype of *Schizillus nunenmacheri* and provided Parker with the following detailed observations on the two specimens: 1. *Schizillus nunenmacheri*: the antennal pubescence similar to *S. beali*; the third segment equal in length to next three combined (not four as mentioned by Blaisdell), antennal segments four, five, & six subequal; shorter and broader than in *S. beali*, apical half of mentum more coarsely and evenly punctate, basal angles of the pronotum slightly reflexed, less than rectangular, the marginal bead not interrupted medially, elytra more elongate and narrow, strial punctures virtually obsolete, interstitial tubercules well developed, the general effect thus seriate, the intervening areas quite smooth, prosternal process sulcate between the forecoxae, narrower and longer than in *S. beali*, with finer and more numerous punctures, mesosternum more abruptly declivous anteriorly and sides more strongly tuberculate and punctation of hind femora as in *S. beali*.

In the total of 109 specimens examined, all of these characters listed above were found variable (thus taxonomically useless) in specimens with the possible exception of the length of the third antennal segment. According to Parker's measurements of *S. beali*, the third antennal segment should be 83% the size of the next three combined. Forty three specimens were measured to determine the reliability of this character including 35 from Mitchell Caverns. The Mitchell Caverns (San Bernardino Co. Calif.) specimens ranged from a high of 104% to a low of 93% averaging 99.08%. The two specimens from Pisgah Crater (San Bernardino Co. Calif) were measured at 91% and 97%. Of the specimens from Inyo County, the Lead Canyon specimen measured 84%, the Rose Valley specimen 96%, and
the Saline Valley specimen 100%. The specimens from Arches, Grand County, Utah, measured 81%, 85%, and 88%. All these measurements seem to indicate a range between 81 to 104 percent although no measurements below 93% were found in the Mitchell Caverns specimens. Furthermore there seems to be a sexual difference with males averaging slightly higher percentages than females. Specimens from Arizona and Utah may be considered as the Painted Desert population of *S. nunenmacheri* which corresponds to *S. beali*. 
DESCRIPTION OF THE IMMATURE STAGES OF THE CRYPTOGLOSSINI

DESCRIPTIVE COMBINATION OF KNOWN IMMATURE STAGES:
MATURE LARVAE: (Figs. 115-121, 133-159) Length to 45 mm.,
body elongate, cylindrical, cream colored; mandibles,
tarsal claws, spicules on apex of abdomen, legs, and head
moderately to heavily sclerotized and melanized, dark
brown to black; base of labrum, membranous areas on
mandibles, apex and basal margins of pronotum, base of
clypeus, hardened structural parts of antennae, maxillae,
labium and prosternum, basal margins of meso, metathorax
and 8th abdominal segment with varying degrees of
sclerotization and melanization.
HEAD: (Figs. 133-142, 150-154, 156-157) Prognathous,
slightly depressed dorso-ventrally; cranium wider than
long, with very few sparse setae dorsally, anterior angles
truncate, cuticle smooth, cream colored, epicranial
suture very faint; lateral margins slightly inflated,
bearing numerous, long, setae; setae on dorso-lateral
margins only 1/3 to 1/4 as long, slightly thicker, as
those on ventro-lateral margins; subgena mesally with
cluster of long, slender setae. Antennae articulated on
prominences just ventral to anterior lateral truncate
margins of cranium; basal segment gradually expanded
toward apex; second segment shorter, gradually expanded
toward apex, sensorium semicircular; 3rd segment small to
minute, with short, slender seta mesally. Clypeus basal
lateral margins bearing few setae. Labrum with two
transverse, rows of setae: First row situated mesally,
composed of short, spicules; second row situated near
apex, composed of unevenly spaced, long slender setae,
mesally setae slightly less apical. Epipharynx (Figs.
133,134 & 142) anterior lateral margin with row of few
spicules directed anteromesally, row interrupted mesally
by thin, sparse setae. Mesal microspicules of epipharynx
variable. Mandibles (Figs. 135-136) with dorsal surface
strongly flattened, subconcave, produced laterally at base
with basal semimembranous patch on posterior dorsolateral
and ventro-lateral surface bearing numerous spicules;
spicules shorter, more robust on dorsolateral surface,
more elongate, slender on ventro-lateral surface. Right
incisor lobe bidentate with subapical tooth on ventral
surface; left incisor lobe bidentate to tridentate; molar

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surface slightly to moderately concave. Maxillary (Fig. 141) mala bearing numerous elongate spicules arranged in two rows interspaced with finer setae, spicules and setae directed anteromesally, finer, usually shorter, setae scattered on ventral, dorsal surfaces; maxillary palp with 2nd segment slightly longer than first, 3rd segment approximately equal to slightly shorter in length to first; articulatory surface between cardo and mentum inflated, surface denticulate. Labium (Fig. 141) with mentum subquadrate, prementum trapezoidal. Ligula (Fig. 137) with hypopharyngeal sclerome strongly sclerotized, varied in shape (Figs. 137, 150-154).

THORAX: Prothorax larger than meso- metathorax; prothorax, mesothorax with laterodorsal surface with scattered fine setae of unequal sizes, metathorax with only few scattered laterodorsal fine setae. Ventral aspects: Sternum broad, marked mesally with anteroposterior convex band of very fine tubercles, broadening toward mid-anterior margin of coxae, marked mesally with clump of long, fine setae, with or without distinct bare areas which are possibly sensory in nature; sternal-coxal-trochantin articulation areas sclerotized; procoxae nearly contiguous; trochantin subtriangular; postcoxale surface convex, enclosing coxae posteriorly to mid lateral region; ventral aspects of meso- metathorax as in Fig. 144. Prothoracic legs (Figs. 145-146) enlarged, robust; trochanter about 1/2 size of femur; femur with basal mesal lobe produced, bearing varying number of spicules on lobe, tibia with apical mesal lobe produced, bearing varying number of spicules on lobe; ventral surface concave, tarsangulus ventrally flat to concave; with short unmelanized base, ventrally bearing short setae, mesally bearing one or two long spicules; apical segment formed into strongly sclerotized, dark claw. Mesothoracic (Fig. 147), metathoracic (Figs. 148) legs similar, both about 2/3 size of prothoracic legs, more slender; mesothoracic leg equal in size to slightly smaller than mesothoracic leg; setation not identical.

ABDOMEN: Dorsal aspect of 9th abdominal segment with tergum generally rounded; surface centrally subconvex to convex, flattened to concave laterally, apically; with few anteriorly directed fine setae mesally; lateral edge with one or two even to uneven rows of medium short to minute, stout spicules (.08 to .26mm long), with numerous longer, finer medium length setae on lateral and apical areas; 9th abdominal sternite with tuft of spicules intermixed with finer setae of equal length; 10th abdominal sternite with pygopodial lobes set laterally with spicules and setae
forming an uneven ellipse and scattered, finer setae; mesal aspect of pygopodial lobes with various number of spicules. Spiracles annular with peripheral air tubes.

EGGS: (Figs. 115-121) Elongate elliptical, narrower at one end, color creamy white. Length 2.1 to 4.2 mm; width .9 to 2.0 mm. Surface smooth, shiny, with no sculpturing visible at 500X magnification.

1ST. INSTAR LARVA: (Figs. 155-156) Length 3.9 to 6.6 mm, head capsule width .4 to .75 mm; Body usually somewhat concave ventrally (C-shaped), more compact than mature larva; white except for tips of mandibles, protarsal claws, spicules on head and prothoracic legs, and junction of episternum, trochantin and procoxa on prothorax. Eggburster usually spicules present on all segments except head and terminal segment, most developed on meso, metanotum; sometimes absent on protergum.

HEAD: (Fig. 156) Approximately in proportion to mature larva, labrum with two spicules on upper anterior lateral surfaces; antenna with second segment longer than first; third segment larger in proportion than in mature larva; mandibles with upper membranous surface with one spicule.

THORAX: Approximately in proportion to mature larva, First leg larger than others. Pro, meso and meta tibia, base of tarsangulus and femur with one spicule on apical mesal margins; largest spicule on tibia.

ABDOMEN: 9th abdominal tergum with small pointed tip at apex; lateral areas without spicules.

2ND INSTAR LARVA: Length 5.0 to 11.5 mm; shape similar to mature larva; head capsule width .64 to .88 mm;

HEAD: Labrum with varying number of spicules on upper surface; antenna (Fig. 157) with second segment equal to longer than first; third segment larger in proportion than in mature larva; mandibles with upper membranous surface bearing varying number of spicules.

THORAX: Unmelanized to moderately melanized. Legs with spicular number variable.

ABDOMEN: 9th abdominal tergum lateral edge with one or two rows of spicules; spicules variable in length; cuticular surface of 9th, 10th abdominal sternites similar to mature larva with slightly fewer spicules.

PUPA: Length 22 - 23 mm., elongate, somewhat depressed, cream colored. Apical tips of mandibles, tarsal claws, tibial spurs, and urogomphi sclerotized and melanized; lateral lamellae of abdominal segments strongly
sclerotized and melanized on apical margins. Mesal dorsal suture visible on all segments.

**HEAD**: Bare, deflexed beneath prothorax, not visible from above; labrum, clypeus as in adult; labial palps extending beyond mandibles; mandibles slightly inflated, with few scattered setae visible on lateral edges.

**PROTHORAX**: As in adult; upper lateral margins with row of sparse, short setae. Meso-metatergites short, strongly transverse, each bearing a short mesolateral seta near posterior margins. Elytra, hindwing visible as relatively short, flattened lobes, acuminate at apex, without any markings; positioned between meso-metathoracic legs; hindwing slightly shorter than elytra. Legs elongate, each bearing few, scattered, short setae on anterior and posterior surfaces of femora, more numerous on profemur; metathoracic leg longest.

**ABDOMEN**: Tapering posteriorly, tergites 1-6 with prominent lateral projections bearing anterior and posterior lateral lamellae; lamellae strongly sclerotized especially on apical margins, each lamellae bearing row of short, sharp, toothlike apical projections; lamellae most developed on tergites 2 & 3; anterior lamellae strongly developed on tergites 2-5, weakly developed on tergites 1 & 6; posterior lamellae strongly developed on tergites 1-4, weakly developed on tergite 5; tergites 7 & 8 with weakly developed, flattened, lateral lobes, tergite 9 with a pair of slender, urogomphi.

Description of Immature Stages of *Cryptoglossa*

**Cryptoglossa variolosa** (Horn)

**MATURE LARVA**: (Figs. 135-138, 141-142, 144, 146-149)
Length 43 mm., base of labrum, membranous areas on mandibles moderately sclerotized and melanized, brown to dark brown; apex and basal margins of pronotum, base of clypeus, hardened structural parts of antennae, maxillae, labium and pro sternum lightly sclerotized, color light brown; basal margins of meso, metathorax and 8th abdominal segment less so, yellowish brown in color. Ratio of segment lengths: H-18; P-17; MST-10; MTT-13; A1-15; A2-22; A3-23; A4-24; A5-24; A6-23; A7-21; A8-18; A9-23.

**HEAD**: (Figs. 135-138, 141-142) Cranium 1.7X wider than long, basal segment about 2.5X as long as width at apex, second segment slightly less than 2X as long as width at apex; apex truncate, concave; 3rd segment minute, situated inside concave apex of 2nd segment, apex barely surpassing
plane of apex of 2nd segment. Clypeus with each side bearing arc of 5 setae situated across basal lateral margins. Labrum with mesal row composed of 18 short spicules mesally followed on each side by 3 longer, more slender setae; second row near apex composed of approximately 60 unevenly spaced, long, slender setae. Epipharynx (Fig. 142) anterior lateral margin with row of 20 thick spicules, row interrupted mesally by 6 thin, sparse setae and 2 patches of approximately 25 microsetae. Mesal microspicules of epipharynx arranged into three widely spaced, anteriorly expanding pairs, posterior pair largest. Mandibles (Figs. 135 & 136) with left incisor lobe tridentate with additional tooth on dorsal mesal surface, molar surface slightly concave. Maxillary (Fig. 141) mala bearing approximately 21 elongate spicules; articulatory surface between cardo and mentum with surface finely denticulate. Labium (Fig. 141) with laterally darker areas on prementum, labial palps. Maxillary palpus with 3rd segment approximately equal in length to first. Ligula (Fig. 137) finely denticulate, hypopharyngeal sclerome subquadrate, anterodorsal surface concave.

THORAX: Prothorax, ventral aspects (Fig. 144) with proternum broad, marked mesally with clump of long, fine setae, surrounded posteriorly by two semicircular areas, bare of microtubercles. Ventral aspects of meso-metathorax as in Fig. Prothoracic legs (Fig. 146); trochanter anterior mesal margin with 9 slender spicules. Femur with base of mesal lobe produced, bearing from base 4 short thickened, spicules followed by 2 more slender, slightly longer spicules and by 2 long subspiculate setae; posterior mesal margin with 3 slender spicules, few subspiculate setae. Tibia with apical mesal lobe produced, bearing on lobe from base 5 long spicules followed by 5 shorter, thickened spicules, ventral surface concave, bearing 2 short slender setae; dorsal surface bearing 2 long spicules at apex. Tarsangulus ventrally concave, with short undarkened, base, ventrally bearing short setae, mesally bearing 2 long spicules; apical segment formed into strongly sclerotized, dark claw. Mesothoracic (Fig. 147), metathoracic (Fig. 148) legs similar, setation not identical. Mesothoracic legs with trochanter bearing 5 stout spicules on anterior mesal margin; 2 spicules on posterior mesal margin. Femur with posterior mesal margins with 2 thick spicules near apex; anterior mesal margin with 5 thick spicules; tibia mesal ventral aspect from base with one long slender seta followed by 5 longer spicules increasing in thickness toward apex; posterior mesal margin with single spicule. Tarsangulus with base
bearing 1 spicule mesally. Metathoracic leg with trochanter anterior mesal margin with 3 spicules; posterior mesal margins with single spicule. Femur with 3 spicules on anterior mesal margin, apical spicule more slender; posterior mesal margin with 2 spicules. Tibia anterior mesal margin from apex with 3 stout spicules followed by 2 more slender spicules and a slender seta; posterior mesal margin with 2 spicules. Base of tarsangulus with 1 spicule on anterior mesal margin.

ABDOMEN: First abdominal segment slightly longer than metathorax, 2nd to 7th longer, subquadrate, slightly wider than long, 8th shorter; 9th abdominal segment with surface flattened laterally, apically; lateral edge with uneven row of very short (.08mm), stout spicules; 9th abdominal sternite with tuft of approximately 10 short spicules intermixed with finer setae of equal length; 10th abdominal sternite with pygopodial lobes set laterally with 11 spicules ventrally, 7 slightly longer dorsally, arranged in an uneven ellipse and with scattered, finer setae; mesal aspect of pygopodial lobes with 7 spicules.

**Cryptoglossa uricata** (LeConte)


**HEAD:** Cranium 1.9X wider than long. Antennae with basal segment about 2.5X as long as width at apex, second segment slightly less than 2X as long as width at apex; apex slightly inflated; 3rd segment minute; Clypeus with each side bearing arc of 5 setae situated across basal lateral margins. Labrum with mesal row composed of 12 short, spicules mesally followed on each side by 2 longer, more slender setae; second row near apex composed of approximately 50 unevenly spaced, long slender setae, mesally setae slightly shorter. Epipharynx anterior lateral margin with row of 18 thick, spicules, apical 8 larger stouter; row interrupted mesally by 6 thin, sparse setae and 2 patches of approximately 25 microsetae. Mesal microspicules of epipharynx arranged into 3 widely spaced, anteriorly expanding pairs, posterior pair largest.
Mandibles with left incisor lobe tridentate with additional tooth on dorsal mesal surface, molar surface slightly concave. Maxillary mala bearing 22 elongate spicules; some lateral setae on mala subspiculate, articulatory surface between cardo and mentum with surface finely denticulate. Maxillary palpus with 3rd segment approximately equal in length to first. Labium with 2 apical setae. Ligula very finely denticulate, hypopharyngeal sclerome subquadrate, anterodorsal surface concave.

THORAX: Ventral aspects with sternum marked mesally with clump of long, fine setae, surrounded posteriorly by two semicircular areas, bare of microtubercles; ventral aspects of meso- metathorax as in C. variolosa. (Fig. 144). Prothoracic legs: trochanter anterior mesal margin with 3 spicules and 3 subspiculate setae; posterior mesal margin with single spicule. Femur with basal mesal lobe produced, bearing from base 5 short, thickened, spicules followed by 3 less stout spicules; posterior mesal margin with 2 subspiculate setae. Tibia with apical mesal lobe produced, bearing on lobe from apex 5 stout spicules followed by 5 longer spicules and a long subspiculate seta; anterior surface concave. Tarsangulus ventrally concave; with short undarkened, base, ventrally bearing short setae, mesally bearing long spicule; apical segment formed into strongly sclerotized, dark claw. Mesothoracic, metathoracic legs similar, setation not identical. Mesothoracic legs, trochanter anterior mesal margin with 3 stout spicules, posterior mesal margins with 4 subspiculate setae. Femur with 4 spicules on anterior mesal margin, 2 stouter spicules on posterior mesal margin. Tibia with 8 long spicules on anterior mesal margin, 4 apical spicules more stout; 1 stout spicule on posterior mesal margin. Base of tarsangulus with 1 spicule on anterior mesal margin. Metathoracic legs, trochanter with 3 spicules on anterior mesal margin; posterior mesal margin with single spicule. Femur with 7 unevenly spaced spicules on anterior mesal margin, apical 4 spicules more slender; posterior mesal margin with 2 short, stout spicules near apex. Tibia anterior mesal margin form apex with 5 spicules followed by a subspiculate seta, apical spicules more stout; posterior mesal margin with 2 stout spicules. Base of tarsangulus with 1 spicule on anterior mesal margin.

ABDOMEN: First abdominal segment slightly longer than metathorax, 2nd to 5th longer, subquadrate, slightly wider than long, 6th to 8th shorter, decreasing in length; 9th abdominal tergum surface flattened laterally, apically;
lateral edge with uneven row of very short (0.08mm), stout spicules; 9th abdominal sternite with tuft of approximately 10 short spicules intermixed with finer setae of equal length; 10th abdominal sternite with pygopodial lobes set laterally with 11 spicules ventrally, 2 subspiculate setae dorsally, arranged in an uneven ellipse and with scattered, finer setae; mesal aspect of pygopodial lobes with 4 spicules.

EGGS: (Fig. 116) Elongate elliptical, narrower at one end, color creamy white. Length 2.10-2.50 mm (mean of 10 eggs 2.45 mm); width 0.9-1.20 mm (mean of 10 eggs 1.08 mm); mean width/length = 0.44. Surface smooth, shiny, with no sculpturing visible at 1000X magnification.


HEAD: Approximately in proportion to mature larva, labrum with 2 spicules on upper anterior lateral surfaces; antenna with 2nd segment longer than 1st; 3rd larger in proportion than in mature larva; mandibles with upper membranous surface with one spicule.

THORAX: Approximately in proportion to mature larva, first leg larger than others. Pro, meso and meta tibia, base of tarsangulus and femur with 1 spicule on apical mesal margins; largest spicule on tibia.

ABDOMEN: 9th abdominal tergum with small pointed tip at apex; lateral areas without spicules.

2ND INSTAR LARVA: Length 5.0 mm; shape similar to mature larva; head capsule width .64 mm; 4 specimens examined with similar measurements.

HEAD: Labrum with 8 spicules on upper surface; antenna with 2nd segment approximately equal to 1st; 3rd segment larger in proportion than in mature larva; mandibles with upper membranous surface bearing 8 spicules.

THORAX: Unmelanized; protibia with 3 spicules on mesal margin; femur with 4 spicules on mesal margin; meso, meta tibia with 1 spicule on mesal margin; femur with 1 spicule
on mesal margin.

ABDOMEN: 9th abdominal tergum lateral edge with single row of short spicules; upper tergal area slightly melanized; cuticular surface of 9th, 10th abdominal sternites similar to mature larva with slightly fewer spicules.

Cryptoglossa infausta (LeConte)


HEAD: Cranium 2.2X wider than long. Antennae with basal segment about 2.75X as long as width at apex, second segment slightly less than 2X as long as width at apex; apex truncate, concave; 3rd segment minute, situated inside concave apex of second segment, apex barely surpassing plane of apex of 2nd segment. Clypeus with each side bearing arc of 6 setae situated across basal lateral margins; lateral 3 setae more closely separated. Labrum with mesal row composed of 21 medium short spicules followed on each side by 3 longer, more slender setae; apical row uneven, composed of approximately 60 unevenly spaced, long slender setae. Epipharynx (Fig. 133) anterior lateral margin with row of 18 spicules, apical 8 more stout; row interrupted mesally by 14 thin, sparse setae and two patches of approximately 25 microsetae. Mesal microspicules of epipharynx arranged into three widely spaced, anteriorly expanding pairs, plus a single setae making up a subpair, fourth row; posterior pair largest. Mandibles with left incisor lobe tridentate with distinct additional tooth on dorsal mesal surface, molar surface slightly concave. Maxillary mala bearing approximately 22 elongate spicules; articulatory surface between cardo and mentum with surface finely denticulate, denticulations on lateral areas larger, more pronounced. Maxillary palpus with 3rd segment approximately equal in length to first. Ligula with hypopharyngeal sclerome subquadrate, anterodorsal surface concave.

THORAX: Prothorax ventral aspects with sternum marked
mesally with clump of long, fine setae, surrounded posteriorly by two oval areas, bare of microtubercles; ventral aspects of meso- metathorax as in *C. variolosa*. Prothoracic legs, trochanter mesal margins bare of spicules, with few subspiculate setae. Femur with basal mesal lobe produced, bearing from base 8 short thickened, spicules followed by 4 more slender, slightly longer spicules. Tibia with apical, mesal lobe produced, bearing on lobe from apex 5 short, thick, spicules followed by 5 longer spicules and 1 long slender seta; ventral surface concave. Tarsangulus ventrally concave; with short undarkened, base, ventrally bearing short setae, mesally bearing long spicule; apical segment formed into strongly sclerotized, dark claw. Mesothoracic, metathoracic legs similar, setation not identical. Mesothoracic legs with trochanter anterior mesal margin with 4 spicules; posterior mesal margins with single spicule. Femur with 4 spicules on anterior mesal margin, 2 stouter spicules on posterior mesal margin. Tibia with 4 long spicules on anterior mesal margin followed by long seta; 1 stout spicule on posterior mesal margin. Base of tarsangulus with 1 spicule on anterior mesal margin. Metathoracic legs: trochanter with 3 spicules on anterior mesal margin; posterior mesal margin with single spicule. Femur with 3 spicules on anterior mesal margin, 2 subspiculate setae between apical and second spicule. Tibia anterior mesal margin form apex with 4 spicules, apical spicules more stout; posterior mesal margin with single spicule. Base of tarsangulus with 1 spicule on anterior mesal margin.

**ABDOMEN:** First abdominal segment approximately as long as prothorax, 2nd to 6th longer, subquadrate, slightly wider than long, 7th, 8th shorter; 9th abdominal segment tergal surface flattened laterally, apically; lateral edge with uneven row of medium short (.22mm), stout spicules; 9th abdominal sternite with tuft of approximately 8 short spicules intermixed with finer setae of equal length; 10th abdominal sternite with pygopodial lobes set laterally with 14 spicules, upper spicules more slender, arranged in an uneven ellipse; mesal aspect of pygopodial lobes with 3 short, stout spicules.

**EGGS:** (Fig. 115) Elongate elliptical, narrower at one end, color creamy white. Length 3.00-3.50 mm (mean of 8 eggs 3.26 mm); width 1.40-1.70 mm (mean of 8 eggs 1.55 mm); mean width/length = 0.475. Surface smooth, shiny, with no sculpturing visible at 1000X magnification.
1ST INSTAR LARVA: Length 6 mm; head capsule width .46 mm; 2 specimens examined with similar measurements. Body somewhat concave ventrally (C-shaped); more compact than mature larva; white except for tips of mandibles, protarsal claws, spicules on head and prothoracic legs, and junction of sternum, trochantin and procoxa on prothorax. Eggburster spicules present on all segments except head and terminal segment, most developed on meso, metanotum. Ratio of segment lengths: H-12: P-17 MST-12: MTT-10: A1-10: A2-10: A3-10: A4-10: A5-11: A6-11: A7-14: A8-10: A9-13.

HEAD: Approximately in proportion to mature larva, labrum with 2 spicules on upper anterior lateral surfaces; antenna with 2nd segment longer than 1st; 3rd larger in proportion than in mature larva; mandibles with upper membranous surface with one spicule.

THORAX: Approximately in proportion to mature larva, First leg larger than others. Pro, meso and meta tibia, base of tarsangulus and femur with 1 spicule on apical mesal margins; largest spicule on tibia.

ABDOMEN: 9th abdominal tergum with small pointed tip at apex; lateral areas without spicules.

2ND INSTAR LARVA: Length 8.2 mm; shape similar to mature larva; head capsule width .88 mm; 2 specimens examined with similar measurements.

HEAD: Labrum with 8 spicules on upper surface; antenna with 2nd segment approximately equal to 1st; 3rd segment larger in proportion than in mature larva; mandibles with upper membranous surface bearing 12 spicules.

THORAX: Unmelanized; protibia with 4 spicules on mesal margin; femur with 4 spicules on mesal margin; meso, meta tibia with 2 spicules on mesal margin; femur with 2 spicules on mesal margin.

ABDOMEN: 9th abdominal tergum lateral edge with single row of medium long spicules; upper tergal area slightly melanized; cuticular surface of 9th, 10th abdominal sternites similar to mature larva with slightly fewer spicules.

Cryptoglossa spiculifera pectoralis (Blaisdell)

EGGS: (Fig. 117) Elongate elliptical, narrower at one end, color creamy white. Length 3.00 mm; width 1.25 mm. Surface smooth, shiny, with no sculpturing visible at 1000X magnification.
Description of Immature Stages of *Asbolus*

*Asbolus verrucosus* LeConte

**MATURE LARVA:** (Fig. 143, 150) Length 45 mm.; marginal areas of protergum; basal and basolateral margins of meso, metatergum; pro, meso, metasternum; meso, meta postcoxale and sternellum moderately sclerotized and melanized, dark brown, cuticle with microscopic denticules (Fig. 143); base of labrum, membranous areas on mandibles, base of clypeus, hardened structural parts of antennae, maxillae, labium and prosternum lightly sclerotized, color brown to light brown; basal margins of 8th abdominal segment less so, yellowish brown in color. Ratio of segment lengths: H-19; P-23; MST-16; MTT-19; A1-22; A2-24; A3-24; A4-24; A5-22; A6-21; A7-18; A8-17; A9-21.

**HEAD:** Cranium 1.7X wider than long. Antennae with basal segment about 3X as long as width at apex, 2nd segment slightly less than 2X as long as width at apex; apex slightly inflated, 3rd segment very small. Clypeus with basal lateral margins each side bearing 3 setae. Labrum with base more melanized; mesal row composed of 36 medium length, spicules followed on each side by 6 longer, more slender setae; apical row composed of approximately 100 unevenly spaced, long slender setae. Epipharynx with anterior lateral margins with numerous elongate, thin setae directed anteromesally, mesally at apex, setae thinner, smaller; at subapex with numerous, very short thin setae; rows interrupted anterolaterally by row of 2 thick, spicules followed laterally on each side by 4 subspiculate setae. Epipharynx with mesal microspicules composed of 13 minute setae arranged in closely separated pairs as in Figure 134. Mandibles left incisor lobe bidentate but with very small subapical obtuse tooth on dorsal edge of incisor lobe; molar surface concave. Maxillary mala bearing 16 elongate spicules followed basally by 8 subspiculate setae; 3rd segment slightly shorter in length than 1st; articulatory surface between cardo and mentum with surface strongly denticulate. Ligula with hypopharyngeal sclerome (Fig. 150) apically expanded, surface concave, pitted centrally.

**THORAX:** Ventral aspects with prosternum marked mesally with anteroposterior convex band of very fine denticules, broadening toward mid anterior margin of coxae, interspaced with fine setae, mesally without distinct bare areas. Prothoracic legs enlarged, robust, much larger than meso, metathoracic legs; trochanter less than 1/2 size of femur. Trochanter with 3 spicules on anterior mesal
margin. Femur with basal mesal lobe slightly produced, bearing 9 spicules. Tibia with apical mesal lobe produced; bearing 15 spicules, 5 apical spicules more stout. Tarsangulus with short undarkened, base, ventrally bearing short setae, mesally bearing long spicule; apical segment formed into strongly sclerotized, dark claw. Mesothoracic, metathoracic legs not equal in size; metathoracic leg shorter, more slender; setation not identical. Mesothoracic legs, trochanter anterior mesal margin with 3 spicules, posterior mesal margins with 2 spicules. Femur with 7 spicules on anterior mesal margin, 2 stouter spicules on posterior mesal margin, 4 spicules on dorsal posterior margin. Tibia with 6 long thin spicules on anterior mesal margin, followed from apex by a long subspiculate seta; 2 spicules on posterior mesal margin. Base of tarsangulus with 1 spicule on anterior mesal margin. Metathoracic legs, trochanter with 2 spicules on anterior mesal margins; 1 spicule on posterior mesal margin. Femur with 4 spicules on anterior mesal margin; posterior mesal margin with 2 spicules. Tibia anterior mesal margin form apex with 5 spicules followed by a subspiculate seta, apical 2 spicules more stout; posterior mesal margin with single spicule. Base of tarsangulus with 1 spicule on anterior mesal margin.

ABDOMEN: First abdominal segment slightly longer than prothorax, 2nd to 5th longer, subquadrate; 6th, 7th, 8th shorter, wider than long; 9th abdominal segment tergum generally rounded, with apex forming a very weak, blunt point; surface basally, centrally convex, becoming subconcave to concave laterally, apically, lateral edge forming two irregular rows of short (.16mm) stout spicules, 9th abdominal sternite with tuft of approximately 12 short spicules intermixed with finer setae of equal length; 10th abdominal sternite with pygopodial lobes set laterally with 12 spicules arranged in an uneven ellipse and with scattered, finer setae, lower spicules more robust; mesal aspect of pygopodial lobes with 6 spicules and 2 shorter setae.

EGGS: (Fig. 120) Elongate elliptical, narrower at one end, color creamy white. Length 3.25-3.80 mm (mean of 10 eggs 3.24 mm); width 1.60-1.75 mm (mean of 10 eggs 1.67 mm); mean width/length = 0.515. Surface smooth, shiny, with no sculpturing visible at 1000X magnification.

1ST INSTAR LARVA: (Fig. 155) Length 5.5 mm, head capsule width .75 mm; 8 specimens examined with similar measurements. Body somewhat concave ventrally (C-shaped),
ventrally concave, more compact than mature larva; white except for tips of mandibles, protarsal claws, spicules on head and prothoracic legs, and junction of prothorax. Eggburster spicules present on all segments except head and terminal segment, very faint on posterior abdominal segments, most developed on meso, metanotum. Ratio of segment lengths: H-14; P-19; MST-10; MTT-10; A1-12; A2-15; A3-15; A4-14; A5-15; A6-15; A7-14; A8-14; A9-16.

HEAD: Approximately in proportion to mature larva, labrum with 2 spicules on upper anterior lateral surfaces; antenna with 2nd segment longer than 1st; 3rd segment larger in proportion than in mature larva; mandibles with upper membranous surface with one spicule.

THORAX: Approximately in proportion to mature larva, first leg larger than others. Pro, meso and meta tibia, base of tarsangulus and femur with 1 spicule on apical mesal margins; largest spicule on tibia.

ABDOMEN: 9th abdominal tergum with small pointed tip at apex; lateral areas without spicules.

2ND INSTAR LARVA: Length 8.0 mm, shape similar to mature larva; head capsule width .75 mm; 10 specimens examined with similar measurements.

HEAD: Labrum with 12 spicules on upper surface; antenna with 2nd segment approximately equal in length to 1st; 3rd segment larger in proportion than in mature larva; mandibles with upper membranous surface bearing 12 spicules.

THORAX: Marginal areas of protergum; basal and basolateral margins of meso, metaergum; pro, meso, metaergum; meso, meta postcoxale and sternellum moderately sclerotized and melanized, dark brown, cuticle denticulate. Protibia with 5 spicules on mesal margin, 4 apical spicules larger; femur with 4 mesal spicules; meso, meta tibia with 3 spicules on mesal margin; femur with 2 spicules on mesal margin.

ABDOMEN: 9th abdominal tergum lateral edge with two rows of short spicules, mesal row more stout; cuticular surface of 9th, 10th abdominal sternite similar to mature larva with slightly fewer spicules.

Asbolus laevis LeConte

EGGS: (Fig. 119) Elongate elliptical, narrower at one end, color creamy white. Length 2.68-3.30 mm (mean of 10 eggs 3.03 mm); width 1.25-1.80 mm (mean of 10 eggs 1.51 mm); mean width/length = 0.498. Surface smooth, shiny, with no
sculpturing visible at 1000X magnification.

1ST INSTAR LARVA: Length 5.0 mm, head capsule width .66 mm; 1 specimen examined. Shape more compact than mature larva; white except for tips of mandibles, protarsal claws, spicules on head and prothoracic legs, and junction of prosternum, trochantin and procoxa on prothorax. Eggburster spicules present on all segments except head, prothorax and terminal segment; very faint on posterior abdominal segments, most developed on meso, metanotum.

Ratio of segment lengths: H-14; P-15; MST-8; MTT-10; A1-10; A2-12; A3-11; A4-11; A5-10; A6-13; A7-12; A8-9; A9-16.

HEAD: Approximately in proportion to mature larva, labrum with 2 spicules on upper anterior lateral surfaces; antenna with 2nd segment longer than 1st; 3rd segment larger in proportion than in mature larva; mandibles with upper membranous surface with one spicule.

THORAX: Approximately in proportion to mature larva, first leg larger than others. Pro, meso and meta tibia, base of tarsangulus and femur with 1 spicule on apical mesal margins; largest spicule on tibia.

ABDOMEN: 9th abdominal tergum with small pointed tip at apex; lateral areas without spicules.

2ND INSTAR LARVA: Length 6.5 mm, shape similar to mature larva; head capsule width .78 mm; 1 specimen examined.

HEAD: Labrum with 10 spicules on upper surface; antenna with 2nd segment longer than 1st; 3rd segment larger in proportion than in mature larva; mandibles with upper lateral membranous surface bearing 10 spicules.

THORAX: Unmelanized; protibia with 4 spicules on mesal margin; femur with 2 mesal spicules; meso, meta tibia with 3 spicules on mesal margin; femur with 2 spicules on mesal margin.

ABDOMEN: 9th abdominal tergum with surface distinctly pointed; lateral edge with single row of very short spicules; cuticular surface of 9th, 10th abdominal sternite similar to mature larva with slightly fewer spicules.

Asbolus mexicanus (Champion)

MATURE LARVA: (Fig. 152) Length 33 mm.; marginal areas of protergum; basal and basolateral margins of meso, metatergum; pro, meso, metasternum; meso, meta postcoxale and sternellum, base of labrum, clypeus moderately sclerotized and melanized, dark brown, cuticle with microscopic denticules; membranous areas on mandibles,
hardened structural parts of antennae, maxillae, labium and prosternum lightly sclerotized, color brown to light brown; basal margins of 8th abdominal segment, upper mesal surface of 9th abdominal tergum less so, yellowish brown in color. Ratio of segment lengths: H-19; P-15; MST-10; MTT-12; A1-13; A2-17; A3-18; A4-17; A5-17; A6-18; A7-16; A8-14; A9-20.

HEAD: Cranium 1.8X wider than long. Antennae with basal segment about 3X as long as width at apex, second segment slightly less than 2X as long as width at apex; apex concave, third segment very small. Clypeus with basal lateral margins each side bearing 5 setae. Labrum with base more melanized; mesal row composed of 22 medium length, spicules followed on each side by 6 longer, more slender setae; apical row composed of approximately 100 unevenly spaced, long slender setae. Epipharynx with anterior lateral margins with numerous elongate, thin setae directed anteromesally, mesally at apex, setae thinner, smaller; at subapex with numerous, very short thin setae; rows interrupted anterolaterally by row of 3 thick, spicules followed laterally on each side by 7 subspiculate, short setae. Epipharynx with mesal microspicules composed of 13 minute setae arranged as in Figure 134. Mandibles left incisor lobe bidentate, molar surface concave. Maxillary mala bearing 20 elongate spicules followed basally by few subspiculate setae; 3rd segment slightly shorter in length than 1st; articulatory surface between cardo and mentum with surface denticulate. Ligula with hypopharyngeal sclerome (Fig. 152) apically expanded, surface concave, centrally excavate, unmelanized.

THORAX: Prosternum mesally without distinct bare areas; Prothoracic legs, trochanter with 2 elongate spicules on mesal margin. Femur with basal mesal lobe slightly produced, apical mesal margin with 6 long spicules and 3 subspiculate setae of equal length. Tibia with apical mesal lobe produced, anterior aspect concave; mesal margin from apex with 5 stout spicules followed by 5 longer spicules. Tarsangulus with short undarkened, base, ventrally bearing short setae, mesally bearing long spicule, apical segment formed into strongly sclerotized, dark claw. Mesothoracic, metathoracic legs not equal in size; metathoracic leg shorter, more slender; setation not identical. Mesothoracic legs, trochanter anterior mesal margin with 2 long spicules, posterior mesal margins with single spicule. Femur with 4 spicules on anterior mesal margin, 2 stouter spicules on posterior mesal margin. Tibia with 6 long thin spicules on anterior mesal margin,
1 stout spicule on posterior mesal margin. Base of tarsangulus with 1 spicule on anterior mesal margin. Metathoracic legs: trochanter with single spicule on both anterior, posterior mesal margins. Femur with 3 spicules on anterior mesal margin, mid spicule more slender; posterior mesal margin with single spicule. Tibia anterior mesal margin form apex with 4 spicules followed by a subspiculate seta; posterior mesal margin with single spicule. Base of tarsangulus with 1 spicule on anterior mesal margin.

ABDOMEN: First abdominal segment slightly longer than metathorax, 2nd to 8th longer, wider than long; 9th abdominal segment dorsal aspect with surface melanized; apex forming a very weak, blunt point; surface basally, centrally convex, becoming subconcave to concave laterally, apically, with few anteriorly directed fine setae mesally; lateral edge forming two irregular rows of short (.18mm) stout spicules, laterally with numerous longer, finer, setae on lateral and apical areas; 9th abdominal sternite with tuft of approximately 12 short spicules intermixed with finer setae of equal length; 10th abdominal sternite with pygopodial lobes set laterally with 11 spicules arranged in an uneven ellipse, upper 4 spicules more slender; mesal aspect of pygopodial lobes with 2 spicules and 2 subspiculate setae.

EGG: (Fig. 119) Elongate elliptical, narrower at one end, color creamy white. Length 3.50 mm; width 1.80 mm. Surface smooth, shiny, with no sculpturing visible at 1000X magnification.

1ST INSTAR LARVA: (Fig. 156) Length 6.6 mm, head capsule width .67 mm; one specimen examined. Shape more compact than mature larva; white except for tips of mandibles, protarsal claws, spicules on head and prothoracic legs, and junction of prosternum, trochantin and procoxa on prothorax. Eggburster spicules present on all segments except head, prothorax and terminal segment; very faint on posterior abdominal segments, most developed on meso, metanotum. Ratio of segment lengths: H-17; P-20; MST-13; MTT-13; A1-12; A2-11; A3-10; A4-12; A5-12; A6-13; A7-10; A8-10; A9-16.

HEAD: (Fig. 156) Approximately in proportion to mature larva, labrum with 2 spicules on upper anterior lateral surfaces; antenna with 2nd segment longer than 1st; 3rd segment larger in proportion than in mature larva; mandibles with upper membranous surface with one spicule.

THORAX: Approximately in proportion to mature larva,
First leg larger than others. Pro, meso and meta tibia, base of tarsangulus and femur with 1 spicule on apical mesal margins; largest spicule on tibia.

**ABDOMEN:** 9th abdominal tergum with small pointed tip at apex; lateral areas without spicules.

**2ND INSTAR LARVA:** (Fig. 157) Length 10.0 mm, shape similar to mature larva; head capsule width .87 mm; 1 specimen examined.

**HEAD:** Labrum with 9 spicules on upper surface; antenna (Fig. 157) with 2nd segment approximately equal in length to 1st; 3rd segment larger in proportion than in mature larva; mandibles with upper lateral membranous surface bearing 14 spicules.

**THORAX:** Marginal areas of protergum; basal and basolateral margins of meso, metatergum; pro, meso, metasternum; meso, meta postcoxale and sternellum lightly sclerotized and melanized, light brown, cuticle denticulate. Protibia with 4 spicules on mesal margin; femur with 4 mesal spicules; meso, meta tibia with 2 spicules on mesal margin; femur with 2 spicules on mesal margin.

**ABDOMEN:** 9th abdominal tergum lateral edge with single row of medium short spicules; cuticular surface of 9th, 10th abdominal sternite similar to mature larva with slightly fewer spicules.


**HEAD:** Eyes visible, shape as in adult; antennae with segments barely distinguishable, last segment reduced as in adult.

**THORAX:** As in tribal descriptive combination.

**ABDOMEN:** Urogomphi of tergite 9 slightly curved laterally; sex female.

**LATE PUPA** (5 days before eclosion): Sclerotization much more extensive; antennal segments clearly visible under clear membrane with generic characters of antennae clearly defined; apical half of mandibles, eyes, apical ends of antennal segments darkly sclerotized; lateral apical edges of head, pronotum, legs and apical 4 abdominal sternites lightly to moderately sclerotized; brownish yellow in color; tergites not sclerotized except lateral lamellae; tarsi, tarsal claws clearly visible under membrane with apical ends of tarsi, spurs, and tarsal claws highly
sclerotized; tarsi mobile in slight regular movements.

Description of Immature Stages of Schizillus

Schizillus laticeps Horn

MATURE LARVA: (Fig. 153) Length 39 mm., apex and basal margins of pronotum, base of clypeus, hardened structural parts of antennae, maxillae, labium, and prosternum lightly sclerotized, color brown to light brown; basal margins of meso, metathorax and 8th abdominal segment less so, yellowish brown in color. Ratio of segment lengths: H-15; P-18; MST-12; MTT-15; A1-16; A2-19; A3-20; A4-18; A5-19; A6-18; A7-19; A8-15; A9-18.

HEAD: Cranium 2X wider than long. Antennae with basal segment about 2.8X as long as width at apex, second segment slightly less than 2X as long as width at apex; apex inflated; 3rd segment very small. Clypeus with basal lateral margins each side bearing 6 setae, lateral setae more closely separated. Labrum with base slightly more melanized; apical row composed of 46 medium length, spicules followed on each side by 6 longer, more slender setae; apical row composed of approximately 100 unevenly spaced, long slender setae. Epipharynx with anterior lateral margins with numerous elongate, thin setae; subapex with row of 3 thin spicules followed laterally by numerous longer thinner setae; mesal microspicules of epipharynx composed of 12 minute setae, arranged as in Figure 134. Mandibles with left incisor lobe bidentate but with very small mesal obtuse tooth on dorsal edge of incisor lobe; molar surface concave. Maxillae with mala bearing approximately 22 elongate spicules, some basal setae subspiculate; maxillary palpus with 3rd segment approximately equal in length to 1st; articulatory surface between cardo and mentum with surface finely denticulate, becoming strongly denticulate on marginal surfaces. Ligula with hypopharyngeal sclerome (Fig. 153) subquadrate, slightly expanding apically, anterodorsal surface concave.

THORAX: Prothorax larger than meso- metathorax; prothorax, mesothorax, metathorax with laterodorsal surface with scattered fine setae of unequal sizes. Ventral aspects, prosternum without distinct bare areas. Prothoracic legs with trochanter with mesal margin with 1 spicule. Femur with basal median lobe slightly produced; mesal margin with 16 spicules, basal 10 spicules more stout; anterior mesal margin with 1 spicule. Tibia with apical mesal lobe produced; mesal margins bearing 23 spicules, anterior apical 8 spicules shorter, stouter.
Tarsangulus with short undarkened, base, ventrally bearing short setae, mesally bearing long stout spicule; apical segment formed into strongly sclerotized, dark claw. Mesothoracic, metathoracic legs similar, both about 2/3 size of prothoracic legs, more slender, setation not identical. Mesothoracic leg trochanter anterior mesal margin with 4 spicules near apex; posterior mesal margin with 1 spicule. Femur with anterior mesal margins bearing 5 slender spicules; posterior mesal margins with 4 stout spicules. Tibia with anterior mesal margins from apex: 2 long stout spicules; 1 long slender spicule; 2 long spicules; 1 long seta. Tarsangulus with base bearing 1 spicule. Metathoracic leg trochanter anterior mesal margin with 3 spicules; posterior mesal margin with 2 spicules. Femur with anterior mesal margins bearing 2 subspiculate setae between 2 stout spicules; posterior mesal margins with 5 spicules. Tibia with anterior mesal margins from apex: 2 long stout spicules; 2 long slender spicules; 1 long setae; posterior mesal margins with 2 spicules; dorsal margin with 2 spicules. Tarsangulus with base bearing 1 spicule.

**ABDOMEN**: First abdominal segment slightly longer than metathorax, 2nd to 7th longer, subquadrate, slightly wider than long, 8th shorter; 9th abdominal segment dorsal aspect with tergum generally rounded, with apex forming a blunt point; surface centrally convex, becoming subconcave to concave laterally, apically, with few anteriorly directed fine setae mesally; lateral edge with two very uneven rows of medium short (.26 mm) stout spicules, mesal row thicker; laterally with numerous longer, finer setae on lateral and apical areas; 9th abdominal sternite with tuft of approximately 10 short spicules intermixed with finer setae of equal length, lower spicules more robust; 10th abdominal sternite with pygopodial lobes set laterally with 13 spicules arranged in an uneven ellipse and with scattered, finer setae; mesal aspect of pygopodial lobes with 1 spicule and 1 subspiculate seta.

**Schizillus nunenmacheri Blaisdell**

**MATURE LARVA**: (Figs. 134, 139, 145, 151) Length 34 mm.; apex and basal margins of pronotum, base of clypeus, hardened structural parts of antennae, maxillae, labium, and prosternum lightly sclerotized, color brown to light brown; basal margins of meso, metathorax and 8th abdominal segment less so, yellowish brown in color. Ratio of segment lengths: H-16; P-17; MST-9; MTT-13; A1-18; A2-18; A3-19; A4-19; A5-20; A6-19; A7-16; A8-15; A9-18.
HEAD: Cranium 1.7X wider than long. Antennae (Fig. 139) with basal segment about 2.8X as long as width at apex, second segment slightly less than 2X as long as width at apex; apex inflated, 3rd segment very small. Clypeus with basal lateral margins, each side bearing 4 setae. Labrum with base darker, more melanized; mesal row composed of 40 medium length, spicules followed on each side by 6 longer, more slender setae; apical row composed of approximately 100 unevenly spaced, long slender setae. Epipharynx (Fig. 134) with anterior lateral margins with numerous elongate, thin setae; rows interrupted mesally by 6 thin, smaller setae and approximately 10 very short thin setae; subapex with row of 3 spicules followed laterally by numerous longer thinner setae. Epipharyngeal microspicules composed of 12 minute setae, arranged into 3 rows. Mandibles with left incisor lobe bidentate with subapical tooth on ventral surface; molar surface concave. Maxillae with mala bearing approximately 21 elongate spicules; maxillary palpus with 3rd segment approximately equal in length to lst; articular surface between cardo and mentum with surface finely denticulate, becoming strongly denticulate mesally. Ligula with hypopharyngeal sclerome (Fig. 151) subquadrate, anterodorsal surface strongly excavated.

THORAX: Ventral aspects, prosternum without distinct bare areas. Prothoracic legs (Fig. 145): anterior mesal margin of trochanter with 1 spicule and 2 subspiculate setae. Femur with basal mesal lobe slightly produced, anterior mesal margin with 10 spicules interspaced with 5 slender subspiculate setae, basal spicules more stout. Tibia with apical mesal lobe produced; anterior mesal margin with 10 long spicules and 5 long subspiculate setae. Tarsangulus with short undarkened, base, ventrally bearing short setae, mesally bearing long spicule; apical segment formed into strongly sclerotized, dark claw. Mesothoracic, metathoracic legs similar, setation not identical. Mesothoracic leg trochanter anterior mesal margin with 4 spicules near apex; posterior mesal margin with 1 spicule. Femur with anterior mesal margins bearing 5 spicules; posterior mesal margins with 2 stout spicules. Tibia anterior mesal margins from apex with: 2 long stout spicules; 4 long slender spicules; 1 long seta. Tarsangulus with base bearing 1 spicule. Metathoracic leg trochanter anterior mesal margin with 4 spicules; posterior mesal margin with 2 spicules. Femur with anterior mesal margins bearing 5 spicules; posterior mesal margins with 2 spicules. Tibia anterior mesal margins from apex with: 3 long stout spicules; 2 long slender spicules; 1 long setae; posterior mesal margins with 1 spicule;
dorsal margin with 3 subspiculate setae. Tarsangulus with base bearing 1 spicule.

ABDOMEN: First abdominal segment slightly longer than metathorax, 2nd to 6th longer, subquadrate, slightly wider than long, 7th, 8th shorter, decreasing in length; 9th abdominal segment dorsal aspect with apex forming a blunt point; surface centrally convex, becoming subconcave to concave laterally, apically, lateral edge with two rows of medium short (0.22 mm) stout spicules, mesal row thicker; 9th abdominal sternite with tuft of approximately 10 short spicules intermixed with finer setae of equal length; 10th abdominal sternite with pygopodial lobes set laterally with 8 spicules arranged in an uneven ellipse and with scattered, finer setae; mesal aspect of pygopodial lobes with 2 spicules.

EGGS: (Fig. 118) Elongate elliptical, narrower at one end, color creamy white. Length 3.80-4.20 mm (mean of 8 eggs 3.96 mm); width 1.60-2.00 mm (mean of 8 eggs 1.77 mm); mean width/length = 0.446. Surface smooth, shiny, appearing granular at high magnifications; granules (Fig. 90) approximately 1 μm in diameter, interspaced with smaller granules.

1ST INSTAR LARVA: Length 6.0 mm, head capsule width 0.61 mm; 5 specimens examined with similar measurements. Shape more compact than mature larva; white except for tips of mandibles, protarsal claws, spicules on head and prothoracic legs, and junction of prosternum, trochantin and procoxa on prothorax. Eggburster spicules present on all segments except head, prothorax and terminal segment; very faint on posterior abdominal segments, most developed on meso, metanotum. Ratio of segment lengths: H-17; P-13; MST-10; MTT-11; A1-10; A2-11; A3-11; A4-16; A5-15; A6-15; A7-16; A8-13; A9-15.

HEAD Approximately in proportion to mature larva, labrum with 2 spicules on upper anterior lateral surfaces; antenna with 2nd segment longer than 1st; 3rd segment larger in proportion than in mature larva; mandibles with upper membranous surface with one spicule.

THORAX: Approximately in proportion to mature larva, first leg larger than others. Pro, meso and meta tibia, base of tarsangulus and femur with 1 spicule on apical mesal margins; largest spicule on tibia.

ABDOMEN: 9th abdominal tergum with small pointed tip at apex; lateral areas without spicules.

2ND INSTAR LARVA: Length 11.5 mm, shape similar to mature
larva; head capsule width .87 mm; 5 specimens examined with similar measurements.

HEAD: Labrum with 10 spicules on upper surface, lateral spicules slightly larger; antenna with 2nd segment approximately equal in length to 1st; 3rd segment larger in proportion than in mature larva; mandibles with upper lateral membranous surface bearing 12 spicules.

THORAX: Unmelanized; protibia with 4 spicules on mesal margin; femur with 4 mesal spicules; meso, meta tibia with 2 spicules on mesal margin; femur with 2 spicules on mesal margin.

ABDOMEN: 9th abdominal tergum lateral edge with single row of medium short spicules; cuticular surface of 9th, 10th abdominal sternite similar to mature larva with slightly fewer spicules.


HEAD: Eyes visible, shape similar to adult but forming one continuous, dorso-ventrally elongate eye with very thin joining eye; antennae with segments clearly visible, 3rd segment elongate as in adult; last segment as in adult.

THORAX: Elytra, hindwing visible as relatively short, flattened, lobes, acuminate at apex, without any markings.

ABDOMEN: Urogomphi on segment 9 posterior pointing. Two specimens examined, female and male.
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Fig. 1 Cryptoglossa bicostata Solier, habitus; scale = 3.875 natural size.

Fig. 2 Cryptoglossa infausta (LeConte), habitus; scale = 3.875 natural size.
Fig. 3 Distribution of *Cryptoglossa bicostata* (open circles) and *Cryptoglossa caraboides* (solid circles).
Fig. 4 Distribution of *Cryptoglossa infausta*.
Fig. 5 Cryptoglossa muricata (LeConte), habitus; scale = 3.875 natural size.

Fig. 6 Cryptoglossa variolosa (Horn), habitus; scale = 3.875 natural size.
Fig. 7 Distribution of Cryptoglossa variolosa.
Fig. 8 Cryptoglossa asperata asperata (Horn), habitus; scale = 3.875 natural size.

Fig. 9 Cryptoglossa asperata discreta (Blaisdell), habitus; scale = 3.875 natural size.

Fig. 10 Cryptoglossa asperata subornata (Blaisdell), habitus; scale = 3.875 natural size.
Figs. 11 to 26, Male genitalic configurations: scale bar equals 1 mm.

Fig. 11 Cryptoglossa bicostata, aedeagus, median lobe, lateral configuration.

Fig. 12 Cryptoglossa bicostata, aedeagus, median lobe, dorsal configuration.

Fig. 13 Cryptoglossa bicostata, aedeagus, parameres, dorsal configuration.

Fig. 14 Cryptoglossa bicostata, aedeagus, parameres, lateral configuration.

Fig. 15 Cryptoglossa infausta, aedeagus, median lobe, lateral configuration.

Fig. 16 Cryptoglossa infausta, aedeagus, median lobe, dorsal configuration.

Fig. 17 Cryptoglossa infausta, aedeagus, parameres, dorsal configuration.

Fig. 18 Cryptoglossa infausta, aedeagus, parameres, lateral configuration.

Fig. 19 Cryptoglossa variolosa, aedeagus, median lobe, lateral configuration.

Fig. 20 Cryptoglossa variolosa, aedeagus, median lobe, dorsal configuration.

Fig. 21 Cryptoglossa variolosa, aedeagus, parameres, dorsal configuration.

Fig. 22 Cryptoglossa variolosa, aedeagus, parameres, lateral configuration.

Fig. 23 Cryptoglossa muricata, aedeagus, median lobe, lateral configuration.

Fig. 24 Cryptoglossa muricata, aedeagus, median lobe, dorsal configuration.

Fig. 25 Cryptoglossa muricata, aedeagus, parameres, dorsal configuration.

Fig. 26 Cryptoglossa muricata, aedeagus, parameres, lateral configuration.
Fig. 27 Distribution of Cryptoglossa asperata:
C. asperata asperata solid circles.
C. asperata discreta solid squares.
C. asperata subornata open circles.
Fig. 28 Distribution of *Cryptoglossa muricata*.
Fig. 29 *Cryptoglossa michelbacheri* (Blaisdell),
habitus; scale = 3.875 natural size.

Fig. 30 *Cryptoglossa caraboides* (Mannerheim),
habitus; scale = 3.875 natural size.
Figs. 31 to 46, Male genitalic configurations: scale bar equals 1 mm.

Fig. 31 *Cryptoglossa michelbacheri*, aedeagus, median lobe, lateral configuration.

Fig. 32 *Cryptoglossa michelbacheri*, aedeagus, median lobe, dorsal configuration.

Fig. 33 *Cryptoglossa michelbacheri*, aedeagus, parameres, dorsal configuration.

Fig. 34 *Cryptoglossa michelbacheri*, aedeagus, parameres, lateral configuration.

Fig. 35 *Cryptoglossa caraboides*, aedeagus, median lobe, lateral configuration.

Fig. 36 *Cryptoglossa caraboides*, aedeagus, median lobe, dorsal configuration.

Fig. 37 *Cryptoglossa caraboides*, aedeagus, parameres, dorsal configuration.

Fig. 38 *Cryptoglossa caraboides*, aedeagus, parameres, lateral configuration.

Fig. 39 *Cryptoglossa spiculifera pectoralis*, aedeagus, median lobe, lateral configuration.

Fig. 40 *Cryptoglossa spiculifera pectoralis*, aedeagus, median lobe, dorsal configuration.

Fig. 41 *Cryptoglossa spiculifera pectoralis*, aedeagus, parameres, dorsal configuration.

Fig. 42 *Cryptoglossa spiculifera pectoralis*, aedeagus, parameres, lateral configuration.

Fig. 43 *Cryptoglossa spiculifera spiculifera*, aedeagus, median lobe, lateral configuration.

Fig. 44 *Cryptoglossa spiculifera spiculifera*, aedeagus, median lobe, dorsal configuration.

Fig. 45 *Cryptoglossa spiculifera spiculifera*, aedeagus, parameres, dorsal configuration.

Fig. 46 *Cryptoglossa spiculifera spiculifera*, aedeagus, parameres, lateral configuration.
Fig. 47 Distribution of *Cryptoglossa michelbacheri*. 
Fig. 48 *Cryptoglossa spiculifera spiculifera* (LeConte) habitus; scale = 3.875 natural size.

Fig. 49 *Cryptoglossa spiculifera pectoralis* (Blaisdell) habitus; scale = 3.875 natural size.
Fig. 50 Distribution of *Cryptoglossa spiculifera*:
*C. spiculifera spiculifera* open circles,
*C. spiculifera pectoralis* closed circles,
half-circles represent intermediate specimens.
Fig. 51 Cryptoglossa seriata seriata (LeConte), habitus; scale = 3.875 natural size.

Fig. 52 Cryptoglossa seriata ceralvoensis Aalbu, habitus; scale = 3.875 natural size.
Fig. 53 Distribution of Cryptoglossa seriata.
C. seriata seriata closed circles.
C. seriata ceralvoensis open circles
Fig. 54 Cryptoglossa muricata, antenna, terminal segments; scale: 6.0 mm = 100.0u.

Fig. 55 Cryptoglossa muricata, antenna, terminal segments, closeup of apex; scale: 11.0 mm = 100.0u.

Fig. 56 Asbolus verrucosus, antenna, terminal segments; scale: 6.0 mm = 100.0u.

Fig. 57 Asbolus verrucosus, antenna, terminal segments, closeup of apex; scale: 11.0 mm = 100.0u.
Fig. 58 *Asbolus mexicanus mexicanus* (Champion), habitus; scale = 3.875 natural size.

Fig. 59 *Asbolus mexicanus angularis* (Horn), habitus; scale = 3.875 natural size. ....
Fig. 60 Distribution of *Asbolus mexicanus*.  
*A. m. mexicanus* open circles.  
*A. m. angularis* closed circles.
Fig. 61 *Asbolus verrucosus* LeConte, habitus; scale = 3.875 natural size.

Fig. 62 *Asbolus papillosus* (Triplehorn), habitus; scale = 3.875 natural size.

Fig. 63 *Asbolus laevis* LeConte, habitus; scale = 3.875 natural size.
Fig. 64 Distribution of *Asbolus verrucosus*. 
Figs. 65 to 84, Male genitalic configurations: scale bar equals 1 mm.

Fig. 65 *Asbolus mexicana mexicana*, aedeagus, median lobe, lateral configuration.

Fig. 66 *Asbolus mexicana mexicana*, aedeagus, median lobe, dorsal configuration.

Fig. 67 *Asbolus mexicana mexicana*, aedeagus, parameres, dorsal configuration.

Fig. 68 *Asbolus mexicana mexicana*, aedeagus, parameres, lateral configuration.

Fig. 69 *Asbolus mexicana angularis*, aedeagus, median lobe, lateral configuration.

Fig. 70 *Asbolus mexicana angularis*, aedeagus, median lobe, dorsal configuration.

Fig. 71 *Asbolus mexicana angularis*, aedeagus, parameres, dorsal configuration.

Fig. 72 *Asbolus mexicana angularis*, aedeagus, parameres, lateral configuration.

Fig. 73 *Asbolus verrucosus*, aedeagus, median lobe, lateral configuration.

Fig. 74 *Asbolus verrucosus*, aedeagus, median lobe, dorsal configuration.

Fig. 75 *Asbolus verrucosus*, aedeagus, parameres, dorsal configuration.

Fig. 76 *Asbolus verrucosus*, aedeagus, parameres, lateral configuration.

Fig. 77 *Asbolus papillosus*, aedeagus, median lobe, lateral configuration.

Fig. 78 *Asbolus papillosus*, aedeagus, median lobe, dorsal configuration.

Fig. 79 *Asbolus papillosus*, aedeagus, parameres, dorsal configuration.

Fig. 80 *Asbolus papillosus*, aedeagus, parameres, lateral configuration.

Fig. 81 *Asbolus laevis*, aedeagus, median lobe, lateral configuration.

Fig. 82 *Asbolus laevis*, aedeagus, median lobe, dorsal configuration.

Fig. 83 *Asbolus laevis*, aedeagus, parameres, dorsal configuration.

Fig. 84 *Asbolus laevis*, aedeagus, parameres, lateral configuration.
Fig. 85 Distribution of *Asbolus papillosus*.
Fig. 86 Distribution of *Asbolus laevis*. 
Fig. 87 *Schizillus nunenmacheri*, surface configuration of egg; scale = 1000x

Fig. 88 *Schizillus nunenmacheri* Blaisdell, habitus; scale = 3.875 natural size.

Fig. 89 *Schizillus laticeps* Horn, habitus; scale = 3.875 natural size.

Fig. 90 *Schizillus laticeps*, antenna, terminal segments scale: 6.0 mm = 100.0u.
Fig. 91 Distribution of *Schizillus laticeps*. 
Fig. 92 Distribution of *Schizillus nunenmacheri*.
Figs. 93 to 108, Male genitalic configurations: scale bar equals 1 mm.

Fig. 93 Cryptoglossa seriata, aedeagus, median lobe, lateral configuration.

Fig. 94 Cryptoglossa seriata, aedeagus, median lobe, dorsal configuration.

Fig. 95 Cryptoglossa seriata, aedeagus, parameres, dorsal configuration.

Fig. 96 Cryptoglossa seriata, aedeagus, parameres, lateral configuration.

Fig. 97 Cryptoglossa asperata, aedeagus, median lobe, lateral configuration.

Fig. 98 Cryptoglossa asperata, aedeagus, median lobe, dorsal configuration.

Fig. 99 Cryptoglossa asperata, aedeagus, parameres, dorsal configuration.

Fig. 100 Cryptoglossa asperata, aedeagus, parameres, lateral configuration.

Fig. 101 Schizillus nunenmacheri, aedeagus, median lobe, lateral configuration.

Fig. 102 Schizillus nunenmacheri, aedeagus, median lobe, dorsal configuration.

Fig. 103 Schizillus nunenmacheri, aedeagus, parameres, dorsal configuration.

Fig. 104 Schizillus nunenmacheri, aedeagus, parameres, lateral configuration.

Fig. 105 Schizillus laticeps, aedeagus, median lobe, lateral configuration.

Fig. 106 Schizillus laticeps, aedeagus, median lobe, dorsal configuration.

Fig. 107 Schizillus laticeps, aedeagus, parameres, dorsal configuration.

Fig. 108 Schizillus laticeps, aedeagus, parameres, lateral configuration.
Figs. 109-110 Female external and internal reproductive structures; scale bar equals 1 mm.
Explanation: c, coxites; p, paraproct; o, oviduct; s, spermatheca; sg, spermathecal accessory gland.

Fig. 109 Asbolus verrucosus.

Fig. 110 Cryptoglossa variolosa.
Figs. 111-112 Female external and internal reproductive structures; scale bar equals 1 mm.
Explanation: c, coxites; p, paraproct; o, oviduct; s, spermatheca; sg; spermathecal accessory gland.

Fig. 111 *Asbolus laevis*

Fig. 112 *Schizillus laticeps*
Fig. 113 *Asbolus papillosus*, metatarsus, lateral configuration; scale bar equals 1 mm.

Fig. 114 *Asbolus laevis*, metatarsus, lateral configuration; scale bar equals 1 mm.

Figs. 115 to 121 lateral outlines of eggs; scale bar equals 4 mm.

Fig. 115 *Cryptoglossa infausta*, egg, lateral aspect.

Fig. 116 *Cryptoglossa muricata*, egg, lateral aspect.

Fig. 117 *Cryptoglossa spiculifera pectoralis*, egg, lateral aspect.

Fig. 118 *Schizillus nuneomachiri*, egg, lateral aspect.

Fig. 119 *Asbolus mexicanus* egg, lateral aspect.

Fig. 120 *Asbolus verrucosus* egg, lateral aspect.

Fig. 121 *Asbolus laevis* egg, lateral aspect.

Figs. 122 to 130, dorsal aspects of spiculum ventrale, scale bar equals 3 mm.

Fig. 122 *Cryptoglossa variolosa*, female, spiculum ventrale dorsoventral configuration.

Fig. 123 *Cryptoglossa michelbacheri*, female, spiculum ventrale dorsoventral configuration.

Fig. 124 *Cryptoglossa asperata*, female, spiculum ventrale dorsoventral configuration.

Fig. 125 *Asbolus laevis*, female, spiculum ventrale dorsoventral configuration.

Fig. 126 *Asbolus papillosus*, female, spiculum ventrale dorsoventral configuration.

Fig. 127 *Cryptoglossa seriata*, female, spiculum ventrale dorsoventral configuration.

Fig. 128 *Schizillus laticeps*, female, spiculum ventrale dorsoventral configuration.

Fig. 128 *Schizillus nuneomachiri*, female, spiculum ventrale dorsoventral configuration.

Fig. 130 *Asbolus verrucosus*, female, spiculum ventrale dorsoventral configuration.

Fig. 131 *Schizillus laticeps*, male, 8th sternite, dorsal configuration; scale bar equals 1 mm.

Fig. 132 *Cryptoglossa spiculifera spiculifera* male, 8th sternite, dorsal configuration; scale bar equals 1 mm.
Fig. 133 *Cryptoglossa infausta*, mature larva, epipharynx; scale bar equals .5 mm.

Fig. 134 *Schizillus nunenmacheri*, mature larva, epipharynx; scale bar equals .5 mm.

Fig. 135 *Cryptoglossa variolosa*, mature larva, left mandible, dorsal configuration; scale bar equals .5 mm.

Fig. 136 *Cryptoglossa variolosa*, mature larva, right mandible, dorsal configuration; scale bar equals .5 mm.
Fig. 137 Cryptoglossa variolosa, mature larva, ligula with hypopharyngeal sclerome; scale bar equals .5 mm.

Fig. 138 Cryptoglossa variolosa, mature larva, antenna; scale bar equals .5 mm.

Fig. 139 Schizillus nunenmacheri mature larva, antenna; scale bar equals .5 mm.

Fig. 140 Cryptoglossa muricata mature larva, antenna; scale bar equals .5 mm.

Fig. 141 Cryptoglossa variolosa, mature larva, labium and maxillae; scale bar equals 1 mm.

Fig. 142 Cryptoglossa variolosa, mature larva, epipharynx; scale bar equals .5 mm.
Fig. 143 *Asbolus verrucosus*, 2nd instar larva, cuticular features of protergal margins of thraox, magnification = 1000X

Fig. 144 *Cryptoglossa variolosa*, mature larva, ventral aspects; scale bar equals 2 mm.
143 glabrous areas

144

trochantin, coxa

postcoxale

sternellum

intersternite

pleuron

sternum
Fig. 145 *Schizillus nurenmacheri* mature larva, prothoracic leg, ventral configuration; scale bar equals 1 mm.

Fig. 146 *Cryptoglossa variolosa* mature larva, prothoracic leg, ventral configuration; scale bar equals 1 mm.
Fig. 147 Cryptoglossa variolosa mature larva, mesothoracic leg, ventral configuration; scale bar equals 1 mm.

Fig. 148 Cryptoglossa variolosa mature larva, metathoracic leg, ventral configuration; scale bar equals 1 mm.

Fig. 149 Cryptoglossa variolosa mature larva, terminal segments, lateral configuration; scale bar equals 1 mm.

Figs. 150 to 154 hypopharyngeal scleromes; scale bar equals 1 mm.

Fig. 150 Asbolus verrucosus, mature larva, hypopharyngeal sclerome, dorsal configuration

Fig. 151 Schizillus nunenmacheri, mature larva, hypopharyngeal sclerome, dorsal configuration...

Fig. 152 Asbolus mexicanus, mature larva, hypopharyngeal sclerome, dorsal configuration...

Fig. 153 Schizillus laticeps, mature larva, hypopharyngeal sclerome, dorsal configuration...

Fig. 154 Cryptoglossa variolosa, mature larva, hypopharyngeal sclerome, dorsal configuration...
Fig. 155 *Asbolus verrucosus*, 1st instar larvalae, lateral configuration; scale bar equals 1 mm.

Fig. 156 *Asbolus mexicanus*, 1st instar larvalae, head, dorsal configuration; scale bar equals .5 mm.

Fig. 157 *Asbolus mexicanus*, 2nd instar larva, antenna; scale bar equals .5 mm.
Fig. 158 *Asbolus mexicanus*, pupa, ventral configuration.

Fig. 159 *Asbolus mexicanus*, pupa, lateral configuration.
Fig. 160 Cladogram of hypothesized relationships among known immature Cryptoglossini.

Explanation: Apomorphic state of characters are indicated as *; numbers to the right of characters indicates character number; symbols to the left indicate states of characters: no symbol indicates state (1) of character; - indicates state (-1) of character. The cladogram is rooted by including a hypothetical ancestor: PLES. Other acronyms represent the first letter of the generic name followed by the first three letters of the species name.
Fig. 161 Concensus cladogram of hypothesized relationships among adult Cryptoglossini.

Explanation: Characters are indicated as * or O; * indicates apomorphic state of character; 0 indicates reversal to plesiomorphic state. Numbers to the right of characters indicates character number; symbols to the left of characters indicates character states: no symbol indicates state (1) of character; 2 indicates state (2) of character; - indicates state (-1) of character. The cladogram is rooted by including a hypothetical ancestor: PLES. Other acronyms represent the first letter of the generic name followed by the first three letters of the species name.
APPENDIX B: CHARACTER AND CHARACTER-STATE DESCRIPTIONS

[State hypothesized to be plesiomorphic listed as (0)]

Characters of the Head:

1. Clypeus (apex), horizontal configuration: straight, truncate (0); strongly inflexed over labrum (1).

2. Epistomal canthus configuration: slightly inflated laterally (0); strongly inflated laterally (1).

3. Eye Configuration: dorsoventrally elongate, slightly narrowed at center, eye facets at center 5 or more (0); narrowed at center to 3 facets (1); dorsal and ventral portions completely divided (2).

4. Subgena, anterior mandibular process configuration: produced antero-mesally, apex variable (0); slightly produced antero-mesally, apex curved, not angulate (1); not produced antero-mesally, apex flat (2).

5. Subgena, anterior mandibular process configuration: strongly, acutely produced anteriorly, apex sharp (0); slightly produced antero-mesally, apex rounded or angulate, not acute (1).

6. Mentum (ventral aspect), anterior margin: concave to cordate (0); centrally deeply excavate (1).

7. Antenna, length of 3rd segment: subequal to next two segments combined (0); equal to next three segments combined (1).

8. Antenna (terminal segment), size of sensory area: subtriangular (0); reduced, truncate (1).

9. Antenna (apical segments), cross section: broadly oval (0); flattened, narrowly oval (1).

10. Antenna (apical segments) base, lateral configuration: wider than long (0); longer than wide (1).

Characters of the Thorax:

11. Pronotum (upper surface) shape: broadly convex (0); inflated, subglobose (1); strongly inflated, forming two lateral lobes (2).
12. Pronotum (upper central surface) sculpturing: 
rugulose-granulate (-1); punctate, punctures large 
(0); punctures small (1); punctures minute (2).

13. Pronotum (upper lateral surface) sculpturing: 
rugulose-granulate (-1); punctate, punctures large, 
dense to confluent (0); small, sparse (1); minute, 
sparse (2).

14. Prosternal process (lateral configuration): moderately 
to deeply produced behind procoxae (0); slightly, 
shallowly produced behind procoxae (1); not produced 
behind procoxae (2).

15. Metafemur, (medial surface) similar to pro, mesofemur 
(0); smooth, concave (1).

16. Metafemur (lateral aspect) sculpturing: punctation 
equal to pro-mesofemur (0); smooth (1).

17. Metafemur, (mesal surface) similar to pro, mesofemur 
(0); modified as locking mechanism with serrate 
upper margins (1).

18. Tarsi setation: subglabrous or short spinose (0); 
long, slender (1).

Characters of the Elytra:

19. Elytral sculpturing: non muricate, apex of interval 
elevations, if present, rounded, not distinctly 
acute, separated to coalescing (0); muricate to 
spiculate, apex of elevations distinctly acute, 
separated (1).

20. Elytral sculpturing: noncostate (0); costate (1).

21. Elytral (postero-pseudepipleural margins) sculpturing: 
not forming distinct spiculate rows (0) with one 
distinct spiculate row longitudinally along 
pseudepipleural ridge (1); with two distinct 
spiculate rows along pseudepipleural ridge (2).

22. Elytral sculpturing (at pseudepipleural margins): not 
smooth (0); smooth (1).

Sexual Characters, Females:
23. Coxites, 4th lobe (apical vestiture) set with minute slender setae or glabrous (0); setae thickened, not strongly sclerotized (1); very short, strongly sclerotized, thick, peglike spicules (2).

24. Ovipositor proportions (coxite-paraproct baculi, ventral length ratio): paraproct equal to subequal twice length of coxites (0); paraproct only slightly longer than coxites (1).

25. Spiculum ventrale (configuration): more than twice longer than wide (0); slightly but distinctly longer than wide (1); wider than long (2).

26. Spermathecal Accessory Gland (length): very long (0); long (1); short (2).

27. Spermathecal Accessory Gland (configuration): thin (0); thick (1).

Sexual characters, Males:

28. Meso, Metafemur, (postero-basal region) males: not modified (0); modified as a distinct raised elongate, flattened, tubercle (1).

29. Meso, Metafemur, (postero-basal region) males: tubercle concave, secretory cells present (~1); tubercle, if present, flattened, elongate, not well developed (0); well developed as large flattened tubercle (1).

30. Male, 8th sternite (dorsal configuration): apical lateral lobes extending to center, central aspect angulate (0); apical lateral lobes confined to lateral edges, central aspect concave (1).

31. Male aedeagus, parameres (apical vestiture): with clearly visible short setae (0); setae greatly reduced, visible only at high magnification (1).

32. Male aedeagus, parameres (apical vestiture), position: ventro and dorso-lateral (0); ventral sublateral (1).

33. Male aedeagus, base of median lobe (dorso-ventral configuration): broad (0); narrow (1).
34. Male aedeagus, median lobe (dorsal joining of lateral rods): gradual toward apex (0); abruptly joining near base (1).

35. Male aedeagus, (parameres) apex: spatulate ventrally at apex (-1); apical aspect narrow, subapex laterally straight to concave, not spatulate ventrally (0); apical aspect broad, subapex laterally distinctly convex to angulate, not spatulate ventrally (1); subapex laterally distinctly angulate (2).

36. Male aedeagus, (parameres) apex (lateral configuration): straight or bent ventrally (-1); gradually bent dorsally (0); abruptly bent dorsally subapically (1).

Characters of Immature Stages:

37. Egg (size): moderate [average length = 2-3mm] (0); large [average length = 4mm] (1).

38. Mature Larva: Epipharyngeal apical spicular configuration: with 3 major lateral spicules (0); with at least 4 major lateral spicules of equal size (1).

39. Mature Larva: Epipharyngeal central microspicular configuration: arranged in widely separated pairs (0); arranged in closely separated pairs (1).

40. Mature Larva: Labral medial spicular number: many, approximately 40 (-1); approximately 20 (0); few, less than 15 (1).

41. Mature Larva: Labral medial spicular length: short, at least .15mm (0); very short, less than .1mm (1).

42. Mature Larva: Mandibles (left incisor lobe): tridentate, with distinct toothlike process on dorso-mesal surface (0); bidentate, without distinct toothlike process on dorsal-mesal surface (1).

43. Mature Larva: Prosternum (mesal cuticular surface), presence of bare areas: not present (0); present (1).

44. Mature Larva: Prosternum (mesal cuticular surface):
distinct bare areas, if present, oval (0); semicircular (1).

45. Mature Larva: Protarsangulus (basal lobe, apex) number of spicules: one (0); two (1).

46. Mature Larva: Protergal margins, prosternum (cuticular melanization): unmelanized to slightly melanized (0); strongly melanized (1).

47. Mature Larva: Ninth abdominal tergum (lateral areas) spicular configuration: irregularly arranged into two uneven rows (0); arranged in one even to uneven row (1).

48. Mature Larva: Ninth abdominal tergum (lateral areas) spicular length: short, at least .15mm (0); very short, less than .1mm (1).

49. Mature Larva: Third antennal segment (size): very small (0); minute (1).
### APPENDIX C: DISTRIBUTION OF CHARACTER STATES:

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[state hypothesized to be plesiomorphic listed as (0); unavailable character/character states listed as (U)]
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APPENDIX D: MATERIAL EXAMINED

APPENDIX D1: Cryptoglossa infausta (LeConte)

col., (6) USNM; Uvalde, XII-11-20, J. Hamlin col., (2)
USNM; Uvalde, VI-15-30, J. Martin col., (1) CASC: Uvalde,
II-25-34, S. James col., (1) TAMU; Uvalde, IX-27-34, S.
James col., (3) TAMU; Uvalde, V-20-38, J. Robinson col.,
(1) NSDA; 16 mi, NW Sabinal, VI-16-59, J. Lawrence col.,
(1) MCZC; Uvalde, VI-18-20, 930', Wickham col., (1) MCZC;
Uvalde, Fall coll., Wickham col., (1) MCZC. LA SALLE CO.:
Encinal, IV-18-06, J. Mitchell col., (2) USNM; Cotulla,
IV-16/17-06, F. Pratt col., (10) USNM; Cotulla, IV-6-07,
under opuntia, J. Mitchell col., (1) USNM; Encinal, IV-
10/12-08, under opuntia, J. Mitchell col., (5) USNM;
Cotulla, IV-12-07, F. Pratt col., (1) USNM; Cotulla, VI-
13-06, at light, E. Tucker col., (1) USNM. HIDALGO CO.:
Mission, IX-30-19, O. Cartwright col., (1) USNM; Edinburg,
Chittenden col., (3) USNM; Edinburg, S. Mulaik col., (1)
AMNH; Sullivan City, VI-22-59, J. Lawrence col., (1) MCZC.
TERREL CO.: 2.5 mi. N Dryden, VII-28-70, R. Stephens col.,
(2) CSLB; 2.5 mi. N Dryden, VII-28-70, R. Stephens col.,
(1) RLAC. STARR CO.: 3.5 mi. N Roma, V-16-72, E. Giesbert
col., (1) LACM; 2.5 mi. N Roma, V-26-65, (1) UCRC. KINNEY
(5) CISC. DIMMIT CO.: Brundage, IV-8-28, Blaisdell, (1)
CASC; IV-8-33, S. James col., (1) TAMU; V-3-33, S. James
col., (1) TAMU; Winterhaven, X-25, (1) TAMU. MEDINA CO.:
20 mi. N. Hondo, VII, K. Stager col., (1) LACM; Hondo, VI-
1-09, on opuntia, J. Mitchell col., (3) USNM. ZAVALA CO.:
Batesville, III-14-34, (1) TAMU. MAVERICK CO.: V-16-06, J.
Mitchell col., (1) USNM; Eagle Pass, C. Grant col., (1)
CUIC. KIMBLE CO.: 5 mi. W Junction, IV-15-61, (4) AMNH.
BLANCO CO.: Gould Davis Cave, V-12-59, under rock, Becker
& Howden cols., (4) CNCI. WEBB CO.: Laredo, V-12-24,
texana det. Blais, (1) KWBC; Laredo, Cope col., (1) ANSP.
JEFF DAVIS CO.: Limpia Cyn. V-30-65, (1) UCRC. KNOX CO.: 8
mi. N Vera, IV-23-47, J. Schmidt col., (3) FMNH. COMAL
CO.: New Braunfels, Fall coll., Leibeck col., (2) MCZC.
PRESIDIO CO.: Presidio, IX-1-35, (1) TAMU. ZAPATA CO.:
Zapata, II-12-33, S. James col., (3) TAMU. MEXICO,
DURANGO: Villa Lerdo, TYPE, SYNTAXE, SPICULOSA, Hoge col.,
(1) BMNH; Villa Lerdo, SYNTAXE, SPICULOSA, Hoge col., (5)
BMNH; Villa Lerdo, PARYTYPE 49477, SPICULOSA, Hoge col.,
(1) USNM; Villa Lerdo, Hoge col., (1) AMNH; 3 mi. W Lerdo,
VIII-24-46, infausta det, Pallister, C. Bogert col., (1)
AMNH; Villa Lerdo, J. Chatanay, Hoge col., (4) MNHP; Villa
Lerdo, PARYTYPE 19903, SPICULOSA, Hoge col., (1) USNM.
COAHUILA: San Felipe Salinas, SYNTAXE, SPICULOSA, J. Cohz
col., (1) BMNH; Sierra de los Burros, VI-18-38, Texana
det. Blaisdell, R. Baker col., (1) CASC; 41 mi. S. Sabino,
VIII-5-63, J. Doyen col., (1) CISC; Don Martin Dam, 8 mi.

APPENDIX D2: Cryptoglossa variolosa (Horn)

MATERIAL EXAMINED: NO DATA: Centrioptera variolosa Horn Type, SYTYPE, (2) BMNH; ARIZONA, (13) USNM; 93-60, Pascoe col., (1) BMNH; (5) AMNH; (2) KSUC; VIII-24-23, (2) KSUC; (2) INHS; (1) PURC; Fall Collection (1) MCZC; R. Hayward (1) MCZC; (4) USNM; Cienega de Flores, VI-14-41, C. Seevers col., (1) FMNH; Huasteca cyn., VI-17/18-82, 3000', dry wash, R. Aalbu col., (22) RLAC; Huasteca cyn., VI-17/18-82, 3000', dry wash, C. Withrow col., (2) RLAC. TAMAULIPAS: Guemez, VI-28-65, P. Spangler col., (1) USNM; Jiminez, V-15-52, M. Cazier, W. Gertsch & R. Schrammel cols., (1) AMNH; Abasolo, V-17-52, M. Cazier, W. Gertsch & R. Schrammel cols., (1) AMNH. UTAH, WAYNE CO.: base of Henry Mts., nr. Hanksville, VI-36, E. Bowles col., (2) USNM; (doubtful locality)
260

APPENDIX D4: Cryptoglossa asperata (Horn)

Appendix D3: Cryptoglossa muricata (LeConte)

271

26-52, Bryant col., (1) CASC; Salton Sea, IV-4-58 (1)
CASC; Deep Canyon, VII-10/26-63, E. Schlinger col., (6)
UCRC; Deep Canyon, V-63, at light, E. Schlinger col., (8)
UCRC; Deep Canyon, II-63, 1200', on *Hyptis*, E. Schlinger col., (2)
UCRC; Deep Canyon, VI-63, at light, E. Schlinger col., (12)
UCRC; Deep Canyon, XI-63, E. Schlinger col., (1)
UCRC; Deep Canyon, VII-63, E. Schlinger col., (2)
UCRC; Deep Canyon, III-63, E. Schlinger col., (1)
UCRC; Deep Canyon, II-63, E. Schlinger col., (1)
UCRC; Deep Canyon, IX-2-64, P. Rauch col., (2)
UCRC; Deep Canyon, VII-1-64, W. Ewart col., (1)
UCRC; Deep Canyon, IX-2-64, A. Gillogly col., (1)
UCRC; Deep Canyon, Coyote Creek, V-10-75, V. Hamister col., (1)
UCRC; Carrizo Creek, VI-30-64, G. Ballmer col., (2)
P. Boyd Desert Research Center, 3.5 mi. S Palm Desert, pitfall trap, VI-20/27-69,
S. Frommer, D. Bixler & L. LaPre cols., (1)
UCRC; P. Boyd Desert Research Center, S Palm Desert, Deep canyon
alluvium, pitfall trap, V-23/VII-9-79, S. Frommer col.,
(1) UCRC; P. Boyd Desert Research Center, 3.5 mi. S Palm
Desert, pitfall trap, IV-73, Quillman col., (1)
UCRC; P. Boyd Desert Research Center, 3.5 mi. S Palm
Desert, at light, VI-11-71, S. Frommer col., (1)
UCRC; P. Boyd Desert Research Center, 3.5 mi. S Palm
Desert, pit trap under *Hyptis*, VI-27/VIII-3-69, S. Frommer col., (3)
UCRC; P. Boyd Desert Research Center, 3.5 mi. S Palm
Desert, pit trap, Deep cyn. alluvium, V-23/VII-9-79, S.
Frommer col., (9) UCRC; P. Boyd Desert Research Center,
3.5 mi. S Palm Desert, Coyote Creek, IV-12-73, L. Clark
col., (2) UCRC; P. Boyd Desert Research Center, 3.5 mi. S
Palm Desert, IV-26-73, J. Tucker col., (1)
UCRC; P. Boyd Desert Research Center, 3.5 mi. S Palm
Desert, near stream, S. Frommer col., (1)
UCRC; P. Boyd Desert Research Center, 3.5 mi. S Palm
Desert, IV-7-75, C. Ward col., (2)
UCRC; P. Boyd Desert Research Center, 3.5 mi. S Palm
Desert, V-16-69, S. Frommer col., (1)
UCRC; P. Boyd Desert Research Center, 3.5 mi. S Palm
Desert, IV-26-70, S. & S. Frommer cols., (1)
UCRC; W. Sharer's Well, IV-7-35, (1) LACM.
IMPERIAL CO: II-1911, J. Bridwell col., (1) USNM; 3.5 mi. WNW Glamis, sand dunes,
(1) UCRC; Morongo Valley, II-12-45, G. Mackenzie col.,
(1) UCRC; Adelanto, 4 mi. N, IV-20-37 (1) UCRC; Sheephole
Mts., cyn. at N end, III-24-73, Garrison col., (1) CISC; 16
W of Cottonwood, Mojave River, II-17-29, G. Villet col.,
(1) LACM; Pisgah Crater, V-6-61, Norris & Heath cols.,
(40) LACM; Pisgah Crater, VI-12-62, Norris & Heath cols.,
(21) LACM; Pisgah Crater, IV-7-62, Norris & Heath cols.,
(5) LACM; Pisgah Crater, V-12-62, Norris & Heath cols.,
(31) LACM; Pisgah Crater, X-7-61, Norris & Heath cols.,
(55) LACM; Pisgah Crater, X-6-62, Norris & Heath cols.,
(7) LACM; Pisgah Crater, XI-11-61, Norris & Heath cols.,
(2) LACM; Pisgah Crater, V-6-62, Norris & Heath cols.,
(18) LACM; Pisgah Crater, VIII-18-62, Norris & Heath
cols., (37) LACM; Pisgah Crater, IX-2-61, Norris & Heath
cols., (35) LACM; Pisgah Crater, VII-26-61, Norris & Heath
cols., (143) LACM; Pisgah Crater, IV-12-61, Norris & Heath
cols., (26) LACM; Pisgah Crater, V-6-61, Norris & Heath
cols., (2) LACM; Pisgah Crater, III-11-61, Norris & Heath
cols., (3) LACM; Pisgah Crater, IX-2-61, Norris & Heath
cols., (30) LACM; Mts. W of Cottonwood, Mojave River, II-
17-29, G. Villet col., (1) LACM; sand dunes 3 mi. NE Death
Valley Nat. Mon., Saratoga Springs, IV-15-73, A. Hardy
col., (1) CDAE; 1.7 mi. NW Old Dale Jct., Joshua Tree Nat.
Mon., V-1-65, ground trap, E. Sleeper col., (1) CDAE; 1.7
mi. NW Old Dale Jct., Joshua Tree Nat. Mon., V-23-63,
ground trap, E. Sleeper col., (2) CDAE. SAN DIEGO CO: (2)
MCZC; (4) USNM; V, Coquillet collection, (3) USNM; V-6-79,
(1) LACM; X-14-49, E. Leach col., (3) CASC; San Diego,
Wickham col., (2) USNM; Split Mt. Anza Desert St. Pk., IV-
1-55, J. Martin col., (1) CNCI; nr. Borrego, VII-6-56,
Simmonds col., (1) CDAE; Borrego Palm cyn., III-19-69, D.
Lindsey col., (4) CDAE; Dos Cabezas Springs, V-31-77, R.
Allen col., (1) CDAE; Box cyn., S of Borrego Springs, IV-
18-59, H. Chambers col., (1) CDAE; Borrego Springs, III-
30-60, M. Wasbauer col., (1) CDAE; Borrego Springs, VII-4-
56, H. Michalk col., (1) CDAE; Anza Borrego, IV-6-79, (2)
CDAE; H. Klages (2) ICCM; Anza Borrego, Sheep cyn., V-16-
69, Moore & Berry cols., (10) RLBC; Lake Jennings, V-23-
69, Moore & Berry cols., (1) RLBC; .5 mi. W Yaqui Well,
II-19/IX-23-78, cholla-ocotillo, 1500', R. Aalbu col., (1)
RLAC; 2 mi. SE San Felipe, II-18-78, R. Aalbu col., (1)
RLAC; Mason Valley, cowchip, II-17-29, C. Searl col., (1)
MCZC; desert edge, VI-15, M. VanDuze col., (1) MCZC;
Caliente, IV-20-1889 (1) MCZC; Caliente, IV-20-07 (1)
ANSP; 6.5 mi. N Scissors Crossing, 2700', X-14-66, K.
Brown col., (3) KWBC; 6.9 mi. NW Scissors Crossing, 2900',
IV-6-66, K. Brown col., (1) KWBC; 8.2 mi. NW Scissors
MXZC; Phoenix, (1) MCZC; Tempe, XI-30-55, Jones col., (1)
NAUF; Gillepse Dam, III-30-58, Menke & Strange cols., (1)
LACM; 14 mi. N Ajo, III-20-68, W. Hanson col., (1) EMUS;
Verde River, R. Hayward col., (2) MCZC; Gila Bend, IV-6-3,
W. Ewart col., (1) UCRC; McDonell Mts., IV-7-51, G. Bender
col., (1) ASUT.
MEXICO, BAJA CALIFORNIA NORTE: 5 mi. N San Felipe,
VI-3-61, H. Howden col., (1) CNCI; km 88, 60 mi. S
Mexicali, VI-3/5-61, H. Howden col., (1) CNCI; San Felipe,
XI-1909, (1) CASC; 14 mi. S Puertecitos, IV-15-65,
Cavagnaro, Ross & Vesterby cols., (2) CASC; Los Medanos,
V-22/24-51, J. Slevin col., (1) CASC; 31 mi. N San Felipe,
I-17-76, salt flats, R. Aalbu col., (1) RLAC; 1 mi. S
Bahia de Los Angeles, VI-11-67, BL, E. Sleeper & E. Fisher
cols., (1) CSLB; Puertocitos, V-31-58, E. Sleeper col.,
(3) CSLB; 25 mi. N. Ba. San Luis Gonzaga, VI-7-67, E.
Sleeper & E. Fisher cols., (1) CSLB; 3 mi. N Puertocitos,
VI-16-76, BL, A. Tilzer col., (1) CSLB; Baja Charlie (1)
LACM; Puertocitos, IV-13-68, D. Morafka col., (1) LACM; 15
mi. S. San Felipe, IV-74, S. Ward col., (1) UCRC; San
Felipe, V-18-63, J. Ball col., (1) UCRC; San Felipe, XI-
30-74, O. Aalbu col., (1) RLAC; 6.2 mi. W Bahia de Los
Angeles, VII-11-79, R. Aalbu col., (7) RLAC; 19 km N San
Borja, 27 km W Punta Arena, V-9/10-76, R. Aalbu col., (1)
RLAC; 11.3 km. N Guerrero Negro, VII-4-79, sand dunes, R.
Aalbu col., (1) RLAC; 6.2 mi. W Bahia de Los Angeles, VII-
11-79, cereal bowl pitfall trap, A. Hardy, F. Andrews & D.
Giuliani cols., (2) RLAC; 6.2 mi. W Bahia de Los Angeles,
VII-11-79, cereal bowl pitfall trap, A. Hardy, F. Andrews
& D. Giuliani cols., (5) CDAE; Valle Montevideo, La Laguna
wash, 18 km. W Los Angeles Bay, 2855/11344, VIII-12-82,
380m, W. Clark and P. Blom cols., (2) IDAHO; Valle
Montevideo, La Laguna wash, 18 km. W Los Angeles Bay,
2855/11344, I-3-82, 380m, W. Clark and P. Blom cols.,
(2) IDAHO; Valle Montevideo, La Laguna wash, 18 km. W Los
Angeles Bay, 2855/11344, Ethylene glycol pitfall trap, I-
3/VIII-12-82, 380m, W. Clark and P. Blom cols., (1) IDAHO;
Los Angeles Bay, VI-2-81, D. Thomas col., (3) DBTC; 6.2
mi. W Bahia de Los Angeles, VII-11-79, R. Aalbu col., (2)
KWBC; San Felipe, VI-15-52, M. Cazier, W. Gertsch and R.
Schrammel cols., (6) AMNH; 43 km ESE of jct. Hwy 1 (by
road to LA Bay), V-5-77, R. Seib col., (1) CASC; 11.0 km
WWW Bahia de Los Angeles, 2856/11339, 207m, VII-8/9-78,
GifCstDst, E. Sleeper col., (3) CSLB; Diablito cyn., E
slope Sierra San Pedro Martir, IV-5-73, J. Doyen, J.
Powell and S. Szerlip cols., (1) CISC; 65 mi. S San
Felipe, IV-10-60, R. Gehring col., (1) CISC; Las Arractras
de Arriela, IV-3-73, J. Doyen, J. Powell, and S. Szerlip
cols., (1) CISC; sulfur mine, 23 mi. S. San Felipe, IV-4-

APPENDIX D5: Cryptoglossa michelbacheri (Blaisdell)

MATERIAL EXAMINED: MEXICO, BAJA CALIFORNIA SUR, 38.6 km. S Santa Rosalia, 27112Cc, V-30/31-73, 100m, trop-scrub, E. Sleeper col., (3) CSLB; 5.7 mi. SE Mulege, VII-7-79, walking dunes at night, Andrews, Hardy & Giuliani cols., (8) CDAE; 5.7 mi. SE Mulege, VII-7-79, cereal bowl pit trap, Andrews, Hardy & Giuliani cols., (20) CDAE; 12.8 mi. SSE Santa Rosalia, IX-23-81, D. Faulkner & F. Andrews cols., (2) CDAE; 10 km. SE Mulege (km 126), sand dunes, VIII-24/25-77, E. Fisher & R. Westcott cols., (2) CASC; 5.7 mi. SE Mulege, VII-7-79, R. Aalbu col., (7) CASC; 8 km. SE Mulege, sand dunes, R. Aalbu col., (1) CASC; 25 mi.
S Santa Rosalia, VII-25-83, PARATYPE, Michelbacher & Ross cols., (4) CASC; 8 km. SE Mulege, IV-12-76 to VII-7-79, ethylene glycol pitfall trap, el. sea level, sand dunes, R. Aalbu col., (242) RLAC; 8 km. SE Mulege, IV-12-76 to VII-7-79, ethylene glycol pitfall trap, el. sea level, sand dunes, R. Aalbu col., (1) KWBC; 5.7 mi. SE Mulege, VII-7-79, R. Aalbu col., (3) KWBC.

APPENDIX D6: Cryptoglossa caraboides (Mannerheim):


APPENDIX D7: Cryptoglossa spiculifera (LeConte)

MATERIAL EXAMINED: NO DATA: Albatross Exp. 1911, (2) AMNH; CAL: San Diego Co., Klages coll., (1) ICCM; Riverside Co., Klages coll., (1) ICCM; SAN BERNARDINO Mts., (1) ICCM; through C. V. Riley, (3) USNM; (1) USNM; Hubbard & Schwarz cols., (1) USNM; L. CAL.: (2) KSUC; VIII-1901, (1) KSUC; (1) BMNH; (1) CASC; (1) CNCI; MEXICO: Fry Coll., 1905-100, (2) BMNH; MEXICO, BAJA CALIFORNIA SUR, 2.0 km. N Puerto San Carlos, el. sea level, 24112Bb, (BeachScrub) VI-15/16-73, E. Sleeper col., (7) CSLB; 4.0 km. NE San Lucas del Cabo, B & S (CpThrn), VI-11/12-73, 22109Aa, 15m, E. Sleeper col., (3) CSLB; .8 km. N San Jose del Cabo, B & S (Agric), VI-12-73, 23109Dc, 25m, light, E. Sleeper col., (1) CSLB; 1 mi. S Puerto Escondido, 100', XI-11-68, E. Sleeper & F. Moore cols., (3) CSLB; 18 mi. W La Paz, 800', XI-7-68, E. Sleeper & F. Moore cols., (4) CSLB; La Paz, 50', X-6-68, E. Sleeper & F. Moore cols., (2) CSLB; 6 mi. E San Jose del Cabo, 400', X-26-68, E. Sleeper & F. Moore cols., (2) CSLB; 3 mi. N San Antonio, 1300', X-9-68, E. Sleeper & F. Moore cols., (3) CSLB; 8 mi. SE La Paz, 1000', X-13-68, E. Sleeper & F. Moore cols., (2) CSLB; 2 mi. S Santiago, VI-30-67, E. Sleeper & E. Fisher cols., (1) CSLB; 22 mi. W La Paz, VI-25-67, E. Sleeper & E. Fisher cols., (6) CSLB; 3.3 mi. S
CARMEN ISLAND: Porto Ballandra, V-12-21, J. Chamberlin
col., (1) CASC. MONSERATE ISLAND: VI-13-21, E. Van Duzee
col., (1) CASC. CERALVO ISLAND: SE end, III-20-53, J.
Figgs Hoblyn col., (1) CASC. MONSERATE ISLAND: VI-13-21,
det. Blais., E. Van Duzee col., (1) CASC. ESPIRITU SANTO
ISLAND: V-31-21, J. Chamberlin col., (1) CASC. PARTIDA
ISLAND: sand dunes, IV-12-74, J. Doyen col., (3) CISC.
MEXICO, BAJA CALIFORNIA NORTE: 6 mi. N Guerrero Negro,
VII-4-79, Cereal bowl pit trap, A. Hardy, F. Andrews & D.
Giuliani cols., (1) CDAE; 2.5 mi. NW Catavina, VII-13-79,
A. Hardy, F. Andrews & D. Giuliani cols., (4) CDAE; 6 mi.
N Guerrero Negro, X-13-81, walking dunes at night, F.
Andrews & D. Faulkner cols., (1) CDAE; 5.4 km. W km Ejido
Morelos, 2817/11407, 13m, VII-16-72, sand dune B & S, E.
Sleeper col., (2) CSLB; San Pedro Martir cyn, Diablito, IIII-26/27-70,
dulzurae det. Triplehorn, J. Grumwell & P.
Perkins cols. (1) CSLB; n. San Simon, VIII-9-55, (2) LACM;
9 km N Guerrero Negro, sand dunes, IX-8-77, E. Fisher & R.
Westcott cols., (1) CASC; 11.3 km N Guerrero Negro, sand
dunes, IV-76 to I-77, ethylene glycol pitfall trap, R.
Aalbu col., (4) RLAC; 27 km. W Punta Arena, 19 km. N San
Borja, IV-9/10-76, sandstone arroyo, R. Aalbu col., (1)
RLAC; 2.1 mi. NW Catavina, VII-3-79, R. Aalbu col., (1)
RLAC; Las Arractras de Arriela, IV-3-73, J. Doyen, J.
Powell & S. Szerlip cols., (1) RLAC; 6.2 mi. W Bahia de
Los Angeles, VII-11-79, R. Aalbu col., (1) RLAC; 9 km NW
Rancho Santa Inez, 2946/11446, VIII-28-82, 550m, W. Clark
and P. Blom cols., (1) IDAHO; 9 km NW Rancho Santa Inez,
2946/11446, VII-3-81, 550m, D. Cnowe col., (1) IDAHO; 22
mi. S Los Angeles Bay, VIII-13-82, (2) IDAHO; 9 km NW
Rancho Santa Inez, 2946/11446, VII-2/3-81, 550m, L. Terrel
col., (4) IDAHO; Rancho Santa Inez, 2943/11441, VI-21-81,
540m, D. Ward, W. Clark and P. Blom cols., (1) IDAHO;
Punta Prieta, IX-5-51, G. Marsh col., (1) CISC; 35 mi. S
El Progresso, Arroyo Catavina, IV-2-76, J. Doyen col., (1)
CISC; Los Angeles Bay, IV-18-74, J. Doyen col., (1) CISC;
11.3 km N Guerrero Negro, sand dunes, IV-76 to I-77,
dulzurae det K. Brown, Pectoralis det. Aalbu, ethylene
glycol pitfall trap, R. Aalbu col., (2) KWBC; Punta
Prieta, XI-7-81, W. Steiner col., (1) WESC; Angeles Bay,
V-5-21, E. VanDuzeecol., (1) CASC; Escondido Bay, V-24-
21, J. Chamberlin col., (1) CASC; Angeles Bay, V-5-21,
dulzurae det. Blais., E. VanDuzeecol., (1) CASC; 6.2 mi.
W Bahia de Los Angeles, VII-11-79, A. Hardy, F. Andrews &
D. Giuliani cols., (1) RLAC; Angeles Bay, V-5-21, dulzurae
det. Blais., E. VanDuzeecol., (1) CASC; 6.2 mi. W Bahia
de Los Angeles, VII-11-79, A. Hardy, F. Andrews & D.
Giuliani cols., (1) RLAC; 2.5 mi E Las Parras, XI-28-69,

APPENDIX D8: Cryptoglossa seriata (Casey):

MATERIAL EXAMINED: NO DATA: F. Psota Collection, (1) FMNH. seriata, (3) MCZC. N. AMERICA, green label. (1) BMNH. ARIZ, d. Le Conte, F. Bates, (1) BMNH. CALIFORNIA, seriata det. Blaisdell, (1) INHS. SO. CALIFORNIA, Liebeck collection, (3) MCZC. CALIFORNIA, San Diego, (1) ICCM; Riverside Co., H. Kames collection, 11.712, (2) ICCM. LOWER CALIFORNIA, green label 41108, Fry collection 1905-100, Edmunds col. (1) BMNH; 39, (1) AMNH. San Felipe, (1) KSUC. San Felipe, VIII, (1) CNCI. San Felipe, 7244, (1) MCZC. MEXICO, BAJA CALIFORNIA SUR, 9 mi. N San Lucas, X-24-68, 1000', E. L. Sleeper and F. Moore cols. (1) CDFA, (1) CSLB; Cape San Lucas, III-5-28, T. Craig (1) CASC; 2 mi. NE Cabo San Lucas, VII-15-57, D. Spencer and J. A. Ryckman cols. (1) CISC; Cabo San Lucas, 7244 (1) INHS; 4.0 km. NE San Lucas Del Cabo, 22109Aa, VI-11/12-75, B & S, 15 m, (Cp Thrn) E. L. Sleeper col. (1) CSLB; Cape San Lucas, 7244, Fall collection (1) MCZC; Cabo San Lucas, X-21/23-78, G. C Mallick col. (1) CASC; rd. from San Lucas to Todos Santos, X-24-78, G. C Mallick col. (1) CASC; Cabo San Lucas, II-5/7-66, V. Roth col. (1) AMNH; Cabo San Lucas, VII-14-67, E. M. Fisher col. (1) CSLB; 4.0 km. NE San Lucas del Cabo, 22109Aa, VI-11/12-73, (Cp Thrn) B & S, 15m., E. L. Sleeper col. (1) CSLB; La Paz, 81-19, F. Bates col. (1) BMNH; 17.1 mi. S La Paz, IX-27/81, on ground at.

APPENDIX D9: Asbolus mexicanus (Champion)

MATERIAL EXAMINED: NO DATA: Ck11.480. (1) USNM; TEXAS; San Antonio, V-15/21, (1) ICCM; TEXAS; EL PASO CO.: Fort
MEXICO; DURANGO: Cueva del Guano (Sierra de la Espana, 20 km S Ciudad Lerdo), 33 km S Torreon, II-24-66, in dusty dry entrance, W. Bell & J. Reddell cols., (1) USNM; Cueva del Guano (Sierra de la Espana, 20 km S Ciudad Lerdo), 20 km SSW Torreon, VI-16/17-72, J. Reddell, E. Alexander & C. Kunath cols., (1) USNM; Cueva de la Siguerita (Cerro Siguerita, near Rancho Descubridora, 40 km WNW Mapimi, 1600m), VI-13-72, J. Reddell, W. Elliott & E. Alexander cols., (2) USNM; Cueva del Guano (Sierra de la Espana, 20 km S Ciudad Lerdo), 20 km SSW Torreon, VI-16/17-72, J. Reddell, E. Alexander & C. Kunath cols., (1) USNM; MEXICO; NUEVO LEON: Grutas de Garcia (7 km NW Villa de Garcia, 1060m), VI-6-66, at base of vertical entrance, A. Smith & J. Reddell cols., (1) USNM; Grutas de San Bartolo (16 km S Monterrey), II-66, W. Russel & D. Mckenzie cols., (5) USNM; Grutas Sur de San Bartolo (16 km S Monterrey), XII-3-66, T. Raines col., (1) USNM; Grutas Sur de San Bartolo (16 km S Monterrey), IX-71, T. Raines col., (1) USNM; Cueva de Carrizal, 15 mi. SE Candela, VI-7-66, J. Reddell, O. Knox & A. Smith cols., (2) USNM; Cueva de Carrizal, 15 mi. SE Candela, T. Rainer col., (3) USNM; Cueva de Carrizal, 20 mi. N Bustamento, III-2-63, in cave, B. Russel col., (1) TAMU; guano of Bat cave, 1300', VI-14-40, H. Hoogstraal col., (7) NSDA; Sabinal Hildalgo, VI-13-79, R. Haag col., (1) MCZC; Sabinal Hildalgo, Cave in bat dung, VI-13-79, R. Haag col., (6) MCZC. BAJA CALIFORNIA NORTE: 6.2 mi NE Rosarito, VII-10-79, col. on dunes at night, Hardy, Andrews & Giuliani cols., (1) CDAE; 2.5 mi. NW Catavina, VII-13-79, in small cave at night, Hardy, Andrews & Giuliani cols., (1) CDAE; Calamajue cyn., VI-1-81, D. Thomas col., (1) DBTC; 2.5 mi. NW Catavina, VII-13-79, R. Aalbu col., (1) KWBC; 2.5 mi. NW Catavina, VII-13-79, R. Aalbu col., (4) RLAC; 2.1 mi. NW Catavina, VII-3-79, R. Aalbu col., (1) RLAC; Catavinacito, 29411445, VII-7/8-78, 576m, (vise #1) BsS, E. Sleeper (1) CSLB; BAJA CALIFORNIA SUR: 4.9 mi. NE Mex. 1 on Hutomonte-San Jose rd., X-10-81, at night on ground, Andrews & Faulknor cols., (2) CDAE; La Paz, VII-3-19, J. Slevin col., (1) CASC; Las Cuevas, III-25-75, thorn scrub, R. Aalbu col., (1) CASC; 3.2 km S El Arco, L28N, L113 23'W, VI-17-82, 290m, W. Clark & P. Blom cols., (2) IDAHO; Las Cuevas, III-25-75, thorn scrub, R. Aalbu col., (1) KWBC; Santiago, VII-22-19, (1) NSDA; Cacahillas Mts., nr. La Paz, La Piedra Pintata, III-31-47, La Rivers col., (4) NSDA; 48 km SW Santa Rosalia, rancho Candelaria area, IV-14-76, R. Aalbu col., (2) RLAC; Las Cuevas, VIII-23-75, sandstone caves, kept alive until III-10-78, R. Aalbu col., (1) RLAC; 23 km. W La Paz, IV-24/27-75, E. & J. Fisher cols., (1) RLAC;

APPENDIX D10: Asbolus verrucosus LeConte

Valley, Warm Springs road, V-8-60, sta. 5D-2, B. Banta col., (2) CASC; Saline Valley, Warm Springs road, IX-17-60, sta. 5D-3, B. Banta col., (3) CASC; Eureka Valley, ethylene glycol pitfall trap, Eureka Valley; III-78 transect, # 6, (1) ; IV-78 transect # 13, (1) ; V-78, transect # 25, (1) # 24, (3) # 23, (1) # 22, (1) # 21, (1) # 19, (1) # 18, (1) # 17, (1) # 16, (1) # 15, (1) # 14, (18) # 13, (1) # 12, (1) # 6, (1) # 4, (1), # 2, (2) # 1, (1) ; VI-78, transect # 22, (1) # 21, (1) # 20, (1) # 19, (2) # 17, (1) # 16, (1) # 15, (1) # 14, (1) # 13, (1) # 12, (1) # 11, (1) # 6, (2) # 3, (1) # 2, (1) # 1, (1) ; VII-78, transect # 23, (2) # 22, (1) # 21, (1) # 20, (2) # 19, (1) # 18, (1) # 17, (1) # 16, (1) # 15, (1) # 14, (1) # 13, (1) # 12, (1) # 11, (1) # 6, (4) # 4, (1) # 3, (4) # 2, (5) # 1, (1) ; VIII-78 transect # 21, (1) # 18, (1) # 17, (1) # 16, (1) # 15, (1) # 14, (1) # 13, (1) # 6, (1) # 5, (1) # 4, (1) # 3, (1) # 2, (1) # 1, (1) ; IX-78 transect # 19, (1) # 18, (1) # 17, (1) # 16, (1) # 15, (1) # 14, (1) # 13, (1) # 6, (1) # 3, (1) # 2, (1) A. Hardy, F. Andrews & D. Giuliani cols., CDFA; 15.5 mi. N., 12 mi. W Eureka Valley sand dunes, 4000', V-5/IX-29-80, ethylene glycol pitfall trap edge of wash, sandy soil among Larrea divaricata, D. Giuliani col., (1) CDFA; 15.5 mi. N., 12 mi. W Eureka Valley sand dunes, 4000', VI-24/VIII-8-82, ethylene glycol pitfall trap, D. Giuliani col., (1) CDFA; 15.5 mi. N., 12 mi. W Eureka Valley sand dunes, 4000', V-5/IX-29-80, ethylene glycol pitfall trap edge of wash, sandy soil among Larrea divaricata, D. Giuliani col., (1) CDFA; 15 mi. N., 11 mi. W Eureka Valley sand dunes, 3800', V-5/IX-29-80, ethylene glycol pitfall trap edge of wash, sandy soil among Larrea divaricata, D. Giuliani col., (2) CDFA; 15 mi. N., 11 mi. W Eureka Valley sand dunes, 3800', VI-28/VIII-8-80, ethylene glycol pitfall trap, D. Giuliani col., (1) CDFA; 16 mi. N., 12 mi. W Eureka Valley sand dunes, 4100', VIII-17/XII-7-81, ethylene glycol pitfall trap, desert wash, D. Giuliani col., (1) CDFA; 16 mi. N., 12 mi. W Eureka Valley sand dunes, 4100', V-5/IX-29-80, ethylene glycol pitfall trap, coarse sandy loam soil, D. Giuliani col., (2) CDFA; 16 mi. N., 12 mi. W Eureka Valley sand dunes, 4100', VI-24/VIII-8-82, ethylene glycol pitfall trap, D. Giuliani col., (1) CDFA; 15 mi. N., 12 mi. W Eureka Valley sand dunes, 4000', VI-4/IX-13-79, ethylene glycol pitfall trap, D. Giuliani col., (1) CDFA; 15 mi. N., 11 mi. W Eureka Valley sand dunes, 3800', IX-29/III-18-81, ethylene glycol pitfall trap desert wash, D. Giuliani col., (1) CDFA; 12 mi. N., 10 mi. W Eureka Valley
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cols., (1) UCRC; Valerie Jean, I-29-62, in fallen palm, 
Ewert & Brauner cols., (2) UCRC; Indio, IV-12-41, J. 
Wilcox col., (1) OSUO; 4 mi. W Indio, Coachella Valley 
sandy arroyo, (1) ICCM; Palm Springs, XII, H. Klages col., 
(1) ICCM; Indio, XI-23-24, W. Benedict col., (4) UASM; 
Palm Springs, (1) UASM; Indio, VI-11-61, C. Johnson col., 
(1) NAUP; Palm Springs, III-31-22, A. Benedict col., (2) 
CNCI; Indio, III-28-24, A. Benedict col., (1) CNCI; Mecca, 
III-28-24, A. Benedict col., (1) CNCI; La Quinta, III-5- 
55, J. Martin col., (1) CNCI; Indio, III-30-55, W. 
Richards col., (1) CNCI; 1000 Palms, II-15-55, J. Martin 
col., (1) CNCI; Indio, I-23-64, L. Anderson col., (1) 
KWBC; Indio, IV-12-51, A. L. col., (1) KWBC; 3.7 mi. E 
1000 Palms, III-10-65, under rocks, K. Brown col., (1) 
KWBC; 1000 Palms cyn., XII-19-63, K. Brown col., (1) KWBC; 
4 mi. E 1000 Palms, XII-31-63, K. Brown col., (1) KWBC; 4 
mi. E 1000 Palms, X-4-64, boards, K. Brown & M. Elliott 
cols., (1) KWBC; Palm cyn., San Jacinto Mts., 1925, H. 
Pilsbry col., (1) ANSP; Palm Springs, VIII-5-28, (8) TAMU; 
Palm Springs, V-13-28, (1) TAMU; 4 mi. N Indio, V-23-42, 
L. Rivers col., (1) NSA; Indio, IV-8-48, E. Meyers col., 
(1) NSA; 1000 Palms Oasis, VII-22-77, R. Aalbu col., (2) 
RLAC; Palm Springs, IV-10, (1) MCZC; Palm Springs, IV, A. 
Fenyes col., (1) MCZC; Indio, (2) MCZC; 4.5 N H. Minr. V- 
2-58, E. Sleeper col., (1) CSLB; Salton Sea, XI-17-69, A. 
Tilzer col., (1) CSLB; JOSHUA TREE NATIONAL MONUMENT: 
Lower Covington Flat: V-18-69, F. Moore & R. Berry cols., 
(1) RLBC; IV-16-75, (1) RLAC; JTNM, Pinto Wash Well: V-1- 
76, R. Aalbu col., (2) RLAC; VIII-18-62, E. Sleeper col., 
(1) CSLB; VII-12-63, hanging bait 4, E. Sleeper col., (4) 
Sleeper col., (3) CSLB; V-25-63, ground trap, E. Sleeper 
col., (1) CSLB; V-11-63, E. Sleeper col., (3) CSLB; V-25- 
63, E. Sleeper col., (4) CSLB; V-25-63, ground trap, E. 
Sleeper col., (2) CSLB; JTNM, Squaw Tank: 7 mi. S Squaw 
Tank, X-22-66, pit fall, E. Sleeper & S. Jenkins cols., 
(1) CSLB; 1.7 mi. S Squaw Tank, V-6-67, E. Sleeper & S. 
Jenkins cols., (1) CSLB; JTNM, Pleasant Valley: X-30-65, 
ground trap 1, E. Sleeper & S. Jenkins cols., (1) CSLB; VI- 
25-66, ground trap 7, E. Sleeper & S. Jenkins cols., 
(1) CSLB; VII-9-66, ground trap 1, E. Sleeper & S. Jenkins 
cols., (6) CSLB; JTNM, Pleasant Valley 1: IX-25-65, ground 
trap 1, E. Sleeper & S. Jenkins cols., (1) CSLB; IV-9-66, 
E. Sleeper & S. Jenkins cols., (1) CSLB; V-15-66, E. 
Sleeper & S. Jenkins cols., (1) CSLB; IV-9-66, ground trap 
1, E. Sleeper & S. Jenkins cols., (1) CSLB; V- 
15-66, ground trap 1, E. Sleeper & S. Jenkins cols., (1) CSLB; V- 
15-66, ground trap 1, E. Sleeper & S. Jenkins cols., (1)


CDFA; Big Dune, Armargosa desert, 2500', IV-29-74, at light, A. Hardy & T. Eichlin col. (1) CDFA; Big Dune, IV-28-75, cereal bowl pitfall trap, F. Andrews & A. Hardy cols., (1) CDFA; Mercury, Nevada test site, IV-10-61, BYU-AEC, (1) USNM; Mercury, Nevada test site, VI-20-61, BYU-AEC, (1) USNM; Mercury, Nevada test site, VI-21-61, BYU-AEC, (1) USNM; Mercury, Nevada test site, VII-27-61, BYU-AEC, (1) USNM; Mercury, Nevada test site, VII-22-61, BYU-AEC, (1) USNM; sand dunes in Armargosa Desert, IX-13-72, D. Giuliani col., (1) CASC; Mercury, Nevada Test Site, VIII-15-61, (2) CASC; Mercury, Nevada Test Site, VIII-14-60, (1) CASC; Mercury, Nevada Test Site, VIII-22-60, (2) CASC; Mercury, Nevada Test Site, IX-10-60, (1) CASC; Mercury, Nevada Test Site, VIII-24-60, (2) CASC; Mercury, Nevada Test Site, IX-8-60, (1) CASC; Mercury, Nevada Test Site, VIII-10-60, (1) CASC; Big Dune, S Beatty, IX-19/20-74, J. Doyen col., (1) CISC; Mercury, Nevada Test Site, VIII-22-60, (1) AMNH; Mercury, Nevada Test Site, VIII-14-60, (1) AMNH; Mercury, Nevada Test Site, VIII-16-60, (1) AMNH; Mercury, Nevada Test Site, VII-31-60, (2) AMNH; Mercury, Nevada Test Site, VIII-18-60, (1) AMNH; Mercury, Nevada Test Site, VIII-20-60, (1) AMNH; Mercury, Nevada Test Site, VIII-12-60, (1) AMNH; Mercury, Nevada Test Site, VIII-30-60, (2) AMNH; Mercury, Nevada Test Site, VII-13-61, (2) FMNH; Mercury, Nevada Test Site, VI-14-62, (1) FMNH; Mercury, Nevada Test Site, IX-15-60, (1) FMNH; Mercury, Nevada Test Site, VIII-24-60, (1) FMNH; Mercury, Nevada Test Site, VIII-22-60, (3) FMNH; Mercury, Nevada Test Site, VIII-16-60, (4) FMNH; Mercury, Nevada Test Site, VII-11-61, (1) FMNH; Mercury, Nevada Test Site, VII-31-60, (1) FMNH; Mercury, Nevada Test Site, VI-16-62, (1) FMNH; Mercury, Nevada Test Site, VII-29-60, (1) FMNH; Mercury, Nevada Test Site, VIII-18-60, (1) FMNH; Mercury, Nevada Test Site, VIII-30-60, (1) FMNH; Mercury, Nevada Test Site, IX-22-61, (1) FMNH; Mercury, Nevada Test Site, VIII-20-60, (1) FMNH; Pahrump, VII-26-59, F. Parker col., (1) NSDA; Big Dune, V-14/16-82, R. Betchel & R. Rust cols., (6) NSDA; Big Dune, IV-27/29-82, R. Betchel, J. Knight & D. Zolter cols., (7) NSDA; Mercury, Nevada Test Site, V-30-61, (1) NSDA; Mercury, Nevada Test Site, V-4-61, (1) NSDA; Mercury, Nevada Test Site, V-24-61, (1) NSDA; Mercury, Nevada Test Site, V-12-61, (2) NSDA; Mercury, Nevada Test Site, IV-17-61, (1) NSDA; Mercury, Nevada Test Site, VII-19-61, (1) NSDA; Fairbank springs, Ash Medows, VII14/17-51, I. LaRivers & T. Frantz cols., (1) NSDA; Pahrump, VIII-26-59, F. Parker col., (1) NSDA. LYON CO: Mason, IX-6-10, 4500-5700', (1) ANSP. CHURCHILL CO: Sand Mt. 9 mi. W Frenchman, VII-1-74, J. Doyen col., (1) CISC;
Indian Lake, sand, VI-4/13-80, J. Knight col., (1) NSDA; Indian Lake, sand, VIII-23-80, J. Knight col., (1) NSDA.

APPENDIX DII: A. papillosus Material Examined

CALIFORNIA, Liebeck Collection, (2) MCZC; Yuma, Liebeck collection, (2) MCZC; Cryptoglossa laevis LeConte, Fall Collection (1) MCZC. CALIFORNIA, IMPERIAL CO: Glamis, III-2-72, F. Andrews, E. A. Kane and A. Hardy cols. (7) CDFA; Glamis, V-26-71, cereal bowl pit trap, M. S. Wasbauer and M. E. Irvin cols. (4) CDFA; Glamis, IV-24-72, cereal bowl pit trap, M. S. Wasbauer col. (2) CDFA; Algodones Dunes, 3.5 mi. SE Glamis, IX-22-77, walking dunes at night, F. Andrews and A. Hardy cols. (1) CDFA; Algodones Dunes, 3.5 mi. SE Glamis, VII-19-78, walking dunes at night, F. Andrews and A. Hardy cols. (1) CDFA; 3 mi. N Glamis, IV-12-73, M. S. and J. S. Wasbauer col. (1) CDFA; 7 mi. NW Glamis, V-23/24-70, M. S. Wasbauer col. (1) CDFA; Algodones Dunes, 7 mi. SE Glamis, 32 55'20"N, 114 59'14"W, III-19-79 to III-24-79, Site 4, cereal bowl pit trap, (1) CDFA; Algodones Dunes, 0.75 mi. E Coachella Drop No. 1, 32 40'37"N, 114 58'33"W, IV-16-79, Site 25, pit trap in Ephedra area, (1) CDFA; Algodones Dunes, 2.5 mi. NE Coachella Bridge No. 1, 32 51'41"N, 115 4'6"W, IV-17-79, Site 24, (1) CDFA; Algodones Dunes, 7 mi. SE Glamis, 32 55'20"N, 114 59'14"W, III-19-79 to III-24-79, Site 4, walking dunes at night, (1) CDFA; Algodones Dunes, 6 mi. NW Glamis, 32 2'30"N, 115 9'37"W, IV-19-79, Site 36, (1) CDFA; Algodones Dunes, 13.7 mi. NW Glamis, 33 6'31"N, 115 0'5"W, IV-19-79, Site 38, (1) CDFA; Algodones Dunes, 3.5 mi. SE Glamis, IV-28-78 to VII-19-78, F. Andrews and A. Hardy cols. (2) CDFA; Sand Hills 5 mi. SW Glamis, XI-24-68, Becker and Campbell cols. (1) CNCI; Grey's Well, Colorado Desert, XIII-3-27, Blaisdell Collection, (1) CASC; Glamis, III-28-64, L. D. Anderson col. (1) UCRC; 1 mi. W Glamis, el. 105m, IV-19-64, sand dune assc., M. Irvin col. (1) UCRC; 2.7 mi. NW Glamis, III-31-72, night on sand, J. Saulnier col. (5) KWBC; 1.3 rd. mi. W Glamis, IV-9-76, A. W. Evans col. (1) RLAC; 3.5 mi. WNW Glamis, el. 280', V-1-75 sand dunes, R. L. Aalbu col. (2) RLAC; 6.2 mi. W Glamis, el. 300', VI-23-79, C. L. Belamy col. (1) RLAC; Glamis Dunes, IV-23-68, H.E. Evans col. (2) MCZC. RIVERSIDE CO: 3 mi. W Blythe, IV-23-72, cereal bowl pit trap, M. S. Wasbauer col. (1) CDFA. SAN BERNARDINO CO: Kelso Sand Dunes, 2500', V-1-74, T. Eichlin and A. Hardy
APPENDIX D12: A. laevis Material Examined

CALIFORNIA, A. laevis (1) MCZC; Colorado Desert, (5) MCZC; Yuma, Liebeck collection, (1) MCZC; A. laevis LeConte, F. Bates Collection, 81-19, (1) BMNH; CALIFORNIA, IMPERIAL CO., IV-1911, A. laevis det. Fall, J. C. Bridwell col., (6) USNM; II-1911, J. C. Bridwell col, (4) USNM; V-1911, J. C. Bridwell col, (1) USNM; IX-4-11, J. C. Bridwell col, (1) USNM; Glamis, III-2-72, F. Andrews, E. A. Kane and A. Hardy cols. (20) CDFA; Algodones Dunes, 3.5 mi. SE Glamis, IV-28-78 to VII-19-78, F. Andrews and A. Hardy cols. (9) CDFA; Algodones Dunes, 3.5 mi. SE Glamis, IX-22-77, walking dunes at night, F. Andrews and A. Hardy cols. (6) CDFA; Algodones Dunes, 3.5 mi. SE Glamis, II-26-78, sifted from sand dunes, F. Andrews and A. Hardy cols. (2) CDFA; Algodones Dunes, 3.5 mi. SE Glamis, IV-28-78, cereal bowl pit trap, F. Andrews and A. Hardy cols. (2) CDFA; Algodones Dunes, 3.5 mi. SE Glamis, VII-19-79, cereal bowl pit trap, F. Andrews and A. Hardy cols. (3) CDFA; Algodones Dunes, 3.5 mi. SE Glamis, VII-19-79, walking dunes at night, F. Andrews and A. Hardy cols. (4) CDFA; Algodones Dunes, 3.5 mi. SE Glamis, 32 57'4"N, 115 1'59"W, IV-13-79, walking dunes at night, (1) CDFA; Algodones...
Dunes, 7 mi. SE Glamis, 32 55'20"N, 114 59'14"W, III-19-79 to III-24-79, Site 4, walking dunes at night, (7) CDFA; Algodones Dunes, 7 mi. SE Glamis, 32 55'20"N, 114 59'14"W, III-19-79 to III-24-79, Site 4, cereal bowl pit trap, (2) CDFA; Algodones Dunes, 7 mi. SE Glamis, 32 55'20"N, 114 59'14"W, III-19-79 to III-24-79, Site 4, cereal bowl pit trap, (3) CDFA; Algodones Dunes, 2 mi. SW Cactus, 32 50'00"N, 114 54'48"W, IV-12-79, Site 5, cereal bowl pit trap, (1) CDFA; Algodones Dunes, 3.5 mi. W Ogilby, 32 48'48"N, 114 53'51"W, IV-12-79, Site 6, walking dunes at night, (1) CDFA; Algodones Dunes, 3.5 mi. W Ogilby, 32 48'48"N, 114 53'51"W, IV-12-79, Site 6, cereal bowl pit trap, (1) CDFA; Algodones Dunes, 3.5 mi. W Ogilby, 32 45'35"N, 114 51'32"W, IV-11/12-79, Site 7, (2) CDFA; Algodones Dunes, 5.25 mi. WSW Ogilby, 32 47'30"N, 114 55'19"W, IV-12-79, Site 8, (1) CDFA; Algodones Dunes, 6 mi. SSE Glamis, 32 55'29"N, 114 59'41"W, IV-12-79, Site 12, sifting sand beneath Larrea tridentata, (1) CDFA; Algodones Dunes, 3.5 mi. S Glamis, 32 55'45"N, 115 2'36"W, IV-13-79, Site 18, (1) CDFA; Algodones Dunes, 1 mi. NE Osborne Park, 32 59'44"N, 115 8'35"W, IV-15-79, Site 22, (1) CDFA; Algodones Dunes, 5.5 mi. SE Hwy 78 on Sand Highway, 32 54'57"N, 115 7'3"W, IV-15-79, Site 23, (1) CDFA; Algodones Dunes, 2.5 mi. NE Coachella Bridge No. 1, 32 51'41"N, 115 4'6"W, IV-17-79, Site 24, cereal bowl under Larrea tridentata, (1) CDFA; Algodones Dunes, 0.75 mi. E Coachella Drop No. 1, 32 40'37"N, 114 58'33"W, IV-16-79, Site 25, (2) CDFA; Algodones Dunes, 1.5 mi. SW Coachella Bridge No. 1, 32 50'3"N, 115 7'11"W, IV-12-79, Site 29, cereal bowl pit trap, (3) CDFA; Algodones Dunes, 12.4 mi. ESE Holtville, 32 44'34"N, 115 11'53"W, IV-13-79, Site 30, cereal bowl pit trap, (1) CDFA; Algodones Dunes, 5.5 mi. N Coachella Bridge No. 3, 33 5'48"N, 115 7'26"W, IV-18-79, Site 32, (1) CDFA; Algodones Dunes, 1 mi. E Coachella Bridge No. 3, 33 5'48"N, 115 14'10"W, IV-18-79, Site 33, (1) CDFA; Algodones Dunes, 5.1 mi. SE Coachella Bridge No. 3, 33 0'13"N, 115 11'17"W, IV-18-79, Site 34, (1) CDFA; Algodones Dunes, 9.5 mi. NW Glamis, 32 4'27"N, 115 12'45"W, IV-19-79, Site 37, (1) CDFA; Glamis, V-26-71, cereal bowl pit trap, M. S. Wasbauer and M. E. Irvin cols. (49) CDFA; Glamis, IV-23-72, cereal bowl pit trap, M. S. Wasbauer col. (21) CDFA; Glamis, IV-24-72, cereal bowl pit trap, M. S. Wasbauer col. (10) CDFA; NW Glamis, III-10-73, ex. sand dune, F. Andrews and A. Hardy cols. (4) CDFA; Seeley, V-8-70, pitfall at night, 20E11-86, Paddock, Flock and Johnson cols. (3) CDFA; 3 mi. NW Glamis, IX-15/16-72, cereal bowl pit trap, M. S. Wasbauer and A. Hardy cols. (10) CDFA; Seeley, V-27-71, near
creosote bush, 71F233, R. A. Frock and L. Pinada cols. (1)
Imperial Valley, VI-10, Blaisdell Collection, (1) CASC;
Westmoreland, V-6-33, laevis det. Blaisdell, F. W.
Nunenmacher col. (4) FMNH; sand hills W of Yuma, Ariz., V-13-37, K. P. Schmidt col. (3) FMNH; 1.8 SW Glamis, IV-23-71, J. Saulnier col. (1) KWBC; Coachella canal, 7 mi. W Glamis, VIII-61, W. W. Mayhew col. (3) KWBC; Glamis sand dunes, VIII-19-77, J. E. Wappes col., (6) KWBC; 2.7 mi. NW Glamis, III-31-72, night on sand, J. Saulnier col. (18) KWBC; Glamis Dunes, IV-23-68, H.E. Evans col. (4) MCZC; 3.5 mi. WW Glmias, el. 280', V-21/23-75, sand dunes, R. L. Aalbu col. (9) RLAC; 3.5 mi. WW Glmias, el. 280', IX-24-77, sand dunes, R. L. Aalbu col. (5) RLAC; 3.5 mi. WW Glmias, el. 280', V-6-78, sand dunes, R. L. Aalbu col. (1) RLAC; 3.5 mi. WW Glmias, el. 280', V-1-75 sand dunes, R. L. Aalbu col. (103) RLAC; 3.5 mi. WW Glmias, el. 280',
APPENDIX D13: *Schizillus laticeps* Material Examined

II-13-65, E. L. Sleeper and S. L. Jenkins cols. (1) CSLB;
JTNM, Lower Covington Flat, VI-24-61, can trap, E. L.
Sleeper col. (2) CSLB; JTNM, Lower Covington Flat, V-9-64,
A. R. Hardy col. (1) CSLB; JTNM, Lower Covington Flat, VI-
30-60, J. Geest col. (1) CSLB; JTNM, Lower Covington Flat,
VI-11-60, J. Geest and W. Schilling cols. (2) CSLB; JTNM,
Lower Covington Flat, III-26-60, D. Rainey and S. Van
Moose cols. (2) CSLB; JTNM, Lower Covington Flat, IV-30-
60, E. L. Sleeper and M. L. West cols. (1) CSLB; JTNM,
Upper Covington Flats, VII-12-61, Lot. No. 4, R. E.
Somerby col. (5) CSLB; JTNM, Upper Covington Flats, VII-
12-61, R. E. Somerby col. (2) CSLB; JTNM, Upper Covington
Flats, VII-10-61, R. E. Somerby col. (1) CSLB; JTNM, Upper
Covington Flats, VII-18-61, R. E. Somerby col. (1) KWBC;
JTNM, Upper Covington Flats, VII-12-61, R. E. Somerby col.
(1) KWBC; JTNM, Upper Covington Flats, V-28-76, R. L.
Aalbu col. (1) RLAC; same except V-1-76, (6) RLAC; JTNM,
Pleasant Valley, Fried Liver Wash, IV-8-66, Ground trap 2,
E. L. Sleeper and S. L. Jenkins cols. (3) CSLB; JTNM,
Pleasant Valley, Fried Liver Wash, VII-26-67, E. L.
Sleeper and S. L. Jenkins cols. (1) CSLB; JTNM, Pleasant
Jenkins cols. (1) CSLB; JTNM, Pleasant Valley, Fried Liver
Wash, VI-12-66, Ground trap 2, E. L. Sleeper and S. L.
Jenkins cols. (1) CSLB; JTNM, Pleasant Valley, Fried Liver
Wash, V-30-65, Ground trap 2, E. L. Sleeper and S. L.
Jenkins cols. (2) CSLB; JTNM, Pleasant Valley, Fried Liver
Wash, V-1-65, E. L. Sleeper and S. L. Jenkins cols. (1)
CSLB; JTNM, Squaw Tank, IV-28-73, R. L. Aalbu col. (2)
RLAC; JTNM, .7 mi S Squaw Tank, VII-30-65, Ground trap 2,
E. L. Sleeper and S. L. Jenkins cols. (1) CSLB; JTNM, .7
mi S Squaw Tank, IX-23-67, pitfall, E. L. Sleeper and S.
L. Jenkins cols. (1) CSLB; JTNM, .7 mi S Squaw Tank, IV-
30-65, ground trap, E. L. Sleeper and S. L. Jenkins cols.
(2) CSLB; JTNM, .7 mi S Squaw Tank, VI-12-65, ground trap
4, E. L. Sleeper and S. L. Jenkins cols. (1) CSLB; JTNM,
.7 mi S Squaw Tank, V-30-65, ground trap 4, E. L. Sleeper
and S. L. Jenkins cols. (1) CSLB; JTNM, .7 mi S Squaw
Tank, VI-6-66, pitfall, E. L. Sleeper and S. L. Jenkins
cols. (1) CSLB; JTNM, .7 mi S Squaw Tank, IV-30-66, ground
trap 4, E. L. Sleeper and S. L. Jenkins cols. (1) CSLB;
JTNM, .7 mi S Squaw Tank, VI-11-66, pitfall, E. L. Sleeper
and S. L. Jenkins cols. (1) CSLB; JTNM, 3.7 mi S Squaw
CSLB; JTNM, 4.7 mi S Squaw Tank, VI-24-67, E. L. Sleeper
and S. L. Jenkins cols. (1) CSLB; JTNM, 5.7 mi S Squaw
CSLB; JTNM, Pleasant Valley 3, VIII-27-66, pitfall, E. L.
Lava Beds, 4.5 mi. N Brown, I-25-46, C. Nichols and D. Tiemann col. (1) CISC; Tuttle Creek, 2 mi. SW Lone Pine, V-9-69, J. Doyen col. (1) CISC; 5 mi. N, 2 mi. W Bishop, V-12 to IX-19-82, 4500, ethylene glycol pitfall trap, D. Giuliani col. (3) CDFA; Panamint Range, Butte Valley, Anvil Spring, 4200', V-3 to VI-2-82, ethylene glycol pitfall trap, D. Giuliani col. (2) CDFA; 4 mi. N, 2.5 mi. W Deep Springs College, Gilbert Summit, 6400', III-28 to X-1-82, ethylene glycol pitfall trap GB2, D. Giuliani col. (2) CDFA; Inyo Mts., Whipoorwill Canyon, 6200', VIII-13-82 to V-25-83, ethylene glycol pitfall trap, D. Giuliani col. (1) CDFA; same except 6100', II-18 to V-5-82, (1) CDFA; same except V-5 to VII-13-82, (1) CDFA; Inyo Mts., Long John Canyon, 5600', V-2 to VII-14-82, ethylene glycol pitfall trap, D. Giuliani col. (7) CDFA; Grapevine Canyon Road, B. Banta col. [the following dates and stations, total of 289]: IV-5-59: Station 14 (1) CASC; Station 17 (6) CASC; Station 18 (1) CASC; Station 24 (22) CASC; IV-11-59: Station 19 (1) CASC; Station 25 (1) CASC; V-2-59: Station? (1) CASC; Station 11 (2) CASC; Station 13 (1) CASC; Station 15 (2) CASC; Station 25 (3) CASC; Station 29 (1) CASC; V-16-59: Station 12 (1) CASC; Station 14 (1) CASC; Station 15 (2) CASC; Station 19 (3) CASC; Station 20 (1) CASC; VI-8-59: Station 17 (1) CASC; VII-15-59: Station 13 (1) CASC; Station 17 (3) CASC; Station 25 (1) CASC; Station 30 (1) CASC; VIII-15-59: Station 4 (2) CASC; Station 21 (1) CASC; Station 28 (1) CASC; Station 35 (1) CASC; Station 50 (1) CASC; III-5-60: Station 19 (6) CASC; Station 22 (1) CASC; IV-2-60: Station 1 (1) CASC; Station 13 (3) CASC; Station 14 (4) CASC; Station 15 (1) CASC; Station 18 (1) CASC; Station 20 (1) CASC; Station 21 (2) CASC; Station 22 (4) CASC; Station 23 (2) CASC; Station 25 (11) CASC; Station 28 (1) CASC; IV-4-60: Station 13 (1) CASC; IV-14-60: Station 11 (3) CASC; Station 24 (10) CASC; IV-19-60: Station 24 (1) CASC; V-2-60: Station 25 (2) CASC; Station 33 (1) CASC; V-7-60: Station 2 (2) CASC; Station 4 (1) CASC; Station 5 (3) CASC; Station 8 (2) CASC; Station 10 (1) CASC; Station 11 (1) CASC; Station 12 (1) CASC; Station 13 (8) CASC; Station 14 (4) CASC; Station 15 (4) CASC; Station 20 (9) CASC; Station 21 (1) CASC; Station 22 (4) CASC; Station 23 (6) CASC; Station 24 (13) CASC; Station 25 (6) CASC; Station 28 (1) CASC; Station 29 (3) CASC; Station 35 (1) CASC; Station 38 (1) CASC; Station 41 (1) CASC; VII-14-60: Station? (1) CASC; Station 1 (1) CASC; Station 4 (2) CASC; Station 5 (5) CASC; Station 9 (1) CASC; Station 10 (6) CASC; Station 12 (1) CASC; Station 13 (14) CASC; Station 14 (6) CASC; Station 17 (4) CASC; Station 18 (2) CASC; Station 19 (6)
CASC; Station 20 (5) CASC; Station 21 (2) CASC; Station 25 (7) CASC; Station 38 (1) CASC; IX-14-60; Station 13 (3) CASC; Station 15 (4) CASC; IX-16-60; Station 13 (2) CASC; Station 15 (2) CASC; IX-17-60; Station 7 (1) CASC; Station 3 (1) CASC; Station 5 (4) CASC; Station 12 (2) CASC; Station 14 (2) CASC; Station 18 (2) CASC; Station 19 (3) CASC; Station 21 (1) CASC; Station 22 (6) CASC;. Grapevine Canyon, IV-23-61, El. 5000', N. L. Rump (1) CNCI; Grapevine Canyon, Saline Valley, 5000', V-25-81, D. Giuliani col. (1) CDFA; Saline Valley Dunes, 1976, G. Akin col. (1) CDFA; Grapevine Canyon, Saline Valley, 4000', IV-20 to VII-21-78, ethylene glycol pitfall trap, D. Giuliani col. (2) CDFA; (1) RLAC; same except 3000', (1) CDFA; same except 3400', (1) CDFA; same except 5200', V-25 to VII-15-81, (6) CDFA; same except 4000', II-16 to IV-2-82, G7, (2) CDFA; same except 5000', G10, (1) CDFA; same except 4400', G8, (1) CDFA; same except 5700', IV-26 to VII-7-82, G11, (6) CDFA; same except 5000', G10, (7) CDFA; same except 4400', G8, (2) CDFA; same except VII-7 to XI-26-82, (3) CDFA; same except 4400', G8, (1) CDFA; same except 5700', G11, D. Giuliani col. (1) CDFA; same except 4000', G7, D. Giuliani col. (1) CDFA; same except IX-26-82 to V-23-83, 5700', G11, D. Giuliani col. (1) CDFA; Owens Valley, Tuttle creek, 4350', III-23 to VII-9-82, ethylene glycol pitfall trap near Neotoma nest, D. Giuliani col. (6) CDFA; Owens Valley, Tuttle creek, 4520', III-23 to VII-9-82, ethylene glycol pitfall trap, D. Giuliani col. (2) CDFA; Owens Valley, Tuttle creek, 4350', XII-2-81 to III-23-83, ethylene glycol pitfall trap near Neotoma nest, D. Giuliani col. (1) CDFA; Owens Valley, Tuttle creek, 4350', IX-23 to XII-2-81, ethylene glycol pitfall trap, D. Giuliani col. (3) CDFA; Owens River, 4450', VIII-7 to XII-5-81, ethylene glycol pitfall trap, D. Giuliani col. (1) CDFA; Owens River Gorge, 4500', V-12 to XII-20-82, ethylene glycol pitfall trap, D. Giuliani col. (5) CDFA; Owens River, Lower Gorge, 4450', XII-5-81 to V-12-82, ethylene glycol pitfall trap, D. Giuliani col. (5) CDFA; 3 mi. N. Trona, V-25-65, A. Hardy col. (1) CSLB; 5 mi. W Westguard Pass, VIII-7-66, E. L. Sleeper col. (1) CSLB. LOS ANGELES CO.: Palmdale, VI-14-63, (1) CDFA; Pearblossom, III-12-54, W. A. McDonald col. (1) LACM; Eagle Rock, V-29-50, (1) LACM; Palmbats ?, V-6-56, (1) LACM; Hesperia, III-31-69, B. W. Howard col. (1) LACM; Tapia canyon, V-12-62, J. Dittmar col. (1) LACM; Piute Butte, VI-20/21-38, E. S. Ross col. (1) CASC; Juniper Hills, V-11-73, A. V. Evans col. (1) RLAC. FRESNO CO.: 8 mi. NW Coalinga, Los Gatos canyon, V-3 to VII-7-81, ethylene glycol pitfall trap, R. L. Aalbu col. (1) CDFA; 2

APPENDIX D14: Schizillus nunenmacheri Material Examined